United States
Department of
Agriculture

Soil
Conservation
Service

P.O. Box 2890
Washington, D.C.
20013

August 4, 1992

NATIONAL SOIL TAXONOMY HANDBOOK
430-VI
ISSUE NO. 15

Purpose. To distribute current amendments to Soil Taxonomy, Agriculture Handbook 436.

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

Filing instructions. File this copy of the changes in the 3-ring binder with Issues Nos. 1 through 15. It is suggested that you keep this binder with the Soil Taxonomy volume for easy reference.

File page iii of "Contents" following page ii. Replace page vii of "Index to pages of Soil Taxonomy" dated August 1992 with the attached pages vii and viii of the index. File pages 615-423 to 615-605 following page 615-422.

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

ROBERT R. SHAW
Deputy Chief for Technology

Attachments

DIST: NSTH

The Soil Conservation Service
is an agency of the
Department of Agriculture

AN EQUAL OPPORTUNITY EMPLOYER

Section

615.89 Wet soils amendment
615.90 Vertisol amendment
615.91 Spodosol amendment
615.92 Diagnostic horizons
615.93 Definition of the mollic epipedon
615.94 Definition of the histic epipedon
615.95 Table 7, additions and deletions
615.96 Key to Ultisols
615.97 Subgroups of Andisols
615.98 Names of subgroups of Aridisols
615.99 Subgroups of Ustifluvents and Ustorthents
615.100 Folists
615.101 Subgroups of Ustochrepts
615.102 Arenic subgroup of Argiborolls
615.103 Udic subgroup of Calciborolls
615.104 Pachic subgroup of Argiudolls
615.105 Cumulic subgroups of Mollisols
615.106 Lithic Ruptic-Entic Haplustolls
615.107 Ultic subgroups of Xerolls
615.108 Udic subgroups of ustic suborders
615.109 Aeric Albaquults
615.110 Key to Palexerults
615.111 Definitions of *Fragmental*, *Pumiceous*, and *Cindery*
615.112 Strongly contrastin particle-size classes
615.113 Sloping families
615.114 Corrections and clarification

| Section | Page |
|---|---|
| 615.87 | 158 (NSTH pages 615-241 to 242), 159 (NSTH pages 615-243 to 246),162 (NSTH page 615-247), 163 (NSTH pages 615-248 to 249), 166 (NSTH pages 615-250 to 252), 168 (NSTH pages 615-252 to 253), 171 (NSTH pages 615-254 to 257), 174 (NSTH pages 615-259 to 260), 176 (NSTH page 615-261), 177 (NSTH page 615-262) |
| 615.88 | 86, 87, 92, 364, 373 (NSTH page 615-383), 384 (NSTH page 615-366) |
| 615.89 | 34, 36 (NSTH page 615-387), 42, 47, 48, 50-51, 54, 55, 63, 77, 79, 83, 85, 89, 90, 93, 95, 96-373 (NSTH pages 615-179/384) |
| 615.90 | 48, 51, 75, 76, 92 (NSTH page 615-179), 95-96 (NSTH page 615-179), 110-382 (NSTH pages 615-209/386) |
| 615.91 | 29-32, 63, 92, 96 NSTH page 615-179), no page number (NSTH pages 615-186, 188, 200, 203), 155, 156 (NSTH page 615-203), 179, 180 (NSTH page 615-204), 186 (NSTH page 615-266), 202 (NSTH page 615-277), 203, 204 (NSTH page 615-277/278), 206 (NSTH page 615-279), 207, 212 NSTH page 615-204), 227, 228-229 (NSTH page 204), 271 (NSTH page 615-204), 272 (NSTH pages 615-13 & 204), 323 (NSTH page 615-123, 333-347, 349 (NSTH pages 615-205 & 389), 364 (NSTH 615-376), 366, 384 |
| 615.92 | 14 (NSTH page 615-15) |
| 615.93 | 15 |
| 615.94 | 17-18 |
| 615.95 | 86-87 |
| 615.96 | 92 |
| 615.97 | No page number (NSTH pages 615-188 to 203) |
| 615.98 | 158 (NSTH page 615-242), 171 (NSTH page 615-257), 174 (NSTH page 615-259) |

| Section | Page |
|---|---|
| 615.99 | 192 (NSTH page 615-270), 200 (NSTH page 615-276) |
| 615.100 | 218, 219 |
| 615.101 | 254 (NSTH pages 615-302/303) |
| 615.102 | 282 (NSTH pages 615-317 & 319) |
| 615.103 | 285 (NSTH page 615-320) |
| 615.104 | 296 (NSTH page 615-328) |
| 615.105 | 286 (NSTH page 615-321), 287, 288 (NSTH page 615-323), 303 (NSTH page 615-338), 316 (NSTH page 615-348), 318 |
| 615.106 | 304 (NSTH page 615-336), 305 |
| 615.107 | 311 (NSTH pages 615-343 to 345), 313, 316 (NSTH pages 615-348 to 350), 317-318 |
| 615.108 | No page numbers (NSTH pages 615-228 to 383) |
| 615.109 | 352 (NSTH page 615-365) |
| 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 |

**615.89 Wet soils amendment**

Introduction

The International Committee on Aquic Moisture Regime (ICOMAQ) was established in 1982 and chaired initially by Frank Moormann, then by Johan Bouma (since 1985). The main classification problems which the committee undertook to solve were the inadequate definition of the term *aquic soil moisture regime*, the lack of distinction between soils with perched and ground watertables, and the question of wetness induced by rice culture (paddy soils).

The following is a summary of the major changes in terminology proposed by ICOMAQ and implemented by this amendment:

1. The concept of *aquic conditions* now replaces that of the *aquic moisture regime*. Aquic conditions in a soil or horizon require saturation, reduction, and redoximorphic features. The new term *aquic conditions* has a wider range of application than the term *aquic moisture regime* and will be used extensively in Soil Taxonomy.

2. Use of the term *mottles that have chroma of 2 or less* is discontinued, and so is the use of the term *mottles*, with few exceptions. The following terms are introduced as replacements:

a. *Redoximorphic features*, which essentially includes all wetness mottles;

b. *Redox concentrations*, which are concentrations of Fe and Mn and include the high-chroma wetness mottles;

c. *Redox depletions*, which represent low-chroma wetness mottles (mottles with a chroma of 2 or less) where Fe and Mn have moved out; and

d. *Reduced matrix*, which represents reduced soil materials that change in color when exposed to air.

3. The new term *endosaturation* means the saturation of a soil with water in all layers from the upper boundary of saturation to a depth of 200 cm or more from the mineral soil surface.

4. *Episaturation* means a saturation with water of one or more layers above a depth of 200 cm from the mineral soil surface in a soil that also has one or more unsaturated layers below the saturated layer.

5. The term *anthric saturation* characterizes a variant of episaturation which is associated with controlled flooding, e.g., of rice paddies.

Also included are changes in criteria for acid sulfate soils. Although ICOMAQ has not emphasized the revision of acid sulfate soils, Circular Letter No. 4 presented an update following the third International Symposium on Acid Sulphate Soils held in Senegal in January of 1986. The revisions included in this amendment were reviewed by the International Symposium on Acid Sulphate Soils held in Ho Chi Minh City, Vietnam, in February of 1992, and included in a paper "Fanning, D.S., and J.E. Witty. 1992. Revisions of *Soil Taxonomy* for acid sulfate soils," which was presented by Fanning at that symposium.

The following changes are required in *Soil Taxonomy* to accommodate the revisions recommended by ICOMAQ.

Page 34, column 1, item 1, paragraph 1. Starting with third sentence, change this paragraph to read as follows:

"If the color is neutral or consists of shades of green and blue and the hue changes on exposure to air, the horizon is excluded from the concept of the cambic horizon on the assumption that losses of iron have been negligible (this condition is defined below as *reduced matrix*). If the level of ground water fluctuates, free iron generally is removed from the individual particles of sand, silt, and clay. This iron is either lost from the horizon or concentrated in the form of *redox concentrations* (defined below). Gray or grayish and brownish horizons with *redoximorphic features* (defined below) are produced by fluctuating ground water. Redoximorphic features alone, however, are not evidence of sufficient alteration for identification of a cambic horizon. The processes of reduction and removal or segregation of the iron must have been intense enough to produce a horizon dominated by redox depletions. The horizon must have its upper boundary less than 50 cm below the mineral soil surface. It must not consist of reduced matrices, but must have 50 percent or more chroma on faces of peds, or in the matrix if peds are absent, as follows:

a. Two or less, and redox concentrations; or

b. Zero, and a color value, moist, of 3 or less; or

c. One or less, and a color value, moist, of 4 or more."

NSTH 615.63, p. 615-387, item 3 (item 4 was changed to item 3 by NSTH 615.69, p. 615-396) (*Soil Taxonomy* p. 36). Change item 3.a to read as follows:

"a. Have aquic conditions for some time in most years (or artificial drainage) and both of the following:

(1) Within 50 cm of the mineral soil surface, either on faces of peds, or in the matrix if peds are absent, 50 percent or more chroma as follows:

(a) Two or less, and redox concentrations; or

(b) Zero, and a color value, moist, of 3 or less; or

(c) One or less, and a color value, moist, of 4 or more; and

(2) One or more of the following properties:"

(a), (b), (c), and (d) are unchanged.

NSTH 615.63, p. 615-387, item 3 (item 4 was changed to item 3 by NSTH 615.69, p. 615-396) (*Soil Taxonomy* p. 36). Change item 3.b to read as follows:

"b. Do not have both aquic conditions (or artificial drainage) and colors defined above (3.a) and, ..."

Page 42, column 1, line 17. Change "mottles" to "redoximorphic features".

Page 42, column 2, line 2. Change "is usually mottled" to "typically has redoximorphic features".

Page 47, Sulfuric horizon. Replace first two paragraphs with the following:

"The sulfuric (L. *sulfur*) horizon is 15 cm or more thick and is composed of either mineral or organic soil material that has a pH value of 3.5 or less (1:1 by weight in water, or in a minimum of water to permit measurement), and evidence that the low pH value is caused by sulfuric acid. The evidence is one or more of the following:

1. Jarosite concentrations, or

2. Directly underlying sulfidic materials (defined below), or

3. 0.05 percent or more water-soluble sulfate.

A sulfuric horizon forms as a result of drainage, most commonly artificial, and oxidation of sulfide-rich mineral or organic soil materials. Such a horizon is highly toxic to most plants. It may also form in places where sulfidic materials have been exposed as a result of surface mining, road construction, dredging, or other earth-moving operations."

Page 48, column 1. Preceding section "Coefficient of linear extensibility, COLE", add new section as follows:

"**Aquic conditions**[1]

Soils with aquic (L. *aqua*, water) conditions are those which currently experience continuous or periodic saturation and reduction. The presence of these conditions is indicated by *redoximorphic features* (defined below) and can be verified, except in artificially drained soils,[2] by measuring saturation and reduction.

Elements of aquic conditions:

1. Saturation is characterized by zero or positive pressure in the soil-water and can generally be determined by observing free water in an unlined auger hole. However, problems may arise in clayey soils with peds, where an unlined auger hole may fill with water flowing along faces of peds while the soil matrix is and remains unsaturated (bypass flow). Such free water may incorrectly suggest the presence of a water table, while the actual water table occurs at greater depth. Use of well-sealed piezometers or tensiometers is therefore recommended for measuring saturation. Problems may, however, still occur if water runs into piezometer slits near the bottom of the piezometer hole or if tensiometers with slowly reacting manometers are used. The first problem can be overcome by using piezometers with smaller slits, and the second by using transducer tensiometry, which reacts faster than manometers. Soils are considered wet if they have pressure heads greater than -1 kPa. Only macropores such as cracks between peds or channels are then filled with air, while the soil matrix is usually still saturated. Obviously exact measurements of the wet state can only be obtained with tensiometers. For operational purposes, the use of piezometers is recommended as a standard method.

The duration of saturation required for creating aquic conditions is variable, depending on the soil environment, and is not specified.

Three types of saturation are defined:

a. Endosaturation.--The soil is saturated with water in all layers from the upper boundary of saturation to a depth of 200 cm or more from the mineral soil surface.

b. Episaturation.--The soil is saturated with water in one or more layers within 200 cm of the mineral soil surface and also has one or more unsaturated layers, with an upper boundary above 200 cm depth, below the saturated layer. The zone of saturation, i.e., the water table, is perched on top of a relatively impermeable layer.

c. Anthric saturation.--This variant of episaturation is associated with controlled flooding (for such crops as wetland rice and cranberries), which causes reduction processes in the saturated, puddled surface soil and oxidation of reduced and mobilized iron and manganese in the unsaturated subsoil.

2. The degree of reduction in a soil can be characterized by the direct measurement of redox potentials. Direct measurements should take into account chemical equilibria as expressed by stability diagrams in standard soil textbooks. Reduction and oxidation processes are also a function of soil pH. Accurate measurements of

[1] The term *aquic conditions* was introduced, and other changes were made throughout *Soil Taxonomy*, in 1992 as a result of recommendations submitted to SCS by the International Committee on Aquic Moisture Regime (ICOMAQ), which was established in 1982 and chaired initially by Frank Moormann, then by Johan Bouma (since 1985).

[2] Artificial drainage is defined here as removal of free water from soils (by surface mounding, ditches, or subsurface tiles) to the extent that watertable levels are changed significantly in connection with specific types of land use. In the keys, artificially drained soils are included with soils that have aquic conditions.

the degree of reduction existing in a soil are difficult to obtain. In the context of Soil Taxonomy, however, only a degree of reduction that results in reduced Fe is considered, because it produces the visible redoximorphic features that are identified in the keys. A simple field test is available to determine if reduced iron ions are present. A freshly broken surface of a field-wet soil sample is treated with $\alpha,\alpha'$-dipyridyl[3] in neutral, 1-normal ammonium-acetate solution. The appearance of a strong red color on the freshly broken surface indicates the presence of reduced iron ions. Use of $\alpha,\alpha'$-dipyridyl in a 10-percent acetic-acid solution is not recommended because the acid is likely to change soil conditions, for example by dissolving $CaCO_3$.

The duration of reduction required for creating aquic conditions is not specified.

3. Redoximorphic features associated with wetness result from the reduction and oxidation of iron and manganese compounds in the soil after saturation with water and desaturation, respectively. The reduced iron and manganese ions are mobile and may be transported by water as it moves through the soil. Certain redox patterns occur as a function of the patterns in which the ion-carrying water moves through the soil, and of the location of aerated zones in the soil. Redox patterns are also affected by the fact that manganese is reduced more rapidly than iron, while iron oxidizes more rapidly upon aeration. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese is oxidized and precipitated, it forms either soft masses or hard concretions or nodules. Movement of iron and manganese as a result of redox processes in a soil may result in redoximorphic features that are defined as follows:

a. Redox concentrations.--These are zones of apparent accumulation of Fe-Mn oxides, including:

(1) Nodules and concretions, i.e., firm, irregularly shaped bodies with diffuse boundaries if formed *in situ*, or with sharp boundaries after pedoturbation;

(2) Masses, i.e., soft bodies of variable shapes within the matrix; and

(3) Pore linings, i.e., zones of accumulation along pores which may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.

b. Redox depletions.--These are zones of low chroma (2 or less) where either Fe-Mn oxides alone or both Fe-Mn oxides and clay have been stripped out, including:

(1) Iron depletions, i.e., zones which contain low amounts of Fe and Mn oxides but have a clay content similar to that of the adjacent matrix (often referred to as albans or neoalbans); and

(2) Clay depletions, i.e., zones which contain low amounts of Fe, Mn, and clay (often referred to as silt coatings or skeletans).

c. Reduced matrix.--This is a soil matrix which has a low chroma *in situ*, but whose hue or chroma increases within 30 minutes after the soil material has been exposed to air.

d. In soils that have no visible redoximorphic features, a reaction to an $\alpha,\alpha'$-dipyridyl solution satisfies the requirement for redoximorphic features.

Field experience indicates that it is not possible to define a specific set of redoximorphic features that is uniquely characteristic of all the taxa in one particular category. Therefore color patterns that are unique to specific taxa are referenced in the keys.

Anthraquic conditions represent a special kind of aquic conditions which occur in soils that are cultivated and irrigated. Soils with anthraquic conditions must meet the requirements for aquic conditions and in addition have both of the following:

a. A tilled surface layer and a directly underlying slowly permeable layer which have, for three months or more per year, both

(1) Saturation and reduction; and

(2) In the matrix, a chroma of two or less; and

b. A subsurface horizon with one or more of the following:

(1) Redox depletions with a color value, moist, of 4 or more and a

---

[3] A positive reaction to the $\alpha,\alpha'$-dipyridyl field test for ferrous iron (Childs 1981*) may be used to confirm the existence of reducing conditions and is especially useful in situations where, despite saturation, normal morphological indicators of such conditions are either absent or obscured (as by the dark colors characteristic of melanic great groups). A negative reaction, however, does not imply that reducing conditions are always absent; this may only mean that the level of free iron in the soil is below the sensitivity limit of the test or that the soil is in an oxidized phase at the time of testing.

*Childs, C.W. 1981: Field test for ferrous iron and ferric-organic complexes (on exchange sites or in water-soluble forms) in soils. Australian Journal of Soil Research 19: 175-180.

chroma of 2 or less in macropores; or

(2) Redox concentrations of iron; or

(3) Two times or more the amount of iron (by dithionite citrate) contained in the tilled surface layer."

Page 48, column 2. Delete section, "Mottles that have chroma of 2 or less".

Pages 50-51, Plinthite. Change "mottles" to "redox concentrations" throughout the section (4 times).

Page 54, column 2, Aquic moisture regime, line 6. Change "Some soil horizons" to "Some soils".

Page 54, column 2, Aquic moisture regime. Delete second paragraph.

Page 55, column 1, line 21. Delete sentence starting with "Although the term..."

Page 55, column 1. Preceding the paragraph starting with "Figure 8", add new paragraph as follows:

"Although the terms *aquic moisture regime* and *peraquic* are not used as either a criterion or a formative element for taxa, they are used in taxon descriptions as an aid in understanding genesis."

Page 63, Sulfidic materials. Replace first paragraph with the following:

"Sulfidic materials contain oxidizable sulfur compounds, and are mineral or organic soil materials with a pH value of more than 3.5 which, if incubated as a layer 1 cm thick under moist aerobic conditions (field capacity) at room temperature, show a drop in pH value of 0.5 or more units to a pH value of 4.0 or less (1:1 by weight in water, or in a minimum of water to permit measurement) within 8 weeks.

Sulfidic materials accumulate in a soil, or as a sediment, which is permanently saturated, generally with brackish water. The sulfates in the water are biologically reduced to sulfides as the materials accumulate. Sulfidic materials most commonly accumulate in coastal marshes near the mouths of rivers that carry noncalcareous sediments, but they may occur in fresh-water marshes if there is sulfur in the water. Upland sulfidic materials may have accumulated in a similar manner in the geologic past.

If a soil containing sulfidic materials is drained, or if sulfidic materials are otherwise exposed to aerobic conditions, the sulfides oxidize and form sulfuric acid. The pH, which normally is near neutrality before drainage or exposure, may drop below 3. The acid may induce formation of iron and aluminum sulfates. The iron sulfate, jarosite, may segregate to form the yellow mottles that commonly characterize a sulfuric horizon. The transition from sulfidic materials to a sulfuric horizon normally requires very few years and may occur within a few weeks. A sample of sulfidic materials, if air-dried slowly in shade for about 2 months with occasional remoistening, becomes extremely acid."

Page 77, column 1, Suborders, lines 6 and 7. Change "aquic moisture regime" to "aquic conditions".

Page 79, column 1, subgroups, lines 13 to 19. Change the two sentences to read as follows:

"For example, some soils have aquic conditions and have throughout their depth, gray colors with reddish or brownish redox concentrations. Other soils have aquic conditions only in their lower horizons, and in those horizons the dominant colors may be shades of brown, red, or yellow with some gray redox depletions."

Page 83, column 2, Suborders, lines 7 and 8. Change "have an aquic moisture regime" to "has aquic conditions".

Page 85, column 2, Names of intergrades toward a great group in the same order, lines 17 and 18. Change "mottling that is" to "redoximorphic features that are".

Page 85, column 2, Names of intergrades toward a great group in the same order, lines 19 and 20. Change "If mottles that have low chroma" to "If redox depletions[4]".

Page 85, column 2, Names of intergrades toward a great group in the same order, line 26. Change "mottling" to "redoximorphic features".

Page 85, column 2, Names of intergrades toward great groups in other orders, line 10. Change "mottles" to "redox depletions".

Page 89, Table 10. Delete "Chrom" and reference.

Page 89, Table 10. Preceding "Eutr" add the following:

"Endo——— Gr. *endon*, *endo-*, within--- ... --- Implying a groundwater table.
Epi——— Gr. *epi*, on, above——— ... --- Implying a perched watertable."

Page 90, Table 11. Preceding "Anthropic" add the following:

"Anthraquic—Modified from Gr. *anthropos*, man-----Anthropology- Controlled flooding."

Page 90, Table 11. Preceding "Cumulic" add the following:

"Chromic---- Gr. *chroma*, color-- Chroma---- High chroma."

Page 90, Table 11. Delete "Epiaquic" and reference.

Page 90, Table 11. Preceding "Pachic" add the following:

---

[4] The zone with redox depletions must also have aquic conditions for some time in most years (or artificial drainage).

"Ombroaquic-- Gr. *ombros*, rain and aquic----- ..... — Surface wetness."

"Oxyaquic-- Oxy, representing oxygen and aquic — ... — Aerated."

Page 90, column 2, line 15. Change "are mottled" to "have redox depletions".

Page 93, item F, Aridisols (refer to NSTH 615.60). Change item 1 to read as follows:

"1. Do not have an argillic, a natric, or a sulfuric horizon *but* have *either*:" (items *a* and *b* remain unchanged).

Page 93, Inceptisols (refer to NSTH 615.60). Change item J to read as follows:

"J. Other soils which have *either*:

1. *One or more* of the following:

a. Either a cambic horizon, or both aquic conditions within 50 cm of the mineral soil surface for some time in most years (or artificial drainage), and permafrost; *or*

b. Within 100 cm of the mineral soil surface, a calcic, petrocalcic, gypsic, petrogypsic, or placic horizon, or a duripan; *or*

c. Either a fragipan or an oxic horizon that has its upper boundary within 200 cm of the mineral soil surface; *or*

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

2. No sulfidic materials within 50 cm of the mineral soil surface; *and both*:

a. In one or more horizons between 20 and 50 cm below the mineral soil surface, either an *n* value of 0.7 or less, or less than 8 percent clay; *and*

b. *One or both* of the following:

(1) An umbric, a mollic, a histic, or a plaggen epipedon, *or*

(2) In 50 percent or more of the layers between the mineral soil surface and a depth of 50 cm, an exchangeable sodium percentage of 15 or more (or a sodium adsorption ratio of 13 or more), which decreases with increasing depth below 50 cm, *and* also ground water within 100 cm of the mineral soil surface at some time during the year when the soil is not frozen in any part.

**Inceptisols"**

Page 95, column 2. Change item 2 to read as follows:

"2. Have an epipedon that is both hard, very hard, or harder and massive when dry, or do not have an aridic moisture regime;"

Pages 96 & 109, Key to suborders (refer to NSTH p. 615-179). Change item IA to read as follows:

"IA. Alfisols that have, in one or more horizons within 50 cm of the mineral soil surface, aquic conditions for some time in most years (or artificial drainage), *and* have *one or both* of the following:

1. Redoximorphic features in all layers between either the lower boundary of an Ap horizon or a depth of 25 cm below the mineral soil surface, whichever is deeper, and a depth of 40 cm; *and one* of the following within the upper 12.5 cm of the argillic, natric, or kandic horizon:

a. Fifty percent or more redox depletions with a chroma of 2 or less on faces of peds, and redox concentrations within peds; *or*

b. Fifty percent or more redox depletions with a chroma or 2 or less and redox concentrations in the matrix; *or*

c. Fifty percent or more redox depletions with a chroma of 1 or less on faces of peds or in the matrix, or both; *or*

2. In the horizons that have aquic conditions, enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aqualfs"**

Page 109, column 1, Aqualfs. Change first sentence to read as follows:

"Aqualfs are the Alfisols that have aquic conditions for some time in most years (or artificial drainage) at or near the soil surface. Their appearance is normally controlled by gray redox depletions and higher-chroma redox concentrations."

Page 109, column 2, Definition. Change definition of Aqualfs to read as follows:

"<u>Definition</u>

Aqualfs are Alfisols that have, within 50 cm of the mineral soil surface, aquic conditions for some time in most years (or artificial drainage), and have one or both of the following:

1. Redoximorphic features in all layers between either the lower boundary of an Ap horizon or a depth of 25 cm below the mineral soil surface, whichever is deeper, and a depth of 40 cm or more; and one of the following:

a. Fifty percent or more redox depletions with a chroma of 2 or less on faces of

peds, and redox concentrations within peds, of the argillic, natric, or kandic horizon; or

b. Fifty percent or more redox depletions with a chroma or 2 or less, and redox concentrations, in the matrix of the argillic, natric, or kandic horizon; or

c. Fifty percent or more redox depletions with a chroma of 1 or less either on faces of peds or in the matrix of the argillic, natric, or kandic horizon; or

2. In the horizons that have aquic conditions, enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated."

Page 109, column 2, Key to great groups (refer to NSTH p. 615-179). Change item IAI and add item IAJ to read as follows:

"IAI. Other Aqualfs that have episaturation.
**Epiaqualfs**

IAJ. Other Aqualfs.
**Endoaqualfs"**

Page 110, column 1, Description of a Typic Albaqualf. In the Ap, EB, Btg1, Btg2, and BCtg horizons change "mottles" to "redox concentrations".

Page 111, column 2. Preceding Fragiaqualfs, add new section as follows:

**"Endoaqualfs**

Definition

Endoaqualfs are the Aqualfs which:

1. Have endosaturation;

2. Do not have an umbric epipedon;

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

4. Do not have an abrupt textural change between the albic and argillic horizons if the saturated hydraulic conductivity of the argillic horizon is low or very low.

**Endoaqualfs**

Key to subgroups

IAJA. Endoaqualfs which 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, and *either*:

a. In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

b. In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.
**Aquandic Endoaqualfs**

IAJB. Other Endoaqualfs 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 to 100 cm.
**Arenic Endoaqualfs**

IAJC. Other Endoaqualfs 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 100 cm or more.
**Grossarenic Endoaqualfs**

IAJD. Other Endoaqualfs that have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, colors as follows: *either*

1. A hue of 7.5YR or redder in 50 percent or more of the matrix; *and*

a. 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*

b. If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*

2. In 50 percent or more of the matrix, a hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more; *or*

b. A chroma of 2 or more if there are no redox concentrations.
**Aeric Endoaqualfs**

IAJE. Other Endoaqualfs which have a mollic epipedon, or an Ap horizon that meets all the requirements for a mollic epipedon except thickness, or materials between the mineral soil surface and a depth of 18 cm that meet these requirements after mixing.
**Mollic Endoaqualfs**

IAJF. Other Endoaqualfs which have an Ap horizon that meets all the requirements for an umbric epipedon except thickness, or materials between the mineral soil surface and a depth of 18 cm that meet these requirements after mixing.

**Umbric Endoaqualfs**

IAJG. Other Endoaqualfs.

**Typic Endoaqualfs**

Definition of Typic Endoaqualfs

Typic Endoaqualfs are the Endoaqualfs which:

1. Have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, colors as follows: either

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 1 or less on 50 percent or more of ped exteriors, or redox depletions with a chroma of 2 or less in ped interiors; or

(2) If peds are absent, a chroma of 1 or less 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) A color value, moist, of 3 or more and a chroma of 2 or less if there are redox concentrations; or

(2) A chroma of 1 or less;

2. Do not, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, have any of the following:

a. 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

b. 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

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and either:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; or

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more;

3. Do not have a mollic epipedon, or an Ap horizon that meets all the requirements for a mollic or umbric epipedon except thickness, or materials between the mineral soil surface and a depth of 18 cm that meet these requirements after mixing; and

4. 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.

**Epiaqualfs**

Epiaqualfs (plate 10B) are the Aqualfs which have an epipedon that rests on an argillic horizon without an abrupt textural change if the argillic horizon has low saturated hydraulic conductivity. They do not have a natric horizon or a fragipan or duripan. They have epiaquic saturation during some part of the year, and ground water fluctuates from a level near the soil surface to below the argillic horizon and is sometimes absent.

Before cultivation most Epiaqualfs supported either a deciduous broadleaf or a coniferous forest. Generally they are nearly level, and their parent materials are typically late-Pleistocene sediments. These soils were mostly classified as Planosols and Low-Humic Gley soils in the 1938 classification as modified before 1949.

Definition

Epiaqualfs are those Aqualfs which:

1. Have episaturation;

2. Do not have an umbric epipedon;

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

4. Do not have an abrupt textural change between the albic and argillic horizons if the saturated hydraulic conductivity of the argillic horizon is low or very low.

Pedon 46 represents a Typic Epiaqualf, an example of the central concept of Epiaqualfs.

Key to subgroups

IAIA. Epiaqualfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Epiaqualfs**

IAIB. Other Epiaqualfs which 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, and *either*:

a. In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

b. In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

**Aquandic Epiaqualfs**

IAIC. Other Epiaqualfs 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 to 100 cm.

**Arenic Epiaqualfs**

IAID. Other Epiaqualfs 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 100 cm or more.

**Grossarenic Epiaqualfs**

IAIE. Other Epiaqualfs which have:

1. An Ap horizon that meets all the requirements for an umbric epipedon except thickness, or materials between the mineral 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, colors as follows: *either*

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 Umbric Epiaqualfs**

IAIF. 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 mineral soil surface and a depth of 18 cm that meet these requirements after mixing; *and*

2. In 50 percent or more of the matrix in one or more horizons between the A or Ap horizon and a depth of 75 cm from the mineral soil surface, chromas as follows:

a. Three or more if the mean annual soil temperature is lower than 15°C; *or*

b. If the mean annual soil temperature is 15°C or higher:

(1) Three or more if the hue is 2.5Y or redder and the color value, moist, is 6 or more; *or*

(2) Two or more if the hue is 2.5Y or redder and the color value, moist, is 5 or less; *or*

(3) Three or more if the hue is yellower than 2.5Y; *or*

c. Two or more if there are no redox concentrations.

**Udollic Epiaqualfs**

IAIG. Other Epiaqualfs that have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, colors as follows: *either*

1. A hue of 7.5YR or redder in 50 percent or more of the matrix; *and*

a. 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*

b. If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*

2. In 50 percent or more of the matrix, a hue of 10YR or yellower, *and either*

a. Both a color value, moist, and chroma of 3 or more; *or*

b. A chroma of 2 or more if there are no redox concentrations.

**Aeric Epiaqualfs**

IAIH. Other Epiaqualfs which have a mollic epipedon, or an Ap horizon that meets all the requirements for a mollic epipedon except thickness, or materials between the mineral soil surface and a depth of 18 cm that meet these requirements after mixing.

**Mollic Epiaqualfs**

IAII. Other Epiaqualfs which have an Ap horizon that meets all the requirements for an umbric epipedon except thickness, or materials between the mineral soil surface and a depth of 18 cm that meet these requirements after mixing.

**Umbric Epiaqualfs**

IAIJ. Other Epiaqualfs.

**Typic Epiaqualfs**

Definition of Typic Epiaqualfs

Typic Epiaqualfs are the Epiaqualfs which:

1. Have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, colors as follows: either

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 1 or less on 50 percent or more of ped exteriors, or redox depletions with a chroma of 2 or less in ped interiors; or

(2) If peds are absent, a chroma of 1 or less 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) A color value, moist, of 3 or more and a chroma of 2 or less if there are redox concentrations; or

(2) A chroma of 1 or less;

2. Do not, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, have any of the following:

a. 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

b. 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

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and either:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; or

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more;

3. Do not have a mollic epipedon, or an Ap horizon that meets all the requirements for a mollic or umbric epipedon except thickness, or materials between the mineral soil surface and a depth of 18 cm that meet these requirements after mixing;

4. 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; and

5. Do not have either:

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.

Description of subgroups

**Typic Epiaqualfs.**–The central concept, or typic subgroup, of Epiaqualfs is that of soils which (1) have low chroma dominant between the A or Ap horizon and a depth of 75 cm or more from the mineral soil surface, (2) have a lighter color value, moist, in the plow layer, or in comparable horizons if undisturbed, than in a mollic epipedon, and (3) do not have a thick sandy epipedon. In addition, they have no surface mantle affected by pyroclastic materials, no cracks and slickensides or wedge-shaped aggregates, nor a linear extensibility of less than 6 cm to a depth of 100 cm from the mineral soil surface.

A chroma higher than that of a Typic Epiaqualf is characteristic of soils that are saturated for shorter periods and serves to define intergrades to freely drained soils. Color values, moist, of 2 or 3 in a plow layer indicate a higher-than-normal content of organic matter and form the basis for defining intergrades to other great groups. A thick layer of sand or loamy sand, starting at the mineral soil surface, is the basis for defining the arenic subgroup. Pyroclastic materials are considered abnormal and define the aquandic subgroup. A clayey argillic horizon with cracks and slickensides or wedge-shaped aggregates in or below the argillic horizon is a property shared with Vertisols and serves to define intergrades to that order.

**Aeric Epiaqualfs.**–These soils have a chroma too high for the typic subgroup but are otherwise like Typic Epiaqualfs in their defined and most

other properties. The high chroma commonly occurs in the matrix of the peds of the argillic horizon. These soils are extensive in the north-central part of the United States that was covered by Wisconsinan glaciers and their valley trains. Nearly all are cultivated.

**Aeric Umbric Epiaqualfs**.--Soils in this subgroup are like Typic Epiaqualfs except they have (1) in some horizon between the A or Ap horizon and a depth of 75 cm from the mineral soil surface, a chroma in more than 40 percent of the matrix that is too high for the typic subgroup; and (2) either an Ap horizon with a color value, moist, of 3 or less and a color value, dry, of 5 or less or, if undisturbed, materials between the mineral soil surface and a depth of 18 cm which have these color values after mixing; and (3) a base saturation of less than 50 percent (by $NH_4OAc$) in the epipedon. In the United States, these soils occur on the lower Atlantic Coastal Plain, but they are not extensive. Most of them are forested.

**Aquandic Epiaqualfs**.--These soils are like Typic Epiaqualfs except they 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, and either:

   a. In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; or

   b. In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

These soils normally have a thin mantle of volcanic ash at the surface or have formed in alluvium that is rich in pyroclastic materials. They are rare in the United States and are known to occur only in the Pacific Northwest. They have gentle slopes, and most of them have formed in alluvium with an appreciable component of volcanic ash or pumice. Most of these soils are cultivated.

**Arenic Epiaqualfs**.--These soils 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 to 100 cm. The upper part of the argillic horizon or the lower part of the epipedon is permitted to have a chroma in 50 percent or more of the matrix that is too high for Typic Epiaqualfs. These soils may also have either an Ap horizon with a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample) or, if undisturbed, materials between the soil surface and a depth of 18 cm which have these colors after mixing. These soils are otherwise like those of the typic subgroup in their defined properties, but they mostly have a sandier argillic horizon than the Typic Epiaqualfs. In the United States they occur principally in Florida, where they are extensive. Many have been cleared and drained and are being cultivated.

**Grossarenic Epiaqualfs**.--The sandy layer is thicker in these soils than in Arenic Epiaqualfs.

**Mollic Epiaqualfs**.--Soils in this subgroup have a mollic epipedon or a surface horizon that meets all requirements for a mollic epipedon except thickness (plate 10B), but have a base saturation of less than 50 percent (by $NH_4OAc$) in some part of the argillic horizon. In the United States, the dark-colored surface horizon of these soils generally is too thin to be recognized as a mollic epipedon. These soils are intergrades between Epiaqualfs and Argiaquolls. They are extensive in the glaciated parts of the United States. Most of them have been cleared and drained and are cultivated.

**Udollic Epiaqualfs**.--These soils are like Typic Epiaqualfs except they have (1) in 50 percent or more of the matrix of some horizon between the A or Ap horizon and a depth of 75 cm from the mineral soil surface, a chroma too high for Typic Epiaqualfs, and (2) either an Ap horizon with a color value, moist, of 3 or less and a color value, dry, of 5 or less, or materials between the mineral soil surface and a depth of 18 cm which have these color values and other properties of a mollic epipedon after mixing. A mollic epipedon is permitted in this subgroup if the base saturation in some part of the argillic horizon is less than 50 percent (by $NH_4OAc$).

Udollic Epiaqualfs are widely scattered in the glaciated parts of the United States, particularly in the north-central states. Most of them have been cleared and drained and are cultivated.

**Umbric Epiaqualfs**.--Soils in this subgroup are like Typic Epiaqualfs except they have (1) either an Ap horizon with a color value, moist, of 3 or less and a color value, dry, of 5 or less or, if undisturbed, materials between the mineral soil surface and a depth of 18 cm which have these color values after mixing, and (2) a base saturation of less than 50 percent (by $NH_4OAc$) in the epipedon. In the United States, these soils occur only in the lower Atlantic Coastal Plain, and they are not extensive. Most of them are forested.

**Vertic Epiaqualfs**.--These soils are like Typic Epiaqualfs except they have one or both of the following characteristics:

1. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in

most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; or

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

In addition, because Vertisols can have a mollic epipedon, the soils in this subgroup may have either an Ap horizon with a color value, moist, of 3 or less and a color value, dry, of 5 or less or, if undisturbed, materials between the mineral soil surface and a depth of 18 cm which have these color values after mixing. A mollic epipedon is permitted if some subhorizon of the argillic horizon has a base saturation of less than 50 percent (by $NH_4OAc$). Vertic Epiaqualfs may also have a somewhat higher chroma than Typic Epiaqualfs."

Page 112, column 1, Description of a Typic Fragiaqualf. Change "mottles" to "redoximorphic features".

NSTH 615.62, p. 615-210, column 2 (*Soil Taxonomy* p. 112). Change item IADA to read as follows:

"IADA. Fragiaqualfs that have, between the A or Ap horizon and a fragipan, a horizon with 50 percent or more chroma of 3 or more if the hue is 10YR or redder, or of 4 or more if the hue is 2.5Y or yellower.

**Aeric Fragiaqualfs"**

NSTH 615.62, p. 615-210, column 2 (*Soil Taxonomy* p. 112), Definition of Typic Fragiaqualfs. Change item 1 to read as follows:

"1. Do not, between the A or Ap horizon and a fragipan, have a horizon with 50 percent or more chroma of 3 or more if the hue is 10YR or redder, or of 4 or more if the hue is 2.5Y or yellower;"

Page 113, column 2 (Description of a Typic Glossaqualf). Change "mottles" in the A horizon to "redox depletions".

Page 113, column 2 (Description of a Typic Glossaqualf). Change "mottles" in the Eg, B/Eg, Btg, BCg, and C horizons to "redox concentrations".

NSTH 615.62, p. 615-211, column 1 (*Soil Taxonomy* p. 113). Change item IAFC to read as follows:

"IAFC. Other Glossaqualfs that have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, colors as follows: *either*

1. A hue of 7.5YR or redder in 50 percent or more of the matrix, *and*

a. If peds are present, either 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*

b. If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*

2. In 50 percent or more of the matrix, a hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more; *or*

b. A chroma of 2 or more if there are no redox concentrations.

**Aeric Glossaqualfs"**

NSTH 615.62, p. 615-211, column 1, Definition of Typic Glossaqualfs (*Soil Taxonomy* p. 113). Change item 1 to read as follows:

"1. Do not, in any horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, have colors as follows: either

a. A hue of 7.5YR or redder in 50 percent or more of the matrix, and

(1) If peds are present, either 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) A color value, moist, of 3 or more and a chroma of 2 or less if there are redox concentrations; or

(2) A chroma of 1 or less;"

NSTH 615.62, pp. 615-211/212, column 2. Change items IAED and IAEE to read as follows:

"IAED. Other Kandiaqualfs that have:

1. An Ap horizon with a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample), or materials between the soil surface and a depth of 18 cm which have these color values 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, colors as follows: either

a. A hue of 7.5YR or redder in 50 percent or more of the matrix, *and*

(1) If peds are present, either 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 Umbric Kandiaqualfs**

IAEE. Other Kandiaqualfs that have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, colors as follows: *either*

1. A hue of 7.5YR or redder in 50 percent or more of the matrix, *and*

a. If peds are present, either 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*

b. If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix, *or*

2. In 50 percent or more of the matrix, a hue of 10YR or yellower; *and either*

a. Both a color value, moist, and chroma of 3 or more; *or*

b. A chroma of 2 or more if there are no redox concentrations.

**Aeric Kandiaqualfs"**

NSTH 615.62, p. 615-212, column 1, Definition of Typic Kandiaqualfs. Change item 1 to read as follows:

"1. Do not, in any horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, have colors as follows: either

a. A hue of 7.5YR or redder in 50 percent or more of the matrix, and

(1) If peds are present, either 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) A color value, moist, of 3 or more and a chroma of 2 or less if there are redox concentrations; or

(2) A chroma of 1 or less;"

Pages 115 to 117, Ochraqualfs (NSTH 615.62, pp. 615-212 to 615-214). Delete whole section on Ochraqualfs.

Page 118, column 2, Description of a Typic Umbraqualf, Btg1. Change "mottled with yellowish brown (10YR 5/6) and yellowish red (5YR 4/6)" to "yellowish brown (10YR 5/6) and yellowish red (5YR 4/6) redox concentrations".

Page 118, column 2, Description of a Typic Umbraqualf, Btg2. Change "coarsely mottled with dark yellowish brown (10YR 4/4)" to "coarse, dark yellowish brown (10YR 4/4) redox concentrations".

Page 119, column 1, Definition. Change item 1 to read as follows:

"1. Do not have both aquic conditions (or artificial drainage) and colors defined for Aqualfs;"

NSTH 615.62, p. 615-216, column 1 (*Soil Taxonomy* p. 120). Change item IBDE to read as follows:

"IBDE. Other Cryoboralfs that have, 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 Cryoboralfs"**

NSTH 615.62, p. 615-216, column 1 (*Soil Taxonomy* p. 120). Change items IBDF-IBDI to IBDG-IBDJ and add new item IBDF to read as follows:

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

**Oxyaquic Cryoboralfs"**

NSTH 615.62, p. 615-216, column 2, Definition of Typic Cryoboralfs (*Soil Taxonomy* p. 120). Change item 6 to read as follows:

"6. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage); and"

NSTH 615.62, p. 615-216, column 2, Definition of Typic Cryoboralfs (*Soil Taxonomy* p. 120). Add item 7 to read as follows:

"7. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or longer in 6 or more out of 10 years."

Page 120, column 2 (Typic Cryoboralfs), lines 4 and 5. Change "Mottles of low chroma" to "Redox depletions".

Page 120, column 2, Aquic Cryoboralfs. Change "mottles" (three times) to "redox depletions".

NSTH 615.62, p. 615-217, Eutroboralfs (*Soil Taxonomy* p. 121). Change items IBED, IBEE, and IBEF to read as follows:

"IBED. Other Eutroboralfs that have:

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

2. 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 to 100 cm.

**Aquic Arenic Eutroboralfs**

IBEE. Other Eutroboralfs which have:

1. A glossic horizon; *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 deeper than 50 cm from the mineral soil surface.

**Glossaquic Eutroboralfs**

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

1. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface, *or*

2. Within 75 cm of the mineral soil surface, if the upper boundary of the argillic horizon is deeper than 50 cm from the mineral soil surface.

**Aquic Eutroboralfs**"

NSTH 615.62, p. 615-217, Eutroboralfs (*Soil Taxonomy* p. 121). Change items IBEG-IBEK to IBEH-IBEL and add new item IBEG to read as follows:

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

**Oxyaquic Eutroboralfs**"

NSTH 615.62, p. 615-217, Definition of Typic Eutroboralfs (*Soil Taxonomy* p. 121). Change item 1 to read as follows:

"1. Do not have redox depletions with a chroma of 2 or less in layers that also have aquic conditions (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 deeper than 50 cm from the mineral soil surface;"

NSTH 615.62, p. 615-217, Definition of Typic Eutroboralfs (*Soil Taxonomy* p. 121). Renumber items 2-7 as 3-8 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 121, column 2, Description of subgroups, Typic Eutroboralfs, line 10. Change "mottles of low chroma" to "redox depletions".

Page 122, column 1, Aquic, Aquic Arenic, and Glossaquic Eutroboralfs (refer to NSTH 615.46, p. 615-159). Change "mottles" to "redox depletions".

NSTH 615.62, p. 615-218, Fragiboralfs (*Soil Taxonomy* p. 122). Change item IBBC to read as follows:

"IBBC. Other Fragiboralfs that have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Fragiboralfs**"

NSTH 615.62, p. 615-218, Fragiboralfs (*Soil Taxonomy* p. 122). Change item IBBD to IBBE and add new item IBBD to read as follows:

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

**Oxyaquic Fragiboralfs**"

NSTH 615.62, p. 615-218, Definition of Typic Fragiboralfs (*Soil Taxonomy* p. 122). Change item 1 to read as follows:

"1. Do not, in any subhorizon within the upper 25 cm of the argillic horizon, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-218, Definition of Typic Fragiboralfs (*Soil Taxonomy* p. 122). Renumber item 2 as 3 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years; and"

NSTH 615.62, p. 615-218, Glossoboralfs (*Soil Taxonomy* p. 123). Change item IBFD to read as follows:

"IBFD. Other Glossoboralfs that have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).
**Aquic Glossoboralfs"**

NSTH 615.62, p. 615-219, Glossoboralfs (*Soil Taxonomy* p. 123). Change items IBFE-IBFG to IBFF-IBFH and add new item IBFE to read as follows:

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

NSTH 615.62, pp. 615-218/219, Definition of Typic Glossoboralfs (*Soil Taxonomy* p. 123). Change item 1 to read as follows:

"1. Do not, in any subhorizon within the upper 25 cm of the argillic horizon, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-219, Definition of Typic Glossoboralfs (*Soil Taxonomy* p. 123). Renumber items 2-5 as 3-6 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 123, column 2, Description of subgroups, Typic Glossoboralfs, 2nd paragraph, first line. Change "mottles" to "redox depletions".

Page 123 and 124, Description of subgroups, Aquic Glossoboralfs. Change "mottles" (twice) to "redox depletions".

NSTH 615.62, p. 615-219, Paleboralfs (*Soil Taxonomy* p. 124). Change item IBAC to read as follows:

"IBAC. Other Paleboralfs that have, 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 Paleboralfs"**

NSTH 615.62, p. 615-219, Paleboralfs (*Soil Taxonomy* p. 124). Change items IBAD-IBAF to IBAE-IBAG and add new item IBAD to read as follows:

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

NSTH 615.62, p. 615-220, Definition of Typic Paleboralfs (*Soil Taxonomy* p. 124). Change item 3 to read as follows:

"3. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-220, Definition of Typic Paleboralfs (*Soil Taxonomy* p. 124). Renumber item 4 as 5 and add new item 4 to read as follows:

"4. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years; and"

Page 125, column 2, Definition of Udalfs. Change item 3.a to read as follows:

"a. Aquic conditions for some time in most years within 50 cm of the mineral soil surface; or"

Page 125, column 2, Key to great groups, item IEI.3.c (refer to NSTH 615.38(a) and 615.60). Change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-220, Ferrudalfs (*Soil Taxonomy* p. 126). Change item IECA to read as follows:

"IECA. Ferrudalfs that have, in one or more horizons within 60 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).
**Aquic Ferrudalfs"**

NSTH 615.62, p. 615-220, Definition of Typic Ferrudalfs (*Soil Taxonomy* p. 126). Change definition to read as follows:

"Typic Ferrudalfs are the Ferrudalfs that do not, in any horizon within 60 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage)."

Page 126, column 2, Fragiudalfs. Change first sentence to read as follows:

"Fragiudalfs (plate 6A) are the Udalfs which normally have a brown argillic or cambic horizon above a fragipan with redoximorphic features that has its upper boundary 50 to 100 cm below the mineral soil surface."

NSTH 615.62, pp. 615-220/221, Fragiudalfs (*Soil Taxonomy* p. 126). Change items IEFC-IEFF to read as follows:

"IEFC. Other Fragiudalfs that have:

1. Directly above the fragipan, a layer 5 cm or more thick which:

a. Has, on faces of primary peds, clay depletions of clean silt and sand that constitute 1 percent or more (by volume) of the layer; *or*

b. Is an eluvial horizon (E) and has 3 or more percent (absolute) less clay than both the overlying and underlying horizons; *and*

2. In one or more horizons within 40 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).

**Glossaquic Fragiudalfs**

IEFD. Other Fragiudalfs which:

1. Do not, above the fragipan, have an argillic horizon with clay films on both vertical and horizontal faces of any peds; *and*

2. Have, in one or more horizons within 40 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).

**Aqueptic Fragiudalfs**

IEFE. Other Fragiudalfs that have:

1. In one or more horizons within 40 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. Within a vertical distance of 7.5 cm at the top of the argillic horizon, a clay increase of more than 15 percent (absolute) in the fine-earth fraction.

**Albaquic Fragiudalfs**

IEFF. Other Fragiudalfs that have, in one or more horizons within 40 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 Fragiudalfs**"

NSTH 615.62, p. 615-221, Fragiudalfs (*Soil Taxonomy* p. 126). Change items IEFG-IEFI to IEFH-IEFJ and add new item IEFG to read as follows:

"IEFG. Other Fragiudalfs that are saturated with water, in one or more layers above the fragipan, for 1 month or more per year in 6 or more out of 10 years.

**Oxyaquic Fragiudalfs**"

NSTH 615.62, p. 615-221, Definition of Typic Fragiudalfs (*Soil Taxonomy* p. 126). Change item 2.a to read as follows:

"a. Has, on faces of primary peds, clay depletions of clean silt and sand that constitute 1 percent or more (by volume) of the layer; or"

NSTH 615.62, p. 615-221, Definition of Typic Fragiudalfs (*Soil Taxonomy* p. 126). Change item 4 to read as follows:

"4. Do not, in any horizon within 40 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-221, Definition of Typic Fragiudalfs (*Soil Taxonomy* p. 126). Renumber item 5 as 6 and add new item 5 to read as follows:

"5. Are not saturated with water in any layer above the fragipan for 1 month or more per year in 6 or more out of 10 years; and"

Page 127, column 1, Description of subgroups, Typic Fragiudalfs, second paragraph. Change third and fourth sentences to read as follows:

"The perched water table is a probable cause of the very common albic materials and bleached clay depletions just above the fragipan. Soils that have these features and also redox depletions of low chroma at a shallow depth in the soil, normally along with redox concentrations of high chroma or of reddish hue, are considered to be intergrades toward Aqualfs."

Page 127, column 2, Description of subgroups, Albaquic Fragiudalfs, line 2. Change "mottles" to "redox depletions".

Page 127, column 2, Description of subgroups, Aqueptic Fragiudalfs, sentence 2. Change "skeletans" to "clay depletions".

Page 127, column 2, Description of subgroups, Aqueptic Fragiudalfs, line 13. Change "mottles" to "redox depletions".

Page 127, column 2, Description of subgroups, Aquic Fragiudalfs. Change first sentence to read as follows:

"These soils are like Typic Fragiudalfs except they have, in one or more horizons within 40 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)."

Page 127, column 2, Description of subgroups, Glossaquic Fragiudalfs. Change first two sentences to read as follows:

"These soils have a brownish horizon which (1) does not have clay films but has clay depletions on primary faces of peds and (2) is separated from the fragipan by an eluvial horizon with thick clay depletions and with a clay content 3 percent or more (absolute) lower than that of the overlying and underlying horizons. In addition, these soils have redox depletions with a chroma of 2 or less within 40 cm of the mineral soil surface."

Page 128, column 1, Description of subgroups, Mollic Fragiudalfs, second sentence. Change "mottles" to "redox depletions".

NSTH 615.62, p. 615-221, Fraglossudalfs (*Soil Taxonomy* p. 128). Change item IEEA to read as follows:

"IEEA. Fraglossudalfs that have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Fraglossudalfs**"

NSTH 615.62, p. 615-221, Fraglossudalfs (*Soil Taxonomy* p. 128). Change item IEEB to IEEC and add new item IEEB to read as follows:

"IEEB. Other Fraglossudalfs that are saturated with water, in one or more layers above the fragipan, for 1 month or more per year in 6 or more out of 10 years.

**Oxyaquic Fraglossudalfs"**

NSTH 615.62, p. 615-221, Definition of Typic Fraglossudalfs (*Soil Taxonomy* p. 128). Change definition to read as follows:

"Typic Fraglossudalfs are the Fraglossudalfs that:

1. Do not, in any subhorizon within the upper 25 cm of the argillic horizon, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage); and

2. Are not saturated with water in any layer above the fragipan for 1 month or more per year in 6 or more out of 10 years."

NSTH 615.62, p. 615-221, Glossudalfs (*Soil Taxonomy* p. 129). Change items IEDB to IEDE and IEDC-IEDE to IEDG-IEDI. Add items IEDB, IEDC, IEDD, and IEDF; and change item IEDE to read as follows:

"IEDB. Other Glossudalfs which have *both*:

1. In one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. 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:

a. 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*

b. 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*

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and *either*:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

**Aquandic Glossudalfs**

IEDC. Other Glossudalfs 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 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.

**Andic Glossudalfs**

IEDD. Other Glossudalfs 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, and *either*:

a. In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

b. In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

**Vitrandic Glossudalfs**

IEDE. Other Glossudalfs that have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Glossudalfs"**

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

**Oxyaquic Glossudalfs"**

NSTH 615.62, p. 615-221, Definition of Typic Glossudalfs (*Soil Taxonomy* p. 129). Change item 1 to read as follows:

"1. Do not, in any subhorizon within the upper 25 cm of the argillic horizon, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-221, Definition of Typic Glossudalfs (*Soil Taxonomy* p. 129). Renumber items 2-4 as 3-5 and add new items 2 and 6 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;

6. Do not, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, have any of the following:

a. 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

b. 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

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and either:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; or

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

Page 129, column 1, Description of subgroups, Aquic Glossudalfs. Change first sentence to read as follows:

"These soils have redox depletions of low chroma and also have aquic conditions for some time in most years at a shallow depth."

Page 129, column 1, Description of subgroups, Fragic Glossudalfs, line 6. Change "mottles" to "redoximorphic features.

Page 129, column 2, Hapludalfs, Definition, item 4.c. Change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-222, Hapludalfs (*Soil Taxonomy* p. 129). Change items IEKA, IEKF, and IEKH to read as follows:

"IEKA. Hapludalfs that have *both*:

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

2. In one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Hapludalfs**

IEKF. Other Hapludalfs which have *both*:

1. 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 deeper than 50 cm from the mineral soil surface; *and*

2. An argillic horizon that *either* has a texture of loamy fine sand or coarser *or* is discontinuous vertically within its upper 20 cm.

**Psammaquentic Hapludalfs"**

IEKH. Other Hapludalfs that have *both*:

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

2. 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.

**Aquic Arenic Hapludalfs"**

NSTH 615.62, pp. 615-223/224, Hapludalfs (*Soil Taxonomy* p. 129). Change items IEKJ-IEKO to IEKK-IEKP and old IEKP to IEKR, IEKQ to IEKS, IEKR to IEKT, IEKS to IEKU, IEKT to IEKV; add new items IEKJ and IEKQ and change other items identified below to read as follows:

"IEKJ. Other Hapludalfs that have anthraquic conditions.

**Anthraquic Hapludalfs**

IEKK. Other Hapludalfs which have:

1. An abrupt textural change; *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 deeper than 50 cm from the mineral soil surface; *and*

3. A base saturation (by sum of cations) of less than 60 percent at a depth of 125 cm from the top of the argillic horizon, or at a depth of 180 cm from the mineral soil surface, or directly above a lithic or paralithic contact, whichever is shallowest.

**Albaquultic Hapludalfs**

IEKL. Other Hapludalfs which have *both*:

1. An abrupt textural change; *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 deeper than 50 cm from the mineral soil surface.

**Albaquic Hapludalfs**

IEKM. Other Hapludalfs which have:

1. Interfingering of albic materials, and albic materials surrounding some peds, in the upper part of the argillic horizon; *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 deeper than 50 cm from the mineral soil surface.

**Glossaquic Hapludalfs**

IEKN. Other Hapludalfs which have *both*:

1. 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 deeper than 50 cm from the mineral soil surface; *and*

2. A base saturation (by sum of cations) of less than 60 percent at a depth of 125 cm from the top of the argillic horizon, or at a depth of 180 cm from the mineral soil surface, or directly above a lithic or paralithic contact, whichever is shallowest.

**Aquultic Hapludalfs**

IEKO. Other Hapludalfs 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 sample), or materials between the soil surface and a depth of 18 cm which have these color values after mixing; *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 deeper than 50 cm from the mineral soil surface.

**Aquollic Hapludalfs**

IEKP. Other Hapludalfs which have redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

1. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface, *or*

2. Within 75 cm of the mineral soil surface, if the upper boundary of the argillic horizon is deeper than 50 cm from the mineral soil surface.

**Aquic Hapludalfs**

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

**Oxyaquic Hapludalfs"**

NSTH 615.62, p. 224, Definition of Typic Hapludalfs (*Soil Taxonomy* p. 129). Change items 1 and 3 to read as follows:

"1. Do not have an abrupt textural change if there are redoximorphic features in the upper 25 cm of the argillic horizon;

3. Do not have 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 deeper than 50 cm from the mineral soil surface;"

NSTH 615,61, p. 615-224, Definition of Typic Hapludalfs (*Soil Taxonomy* p. 129). Renumber items 4-11 as 6-13 and add new items 4-5 to read as follows:

"4. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;

5. Do not have anthraquic conditions;"

Page 130, column 2, Description of subgroups, Typic Hapludalfs, 2nd paragraph. Change "mottles" to "redox concentrations".

Page 130, column 2, Description of subgroups, Typic Hapludalfs. Change third paragraph to read as follows:

"If the upper 25 cm of the argillic horizon have aquic conditions for some time in most years (or artificial drainage) and redox depletions with a chroma of 2 or less, the soil is excluded from Typic Hapludalfs because those properties are shared with Aqualfs."

Page 131, column 1, Description of subgroups, Albaquic Hapludalfs. Change second sentence to read as follows:

"They also have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage)."

Page 131, column 1, Description of subgroups, Albaquultic Hapludalfs. Change second sentence to read as follows:

"They also have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage)."

Page 131, column 2, Description of subgroups, Aquic Hapludalfs. Change first sentence to read as follows:

"These soils are like Typic Hapludalfs except they have redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) either within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface, or within 75 cm of the mineral soil surface, if the upper boundary of the argillic horizon is deeper than 50 cm."

Page 131, column 2, Description of subgroups, Aquic Arenic Hapludalfs. Change first sentence to read as follows:

"Soils in this subgroup have, 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)."

Page 131, column 2, Description of subgroups, Aquic Lithic Hapludalfs. Change first sentence to read as follows:

"These soils have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage)."

Page 131, column 2, Description of subgroups, Aquollic Hapludalfs. Change first sentence to read as follows:

"Soils in this subgroup have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage)."

Page 131, column 2, Description of subgroups, Aquultic Hapludalfs. Change first sentence to read as follows:

"These soils have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage)."

Page 132, column 1, Description of subgroups, Glossaquic Hapludalfs. Change first sentence to read as follows:

"These soils have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage)."

Page 132, column 1, Description of subgroups, Psammaquentic Hapludalfs. Change second and third sentences to read as follows:

"They also have redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) either within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface, or within 75 cm of the mineral soil surface, if the upper boundary of the argillic horizon is deeper than 50 cm."

NSTH 615.62, p. 615-225, Kandiudalfs. Change items IEGA and IEGB to read as follows:

"IEGA. Kandiudalfs that have:

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

2. Five percent or more (by volume) plinthite in one or more horizons within 150 cm of the mineral soil surface.

**Plinthaquic Kandiudalfs**

IEGB. Other Kandiudalfs that have, 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 Kandiudalfs**"

NSTH 615.62, p. 615-225, Kandiudalfs. Change items IEGC-IEGJ to IEGD-IEGK and add new item IEGC to read as follows:

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

**Oxyaquic Kandiudalfs**"

NSTH 615.62, p. 615-225, Definition of Typic Kandiudalfs. Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-225, Definition of Typic Kandiudalfs. Renumber items 2-5 as 3-6 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

NSTH 615.62. p. 615-225, Kanhapludalfs. Change item IEHB to read as follows:

"IEHB. Other Kanhapludalfs that have, 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 Kanhapludalfs"**

NSTH 615.62. p. 615-225, Kanhapludalfs. Change items IEHC and IEHD to IEHD and IEHE, respectively, and add new item IEHC to read as follows:

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

**Oxyaquic Kanhapludalfs"**

NSTH 615.62, p. 615-226, Definition of Typic Kanhapludalfs. Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-226, Definition of Typic Kanhapludalfs. Renumber items 2-3 as 3-4 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 133, column 1, Natrudalfs, line 10. Change "is commonly mottled" to "commonly has redoximorphic features".

NSTH 615.62, p. 615-226, Natrudalfs (*Soil Taxonomy* p. 133). Delete item IEBD and change IEBE to IEBD.

NSTH 615.62, p. 615-226, Definition of Typic Natrudalfs (*Soil Taxonomy* p. 133). Delete item 1 and renumber items 2-4 as 1-3.

Page 134, column 1, Definition, item 4.c (refer to NSTH 615.38(a)). Change "mottles" to "redox concentrations".

NSTH 615.62, pp. 615-226/227, Paleudalfs (*Soil Taxonomy* p. 134). Change items IEIB-IEIE to IEIC-IEIF, and old IEIF to IEIH, IEIG to IEII, IEIH to IEIJ, IEII to IEIK, IEIJ to IEIL, IEIK to IEIM, IEIL to IEIN, IEIM to IEIO, IEIN to IEIP, and IEIO to IEIQ; add new items IEIB and IEIG and change items identified below to read as follows:

"IEIB. Other Paleudalfs that have anthraquic conditions.

**Anthraquic Paleudalfs**

IEIC. Other Paleudalfs that have:

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

2. Five percent or more (by volume) plinthite in one or more horizons within 150 cm of the mineral soil surface.

**Plinthaquic Paleudalfs**

IEID. Other Paleudalfs which have:

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

2. In the upper part of the argillic horizon, one or more subhorizons that have 5 percent or more (by volume) clay depletions with a chroma of 2 or less.

**Glossaquic Paleudalfs**

IEIE. Other Paleudalfs that have:

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

2. An increase of 15 percent or more (absolute) clay within a vertical distance of 2.5 cm at the upper boundary of the argillic horizon.

**Albaquic Paleudalfs**

IEIF. Other Paleudalfs that have, 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 Paleudalfs**

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

**Oxyaquic Paleudalfs"**

NSTH 615.62, p. 615-227, Definition of Typic Paleudalfs (*Soil Taxonomy* p. 134). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage), and do not have an increase of 15 percent or more (absolute) clay within a vertical distance of 2.5 cm at the upper boundary of the argillic horizon;"

NSTH 615.62, p. 615-228, Definition of Typic Paleudalfs (*Soil Taxonomy* p. 134). Renumber items 2-9 as 4-11 and add new items 2 and 3 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;

3. Do not have anthraquic conditions;"

NSTH 615.62, p. 615-228, Definition of Typic Paleudalfs (*Soil Taxonomy* p. 134). Change "skeletans" in renumbered item 10 to "clay depletions".

Page 135, column 1, line 3 (Description of subgroups, Typic Paleudalfs). Change "skeletans" to "clay depletions".

Page 135, column 1, first full paragraph (Description of subgroups, Typic Paleudalfs). Change first sentence to read as follows:

"Soils with shallow redox depletions of low chroma in horizons that also have aquic conditions for some time in most years (or artificial drainage) are excluded from Typic Paleudalfs because those properties are shared with Aqualfs."

Page 135, column 1, first full paragraph (Description of subgroups, Typic Paleudalfs), last sentence. Change "skeletans" to "clay depletions".

Page 135, column 1, Albaquic Paleudalfs. Change first sentence to read as follows:

"Soils in this subgroup are like Typic Paleudalfs except they have, 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)."

Page 135, column 1, Aquic Paleudalfs. Change first sentence to read as follows:

"Soils in this subgroup are like Typic Paleudalfs except they have, 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)."

Page 135, column 1, Glossaquic Paleudalfs. Change first sentence to read as follows:

"Soils in this subgroup are like Typic Paleudalfs except they have, 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)."

Page 135, column 1, Plinthaquic Paleudalfs. Change second sentence to read as follows:

"The soils have, 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)."

Page 137, column 2, Definition. Change item 2 to read as follows:

"2. Have chroma too high for Aqualfs, or do not have aquic conditions for some time in most years (or artificial drainage) within 50 cm of the mineral soil surface; and"

Page 138, column 1, Key to great groups, item ICF.2.b.(3), first line (Refer to NSTH 615.38(a) and 615.60). Change "mottles" to "redox concentrations".

Page 138, column 2, Definition, item 6.c, first line (refer to NSTH 615.71). Change "mottles" to "redox concentrations".

NSTH 615.62, pp. 615-228/229, Haplustalfs (*Soil Taxonomy* p. 139). Change items ICHD, ICHE, and ICHF to read as follows:

"ICHD. Other Haplustalfs that have:

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

2. 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 to 100 cm.

**Aquic Arenic Haplustalfs**

ICHE. Other Haplustalfs that have:

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

2. An argillic horizon that has a base saturation (by sum of cations) of less than 75 percent throughout.

**Aquultic Haplustalfs**

ICHF. Other Haplustalfs that have, 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 Haplustalfs**"

NSTH 615.62, pp. 615-229, Haplustalfs (*Soil Taxonomy* p. 139). Change items ICHG-ICHN to ICHH-ICHO and add new item ICHG to read as follows:

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

**Oxyaquic Haplustalfs"**

NSTH 615.62, p. 615-229, Definition of Typic Haplustalfs (*Soil Taxonomy* p. 139). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-230, Definition of Typic Haplustalfs (*Soil Taxonomy* p. 139). Renumber items 2-9 as 3-10 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 139, column 2, Description of subgroups, Typic Haplustalfs, 2nd paragraph. Change first sentence to read as follows:

"Soils that have redox depletions of low chroma near the surface in one or more horizons that also have aquic conditions for some time in most years (or artificial drainage) are excluded from Typic Haplustalfs because those properties are shared with Aqualfs."

Page 140, column 1, Aquic Haplustalfs. Change first sentence to read as follows:

"These soils are like Typic Haplustalfs except they have redox depletions of low chroma within 75 cm of the mineral soil surface that are caused by periods of wetness."

Page 140, column 1, Aquic Arenic Haplustalfs. Change first sentence to read as follows:

"These soils have, 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)."

NSTH 615.62, p. 615-230, Kandiustalfs. Change items ICDB and ICDD to read as follows:

"ICDB. Other Kandiustalfs that have:

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

2. 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 to 100 cm.

**Aquic Arenic Kandiustalfs**

ICDD. Other Kandiustalfs that have, 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 Kandiustalfs"**

NSTH 615.62, p. 615-231, Definition of Typic Kandiustalfs. Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-231, Kanhaplustalfs. Change item ICEB to read as follows:

"ICEB. Other Kanhaplustalfs that have, 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 Kanhaplustalfs"**

NSTH 615.62, p. 615-231, Definition of Typic Kanhaplustalfs. Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

Page 141, column 2, C2 horizon, line 3. Change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-232, Natrustalfs (*Soil Taxonomy* p. 141). Change items ICCB and ICCC to read as follows:

"ICCB. Other Natrustalfs that have:

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

2. 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 to 100 cm.

**Aquic Arenic Natrustalfs**

ICCC. Other Natrustalfs that have, 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 Natrustalfs"**

NSTH 615.62, p. 615-232, Definition of Typic Natrustalfs (*Soil Taxonomy* p. 141). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

Page 142, column 1. Change lines 3-7 to read as follows:

"Soils that have shallow redox depletions of low chroma in horizons that also have aquic conditions for some time in most years (or artificial drainage) are excluded from the typic subgroup because those properties are shared with Aqualfs."

Page 142, column 1, Aquic Natrustalfs. Change first sentence to read as follows:

"These soils are like Typic Natrustalfs except they have, 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)."

Page 142, column 1, Aquic Arenic Natrustalfs (refer to NSTH 615.51). Change first sentence to read as follows:

"These soils have, 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)."

Page 142, column 2, Definition (Paleustalfs), item 3.b.(2)(c). Change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-233, Paleustalfs (*Soil Taxonomy* p. 142). Change items ICFE and ICFG to read as follows:

"ICFE. Other Paleustalfs that have:

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

2. 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 to 100 cm.

**Aquic Arenic Paleustalfs**

ICFG. Other Paleustalfs that have, 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 Paleustalfs**"

NSTH 615.62, p. 615-233, Paleustalfs (*Soil Taxonomy* p. 142). Change items ICFH-ICFQ to ICFI-ICFR and add new item ICFH to read as follows:

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

**Oxyaquic Paleustalfs**"

NSTH 615.62, p. 615-234, Definition of Typic Paleustalfs (*Soil Taxonomy* p. 142). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-234, Definition of Typic Paleustalfs (*Soil Taxonomy* p. 142). Renumber items 2-11 as 3-12 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 143, column 2, Description of subgroups, Typic Paleustalfs, 2nd paragraph. Change first sentence to read as follows:

"Soils that have shallow redox depletions of low chroma in horizons that also have aquic conditions for some time in most years (or artificial drainage) are excluded from Typic Paleustalfs because those properties are shared with Aqualfs."

Page 144, column 1, Aquic Paleustalfs. Change first two sentences to read as follows:

"These soils are like Typic Paleustalfs except they have, 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). Skeletans with low chroma should not be mistaken for redox depletions of low chroma, which are caused by wetness."

Page 144, column 1, Aquic Paleustalfs. Change first sentence to read as follows:

"Soils in this subgroup have, 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)."

Page 145, column 1, Udertic Paleustalfs, line 7. Change "mottles" to "redox depletions".

Page 145, column 2, Rhodustalfs, Definition (refer to NSTH 615.71). Change item 4.b to read as follows:

"b. There are common coarse redox concentrations with a chroma of 6 or more; and"

Page 146, column 2, Xeralfs, Definition. Change 3 to read as follows:

"3. Have chroma too high for Aqualfs, or do not have aquic conditions for some time in most years (or artificial drainage) within 50 cm of the mineral soil surface; and".

Page 147, column 1, Key to great groups, item IDF (refer to NSTH p. 615-179). In item (2) change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-236, Durixeralfs (*Soil Taxonomy* p. 147). Change item IDAB to read as follows:

"IDAB. Other Durixeralfs that have, in one or more subhorizons within the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Durixeralfs"**

NSTH 615.62, p. 615-236, Definition of Typic Durixeralfs (*Soil Taxonomy* p. 147). Change item 2 to read as follows:

"2. Do not, in any subhorizon within the argillic horizon, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

Page 147, column 2, Description of subgroups, Typic Durixeralfs, line 14. Change "mottles of low chroma" to "redox depletions of low chroma, and aquic conditions for some time in most years (or artificial drainage)".

Page 148, column 1, Natric Durixeralfs, line 3. Change "mottles" to "redox depletions".

NSTH 615.04(f), p. 615-6, Fragixeralfs. Change first paragraph to read as follows:

"Fragixeralfs are the Xeralfs that normally have a brown argillic or cambic horizon above a fragipan with redoximorphic features that has its upper boundary 50 to 100 cm below the mineral soil surface. A perched water table is present seasonally above the pan, and just above the pan there is usually a thin eluvial horizon with peds that have gray clay depletions."

NSTH 615.62, p. 615-237, Fragixeralfs. Change item IDCD to read as follows:

"IDCD. Other Fragixeralfs that have, in one or more horizons within 40 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 Fragixeralfs"**

NSTH 615.62, p. 615-237, Definition of Typic Fragixeralfs. Change item 4 to read as follows:

"4. Do not, in any horizon within 40 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage)."

NSTH 615.04(f), p. 615-7, Description of subgroups, Typic Fragixeralfs, 2nd paragraph. Change last two sentences to read as follows:

"The perched water table is a probable cause of the very common albic materials and grey clay depletions just above the fragipan. Soils that have these features and also redox depletions of low chroma at a shallow depth together with redox concentrations of high chroma or of reddish hue are considered to be intergrades toward Aqualfs."

NSTH 615.04(f), p. 615-8, Mollic Fragixeralfs, line 4. Change "mottles" to "redox depletions".

Page 148, Haploxeralfs, Definition, item 4.b.(2). Change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-238, Haploxeralfs (*Soil Taxonomy* p. 148). Change items IDGE-IDGO to IDGF-IDGP. Add item IDGE; and change items IDGH and IDGI to read as follows:

"IDGE. Other Haploxeralfs which have *both*:

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

2. 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:

a. 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*

b. 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*

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and *either*:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

**Aquandic Haploxeralfs**

IDGH. Other Haploxeralfs which have:

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

2. An argillic horizon that has a base saturation (by sum of cations) of less than 75 percent in one or more subhorizons within its upper 75 cm or above a lithic or paralithic contact, whichever is shallower.

**Aquultic Haploxeralfs**

IDGI. Other Haploxeralfs that have, 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 Haploxeralfs"**

NSTH 615.62, p. 615-238, Definition of Typic Haploxeralfs (*Soil Taxonomy* p. 148). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

Page 149, column 1, Description of subgroups, Typic Haploxeralfs, 2nd paragraph, line 1. Change "mottles" to "redox depletions".

Page 149, column 2, Aquic Haploxeralfs. Change first sentence to read as follows:

"Soils in this subgroup are like Typic Haploxeralfs except they have, 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)."

Page 149, column 2, Aquultic Haploxeralfs. Change first sentence to read as follows:

"These soils are like Typic Haploxeralfs except they have, 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)."

NSTH 615.62, p. 615-239, Natrixeralfs (*Soil Taxonomy* p. 150). Change item IDBA to read as follows:

"IDBA. Natrixeralfs that have, 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 Natrixeralfs**"

NSTH 615.62, p. 615-239, Definition of Typic Natrixeralfs (*Soil Taxonomy* p. 150). Change definition to read as follows:

"Typic Natrixeralfs are the Natrixeralfs that:

1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage)."

Page 150, Description of subgroups, Typic Natrixeralfs, line 8. Change "mottles" to "redox depletions".

Page 151, column 1, Aquic Natrixeralfs. Change first sentence to read as follows:

"These soils are like Typic Natrixeralfs except they have, 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)."

Page 151, Palexeralfs, Definition, item 1.b.(2)(b) (refer to NSTH 615.38(a)). Change "mottles" to "redox concentrations".

NSTH 615.62, p. 239, Palexeralfs (*Soil Taxonomy* p. 151). Change item, IDFB-IDFM to IDFC-IDFN. Add item IDFB, and change item IDFE to read as follows:

"IDFB. Other Palexeralfs which have *both*:

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

2. 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:

a. 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*

b. 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*

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and *either*:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

**Aquandic Palexeralfs**

IDFE. Other Palexeralfs that have, 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 Palexeralfs**"

NSTH 615.62, p. 615-240, Definition of Typic Palexeralfs (*Soil Taxonomy* p. 151). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

Page 152, column 1, Description of subgroups, Typic Palexeralfs, 2nd paragraph, line 1. Change "mottles" to "redox depletions".

Page 152, column 1, Description of subgroups, Aquic Palexeralfs. Change first sentence to read as follows:

"These soils are like Typic Palexeralfs except they have, 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)."

NSTH 615.60, p. 615-180, column 1. Change item BA to read as follows:

"BA. Andisols that have *either*:

1. A histic epipedon; *or*

2. 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 shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

a. Two percent or more redox concentrations; *or*

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquands**"

NSTH 615.60, p. 615-180, column 2, Aquands, Definition. Change definition to read as follows:

"Aquands are the Andisols that have either:

1. A histic epipedon; or

2. 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 shallower, aquic conditions for some time in most years (or artificial drainage), and one or more of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated."

NSTH 615.60, p. 615-181, column 1, Key to great groups. Delete item BAF and substitute the following two items:

"BAF. Other Aquands that have episaturation.

**Epiaquands**

BAG. Other Aquands.

**Endoaquands**"

NSTH 615.60, p. 615-182, column 1, Definition of Typic Duraquands. After item 3, add the following section:

"**Endoaquands**

Definition

Endoaquands are the Aquands that:

1. Do not, in 75 percent or more of each pedon, have a cemented layer which does not slake in water after air-drying and which has its upper boundary within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower;

2. Do not, in half or more of each pedon, have a placic horizon within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower;

3. Do not have a melanic epipedon;

4. Do not have a cryic or pergelic soil temperature regime;

5. Have a 1500-kPa water retention either of 15 percent or more on air-dried samples or of 30 percent or more on undried samples, throughout one or more layers with a total thickness of more than 25 cm within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; and

6. Have endosaturation.

Key to subgroups

BAGA. Endoaquands that have a lithic contact within 50 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Lithic Endoaquands**

BAGB. Other Endoaquands that have a petroferric contact within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Petroferric Endoaquands**

BAGC. Other Endoaquands which have a horizon with an upper boundary within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, that is more than 15 cm thick and contains 20 percent or more (by volume) cemented soil material that does not slake in water after air-drying.

**Duric Endoaquands**

BAGD. Other Endoaquands that have a histic epipedon.

**Histic Endoaquands**

BAGE. Other Endoaquands that have more than 2.0 cmol(+)/kg $Al^{3+}$ (by 1N KCl) in the fine-earth fraction of one or more horizons with a total thickness of 10 cm or more, between 25 and 50 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower.
**Alic Endoaquands**

BAGF. Other Endoaquands that have, undried, a 1500-kPa water retention of 70 percent or more throughout a layer 35 cm or more thick within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.
**Hydric Endoaquands**

BAGG. Other Endoaquands that have, between 25 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, a layer 10 cm or more thick with more than 3.0 percent organic carbon and colors of a mollic epipedon throughout, underlying one or more horizons with a total thickness of 10 cm or more that have a color value, moist, 1 unit or more higher and an organic-carbon content 1 percent or more (absolute) lower.
**Thaptic Endoaquands**

BAGH. Other Endoaquands.
**Typic Endoaquands**

Definition of Typic Endoaquands

Typic Endoaquands are the Endoaquands which:

1. Do not have a lithic contact within 50 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower;

2. Do not have a petroferric contact within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower;

3. Do not have a horizon with an upper boundary within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, that is more than 15 cm thick and contains 20 percent or more (by volume) cemented soil material that does not slake in water after air-drying;

4. Do not have a histic epipedon;

5. Do not, between 25 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have a layer 10 cm or more thick with more than 3.0 percent organic carbon and colors of a mollic epipedon throughout, underlying one or more horizons with a total thickness of 10 cm or more that have a color value, moist, 1 unit or more higher and an organic-carbon content 1 percent or more (absolute) lower;

6. Have 2.0 cmol(+)/kg or less $Al^{3+}$ (by 1N KCl) in the fine-earth fraction throughout a layer 10 cm or more thick between 25 and 50 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower; and

7. Have, undried, a 1500-kPa water retention of less than 70 percent throughout a layer 35 cm or more thick within 100 cm either from the mineral soil surface, or from the upper boundary of an organic layer with andic soil properties, whichever is shallower."

NSTH 615.60, p. 615-182. Delete whole section on Haplaquands and replace with the following section:

"**Epiaquands**

Definition

Epiaquands are the Aquands which:

1. Do not, in 75 percent or more of each pedon, have a cemented layer which does not slake in water after air-drying and which has its upper boundary within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower;

2. Do not, in half or more of each pedon, have a placic horizon within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower;

3. Do not have a melanic epipedon;

4. Do not have a cryic or pergelic soil temperature regime;

5. Have a 1500-kPa water retention either of 15 percent or more on air-dried samples or of 30 percent or more on undried samples, throughout one or more layers with a total thickness of more than 25 cm within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; and

6. Have episaturation.

Key to subgroups

BAFA. Other Epiaquands that have a petroferric contact within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.
**Petroferric Epiaquands**

BAFB. Other Epiaquands that have a horizon with an upper boundary within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, that is more than 15 cm thick and contains 20 percent or more (by volume) cemented soil material that does not slake in water after air-drying.
**Duric Epiaquands**

BAFC. Other Epiaquands that have a histic epipedon.

**Histic Epiaquands**

BAFD. Other Epiaquands that have more than 2.0 cmol(+)/kg $Al^{3+}$ (by 1N KCl) in the fine-earth fraction of one or more horizons with a total thickness of 10 cm or more, between 25 and 50 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower.

**Alic Epiaquands**

BAFE. Other Epiaquands that have, undried, a 1500-kPa water retention of 70 percent or more throughout a layer 35 cm or more thick within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Hydric Epiaquands**

BAFF. Other Epiaquands that have, between 25 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, a layer 10 cm or more thick with more than 3.0 percent organic carbon and colors of a mollic epipedon throughout, underlying one or more horizons with a total thickness of 10 cm or more that have a color value, moist, 1 unit or more higher and an organic-carbon content 1 percent or more (absolute) lower.

**Thaptic Epiaquands**

BAFG. Other Epiaquands.

**Typic Epiaquands**

Definition of Typic Epiaquands

Typic Epiaquands are the Epiaquands which:

1. Do not have a petroferric contact within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower;

2. Do not have a horizon with an upper boundary within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, that is more than 15 cm thick and contains 20 percent or more (by volume) cemented soil material that does not slake in water after air-drying;

3. Do not have a histic epipedon;

4. Do not, between 25 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have a layer 10 cm or more thick with more than 3.0 percent organic carbon and colors of a mollic epipedon throughout, underlying one or more horizons with a total thickness of 10 cm or more that have a color value, moist, 1 unit or more higher and an organic-carbon content 1 percent or more (absolute) lower;

5. Have 2.0 cmol(+)/kg or less $Al^{3+}$ (by 1N KCl) in the fine-earth fraction throughout a layer 10 cm or more thick between 25 and 50 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower; and

6. Have, undried, a 1500-kPa water retention of less than 70 percent throughout a layer 35 cm or more thick within 100 cm either from the mineral soil surface, or from the upper boundary of an organic layer with andic soil properties, whichever is shallower."

NSTH 615.60, p. 615-184, column 2, Cryands, Definition. Change item 2 to read as follows:

"2. Do not have a histic epipedon or aquic conditions defined for Aquands."

NSTH 615.60, pp. 615-185/186, Haplocryands. Change item BBFC to read as follows:

BBFC. Other Haplocryands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Haplocryands"**

NSTH 615.60, p. 615-186, Definition of Typic Haplocryands. Change item 2 to read as follows:

"2. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, pp. 615-186/187, Hydrocryands. Change item BBDC to read as follows:

"BBDC. Other Hydrocryands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for

some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Hydrocryands**"

NSTH 615.60, p. 615-187, Definition of Typic Hydrocryands. Change item 2 to read as follows:

"2. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, pp. 615-187/188, Vitricryands. Change item BBEB to read as follows:

"BBEB. Other Vitricryands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Vitricryands**"

NSTH 615.60, p. 615-188, Definition of Typic Vitricryands. Change item 2 to read as follows:

"2. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, p. 615-188, Torrands. Change item 3 to read as follows:

"3. Do not have a histic epipedon or aquic conditions defined for Aquands.

NSTH 615.60, p. 615-188, Vitritorrands. Change item BCAD to read as follows:

"BCAD. Other Vitritorrands that have, in one or more horizons between 50 and 100 cm from the mineral soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Vitritorrands**"

NSTH 615.60, p. 615-189, Definition of Typic Vitritorrands. Change item 4 to read as follows:

"4. Do not, in any horizon between 50 and 100 cm from the mineral soil surface, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated; and"

NSTH 615.60, p. 615-189, Udands, Definition. Change item 3 to read as follows:

"3. Do not have a histic epipedon or aquic conditions defined for Aquands; and".

NSTH 615.60, p. 615-188, Durudands. Change item BGBA to read as follows:

"BGBA. Durudands that have, in one or more horizons between 50 and 100 cm either from the

mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Durudands"**

NSTH 615.60, p. 615-190, Definition of Typic Durudands. Change item 1 to read as follows:

"1. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, p. 615-188, Fulvudands. Change item BGDD to read as follows:

"BGDD. Other Fulvudands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Fulvudands"**

NSTH 615.60, p. 615-191, Definition of Typic Fulvudands. Change item 2 to read as follows:

"2. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, p. 615-192, Hapludands. Change items BGFC-BGFT to BGFD-BGFU and add new item BGFC to read as follows:

"BGFC. Other Hapludands that have anthraquic conditions.

**Anthraquic Hapludands"**

NSTH 615.60, p. 615-192, Hapludands. Change items BGFD and BGFG to read as follows:

"BGFD. Other Hapludands which have:

1. A horizon 15 cm or more thick, with 20 percent or more (by volume) cemented soil material that does not slake in water after air-drying, that has its upper boundary within 100 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; *and*

2. In one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

a. Two percent or more redox concentrations; *or*

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Duric Hapludands**

BGFG. Other Hapludands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Hapludands"**

NSTH 615.60, p. 615-193, Definition of Typic Hapludands. Change item 4 to read as follows:

"4. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, p. 615-193, Definition of Typic Hapludands. Renumber items 5-10 as 6-11 and add new item 5 to read as follows:

"5. Do not have anthraquic conditions;"

NSTH 615.60, p. 615-194, Hydrudands. Change items BGEB to read as follows:

"BGEB. Other Hydrudands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Hydrudands"**

NSTH 615.60, p. 615-194, Definition of Typic Hydrudands. Change item 2 to read as follows:

"2. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, pp. 615-195/196, Melanudands. Change items BGCB-BGCS to BGCC-BGCT and add new item BGCB to read as follows:

"BGCB. Other Melanudands that have anthraquic conditions.

**Anthraquic Melanudands"**

NSTH 615.60, p. 615-195, Melanudands. Change items BGCC (Alic Aquic Melanudands) and BGCG (Aquic Melanudands) to read as follows:

"BGCC. Other Melanudands that have:

1. More than 2.0 cmol(+)/kg $Al^{3+}$ (by 1N KCl) in the fine-earth fraction of one or more horizons with a total thickness of 10 cm or more, between 25 and 50 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower; *and*

2. In one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

a. Two percent or more redox concentrations; *or*

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Alic Aquic Melanudands**

BGCG. Other Melanudands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Melanudands"**

NSTH 615.60, p. 615-196, Definition of Typic Melanudands. Change item 2 to read as follows:

"2. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, p. 615-197, Definition of Typic Melanudands. Add item 10 to read as follows:

"10. Do not have anthraquic conditions."

NSTH 615.60, p. 615-197, Placudands. Change item BGAB to read as follows:

"BGAB. Other Placudands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Placudands"**

NSTH 615.60, p. 615-198, Definition of Typic Placudands. Change item 2 to read as follows:

"2. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, p. 615-198, Ustands, Definition. Change item 3 to read as follows:

"3. Do not have a histic epipedon or aquic conditions defined for Aquands; and".

NSTH 615.60, p. 615-198, Durustands. Change item BFAA to read as follows:

"BFAA. Durustands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Durustands"**

NSTH 615.60, p. 615-198, Definition of Typic Durustands. Change item 1 to read as follows:

"1. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, p. 615-199, Haplustands. Change item BFBB to read as follows:

"BFBB. Other Haplustands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Haplustands"**

NSTH 615.60, p. 615-199, Definition of Typic Haplustands. Change item 2 to read as follows:

"2. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, p. 615-200, Vitrands, Definition. Change items 2 and 3 to read as follows:

"2. Do not have a histic epipedon or aquic conditions defined for Aquands;

3. Have a udic or an ustic soil moisture regime; and"

NSTH 615.60, p. 615-200, Udivitrands. Change item BEBB to read as follows:

"BEBB. Other Udivitrands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Udivitrands"**

NSTH 615.60, p. 615-200, Definition of Typic Udivitrands. Change item 2 to read as follows:

"2. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, p. 615-201, Ustivitrands. Change item BEAB to read as follows:

"BEAB. Other Ustivitrands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Ustivitrands"**

NSTH 615.60, p. 615-201, Definition of Typic Ustivitrands. Change item 2 to read as follows:

"2. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, p. 615-201, Xerands, Definition. Change item 3 to read as follows:

"3. Do not have a histic epipedon or aquic conditions defined for Aquands."

NSTH 615.60, p. 615-201, Haploxerands. Change item BDCB to read as follows:

"BDCB. Other Haploxerands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Haploxerands"**

NSTH 615.60, p. 615-202, Definition of Typic Haploxerands. Change item 2 to read:

"2. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.60, p. 615-203, Vitrixerands. Change item BDAB to read as follows:

"BDAB. Other Vitrixerands that have, in one or more horizons between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. Two percent or more redox concentrations; *or*

2. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Vitrixerands"**

NSTH 615.60, p. 615-203, Definition of Typic Vitrixerands. Change item 2 to read as follows:

"2. Do not, in any horizon between 50 and 100 cm either from the mineral soil surface, or from the top of an organic layer with andic soil properties, whichever is shallower, have both aquic conditions (or artificial drainage) and any of the following:

a. Two percent or more redox concentrations; or

b. A color value, moist, of 4 or more, and 50 percent or more chroma of 2 or less either in redox depletions on faces of peds, or in the matrix if peds are absent; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.62, p. 615-241, Durargids (*Soil Taxonomy* p. 157). Change item FAAA to read as follows:

"FAAA. Durargids that have, in one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; *or*

2. Redox concentrations and 50 percent or more chroma of 2 or less; *or*

3. Fifty percent or more chroma of 2 or less and, in horizons with a total thickness of 25 cm or more within 50 cm of the soil surface, a higher exchangeable sodium percentage (or sodium adsorption ratio) than in the zone with aquic conditions; *or*

4. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Durargids"**

NSTH 615.62, p. 615-242, Definition of Typic Durargids (*Soil Taxonomy* p. 157). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the soil surface, have both aquic conditions (or artificial drainage) and any of the following:

a. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; or

b. Redox concentrations and 50 percent or more chroma of 2 or less; or

c. Fifty percent or more chroma of 2 or less and, in horizons with a total thickness of 25 cm or more within 50 cm of the soil surface, a higher exchangeable sodium percentage (or sodium adsorption ratio) than in the zone with aquic conditions; or

d. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.62, p. 615-245, Haplargids (*Soil Taxonomy* p. 159). Change item FAEK to read as follows:

"FAEK. Other Haplargids that have, in one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage) and *one or more* of the following:

1. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; *or*

2. Redox concentrations and 50 percent or more chroma of 2 or less; *or*

3. Fifty percent or more chroma of 2 or less and, in horizons with a total thickness of 25 cm or more within 50 cm of the soil surface, a higher exchangeable sodium percentage (or sodium adsorption ratio) than in the zone with aquic conditions; *or*

4. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Haplargids**"

NSTH 615.62, p. 615-246, Definition of Typic Haplargids (*Soil Taxonomy* p. 159). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the soil surface, have both aquic conditions (or artificial drainage) and any of the following:

a. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; or

b. Redox concentrations and 50 percent or more chroma of 2 or less; or

c. Fifty percent or more chroma of 2 or less and, in horizons with a total thickness of 25 cm or more within 50 cm of the soil surface, a higher exchangeable sodium percentage (or sodium adsorption ratio) than in the zone with aquic conditions; or

d. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

Page 160, column 2, Description of subgroups, Aquic Haplargids. Change 2nd sentence to read as follows:

"They have aquic conditions for some time in most years (or artificial drainage) within 100 cm of the soil surface."

NSTH 615.62, p. 615-247, Nadurargids (*Soil Taxonomy* p. 162). Change items FABA and FABB to read as follows:

"FABA. Nadurargids which have *both*:

1. A duripan that is either not platy or massive, or not indurated in any subhorizon; *and*

2. In one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

a. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; *or*

b. Redox concentrations and 50 percent or more chroma of 2 or less; *or*

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Haplic Nadurargids**

FABB. Other Nadurargids that have, in one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; *or*

2. Redox concentrations and 50 percent or more chroma of 2 or less; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Nadurargids**"

NSTH 615.62, p. 615-247, Definition of Typic Nadurargids (*Soil Taxonomy* p. 162). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the soil surface, have both aquic conditions (or artificial drainage) and any of the following:

a. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; or

b. Redox concentrations and 50 percent or more chroma of 2 or less; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

Page 163, column 1, Description of subgroups, Aquic Haplic Nadurargids. Change first sentence to read as follows:

"These soils have, in one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage)."

NSTH 615.62, p. 615-248, Natrargids (*Soil Taxonomy* p. 163). Change item FACE to read as follows:

"FACE. Other Natrargids that have, in one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; *or*

2. Redox concentrations and 50 percent or more chroma of 2 or less; *or*

3. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Natrargids"**

NSTH 615.62, pp. 615-249/250, Definition of Typic Natrargids (*Soil Taxonomy* p. 163). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the soil surface, have both aquic conditions (or artificial drainage) and any of the following:

a. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; or

b. Redox concentrations and 50 percent or more chroma of 2 or less; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

Page 164, column 2, Aquic Natrargids. Change 2nd sentence to read as follows:

"They also have, in one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage)."

NSTH 615.62, p. 615-253, Calciorthids (*Soil Taxonomy* p. 168). Change items FBEF and FBEG to read as follows:

"FBEF. Other Calciorthids that have *both*:

1. A horizon within 100 cm of the soil surface that is more than 15 cm thick and either contains 20 percent or more (by volume) durinodes or is brittle and has firm consistence when moist; *and*

2. In one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

a. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; *or*

b. Redox concentrations and 50 percent or more chroma of 2 or less; *or*

c. Fifty percent or more chroma of 2 or less and, in horizons with a total thickness of 25 cm or more within 50 cm of the soil surface, a higher exchangeable sodium percentage (or sodium adsorption ratio) than in the zone with aquic conditions; *or*

d. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Duric Calciorthids**

FBEG. Other Calciorthids that have, in one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; *or*

2. Redox concentrations and 50 percent or more chroma of 2 or less; *or*

3. Fifty percent or more chroma of 2 or less and, in horizons with a total thickness of 25 cm or more within 50 cm of the soil surface, a higher exchangeable sodium percentage (or sodium adsorption ratio) than in the zone with aquic conditions; *or*

4. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Calciorthids"**

NSTH 615.62, p. 615-254, Definition of Typic Calciorthids (*Soil Taxonomy* p. 168). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the soil surface, have both aquic conditions (or artificial drainage) and any of the following:

a. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; or

b. Redox concentrations and 50 percent or more chroma of 2 or less; or

c. Fifty percent or more chroma of 2 or less and, in horizons with a total thickness of 25 cm or more within 50 cm of the soil surface, a higher exchangeable sodium percentage (or sodium adsorption ratio) than in the zone with aquic conditions; or

d. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.62, p. 615-256, Camborthids (*Soil Taxonomy* p. 171). Change items FBFK and FBFL to read as follows:

"FBFK. Other Camborthids that have *both*:

1. A horizon within 100 cm of the soil surface that is more than 15 cm thick and either contains 20 percent or more (by volume) durinodes or is brittle and has firm consistence when moist; *and*

2. In one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage),*and one or more* of the following:

a. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; *or*

b. Redox concentrations and 50 percent or more chroma of 2 or less; *or*

c. Fifty percent or more chroma of 2 or less and, in horizons with a total thickness of 25 cm or more within 50 cm of the soil surface, a higher exchangeable sodium percentage (or sodium adsorption ratio) than in the zone with aquic conditions; *or*

d. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Duric Camborthids**

FBFL. Other Camborthids that have, in one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; *or*

2. Redox concentrations and 50 percent or more chroma of 2 or less; *or*

3. Fifty percent or more chroma of 2 or less, and a higher exchangeable sodium percentage (or sodium adsorption ratio) in more than half the thickness of the horizons between the soil surface and a depth of 50 cm than in the saturated zone; *or*

4. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Camborthids"**

NSTH 615.62, p. 615-258, Definition of Typic Camborthids (*Soil Taxonomy* p. 171). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the soil surface, have both aquic conditions (or artificial drainage) and any of the following:

a. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; or

b. Redox concentrations and 50 percent or more chroma of 2 or less; or

c. Fifty percent or more chroma of 2 or less, and a higher exchangeable sodium percentage (or sodium adsorption ratio) in more than half the thickness of the horizons between the soil surface and a depth of 50 cm than in the saturated zone; or

d. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.62, p. 615-259, Durorthids (*Soil Taxonomy* p. 174). Change items FBCA and FBCB to read as follows:

"FBCA. Durorthids that have *both*:

1. A duripan that is not indurated in any subhorizon; *and*

2. In one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

a. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; *or*

b. Redox concentrations and 50 percent or more chroma of 2 or less; *or*

c. Fifty percent or more chroma of 2 or less, and a higher exchangeable sodium percentage (or sodium adsorption ratio) in more than half the thickness of the horizons between the soil surface and 50 cm depth than in the saturated zone; *or*

d. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquentic Durorthids**

FBCB. Other Durorthids that have, in one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; *or*

2. Redox concentrations and 50 percent or more chroma of 2 or less; *or*

3. Fifty percent or more chroma of 2 or less, and a higher exchangeable sodium percentage (or sodium adsorption ratio) in more than half the thickness of the horizons between the soil surface and 50 cm depth than in the saturated zone; *or*

4. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Durorthids"**

NSTH 615.62, p. 615-260, Definition of Typic Durorthids (*Soil Taxonomy* p. 174). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the soil surface, have both aquic conditions (or artificial drainage) and any of the following:

a. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; or

b. Redox concentrations and 50 percent or more chroma of 2 or less; or

c. Fifty percent or more chroma of 2 or less, and a higher exchangeable sodium percentage (or sodium adsorption ratio) in

more than half the thickness of the horizons between the soil surface and 50 cm depth than in the saturated zone; or

d. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

NSTH 615.62, p. 615-261, Paleorthids (*Soil Taxonomy* p. 176). Change item FBBB to read as follows:

"FBBB. Other Paleorthids that have, in one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

1. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; *or*

2. Redox concentrations and 50 percent or more chroma of 2 or less; *or*

3. Fifty percent or more chroma of 2 or less, and a higher exchangeable sodium percentage (or sodium adsorption ratio) in more than half the thickness of the horizons between the soil surface and 50 cm depth than in the saturated zone; *or*

4. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Paleorthids**

NSTH 615.62, p. 615-262, Definition of Typic Paleorthids (*Soil Taxonomy* p. 176). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the soil surface, have both aquic conditions (or artificial drainage) and any of the following:

a. A chroma of 0, or a hue of 2.5Y or yellower and a chroma of 1; or

b. Redox concentrations and 50 percent or more chroma of 2 or less; or

c. Fifty percent or more chroma of 2 or less, and a higher exchangeable sodium percentage (or sodium adsorption ratio) in more than half the thickness of the horizons between the soil surface and 50 cm depth than in the saturated zone; or

d. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;"

Page 177, column 1, Salorthids. Change 2nd sentence to read as follows:

"Generally the chroma is low, and high-contrast redoximorphic features are present."

Page 177, column 2, Description of subgroups, Typic Salorthids, 2nd paragraph. Change "mottles" to "redox concentrations".

Page 181, column 2, Key to suborders (refer to NSTH p. 615-179). Change item KA to read as follows:

"KA. Entisols that have *one or more* of the following:

1. Aquic conditions and sulfidic materials within 50 cm of the mineral soil surface; *or*

2. Permanent saturation with water, and a reduced matrix in all horizons below a depth of 25 cm from the mineral soil surface; *or*

3. In a layer between 40 and 50 cm from the mineral soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

a. A texture finer than loamy fine sand *and*, in 50 percent or more of the matrix, *one or more* of the following:

(1) A chroma of 0; *or*

(2) A chroma of 1 or less and a color value, moist, of 4 or more; *or*

(3) A chroma of 2 or less, and redox concentrations are present; *or*

b. A texture of loamy fine sand or coarser *and*, in 50 percent or more of the matrix, *one or more* of the following:

(1) A chroma of 0; *or*

(2) A hue of 10YR or redder, a color value, moist, of 4 or more, and a chroma of 1; *or*

(3) A hue of 10YR or redder and a chroma of 2 or less, and there are redox concentrations; *or*

(4) A hue of 2.5Y or yellower and a chroma of 3 or less, and there are distinct or prominent redox concentrations; *or*

(5) A hue of 2.5Y or yellower and a chroma of 1; *or*

(6) A hue of 5GY, 5G, 5BG, or 5B; *or*

(7) Any color if it results from uncoated sand grains; *or*

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquents"**

Page 181, column 1, Aquents, line 6. Change "and mottled" to "with redoximorphic features".

Page 181, column 1, Definition. Change definition to read as follows:

"Aquents are the Entisols that have one or more of the following:

1. Aquic conditions and sulfidic materials within 50 cm of the mineral soil surface; or

2. Permanent saturation with water, and a reduced matrix in all horizons below a depth of 25 cm from the mineral soil surface; or

3. In a layer between 40 and 50 cm from the mineral soil surface, aquic conditions for some time in most years (or artificial drainage) and either:

a. A texture finer than loamy fine sand and, in 50 percent or more of the matrix, either

(1) A chroma of 0; or

(2) A chroma of 2 or less if redox concentrations are present; or

(3) A chroma of 1 or less and a color value, moist, of 4 or more if redox concentrations are absent; or

b. A texture of loamy fine sand or coarser and, in 50 percent or more of the matrix, either

(1) A chroma of 0; or

(2) A hue of 10YR or redder, a color value, moist, of 4 or more, and a chroma of 1; or

(3) A hue of 10YR or redder and a chroma of 2 or less it there are redox concentrations; or

(4) A hue of 2.5Y or yellower and a chroma of 3 or less if there are distinct or prominent redox concentrations; or

(5) A hue of 2.5Y or yellower and a chroma of 1; or

(6) A hue of 5GY, 5G, 5BG, or 5B; or

(7) Any color if it results from uncoated sand grains; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated."

Page 181, column 2, Key to great groups (refer to NSTH p. 615-179). Delete all of item KAE, and change item KAF to KAD and KAD to KAE (including codes in subgroups), to read as follows:

"KAD. Other Aquents that have a sandy particle size in all horizons between either the Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 100 cm or a lithic or paralithic contact, whichever is shallower.

**Psammaquents**

KAE. Other Aquents that have *either* 0.2 percent or more organic carbon[5] at a depth of 125 cm below the mineral soil surface[6], *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.

**Fluvaquents**"

Page 181, column 2, Key to great groups (refer to NSTH p. 615-179). Add new item KAF and change item KAG to read as follows:

"KAF. Other Aquents that have episaturation.

**Epiaquents**

KAG. Other Aquents.

**Endoaquents**"

Page 182, column 1, Description of a Typic Cryaquent. In the Cg1 and Cg2 horizons, change "mottles" to "redox concentrations".

Page 182, column 1. Preceding the section on Fluvaquents, add new section as follows:

"**Endoaquents**

Definition

Endoaquents are the Aquents which:

1. Do not have sulfidic materials within 50 cm of the mineral soil surface;

2. Do not have a cryic soil temperature regime;

3. Have either an *n* value of 0.7 or less, or less than 8 percent clay, in some or all horizons between 20 and 50 cm from the mineral soil surface;

4. Have either:

a. A lithic or paralithic contact within 25 cm of the mineral soil surface, or have a texture finer than loamy fine sand in some or all horizons between either the Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 100 cm or a lithic or

---

[5] The carbon should be of Holocene age, not fossil carbon from transported fragments of bedrock or from buried Pleistocene deposits. The mean residence time of the carbon should be less than 11,000 years B.P.

[6] Thin strata of sand or loamy sand may have less organic carbon if finer sediments 125 cm or more below the mineral soil surface have 0.2 percent or more organic carbon.

paralithic contact, whichever is shallower; or

b. More than 35 percent (by volume) rock fragments in one or more horizons within 100 cm of the mineral soil surface;

5. Have less than 0.2 percent organic carbon at a depth of 125 cm below the mineral soil surface and a regular 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

6. Have endosaturation.

Key to subgroups

KAGA. Endoaquents which have, within 100 cm of the mineral soil surface, *one or both*:

1. Sulfidic materials; *or*

2. A horizon 15 cm or more thick that has all the characteristics of a sulfuric horizon, except for having a pH between 3.5 and 4.0.

**Sulfic Endoaquents**

KAGB. Other Endoaquents that have a lithic contact within 50 cm of the mineral soil surface.

**Lithic Endoaquents**

KAGC. Other Endoaquents that have, in one or more horizons between either the Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, colors in 50 percent or more of the matrix as follows:

1. A hue of 2.5Y or redder, a color value, moist, of 6 or more, and a chroma of 3 or more; *or*

2. A hue of 2.5Y or redder, a color value, moist, of 5 or less, and a chroma of 2 or more; *or*

3. A hue of 5Y and a chroma of 3 or more; *or*

4. A hue of 5Y or redder and a chroma of 2 or more if there are no redox concentrations.

**Aeric Endoaquents**

KAGD. Other Endoaquents which have *both*:

1. An Ap horizon, or an A horizon 15 cm or more thick, that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample); *and*

2. A base saturation (by $NH_4OAc$) of less than 50 percent at a depth of 100 cm below the mineral soil surface.

**Humaqueptic Endoaquents**

KAGE. Other Endoaquents which have either an Ap horizon, or an A horizon 15 cm or more thick, that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample).

**Mollic Endoaquents**

KAGF. Other Endoaquents.

**Typic Endoaquents**

Definition of Typic Endoaquents

Typic Endoaquents are the Endoaquents which:

1. Have, in one or more horizons between either the Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, colors in 50 percent or more of the matrix as follows:

a. If redox concentrations are present, either

(1) A hue of 2.5Y or redder, a color value, moist, of 6 or more, and a chroma of 2 or less; or

(2) A hue of 2.5Y or redder, a color value, moist, of 5 or less, and a chroma of 1; or

(3) A hue of 5Y and a chroma of 2 or less; or

b. A chroma of 1 or less;

2. Have either an Ap horizon, or an A horizon 15 cm or more thick, that has a color value, moist, of 4 or more and a color value, dry, of 6 or more (crushed and smoothed sample), or a thinner A horizon with any color;

3. Have base saturation (by $NH_4OAc$) of 50 percent or more in one or more horizons within 100 cm of the mineral soil surface;

4. Do not have a lithic contact within 50 cm of the mineral soil surface; and

5. Do not have, within 100 cm of the mineral soil surface, either:

1. Sulfidic materials; or

2. A horizon 15 cm or more thick that has all the characteristics of a sulfuric horizon, except for having a pH between 3.5 and 4.0.

**Epiaquents**

Definition

Epiaquents are the Aquents which:

1. Do not have sulfidic materials within 50 cm of the mineral soil surface;

2. Do not have a cryic soil temperature regime;

3. Have either an *n* value of 0.7 or less, or less than 8 percent clay, in some or all horizons between 20 and 50 cm from the mineral soil surface;

4. Have either:

a. A lithic or paralithic contact within 25 cm of the mineral soil surface, or a texture finer than loamy fine sand in some or all horizons between either the Ap horizon or

a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; or

b. More than 35 percent (by volume) rock fragments in one or more horizons within 100 cm of the mineral soil surface;

5. Have less than 0.2 percent organic carbon at a depth of 125 cm below the mineral soil surface, and a regular 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

6. Have episaturation.

Key to subgroups

KAFA. Epiaquents that have, in one or more horizons between either the Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, colors in 50 percent or more of the matrix as follows:

1. A hue of 2.5Y or redder, a color value, moist, of 6 or more, and a chroma of 3 or more; *or*

2. A hue of 2.5Y or redder, a color value, moist, of 5 or less, and a chroma of 2 or more; *or*

3. A hue of 5Y and a chroma of 3 or more; *or*

4. A chroma of 2 or more if there are no redox concentrations.

**Aeric Epiaquents**

KAFB. Other Epiaquents which have *both*:

1. An Ap horizon, or an A horizon 15 cm or more thick, that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample); *and*

2. A base saturation (by $NH_4OAc$) of less than 50 percent at a depth of 100 cm below the mineral soil surface.

**Humaqueptic Epiaquents**

KAFC. Other Epiaquents which have either an Ap horizon, or an A horizon 15 cm or more thick, that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample).

**Mollic Epiaquents**

KAFD. Other Epiaquents.

**Typic Epiaquents**

Definition of Typic Epiaquents

Typic Epiaquents are the Epiaquents which have:

1. In one or more horizons between either the Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, colors in 50 percent or more of the matrix as follows:

a. If redox concentrations are present, either

(1) A hue of 2.5Y or redder, a color value, moist, of 6 or more, and a chroma of 2 or less; or

(2) A hue of 2.5Y or redder, a color value, moist, of 5 or less, and a chroma of 1 or less; or

(3) A hue of 5Y and a chroma of 2 or less; or

b. A chroma of 1 or less;

2. A base saturation (by $NH_4OAc$) of 50 percent or more in one or more horizons within 100 cm of the mineral soil surface; and

3. Either an Ap horizon, or an A horizon 15 cm or more thick, that has a color value, moist, of 4 or more and a color value, dry, of 6 or more (crushed and smoothed sample), or a thinner A horizon with any color."

Page 182, column 2, Description of a Typic Fluvaquent. In the Ag and Cg1 horizons, change "stains" to "redox concentrations".

NSTH 615.62, pp. 615-263/264, Fluvaquents (*Soil Taxonomy* p. 182). Change items KADA, KADF, KADG, and KADJ to read as follows:

"KADA. Fluvaquents which have, within 100 cm of the mineral soil surface, *one or both*:

1. Sulfidic materials; *or*

2. A horizon 15 cm or more thick that has all the characteristics of a sulfuric horizon, except for having a pH between 3.5 and 4.0.

**Sulfic Fluvaquents**

KADF. Other Fluvaquents that have:

1. A difference of less than 5°C between mean summer and mean winter soil temperatures either at a depth of 50 cm from the soil surface or at a lithic or paralithic contact, whichever is shallower; *and*

2. In one or more horizons between either the Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, colors in 50 percent or more of the matrix as follows:

a. A hue of 2.5Y or redder, a color value, moist, of 6 or more, and a chroma of 3 or more; *or*

b. A hue of 2.5Y or redder, a color value, moist, of 5 or less, and a chroma of 2 or more; *or*

c. A hue of 5Y and a chroma of 3 or more; *or*

d. A chroma of 2 or more if there are no redox concentrations.

**Aeric Tropic Fluvaquents**

KADG. Other Fluvaquents that have, in one or more horizons between either the Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, colors in 50 percent or more of the matrix as follows:

1. A hue of 2.5Y or redder, a color value, moist, of 6 or more, and a chroma of 3 or more; *or*

2. A hue of 2.5Y or redder, a color value, moist, of 5 or less, and a chroma of 2 or more; *or*

3. A hue of 5Y and a chroma of 3 or more; *or*

4. A chroma of 2 or more if there are no redox concentrations.

**Aeric Fluvaquents**

KADJ. Other Fluvaquents which have either an Ap horizon, or an A horizon 15 cm or more thick, that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample).

**Mollic Fluvaquents"**

NSTH 615.62, p. 615-264, Definition of Typic Fluvaquents (*Soil Taxonomy* p. 182). Change items 1 and 6 to read as follows:

"1. Have, in one or more horizons between either the Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, colors in 50 percent or more of the matrix as follows:

a. If redox concentrations are present, either

(1) A hue of 2.5Y or redder, a color value, moist, of 6 or more, and a chroma of 2 or less; or

(2) A hue of 2.5Y or redder, a color value, moist, of 5 or less, and a chroma of 1 or less; or

(3) A hue of 5Y and a chroma of 2 or less; or

b. A chroma of 1 or less;

6. Do not, within 100 cm of the mineral soil surface, have either:

a. Sulfidic materials; or

b. A horizon 15 cm or more thick that has all the characteristics of a sulfuric horizon except for having a pH between 3.5 and 4.0; and"

Page 183, column 2, Description of subgroups, Typic Fluvaquents, line 5. Change "Mottling" to "Redoximorphic features".

Pages 184 and 185, Haplaquents (NSTH 615.62, pp. 615-265/266). Delete whole section on Haplaquents.

Page 185, column 1, Hydraquents, line 12. Change "Their colors" to "They have reduced matrices, and their colors".

Page 185, column 2, Psammaquents. Change first sentence to read as follows:

"These Aquents have sandy texture and are gray, with or without redox concentrations."

Page 185, column 2, Psammaquents, Definition. Change item 1 to read as follows:

"1. Do not have a cryic soil temperature regime;"

Page 186, column 1, Description of Typic Psammaquents. In the Cg1 horizon, change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-266, Fluvaquents (*Soil Taxonomy* p. 186). Change item KADD to read as follows:

"KADD. Other Psammaquents which have either an Ap horizon, or an A horizon 15 cm or more thick, that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample).

**Mollic Psammaquents"**

NSTH 615.62, p. 615-266, Sulfaquents (*Soil Taxonomy* p. 186). Change *Key to subgroups* to read as follows:

"Key to subgroups

KAAA. Sulfaquents that have a histic epipedon.

**Histic Sulfaquents**

KAAB. Other Sulfaquents which have *both*:

1. Sulfidic materials that have their upper boundary 30 cm or more below the mineral soil surface; *and*

2. An *n* value of 0.7 or less in one or more horizons between 20 and 50 cm from the mineral soil surface.

**Haplic Sulfaquents**

KAAC. Other Sulfaquents.

**Typic Sulfaquents"**

NSTH 615.62, p. 615-266, Sulfaquents (*Soil Taxonomy* p. 186). Change *Definition of Typic Sulfaquents* to read as follows:

"Definition of Typic Sulfaquents

Typic Sulfaquents are the Sulfaquents that do not have both:

1. Sulfidic materials that have their upper boundary 30 cm or more below the mineral soil surface; and

2. An *n* value of 0.7 or less in one or more horizons between 20 and 50 cm from the mineral soil surface."

Page 187, column 1. Delete whole section on Tropaquents.

Page 187, column 2, Definition. Change item 2 to read as follows:

"2. Do not have sulfidic materials within 50 cm of the mineral soil surface, or both aquic conditions and colors defined for Aquents."

Page 188, column 1, Definition. Change item 5 to read as follows:

"5. Do not have sulfidic materials within 50 cm of the mineral soil surface, or both aquic conditions and colors defined for Aquents."

NSTH 615.62, p. 615-267, Cryofluvents (*Soil Taxonomy* p. 188). Change item KDAC to read as follows:

"KDAC. Other Cryofluvents that have, in one or more horizons within 50 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Cryofluvents"**

NSTH 615.62, p. 615-267, Cryofluvents (*Soil Taxonomy* p. 188). Change items KDAD and KDAE to KDAE and KADF, respectively, and add new item KDAD to read as follows:

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

**Oxyaquic Cryofluvents"**

NSTH 615.62, p. 615-267, Definition of Typic Cryofluvents (*Soil Taxonomy* p. 188). Change item 2 to read as follows:

"2. Do not, in any horizon within 50 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-267, Definition of Typic Cryofluvents (*Soil Taxonomy* p. 188). Renumber item 3 as 4 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 189, column 1, Description of subgroups, Typic Cryofluvents, line 8. Change "mottles" to "redox depletions".

Page 189, column 1, Description of subgroups, Typic Cryofluvents. Change 4th sentence to read as follows:

"Spheroidal redox concentrations are absent or faint."

Page 189, column 1, Description of subgroups, Aquic Cryofluvents. Change first sentence to read as follows:

"These soils are like Typic Cryofluvents except they have some redox depletions of low chroma (2 or less) within the upper 50 cm of the mineral soil surface in horizons that also have aquic conditions for some time in most years (or artificial drainage)."

NSTH 615.62, p. 615-268, Torrifluvents (*Soil Taxonomy* p. 189). Change items KDDE-KDDH to KDDG-KDDJ and add new items KDDE and KDDF to read as follows:

"KDDE. Other Torrifluvents that have, in one or more horizons within 100 cm of the 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 Torrifluvents**

KDDF. Other Torrifluvents that are saturated with water, in one or more layers within 150 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

**Oxyaquic Torrifluvents"**

NSTH 615.62, p. 615-269, Definition of Typic Torrifluvents (*Soil Taxonomy* p. 189). Add new items 6 and 7 to read as follows:

"6. Do not, in any horizon within 100 cm of the soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage); and

7. Are not saturated with water in any layer within 150 cm of the soil surface for 1 month or more per year in 6 or more out of 10 years."

NSTH 615.62, p. 615-269, Udifluvents (*Soil Taxonomy* p. 191). Change item KDFC to read as follows:

"KDFC. Other Udifluvents that have *either*:

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

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

**Aquic Udifluvents"**

NSTH 615.62, p. 615-269, Udifluvents (*Soil Taxonomy* p. 191). Change items KDFD-KDFE

to KDFE-KDFF, and add new item KDFD to read as follows:

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

NSTH 615.62, p. 615-269, Definition of Typic Udifluvents (*Soil Taxonomy* p. 191). Change item 2 to read as follows:

"2. Do not have either:

a. In any horizon within 50 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage); or

b. In any horizon within 100 cm of the mineral soil surface, a color value, moist, of 4 or more and either a chroma of 0 or a hue of 5GY, 5G, 5BG, or 5B; and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-269, Definition of Typic Udifluvents (*Soil Taxonomy* p. 191). Renumber item 3 as 4 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years; and"

Page 191, column 1, Description of subgroups, Typic Udifluvents. Change 2nd sentence to read as follows:

"They occur in relatively high places on flood plains, and the water table is deeper than 50 cm all the time or enough of the time that there are no redox depletions with a chroma of 2 or less and aquic conditions (or artificial drainage) within 50 cm of the mineral soil surface, or a chroma of 0 or a hue bluer than 10Y and aquic conditions within 100 cm."

Page 191, column 1, Description of subgroups, Typic Udifluvents, line 13. Change "mottles" to "redox depletions".

Page 191, Description of subgroups, Aquic Udifluvents. Change 2nd and 3rd sentences to read as follows:

"They either have some redox depletions with a chroma of 2 or less within 50 cm of the mineral soil surface, although a chroma of 3 or more is dominant to this depth or deeper, or they have a chroma of 0 or a hue bluer than 10Y in one or more horizons between 50 and 100 cm from the mineral soil surface. In either situation, they have aquic conditions for some time in most years within these depths (or artificial drainage)."

NSTH 615.62, p. 615-270, Ustifluvents (*Soil Taxonomy* p. 191). Change items KDCB to KDCC and KDCC-KDCD to KDCE-KDCF; add new items KDCB and KDCD, and change item KDCC to read as follows:

"KDCB. Other Ustifluvents that have anthraquic conditions.
**Anthraquic Ustifluvents**

KDCC. Other Ustifluvents that have *either*

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

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

KDCD. Other Ustifluvents that are saturated with water, in one or more layers within 150 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.
**Oxyaquic Ustifluvents**"

NSTH 615.62, p. 615-270, Definition of Typic Ustifluvents (*Soil Taxonomy* p. 191). Change item 1 to read as follows:

"1. Do not have either:

a. In any horizon within 50 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage); or

b. In any horizon within 150 cm of the mineral soil surface, a color value, moist, of 4 or more and either a chroma of 0 or a hue of 5GY, 5G, 5BG, or 5B; and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-270, Definition of Typic Ustifluvents (*Soil Taxonomy* p. 191). Renumber items 2-3 as 4-5 and add new items 2 and 3 to read as follows:

"2. Are not saturated with water in any layer within 150 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;

3. Do not have anthraquic conditions;"

Page 192, column 2, Description of subgroups, Typic Ustifluvents. Change 2nd and 3rd sentences to read as follows:

"They occur in relatively high places on flood plains, and the water table is deeper than 50 cm all the time or enough of the time that there are no redox depletions with a chroma of 2 or less and aquic conditions (or artificial drainage) within 50 cm of the mineral soil surface, or a chroma of 0 or a hue bluer than 10Y and aquic conditions within 100 cm."

Page 192 and 193, Description of subgroups, Aquic Ustifluvents. Change 2nd sentence to read as follows:

"They commonly either have some redox depletions with a chroma of 2 or less within 50 cm of the mineral soil surface, or they have a chroma of 0 or a hue bluer than 10Y at some depth between 50 cm and 150 cm."

NSTH 615.62, p. 271, Xerofluvents (*Soil Taxonomy* p. 193). Delete item KDBC and change items KDBB to KDBD, KDBD to KDBE, KDBE-KDBG to KDBG-KDBI. Add items KDBB, KDBC, and KDBF; and change item KDBE to read as follows:

"KDBB. Other Xerofluvents which have:

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

2. In one or more horizons within 150 cm of the mineral soil surface, a color value, moist, of 4 or more and either a chroma of 0 or a hue bluer than 10Y, and also aquic conditions for some time in most years (or artificial drainage); *and*

3. 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:

a. 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*

b. 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*

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and *either*:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

**Aquandic Xerofluvents**

KDBC. Other Xerofluvents 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 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.

**Andic Xerofluvents**

KDBE. Other Xerofluvents that have *either*:

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

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

**Aquic Xerofluvents"**

"KDBF. Other Xerofluvents that are saturated with water, in one or more layers within 150 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

**Oxyaquic Xerofluvents"**

NSTH 615.62, p. 271, Definition of Typic Xerofluvents (*Soil Taxonomy* p. 193). Change items 1 and 5 to read as follows:

"1. Do not have either:

a. In any horizon within 50 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage); or

b. In any horizon within 150 cm of the mineral soil surface, a color value, moist, of 4 or more and either a chroma of 0 or a hue of 5GY, 5G, 5BG, or 5B; and also aquic conditions (or artificial drainage);

5. Do not, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, have any of the following:

a. 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

b. 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

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and either:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; or

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

NSTH 615.62, p. 271, Definition of Typic Xerofluvents (*Soil Taxonomy* p. 193). Renumber items 2-5 as 3-6 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 150 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 194, column 1, Description of subgroups, Aquic Xerofluvents. Change first sentence to read as follows:

"These soils have either (1) in one or more horizons within 50 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); or (2) in one or more horizons within 150 cm of the mineral soil surface, a color value, moist, of 4 or more, and either a chroma of 0 or a hue bluer than 10Y, and also aquic conditions for some time in most years (or artificial drainage)."

Page 194, column 1, Description of subgroups. Delete description of Aquic Durorthidic Xerofluvents.

Page 194, column 2, Definition, item 4. Change item 4 to read as follows:

"4. Do not have sulfidic materials within 50 cm of the mineral soil surface, nor both aquic conditions and colors defined for Aquents."

NSTH 615.62, p. 615-272, Cryorthents (*Soil Taxonomy* p. 195). Change item KEAD to read as follows:

"KEAD. Other Cryorthents that have, in one or more horizons within 50 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Cryorthents"**

NSTH 615.62, p. 615-272, Cryorthents (*Soil Taxonomy* p. 195). Change items KEAE-KEAF to KEAF-KEAG, and add new item KEAE to read as follows:

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

**Oxyaquic Cryorthents"**

NSTH 615.62, p. 615-272, Definition of Typic Cryorthents (*Soil Taxonomy* p. 195). Change item 2 to read as follows:

"2. Do not, in any horizon within 50 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-272, Definition of Typic Cryorthents (*Soil Taxonomy* p. 195). Renumber items 3-5 as 4-6 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 196, column 1, Aquic Cryorthents, line 3. Change "mottles" to "redox depletions".

NSTH 615.62, p. 615-273, Torriorthents (*Soil Taxonomy* p. 196). Change items KEBH and KEBI to read as follows:

"KEBH. Other Torriorthents that have *both*:

1. In one or more horizons within 100 cm of the soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. A horizon within 100 cm of the soil surface that is 15 cm or more thick and either contains 20 percent or more (by volume) durinodes or is brittle and has firm consistence when moist.

**Aquic Durorthidic Torriorthents**

KEBI. Other Torriorthents that have, in one or more horizons within 100 cm of the soil surfac , redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Torriorthents"**

NSTH 615.62, p. 615-273, Torriorthents (*Soil Taxonomy* p. 196). Change items KEBJ-KEBN to KEBK-KEBO and add new item KEBJ to read as follows:

"KEBJ. Other Torriorthents that are saturated with water, in one or more layers within 150 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

**Oxyaquic Torriorthents"**

NSTH 615.62, p. 615-274, Definition of Typic Torriorthents (*Soil Taxonomy* p. 196). Change item 5 to read as follows:

"5. Do not, in any horizon within 100 cm of the soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-274, Definition of Typic Torriorthents (*Soil Taxonomy* p. 196). Renumber item 6 as 7 and add new item 6 to read as follows:

"6. Are not saturated with water in any layer within 150 cm of the soil surface for 1 month or more per year in 6 or more out of 10 years; and"

Page 197, Description of subgroups, Aquic Torriorthents. Change first sentence to read as follows:

"These soils have, in one or more horizons within 100 cm of the soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage)."

Page 197, Description of subgroups, Aquic Durorthidic Torriorthents. Change first sentence to read as follows:

"Soils in this subgroup differ from Typic Torriorthents by having, in one or more horizons within 100 cm of the soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage). They also have a horizon 15 cm or more thick that is either weakly cemented or contains 20 percent or more (by volume) durinodes."

NSTH 615.62, p. 615-275, Udorthents (*Soil Taxonomy* p. 199). Change item KEED to read as follows:

"KEED. Other Udorthents that have, 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 Udorthents**"

NSTH 615.62, p. 615-275, Udorthents (*Soil Taxonomy* p. 199). Change items KEEE and KEEF to KEEF and KEEG and add new item KEEE to read as follows:

"KEEE. Other Udorthents that are saturated with water, in one or more layers within 150 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.
**Oxyaquic Udorthents**"

NSTH 615.62, p. 615-275, Definition of Typic Udorthents (*Soil Taxonomy* p. 199). Change item 2 to read as follows:

"2. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-275, Definition of Typic Udorthents (*Soil Taxonomy* p. 199). Renumber items 3-4 as 4-5 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 150 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 199, column 2, Description of subgroups, Aquic Udorthents. Change first sentence to read as follows:

"These soils have, 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)."

NSTH 615.62, p. 615-276, Ustorthents (*Soil Taxonomy* p. 200). Change items KEFC to KEFD and KEFD-KEFF to KEFF-KEFH; add new items KEFC and KEFE, and change item KEFD to read as follows:

"KEFC. Other Ustorthents that have anthraquic conditions.
**Anthraquic Ustorthents**

KEFD. Other Ustorthents that have, 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 Ustorthents**

KEFE. Other Ustorthents that are saturated with water, in one or more layers within 150 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.
**Oxyaquic Ustorthents**"

NSTH 615.62, p. 615-276, Definition of Typic Ustorthents (*Soil Taxonomy* p. 200). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-276, Definition of Typic Ustorthents (*Soil Taxonomy* p. 200). Renumber items 2-5 as 4-7 and add new items 2 and 3 to read as follows:

"2. Are not saturated with water in any layer within 150 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;

3. Do not have anthraquic conditions;"

Page 201, column 1, Description of subgroups, Aquic Ustorthents. Change first sentence to read as follows:

"These soils have, 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)."

NSTH 615.62, p. 615-276, Xerorthents (*Soil Taxonomy* p. 201). Change items KECB-KECD to KECD-KECF and KECE-KEDG to KECH-KECJ. Add items KECB, KECC, and KECG; and change items KECE and KECF to read as follows:

"KECB. Other Xerorthents which have *both*:

1. In one or more horizons within 100 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. 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:

a. 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*

b. 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*

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and *either*:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

**Aquandic Xerorthents**

KECC. Other Xerorthents 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 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.

**Andic Xerorthents**

KECE. Other Xerorthents that have *both*:

1. In one or more horizons within 100 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. A horizon within 100 cm of the mineral soil surface that is 15 cm or more thick and either contains 20 percent or more (by volume) durinodes or is brittle and has firm consistence when moist.

**Aquic Durorthidic Xerorthents**

KECF. Other Xerorthents that have, 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 Xerorthents**

KECG. Other Xerorthents that are saturated with water, in one or more layers within 150 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

**Oxyaquic Xerorthents"**

NSTH 615.62, p. 615-277, Definition of Typic Xerorthents (*Soil Taxonomy* p. 201). Change items 1 and 5 to read as follows:

"1. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);

5. Do not, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, have any of the following:

a. 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

b. 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

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and either:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; or

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

NSTH 615.62, p. 615-277, Definition of Typic Xerorthents (*Soil Taxonomy* p. 201). Renumber items 2-5 as 3-6 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 150 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 201, column 2, Description of subgroups, Aquic Xerorthents. Change first two sentences to read as follows:

"These soils have, 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)."

Page 202, column 1, Psamments, Definition. Change item 4 to read as follows:

"4. Do not have sulfidic materials within 50 cm of the mineral soil surface, nor both aquic conditions and colors defined for Aquents."

NSTH 615.62, p. 615-277, Cryopsamments (*Soil Taxonomy* p. 202). Change item KCAC to read as follows:

"KCAC. Other Cryopsamments that have, in one or more horizons within 50 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Cryopsamments"**

NSTH 615.62, p. 615-277, Cryopsamments (*Soil Taxonomy* p. 202). Change items KCAD-KCAF

to KCAE-KCAG and add new item KCAD to read as follows:

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

**Oxyaquic Cryopsamments"**

NSTH 615.62, p. 615-277, Definition of Typic Cryopsamments (*Soil Taxonomy* p. 202). Change item 2 to read as follows:

"2. Do not, in any horizon within 50 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-277, Definition of Typic Cryopsamments (*Soil Taxonomy* p. 202). Renumber items 3-5 as 4-6 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 202, column 2, Description of subgroups, Typic Cryopsamments, line 3. Change "deeper than 50 cm" to "deeper than 100 cm".

Page 203, column 1, Aquic Cryopsamments. Change first sentence to read as follows:

"These soils have aquic conditions for some time in most years (or artificial drainage) and redox depletions with a chroma of 2 or less within 50 cm of the mineral soil surface."

Page 203, column 1, Lithic Cryopsamments, line 6. Change "mottles" to "redox depletions".

Page 203, column 1, Pergelic Cryopsamments, lines 3 and 5. Change "mottles" to "redox depletions".

Page 203, column 2, Description of a Typic Quartzipsamment. In the C4 horizon, change "mottles" to "redox concentrations".

NSTH 615.62, pp. 615-277/278, Quartzipsamments (*Soil Taxonomy* p. 203). Change items KCCC and KCCD to read as follows:

"KCCC. Other Quartzipsamments which have:

1. In one or more horizons within 100 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. A horizon 5 cm or more thick, either below an Ap horizon or at a depth of 18 cm or more from the mineral soil surface, whichever is deeper, that has *one or more* of the following:

a. In 25 percent or more of each pedon, cementation by organic matter and aluminum, with or without iron; *or*

b. Aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.25 or more, and half that amount or less in an overlying horizon; *or*

c. An ODOE value of 0.12 or more, and a value half as high or lower in an overlying horizon.

**Aquodic Quartzipsamments**

KCCD. Other Quartzipsamments that have, 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 Quartzipsamments"**

NSTH 615.62, p. 615-278 (refer to NSTH 615-397), Quartzipsamments (*Soil Taxonomy* p. 203). Change items KCCE-KCCM to KCCF-KCCN and add new item KCCE to read as follows:

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

**Oxyaquic Quartzipsamments"**

NSTH 615.62, p. 615-278, Definition of Typic Quartzipsamments (*Soil Taxonomy* p. 203). Change items 1 and 2 to read as follows:

"1. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);

2. Do not have a horizon 5 cm or more thick, either below an Ap horizon or at a depth of 18 cm or more from the mineral soil surface, whichever is deeper, that has *one or more* of the following:

a. In 25 percent or more of each pedon, cementation by organic matter and aluminum, with or without iron; *or*

b. Aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.25 or more, and half that amount or less in an overlying horizon; *or*

c. An ODOE value of 0.12 or more, and a value half as high or lower in an overlying horizon;"

NSTH 615.62, p. 615-278 (refer to NSTH 615-397), Definition of Typic Quartzipsamments (*Soil Taxonomy* p. 203). Renumber items 2-7 as 3-8 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 204, Description of subgroups, Aquic Quartzipsamments. Change first two sentences to read as follows:

"These soils have, 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)."

Page 204, Description of subgroups, Haplaquodic Quartzipsamments. Change *Haplaquodic* to *Aquodic* and change first two sentences to read as follows:

"These soils have weak accumulations of amorphous materials. They also have, in one or more horizons within 100 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and aquic conditions for some time in most years (or artificial drainage)."

NSTH 615.62, p. 615-279, Tropopsamments (*Soil Taxonomy* p. 205). Change item KCEB to read as follows:

"KCEB. Tropopsamments that have, 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 Tropopsamments**"

NSTH 615.62, p. 615-279, Tropopsamments (*Soil Taxonomy* p. 205). Change item KCEC to KCED and add new item KCEC to read as follows:

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

NSTH 615.62, p. 615-279, Definition of Typic Tropopsamments (*Soil Taxonomy* p. 205). Change item 2 to read as follows:

"2. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage); and"

NSTH 615.62, p. 615-279, Definition of Typic Tropopsamments (*Soil Taxonomy* p. 205). Add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years."

NSTH 615.62, p. 615-279, Udipsamments (*Soil Taxonomy* p. 206). Change item KCDB to read as follows:

"KCDB. Other Udipsamments that have, 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 Udipsamments**"

NSTH 615.62, p. 615-279 (refer to NSTH 615-398), Udipsamments (*Soil Taxonomy* p. 206). Change items KCDC-KCDF to KCDD-KCDG and add new item KCDC to read as follows:

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

NSTH 615.62, p. 615-279, Definition of Typic Udipsamments (*Soil Taxonomy* p. 206). Change item 2 to read as follows:

"2. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-279, Definition of Typic Udipsamments (*Soil Taxonomy* p. 206). Renumber items 3-5 as 4-6 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 206, column 2, Description of subgroups, Typic Udipsamments, line 13. Change "mottles" to "redox depletions".

Page 206, column 2, Description of subgroups, Aquic Udipsamments, line 2. Change "mottles" to "redox depletions".

NSTH 615.62, p. 615-280, Ustipsamments (*Soil Taxonomy* p. 207). Change item KCGB to read as follows:

"KCGB. Other Ustipsamments that have, 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 Ustipsamments**"

NSTH 615.62, p. 615-280 (refer to NSTH 615-398), Ustipsamments (*Soil Taxonomy* p. 207). Change items KCGC-KCGD to KCGD-KCGE, and add new item KCGC to read as follows:

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

NSTH 615.62, p. 615-280, Definition of Typic Ustipsamments (*Soil Taxonomy* p. 207). Change item 2 to read as follows:

"2. Do not, in any horizon within 100 cm of the mineral soil surface, have distinct or prominent redox concentrations and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-280, Definition of Typic Ustipsamments (*Soil Taxonomy* p. 207). Renumber item 3 as 4 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years; and"

Page 207, column 2, Description of subgroups, Typic Ustipsamments, line 12. Change "Mottles" to "Redoximorphic features".

Page 207, column 2, Description of subgroups, Aquic Ustipsamments, line 3. Change "mottles" to "redoximorphic features".

NSTH 615.62, p. 615-280, Xeropsamments (*Soil Taxonomy* p. 208). Change items KCFB and KCFC to read as follows:

"KCFB. Other Xeropsamments that have *both*:

1. 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); *and*

2. A horizon within 100 cm of the mineral soil surface that is 15 cm or more thick and either contains 20 percent or more (by volume) durinodes or is brittle and has firm consistence when moist.

**Aquic Durorthidic Xeropsamments**

KCFC. Other Xeropsamments that have, 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 Xeropsamments"**

NSTH 615.62, p. 615-280, Xeropsamments (*Soil Taxonomy* p. 208). Change items KCFD-KCFG to KCFE-KCFH and add new item KCFD to read as follows:

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

**Oxyaquic Xeropsamments"**

NSTH 615.62, p. 615-280, Definition of Typic Xeropsamments (*Soil Taxonomy* p. 208). Change item 2 to read as follows:

"2. Do not, in any horizon within 100 cm of the mineral soil surface, have distinct or prominent redox concentrations and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-280, Definition of Typic Xeropsamments (*Soil Taxonomy* p. 208). Renumber items 3-5 as 4-6 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 208, column 2, Description of Typic Xeropsamments, 2nd paragraph, line 7. Change "mottles of low chroma" to "distinct or prominent redox concentrations".

Page 209, column 1, Description of Aquic Xeropsamments, line 3. Change "mottles of low chroma" to "distinct or prominent redox concentrations".

Page 209, column 1, Description of Aquic Durorthidic Xeropsamments, line 7. Change "mottles of low chroma" to "distinct or prominent redox concentrations".

Page 212, Key to suborders, item AB. Delete item 3.

Page 212, Key to suborders. Change item AC to read as follows:

"AC. Other Histosols that are dominantly[1] hemic *either*

1. In the subsurface tier if that tier is wholly organic except for one or more thin mineral layers; *or*

2. In 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"**

Page 213, Fibrists, Definition. Delete item 3.

Page 219, Hemists, first paragraph. Delete last sentence.

Page 219, Hemists, Definition. Delete item 3.

Page 222, Sulfihemists. Delete third sentence.

Page 222, Sulfohemists. Delete last sentence.

Page 223, Saprists, Definition. Delete item 3.

Page 223, Key to great groups, Saprists. Change items ADA-ADD to ADC-ADF (and change subgroup codes), and add new items ADA and ADB to read as follows:

"ADA. Saprists which have a sulfuric horizon that has its upper boundary within 50 cm of the soil surface.

**Sulfosaprists**

ADB. Other Saprists that have sulfidic materials within 100 cm of the soil surface.

**Sulfisaprists"**

Page 224, Borosaprists, Definition. Add new item 3 to read as follows:

"3. Do not have either:

---

[1] Dominant, in this context, means the most abundant of either fibric, hemic, or sapric soil materials.

a. A sulfuric horizon that has its upper boundary within 50 cm of the soil surface; or

b. Sulfidic materials within 100 cm of the soil surface."

Page 225, Cryosaprists. Change definition to read as follows:

"Cryosaprists are the Saprists which:

1. In most years, are either frozen in one or more layers within the control section 2 months after the summer solstice, or never freeze below a depth of 5 cm from the soil surface but have a mean annual soil temperature lower than 8°C; and

2. Do not have either:

a. A sulfuric horizon that has its upper boundary within 50 cm of the soil surface; or

b. Sulfidic materials within 100 cm of the soil surface."

Page 225, Medisaprists, Definition. Add new item 3 to read as follows:

"3. Do not have either:

a. A sulfuric horizon that has its upper boundary within 50 cm of the soil surface; or

b. Sulfidic materials within 100 cm of the soil surface."

Page 226. Preceding Troposaprists, add 2 new sections as follows:

**Sulfisaprists**

These are the potentially acid sulfate soils (cat clays) that consist of organic soil materials. They have sulfidic materials within 100 cm of the soil surface and have not been drained. They occur mainly in coastal marshes near the mouths of rivers, or in the deltas of rivers that carry sediments with a low carbonate content.

**Definition**

Sulfisaprists are the Saprists that have sulfidic materials within 100 cm of the soil surface.

They are locally extensive in coastal marshes and deltas of some large rivers that drain humid regions.

Key to subgroups

ACBA. Sulfisaprists which have a mineral layer 30 cm or more thick that has its upper boundary within the control section below the surface tier.
**Terric Sulfisaprists**

ACBB. Other Sulfihemists.
**Typic Sulfisaprists**

Definition of Typic Sulfisaprists

Typic Sulfisaprists are the Sulfisaprists which do not have a mineral layer 30 cm or more thick that has its upper boundary in the control section below the surface tier.

**Sulfohemists**

These are the acid sulfate soils (cat clays) that consist of organic soil materials. They have a sulfuric horizon that has formed as a consequence of draining sulfidic materials. They are extremely acid, and are toxic to most plants. They are mainly in drained coastal marshes or deltas near the mouths of rivers that carry sediments containing few or no carbonates. Most of them have an appreciable amount of mineral material within the control section.

**Definition**

Sulfosaprists are the Saprists which have a sulfuric horizon that has its upper boundary within 50 cm of the soil surface.

Key to subgroups

ACAA. All Sulfosaprists (provisionally).
**Typic Sulfosaprists"**

Page 226, Troposaprists, Definition. Add new item 3 to read as follows:

"3. Do not have either:

a. A sulfuric horizon that has its upper boundary within 50 cm of the soil surface; or

b. Sulfidic materials within 100 cm of the soil surface."

Page 228, column 2. Change item 5 to read as follows:

"5. Aquic conditions within 50 cm of the mineral soil surface for some time in most years (or artificial drainage), and permafrost; *and*"

Page 229, column 1, item 4.c. (refer to NSTH p. 615-204). Change item (4) to read as follows:

"(4) Either a cambic horizon, or both aquic conditions within 50 cm of the mineral soil surface for some time in most years (or artificial drainage), and permafrost;"

Page 230, column 1, Key to suborders (refer to NSTH p. 615-179). Change item JA to read as follows:

"JA. Inceptisols which have:

1. Aquic conditions for some time in most years (or artificial drainage) in a layer between 40 and 50 cm from the mineral soil surface; *and one or more* of the following:

a. A histic epipedon; *or*

b. A sulfuric horizon that has its upper boundary within 50 cm of the mineral soil surface; *or*

c. A mollic, an ochric, or an umbric epipedon that is underlain directly, or within 50 cm of the mineral soil surface, by a horizon that has, on faces of peds or in the matrix if peds are absent, 50 percent or more chroma of *either*

(1) Two or less if there are redox concentrations; *or*

(2) One or less; *or*

2. An exchangeable sodium percentage (ESP) of 15 or more (or a sodium adsorption ratio, SAR, of 13 or more), in half or more of the soil within 50 cm of the mineral soil surface, and an ESP (or SAR) below 50 cm that decreases with increasing depth, *and* ground water within 100 cm of the mineral soil surface for some time of the year; *or*

3. Within 50 cm of the mineral soil surface, enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquepts"**

Page 236, column 1, Aquepts, lines 6 and 7. Change "and a mottled gray subsurface horizon" to "and a gray subsurface horizon with redox concentrations".

Page 236, column 2, lines 5 and 6. Change "are the mottled gray and rusty colors" to "are the gray and rusty colors of redoximorphic features".

Page 236, column 2, Definition. Change definition to read as follows:

"Aquepts are the Inceptisols which have:

1. Aquic conditions for some time in most years (or artificial drainage) in a layer between 40 and 50 cm from the mineral soil surface; and one or more of the following:

a. A histic epipedon; or

b. A sulfuric horizon that has its upper boundary within 50 cm of the mineral soil surface; or

c. A mollic, an ochric, or an umbric epipedon that is underlain directly, or within 50 cm of the mineral soil surface, by a horizon that has, on faces of peds or in the matrix if peds are absent, 50 percent or more chroma of either

(1) Two or less if there are redox concentrations; or

(2) One or less; or

2. An exchangeable sodium percentage (ESP) of 15 or more (or a sodium adsorption ratio, SAR, of 13 or more), in half or more of the soil within 50 cm of the mineral soil surface, and an ESP (or SAR) below 50 cm that decreases with increasing depth, and ground water within 100 cm of the mineral soil surface for some time of the year; or

3. Within 50 cm of the mineral soil surface, enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated."

Page 237, column 1, Key to great groups (refer to NSTH p. 615-179). Change item JAI and add new item JAJ to read as follows:

"JAI. Other Aquepts that have episaturation.

**Epiaquepts**

JAJ. Other Aquepts.

**Endoaquepts"**

Page 238, Description of a Cryaquept, Bg horizon. Change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-289, Cryaquepts (*Soil Taxonomy* p. 238). Change items JAEA-JAEL to JAEB-JAEM, add "Other" to JAEB, and add new item JAEA to read as follows:

"JAEA. Cryaquepts which have, within 150 cm of the mineral soil surface, *one or more* of the following:

1. A sulfuric horizon; *or*

2. A horizon 15 cm or more thick that has all the characteristics of a sulfuric horizon, except that it has a pH between 3.5 and 4.0; *or*

3. Sulfidic materials.

**Sulfic Cryaquepts"**

NSTH 615.62, p. 615-290, Definition of Typic Cryaquepts (*Soil Taxonomy* p. 238). Add new item 6 to read as follows:

"6. Do not, within 150 cm of the mineral soil surface, have any of the following:

a. A sulfuric horizon; or

b. A horizon 15 cm or more thick that has all the characteristics of a sulfuric horizon, except that it has a pH between 3.5 and 4.0; or

c. Sulfidic materials."

Page 239, column 2. Preceding Fragiaquepts, add new sections on Endoaquepts and Epiaquepts as follows:

**"Endoaquepts**

<u>Definition</u>

Endoaquepts are the Aquepts which:

1. Do not have a fragipan;

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

3. Do not have plinthite that either forms a continuous phase, or constitutes more than half the matrix (by volume), in any horizon within 125 cm of the mineral soil surface;

4. Do not have a sulfuric horizon that has its upper boundary within 50 cm of the mineral soil surface;

5. Have an ochric epipedon;

6. Have a soil temperature regime warmer than cryic and have, at a depth of 50 cm from the soil surface, mean summer and mean winter soil temperatures that differ by 5°C or more;

7. Have an exchangeable sodium percentage (ESP) of less than 15 (or a sodium adsorption ratio, SAR, of less than 13), in half or more of the soil within 50 cm of the mineral soil surface, or an ESP (or SAR) below 50 cm that remains constant or increases with depth; and

8. Have endosaturation.

Key to subgroups

JAJA. Endoaquepts which have, within 150 cm of the mineral soil surface, *one or more* of the following:

1. A sulfuric horizon; *or*

2. A horizon 15 cm or more thick that has all the characteristics of a sulfuric horizon, except that it has a pH between 3.5 and 4.0; *or*

3. Sulfidic materials.

**Sulfic Endoaquepts"**

JAJB. Other Endoaquepts that have a lithic contact within 50 cm of the mineral soil surface.

**Lithic Endoaquepts**

JAJC. Other Endoaquepts which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Endoaquepts**

JAJD. Other Endoaquepts 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, and *either*:

a. In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

b. In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

**Aquandic Endoaquepts**

JAJE. Other Endoaquepts that have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, colors as follows: *either*

1. A hue of 7.5YR or redder in 50 percent or more of the matrix, *and*

a. 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*

b. If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*

2. In 50 percent or more of the matrix, a hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more; *or*

b. A chroma of 2 or more if there are no redox concentrations.

**Aeric Endoaquepts**

JAJF. Other Endoaquepts which have:

1. An Ap horizon, or an A horizon 15 cm or more thick, with a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample); *and*

2. A base saturation (by $NH_4OAc$) of less than 50 percent that does not increase with depth to 50 percent or more within 100 cm of the mineral soil surface.

**Humic Endoaquepts**

JAJG. Other Endoaquepts that have an Ap horizon, or an A horizon 15 cm or more thick, with a color value, moist, of 3 or less and a color

value, dry, of 5 or less (crushed and smoothed sample).

**Mollic Endoaquepts**

JAJH. Other Endoaquepts.

**Typic Endoaquepts**

Definition of Typic Endoaquepts

Typic Endoaquepts are the Endoaquepts which:

1. Have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, colors as follows: either

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 1 or less on 50 percent or more of ped exteriors, or redox depletions with a chroma of 2 or less in ped interiors; or

(2) If peds are absent, a chroma of 1 or less 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) If there are redox concentrations, a color value, moist, of 3 or more and a chroma of 2 or less; or

(2) A chroma of 1 or less;

2. Have an Ap horizon, or an A horizon 15 cm or more thick, with a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed sample), or a thinner A horizon with any color;

3. Do not, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, have any of the following:

a. 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

b. 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

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and either:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; or

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more;

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

5. Do not have either:

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

6. Do not, within 150 cm of the mineral soil surface, have any of the following:

a. A sulfuric horizon; or

b. A horizon 15 cm or more thick that has all the characteristics of a sulfuric horizon, except that it has a pH between 3.5 and 4.0; or

c. Sulfidic materials.

**Epiaquepts**

Definition

Epiaquepts are the Aquepts which:

1. Do not have a fragipan;

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

3. Do not have plinthite that either forms a continuous phase, or constitutes more than half the matrix (by volume), in any horizon within 125 cm of the mineral soil surface;

4. Do not have a sulfuric horizon that has its upper boundary within 50 cm of the mineral soil surface;

5. Have an ochric epipedon;

6. Have a soil temperature regime warmer than cryic and have, at a depth of 50 cm from the soil surface, mean summer and mean winter soil temperatures that differ by 5°C or more;

7. Have an exchangeable sodium percentage (ESP) of less than 15 (or a sodium adsorption ratio, SAR, of less than 13), in half or more of the soil within 50 cm of the mineral soil surface, or an ESP (or SAR) below 50 cm that remains constant or increases with depth; and

8. Have episaturation.

Key to subgroups

JAIA. Epiaquepts which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Epiaquepts**

JAIB. Other Epiaquepts that have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, colors as follows: *either*

1. A hue of 7.5YR or redder in 50 percent or more of the matrix, *and*

a. 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*

b. If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*

2. In 50 percent or more of the matrix, a hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more; *or*

b. A chroma of 2 or more if there are no redox concentrations.

**Aeric Epiaquepts**

JAIC. Other Epiaquepts.

**Typic Epiaquepts**

Definition of Typic Epiaquepts

Typic Epiaquepts are the Epiaquepts that:

1. Have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, colors as follows: either

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 1 or less on 50 percent or more of ped exteriors, or redox depletions with a chroma of 2 or less in ped interiors; or

(2) If peds are absent, a chroma of 1 or less 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) If there are redox concentrations, a color value, moist, of 3 or more and a chroma of 2 or less; or

(2) A chroma of 1 or less;

2. Do not have either:

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."

NSTH 615.62, p. 615-290, Fragiaquepts (*Soil Taxonomy* p. 239). Change item JADA to read as follows:

"JADA. Fragiaquepts that have, in 50 percent or more of the matrix of one or more horizons, either between the plow layer and a depth of 75 cm below the mineral soil surface or, if there is no plow layer, between 15 and 75 cm depth, a chroma of *either*

1. Three or more; *or*

2. Two or more if there are no redox concentrations.

**Aeric Fragiaquepts"**

NSTH 615.62, p. 615-291, Definition of Typic Fragiaquepts (*Soil Taxonomy* p. 139). Change item 2 to read as follows:

"2. Have, in more than 50 percent of the matrix of one or more horizons, either between the plow layer and 75 cm below the mineral soil surface or, if there is no plow layer, between 15 and 75 cm depth, a chroma of either

a. Two or less if redox concentrations are present; or

b. One or less."

Page 240, column 1, Description of subgroups, Typic Fragiaquepts. Change lines 4 and 5 to read as follows:

"2 or less if there are redox concentrations, or of 1 or less if there are no redox concentrations, in the matrix of all"

Page 240, column 1, Halaquepts, 2nd paragraph, first line. Change "and mottled" to "with redox concentrations".

Page 241-243, Haplaquepts. Delete whole section on Haplaquepts.

Page 243, column 2, Description of a Typic Humaquept. In the AB and BAg horizons, change "mottles" to "redox concentrations".

Page 243, column 2, Description of a Typic Humaquept. In the Bg horizon, change "mottles" to "redoximorphic features".

Page 243, column 2, Description of a Typic Humaquept. In the Cg horizon, change "mottles" to "redox depletions".

Page 243, column 2, Description of a Typic Humaquept. In the 2C horizon, change "mottles" to "redox concentrations".

NSTH 615.62, Sulfaquepts (*Soil Taxonomy* p. 245). Change *Key to subgroups* to read as follows:

"Key to subgroups

JAAA. Sulfaquepts that have a salic horizon within 75 cm of the mineral soil surface.
**Salorthidic Sulfaquepts**

JAAB. Other Sulfaquepts that have *both*:

1. An *n* value of more than 0.7; *and*

2. Eight percent or more clay in all horizons between 20 and 50 cm from the mineral soil surface.
**Hydraquentic Sulfaquepts**

JAAC. Other Sulfaquepts.
**Typic Sulfaquepts**

Definition of Typic Sulfaquepts

Typic Sulfaquepts are the Sulfaquepts that:

1. Do not have a salic horizon within 75 cm of the mineral soil surface; and

2. Have one or both of the following:

a. An *n* value of 0.7 or less; or

b. Less than 8 percent clay in one or more horizons between 20 and 50 cm from the mineral soil surface."

Page 245, column 2, Tropaquepts, line 3. Change "mottled" to "with redox concentrations".

NSTH 615.62, pp. 615-295/296, Tropaquepts (*Soil Taxonomy* p. 246). Change items JAGA and JAGG to read as follows:

"JAGA. Tropaquepts which have, within 150 cm of the mineral soil surface, *one or more* of the following:

1. A sulfuric horizon; *or*

2. A horizon 15 cm or more thick that has all the characteristics of a sulfuric horizon, except that it has a pH between 3.5 and 4.0; *or*

3. Sulfidic materials.
**Sulfic Tropaquepts**

JAGG. Other Tropaquepts that have, in 50 percent or more of the matrix of one or more horizons between either the Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, colors as follows:

1. A hue of 2.5Y or redder, a color value, moist, of 6 or more, and a chroma of 3 or more; *or*

2. A hue of 2.5Y or redder, a color value, moist, of 5 or less, and a chroma of 2 or more; *or*

3. A hue of 5Y and a chroma of 3 or more; *or*

4. A chroma of 2 or more if there are no redox concentrations.
**Aeric Tropaquepts**"

NSTH 615.62, p. 615-296, Definition of Typic Tropaquepts (*Soil Taxonomy* p. 246). Change items 1 and 6 to read as follows:

"1. Have, in 50 percent or more of the matrix of one or more horizons between either the Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, colors as follows:

a. If redox concentrations are present, either

(1) A hue of 2.5Y or redder, a color value, moist, of 6 or more, and a chroma of 2 or less; or

(2) A hue of 2.5Y or redder, a color value, moist, of 5 or less, and a chroma of 1 or less; or

(3) A hue of 5Y and a chroma of 2 or less; or

b. A chroma of 1 or less;

6. Do not, within 150 cm of the mineral soil surface, have any of the following:

a. A sulfuric horizon; or

b. A horizon 15 cm or more thick that has all the characteristics of a sulfuric horizon, except that it has a pH between 3.5 and 4.0; or

c. Sulfidic materials; and"

Page 247, column 1, Definition (refer to NSTH 615.60). Change item 3 to read as follows:

"3. Do not have both aquic conditions and colors defined for Aquepts; and"

Page 247, Key to great groups, Ochrepts (refer to NSTH 615.60). Change items JDA-JDG to JDB-JDH (also change subgroup codes accordingly), add "Other" to JDB, and add new item JDA to read as follows:

"JDA. Ochrepts that have a sulfuric horizon within 50 cm of the mineral soil surface.
**Sulfochrepts"**

NSTH 615.62, p. 615-297, Cryochrepts (*Soil Taxonomy* p. 248). Change item JDDE to read as follows:

"JDDE. Other Cryochrepts that have, 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 Cryochrepts"**

NSTH 615.62, p. 615-297, Cryochrepts (*Soil Taxonomy* p. 248). Change items JDDF-JDDH to JDDG-JDDI and add new item JDDF to read as follows:

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

NSTH 615.62, p. 615-297, Definition of Typic Cryochrepts (*Soil Taxonomy* p. 248). Change item 3 to read as follows:

"3. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-297, Definition of Typic Cryochrepts (*Soil Taxonomy* p. 248). Renumber items 4-6 as 5-7 and add new item 4 to read as follows:

"4. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

NSTH 615.14, p. 615-21, Description of subgroups, Aquic Cryochrepts (*Soil Taxonomy* p. 248). Change first sentence to read as follows:

"These soils have, 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)."

NSTH 615.62, p. 615-297, Durochrepts (*Soil Taxonomy* p. 249). Change items JDCA to JDCB and JDCB-JDCG to JDCD-JDCI. Add items JDCA and JDCC, and change item JDCD to read as follows:

"JDCA. Durochrepts which have *both*:

1. In one or more horizons within 30 cm of the mineral soil surface, distinct or prominent redox concentrations, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. 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:

a. 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*

b. 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*

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and *either*:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.
**Aquandic Durochrepts**

JDCC. Other Durochrepts 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, and *either*:

a. In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

b. In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.
**Vitrandic Durochrepts**

JDCD. Other Durochrepts that have, in one or more horizons within 30 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 Durochrepts"**

NSTH 615.62, p. 615-298, Definition of Typic Durochrepts (*Soil Taxonomy* p. 249). Change items 2 and 5 to read as follows:

"2. Do not, in any horizon within 30 cm of the mineral soil surface, have distinct or prominent

redox concentrations and also aquic conditions (or artificial drainage);

5. Do not, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, have any of the following:

a. 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

b. 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

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and either:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; or

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more."

Page 249, column 1, Description of subgroups, Typic Durochrepts, line 2. Change "mottling" to "redoximorphic features".

NSTH 615.62, p. 615-298, Dystrochrepts (*Soil Taxonomy* p. 249). Change items JDHD-JDHG to JDHE-JDHH and JDHH-JDHM to JDHJ-JDHO. Add items JDHD andJDHI; and change items JDHG and JDHH to read as follows:

"JDHD. Other Dystrochrepts which have *both*:

1. In one or more horizons within 60 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. 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:

a. 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*

b. 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*

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and *either*:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

**Aquandic Dystrochrepts**

JDHG. Other Dystrochrepts which have:

1. In one or more horizons within 60 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. *Either* 0.2 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 less than 25 percent.

**Fluvaquentic Dystrochrepts**

JDHH. Other Dystrochrepts that have, in one or more horizons within 60 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Dystrochrepts**

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

**Oxyaquic Dystrochrepts"**

NSTH 615.62, p. 615-299, Definition of Typic Dystrochrepts (*Soil Taxonomy* p. 249). Change item 2 to read as follows:

"2. Do not, in any horizon within 60 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-299, Definition of Typic Dystrochrepts (*Soil Taxonomy* p. 249). Renumber items 3-6 as 4-7 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 250, Description of subgroups, Typic Dystrochrepts, line 14. Change "mottles" to "redox depletions".

Page 250, Description of subgroups, Aquic Dystrochrepts. Change "mottles" to "redox depletions" in line 1 and to "redox concentrations" in line 4.

Page 250, Description of subgroups, Fluvaquentic Dystrochrepts. Change "mottles" in line 1 and "mottled" in line 7 to "redox depletions" and "redox-depleted", respectively.

NSTH 615.62, p. 615-300, Eutrochrepts (*Soil Taxonomy* p. 251). Change items JDGF-JDGH to JDGE-JDGI and JDGI-JDGO to JDGK-JDGQ and add or change items JDGF, JDGG, JDGH, JDGI, and JDGJ to read as follows:

"JDGF. Other Eutrochrepts that have anthraquic conditions.

**Anthraquic Eutrochrepts**

JDGG. Other Eutrochrepts that have:

1. In one or more horizons within 60 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. *Either* 0.2 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 less than 25 percent.

**Fluvaquentic Eutrochrepts**

JDGH. Other Eutrochrepts that:

1. Have, in one or more horizons within 60 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. Do not, in each pedon, have carbonates in all horizons within 100 cm of the mineral soil surface.

**Aquic Dystric Eutrochrepts**

JDGI. Other Eutrochrepts that have, in one or more horizons within 60 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Eutrochrepts**

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

**Oxyaquic Eutrochrepts"**

NSTH 615.62, p. 615-301, Definition of Typic Eutrochrepts (*Soil Taxonomy* p. 251). Change item 2 to read as follows:

"2. Do not, in any horizon within 60 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-301, Definition of Typic Eutrochrepts (*Soil Taxonomy* p. 251). Renumber items 3-10 as 5-12 and add new items 3 and 4 to read as follows:

"3. Do not have anthraquic conditions;

4. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 252, Description of subgroups, Typic Eutrochrepts, 2nd paragraph, line 5. Change "mottles" to "redox depletions".

Page 252, Description of subgroups, Aquic Eutrochrepts. Change "mottles" in line 1 and "mottled" in line 4 to "redox depletions" and "redox-depleted", respectively.

Page 252, Description of subgroups, Aquic Dystric Eutrochrepts, lines 1 and 4. Change "mottles" in line 1 and "mottled" in line 4 to "redox depletions" and "redox-depleted", respectively.

Page 252, Description of subgroups, Fluvaquentic Eutrochrepts, line 3. Change "mottles" to "redox depletions".

NSTH 615.62, p. 615-301, Fragiochrepts (*Soil Taxonomy* p. 253). Change item JDBC to read as follows:

"JDBC. Other Fragiochrepts that have, in one or more horizons within 30 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 Fragiochrepts"**

NSTH 615.62, p. 615-301, Definition of Typic Fragiochrepts (*Soil Taxonomy* p. 253). Change item 2 to read as follows:

"2. Do not, in any horizon within 30 cm of the mineral soil surface, have distinct or prominent redox concentrations and also aquic conditions (or artificial drainage); and"

Page 253, column 2, Description of subgroups, Typic Fragiochrepts. Change "mottles" in line 3 and "mottling" in line 10 to "redox concentrations".

Page 254, column 1, Aquic Fragiochrepts, line 2. Change "mottles" to "redox concentrations".

Page 254. Preceding Ustochrepts, add new section as follows:

"**Sulfochrepts**

These are extremely acid soils which have formed from sulfidic materials that have been exposed to aerobic conditions, mainly as a result of surface mining, road construction, dredging, or other earth-moving operations.

<u>Definition</u>

Sulfochrepts are the Ochrepts that have a sulfuric horizon within 50 cm of the mineral soil surface.

Key to subgroups

JDAA. All Sulfochrepts (provisional).
**Typic Sulfochrepts"**

NSTH 615.62, p. 615-302, Ustrochrepts (*Soil Taxonomy* p. 254). Change items JDEG-JDEJ to JDEH-JDEK; change item JDEF and add new item JDEG to read as follows:

"JDEF. Other Ustochrepts that have anthraquic conditions.
**Anthraquic Ustochrepts**

JDEG. Other Ustochrepts that have, 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 Ustochrepts"**

NSTH 615.62, p. 615-303, Definition of Typic Ustrochrepts (*Soil Taxonomy* p. 254). Renumber items 5-7 as 6-8; change item 4 and add new item 5 to read as follows:

"4. Do not have anthraquic conditions;

5. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-304, Xerochrepts (*Soil Taxonomy* p. 256). Change items JDFG-JDFP to JDFH-JDFQ. Add item JDFG and change items JDFK and JDFL to read as follows:

"JDFG. Other Xerochrepts which have *both*:

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

2. 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:

a. 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*

b. 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*

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and *either*:

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.
**Aquandic Xerochrepts**

JDFK. Other Xerochrepts that have:

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

2. A base saturation (by $NH_4OAc$) of less than 60 percent in all horizons between 25 and 75 cm from the mineral soil surface.
**Aquic Dystric Xerochrepts**

JDFL. Other Xerochrepts that have, 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 Xerochrepts"**

NSTH 615.62, p. 615-305, Definition of Typic Xerochrepts (*Soil Taxonomy* p. 256). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

Page 256, column 2, Description of subgroups, Typic Xerochrepts, 2nd paragraph. Change "mottles" in line 1 and "mottled" in line 2 to "redox depletions" and "redox-depleted", respectively.

Page 257, column 1, Description of subgroups, Aquic Xerochrepts. Change "mottles" in line 1 and "mottled" in line 4 to "redox depletions" and "redox-depleted", respectively.

Page 257, column 1, Description of subgroups, Aquic Dystric Xerochrepts. Change "mottles" in line 1 and "mottled" in line 4 to "redox depletions" and "redox-depleted", respectively.

Page 258, column 1, Definition. Change item 2 to read as follows:

"2. Do not have both aquic conditions and colors defined for Aquepts;"

NSTH 615.62, p. 615-306, Dystropepts (*Soil Taxonomy* p. 258). Change item JCEF to read as follows:

"JCEF. Other Dystropepts that have, 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 Dystropepts"**

NSTH 615.62, p. 615-306, Dystropepts (*Soil Taxonomy* p. 258). Change items JCEG-JCEK to JCEH-JCEL and add new item JCEG to read as follows:

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

NSTH 615.62, p. 615-306, Definition of Typic Dystropepts (*Soil Taxonomy* p. 258). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-306, Definition of Typic Dystropepts (*Soil Taxonomy* p. 258). Renumber items 2-7 as 3-8 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 259, Description of subgroups, Typic Dystropepts, column 2. Change "mottles" in line 1 and "mottled" in line 2 to "redox depletions" and "redox-depleted", respectively.

Page 259, column 2, Aquic Dystropepts. Change "mottles" in line 1 and "mottled" in line 2 to "redox depletions" and "redox-depleted", respectively.

NSTH 615.62, p. 615-307, Eutropepts (*Soil Taxonomy* p. 260). Change items JCDE and JCDF to read as follows:

"JCDE. Other Eutropepts that have:

1. In one or more horizons within 100 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. *Either* 0.2 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 less than 25 percent.
**Fluvaquentic Eutropepts**

JCDF. Other Eutropepts that have, 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 Eutropepts"**

NSTH 615.62, p. 615-307, Eutropepts (*Soil Taxonomy* p. 260). Change items JCDG and JCDH to JCDH and JCDI, respectively, and add new item JCDG to read as follows:

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

NSTH 615.62, p. 615-308, Definition of Typic Eutropepts (*Soil Taxonomy* p. 260). Change item 2 to read as follows:

"2. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-308, Definition of Typic Eutropepts (*Soil Taxonomy* p. 260). Renumber items 3-5 as 4-6 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 260, column 2, Description of subgroups, Typic Eutrochrepts. Change "mottles" in lines 4 and 16 and "mottled" in line 7 to "redox depletions" and "redox-depleted", respectively.

Page 261, column 1, Description of subgroups, Aquic Eutrochrepts, line 1. Change "mottles" to "redox depletions".

Page 261, column 1, Description of subgroups, Fluvaquentic Eutrochrepts, line 4. Change "mottles" to "redox depletions".

NSTH 615.62, p. 615-308, Humitropepts (*Soil Taxonomy* p. 261). Change item JCAE to read as follows:

"JCAE. Other Humitropepts that have, 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 Humitropepts"**

NSTH 615.62, pp. 615-308/309, Humitropepts (*Soil Taxonomy* p. 261). Change items JCAF-JCAJ to JCAG-JCAK and add new item JCAF to read as follows:

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

NSTH 615.62, p. 615-309, Definition of Typic Humitropepts (*Soil Taxonomy* p. 261). Change item 2 to read as follows:

"2. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with

a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-309, Definition of Typic Humitropepts (*Soil Taxonomy* p. 261). Renumber items 3-6 as 4-7 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 262, column 1, Description of subgroups, Typic Humitropepts, 2nd paragraph, line 4. Change "Mottles" to "Redox depletions".

NSTH 615.62, p. 615-309, Ustropepts (*Soil Taxonomy* p. 263). Change item JCCC to read as follows:

"JCCC. Other Ustropepts that have, 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 Ustropepts**"

NSTH 615.62, p. 615-309, Ustropepts (*Soil Taxonomy* p. 263). Change items JCCD-JCCF to JCCE-JCCG, respectively, and add new item JCCD to read as follows:

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

NSTH 615.62, p. 615-310, Definition of Typic Ustropepts (*Soil Taxonomy* p. 263). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-310, Definition of Typic Ustropepts (*Soil Taxonomy* p. 263). Renumber items 2-5 as 3-6 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 263, column 2, Description of subgroups, Typic Ustropepts, 2nd paragraph, line 1. Change "Mottles" to "Redox depletions".

Page 264, Umbrepts, Definition (refer to NSTH p. 615-204). Change item 1 to read as follows:

"1. Do not have both aquic conditions and colors defined for Aquepts;"

NSTH 615.62, p. 615-310, Cryumbrepts (*Soil Taxonomy* p. 265). Change item JEBG to read as follows:

"JEBG. Other Cryumbrepts that have, 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 Cryumbrepts**"

NSTH 615.62, p. 615-310, Cryumbrepts (*Soil Taxonomy* p. 265). Change items JEBH and JEBI to JEBI and JEBJ, respectively, and add new item JEBH to read as follows:

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

NSTH 615.62, p. 615-311, Definition of Typic Cryumbrepts (*Soil Taxonomy* p. 265). Change item 5 to read as follows:

"5. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-311, Definition of Typic Cryumbrepts (*Soil Taxonomy* p. 265). Renumber item 6 as 7 and add new item 6 to read as follows:

"6. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years; and"

Page 265, column 2, Fragiumbrepts, line 5. Change "mottles" to "redox depletions".

NSTH 615.62, p. 615-311, Fragiumbrepts (*Soil Taxonomy* p. 266). Change item JEAC to read as follows:

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

NSTH 615.62, p. 615-311, Definition of Typic Fragiumbrepts (*Soil Taxonomy* p. 266). Change item 2 to read as follows:

"2. Do not, in any horizon within 50 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage)."

Page 266, Description of subgroups, Typic Fragiumbrepts, column 2, lines 2 and 6. Change "mottles" to "redox depletions".

Page 266, Description of subgroups, Aquic Fragiumbrepts, column 2. Change "mottles" in line 1 and "mottled" in line 3 to "redox depletions" and "redox-depleted", respectively.

NSTH 615.62, pp. 615-311/312, Haplumbrepts (*Soil Taxonomy* p. 267). Change items JEDB and JEDI to read as follows:

"JEDB. Other Haplumbrepts that have *both*:

1. 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 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; *and*

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

**Aquandic Haplumbrepts**

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

**Aquic Haplumbrepts"**

NSTH 615.62, p. 615-312, Haplumbrepts (*Soil Taxonomy* p. 267). Change items JEDJ-JEDL to JEDI-JEDM and add new item JEDJ to read as follows:

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

**Oxyaquic Haplumbrepts"**

NSTH 615.62, p. 615-312, Definition of Typic Haplumbrepts (*Soil Taxonomy* p. 267). Change item 2 to read as follows:

"2. Do not, in any horizon within 50 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-312, Definition of Typic Haplumbrepts (*Soil Taxonomy* p. 267). Renumber items 3-7 as 4-8 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

NSTH 615.14, p. 615-22, Description of subgroups, Aquandic Haplumbrepts (refer to NSTH 615.62). Change "mottles" in line 3 and "mottled" in line 4 to "redox depletions" and "redox-depleted", respectively.

NSTH 615.62, p. 615-313, Xerumbrepts (*Soil Taxonomy* p. 268). Change item JECE to read as follows:

"JECE. Other Xerumbrepts that have, 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 Xerumbrepts"**

NSTH 615.62, p. 615-313, Definition of Typic Xerumbrepts (*Soil Taxonomy* p. 268). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.74, p. 615-399, item HA (*Soil Taxonomy* p. 273). Change item 3 to read as follows:

"3. In one or more subhorizons of the albic and/or the argillic or natric horizon and within 100 cm of the mineral soil surface, redox concentrations in the form of masses or concretions or both, and also aquic conditions for some time in most years (or artificial drainage)."

NSTH 615.74, p. 615-399, item HB (*Soil Taxonomy* p. 273). Change item HB to read as follows:

"HB. Other Mollisols that have aquic conditions for some time in most years (or artificial drainage) between 40 and 50 cm from the mineral soil surface; *and one or more* of the following:

1. A histic epipedon overlying the mollic epipedon; *or*

2. An exchangeable sodium percentage (ESP) of 15 or more (or a sodium adsorption ratio, SAR, of 13 or more), in the upper part of the mollic epipedon, and a decrease in ESP (or SAR) values with increasing depth below 50 cm from the mineral soil surface; *or*

3. A calcic or petrocalcic horizon that has its upper boundary within 40 cm of the mineral soil surface; *or*

4. *One* of the following colors:

a. A chroma of 1 or less in the lower part of the mollic epipedon[1], *and either*

(1) Distinct or prominent redox concentrations in the lower part of the mollic epipedon; *or*

(2) Either directly below the mollic epipedon, or within 75 cm of the mineral soil surface if a calcic horizon intervenes, a color value, moist, of 4 or more *and one* of the following:

(a) Fifty percent or more chroma of 1 on faces of peds or in the matrix, a hue of 10YR or redder, and redox concentrations; *or*

[1] If the mollic epipedon extends to a lithic contact within 30 cm of the mineral soil surface, the requirement for redoximorphic features is waived.

(b) Fifty percent or more chroma of 2 or less on faces of peds or in the matrix, a hue of 2.5Y, and redox concentrations; *or*

(c) Fifty percent or more chroma of 1 on faces of peds or in the matrix, and a hue of 2.5Y or yellower; *or*

(d) Fifty percent or more chroma of 3 or less on faces of peds or in the matrix, a hue of 5Y, and redox concentrations; *or*

(e) Fifty percent or more chroma of 0 on faces of peds or in the matrix; *or*

(f) A hue of 5GY, 5G, 5BG, or 5B; *or*

(g) Any color if it results from uncoated sand grains; *or*

b. A chroma of 2 in the lower part of the mollic epipedon, *and either*

(1) Distinct or prominent redox concentrations in the lower part of the mollic epipedon; *or*

(2) Matrix colors directly below the mollic epipedon as follows: *either*

(a) A color value, moist, of 4, a chroma of 2, and some redox depletions with a color value, moist, of 4 or more and a chroma of 1 or less; *or*

(b) A color value, moist, of 5 or more, a chroma of 2 or less, and redox concentrations; *or*

(c) A color value, moist, of 4 and a chroma of 1 or less; *or*

5. Between 40 and 50 cm from the mineral soil surface, enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquolls"**

Page 274, column 1, Albolls, Definition. Change item 3 to read as follows:

"3. In one or more subhorizons of the albic and/or the argillic or natric horizon and within 100 cm of the mineral soil surface, redox concentrations in the form of masses or concretions or both, and also aquic conditions for some time in most years (or artificial drainage)."

Page 275, column 1, Aquolls, line 3. Change "mottles" to "redox concentrations".

Page 275, Aquolls, Definition. Change definition to read as follows:

"Aquolls are the Mollisols that have aquic conditions for some time in most years (or artificial drainage) between 40 and 50 cm from the mineral soil surface; and one or more of the following:

1. A histic epipedon overlying the mollic epipedon; or

2. An exchangeable sodium percentage (ESP) of 15 or more (or a sodium adsorption ratio, SAR, of 13 or more), in the upper part of the mollic epipedon, and a decrease in ESP (or SAR) values with increasing depth below 50 cm from the mineral soil surface; or

3. A calcic or petrocalcic horizon that has its upper boundary within 40 cm of the mineral soil surface; or

4. One of the following colors:

a. A chroma of 1 or less in the lower part of the mollic epipedon[1], and either

(1) Distinct or prominent redox concentrations in the lower part of the mollic epipedon; or

(2) Either directly below the mollic epipedon, or within 75 cm of the mineral soil surface if a calcic horizon intervenes, a color value, moist, of 4 or more and one of the following:

(a) Fifty percent or more chroma of 1 on faces of peds or in the matrix, a hue of 10YR or redder, and redox concentrations; or

(b) Fifty percent or more chroma of 2 or less on faces of peds or in the matrix, a hue of 2.5Y, and redox concentrations; or

(c) Fifty percent or more chroma of 1 on faces of peds or in the matrix, and a hue of 2.5Y or yellower; or

(d) Fifty percent or more chroma of 3 or less on faces of peds or in the matrix, a hue of 5Y, and redox concentrations; or

[1] If the mollic epipedon extends to a lithic contact within 30 cm of the mineral soil surface, the requirement for redoximorphic features is waived.

(e) Fifty percent or more chroma of 0 on faces of peds or in the matrix; or

(f) A hue of 5GY, 5G, 5BG, or 5B; or

(g) Any color if it results from uncoated sand grains; or

b. A chroma of 2 in the lower part of the mollic epipedon, and either

(1) Distinct or prominent redox concentrations in the lower part of the mollic epipedon; or

(2) Matrix colors directly below the mollic epipedon as follows: either

(a) A color value, moist, of 4, a chroma of 2, and some redox depletions with a color value, moist, of 4 or more and a chroma of 1 or less; or

(b) A color value, moist, of 5 or more, a chroma of 2 or less, and redox concentrations; or

(c) A color value, moist, of 4 and a chroma of 1 or less; or

5. Between 40 and 50 cm from the mineral soil surface, enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated; and

6. Do not have both an albic horizon and, within 100 cm of the mineral soil surface in any subhorizon of the albic and/or argillic or natric horizon, redox concentrations in the form of masses or concretions or both and also aquic conditions (or artificial drainage)."

Page 276, column 1, Key to great groups (refer to NSTH p. 615-179). Delete all of item HBF and substitute new items HBF and HBG to read as follows:

"HBF. Other Aquolls that have episaturation.
**Epiaquolls**

HBG. Other Aquolls.
**Endoaquolls"**

NSTH 615.62, p. 315, Calciaquolls (*Soil Taxonomy* p. 277). Change item HBDB to read as follows:

"HBDB. Other Calciaquolls that have 50 percent or more chroma of 3 or more on the faces of peds or in the matrix of one or more horizons within 75 cm of the mineral soil surface, or have, directly below the mollic epipedon, colors as follows:

1. A hue of 2.5Y or yellower and a chroma of 3 or more; *or*

2. A hue of 10YR or redder and a chroma of 2 or more; *or*

3. A hue of 2.5Y or yellower and a chroma of 2 or more if there are no distinct or prominent redox concentrations.
**Aeric Calciaquolls"**

NSTH 615.62, p. 315, Definition of Typic Calciaquolls (*Soil Taxonomy* p. 277). Change item 1 to read as follows:

"1. Have more than 50 percent chroma of 2 or less on faces of peds or in the matrix in all horizons within 75 cm of the mineral soil surface, or have, directly below the mollic epipedon, colors as follows:

a. A hue of 2.5Y or yellower, a chroma of 2 or less, and distinct or prominent redox concentrations; or

b. A hue of 2.5Y or yellower and a chroma of 1; or

c. A hue of 10YR or redder and a chroma of 1; or

d. A chroma of 0; and"

Page 277, column 1, Description of subgroups, Typic Calciaquolls, lines 3 and 6. Change "mottles" (both lines) to "redox concentrations".

Page 277, column 1, Description of subgroups, Aeric Calciaquolls, line 2. Change "mottles" to "redox concentrations".

Page 277, column 2, Description of a Typic Cryaquoll, Ag1, Ag2, Bg, and 2Cg horizons. Change "mottles" (4 times) to "redox concentrations".

Page 279 and 280, Haplaquolls. Delete whole section on Haplaquolls and substitute the following sections on Endoaquolls and Epiaquolls:

**"Endoaquolls**

Definition

Endoaquolls are the Aquolls which:

1. Do not have an argillic or a natric horizon;

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

3. Do not have a calcic horizon that has its upper boundary within 40 cm of the mineral soil surface;

4. Have a soil temperature regime that is warmer than cryic; and

5. Have endosaturation.

Key to subgroups

HBGA. Endoaquolls that have a lithic contact within 50 cm of the mineral soil surface.
**Lithic Endoaquolls**

HBGB. Other Endoaquolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Endoaquolls**

HBGC. Other Endoaquolls that have a histic epipedon.

**Histic Endoaquolls**

HBGD. Other Endoaquolls which have a buried Histosol that has its upper boundary within 100 cm of the mineral soil surface.

**Thapto-Histic Endoaquolls**

HBGE. Other Endoaquolls 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, and *either*

a. In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

b. In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

**Aquandic Endoaquolls**

HBGF. Other Endoaquolls which have a horizon 15 cm or more thick within 100 cm of the mineral soil surface that contains 20 percent or more (by volume) durinodes or is brittle and has firm consistence when moist.

**Duric Endoaquolls**

HBGG. Other Endoaquolls that have a mollic epipedon 60 cm or more thick.

**Cumulic Endoaquolls**

HBGH. Other Endoaquolls which have *both*:

1. *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*

2. A slope of less than 25 percent.

**Fluvaquentic Endoaquolls**

HBGI. Other Endoaquolls.

**Typic Endoaquolls**

Definition of Typic Endoaquolls

Typic Endoaquolls are the Endoaquolls which:

1. Do not have a histic epipedon;

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

3. Do not have a horizon 15 cm or more thick within 100 cm of the mineral soil surface that contains 20 percent or more (by volume) durinodes or is brittle and has firm consistence when moist;

4. Do not have either:

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

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;

5. Do not, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, have any of the following:

a. 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

b. 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

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and either

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; or

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and

in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more;

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

7. Have a mollic epipedon that is less than 60 cm thick; and

8. Have either less than 0.3 percent organic carbon at a depth of 125 cm below the mineral soil surface and a regular 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; or a slope of 25 percent or more.

**Epiaquolls**

Definition

Epiaquolls are the Aquolls which:

1. Do not have an argillic or a natric horizon;

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

3. Do not have a calcic horizon that has its upper boundary within 40 cm of the mineral soil surface;

4. Have a soil temperature regime that is warmer than cryic; and

5. Have episaturation.

Key to subgroups

HBFA. Other Epiaquolls that have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Epiaquolls**

HBFB. Other Epiaquolls that have a histic epipedon.

**Histic Epiaquolls**

HBFC. Other Epiaquolls which have a buried Histosol that has its upper boundary within 100 cm of the mineral soil surface.

**Thapto-Histic Epiaquolls**

HBFD. Other Epiaquolls 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, and *either*

a. In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; *or*

b. In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more.

**Aquandic Epiaquolls**

HBFE. Other Epiaquolls which have a horizon 15 cm or more thick within 100 cm of the mineral soil surface that contains 20 percent or more (by volume) durinodes or is brittle and has firm consistence when moist.

**Duric Epiaquolls**

HBFF. Other Epiaquolls that have a mollic epipedon 60 cm or more thick.

**Cumulic Epiaquolls**

HBFG. Other Epiaquolls which have:

1. *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*

2. A slope of less than 25 percent.

**Fluvaquentic Epiaquolls**

HBFH. Other Epiaquolls.

**Typic Epiaquolls**

Definition of Typic Epiaquolls

Typic Epiaquolls are the Epiaquolls which:

1. Do not have a histic epipedon;

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

3. Do not have a horizon 15 cm or more thick within 100 cm of the mineral soil surface that contains 20 percent or more (by volume) durinodes or is brittle and has firm consistence when moist;

4. Do not, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, have any of the following:

a. 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

b. 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

c. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and either

(1) In the 0.02-to-2.0-mm fraction, more than 30 percent volcanic glass; or

(2) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, and in the fine-earth fraction, aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.40 or more;

5. Do not have either:

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;

6. Have a mollic epipedon less than 60 cm thick; and

7. Have either less than 0.3 percent organic carbon at a depth of 125 cm below the mineral soil surface and a regular 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; or a slope of 25 percent or more."

Page 281, column 2, Borolls, Definition. Change item 3 to read as follows:

"3. Do not have both an albic horizon and, within 100 cm of the mineral soil surface in any subhorizon of the albic and/or argillic or natric horizon, redox concentrations in the form of masses or concretions or both and also aquic conditions (or artificial drainage)."

NSTH 615.62, p. 615-319, Argiborolls (*Soil Taxonomy* p. 282). Change item HEDL to read as follows:

"HEDL. Other Argiborolls that have, 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 Argiborolls**"

NSTH 615.62, pp. 615-317 to 615-319, Argiborolls (*Soil Taxonomy* p. 282). Change items HEDM-HEDQ to HEDN-HEDR and add new item HEDM to read as follows:

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

NSTH 615.62, p. 615-319, Definition of Typic Argiborolls (*Soil Taxonomy* p. 282). Change item 4 to read as follows:

"4. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-319, Definition of Typic Argiborolls (*Soil Taxonomy* p. 282). Renumber items 5-8 as 6-9 and add new item 5 to read as follows:

"5. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 283, Description of subgroups, Typic Argiborolls, 2nd paragraph, line 15. Change "a mottled argillic horizon" to "redox depletions within 100 cm of the mineral soil surface".

Page 283, Description of subgroups, Typic Argiborolls, 2nd paragraph, line 18. Change "Mottles" to "Redox depletions".

Page 283, Description of subgroups, Albic Argiborolls, line 6. Change "mottles" to "redox depletions".

Page 283, Description of subgroups, Aquic Argiborolls, line 3. Change "mottles" to "redox depletions".

NSTH 615.62, p. 615-320, Calciborolls (*Soil Taxonomy* p. 285). Change item HEFD to read as follows:

"HEFD. Other Calciborolls that have, 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 Calciborolls**"

NSTH 615.62, p. 615-320, Calciborolls (*Soil Taxonomy* p. 285). Change item HEFE to HEFF and add new item HEFE to read as follows:

"HEFE. Other Calciborolls that are saturated with water, in one or more layers within 100 cm

of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.
**Oxyaquic Calciborolls"**

NSTH 615.62, p. 615-320, Definition of Typic Calciborolls (*Soil Taxonomy* p. 285). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the mineral soil surface, have distinct or prominent redox concentrations and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-320, Definition of Typic Calciborolls (*Soil Taxonomy* p. 285). Renumber items 2-4 as 3-5 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

NSTH 615.62, p. 615-321, Cryoborolls (*Soil Taxonomy* p. 285). Change items HEBR, HEBS, and HEBT to read as follows:

"HEBR. Other Cryoborolls that have *both*:

1. An argillic horizon; *and*

2. 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).
**Argiaquic Cryoborolls**

HEBS. Other Cryoborolls that have:

1. *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*

2. 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); *and*

3. A slope of less than 25 percent.
**Fluvaquentic Cryoborolls**

HEBT. Other Cryoborolls that have, 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 Cryoborolls"**

NSTH 615.62, pp. 615-321/322, Cryoborolls (*Soil Taxonomy* p. 285). Change items HEBV-HEBZ to HEBW-HEBZa and add new item HEBV to read as follows:

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

NSTH 615.62, p. 615-322, Definition of Typic Cryoborolls (*Soil Taxonomy* p. 285). Change item 3 to read as follows:

"3. Do not, in any horizon within 100 cm of the mineral soil surface, have distinct or prominent redox concentrations and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-322, Definition of Typic Cryoborolls (*Soil Taxonomy* p. 285). Renumber items 4-11 as 5-12 and add new item 4 to read as follows:

"4. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 286, Description of subgroups, Typic Cryoborolls, 2nd paragraph, line 6. Change "Mottles" to "Redox concentrations".

Page 287, Description of subgroups, Aquic Cryoborolls, line 2. Change "mottles" to "redox concentrations".

Page 287, Description of subgroups, Argic Pachic Cryoborolls, line 6. Change "is mottled" to "has redoximorphic features".

Page 287, Description of subgroups, Argic Vertic Cryoborolls, line 5. Change "mottles" to "redoximorphic features".

Page 288, Description of subgroups, Pachic Cryoborolls, line 3. Change "mottles" to "redoximorphic features".

Page 288, Description of subgroups, Vertic Cryoborolls, line 4. Change "mottles" to "redoximorphic features".

NSTH 615.62, p. 615-324, Haploborolls (*Soil Taxonomy* p. 288). Change items HEGL and HEGM to read as follows:

"HEGL. Other Haploborolls that have:

1. *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*

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); *and*

3. A slope of less than 25 percent.
**Fluvaquentic Haploborolls**

HEGM. Other Haploborolls that have, 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 Haploborolls"**

NSTH 615.62, p. 615-324, Haploborolls (*Soil Taxonomy* p. 288). Change items HEGN-HEGU to HEGO-HEGV and add new item HEGN to read as follows:

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

**Oxyaquic Haploborolls"**

NSTH 615.62, pp. 615-324/325, Definition of Typic Haploborolls (*Soil Taxonomy* p. 288). Change item 2 to read as follows:

"2. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, pp. 615-324/325, Definition of Typic Haploborolls (*Soil Taxonomy* p. 288). Renumber items 3-9 as 4-10 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 289, Description of subgroups, Typic Haploborolls, 2nd paragraph, line 1. Change "mottles" to "redox depletions".

Page 289, Description of subgroups, Aquic Haploborolls. Change "mottles" in line 1 and "mottled" in line 2 to "redox depletions" and "redox-depleted", respectively.

Page 290, Description of subgroups, Fluvaquentic Haploborolls, line 3. Change "are mottled" to "have redoximorphic features".

Page 290, Description of subgroups, Pachic Haploborolls, line 4. Change "mottles" to "redox depletions".

Page 290, Description of subgroups, Pachic Udic Haploborolls, line 4. Change "mottles" to "redox depletions".

Page 290, Description of subgroups, Torrifluventic Haploborolls. Delete 4th sentence starting with "There may be ..."

NSTH 615.62, p. 615-326, Paleborolls (*Soil Taxonomy* p. 292). Change item HEAF to read as follows:

"HEAF. Other Paleborolls that have, 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 Paleborolls"**

NSTH 615.62, p. 615-326, Paleborolls (*Soil Taxonomy* p. 292). Change item HEAG to HEAH and add new item HEAG to read as follows:

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

**Oxyaquic Paleborolls"**

NSTH 615.62, p. 615-326, Definition of Typic Paleborolls (*Soil Taxonomy* p. 292). Change item 2 to read as follows:

"2. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-326, Definition of Typic Paleborolls (*Soil Taxonomy* p. 292). Renumber items 3-4 as 4-5 and add new item 3 to read as follows:

"3. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 293, Description of subgroups, Abruptic Cryic Paleborolls, line 5. Change "mottles" to "redox depletions".

Page 293, Description of subgroups, Cryic Pachic Paleborolls, line 4. Change "mottles" to "redox depletions".

Page 293, Description of subgroups, Pachic Paleborolls, line 3. Change "mottles" to "redox depletions".

Page 294, column 1, Rendolls, Definition. Add new item 5 to read as follows:

"5. Do not have both aquic conditions and colors defined for Aquolls;"

Page 295, column 1, Udolls, Definition. Change items 2 and 3 to read as follows:

"2. Do not have both an albic horizon and, within 100 cm of the mineral soil surface in any subhorizon of the albic and/or argillic or natric horizon, redox concentrations in the form of masses or concretions or both and also aquic conditions (or artificial drainage);

3. Do not have both aquic conditions and colors defined for Aquolls;"

Page 295, Key to great groups, item HGA.2 (refer to NSTH p. 615-179). Change "mottles" to "redox concentrations".

Page 295, Argiudolls, Definition, item 2. Change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-328, Argiudolls (*Soil Taxonomy* p. 295). Change item HGCF to read as follows:

"HGCF. Other Argiudolls which have aquic conditions for some time in most years (or artificial drainage), *either*

1. Within 40 cm of the mineral soil surface, in horizons that also have redoximorphic features; *or*

2. Directly below the mollic epipedon, in 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 Argiudolls"**

NSTH 615.62, p. 615-328 (see also p. 615-404), Argiudolls (*Soil Taxonomy* p. 295). Change items HGCG-HGCI to HGCH-HGCJ and add new item HGCG to read as follows:

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

**Oxyaquic Argiudolls"**

NSTH 615.62, p. 615-328, Definition of Typic Argiudolls (*Soil Taxonomy* p. 295). Change item 1 to read as follows:

"1. Do not have aquic conditions for some time in most years (or artificial drainage), *either*

a. Within 40 cm of the mineral soil surface, in horizons that also have redoximorphic features; *or*

b. Directly below the mollic epipedon, in horizons with a total thickness of 15 cm or more that have *one or more* of the following:

(1) A color value, moist, of 4 or more and redox depletions with a chroma of 2 or less; *or*

(2) A hue of 10YR or redder and a chroma of 2 or less; *or*

(3) A hue of 2.5Y or yellower and a chroma of 3 or less;"

NSTH 615.62, p. 615-328 (see also p. 615-404), Definition of Typic Argiudolls (*Soil Taxonomy* p. 295). Change items 2-7 to 3-8 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 296, Description of subgroups, Typic Argiudolls, 2nd paragraph, line 1. Change "mottles" to "redoximorphic features".

Page 296, Description of subgroups, Aquic Argiudolls, line 3. Change "mottles" to "redoximorphic features".

NSTH 615.85, p. 615-405, Calciudolls. Change item HGBC to read as follows:

"HGBC. Other Calciudolls that have, 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 Calciudolls"**

NSTH 615.85, p. 615-405, Definition of Typic Calciudolls. Change item 3 to read as follows:

"3. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage)."

NSTH 615.62, pp. 615-329/330 (see also p. 615-404), Hapludolls (*Soil Taxonomy* p. 296). Change items HGEF and HGEG to read as follows:

"HGEF. Other Hapludolls that have:

1. Aquic conditions for some time in most years (or artificial drainage), *either*

a. Within 40 cm of the mineral soil surface, in horizons that also have redoximorphic features; *or*

b. 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:

(1) A color value, moist, of 4 or more and redox depletions with a chroma of 2 or less; *or*

(2) A hue of 10YR or redder and a chroma of 2 or less; *or*

(3) A hue of 2.5Y or yellower and a chroma of 3 or less; *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 less than 25 percent.

**Fluvaquentic Hapludolls**

HGEG. Other Hapludolls which have aquic conditions for some time in most years (or artificial drainage), *either*

1. Within 40 cm of the mineral soil surface, in horizons that also have redoximorphic features; *or*

2. 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 Hapludolls"**

NSTH 615.62, p. 615-330 (see also p. 615-404), Hapludolls (*Soil Taxonomy* p. 296). Change items HGEH-HGEL to HGEI-HGEM and add new item HGEH to read as follows:

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

**Oxyaquic Hapludolls"**

NSTH 615.62, p. 615-330 (see also p. 615-404), Definition of Typic Hapludolls (*Soil Taxonomy* p. 296). Change item 1 to read as follows:

"1. Do not have aquic conditions for some time in most years (or artificial drainage), *either*

a. Within 40 cm of the mineral soil surface, in horizons that also have redoximorphic features; *or*

b. Directly below the mollic epipedon, in horizons with a total thickness of 15 cm or more that have *one or more* of the following:

(1) A color value, moist, of 4 or more and redox depletions with a chroma of 2 or less; *or*

(1) A hue of 10YR or redder and a chroma of 2 or less; *or*

(3) A hue of 2.5Y or yellower and a chroma of 3 or less;"

NSTH 615.62, p. 615-330 (see also p. 615-404), Definition of Typic Hapludolls (*Soil Taxonomy* p. 296). Renumber items 2-8 as 3-9 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 297, Description of subgroups, Typic Hapludolls, 2nd paragraph, line 1. Change "mottles" to "redoximorphic features".

Page 297, Description of subgroups, Aquic Hapludolls, line 2. Change "mottles" to "redoximorphic features".

Page 298, Paleudolls, Definition, item 2. Change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-331 (see also p. 615-405), Paleudolls (*Soil Taxonomy* p. 298). Change item HGAC to read as follows:

"HGAC. Paleudolls that have, in one or more subhorizons within the upper 50 cm of the argillic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Paleudolls"**

NSTH 615.62, p. 615-331 (see also p. 615-405), Paleudolls (*Soil Taxonomy* p. 298). Change items HGAD and HGAE to HGAE and HGAF and add new item HGAD to read as follows:

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

**Oxyaquic Paleudolls"**

NSTH 615.62, p. 615-331 (see also p. 615-405), Definition of Typic Paleudolls (*Soil Taxonomy* p. 298). Change item 1 to read as follows:

"1. Do not, in any subhorizon within the upper 50 cm of the argillic horizon, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-331 (see also p. 615-405), Definition of Typic Paleudolls (*Soil Taxonomy* p. 298). Renumber items 2 and 4 as 3 and 5, respectively, and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 298, Description of subgroups, Typic Paleudolls. Change "mottles" in lines 4 and 6 and "mottled" in line 6 to "redox depletions" and "redox-depleted", respectively.

Page 298, Description of subgroups, Aquic Paleudolls. Change "mottles" in line 1 and "mottled" in line 4 to "redox depletions" and "redox-depleted", respectively.

Page 299, Ustolls, Definition. Change items 2 and 3 to read as follows:

"2. Do not have both an albic horizon and, within 100 cm of the mineral soil surface in any subhorizon of the albic and/or argillic or natric horizon, redox concentrations in the form of masses or concretions or both and also aquic conditions (or artificial drainage);

3. Do not have both aquic conditions and colors defined for Aquolls;"

Page 299, Key to great groups, item HFC.1.b (refer to NSTH 615.60). Change "mottles" to "redox concentrations".

Page 299, Argiustolls, Definition, item 1.a.(2). Change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-333, Argiustolls (*Soil Taxonomy* p. 299). Change item HFEL to read as follows:

"HFEL. Other Argiustolls that have, 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 Argiustolls"**

NSTH 615.62, p. 615-333, Argiustolls (*Soil Taxonomy* p. 299). Change items HFEM-HFEP to HFEN-HFEQ and add new item HFEM to read as follows:

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

**Oxyaquic Argiustolls"**

NSTH 615.62, p. 615-333, Definition of Typic Argiustolls (*Soil Taxonomy* p. 299). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-333, Definition of Typic Argiustolls (*Soil Taxonomy* p. 299). Renumber items 2-9 as 3-10 and add new item 3 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 300, Description of subgroups, Typic Argiustolls, 2nd paragraph, line 2. Change "mottles" to "redox depletions".

Page 300, Description of subgroups, Aquic Argiustolls, line 1. Change "mottles" to "redox depletions".

Page 301, Description of subgroups, Pachic Argiustolls, line 4. Change "mottles" to "redox depletions".

NSTH 615.62, p. 615-335, Calciustolls (*Soil Taxonomy* p. 301). Change item HFDI to read as follows:

"HFDI. Other Calciustolls that have, in one or more horizons within 75 cm of the mineral soil surface, redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Calciustolls"**

NSTH 615.62, p. 615-335, Calciustolls (*Soil Taxonomy* p. 301). Change items HFDJ-HFDL to HFDK-HFDM and add new item HFDJ to read as follows:

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

**Oxyaquic Calciustolls"**

NSTH 615.62, p. 615-335, Definition of Typic Calciustolls (*Soil Taxonomy* p. 301). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox concentrations and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-335, Definition of Typic Calciustolls (*Soil Taxonomy* p. 301). Change items 2-8 to 3-9 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 302, Description of subgroups, Typic Calciustolls, line 4. Change "mottles" to "redoximorphic features".

Page 302, Description of subgroups, Typic Calciustolls, 2nd paragraph. Change first sentence to read as follows:

"Redox concentrations and a groundwater table that fluctuates within 75 cm of the mineral soil surface are properties shared with Aquolls and define the aquic subgroups."

Page 302, Description of subgroups, Aquic Calciustolls. Change first sentence to read as follows:

"Soils in this subgroup have shallow ground water and redox concentrations."

NSTH 615.62, p. 615-338, Haplustolls (*Soil Taxonomy* p. 303). Change items HFGO to HFGP, HFGP to HFGQ, and HFGQ-HFGY to HFGS-HFGZa; add new items HFGO and HFGR, and change other items identified below to read as follows:

"HFGO. Other Haplustolls that have anthraquic conditions.

**Anthraquic Haplustolls**

HFGP. Other Haplustolls that have:

1. In one or more horizons within 100 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. *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 less than 25 percent.

**Fluvaquentic Haplustolls**

HFGQ. Other Haplustolls that have, 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 Haplustolls**

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

**Oxyaquic Haplustolls"**

NSTH 615.62, p. 615-340, Definition of Typic Haplustolls (*Soil Taxonomy* p. 303). Change item 1 to read as follows:

"1. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-340, Definition of Typic Haplustolls (*Soil Taxonomy* p. 303). Renumber items 2-12 as 4-14 and add new items 2 and 3 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;

3. Do not have anthraquic conditions;"

Page 304, Description of subgroups, Typic Haplustolls, 2nd paragraph, line 1. Change "mottles" to "redox depletions".

Page 304, Description of subgroups, Typic Haplustolls, 2nd paragraph, lines 1 and 19. Change "mottles" to "redox depletions".

Page 304, Description of subgroups, Aquic Haplustolls, line 2. Change "mottles" to "redox depletions".

Page 305, Description of subgroups, Cumulic Haplustolls, line 10. Change "mottles" to "redox depletions".

Page 305, Description of subgroups, Fluvaquentic Haplustolls, line 3. Change "mottles" to "redox depletions".

Page 305, Description of subgroups, Pachic Haplustolls, line 4. Change "mottles" to "redox depletions".

NSTH 615.62, p. 615-340, Natrustolls (*Soil Taxonomy* p. 306). Change item HFBB to read as follows:

"HFBB. Other Natrustolls that have, in one or more horizons between 50 and 100 cm from the mineral soil surface, aquic conditions for some time in most years (or artificial drainage) *and one* of the following:

1. Fifty percent or more chroma of 1 or less, and a hue of 2.5Y or yellower; *or*

2. Fifty percent or more chroma of 2 or less, and redox concentrations; *or*

3. Fifty percent or more chroma of 2 or less; *and also* a higher exchangeable sodium percentage (or sodium adsorption ratio) between the mineral soil surface and a depth of 25 cm than in the underlying horizon.

**Aquic Natrustolls"**

NSTH 615.62, p. 615-341, Definition of Typic Natrustolls (*Soil Taxonomy* p. 303). Change item 1 to read as follows:

"1. Do not, in any horizon between 50 and 100 cm from the mineral soil surface, have aquic conditions (or artificial drainage) and any of the following:

a. Fifty percent or more chroma of 1 or less throughout, and a hue of 2.5Y or yellower in some part; or

b. Fifty percent or more chroma of 2 or less, and redox concentrations; or

c. Fifty percent or more chroma of 2 or less; and also a higher exchangeable sodium percentage (or sodium adsorption ratio) between the mineral soil surface and a depth of 25 cm than in the underlying horizon;"

Page 306, Description of subgroups, Typic Natrustolls, line 3. Change "mottles" to "redox concentrations".

Page 307, Paleustolls, Definition, item 1.a.(2). Change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-342, Paleustolls (*Soil Taxonomy* p. 308). Change item HFCF to read as follows:

"HFCF. Other Paleustolls that have, 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 Paleustolls"**

NSTH 615.62, p. 615-343, Definition of Typic Paleustolls (*Soil Taxonomy* p. 308). Change item 2 to read as follows:

"2. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

Page 308, Description of subgroups, Typic Paleustolls, 2nd paragraph, line 4. Change "Mottles" to "Redox depletions".

Page 309, Description of subgroups, Aquic Paleustolls, line 3. Change "mottles" to "redox depletions".

NSTH 615.62, p. 615-343, Vermustolls (*Soil Taxonomy* p. 309). Change item HFFC to read as follows:

"HFFC. Other Vermustolls that have, 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 Vermustolls**"

NSTH 615.62, p. 615-343, Definition of Typic Vermustolls (*Soil Taxonomy* p. 309). Change item 4 to read as follows:

"4. Do not, in any horizon within 100 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage)."

Page 310, Xerolls, Definition. Change items 2 and 3 to read as follows:

"2. Do not have both an albic horizon and, within 100 cm of the mineral soil surface in any subhorizon of the albic and/or argillic or natric horizon, redox concentrations in the form of masses or concretions or both and also aquic conditions (or artificial drainage);

3. Do not have both aquic conditions and colors defined for Aquolls;"

Page 310, Key to great groups, item HDC.1.b (refer to NSTH p. 615-179). Change "mottles" to "redox concentrations".

Page 311, Key to great groups, Argixerolls, Definition, item 2.a.(2). Change "mottles" to "redox concentrations".

NSTH 615.62, pp. 615-344/345, Argixerolls (*Soil Taxonomy* p. 311). Change items HDEK and HDEL to read as follows:

"HDEK. Other Argixerolls that have *both*:

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

2. A base saturation (by sum of cations) of 75 percent or less in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm or a lithic or paralithic contact, whichever is shallower.
**Aquultic Argixerolls**

HDEL. Other Argixerolls that have, 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 Argixerolls**"

NSTH 615.62, p. 615-345, Argixerolls (*Soil Taxonomy* p. 311). Change items HDEM-HDET to HDEN-HDEU and add new item HDEM to read as follows:

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

NSTH 615.62, p. 615-345, Definition of Typic Argixerolls (*Soil Taxonomy* p. 311). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-345, Definition of Typic Argixerolls (*Soil Taxonomy* p. 311). Renumber items 2-10 as 3-11 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 312, Description of subgroups, Typic Argixerolls, lines 3 and 4. Change "do not have evidence of wetness within 75 cm of the mineral soil surface" to "do not have redox depletions and aquic conditions within 75 cm of the mineral soil surface".

Page 312, Description of subgroups, Typic Argixerolls, 2nd paragraph, line 2. Change "mottles" to "redox depletions".

Page 312, Description of subgroups, Aquic Argixerolls, line 1. Change "mottles" to "redox depletions".

Page 312, Description of subgroups, Aquultic Argixerolls, line 2. Change "mottles" to "redox depletions".

Page 312, Description of subgroups, Calcic Pachic Argixerolls, lines 5 and 6. Change "some characteristics associated with wetness" to "aquic conditions".

Page 313, Description of subgroups, Pachic Argixerolls, line 4. Change "some characteristics associated with wetness" to "aquic conditions".

Page 313, Description of subgroups, Pachic Ultic Argixerolls, line 6. Change "some characteristics associated with wetness" to "aquic conditions".

NSTH 615.62, p. 615-346, Calcixerolls (*Soil Taxonomy* p. 313). Change item HDDD to read as follows:

"HDDD. Other Calcixerolls that have, in one or more horizons within 75 cm of the mineral soil surface, redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).
**Aquic Calcixerolls**"

NSTH 615.62, p. 615-346, Calcixerolls (*Soil Taxonomy* p. 313). Change items HDDE-HDDG to HDDF-HDDH and add new item HDDE to read as follows:

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

NSTH 615.62, p. 615-346, Definition of Typic Calcixerolls (*Soil Taxonomy* p. 313). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox concentrations and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-346, Definition of Typic Calcixerolls (*Soil Taxonomy* p. 313). Renumber items 2-6 as 3-7 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 314, Description of subgroups, Typic Calcixerolls, line 4. Change "mottles" to "redox concentrations".

Page 314, Description of subgroups, Typic Calcixerolls, 2nd paragraph. Change first sentence to read as follows:

"Redox concentrations and a groundwater table that fluctuates within 75 cm of the mineral soil surface are properties shared with Aquolls and define the aquic subgroups."

Page 314, Description of subgroups, Aquic Calcixerolls. Change first sentence to read as follows:

"These soils have shallow ground water and redox concentrations."

NSTH 615.62, p. 615-347, Durixerolls (*Soil Taxonomy* p. 314). Change item HDAC to read as follows:

"HDAC. Other Durixerolls that have, in one or more horizons above the duripan, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).
**Aquic Durixerolls**"

NSTH 615.62, p. 615-347, Definition of Typic Durixerolls (*Soil Taxonomy* p. 314). Change item 5 to read as follows:

"5. Do not, in any horizon above the duripan, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage); and"

NSTH 615.62, p. 615-349, Haploxerolls (*Soil Taxonomy* p. 316). Change items HDFL, HDFM, HDFN, and HDFO to read as follows:

"HDFL. Other Haploxerolls that have:

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

2. *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 Haploxerolls**

HDFM. Other Haploxerolls that have *both*:

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

2. A horizon 15 cm or more thick within 100 cm of the mineral soil surface that contains 20 percent or more (by volume) durinodes or is brittle and has firm consistence when moist.
**Aquic Duric Haploxerolls**

HDFN. Other Haploxerolls that have *both*:

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

2. A base saturation (by sum of cations) of 75 percent or less in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm or a lithic or paralithic contact, whichever is shallower.
**Aquultic Haploxerolls**

HDFO. Other Haploxerolls that have, 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 Haploxerolls**"

NSTH 615.62, p. 615-349, Haploxerolls (*Soil Taxonomy* p. 316). Change items HDFP-HDFZc to HDFQ-HDFZd and add new item HDFP to read as follows:

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

NSTH 615.62, p. 615-350, Definition of Typic Haploxerolls (*Soil Taxonomy* p. 316). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-350, Definition of Typic Haploxerolls (*Soil Taxonomy* p. 316). Renumber items 2-12 as 3-13 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 317, Description of subgroups, Typic Haploxerolls, line 4. Change "evidence of wetness" to "aquic conditions".

Page 317, Description of subgroups, Typic Haploxerolls, 2nd paragraph, line 2. Change "mottles" to "redox depletions".

Page 317, Description of subgroups, Aquic Haploxerolls, line 2. Change "mottles" to "redox depletions".

Page 317, Description of subgroups, Aquic Duric Haploxerolls, line 1. Change "mottles" to "redox depletions".

Page 317, Description of subgroups, Aquultic Haploxerolls, line 1. Change "mottles" to "redox depletions".

Page 318, Description of subgroups, Calcic Pachic Haploxerolls, line 7. Change "mottles" to "redox depletions".

Page 318, Description of subgroups, Cumulic Haploxerolls, line 11. Change "mottles" to "redox depletions".

Page 318, Description of subgroups, Fluvaquentic Haploxerolls, line 1. Change "mottles" to "redox depletions".

Page 318, Description of subgroups, Pachic Haploxerolls, line 4. Change "mottles" to "redox depletions".

Page 318, Description of subgroups, Pachic Ultic Haploxerolls, line 8. Change "mottles" to "redox depletions".

NSTH 615.62, p. 615-351, Natrixerolls (*Soil Taxonomy* p. 319). Change items HDBA and HDBB to read as follows:

"HDBA. Natrixerolls that have *both*:

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

2. A horizon 15 cm or more thick within 100 cm of the mineral soil surface that contains 20 percent or more (by volume) durinodes or is brittle and has firm consistence when moist.

**Aquic Duric Natrixerolls**

HDBB. Other Natrixerolls that have, 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 Natrixerolls**"

NSTH 615.62, p. 615-351, Definition of Typic Natrixerolls (*Soil Taxonomy* p. 319). Change item 1 to read as follows:

"1. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

Page 319, Description of subgroups, Typic Natrixerolls, line 3. Change "mottles" to "redox depletions".

Page 319, Description of subgroups, Typic Natrixerolls, 2nd paragraph, line 2. Change "mottles" to "redox depletions".

Page 319, Description of subgroups, Aquic Natrixerolls, line 1. Change "mottles" to "redox depletions".

Page 320, Description of subgroups, Aquic Duric Natrixerolls, line 1. Change "mottles" to "redox depletions".

Page 320, Palexerolls, Definition, item 1.a.(2). Change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-351, Palexerolls (*Soil Taxonomy* p. 320). Change item HDCD to read as follows:

"HDCD. Other Palexerolls that have, 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 Palexerolls**"

NSTH 615.62, p. 615-352, Definition of Typic Palexerolls (*Soil Taxonomy* p. 320). Change item 2 to read as follows:

"2. Do not, in any horizon within 75 cm of the mineral soil surface, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.45, p. 615-123, item DA (refer to NSTH p. 615-179). Change item DA to read as follows:

"DA. Oxisols that have aquic conditions for some time in most years (or artificial drainage) in one or more horizons within 50 cm of the mineral soil surface, *and one or more* of the following:

1. A histic epipedon; *or*

2. An epipedon with a color value, moist, of 3 or less, and directly below it, a horizon with a chroma of 2 or less; *or*

3. Distinct or prominent redox concentrations within 50 cm of the mineral soil surface, an epipedon, and directly below it, a horizon with *one or both* of the following:

a. Fifty percent or more hue of 2.5Y or yellower; *or*

b. A chroma of 3 or less; *or*

4. Within 50 cm of the mineral soil surface, enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquox**"

NSTH 615.45, p. 615-124, Aquox, Definition. Change the definition to read as follows:

"Aquox are the Oxisols that have aquic conditions for some time in most years (or artificial drainage) in one or more horizons within 50 cm of the mineral soil surface, and one or more of the following:

1. A histic epipedon; or

2. An epipedon directly above a horizon with 50 percent or more hue of 2.5Y or yellower or chroma of 3 or less, and distinct or prominent redox concentrations within 50 cm of the mineral soil surface; or

3. An epipedon with a color value, moist, of 3 or less, directly above a horizon with a chroma of 2 or less; or

4. Within 50 cm of the mineral soil surface, enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated."

NSTH 615.45, p. 615-125, Acraquox (refer to NSTH p. 615-179). Change item DAAB to read as follows:

"DAAB. Other Acraquox which have, directly below an epipedon, a horizon 10 cm or more thick that has 50 percent or more chroma of 3 or more.

**Aeric Acraquox**"

NSTH 615.62, p. 615-352, Definition of Typic Acraquox. Change item 2 to read as follows:

"2. Do not, directly below an epipedon, have a horizon 10 cm or more thick that has 50 percent or more chroma of 3 or more."

NSTH 615.45, pp. 615-125/126, Eutraquox (refer to NSTH p. 615-179). Change item DACC to read as follows:

"DACC. Other Eutraquox which have, directly below an epipedon, a horizon 10 cm or more thick that has 50 percent or more chroma of 3 or more.

**Aeric Eutraquox**"

NSTH 615.62, p. 615-352, Definition of Typic Eutraquox. Change item 3 to read as follows:

"3. Do not, directly below an epipedon, have a horizon 10 cm or more thick that has 50 percent or more chroma of 3 or more; and"

NSTH 615.45, p. 615-126, Haplaquox. Change item DADC to read as follows:

"DADC. Other Haplaquox which have, directly below an epipedon, a horizon 10 cm or more thick that has 50 percent or more chroma of 3 or more.

**Aeric Haplaquox**"

NSTH 615.62, p. 615-352, Definition of Typic Haplaquox. Change item 3 to read as follows:

"3. Do not, directly below an epipedon, have a horizon 10 cm or more thick that has 50 percent or more chroma of 3 or more; and"

NSTH 615.45, p. 615-127, Plinthaquox (refer to NSTH p. 615-179). Change item DABA to read as follows:

"DABA. Other Plinthaquox which have, directly below an epipedon, a horizon 10 cm or more thick that has 50 percent or more chroma of 3 or more.

**Aeric Plinthaquox**"

NSTH 615.62, p. 615-352, Definition of Typic Plinthaquox. Change definition to read as follows:

"Typic Plinthaquox are the Plinthaquox which do not, directly below an epipedon, have a horizon 10 cm or more thick that has 50 percent or more chroma of 3 or more."

NSTH 615.45, pp. 615-128/129, Acroperox (refer to NSTH p. 615-179). Change items DDBA, DDBC, and DDBG to read as follows:

"DDBA. Acroperox that have, within 125 cm of the mineral soil surface, *both*:

1. A petroferric contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Petroferric Acroperox**

DDBC. Other Acroperox that have, within 125 cm of the mineral soil surface, *both*:

1. A lithic contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Acroperox**

DDBG. Other Acroperox that have, in one or more horizons within 125 cm of the mineral soil

surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Acroperox"**

NSTH 615.62, p. 615-353, Definition of Typic Acroperox. Change item 4 to read as follows:

"4. Do not, in any horizon within 125 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.45, p. 615-130, Eutroperox (refer to NSTH p. 615-179). Change items DDCA, DDCC, DDCE, and DDCG to read as follows:

"DDCA. Eutroperox that have, within 125 cm of the mineral soil surface, *both*:

1. A petroferric contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Petroferric Eutroperox**

DDCC. Other Eutroperox that have, within 125 cm of the mineral soil surface, *both*:

1. A lithic contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Eutroperox**

DDCE. Other Eutroperox that have, in one or more horizons within 125 cm of the mineral soil surface, *both*:

1. Five percent or more (by volume) plinthite; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Plinthaquic Eutroperox**

DDCG. Other Eutroperox that have, in one or more horizons within 125 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Eutroperox"**

NSTH 615.62, p. 615-353, Definition of Typic Eutroperox. Change item 3 to read as follows:

"3. Do not, in any horizon within 125 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 cr less, and also aquic conditions (or artificial drainage);"

NSTH 615.45, p. 615-132, Haploperox (refer to NSTH p. 615-179). Change items DDEA, DDEC, DDEE, and DDEG to read as follows:

"DDEA. Haploperox that have, within 125 cm of the mineral soil surface, *both*:

1. A petroferric contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Petroferric Haploperox**

DDEC. Other Haploperox that have, within 125 cm of the mineral soil surface, *both*:

1. A lithic contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Haploperox**

DDEE. Other Haploperox that have, in one or more horizons within 125 cm of the mineral soil surface, *both*:

1. Five percent or more (by volume) plinthite; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Plinthaquic Haploperox**

DDEG. Other Haploperox that have, in one or more horizons within 125 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Haploperox"**

NSTH 615.62, p. 615-353, Definition of Typic Haploperox. Change item 3 to read as follows:

"3. Do not, in any horizon within 125 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.45, p. 615-134, Kandiperox (refer to NSTH p. 615-179). Change items DDDA, DDDC, DDDE, and DDDG to read as follows:

"DDDA. Kandiperox that have, within 125 cm of the mineral soil surface, *both*:

1. A petroferric contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Petroferric Kandiperox**

DDDC. Other Kandiperox that have, within 125 cm of the mineral soil surface, *both*:

1. A lithic contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Kandiperox**

DDDE. Other Kandiperox that have, in one or more horizons within 125 cm of the mineral soil surface, *both*:

1. Five percent or more (by volume) plinthite; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Plinthaquic Kandiperox**

DDDG. Other Kandiperox that have, in one or more horizons within 125 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Kandiperox"**

NSTH 615.62, p. 615-354, Definition of Typic Kandiperox. Change item 3 to read as follows:

"3. Do not, in any horizon within 125 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.45, pp. 615-139/140, Acrudox (refer to NSTH p. 615-179). Change items DEBA, DEBC, DEBE, and DEBH to read as follows:

"DEBA. Acrudox that have, within 125 cm of the mineral soil surface, *both*:

1. A petroferric contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Petroferric Acrudox**

DEBC. Other Acrudox that have, within 125 cm of the mineral soil surface, *both*:

1. A lithic contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Acrudox**

DEBE. Other Acrudox that have, within 125 cm of the mineral soil surface, *both*:

1. A delta pH (KCl pH - 1:1 water pH) with a 0 or net positive charge in a layer 18 cm or more thick; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Anionic Aquic Acrudox**

DEBH. Other Acrudox that have, in one or more horizons within 125 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Acrudox"**

NSTH 615.62, p. 615-354, Definition of Typic Acrudox. Change item 4 to read as follows:

"4. Do not, in any horizon within 125 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.45, pp. 615-141/142, Eutrudox (refer to NSTH p. 615-179). Change items DECA, DECC, DECE, and DECG to read as follows:

"DECA. Eutrudox that have, within 125 cm of the mineral soil surface, *both*:

1. A petroferric contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Petroferric Eutrudox**

DECC. Other Eutrudox that have, within 125 cm of the mineral soil surface, *both*:

1. A lithic contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Eutrudox**

DECE. Other Eutrudox that have, in one or more horizons within 125 cm of the mineral soil surface, *both*:

1. Five percent or more (by volume) plinthite; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Plinthaquic Eutrudox**

DECG. Other Eutrudox that have, in one or more horizons within 125 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Eutrudox"**

NSTH 615.62, p. 615-354, Definition of Typic Eutrudox. Change item 3 to read as follows:

"3. Do not, in any horizon within 125 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.45, pp. 615-143/144, Hapludox (refer to NSTH p. 615-179). Change items DEEA, DEEC, DEEE, and DEEG to read as follows:

"DEEA. Hapludox that have, within 125 cm of the mineral soil surface, *both*:

1. A petroferric contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Petroferric Hapludox**

DEEC. Other Hapludox that have, within 125 cm of the mineral soil surface, *both*:

1. A lithic contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Hapludox**

DEEE. Other Hapludox that have, in one or more horizons within 125 cm of the mineral soil surface, *both*:

1. Five percent or more (by volume) plinthite; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Plinthaquic Hapludox**

DEEG. Other Hapludox that have, in one or more horizons within 125 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Hapludox"**

NSTH 615.62, p. 615-355, Definition of Typic Hapludox. Change item 3 to read as follows:

"3. Do not, in any horizon within 125 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.45, pp. 615-1'5/146, Kandiudox (refer to NSTH p. 615-179). Change items DEDA, DEDC, DEDE, and DEDG to read as follows:

"DEDA. Kandiudox that have, within 125 cm of the mineral soil surface, *both*:

1. A petroferric contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Petroferric Kandiudox**

DEDC. Other Kandiudox that have, within 125 cm of the mineral soil surface, *both*:

1. A lithic contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Kandiudox**

DEDE. Other Kandiudox that have, in one or more horizons within 125 cm of the mineral soil surface, *both*:

1. Five percent or more (by volume) plinthite; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Plinthaquic Kandiudox**

DEDG. Other Kandiudox that have, in one or more horizons within 125 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Kandiudox"**

NSTH 615.62, p. 615-355, Definition of Typic Kandiudox. Change item 3 to read as follows:

"3. Do not, in any horizon within 125 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.45, pp. 615-148/149, Acrustox (refer to NSTH p. 615-179). Change items DCBA, DCBC, DCBE, and DCBH to read as follows:

"DCBA. Acrustox that have, within 125 cm of the mineral soil surface, *both*:

1. A petroferric contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Petroferric Acrustox**

DCBC. Other Acrustox that have, within 125 cm of the mineral soil surface, *both*:

1. A lithic contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Acrustox**

DCBE. Other Acrustox that have, within 125 cm of the mineral soil surface, *both*:

1. A delta pH (KCl pH - 1:1 water pH) with a 0 or net positive charge in a layer 18 cm or more thick; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Anionic Aquic Acrustox**

DCBH. Other Acrustox that have, in one or more horizons within 125 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Acrustox"**

NSTH 615.62, p. 615-354, Definition of Typic Acrustox. Change item 4 to read as follows:

"4. Do not, in any horizon within 125 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.45, pp. 615-150/151, Eutrustox (refer to NSTH p. 615-179). Change items DCCA, DCCC, DCCE, and DCCG to read as follows:

"DCCA. Eutrustox that have, within 125 cm of the mineral soil surface, *both*:

1. A petroferric contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Petroferric Eutrustox**

DCCC. Other Eutrustox that have, within 125 cm of the mineral soil surface, *both*:

1. A lithic contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Eutrustox**

DCCE. Other Eutrustox that have, in one or more horizons within 125 cm of the mineral soil surface, *both*:

1. Five percent or more (by volume) plinthite; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Plinthaquic Eutrustox**

DCCG. Other Eutrustox that have, in one or more horizons within 125 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Eutrustox"**

NSTH 615.62, p. 615-356, Definition of Typic Eutrustox. Change item 3 to read as follows:

"3. Do not, in any horizon within 125 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.45, pp. 615-152/153, Haplustox (refer to NSTH p. 615-179). Change items DCEA, DCEC, DCEE, DCEG, and DCEH to read as follows:

"DCEA. Haplustox that have, within 125 cm of the mineral soil surface, *both*:

1. A petroferric contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Petroferric Haplustox**

DCEC. Other Haplustox that have, within 125 cm of the mineral soil surface, *both*:

1. A lithic contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Haplustox**

DCEE. Other Haplustox that have, in one or more horizons within 125 cm of the mineral soil surface, *both*:

1. Five percent or more (by volume) plinthite; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Plinthaquic Haplustox**

DCEG. Other Haplustox that have, within 125 cm of the mineral soil surface, *both*:

1. The lower boundary of the oxic horizon; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aqueptic Haplustox**

DCEH. Other Haplustox that have, in one or more horizons within 125 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Haplustox"**

NSTH 615.45, p. 615-153, Haplustox (refer to NSTH p. 615-179). Change items DCEI-DCEO to DCEJ-DCEP and add new item DCEI to read as follows:

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

**Oxyaquic Haplustox"**

NSTH 615.62, p. 615-356, Definition of Typic Haplustox. Change item 3 to read as follows:

"3. Do not, in any horizon within 125 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-356, Definition of Typic Haplustox. Renumber items 4-6 as 5-7 and add new item 4 to read as follows:

"4. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

NSTH 615.45, pp. 615-154/155, Kandiustox (refer to NSTH p. 615-179). Change items DCDA, DCDC, DCDE, and DCDG to read as follows:

"DCDA. Kandiustox that have, within 125 cm of the mineral soil surface, *both*:

1. A petroferric contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Petroferric Kandiustox**

DCDC. Other Kandiustox that have, within 125 cm of the mineral soil surface, *both*:

1. A lithic contact; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Lithic Kandiustox**

DCDE. Other Kandiustox that have, in one or more horizons within 125 cm of the mineral soil surface, *both*:

1. Five percent or more (by volume) plinthite; *and*

2. Redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Plinthaquic Kandiustox**

DCDG. Other Kandiustox that have, in one or more horizons within 125 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Kandiustox"**

NSTH 615.62, p. 615-356, Definition of Typic Kandiustox. Change item 3 to read as follows:

"3. Do not, in any horizon within 125 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

Page 350, Key to suborders (refer to NSTH p. 615-179). Change item GA to read as follows:

"GA. Ultisols that have aquic conditions for some time in most years (or artificial drainage) in one or more horizons within 50 cm of the mineral soil surface, *and one or both* of the following:

1. Redoximorphic features in all layers between either the lower boundary of an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 40 cm; *and one* of the following within the upper 12.5 cm of the argillic or kandic horizon:

a. Redox concentrations, and 50 percent or more redox depletions with a chroma of 2 or less either on faces of peds or in the matrix; *or*

b. Fifty percent or more redox depletions with a chroma of 1 or less either on faces of peds or in the matrix; *or*

c. Distinct or prominent redox concentrations and 50 percent or more hue of 2.5Y or 5Y in the matrix, *and also* a thermic, isothermic, or warmer soil temperature regime; *or*

2. Within 50 cm of the mineral soil surface, enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquults"**

Page 351, Aquults, Definition. Change the definition to read as follows:

"<u>Definition</u>

Aquults are the Ultisols that have aquic conditions for some time in most years (or artificial drainage) in one or more horizons

within 50 cm of the mineral soil surface, and one or both of the following:

1. Redoximorphic features in all layers between either the lower boundary of an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 40 cm; and one of the following within the upper 12.5 cm of the argillic or kandic horizon:

a. Redox concentrations, and 50 percent or more redox depletions with a chroma of 2 or less either on faces of peds or in the matrix; *or*

b. Fifty percent or more redox depletions with a chroma of 1 or less either on faces of peds or in the matrix; *or*

c. Distinct or prominent redox concentrations and 50 percent or more hue of 2.5Y or 5Y in the matrix, and also a thermic, isothermic, or warmer soil temperature regime; or

2. Within 50 cm of the mineral soil surface, enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated."

Page 351, Key to great groups (refer to NSTH 615.38 and 615.60). Change item GAG (and change subgroup codes of Umbraquults, e.g., GAH to GAG) to read as follows:

"GAG. Other Aquults that have an umbric or a mollic epipedon.
**Umbraquults**"

Page 351, Key to great groups (refer to NSTH 615.38 and 615.60). Delete item GAH and add new items GAH and GAI to read as follows:

"GAH. Other Aquults that have episaturation.
**Epiaquults**

GAI. Other Aquults.
**Endoaquults**"

Page 352, column 1. Preceding Fragiaquults, add new section as follows:

"**Endoaquults**

Definition

Endoaquults are the Aquults which:

1. Do not have a fragipan or a kandic horizon;

2. Do not have an abrupt textural change at the upper boundary of the argillic horizon if the hydraulic conductivity of that horizon is low;

3. Do not have plinthite that either forms a continuous phase, or constitutes more than half the matrix (by volume), in any horizon within 150 cm of the mineral soil surface;

4. Have an ochric epipedon;

5. Have, with increasing depth within 150 cm of the mineral soil surface, a decrease of 20 p rcent or more (relative) from the maximum clay content, and either less than 5 percent (by volume) clay depletions on faces of peds in the layer that has the 20 percent lower clay content or, below that layer, no clay increase or an increase of less than 3 percent (absolute); and

6. Have endosaturation.

Key to subgroups

GAIA. Endoaquults 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 to 100 cm.
**Arenic Endoaquults**

GAIB. Other Endoaquults 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 100 cm or more.
**Grossarenic Endoaquults**

GAIC. Endoaquults that have 50 percent or more chroma of 3 or more in one or more horizons between either the A or Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm.
**Aeric Endoaquults**

GAID. Other Endoaquults.
**Typic Endoaquults**

Definition of Typic Endoaquults

Typic Endoaquults are the Endoaquults which:

1. 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; and

2. Have more than 50 percent chroma of 2 or less in all horizons between either the A or Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm.

**Epiaquults**

Definition

Epiaquults are the Aquults which:

1. Do not have a fragipan or a kandic horizon;

2. Do not have an abrupt textural change at the upper boundary of the argillic horizon if the hydraulic conductivity of that horizon is low;

3. Do not have plinthite that either forms a continuous phase, or constitutes more than half the matrix (by volume), in any horizon within 150 cm of the mineral soil surface;

4. Have an ochric epipedon;

5. Have, with increasing depth within 150 cm of the mineral soil surface, a decrease of 20 percent or more (relative) from the maximum clay

content, and either less than 5 percent (by volume) clay depletions on faces of peds in the layer that has the 20 percent lower clay content or, below that layer, no clay increase or an increase of less than 3 percent (absolute); and

6. Have episaturation.

Key to subgroups

GAHA. Epiaquults that have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Epiaquults**

GAHB. Other Epiaquults 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 to 100 cm.

**Arenic Epiaquults**

GAHC. Other Epiaquults 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 100 cm or more.

**Grossarenic Epiaquults**

GAHD. Epiaquults that have 50 percent or more chroma of 3 or more in one or more horizons between either the A or Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm.

**Aeric Epiaquults**

GAHE. Other Epiaquults.

**Typic Epiaquults**

Definition of Typic Epiaquults

Typic Epiaquults are the Epiaquults which:

1. 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;

2. Do not have either:

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

3. Have more than 50 percent chroma of 2 or less in all horizons between either the A or Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm."

NSTH 615.62, p. 615-365, Fragiaquults (*Soil Taxonomy* p. 352). Change items GABA and GABB to read as follows:

"GABA. Fragiaquults that have *both*:

1. Fifty percent or more chroma of 3 or more in one or more horizons between either the A or Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and the fragipan; *and*

2. Five percent or more (by volume) plinthite in one or more horizons within 150 cm of the mineral soil surface.

**Plinthudic Fragiaquults**

GABB. Other Fragiaquults that have 50 percent or more chroma of 3 or more in one or more horizons between either the A or Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and the fragipan.

**Aeric Fragiaquults"**

NSTH 615.62, p. 615-366, Definition of Typic Fragiaquults (*Soil Taxonomy* p. 352). Change item 2 to read as follows:

"2. Have 50 percent or more chroma of 2 or less in all horizons between the A or Ap horizon and the fragipan; and".

Page 352 and 353, Ochraquults (refer to NSTH 615.62). Delete whole section on Ochraquults.

Page 353, column 2, Paleaquults, lines 2 and 3. Change "thick, mottled, gray argillic horizon" to "thick, gray argillic horizon with redoximorphic features".

Page 356, Definition, Humults. Change lines 1-3 to read as follows:

"Humults are the Ultisols which do not have both aquic conditions and colors defined for Aquults, and which either".

NSTH 615.62, p. 615-368, Haplohumults (*Soil Taxonomy* p. 356). Change item GBFB to read as follows:

"GBFB. Other Haplohumults that have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Haplohumults"**

NSTH 615.62, p. 615-368, Definition of Typic Haplohumults (*Soil Taxonomy* p. 356). Change item 3 to read as follows:

"3. Do not, in any subhorizon within the upper 25 cm of the argillic horizon, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions (or artificial drainage);"

Page 356, Description of subgroups, Typic Haplohumults, line 5. Change "Mottles" to "Redox depletions".

Page 357, Description of subgroups, Aquic Haplohumults. Change "mottles" in line 1 and "mottled" in line 3 to "redox depletions" and "redox-depleted", respectively.

NSTH 615.62, p. 615-368, Kandihumults. Change items GBCA, GBCD, and GBCE to read as follows:

"GBCA. Kandihumults that have *both*:

1. 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 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; *and*

2. In one or more horizons within 75 cm of the mineral soil surface, redox concentrations, a color value, moist, of 4 or more, and a hue which is 10YR or yellower, but which becomes redder with increasing depth within 100 cm of the mineral soil surface.

**Andic Ombroaquic Kandihumults**

GBCD. Other Kandihumults that have, in one or more subhorizons within the upper 25 cm of the argillic or kandic horizon, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Kandihumults**

GBCE. Other Kandihumults that have, in one or more horizons within 75 cm of the mineral soil surface, redox concentrations, a color value, moist, of 4 or more, and a hue which is 10YR or yellower, but which becomes redder with increasing depth within 100 cm of the mineral soil surface.

**Ombroaquic Kandihumults"**

NSTH 615.62, p. 615-369, Definition of Typic Kandihumults. Change items 1 and 5 to read as follows:

"1. Do not, in any subhorizon within the upper 25 cm of the argillic or kandic horizon, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions (or artificial drainage);

5. Have, within 75 cm of the mineral soil surface, a hue of 7.5YR or redder in all horizons with a color value, moist, of 4 or more if there are redox concentrations or if the hue becomes redder with depth within 100 cm of the soil surface; and".

NSTH 615.62, p. 615-370, Kanhaplohumults. Change items GBDD and GBDE to read as follows:

"GBDD. Other Kanhaplohumults that have, in one or more subhorizons within the upper 25 cm of the argillic or kandic horizon, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Kanhaplohumults**

GBDE. Other Kanhaplohumults that have, in one or more horizons within 75 cm of the mineral soil surface, redox concentrations, a color value, moist, of 4 or more, and a hue which is 10YR or yellower, but which becomes redder with increasing depth within 100 cm of the mineral soil surface.

**Ombroaquic Kanhaplohumults"**

NSTH 615.62, p. 615-370, Definition of Typic Kanhaplohumults. Change items 1 and 5 to read as follows:

"1. Do not, in any subhorizon within the upper 25 cm of the argillic or kandic horizon, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions (or artificial drainage);

5. Have, within 75 cm of the mineral soil surface, a hue of 7.5YR or redder in all horizons with a color value, moist, of 4 or more if there are redox concentrations or if the hue becomes redder with depth within 100 cm of the soil surface; and".

NSTH 615.62, p. 615-370, Palehumults (*Soil Taxonomy* p. 357). Change item GBEB to read as follows:

"GBEB. Other Palehumults that have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Palehumults"**

NSTH 615.62, p. 615-371, Definition of Typic Palehumults (*Soil Taxonomy* p. 357). Change item 1 to read as follows:

"1. Do not, in any subhorizon within the upper 25 cm of the argillic horizon, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions (or artificial drainage);"

NSTH 615.56, p. 615-172, Description of subgroups, Typic Palehumults, 2nd paragraph, line 1. Change "Mottles" to "Redox depletions".

NSTH 615.56, p. 615-172, Description of subgroups, Aquic Palehumults. Change "mottles" in line 1 and "mottled" in line 3 to "redox depletions" and "redox-depleted", respectively.

Page 360, Udults, Definition. Change item 1 to read as follows:

"1. Do not have both aquic conditions and colors defined for Aquults;"

Page 360, Fragiudults, line 7. Change "skeletans" to "clay depletions".

NSTH 615.62, p. 615-371, Fragiudults (*Soil Taxonomy* p. 361). Change items GCBB, GCBC, and GCBD to read as follows:

"GCBB. Other Fragiudults which have:

1. *Either* of the following:

a. Above the fragipan, no argillic or kandic horizon that has clay films on both vertical and horizontal surfaces of any structural aggregates; *or*

b. Between the argillic or kandic horizon and the fragipan, one or more horizons with 50 percent or more chroma of 3 or less and with a clay content 3 percent or more (absolute) lower than in both the argillic or kandic horizon and the fragipan; *and*

2. In one or more horizons within 40 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

3. Five percent or more (by volume) plinthite in one or more horizons within 150 cm of the mineral soil surface.

**Plinthaquic Fragiudults**

GCBC. Other Fragiudults that have *both*:

1. *Either* of the following:

a. Above the fragipan, no argillic or kandic horizon that has any clay films on vertical and horizontal surfaces of any structural aggregates; *or*

b. Between the argillic or kandic horizon and the fragipan, one or more horizons with 50 percent or more chroma of 3 or less and with a clay content 3 percent or more (absolute) lower than in both the argillic or kandic horizon and the fragipan; *and*

2. In one or more horizons within 40 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).

**Glossaquic Fragiudults**

GCBD. Other Fragiudults that have, in one or more subhorizons above the fragipan and within the upper 25 cm of the argillic or kandic horizon, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Fragiudults"**

NSTH 615.62, p. 615-372, Definition of Typic Fragiudults (*Soil Taxonomy* p. 361). Change item 2 to read as follows:

"2. Do not, in any subhorizon above the fragipan and within the upper 25 cm of the argillic or kandic horizon, have redox depletions with a chroma of 2 or less, and also aquic conditions (or artificial drainage);"

Page 361, Description of subgroups, Typic Fragiudults, lines 5 and 13. Change "mottles" to "redox depletions".

Page 361, Description of subgroups, Aquic Fragiudults. Change "mottles" in line 1 and "mottled" in line 3 to "redox depletions" and "redox-depleted", respectively.

Page 362, Description of subgroups, Glossaquic Fragiudults. Change "mottles" in line 2 and "mottled" in line 3 to "redox depletions" and "redox-depleted", respectively.

Page 362, Description of subgroups, Plinthaquic Fragiudults. Change "mottles" in line 2 and "mottled" in line 4 to "redox depletions" and "redox-depleted", respectively.

NSTH 615.62, p. 615-372, Hapludults (*Soil Taxonomy* p. 363). Change item GCGG to read as follows:

"GCGG. Other Hapludults that have, in one or more subhorizons within the upper 60 cm of the argillic horizon, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Hapludults"**

NSTH 615.62, p. 615-372, Hapludults (*Soil Taxonomy* p. 363). Change items GCGH-GCGJ to GCGI-GCGK and add new item GCGH to read as follows:

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

**Oxyaquic Hapludults"**

NSTH 615.62, p. 615-372, Definition of Typic Hapludults (*Soil Taxonomy* p. 363). Change item 1 to read as follows:

"1. Do not, in any subhorizon within the upper 60 cm of the argillic horizon, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-373, Definition of Typic Hapludults (*Soil Taxonomy* p. 363). Renumber items 2-8 as 3-9 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

Page 363, Description of subgroups, Typic Hapludults, 2nd paragraph. Change "mottles" in line 1 and "mottled" in line 2 to "redox depletions" and "redox-depleted", respectively.

Page 363, Description of subgroups, Aquic Hapludults, line 3. Change "mottles" to "redox depletions".

NSTH 615.62, pp. 615-373/374, Kandiudults. Change items GCCA, GCCB, GCCJ, GCCK, GCCM, and GCCO to read as follows:

"GCCA. Kandiudults 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 to 100 cm; *and*

2. Five percent or more (by volume) plinthite in one or more horizons within 150 cm of the mineral soil surface; *and*

3. In one or more layers *either* within 75 cm of the mineral soil surface *or*, if the chroma throughout the upper 75 cm results from uncoated sand grains, within the upper 12.5 cm of the argillic or kandic horizon, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Arenic Plinthaquic Kandiudults**

GCCB. Other Kandiudults that have *both*:

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 to 100 cm; *and*

2. In one or more layers *either* within 75 cm of the mineral soil surface *or*, if the chroma throughout the upper 75 cm results from uncoated sand grains, within the upper 12.5 cm of the argillic or kandic horizon, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Arenic Kandiudults**

GCCJ. Other Kandiudults that have *both*:

1. Five percent or more (by volume) plinthite in one or more horizons within 150 cm of the mineral soil surface; *and*

2. In one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Plinthaquic Kandiudults**

GCCK. Other Kandiudults that have *both*:

1. 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 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; *and*

2. In one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquandic Kandiudults**

GCCM. Other Kandiudults that have, in one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Kandiudults**

GCCO. Other Kandiudults that have, in one or more horizons within 75 cm of the mineral soil surface, redox concentrations, a color value, moist, of 4 or more, and a hue which is 10YR or yellower, but which becomes redder with increasing depth within 100 cm of the mineral soil surface.

**Ombroaquic Kandiudults"**

NSTH 615.62, p. 615-375, Kandiudults. Change items GCCP-GCCR to GCCQ-GCCS and add new item GCCP to read as follows:

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

**Oxyaquic Kandiudults"**

NSTH 615.62, p. 615-375, Definition of Typic Kandiudults. Change items 1 and 6 to read as follows:

"1. Do not, in any layer either within 75 cm of the mineral soil surface or, if the chroma throughout the upper 75 cm results from uncoated sand grains, within the upper 12.5 cm of the argillic or kandic horizon, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions (or artificial drainage);

6. Have, within 75 cm of the mineral soil surface, a hue of 7.5YR or redder in all horizons with a color value, moist, of 4 or more if there are redox concentrations or if the hue becomes redder with depth within 100 cm of the mineral soil surface;"

NSTH 615.62, p. 615-375, Definition of Typic Kandiudults. Renumber items 2-8 as 3-9 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

NSTH 615.62, pp. 615-375/376, Kanhapludults. Change items GCDE, GCDG, and GCDI to read as follows:

"GCDE. Other Kanhapludults that have *both:*

1. Five percent or more (by volume) plinthite in one or more horizons within 150 cm of the mineral soil surface; *and*

2. In one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Plinthaquic Kanhapludults**

GCDG. Other Kanhapludults that have, in one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Kanhapludults**

GCDI. Other Kanhapludults that have, in one or more horizons within 75 cm of the mineral soil surface, redox concentrations, a color value, moist, of 4 or more, and a hue which is 10YR or yellower, but which becomes redder with increasing depth within 100 cm of the mineral soil surface.

**Ombroaquic Kanhapludults"**

NSTH 615.62, p. 615-376, Kanhapludults. Change items GCDJ-GCDK to GCDK-GCDL, and add new item GCDJ to read as follows:

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

**Oxyaquic Kanhapludults"**

NSTH 615.62, p. 615-376, Definition of Typic Kanhapludults. Change items 1 and 5 to read as follows:

"1. Do not, in any layer either within 75 cm of the mineral soil surface or, if the chroma throughout the upper 75 cm results from uncoated sand grains, within the upper 12.5 cm of the argillic or kandic horizon, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions (or artificial drainage);

5. Have, within 75 cm of the mineral soil surface, a hue of 7.5YR or redder in all horizons with a color value, moist, of 4 or more if there are redox concentrations or if the hue becomes redder with depth within 100 cm of the mineral soil surface;"

NSTH 615.62, p. 615-376, Definition of Typic Kanhapludults. Change items 2-8 to 3-9 and add new item 2 to read as follows:

"2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;"

NSTH 615.62, pp. 615-376 to 615-378, Paleudults (*Soil Taxonomy* p. 364). Change items GCEB, GCED, GCEE, GCEK, GCEL, and GCEM to read as follows:

"GCEB. Other Paleudults that have *both*:

1. A texture of loamy fine sand or coarser throughout the argillic horizon, or lamellae within its upper 100 cm; *and*

2. In one or more layers *either* within 75 cm of the mineral soil surface *or*, if the chroma throughout the upper 75 cm results from uncoated sand grains, within the upper 12.5 cm of the argillic or kandic horizon, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Psammaquentic Paleudults**

GCED. Other Paleudults that have:

1. In one or more layers *either* within 75 cm of the mineral soil surface *or*, if the chroma throughout the upper 75 cm results from uncoated sand grains, within the upper 12.5 cm of the argillic or kandic horizon, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. 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 to 100 cm; *and*

3. Five percent or more (by volume) plinthite in one or more horizons within 150 cm of the mineral soil surface.

**Arenic Plinthaquic Paleudults**

GCEE. Other Paleudults that have *both*:

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 to 100 cm; *and*

2. In one or more layers *either* within 75 cm of the mineral soil surface *or*, if the chroma throughout the upper 75 cm results from uncoated sand grains, within the upper 12.5 cm of the argillic or kandic horizon, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Arenic Paleudults**

GCEK. Other Paleudults that have *both*:

1. Five percent or more (by volume) plinthite in one or more horizons within 150 cm of the mineral soil surface; *and*

2. In one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Plinthaquic Paleudults**

GCEL. Other Paleudults that have *both*:

1. Within 125 cm of the mineral soil surface, one or more subhorizons in the argillic horizon with all the properties of a fragipan, except that only 40 to 60 percent of the volume is brittle; *and*

2. In one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Fragiaquic Paleudults**

GCEM. Other Paleudults that have, in one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Paleudults"**

NSTH 615.62, p. 615-378, Paleudults (*Soil Taxonomy* p. 364). Change items GCEK-GCEQ to GCEL-GCER and add new item GCEK to read as follows:

"GCEK. Other Paleudults that have anthraquic conditions.

**Anthraquic Paleudults"**

NSTH 615.62, p. 615-378, Definition of Typic Paleudults (*Soil Taxonomy* p. 364). Change item 1 to read as follows:

"1. Do not, in any layer either within 75 cm of the mineral soil surface or, if the chroma throughout the upper 75 cm results from uncoated sand grains, within the upper 12.5 cm of the argillic or kandic horizon, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions (or artificial drainage);"

NSTH 615.62, p. 615-378, Definition of Typic Paleudults (*Soil Taxonomy* p. 364). Renumber items 2-7 as 3-8 and add new item 2 to read as follows:

"2. Do not have anthraquic conditions;"

Page 365, Description of subgroups, Typic Paleudults, 2nd paragraph, line 1. Change "Mottles" to "Redox depletions".

Page 365, Description of subgroups, Aquic Paleudults, line 5. Change "mottles" to "redox depletions".

Page 365, Description of subgroups, Aquic Arenic Paleudults, line 5. Change "mottles" to "redox depletions".

Page 366, Description of subgroups, Plinthaquic Paleudults. Change "mottles" in line 5 and "mottled" in line 6 to "redox depletions" and "redox-depleted", respectively.

Page 366, Description of subgroups, Plinthaquic Paleudults, line 6. Change "mottles" (2 times) to "redox depletions".

Page 369, Ustults, Definition. Change item 1 to read as follows:

"1. Do not have both aquic conditions and colors defined for Aquults;"

NSTH 615.62, p. 615-379, Haplustults (*Soil Taxonomy* p. 370). Change items GDFC and GDFE to read as follows:

"GDFC. Other Haplustults that have, in one or more layers both within the upper 12.5 cm of the argillic horizon and within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Haplustults**

GDFE. Other Haplustults that have, in one or more horizons within 75 cm of the mineral soil surface, redox concentrations, a color value, moist, of 4 or more, and a hue which is 10YR or yellower, but which becomes redder with increasing depth within 100 cm of the mineral soil surface.

**Ombroaquic Haplustults"**

NSTH 615.62, p. 615-379, Definition of Typic Haplustults (*Soil Taxonomy* p. 370). Change items 3 and 4 to read as follows:

"3. Do not, in any layer within the upper 12.5 cm of the argillic horizon and within 75 cm of

the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions (or artificial drainage);

4. Have, within 75 cm of the mineral soil surface, a hue of 7.5YR or redder in all horizons with a color value, moist, of 4 or more if there are redox concentrations or if the hue becomes redder with depth within 100 cm of the mineral soil surface;"

Page 370, Description of subgroups, Typic Haplustults, 2nd paragraph, lines 1, 3, 6, and 8. Change "Mottles", "mottled", "mottles", and "epiaquic" to "Redox depletions", "redox-depleted", "redox concentrations", and "Ombroaquic" in the respective lines.

Page 370, Description of subgroups, Aquic Haplustults, line 3. Change "mottles" to "redox depletions".

Page 371, Description of subgroups, Epiaquic Haplustults. Change "Epiaquic Haplustults" to "Ombroaquic Haplustults", and in line 3 change "mottles" to "redox concentrations".

NSTH 615.62, p. 615-380, Kandiustults. Change item GDBB to read as follows:

"GDBB. Other Kandiustults that have, in one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Kandiustults"**

NSTH 615.62, p. 615-381, Definition of Typic Kandiustults. Change item 1 to read as follows:

"1. Do not, in any layer within 75 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions (or artificial drainage);"

NSTH 615.62, pp. 615-381/382, Kandiustults. Change items GDCC and GDCH to read as follows:

"GDCC. Other Kanhaplustults that have, in one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Kanhaplustults**

GDCH. Other Kanhaplustults that have, in one or more horizons within 75 cm of the mineral soil surface, redox concentrations, a color value, moist, of 4 or more, and a hue which is 10YR or yellower, but which becomes redder with increasing depth within 100 cm of the mineral soil surface.

**Ombroaquic Kanhaplustults"**

NSTH 615.62, p. 615-382, Definition of Typic Kanhaplustults. Change items 2 and 3 to read as follows:

"2. Do not, in any layer within 75 cm of the mineral soil surface, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions (or artificial drainage);

3. Have, within 75 cm of the mineral soil surface, a hue of 7.5YR or redder in all horizons with a color value, moist, of 4 or more if there are redox concentrations or if the hue becomes redder with depth within 100 cm of the mineral soil surface;"

Page 372, Xerults, Definition. Change item 4 to read as follows:

"4. Do not have both aquic conditions and colors defined for Aquults;"

NSTH 615.62, p. 615-383, Haploxerults (*Soil Taxonomy* p. 373). Change item GEBC to read as follows:

"GEBC. Other Haploxerults that have, in one or more subhorizons within the upper 25 cm of the argillic horizon, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Haploxerults"**

NSTH 615.62, p. 615-384, Definition of Typic Haploxerults (*Soil Taxonomy* p. 373). Change item 1 to read as follows:

"1. Do not, in any subhorizon within the upper 25 cm of the argillic horizon, have redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions (or artificial drainage);"

## 615.90 Vertisol amendment

The International Committee on Vertisols (ICOMERT) was established in 1980, with Juan Comerma serving as chair. The objectives of the committee were to:

1. Identify those criteria in the classification of Vertisols that have resulted in taxa with misleading or vague definitions or very few identifiable soils;

2. Propose improvements in the classification of Vertisols, considering both genetic and practical implications; and

3. Test the proposals and submit recommendations to the Soil Conservation Service for improving the classification of Vertisols in *Soil Taxonomy*.

The following is a summary of the major changes proposed by ICOMERT and implemented by this amendment:

1. Establishment of two new suborders, Aquerts and Cryerts, and their respective great groups and subgroups;

2. Introduction of new great-group and subgroup criteria to provide better interpretive groupings;

3. Elimination of the *pell* and *chrom* great groups because of the questionable value of the resulting classes; and

4. Redefinition of the vertic subgroup criteria to include more soils with high shrink-swell potential.

The following changes are required in *Soil Taxonomy* to accommodate these revisions.

Page 48, Coefficient of linear extensibility, COLE. Change last sentence to read as follows:

"An estimate of COLE can be calculated in the field by measuring the distance between two pins in a clod of undisturbed soil at field capacity and again after the clod has dried. COLE does not apply if the shrinkage is irreversible."

Page 51, column 1. Change title "Potential linear extensibility" to "Linear extensibility (LE)" and replace the text with the following:

"This characteristic is the product of the thickness, in centimeters, multiplied by the COLE of the layer in question. The linear extensibility of a soil is the sum of these products for each soil horizon."

Page 75, Vertisols, lines 12 and 13. Change "deep wide cracks (1 cm or more wide at depth of 50 cm) at some season;" to "cracks that open and close periodically;"

Page 75, Vertisols, line 15. Delete ", gilgai microrelief,"

Page 76, Examples of differences in orders, 2nd paragraph, 2nd sentence. Preceding "deep wide cracks", add "normally".

Page 92, Keys to soil orders (refer to NSTH p. 615-179). Change item E to read as follows:

"E. Other soils which have:

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

2. 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 in an Ap horizon, whichever is thicker, *and* 30 percent or more clay in 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*

3. Cracks[10] that open and close periodically.

**Vertisols**"

Pages 95-96, Definition (Alfisols). Change item 4 to read as follows:

"4. 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 soil surface, that has either 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 in an Ap horizon, whichever is thicker, and 30 percent or more clay in 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. Cracks that open and close periodically."

Page 96, Limits between Alfisols and soils of other orders (refer to NSTH p. 615-179). Change item 9 to read as follows:

"9. To distinguish Alfisols from Vertisols, Alfisols must not have all of the following:

a. A layer 25 cm or more thick, with an upper boundary within 100 cm of the mineral soil surface, that has either 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 in an Ap horizon, whichever is thicker, and 30 percent or more clay in 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. Cracks that open and close periodically."

---

[10] A crack is a separation between gross polyhedrons. If the surface horizon is strongly self-mulching, i.e., a mass of loose granules, or if the soil is cultivated while cracks are open, the cracks may be largely filled with granular materials from the surface; but they are open in the sense that the polyhedrons are separated. A crack is regarded as open if it controls the infiltration and percolation of water in a dry clayey soil.

NSTH 615.62, p. 615-209, Albaqualfs (*Soil Taxonomy* p. 110). Delete item IAGB and change items IAGC-IAGI to IAGB-IAGH.

NSTH 615.62, p. 615-209, Albaqualfs (*Soil Taxonomy* p. 110). Change item IAGB to read as follows:

"IAGB. Other Albaqualfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Albaqualfs"**

NSTH 615.62, p. 615-210, Definition of Typic Albaqualfs (*Soil Taxonomy* p. 110). Change item 5 to read as follows:

"5. Do not have either:

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;"

Page 111, Description of subgroups, Typic Albaqualfs, lines 4-6. Change "do not have deep wide cracks in the argillic horizon in most years" to "do not have cracks and slickensides or wedge-shaped aggregates".

NSTH 615.62, p. 615-212, Natraqualfs (*Soil Taxonomy* p. 114). Change items IABA-IABE to IABB-IABF and add new item IABA to read as follows:

"IABA. Natraqualfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Natraqualfs"**

NSTH 615.62, p. 615-212, Definition of Typic Natraqualfs (*Soil Taxonomy* p. 114). Add new item 4 to read as follows:

"4. Do not have either:

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."

NSTH 615.62, p. 615-215, Cryoboralfs (*Soil Taxonomy* p. 120). Change items IBDC-IBDI to IBDD-IBDJ and add new item IBDC to read as follows:

"IBDC. Other Cryoboralfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Cryoboralfs"**

NSTH 615.62, p. 615-216, Definition of Typic Cryoboralfs (*Soil Taxonomy* p. 120). Add new item 8 to read as follows:

"8. Do not have either:

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."

NSTH 615.62, p. 615-216, Eutroboralfs (*Soil Taxonomy* p. 121). Change items IBEB-IBEK to IBEC-IBEL and add new item IBEB to read as follows:

"IBEB. Other Eutroboralfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Eutroboralfs**"

NSTH 615.62, p. 615-217, Definition of Typic Eutroboralfs (*Soil Taxonomy* p. 121). Add new item 9 to read as follows:

"9. Do not have either:

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."

NSTH 615.62, p. 615-222, Hapludalfs (*Soil Taxonomy* p. 129). Change items IEKC-IEKV to IEKD-IEKW and add new item IEKC to read as follows:

"IEKC. 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. 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 deeper than 50 cm from the mineral soil surface.

**Aquertic Hapludalfs**"

NSTH 615.62, p. 615-222, Hapludalfs (*Soil Taxonomy* p. 129). Change item IEKD to read as follows:

"IEKD. Other Hapludalfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Hapludalfs**"

NSTH 615.62, p. 615-224, Definition of Typic Hapludalfs (*Soil Taxonomy* p. 129). Change item 12 to read as follows:

"12. Do not have either:

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."

Page 130, Description of subgroups, Typic Hapludalfs, lines 10-11. Change "deep wide cracks in most years" to "cracks and slickensides or wedge-shaped aggregates".

Page 131, Description of subgroups, Typic Hapludalfs, last paragraph, lines 1-2. Change "Deep wide cracks that open in most years ... cause" to "The presence of cracks and slickensides or wedge-shaped aggregates ... causes".

Page 132, column 2, Description of subgroups, Vertic Hapludalfs. Delete "wide" in first line and delete 2nd sentence.

NSTH 615.62, p. 615-226, Natrudalfs (*Soil Taxonomy* p. 133). Change item IEBA to read as follows:

"IEBA. Other Natrudalfs which have *one or both* of the following:

1. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides

or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

2. A linear extensibility of 6.0 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 Natrudalfs"**

NSTH 615.62, p. 615-226, Definition of Typic Natrudalfs (*Soil Taxonomy* p. 133). Change item 2 to read as follows:

"2. Do not have either:

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"

Page 133, Description of subgroups, Typic Natrudalfs. Change last sentence to read as follows:

"Soils that have cracks and slickensides or wedge-shaped aggregates are excluded ..."

Page 133, Description of subgroups, Vertic Natrudalfs, line 3. Change "item c" to "item 3".

NSTH 615.62, p. 615-226, Paleudalfs (*Soil Taxonomy* p. 134). Change item IEIA to read as follows:

"IEIA. Paleudalfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Paleudalfs"**

NSTH 615.62, p. 615-228, Definition of Typic Paleudalfs (*Soil Taxonomy* p. 134). Change item 7 to read as follows:

"7. Do not have either:

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;"

Page 135, Description of subgroups, Typic Paleudalfs, column 1, line 1. Change "deep wide cracks in most years" to "cracks and slickensides or wedge-shaped aggregates".

NSTH 615.62, p. 615-228, Haplustalfs, item ICHB (*Soil Taxonomy* p. 139). Change item 2 to read as follows:

"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."

NSTH 615.62, p. 615-228, Haplustalfs (*Soil Taxonomy* p. 139). Change item ICHC to read as follows:

"ICHC. Other Haplustalfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Haplustalfs"**

NSTH 615.62, p. 615-230, Definition of Typic Haplustalfs (*Soil Taxonomy* p. 139). Change item 9 to read as follows:

"9. Do not have either:

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"

Page 140, Description of subgroups, Typic Haplustalfs, 3rd paragraph, line 1. Change "Deep wide cracks in most years and a high COLE" to "Cracks and slickensides or wedge-shaped aggregates".

NSTH 615.62, p. 615-232, Natrustalfs (*Soil Taxonomy* p. 141). Change items ICCA-ICCH to ICCB-ICCI and add new item ICCA to read as follows:

"ICCA. Natrustalfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Natrustalfs"**

NSTH 615.62, p. 615-233, Definition of Typic Natrustalfs (*Soil Taxonomy* p. 141). Add new item 6 to read as follows:

"6. Do not have either:

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."

NSTH 615.62, p. 615-233, Paleustalfs, item ICFA (*Soil Taxonomy* p. 143). Change item 2 to read as follows:

"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."

NSTH 615.62, p. 615-233, Paleustalfs (*Soil Taxonomy* p. 143). Change item ICFB to read as follows:

"ICFB. Other Paleustalfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Paleustalfs"**

NSTH 615.62, p. 615-235, Definition of Typic Paleustalfs (*Soil Taxonomy* p. 143). Change item 7 to read as follows:

"7. Do not have either:

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;"

Page 143, Description of subgroups, Typic Paleustalfs, lines 7 and 8. Change "that do not have deep wide cracks in most years and do not have a high COLE" to "that do not have cracks and slickensides or wedge-shaped aggregates".

Page 144, Description of subgroups, Typic Paleustalfs, 3rd paragraph, line 1. Change "Deep wide cracks in most years and a high COLE" to "Cracks and slickensides or wedge-shaped aggregates".

Page 145, Description of subgroups, Udertic Paleustalfs, line 6. Change "deep wide cracks in most years" to "cracks and slickensides or wedge-shaped aggregates".

NSTH 615.62, p. 615-236, Durixeralfs (*Soil Taxonomy* p. 147). Change items IDAB-IDAF to IDAC-IDAG and add new item IDAB to read as follows:

"IDAB. Other Durixeralfs which have, above the duripan, *one or both* of the following:

1. Cracks 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; *or*

2. A linear extensibility of 6.0 cm or more.
**Vertic Durixeralfs"**

NSTH 615.62, p. 615-236, Definition of Typic Durixeralfs (*Soil Taxonomy* p. 147). Add new item 5 to read as follows:

"5. Do not, above the duripan, have either:

a. Cracks 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; or

b. A linear extensibility of 6.0 cm or more."

NSTH 615.62, p. 615-237, Haploxeralfs (*Soil Taxonomy* p. 148). Change item IDGD to read as follows:

"IDGD. Other Haploxeralfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Haploxeralfs"**

NSTH 615.62, p. 615-238, Definition of Typic Haploxeralfs (*Soil Taxonomy* p. 148). Change item 7 to read as follows:

"7. Do not have either:

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;"

Page 149, Description of subgroups, Typic Haploxeralfs, lines 8 and 9. Change "deep wide cracks that open nearly every year" to "cracks and slickensides or wedge-shaped aggregates".

Page 149, Description of subgroups, Typic Haploxeralfs, column 2, lines 6 and 7. Change "deep wide cracks and a high COLE" to "cracks and slickensides or wedge-shaped aggregates".

Page 150, Description of subgroups, Vertic Haploxeralfs, line 2. Change "deep wide cracks in most years" to "cracks and slickensides or wedge-shaped aggregates".

NSTH 615.62, p. 615-239, Natrixeralfs (*Soil Taxonomy* p. 150). Change items IDBA-IDBB to IDBB-IDBC and add new item IDBA to read as follows:

"IDBA. Natrixeralfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Natrixeralfs"**

NSTH 615.62, p. 615-239, Definition of Typic Natrixeralfs (*Soil Taxonomy* p. 150). Add new item 2 to read as follows:

"2. Do not have either:

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."

NSTH 615.62, p. 615-239, Palexeralfs (*Soil Taxonomy* p. 151). Change item IDFA to read as follows:

"IDFA. Other Palexeralfs which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Palexeralfs"**

NSTH 615.62, p. 615-240, Definition of Typic Palexeralfs (*Soil Taxonomy* p. 151). Change item 8 to read as follows:

"8. Do not have either:

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;"

Page 152, Description of subgroups, Typic Palexeralfs, lines 8 and 9. Change "deep wide cracks in most years" to "cracks and slickensides or wedge-shaped aggregates".

Page 152, Description of subgroups, Typic Palexeralfs, 2nd paragraph, line 19. Change "Deep wide cracks and a high COLE" to "Cracks and slickensides or wedge-shaped aggregates".

Page 152, Description of subgroups, Vertic Palexeralfs, line 1. Change "deep wide cracks in most years" to "cracks and slickensides or wedge-shaped aggregates".

Page 156, column 1 (Definition of Aridisols). Change item 3 to read as follows:

"3. 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 soil surface, that has either 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 in an Ap horizon, whichever is thicker, *and* 30 percent or more clay in 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. Cracks that open and close periodically."

Page 157, Limits between Aridisols and soils of other orders (refer to NSTH p. 615-203). Change item 10 to read as follows:

"10. To distinguish Aridisols from Vertisols, Aridisols must not have all of the following:

a. A layer 25 cm or more thick, with an upper boundary within 100 cm of the mineral soil surface, that has either 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 in an Ap horizon, whichever is thicker, *and* 30 percent or more clay in 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. Cracks that open and close periodically."

NSTH 615.62, p. 615-241, Durargids (*Soil Taxonomy* p. 157). Change items FAAA-FAAJ to FAAB-FAAK and add new item FAAA to read as follows:

"FAAA. Other Durargids which have, above the duripan, *one or both* of the following:

1. Cracks 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; *or*

2. A linear extensibility of 6.0 cm or more.

**Vertic Durargids**"

NSTH 615.62, p. 615-243, Definition of Typic Durargids (*Soil Taxonomy* p. 157). Add new item 7 to read as follows:

"7. Do not, above the duripan, have either:

a. Cracks 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; *or*

b. A linear extensibility of 6.0 cm or more."

NSTH 615.62, p. 615-244, Haplargids, item FAEF (*Soil Taxonomy* p. 159). Change items 3-5 to new item 3 as follows:

"3. *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 a lithic or paralithic contact, whichever is shallower.

**Borollic Vertic Haplargids**"

NSTH 615.62, p. 615-244, Haplargids (*Soil Taxonomy* p. 159). Change item FAEH to read as follows:

"FAEH. 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 a lithic or paralithic contact, whichever is shallower; *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 an aridic moisture regime that borders on a xeric regime.

**Xerertic Haplargids"**

NSTH 615.62, p. 615-244, Haplargids (*Soil Taxonomy* p. 159). Change items FAEI and FAEJ to read as follows:

"FAEI. 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 a lithic or paralithic contact, whichever is shallower; *and*

2. A mean annual soil temperature of 8°C or higher and an aridic moisture regime that borders on an ustic regime.

**Ustertic Haplargids**

FAEJ. Other Haplargids 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, 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 a lithic or paralithic contact, whichever is shallower.

**Vertic Haplargids"**

NSTH 615.62, p. 615-246, Definition of Typic Haplargids (*Soil Taxonomy* p. 159). Change item 6 to read as follows:

"6. Do not have either:

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 a lithic or paralithic contact, whichever is shallower; and"

NSTH 615.62, p. 615-247, Nadurargids (*Soil Taxonomy* p. 162). Change items FABA-FABF to FABB-FABG and add new item FABA to read as follows:

"FABA. Nadurargids which have, above the duripan, *one or both* of the following:

1. Cracks 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; *or*

2. A linear extensibility of 6.0 cm or more.

**Vertic Nadurargids"**

NSTH 615.62, p. 615-248, Definition of Typic Nadurargids (*Soil Taxonomy* p. 162). Add new item 4 to read as follows:

"4. Do not, above the duripan, have either:

a. Cracks 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; or

b. A linear extensibility of 6.0 cm or more."

NSTH 615.62, p. 615-248, Natrargids (*Soil Taxonomy* p. 163). Change items FACC-FACO to FACD-FACP and add new item FACC to read as follows:

"FACC. 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, 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 a lithic or paralithic contact, whichever is shallower.

**Vertic Natrargids"**

NSTH 615.62, p. 615-250, Definition of Typic Natrargids (*Soil Taxonomy* p. 163). Add new item 7 to read as follows:

"7. Do not have either:

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 a lithic or paralithic contact, whichever is shallower."

NSTH 615.62, p. 615-250, Paleargids, item FADA (*Soil Taxonomy* p. 166). Change items 2-5 to new items 2-3 as follows:

"2. A frigid or colder soil temperature regime; *and*

3. *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 a lithic or paralithic contact, whichever is shallower.

**Borollic Vertic Paleargids**"

NSTH 615.62, p. 615-250, Paleargids (*Soil Taxonomy* p. 166). Change item FADC to read as follows:

"FADC. Other Paleargids 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, 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 a lithic or paralithic contact, whichever is shallower.

**Vertic Paleargids**"

NSTH 615.62, p. 615-252 and NSTH 615.82, p. 615-403, Definition of Typic Paleargids (*Soil Taxonomy* p. 166). Change item 4 to read as follows:

"4. Do not have either:

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 a lithic or paralithic contact, whichever is shallower; and"

Page 166, Description of subgroups, Typic Paleargids, lines 6 and 7. Change "deep wide cracks" to "cracks and slickensides or wedge-shaped aggregates".

NSTH 615.62, p. 615-255, Camborthids (*Soil Taxonomy* p. 171). Change item FBFF to read as follows:

"FBFF. Other Camborthids that have:

1. A frigid or colder temperature regime; *and*

2. A weighted average percentage of organic carbon, relative to the weighted average ratio of sand to clay, between the soil surface and a depth of 40 cm as follows:

a. 0.60 or more, with a sand/clay ratio of 1.0 or less; *or*

b. 0.15 or more, with a sand/clay ratio of 13 or more; *or*

c. 0.64-(0.038 x sand/clay ratio), or more, with a sand/clay ratio between 1 and 13; *and*

3. *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 a lithic or paralithic contact, whichever is shallower.

**Borollic Vertic Camborthids**"

NSTH 615.62, p. 615-255/256, Camborthids (*Soil Taxonomy* p. 171). Change items FBFH-FBFJ to read as follows:

"FBFH. Other Camborthids 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 a lithic or paralithic contact, whichever is shallower; *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 an aridic moisture regime that borders on a xeric regime.

**Xerertic Camborthids**

FBFI. Other Camborthids 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 a lithic or paralithic contact, whichever is shallower; *and*

2. An aridic moisture regime that borders on an ustic regime.

**Ustertic Camborthids**

FBFJ. Other Camborthids 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, 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 a lithic or paralithic contact, whichever is shallower.

**Vertic Camborthids"**

NSTH 615.62, p. 615-258, Definition of Typic Camborthids (*Soil Taxonomy* p. 171). Change item 6 to read as follows:

"6. Do not have either:

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 a lithic or paralithic contact, whichever is shallower;"

Page 173, Description of subgroups, Ustertic Camborthids. Change 2nd sentence to read as follows:

"They have cracks and slickensides or wedge-shaped aggregates."

Page 173, Description of subgroups, Vertic Camborthids. Change first sentence to read as follows:

"These soils have cracks and slickensides or wedge-shaped aggregates."

Page 173, Description of subgroups, Xerertic Camborthids. Change first sentence to read as follows:

"These soils have cracks and slickensides or wedge-shaped aggregates."

Page 179, Definition (Entisols). Change item 3 to read as follows:

"3. 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 soil surface, that has either 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 in an Ap horizon, whichever is thicker, and 30 percent or more clay in 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. Cracks that open and close periodically."

Page 180, Limits between Entisols and soils of other orders (refer to NSTH p. 615-204). Change item 10 to read as follows:

"10. To distinguish Entisols from Vertisols, Entisols must not have all of the following:

a. A layer 25 cm or more thick, with an upper boundary within 100 cm of the mineral soil surface, that has either 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 in an Ap horizon, whichever is thicker, *and* 30 percent or more clay in 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. Cracks that open and close periodically."

NSTH 615.62, p. 615-263, Fluvaquents (*Soil Taxonomy* p. 182). Change item KADB to read as follows:

"KADB. Other Fluvaquents which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Fluvaquents"**

NSTH 615.62, p. 615-265, Definition of Typic Fluvaquents (*Soil Taxonomy* p. 171). Change item 3 to read as follows:

"3. Do not have either:

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;"

Page 184, Description of subgroups, Vertic Fluvaquents. Change first two sentences to read as follows:

"These soils are like Typic Fluvaquents except they have either cracks and slickensides or wedge-shaped aggregates, or a linear extensibility of 6.0 or more within 100 cm of the mineral soil surface."

NSTH 615.62, pp. 615-267/268, Torrifluvents (*Soil Taxonomy* p. 189). Change items KDDA and KDDB to read as follows:

"KDDA. Other Torrifluvents which have:

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 moisture control section which, in 6 or more out of 10 years, is dry in all its parts for less than three fourths of the cumulative days per year when the soil temperature at a depth of 50 cm from the soil surface is 5°C or higher; *and*

3. A hyperthermic, thermic, mesic, frigid, or an *iso* soil temperature regime, and a torric moisture regime that borders on an ustic regime.

**Ustertic Torrifluvents"**

KDDB. Other Torrifluvents 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, 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 a lithic or paralithic contact, whichever is shallower.

**Vertic Torrifluvents"**

NSTH 615.62, p. 615-269, Definition of Typic Torrifluvents (*Soil Taxonomy* p. 189). Change item 2 to read as follows:

"2. Do not have either:

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 a lithic or paralithic contact, whichever is shallower;"

Page 190, Description of subgroups, Typic Torrifluvents, 2nd paragraph. Change 2nd sentence to read as follows:

"Cracks and slickensides or wedge-shaped aggregates are properties shared with Vertisols and define the vertic subgroups."

Page 190, Description of subgroups, Ustertic Torrifluvents. Change first sentence to read as follows:

"These soils have deep cracks and slickensides or wedge-shaped aggregates."

Page 190, Description of subgroups, Vertic Torrifluvents. Change sentences 1-3 to read as follows:

"These soils are like Typic Torrifluvents except they have cracks and slickensides or wedge-shaped aggregates and have many of the properties of Vertisols."

NSTH 615.62, p. 615-270, Ustifluvents (*Soil Taxonomy* p. 192). Change item KDCA to read as follows:

"KDCA. Ustifluvents which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Ustifluvents"**

NSTH 615.62, p. 615-270, Definition of Typic Ustifluvents (*Soil Taxonomy* p. 192). Change item 4 to read as follows:

"4. Do not have either:

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."

Page 193, Description of subgroups, Vertic Ustifluvents. Change first sentence to read as follows:

"These soils are like Typic Ustifluvents except they have cracks and slickensides or wedge-shaped aggregates, which are properties shared with Vertisols."

NSTH 615.62, p. 615-270, Xerofluvents (*Soil Taxonomy* p. 193). Change item KDBA to read as follows:

"KDBA. Xerofluvents which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Xerofluvents"**

NSTH 615.62, p. 615-271, Definition of Typic Xerofluvents (*Soil Taxonomy* p. 193). Change item 4 to read as follows:

"4. Do not have either:

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."

Page 194, Description of subgroups, Typic Xerofluvents, 2nd paragraph. Change 2nd sentence to read as follows:

"Soils that have cracks and slickensides or wedge-shaped aggregates are excluded from the typic subgroup because they have most of the properties of Xererts."

NSTH 615.62, pp. 615-272/273, Torriorthents (*Soil Taxonomy* p. 196). Change items KEBA-KEBC to read as follows:

"KEBA. Torriorthents which have:

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 moisture control section which, in 6 or more out of 10 years, is dry in all its parts for less than three fourths of the cumulative days per year when the soil temperature at a depth of 50 cm from the soil surface is 5°C or higher; *and*

3. A hyperthermic, thermic, mesic, frigid, or an *iso* soil temperature regime, and a torric moisture regime that borders on an ustic regime.

**Ustertic Torriorthents**

**KEBB**. Other Torriorthents which have:

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 moisture control section which, in 6 or more out of 10 years, is dry in all its parts for less than three fourths of the cumulative days per year when the soil temperature at a depth of 50 cm from the soil surface is 5°C or higher; *and*

3. A thermic, mesic, or frigid soil temperature regime, and a torric moisture regime that borders on a xeric regime.

**Xerertic Torriorthents**

**KEBC**. Other Torriorthents 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, 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 a lithic or paralithic contact, whichever is shallower.

**Vertic Torriorthents"**

NSTH 615.62, p. 615-274, Definition of Typic Torriorthents (*Soil Taxonomy* p. 196). Change item 3 to read as follows:

"3. Do not have either:

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 a lithic or paralithic contact, whichever is shallower;"

Page 197, Description of subgroups, Typic Torriorthents, 2nd paragraph. Change 2nd sentence to read as follows:

"The Torriorthents that have cracks and slickensides or wedge-shaped aggregates are also excluded because they share so many properties with Torrerts."

Page 198, Description of subgroups, Ustertic Torriorthents. Change first sentence to read as follows:

"These soils have cracks and slickensides or wedge-shaped aggregates."

Page 198, Description of subgroups, Vertic Torriorthents. Change first sentence to read as follows:

"These soils have cracks and slickensides or wedge-shaped aggregates."

Page 198, Description of subgroups, Xerertic Torriorthents. Change first sentence to read as follows:

"These soils have cracks that regularly close during a cool or cold season, and slickensides or wedge-shaped aggregates."

NSTH 615.62, pp. 615-275/276, Ustorthents (*Soil Taxonomy* p. 200). Change item KEFB to read as follows:

"KEFB. Other Ustorthents which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Ustorthents"**

NSTH 615.62, p. 615-276, Definition of Typic Ustorthents (*Soil Taxonomy* p. 200). Change item 7 to read as follows:

"5. Do not have either:

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."

Page 201, Description of subgroups, Vertic Ustorthents. Change first sentence to read as follows:

"These soils have cracks and slickensides or wedge-shaped aggregates."

Page 227, Definition (Inceptisols). Change item 1.e to read as follows:

"e. Do not have all of the following:

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

(2) 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 in an Ap horizon, whichever is thicker, and 30 percent or more clay in 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

(3) Cracks that open and close periodically;"

Page 229, Limits between Inceptisols and soils of other orders (refer to NSTH p. 615-204). Change item 10 to read as follows:

"10. To distinguish Inceptisols from Vertisols, Inceptisols must not have all of the following:

a. A layer 25 cm or more thick, with an upper boundary within 100 cm of the mineral soil surface, that has either 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 in an Ap horizon, whichever is thicker, and 30 percent or more clay in 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. Cracks that open and close periodically."

NSTH 615.62, p. 615-290, Cryaquepts (*Soil Taxonomy* p. 238). Change items JAEH-JAEM to JAEI-JAEN and add new item JAEH to read as follows:

"JAEH. Other Cryaquepts which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Cryaquepts"**

NSTH 615.62, p. 615-290, Definition of Typic Halaquepts (*Soil Taxonomy* p. 238). Add new item 7 to read as follows:

"7. Do not have either:

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."

NSTH 615.62, p. 615-291, Halaquepts (*Soil Taxonomy* p. 241). Change item JACA to read as follows:

"JACA. Halaquepts which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Halaquepts"**

NSTH 615.62, p. 615-291, Definition of Typic Halaquepts (*Soil Taxonomy* p. 241). Change item 3 to read as follows:

"3. Do not have either:

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"

NSTH 615.62, p. 615-295, Tropaquepts (*Soil Taxonomy* p. 246). Change item JAGC to read as follows:

"JAGC. Other Tropaquepts which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Tropaquepts"**

NSTH 615.62, p. 615-296, Definition of Typic Tropaquepts (*Soil Taxonomy* p. 246). Change item 4 to read as follows:

"4. Do not have either:

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;"

Page 246, Description of subgroups, Typic Tropaquepts, line 6. Delete "wide".

Page 246, Description of subgroups, Typic Tropaquepts, column 2, line 6. Delete "wide".

NSTH 615.62, p. 615-299, Eutrochrepts (*Soil Taxonomy* p. 251). Change item JDGC to read as follows:

"JDGC. Other Eutrochrepts which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Eutrochrepts"**

NSTH 615.62, p. 615-301, Definition of Typic Eutrochrepts (*Soil Taxonomy* p. 251). Change item 11 to read as follows:

"11. Do not have either:

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"

Page 252, Description of subgroups, Typic Eutrochrepts, last sentence. Delete "wide".

NSTH 615.62, p. 615-302, Ustochrepts, item JDDB (*Soil Taxonomy* p. 254). Change item 2 to read as follows:

"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."

NSTH 615.62, p. 615-302, Ustochrepts, (*Soil Taxonomy* p. 254). Change item JDDC to read as follows:

"JDDC. Other Ustochrepts which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Ustochrepts"**

NSTH 615.62, p. 615-303, Definition of Typic Eutrochrepts (*Soil Taxonomy* p. 255). Change item 3 to read as follows:

"3. Do not have either:

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;"

Page 255, Description of subgroups, Typic Ustochrepts. Delete last sentence, and change preceding sentence to read as follows:

"Clayey soils that have expanding clay and deep cracks are excluded because they have some properties of Vertisols."

Page 255, Description of subgroups, Vertic Ustochrepts, line 2. Delete "wide".

NSTH 615.62, p. 615-304, Xerochrepts, (*Soil Taxonomy* p. 256). Change item JDEF to read as follows:

"JDEF. Other Xerochrepts which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Xerochrepts"**

NSTH 615.62, p. 615-305, Definition of Typic Xerochrepts (*Soil Taxonomy* p. 256). Change item 5 to read as follows:

"5. Do not have either:

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;"

Page 256, Description of subgroups, Typic Xerochrepts, 2nd paragraph, line 12. Delete "wide".

Page 257, Description of subgroups, Vertic Xerochrepts, line 2. Delete "wide".

NSTH 615.62, p. 615-305, Dystropepts, (*Soil Taxonomy* p. 258). Change item JCEC to read as follows:

"JCEC. Other Dystropepts which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Dystropepts"**

NSTH 615.62, p. 615-307, Definition of Typic Dystropepts (*Soil Taxonomy* p. 258). Change item 8 to read as follows:

"8. Do not have either:

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."

Page 259, Description of subgroups, Vertic Dystropepts, line 2. Delete "wide".

NSTH 615.62, p. 615-307, Eutropepts (*Soil Taxonomy* p. 260). Change items JCDB-JCDI to JCDC-JCDJ and add new item JCDB to read as follows:

"JCDB. Other Eutropepts 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 Eutropepts"**

NSTH 615.62, p. 615-307, Eutropepts, (*Soil Taxonomy* p. 260). Change item JCDC to read as follows:

"JCDC. Other Eutropepts which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Eutropepts"**

NSTH 615.62, p. 615-308, Definition of Typic Eutropepts (*Soil Taxonomy* p. 260). Change item 6 to read as follows:

"6. Do not have either:

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."

**Page 260**, Description of subgroups, Typic Eutropepts, line 13. Delete "wide".

**Page 261**, Description of subgroups, Typic Eutropepts, line 10. Delete "wide".

**Page 261**, Description of subgroups, Vertic Eutropepts, line 2. Delete "wide".

NSTH 615.62, p. 615-308, Humitropepts (*Soil Taxonomy* p. 261). Change items JCAB-JCAK to JCAD-JCAM and add new items JCAB and JCAC to read as follows:

"JCAB. Other Humitropepts 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 Humitropepts**

JCAC. Other Humitropepts which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Humitropepts"**

NSTH 615.62, p. 615-309, Definition of Typic Humitropepts (*Soil Taxonomy* p. 260). Add new item 8 to read as follows:

"8. Do not have either:

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."

NSTH 615.62, p. 615-309, Ustropepts, (*Soil Taxonomy* p. 263). Change item JCCB to read as follows:

"JCCB. Other Ustropepts which have *one or both* of the following:

1. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for

some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

2. A linear extensibility of 6.0 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 Ustropepts**"

NSTH 615.62, p. 615-310, Definition of Typic Ustropepts (*Soil Taxonomy* p. 260). Change item 6 to read as follows:

"6. Do not have either:

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."

Page 263, Description of subgroups, Typic Ustropepts, line 7. Change "deep wide cracks or" to "deep cracks and".

Page 263, Description of subgroups, Typic Ustropepts, 2nd paragraph. Change last sentence to read as follows:

"Cracks and slickensides or wedge-shaped aggregates are properties shared with Vertisols and define the vertic subgroup."

Page 264, Description of subgroups, Vertic Ustropepts. Change first sentence to read as follows:

"Soils in this subgroup have cracks and slickensides or wedge-shaped aggregates, which are properties shared with Vertisols."

Page 271, Definition (Mollisols). Change item 4 to read as follows:

"4. 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 soil surface, that has either 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 in 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. Cracks that open and close periodically;"

Page 272, Limits between Mollisols and soils of other orders (refer to NSTH p. 615-204). Change item 10 to read as follows:

"10. To distinguish Mollisols from Vertisols, Mollisols must not have all of the following:

a. A layer 25 cm or more thick, with an upper boundary within 100 cm of the mineral soil surface, that has either 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 in 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. Cracks that open and close periodically."

NSTH 615.62, p. 615-313, Argialbolls (*Soil Taxonomy* p. 274). Change items HABA-HABE to HABC-HABG and add new items HABA and HABB to read as follows:

"HABA. Argialbolls 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. If not irrigated, a moisture control section which, in 6 or more out of 10 years, is dry in all parts for 45 or more consecutive days during the 120 days following the summer solstice.

**Xerertic Argialbolls**

HABB. Other Argialbolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Argialbolls"**

NSTH 615.62, p. 615-314, Definition of Typic Argialbolls (*Soil Taxonomy* p. 274). Add new item 4 to read as follows:

"4. Do not have either:

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."

NSTH 615.62, p. 615-314, Argiaquolls (*Soil Taxonomy* p. 276). Change item HBEC to read as follows:

"HBEC. Other Argiaquolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Argiaquolls"**

NSTH 615.62, p. 615-315, Definition of Typic Argiaquolls (*Soil Taxonomy* p. 276). Change item 3 to read as follows:

"3. Do not have either:

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."

Page 276, Description of subgroups, Typic Argiaquolls, lines 5 and 16. Delete "wide".

Page 276, Description of subgroups, Vertic Argiaquolls, line 4. Delete "wide".

NSTH 615.62, p. 615-315, Cryaquolls (*Soil Taxonomy* p. 277). Change items HBAB-HBAH to HBAC-HBAI and add new item HBAB to read as follows:

"HBAB. Other Cryaquolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Cryaquolls"**

NSTH 615.62, p. 615-316, Definition of Typic Cryaquolls (*Soil Taxonomy* p. 277). Add new item 8 to read as follows:

"8. Do not have either:

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."

NSTH 615.62, p. 615-316, Duraquolls (*Soil Taxonomy* p. 279). Change items HBBB-HBBC to HBBC-HBBD and add new item HBBB to read as follows:

"HBBB. Other Duraquolls which have, above the duripan, *one or both* of the following:

1. Cracks 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; *or*

2. A linear extensibility of 6.0 cm or more.

**Vertic Duraquolls"**

NSTH 615.62, p. 615-316, Definition of Typic Duraquolls (*Soil Taxonomy* p. 277). Change definition to read as follows:

"Typic Duraquolls are the Duraquolls which:

1. Do not have an argillic or natric horizon; and

2. Do not have either:

a. Cracks that are 5 mm or more wide, throughout a layer 30 cm or more thick either within 125 cm of the mineral soil surface, or above a duripan if shallower, 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 above a duripan if shallower; 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 or duripan, whichever is shallower."

NSTH 615.62, p. 615-317, Natraquolls (*Soil Taxonomy* p. 281). Change *Key to subgroups* to read as follows:

"HBCA. Natraquolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Natraquolls**

HBCB. Other Natraquolls.

**Typic Natraquolls"**

NSTH 615.62, p. 615-317, Natraquolls (*Soil Taxonomy* p. 281). Delete paragraph after *Key to subgroups* and replace with the following:

"<u>Definition of Typic Natraquolls</u>

Typic Natraquolls are the Natraquolls which do not have either:

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

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

NSTH 615.62, p. 615-318, Argiborolls (*Soil Taxonomy* p. 282). Change items HEDE-HEDR to HEDF-HEDS and add new item HEDE to read as follows:

"HEDE. 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. *Both* of the following:

a. A color value, dry, of 5 in the upper 18 cm of the mollic epipedon, after mixing, or in any Ap horizon that is more than 18 cm thick; *and*

b. If not irrigated, 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 from the soil surface is 5°C or higher.

**Torrertic Argiborolls"**

NSTH 615.62, p. 615-318, Argiborolls (*Soil Taxonomy* p. 282). Change items HEDF and HEDG to read as follows:

"HEDF. 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. *Both* of the following:

a. A color value, dry, of 5 or more in the upper 18 cm of the mollic

epipedon (after mixing) or in any Ap horizon that is more than 18 cm thick; *and*

b. If not irrigated, 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 from the soil surface is 5°C or higher.

**Ustertic Argiborolls**

HEDG. Other Argiborolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Argiborolls"**

NSTH 615.62, p. 615-319, Definition of Typic Argiborolls (*Soil Taxonomy* p. 282). Change item 9 to read as follows:

"9. Do not have either:

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."

Page 283, Description of subgroups, Typic Argiborolls, line 11. Delete "wide".

Page 283, Description of subgroups, Typic Argiborolls, column 2, line 6. Delete "wide".

Page 284, Description of subgroups, Ustertic Argiborolls, line 3. Delete "wide".

Page 284, Description of subgroups, Vertic Argiborolls, line 3. Delete "wide".

NSTH 615.62, pp. 615-320/321, Cryoborolls (*Soil Taxonomy* p. 285). Change items HEBH and HEBI to read as follows:

"HEBH. Other Cryoborolls which have an argillic horizon and *one or both* of the following:

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

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

**Argic Vertic Cryoborolls**

HEBI. Other Cryoborolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Cryoborolls"**

NSTH 615.62, p. 615-322, Definition of Typic Cryoborolls (*Soil Taxonomy* p. 285). Change item 12 to read as follows:

"12. Do not have either:

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."

Page 287, Description of subgroups, Argic Vertic Cryoborolls, line 2. Delete "wide".

Page 288, Description of subgroups, Vertic Cryoborolls, line 1. Delete "wide".

NSTH 615.62, p. 615-323, Haploborolls (*Soil Taxonomy* p. 288). Change items HEGD and HEGE to read as follows:

"HEGD. Other Haploborolls which have *both*:

1. *Either* a chroma of 1 or less (crushed and smoothed sample) in the upper 18 cm of the mollic epipedon (after mixing) or in any Ap horizon that is more than 18 cm thick, *or* a moisture control section that is not dry in all its parts throughout the year in 6 or more out or 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.

**Udertic Haploborolls**

HEGE. Other Haploborolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Haploborolls"**

NSTH 615.62, p. 615-325, Definition of Typic Haploborolls (*Soil Taxonomy* p. 288). Change item 8 to read as follows:

"8. Do not have either:

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;"

Page 289, Description of subgroups, Typic Haploborolls, line 10. Delete "wide".

Page 289, Description of subgroups, Typic Haploborolls, column 2, 2nd paragraph, line 7. Delete "wide".

Page 290, Description of subgroups, Udertic Haploborolls, line 2. Delete "wide".

Page 290, Description of subgroups, Vertic Haploborolls, line 2. Delete "wide".

NSTH 615.62, p. 615-325, Natriborolls (*Soil Taxonomy* p. 291). Change items HECA-HECF to HECB-HECG and add new item HECA to read as follows:

"HECA. Natriborolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Natriborolls"**

NSTH 615.62, p. 615-326, Definition of Typic Natriborolls (*Soil Taxonomy* p. 291). Add new item 4 to read as follows:

"4. Do not have either:

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."

NSTH 615.62, p. 615-326, Paleborolls (*Soil Taxonomy* p. 292). Move Abruptic Paleborolls after Cryic Paleborolls; change items HEAD-HEAH to HEAE-HEAI, and add new item HEAD to read as follows:

"HEAD. Other Paleborolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Paleborolls"**

NSTH 615.62, p. 615-326, Definition of Typic Paleborolls (*Soil Taxonomy* p. 292). Add new item 6 to read as follows:

"6. Do not have either:

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."

NSTH 615.62, p. 615-327, Rendolls (*Soil Taxonomy* p. 294). Change item HCAD to read as follows:

"HCAD. Other Rendolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Rendolls"**

NSTH 615.62, p. 615-327, Definition of Typic Rendolls (*Soil Taxonomy* p. 294). Change item 4 to read as follows:

"4. Do not have either:

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"

Page 294, Description of subgroups, Typic Rendolls, 2nd paragraph, line 10. Delete "wide".

NSTH 615.62, p. 615-328, Argiudolls (*Soil Taxonomy* p. 295). Change items HGCB-HGCJ to HGCC-HGCK and add new item HGCB to read as follows:

"HGCB. Other Argiudolls which have *both*:

1. Aquic conditions for some time in most years (or artificial drainage), *either*:

a. Within 40 cm of the mineral soil surface, in horizons that also have redoximorphic features; *or*

b. 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:

(1) A color value, moist, of 4 or more and redox depletions with a chroma of 2 or less; *or*

(2) A hue of 10YR or redder and a chroma of 2 or less; *or*

(3) A hue of 2.5Y or yellower and a chroma of 3 or less; *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.

**Aquertic Argiudolls"**

NSTH 615.62, p. 615-328, Argiudolls (*Soil Taxonomy* p. 295). Change item HGCC to read as follows:

"HGCC. Other Argiudolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Argiudolls"**

NSTH 615.62, p. 615-328, Definition of Typic Argiudolls (*Soil Taxonomy* p. 295). Change item 5 to read as follows:

"5. Do not have either:

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;"

Page 296, Description of subgroups, Typic Argiudolls, lines 6 and 14. Delete "wide".

Page 296, Description of subgroups, Vertic Argiudolls, line 3. Delete "wide".

NSTH 615.85, p. 615-404, Calciudolls. Change item HGBB to read as follows:

"HGBB. Other Calciudolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Calciudolls"**

NSTH 615.85, p. 615-405, Definition of Typic Calciudolls. Change item 2 to read as follows:

"2. Do not have either:

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"

NSTH 615.62, p. 615-329, Hapludolls (*Soil Taxonomy* p. 296). Change items HGEB-HGEM to HGEC-HGEN and add new item HGEB to read as follows:

"HGEB. Other Hapludolls which have *both*:

1. Aquic conditions for some time in most years (or artificial drainage), *either*:

a. Within 40 cm of the mineral soil surface, in horizons that also have redoximorphic features; *or*

b. 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:

(1) A color value, moist, of 4 or more and redox depletions with a chroma of 2 or less; *or*

(2) A hue of 10YR or redder and a chroma of 2 or less; *or*

(3) A hue of 2.5Y or yellower and a chroma of 3 or less; *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.

**Aquertic Hapludolls"**

NSTH 615.62, p. 615-329, Hapludolls (*Soil Taxonomy* p. 296). Change item HGEC to read as follows:

"HGEC. Other Argiudolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Hapludolls"**

NSTH 615.62, p. 615-330, Definition of Typic Hapludolls (*Soil Taxonomy* p. 296). Change item 7 to read as follows:

"7. Do not have either:

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"

Page 297, Description of subgroups, Typic Hapludolls, column 2, line 6. Delete "wide".

Page 297, Description of subgroups, Vertic Hapludolls, line 1. Delete "wide".

NSTH 615.85, p. 615-405, Paleudolls (*Soil Taxonomy* p. 298). Change item HGAA to read as follows:

"HGAA. Paleudolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Paleudolls**"

NSTH 615.85, p. 615-405, Definition of Typic Paleudolls (*Soil Taxonomy* p. 298). Change item 3 to read as follows:

"3. Do not have either:

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;"

NSTH 615.62, p. 615-331, Argiustolls (*Soil Taxonomy* p. 299). Change items HFEC, HFED, and HFEE to read as follows:

"HFEC. Other Argiustolls 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. If neither irrigated nor fallowed to store moisture, *either*:

a. 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 or all parts 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*

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

**Torrertic Argiustolls**

HFED. Other Argiustolls 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. If neither irrigated nor fallowed to store moisture, *either*:

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

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

**Udertic Argiustolls**

HFEE. Other Argiustolls which have *one or both* of the following:

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

cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

2. A linear extensibility of 6.0 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 Argiustolls"**

NSTH 615.62, p. 615-333, Definition of Typic Argiustolls (*Soil Taxonomy* p. 299). Delete item 7, renumber 8-10 as 7-9, and change items 7 and 8 to read as follows:

"7. If neither irrigated nor fallowed to store moisture, either:

a. 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 or all parts for more than four tenths but less than six tenths of the cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; or

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

8. Do not have either:

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"

Page 300, Description of subgroups, Typic Argiustolls, lines 8 and 20. Delete "wide".

Page 301, Description of subgroups, Torrertic Argiustolls, line 1. Delete "wide".

Page 301, Description of subgroups, Vertic Argiustolls, line 1. Delete "wide".

NSTH 615.62, p. 615-334, Calciustolls (*Soil Taxonomy* p. 301). Change items HFDD, HFDE, and HFDF to read as follows:

"HFDD. Other Calciustolls 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. If neither irrigated nor fallowed to store moisture, *either*:

a. 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 or all parts 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*

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

**Torrertic Calciustolls**

HFDE. Other Calciustolls 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. If neither irrigated nor fallowed to store moisture, *either*:

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

b. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime,

*and* a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for 90 cumulative days or less per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

**Udertic Calciustolls**

HFDF. Other Calciustolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Calciustolls"**

NSTH 615.62, p. 615-335, Definition of Typic Calciustolls (*Soil Taxonomy* p. 301). Delete item 3, renumber 4-9 as 3-8, and change items 7 and 8 to read as follows:

"7. If neither irrigated nor fallowed to store moisture, either:

a. 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 or all parts for more than four tenths but less than six tenths of the cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; or

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

8. Do not have either:

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."

Page 302, Description of subgroups, Typic Calciustolls, lines 7 and 21. Delete "wide".

Page 302, Description of subgroups, Torrertic Calciustolls, line 1. Delete "wide".

Page 302, Description of subgroups, Vertic Calciustolls, line 1. Delete "wide".

NSTH 615.62, p. 615-337, Haplustolls (*Soil Taxonomy* p. 303). Change items HFGE, HFGF, and HFGG to read as follows:

"HFGE. Other Haplustolls 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. If neither irrigated nor fallowed to store moisture, *either*:

a. 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 or all parts 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*

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

**Torrertic Haplustolls**

HFGF. Other Haplustolls 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. If neither irrigated nor fallowed to store moisture, *either*:

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

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

**Udertic Haplustolls**

HFGG. Other Haplustolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Haplustolls**"

NSTH 615.62, p. 615-340, Definition of Typic Haplustolls (*Soil Taxonomy* p. 303). Delete item 10, renumber items 11-13 as 10-13, and change items 10 and 11 to read as follows:

"10. Do not have either:

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;

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

a. 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 or all parts for more than four tenths but less than six tenths of the cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; or

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

Page 304, Description of subgroups, Typic Haplustolls, lines 7 and 29. Delete "wide".

Page 305, Description of subgroups, Torrertic Haplustolls, line 2. Delete "wide".

Page 306, Description of subgroups, Udertic Haplustolls, line 2. Delete "wide".

Page 306, Description of subgroups, Vertic Haplustolls, line 2. Delete "wide".

NSTH 615.62, p. 615-340, Natrustolls (*Soil Taxonomy* p. 306). Change items HFBA-HFBF to HFBB-HFBG and add new item HFBA to read as follows:

"HFBA. Natrustolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Natrustolls**"

NSTH 615.62, p. 615-341, Definition of Typic Natrustolls (*Soil Taxonomy* p. 303). Add new item 6 to read as follows:

"6. Do not have either:

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."

NSTH 615.62, p. 615-341, Paleustolls (*Soil Taxonomy* p. 308). Change items HFCA, HFCB, and HFCC to read as follows:

"HFCA. Paleustolls 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. If neither irrigated nor fallowed to store moisture, *either*:

a. 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 or all parts 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*

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

**Torrertic Paleustolls**

HFCB. Other Paleustolls 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. If neither irrigated nor fallowed to store moisture, *either*:

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

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

**Udertic Paleustolls**

HFCC. Other Paleustolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Paleustolls**"

NSTH 615.62, p. 615-343, Definition of Typic Paleustolls (*Soil Taxonomy* p. 308). Delete item 5, renumber items 6-7 as 5-6, and change items 5 and 6 to read as follows:

"5. Do not have either:

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

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

a. 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 or all parts for more than four tenths but less than six tenths of the cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; or

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

Page 308, Description of subgroups, Typic Paleustolls, line 5. Delete "wide".

Page 309, Description of subgroups, Typic Paleustolls, line 6. Delete "wide".

Page 309, Description of subgroups, Torrertic Paleustolls, line 1. Delete "wide".

Page 309, Description of subgroups, Udertic Paleustolls, line 1. Delete "wide".

Page 309, Description of subgroups, Vertic Paleustolls, line 2. Delete "wide".

NSTH 615.62, p. 615-344, Argixerolls (*Soil Taxonomy* p. 311). Change items HDEC-HDEU to HDED-HDEV and add new item HDEC to read as follows:

"HDEC. Argixerolls which have *both*:

1. An aridic moisture regime; *and*

2. *One or both* of the following:

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

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

**Torrertic Argixerolls"**

NSTH 615.62, p. 615-344, Argixerolls (*Soil Taxonomy* p. 311). Change item HDED to read as follows:

"HDED. Other Argixerolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Argixerolls"**

NSTH 615.62, p. 615-345, Definition of Typic Argixerolls (*Soil Taxonomy* p. 311). Change item 10 to read as follows:

"10. Do not have either:

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"

Page 312, Description of subgroups, Typic Argixerolls, 2nd paragraph. Change last sentence to read as follows:

"Deep cracks are properties of Vertisols and are used to define the vertic subgroup."

Page 313, Description of subgroups, Vertic Argixerolls. Change first sentence to read as follows:

"These soils have deep cracks that are normally open during the summer."

NSTH 615.62, p. 615-346, Calcixerolls (*Soil Taxonomy* p. 313). Change item HDDB to read as follows:

"HDDB. Other Calcixerolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Calcixerolls"**

NSTH 615.62, p. 615-346, Definition of Typic Calcixerolls (*Soil Taxonomy* p. 313). Change item 7 to read as follows:

"7. Do not have either:

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."

Page 314, Description of subgroups, Typic Calcixerolls, 2nd paragraph. Change last sentence to read as follows:

"Deep cracks are properties of Vertisols and are used to define the vertic subgroup."

Page 314, Description of subgroups, Vertic Calcixerolls. Change first sentence to read as follows:

"These soils have deep cracks that are normally open during the summer."

NSTH 615.62, p. 615-346, Durixerolls (*Soil Taxonomy* p. 314). Change items HDAA-HDAK to HDAB-HDAL and add new item HDAA to read as follows:

"HDAA. Durixerolls which have, above the duripan, *one or both* of the following:

1. Cracks 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; *or*

2. A linear extensibility of 6.0 cm or more.

**Vertic Durixerolls"**

NSTH 615.62, p. 615-347, Definition of Typic Durixerolls (*Soil Taxonomy* p. 314). Add new item 7 to read as follows:

"7. Do not have either:

a. Cracks that are 5 mm or more wide, throughout a layer 30 cm or more thick either within 125 cm of the mineral soil surface, or above a duripan if shallower, 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 above a duripan if shallower; 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 or duripan, whichever is shallower."

NSTH 615.62, p. 615-348, Haploxerolls (*Soil Taxonomy* p. 316). Change items HDFC and HDFD to read as follows:

"HDFC. Other Haploxerolls which have *both*;

1. An aridic moisture regime; *and*

2. *One or both* of the following:

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

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

**Torrertic Haploxerolls**

HDFD. Other Haploxerolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Haploxerolls"**

NSTH 615.62, pp. 615-350/351, Definition of Typic Haploxerolls (*Soil Taxonomy* p. 316). Change item 11 to read as follows:

"11. Do not have either:

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;"

Page 317, Description of subgroups, Typic Haploxerolls, line 11. Delete "wide".

Page 317, Description of subgroups, Typic Haploxerolls, 2nd paragraph, column 1. Change last sentence to read as follows:

"Deep cracks are properties of Vertisols and are used to define the vertic groups."

Page 319, Description of subgroups, Torrertic Haploxerolls, line 2. Delete "wide".

Page 319, Description of subgroups, Vertic Haploxerolls, line 2. Delete "wide".

NSTH 615.62, p. 615-351, Natrixerolls (*Soil Taxonomy* p. 319). Change items HDBA-HDBE to HDBB-HDBF and add new item HDBA to read as follows:

"HDBA. Natrixerolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Natrixerolls"**

NSTH 615.62, p. 615-351, Definition of Typic Natrixerolls (*Soil Taxonomy* p. 319). Add new item 4 to read as follows:

"4. Do not have either:

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."

NSTH 615.62, p. 615-351, Palexerolls (*Soil Taxonomy* p. 320). Change item HDCB to read as follows:

"HDCB. Other Palexerolls which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Palexerolls"**

NSTH 615.62, p. 615-352, Definition of Typic Palexerolls (*Soil Taxonomy* p. 320). Change item 7 to read as follows:

"7. Do not have either:

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"

Page 349, Definition of Ultisols (refer to NSTH p. 615-389). Add item 4 to read as follows:

"4. 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 soil surface, that has either 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 in 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. Cracks that open and close periodically."

Page 350, Limits between Ultisols and soils of other orders (refer to NSTH p. 615-205). Change item 9 to read as follows:

"9. To distinguish Ultisols from Vertisols, Ultisols must not have all of the following:

a. A layer 25 cm or more thick, with an upper boundary within 100 cm of the mineral soil surface, that has either 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 in 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. Cracks that open and close periodically."

NSTH 615.62, p. 615-365, Albaquults (*Soil Taxonomy* p. 352). Change items GACA-GACB to GACB-GACC and add new item GACA to read as follows:

"GACA. Albaquults which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Albaquults**"

NSTH 615.62, p. 615-365, Definition of Typic Albaquults (*Soil Taxonomy* p. 352). Add new item 3 to read as follows:

"3. Do not have either:

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."

NSTH 615.62, p. 615-367, Paleaquults (*Soil Taxonomy* p. 353). Change items GAFA-GAFH to GAFB-GAFI and add new item GAFA to read as follows:

"GAFA. Paleaquults which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Paleaquults**"

NSTH 615.62, p. 615-368, Definition of Typic Paleaquults (*Soil Taxonomy* p. 353). Add new item 5 to read as follows:

"4. Do not have either:

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."

NSTH 615.62, p. 615-372, Hapludults (*Soil Taxonomy* p. 362). Change item GCGC to read as follows:

"GCGC. Other Hapludults which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Hapludults**"

NSTH 615.62, p. 615-373, Definition of Typic Hapludults (*Soil Taxonomy* p. 362). Change item 8 to read as follows:

"8. Do not have either:

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"

Page 363, Description of subgroups, Typic Hapludults, line 7. Delete "wide".

Page 363, Description of subgroups, Typic Hapludults, column 2. Change last sentence to read as follows:

"A clayey particle size, deep cracks, and a high COLE are properties shared with Vertisols and define the vertic subgroup."

Page 364, Description of subgroups, Vertic Hapludults. Change first sentence to read as follows:

"These soils have clay texture in the argillic horizon, their COLE is high, and there are deep cracks in most years."

NSTH 615.62, p. 615-376, Paleudults (*Soil Taxonomy* p. 364). Change items GCEA-GCER to GCEB-

GCES and add new item GCEA to read as follows:

"GCEA. Paleudults which have *one or both* of the following:

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

2. A linear extensibility of 6.0 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 Paleudults"**

NSTH 615.62, p. 615-379, Definition of Typic Paleudults (*Soil Taxonomy* p. 364). Add new item 9 to read as follows:

"9. Do not have either:

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."

Page 375, Vertisols. Delete whole chapter on Vertisols and replace with the following:

## "CHAPTER 18
## VERTISOLS[11]

The central concept of Vertisols (Plates 10A, 12C, and 12D) is that of clayey soils which have deep, wide cracks for some time during the year and slickensides within 100 cm of the mineral soil surface. They shrink when dry and swell when moistened. Vertisols make up a relatively homogeneous order because of the amounts and kinds of clay common to them; however, their microvariability within a pedon is great. Before the advent of modern classification systems, these soils were already well known to farmers for their characteristic color, the cracks they produce during the dry season, and the difficulty of their management. In many countries where Vertisols are extensive, they are known by local names such as cracking clays (Australia), Adobe (Philippines), Shachiang (China), Black Cotton soils (India), Smolnitza (Bulgaria, Rumania), Tirs (Morocco), Makande (Malawi), Vleigrond (South Africa), and Sonsosuite (Nicaragua); in addition, numerous coined terms have been used such as Margalite soils (Indonesia), Densinegra soils (Angola), and Grumusols (USA). These soils are generally sticky in the wet season and hard in the dry season, so they require special cultivation practices regardless of whether modern equipment or traditional implements such as the hoe or bullock-drawn plow are used. Among engineers the soils are also well known because their unique properties present constraints to engineering uses.

Vertisols are mapped in many countries, with the largest areas in Australia (80,000,000 ha), India (73,000,000 ha), Sudan (50,000,000 ha), and the USA (18,000,000 ha). The soil moisture regime in the areas where they occur is ustic for about 65 percent, aridic for 18 percent, udic for 13 percent, and xeric for 4 percent of Vertisols. However, the defined moisture regimes have little significance for these soils because when rains come, the water commonly runs into the cracks so that the soil is remoistened from both above and below. Vertisols are known to occur in all soil temperature regimes that are cryic and warmer.

The shrink-swell phenomenon, which is responsible for the genesis and behavior of Vertisols, is a complex, dynamic, but incompletely understood set of processes. Expressions of this phenomenon are linear and normal gilgai, cyclic horizons, surface cracking upon desiccation, and slickenside formation. Of these properties, cracks when dry and slickensides are the unifying morphogenetic markers that are found in all Vertisols. The movement of these soils can tilt trees, throw fence posts as well as telephone poles and power poles out of line, and break pipelines, highway pavements, and the masonry foundations of buildings. Fig. 39 shows a fence, and fig. 40 a sidewalk, on a Vertisol. This movement also affects the thickness of soil horizons, which can vary widely within a pedon. A black *A* horizon, for example, may be only a few centimeters thick or even absent on the microknolls but more than 100 cm thick in the microdepressions. Organic-matter content and depth to carbonates or to a *Bk* horizon can be equally variable.

Shrink-swell processes in soils are related to total-clay and fine-clay content and mineralogy. Vertisols generally have a high clay content (50-70 percent), with a relatively large proportion of fine clay in the clay fraction. The clays in Vertisols consist predominantly of 2:1 and 2:2-layer clay minerals, but some have high kaolinite content. Apart from the amounts and types of clay, a number of other factors determine the morphological features of Vertisols. Prior soil moisture content, for example, is a very important factor in the shrink-swell process; vertic features are best expressed where the soil has undergone maximum change from wet to dry state. The moisture change by itself, however, is insufficient to induce all the vertic properties. To produce movement along the slickensides there must be a confining pressure, which is provided by the thickness of the soil material above the slickensides. The shrink-swell potential of the clays may be reduced by an admixture of organic matter, carbonates, or other particles. The coefficient of linear extensibility (COLE) normally ranges from 0.07 to 0.2.

Intergrades to Vertisols are recognized in several of the other soil orders. There are basically two kinds of intergrades, although both are considered in the same subgroup. One consists of soils which show evidence of swelling and shrinking as a result of changes from

[11] This chapter on Vertisols was rewritten in 1992 following the recommendations of the International Committee on the Classification of Vertisols (ICOMERT), chaired by Juan Comerma.

wet to dry state, but which do not meet the minimum requirements for Vertisols. The intergrades of the other kind show little or no evidence of actual soil movement, but the potential exists because of their relatively high COLE. These intergrades, however, do not become dry enough or moist enough to produce soil movement except in years with unusually low or abnormally high precipitation.

Vertisols generally have gentle slopes, although a few are strongly sloping. They commonly develop in large pedons and polypedons. The natural vegetation on these soils is predominantly grass, savanna, open forest, or desert shrub.

Most Vertisols are well suited for mechanized farming if there is plenty of rainfall or irrigation water and if suitable management practices are followed. Large areas of Vertisols in the world are not farmed, however, because their cultivation would require too much energy, especially where traditional, low-input methods are used. This constraint is a major limiting land-use characteristic of Vertisols.

Irrigation of Usterts, Xererts, and Torrerts presents special problems since their saturated hydraulic conductivity is very low. Bypass flow through open cracks is a common situation. Because the permeability of these soils is so low, their irrigation may result in waterlogging and a buildup of salinity unless adequate artificial drainage is provided. A drainage system designed for Alfisols or Ultisols may be totally inadequate for Vertisols.

Definition

Vertisols are mineral soils which:

1. 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;

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

3. Within 150 cm of the mineral soil 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; and

4. Have all of the following:

a. A layer 25 cm or more thick, with an upper boundary within 100 cm of the mineral soil surface, that has either 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 in 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[12] in some or most years."

Key to suborders

EA. Vertisols which have, in one or more horizons between 40 and 50 cm from the mineral soil surface, aquic conditions for some time in most years (or artificial drainage) *and one or both* of the following:

1. In more than half of each pedon, either on faces of peds or in the matrix if peds are absent, 50 percent or more chroma of *either*

a. Two or less if redox concentrations are present; *or*

b. One or less; *or*

2. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquerts**

EB. Other Vertisols that have a cryic soil temperature regime.

**Cryerts**

EC. Other Vertisols which, in 6 or more out of 10 years, have *both*:

1. A thermic, mesic, or frigid soil temperature regime; *and*

2. If not irrigated during the year, cracks that remain both

a. Five mm or more wide, throughout 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.

**Xererts**

ED. Other Vertisols which, if not irrigated during the year, have cracks in 6 or more out of 10 years that remain closed for less than 60 consecutive days during a period when the soil temperature at a depth of 50 cm from the soil surface is continuously higher than 8°C.

**Torrerts**

EE. Other Vertisols which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or

---

[12] A crack is a separation between gross polyhedrons. If the surface horizon is strongly self-mulching, i.e., a mass of loose granules, or if the soil is cultivated while cracks are open, the cracks may be largely filled with granular materials from the surface; but they are open in the sense that the polyhedrons are separated. A crack is regarded as open if it controls the infiltration and percolation of water in a dry clayey soil.

more within 50 cm of the mineral soil surface, for 90 or more cumulative days per year.

**Usterts**

EF. Other Vertisols.

**Uderts**

**Aquerts**

Definition

Aquerts are the Vertisols which have, in one or more horizons between 40 and 50 cm from the mineral soil surface, aquic conditions for some time in most years (or artificial drainage) and one or both of the following:

1. In more than half of each pedon, either on faces of peds or in the matrix if peds are absent, 50 percent or more chroma of either

   a. Two or less if redox concentrations are present; or

   b. One or less; or

2. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

Key to great groups

EAA. Aquerts which have a salic horizon that has its upper boundary within 100 cm of the mineral soil surface.

**Salaquerts**

EAB. Other Aquerts which have a duripan that has its upper boundary within 100 cm of the mineral soil surface.

**Duraquerts**

EAC. Other Aquerts that have a natric horizon.

**Natraquerts**

EAD. Other Aquerts which have a calcic horizon that has its upper boundary within 100 cm of the mineral soil surface.

**Calciaquerts**

EAE. Other Aquerts that have, in 50 percent or more of the soil volume between the mineral soil surface and a depth of 50 cm, *both*:

1. An electrical conductivity of the saturation extract of less than 4.0 dS/m at 25°C; *and*

2. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water).

**Dystraquerts**

EAF. Other Aquerts that have episaturation.

**Epiaquerts**

EAG. Other Aquerts.

**Endoaquerts**

**Calciaquerts**

Definition

Calciaquerts are the Aquerts which do not have a salic horizon or duripan that has its upper boundary within 100 cm of the mineral soil surface, or a natric horizon.

Key to subgroups

EADA. Calciaquerts that have, in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm, or the upper boundary of a duripan if shallower, 50 percent or more colors as follows:

1. A hue of 2.5Y or redder and *either*

   a. A color value, moist, of 6 or more and a chroma of 3 or more;.*or*

   b. A color value, moist, of 5 or less and a chroma of 2 or more; *or*

2. A hue of 5Y and a chroma of 3 or more; *or*

3. A chroma of 2 or more, and no redox concentrations.

**Aeric Calciaquerts**

EADB. Other Calciaquerts.

**Typic Calciaquerts**

Definition of Typic Calciaquerts

Typic Calciaquerts are the Calciaquerts which do not, in more than half of each pedon, have a horizon between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm, or the upper boundary of a duripan if shallower, that has any of the following:

1. A hue of 2.5Y or redder and either

   a. A color value, moist, of 6 or more and a chroma of 3 or more; or

   b. A color value, moist, of 5 or less and a chroma of 2 or more; or

2. A hue of 5Y or yellower and a chroma of 3 or more; or

3. A chroma of 2 or more, and no redox concentrations.

**Duraquerts**

Definition

Duraquerts are the Aquerts which:

1. Do not have a salic horizon that has its upper boundary within 100 cm of the mineral soil surface; and

2. Have a duripan that has its upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

EABA. Duraquerts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or

more within 50 cm of the mineral soil surface, for 210 or more cumulative days per year.

**Aridic Duraquerts**

EABB. Other Duraquerts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 or more cumulative days per year.

**Ustic Duraquerts**

EABC. Other Duraquerts that have, in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm, or the upper boundary of the duripan if shallower, 50 percent or more colors as follows:

1. A hue of 2.5Y or redder and *either*

a. A color value, moist, of 6 or more and a chroma of 3 or more; *or*

b. A color value, moist, of 5 or less and a chroma of 2 or more; *or*

2. A hue of 5Y and a chroma of 3 or more; *or*

3. A chroma of 2 or more, and no redox concentrations.

**Aeric Duraquerts**

EABD. Other Duraquerts that have, in one or more horizons within 30 cm of the mineral soil surface, *one or both* of the following in more than half of each pedon:

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

2. A color value, dry, of 6 or more.

**Chromic Duraquerts**

EABE. Other Duraquerts.

**Typic Duraquerts**

Definition of Typic Duraquerts

Typic Duraquerts are the Duraquerts which:

1. Do not, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 or more cumulative days per year;

2. Do not, in more than half of each pedon, have a horizon between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm, or the upper boundary of the duripan if shallower, that has any of the following:

a. A hue of 2.5Y or redder and either

(1) A color value, moist, of 6 or more and a chroma of 3 or more; or

(2) A color value, moist, of 5 or less and a chroma of 2 or more; or

b. A hue of 5Y or yellower and a chroma of 3 or more; or

c. A chroma of 2 or more, and no redox concentrations; and

3. Have, in all horizons within 30 cm of the mineral soil surface, one or both of the following in more than half of each pedon:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less.

**Dystraquerts**

Definition

Dystraquerts are the Aquerts which:

1. Have, in 50 percent or more of the soil volume between the mineral soil surface and a depth of 50 cm, both:

a. An electrical conductivity of the saturation extract of less than 4.0 dS/m at 25°C; and

b. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water); and

2. Do not have a calcic or salic horizon or a duripan that has its upper boundary within 100 cm of the mineral soil surface, or a natric horizon.

Key to subgroups

EAEA. Dystraquerts that have, in one or more horizons within 100 cm of the mineral soil surface, jarosite concentrations and a pH value of 4.0 or less (1:1 water, air-dried slowly in shade).

**Sulfaqueptic Dystraquerts**

EAEB. Other Dystraquerts that have more than 2.0 cmol(+)/kg $Al^{3+}$ (by 1N KCl) in the fine-earth fraction throughout a layer 10 cm or more thick with an upper boundary between 25 and 50 cm from the mineral soil surface.

**Alic Dystraquerts**

EAEC. Other Dystraquerts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 210 or more cumulative days per year.

**Aridic Dystraquerts**

EAED. Other Dystraquerts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 or more cumulative days per year.

**Ustic Dystraquerts**

EAEE. Other Dystraquerts that have, in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, 50 percent or more colors as follows:

1. A hue of 2.5Y or redder and *either*

a. A color value, moist, of 6 or more and a chroma of 3 or more; *or*

b. A color value, moist, of 5 or less and a chroma of 2 or more; *or*

2. A hue of 5Y and a chroma of 3 or more; *or*

3. A chroma of 2 or more, and no redox concentrations.

**Aeric Dystraquerts**

EAEF. Other Dystraquerts that have a lithic or paralithic contact within 100 cm of the mineral soil surface.

**Leptic Dystraquerts**

EAEG. Other Dystraquerts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.

**Entic Dystraquerts**

EAEH. Other Dystraquerts that have, in one or more horizons within 30 cm of the mineral soil surface, *one or both* of the following in more than half of each pedon:

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

2. A color value, dry, of 6 or more.

**Chromic Dystraquerts**

EAEI. Other Dystraquerts.

**Typic Dystraquerts**

Definition of Typic Dystraquerts

Typic Dystraquerts are the Dystraquerts that:

1. Do not, in any horizon within 100 cm of the mineral soil surface, have both jarosite concentrations and a pH value of 4.0 or less (1:1 water, air-dried slowly in shade);

2. Do not, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 or more cumulative days per year;

3. Do not, in any horizon between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, have any of the following in more than half of each pedon:

a. A hue of 2.5Y or redder and either

(1) A color value, moist, of 6 or more and a chroma of 3 or more; or

(2) A color value, moist, of 5 or less and a chroma of 2 or more; or

b. A hue of 5Y or yellower and a chroma of 3 or more; or

c. A chroma of 2 or more, and no redox concentrations;

4. Do not have a lithic or paralithic contact within 100 cm of the mineral soil surface;

5. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface;

6. Have 2.0 cmol(+)/kg or less $Al^{3+}$ (by 1N KCl) in the fine-earth fraction throughout a layer 10 cm or more thick with an upper boundary between 25 and 50 cm from the mineral soil surface; and

7. Have, in all horizons within 30 cm of the mineral soil surface, one or both of the following in more than half of each pedon:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less.

**Endoaquerts**

Definition

Endoaquerts are the Aquerts which:

1. Do not have a salic or calcic horizon or a duripan that has its upper boundary within 100 cm of the mineral soil surface, or a natric horizon;

2. Do not have both of the following:

a. An electrical conductivity of the saturation extract of less than 4.0 dS per m at 25°C; and

b. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water) in more than 50 percent of the soil volume between the mineral soil surface and a depth of 50 cm in each pedon; and

3. Have endosaturation.

Key to subgroups

EAGA. Endoaquerts that have, throughout a layer 15 cm or more thick within 100 cm of the mineral soil surface, an electrical conductivity of 15 dS/m or more (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years.

**Halic Endoaquerts**

EAGB. Other Endoaquerts that have, in one or more horizons within 100 cm of the mineral 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 Endoaquerts**

EAGC. Other Endoaquerts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 210 or more cumulative days per year.

**Aridic Endoaquerts**

EAGD. Other Endoaquerts 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 Endoaquerts**

EAGE. Other Endoaquerts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 or more cumulative days per year.

**Ustic Endoaquerts**

EAGF. Other Endoaquerts that have, in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, 50 percent or more colors as follows:

1. A hue of 2.5Y or redder and *either*

a. A color value, moist, of 6 or more and a chroma of 3 or more; *or*

b. A color value, moist, of 5 or less and a chroma of 2 or more; *or*

2. A hue of 5Y and a chroma of 3 or more; *or*

3. A chroma of 2 or more, and no redox concentrations.

**Aeric Endoaquerts**

EAGG. Other Endoaquerts that have a lithic or paralithic contact within 100 cm of the mineral soil surface.

**Leptic Endoaquerts**

EAGH. Other Endoaquerts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.

**Entic Endoaquerts**

EAGI. Other Endoaquerts that have, in one or more horizons within 30 cm of the mineral soil surface, *one or both* of the following in more than half of each pedon:

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

2. A color value, dry, of 6 or more.

**Chromic Endoaquerts**

EAGJ. Other Endoaquerts.

**Typic Endoaquerts**

Definition of Typic Endoaquerts

Typic Endoaquerts are the Endoaquerts which:

1. Do not have a thermic, mesic, or frigid soil temperature regime and, if not irrigated during the year, 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;

2. Do not, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 or more cumulative days per year;

3. Do not, in any horizon between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, have any of the following in more than half of each pedon:

a. A hue of 2.5Y or redder and either

(1) A color value, moist, of 6 or more and a chroma of 3 or more; or

(2) A color value, moist, of 5 or less and a chroma of 2 or more; or

b. A hue of 5Y or yellower and a chroma of 3 or more; or

c. A chroma of 2 or more, and no redox concentrations;

4. Do not have a lithic or paralithic contact within 100 cm of the mineral soil surface;

5. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface;

6. Have, throughout all layers 15 cm or more thick within 100 cm of the mineral soil surface, an electrical conductivity of less than 15 dS/m (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years;

7. Have, in all horizons within 100 cm of the mineral soil surface, an exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than 13) for 6 or more months per year in 6 or more out of 10 years;

8. Have, in all horizons within 30 cm of the mineral soil surface, one or both of the following in more than half of each pedon:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less.

**Epiaquerts**

Definition

Epiaquerts are the Aquerts which:

1. Do not have a calcic or salic horizon or a duripan that has its upper boundary within 100 cm of the mineral soil surface, or a natric horizon;

2. Do not have both:

a. An electrical conductivity of the saturation extract of less than 4.0 dS/m at 25°C; and

b. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water) in more than 50 percent

of the soil volume between the mineral soil surface and a depth of 50 cm in each pedon; and

3. Have episaturation.

Key to subgroups

EAFA. Epiaquerts that have, throughout a layer 15 cm or more thick within 100 cm of the mineral soil surface, an electrical conductivity of 15 dS/m or more (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years.

**Halic Epiaquerts**

EAFB. Other Epiaquerts that have, in one or more horizons within 100 cm of the mineral 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 Epiaquerts**

EAFC. Other Epiaquerts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 210 or more cumulative days per year.

**Aridic Epiaquerts**

EAFD. Other Epiaquerts 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 Epiaquerts**

EAFE. Other Epiaquerts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 or more cumulative days per year.

**Ustic Epiaquerts**

EAFF. Other Epiaquerts that have, in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, 50 percent or more colors as follows:

1. A hue of 2.5Y or redder and *either*

a. A color value, moist, of 6 or more and a chroma of 3 or more; *or*

b. A color value, moist, of 5 or less and a chroma of 2 or more; *or*

2. A hue of 5Y and a chroma of 3 or more; *or*

3. A chroma of 2 or more, and no redox concentrations.

**Aeric Epiaquerts**

EAFG. Other Epiaquerts that have a lithic or paralithic contact within 100 cm of the mineral soil surface.

**Leptic Epiaquerts**

EAFH. Other Epiaquerts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.

**Entic Epiaquerts**

EAFI. Other Epiaquerts that have, in one or more horizons within 30 cm of the mineral soil surface, *one or both* of the following in more than half of each pedon:

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

2. A color value, dry, of 6 or more.

**Chromic Epiaquerts**

EAFJ. Other Epiaquerts.

**Typic Epiaquerts**

Definition of Typic Epiaquerts

Typic Epiaquerts are the Epiaquerts which:

1. Do not have a thermic, mesic, or frigid soil temperature regime and, if not irrigated during the year, cracks in 6 or more out of 10 years that remain both:

a. Five mm or more wide throughout a layer 25 cm or more thick 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;

2. Do not, in any horizon between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, have any of the following in more than half of each pedon:

a. A hue of 2.5Y or redder and either

(1) A color value, moist, of 6 or more and a chroma of 3 or more; or

(2) A color value, moist, of 5 or less and a chroma of 2 or more; or

b. A hue of 5Y or yellower and a chroma of 3 or more; or

c. A chroma of 2 or more, and no redox concentrations;

3. Do not have a lithic or paralithic contact within 100 cm of the mineral soil surface;

4. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface;

5. Have, if not irrigated during the year, cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 to 210 or more cumulative days per year;

6. Have, throughout all layers 15 cm or more thick within 100 cm of the mineral soil surface, an electrical conductivity of less than 15 dS/m (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years;

7. Have, in all horizons within 100 cm of the mineral soil surface, an exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than 13) for 6 or more months per year in 6 or more out of 10 years;

8. Have, in all horizons within 30 cm of the mineral soil surface, one or both of the following in more than half of each pedon:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less.

**Natraquerts**

Definition

Natraquerts are the Aquerts which have a natric horizon, and which do not have a salic horizon or duripan that has its upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

EAAC. All Natraquerts.

**Typic Natraquerts**

**Salaquerts**

Definition

Salaquerts are the Aquerts which have a salic horizon that has its an upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

EAAA. Salaquerts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 210 or more cumulative days per year.

**Aridic Salaquerts**

EAAB. Other Salaquerts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 or more cumulative days per year.

**Ustic Salaquerts**

EAAC. Other Salaquerts that have a lithic or paralithic contact within 100 cm of the mineral soil surface.

**Leptic Salaquerts**

EAAD. Other Salaquerts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.

**Entic Salaquerts**

EAAE. Other Salaquerts that have, in one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Salaquerts**

EAAF. Other Salaquerts.

**Typic Salaquerts**

Definition of Typic Salaquerts

Typic Salaquerts are the Salaquerts which:

1. Do not, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 or more cumulative days per year;

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

3. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface; and

4. Have, in all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Cryerts**

Definition

Cryerts are the Vertisols which:

1. Have a cryic soil temperature regime; and

2. Do not, in any horizon between 40 and 50 cm from the mineral soil surface, have aquic conditions (or artificial drainage) and any of the following:

a. In more than half of each pedon, either on faces of peds or in the matrix if peds are absent, 50 percent or more chroma of either:

(1) Two or less if redox concentrations are present; or

(2) One or less if redox concentrations are absent; or

b. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

Key to great groups

EBA. Cryerts that have 10 $kg/m^2$ or more organic carbon between the mineral soil surface and a depth of 50 cm.

**Humicryerts**

EBB. Other Cryerts.

**Haplocryerts**

**Haplocryerts**

Definition

Haplocryerts are the Cryerts that have less than 10 $kg/m^2$ organic carbon between the mineral soil surface and a depth of 50 cm.

Key to subgroups

EBBA. Haplocryerts that have, in one or more horizons within 100 cm of the mineral 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 Haplocryerts**

EBBB. Other Haplocryerts that have, in one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.
**Chromic Haplocryerts**

EBBC. Other Haplocryerts.
**Typic Haplocryerts**

Definition of Typic Haplocryerts

Typic Haplocryerts are the Haplocryerts that have:

1. In all horizons within 100 cm of the mineral soil surface, an exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than 13) for 6 or more months per year in 6 or more out of 10 years;

2. In all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Humicryerts**

Definition

Humicryerts are the Cryerts that have 10 $kg/m^2$ or more organic carbon between the mineral soil surface and a depth of 50 cm.

Key to subgroups

EBAA. Humicryerts that have, in one or more horizons within 100 cm of the mineral 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 Humicryerts**

EBAB. Other Humicryerts.
**Typic Humicryerts**

Definition of Typic Humicryerts

Typic Humicryerts are the Humicryerts that have, in all horizons within 100 cm of the mineral soil surface, an exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than 13) for 6 or more months per year in 6 or more out of 10 years;

**Torrerts**

Definition

Torrerts are the Vertisols which:

1. Do not have a cryic soil temperature regime;

2. Do not, in any horizon between 40 and 50 cm from the mineral soil surface, have aquic conditions (or artificial drainage) and any of the following:

a. In more than half of each pedon either on faces of peds or in the matrix if peds are absent, 50 percent or more chroma of either:

(1) Two or less if redox concentrations are present; or

(2) One or less if redox concentrations are absent; or

b. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;

3. Do not, in 6 or more out of 10 years, have both:

a. A thermic, mesic, or frigid soil temperature regime; and

b. If not irrigated during the year, cracks that remain both

(1) Five mm or more wide throughout a layer 25 cm or more thick within 50 cm of the 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; and

4. If not irrigated during the year, have cracks in 6 or more out of 10 years that remain closed for less than 60 consecutive days during a period when the soil temperature at a depth of 50 cm from the soil surface is continuously higher than 8°C.

Key to great groups

EDA. Torrerts which have a salic horizon that has its upper boundary within 100 cm of the soil surface.
**Salitorrerts**

EDB. Other Torrerts which have a gypsic horizon that has its upper boundary within 100 cm of the soil surface.
**Gypsitorrerts**

EDC. Other Torrerts which have a calcic or petrocalcic horizon that has its upper boundary within 100 cm of the soil surface.
**Calcitorrerts**

EDD. Other Torrerts.

**Haplotorrerts**

**Calcitorrerts**

Definition

Calcitorrerts are the Torrerts which:

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

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

Key to subgroups

EDCA. Calcitorrerts that have a petrocalcic horizon with an upper boundary within 100 cm of the soil surface.

**Petrocalcic Calcitorrerts**

EDCB. Other Calcitorrerts that have a lithic or paralithic contact, or the upper boundary of a duripan, within 100 cm of the soil surface.

**Leptic Calcitorrerts**

EDCC. Other Calcitorrerts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.

**Entic Calcitorrerts**

EDCD. Other Calcitorrerts that have, in one or more horizons within 30 cm of the soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Calcitorrerts**

EDCE. Other Calcitorrerts.

**Typic Calcitorrerts**

Definition of Typic Calcitorrerts

Typic Calcitorrerts are the Calcitorrerts which:

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

2. Do not have a lithic or paralithic contact, or the upper boundary of a duripan, within 100 cm of the soil surface;

3. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface; and

4. Have, in all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Gypsitorrerts**

Definition

Gypsitorrerts are the Torrerts which:

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

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

Key to subgroups

EDBA. Gypsitorrerts that have, in one or more horizons within 30 cm of the soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Gypsitorrerts**

EDBB. Other Gypsitorrerts.

**Typic Gypsitorrerts**

Definition of Typic Gypsitorrerts

Typic Gypsitorrerts are the Gypsitorrerts that have, in all horizons within 30 cm of the soil surface, 50 percent or more colors as follows:

1. A color value, moist, of 3 or less; or

2. A color value, dry, of 5 or less; or

3. A chroma of 2 or less.

**Haplotorrerts**

Definition

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

Key to subgroups

EDDA. Haplotorrerts that have, throughout a layer 15 cm or more thick within 100 cm of the soil surface, an electrical conductivity of 15 dS/m or more (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years.

**Halic Haplotorrerts**

EDDB. Other Haplotorrerts that 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 Haplotorrerts**

EDDC. Other Haplotorrerts that have a lithic or paralithic contact, or the upper boundary of a duripan, within 100 cm of the soil surface.

**Leptic Haplotorrerts**

EDDD. Other Haplotorrerts which have a layer 25 cm or more thick that contains less than 27 percent clay in

its fine-earth fraction and has its upper boundary within 100 cm of the soil surface.

**Entic Haplotorrerts**

EDDE. Other Haplotorrerts that have, in one or more horizons within 30 cm of the soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Haplotorrerts**

EDDF. Other Haplotorrerts.

**Typic Haplotorrerts**

Definition of Typic Haplotorrerts

Typic Haplotorrerts are the Haplotorrerts which:

1. Do not have a lithic or paralithic contact, or the upper boundary of a duripan, within 100 cm of the soil surface;

2. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the soil surface;

3. Have, in all layers 15 cm or more thick within 100 cm of the soil surface, an electrical conductivity of less than 15 dS/m (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years;

4. Have, in all horizons within 100 cm of the soil surface, an exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than 13) for 6 or more months per year in 6 or more out of 10 years;

5. Have, in all horizons within 30 cm of the soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Salitorrerts**

Definition

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

Key to subgroups

EDAA. Salitorrerts that have, in one or more horizons within 100 cm of the soil surface, aquic conditions for some time in most years (or artificial drainage) *and either*

1. Redoximorphic features; *or*

2. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Salitorrerts**

EDAB. Other Salitorrerts that have a lithic or paralithic contact, or the upper boundary of a duripan or petrocalcic horizon, within 100 cm of the soil surface.

**Leptic Salitorrerts**

EDAC. Other Salitorrerts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the soil surface.

**Entic Salitorrerts**

EDAD. Other Salitorrerts that have, in one or more horizons within 30 cm of the soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Salitorrerts**

EDAE. Other Salitorrerts.

**Typic Salitorrerts**

Definition of Typic Salitorrerts

Typic Salitorrerts are the Salitorrerts which:

1. Do not, in any horizon within 100 cm of the soil surface, have aquic conditions (or artificial drainage) and either

a. Redoximorphic features; or

b. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;

2. Do not have a lithic or paralithic contact, or the upper boundary of a duripan or petrocalcic horizon, within 100 cm of the soil surface;

3. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the soil surface; and

4. Have, in all horizons within 30 cm of the soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Uderts**

Definition

Uderts are the Vertisols which:

1. Do not have a cryic soil temperature regime;

2. Do not, in any horizon between 40 and 50 cm from the mineral soil surface, have aquic conditions (or artificial drainage) and any of the following:

a. In more than half of each pedon, either on faces of peds or in the matrix if peds are absent, 50 percent or more chroma of either:

(1) Two or less if redox concentrations are present; or

(2) One or less if redox concentrations are absent; or

b. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;

3. Do not, in 6 or more out of 10 years, have both:

a. A thermic, mesic, or frigid soil temperature regime; and

b. If not irrigated during the year, cracks that remain both

(1) Five mm or more wide throughout a layer 25 cm or more thick 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;

4. Do not, if not irrigated during the year, have cracks in 6 or more out of 10 years that remain closed for less than 60 consecutive days during a period when the soil temperature at a depth of 50 cm from the soil surface is continuously higher than 8°C; and

5. Do not, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 or more cumulative days.

Key to great groups

EFA. Uderts that have, in 50 percent or more of the soil volume between the mineral soil surface and a depth of 50 cm, *both*:

1. An electrical conductivity of the saturation extract of less than 4.0 dS/m at 25°C; *and*

2. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water).

**Dystruderts**

EFB. Other Uderts.

**Hapluderts**

**Dystruderts**

Definition

Dystruderts are the Uderts that have, in 50 percent or more of the soil volume between the mineral soil surface and a depth of 50 cm, both:

1. An electrical conductivity of the saturation extract of less than 4.0 dS/m at 25°C; and

2. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water).

Key to subgroups

EFAA. Other Dystruderts that have more than 2.0 cmol(+)/kg $Al^{3+}$ (by 1N KCl) in the fine-earth fraction throughout a layer 10 cm or more thick with an upper boundary between 25 and 50 cm from the mineral soil surface.

**Alic Dystruderts**

EFAB. Other Dystruderts that have, in one or more horizons within 100 cm of the mineral soil surface, aquic conditions for some time in most years (or artificial drainage) *and either*

1. Redoximorphic features; *or*

2. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Dystruderts**

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

**Oxyaquic Dystruderts**

EFAD. Other Dystruderts that have a lithic or paralithic contact within 100 cm of the mineral soil surface.

**Leptic Dystruderts**

EFAE. Other Dystruderts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.

**Entic Dystruderts**

EFAF. Other Dystruderts that have, in one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Dystruderts**

EFAG. Other Dystruderts.

**Typic Dystruderts**

Definition of Typic Dystruderts

Typic Dystruderts are the Dystruderts which:

1. Do not, in any horizon within 100 cm of the mineral soil surface, have aquic conditions (or artificial drainage) and either

a. Redoximorphic features; or

b. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;

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

3. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface;

4. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;

5. Have 2.0 cmol(+)/kg or less $Al^{3+}$ (by 1N KCl) in the fine-earth fraction throughout all layers 10 cm or more thick with an upper boundary between 25 and 50 cm from the mineral soil surface; and

6. Have, in all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Hapluderts**

Definition

Hapluderts are the Uderts that do not have both:

1. An electrical conductivity of the saturation extract of less than 4.0 dS/m at 25°C; and

2. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water) in more than 50 percent of the soil volume between the mineral soil surface and a depth of 50 cm in each pedon.

Key to subgroups

EFBA. Hapluderts that have a lithic contact within 50 cm of the mineral soil surface.

**Lithic Hapluderts**

EFBB. Other Hapluderts that have, in one or more horizons within 100 cm of the mineral soil surface, aquic conditions for some time in most years (or artificial drainage) *and either*

1. Redoximorphic features; *or*

2. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Hapluderts**

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

**Oxyaquic Hapluderts**

EFBD. Other Hapluderts that have a lithic or paralithic contact within 100 cm of the mineral soil surface.

**Leptic Hapluderts**

EFBE. Other Hapluderts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.

**Entic Hapluderts**

EFBF. Other Hapluderts that have, in one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Hapluderts**

EFBG. Other Hapluderts.

**Typic Hapluderts**

Definition of Typic Hapluderts

Typic Hapluderts are the Hapluderts which:

1. Do not have a lithic or paralithic contact within 100 cm of the mineral soil surface;

2. Do not, in any horizon within 100 cm of the mineral soil surface, have aquic conditions (or artificial drainage) and either

a. Redoximorphic features; or

b. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;

3. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface;

4. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years; and

5. Have, in all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Usterts**

Definition

Usterts are the Vertisols which:

1. Do not have a cryic soil temperature regime;

2. Do not, in any horizon between 40 and 50 cm from the mineral soil surface, have aquic conditions (or artificial drainage) and any of the following:

a. In more than half of each pedon, either on faces of peds or in the matrix if peds are absent, 50 percent or more chroma of either:

(1) Two or less if redox concentrations are present; or

(2) One or less if redox concentrations are absent; or

b. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;

3. Do not, in 6 or more out of 10 years, have both:

a. A thermic, mesic, or frigid soil temperature regime; and

b. If not irrigated during the year, cracks that remain both

(1) Five mm or more wide throughout a layer 25 cm or more thick 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;

4. Do not, if not irrigated during the year, have cracks in 6 or more out of 10 years that remain closed for less than 60 consecutive days during a period when the soil temperature at a depth of 50 cm from the soil surface is continuously higher than 8°C; and

5. If not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 or more cumulative days per year.

Key to great groups

EEA. Usterts that have, in 50 percent or more of the soil volume between the mineral soil surface and a depth of 50 cm, *both*:

1. An electrical conductivity of the saturation extract of less than 4.0 dS/m at 25°C; *and*

2. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water).

**Dystrusterts**

EEB. Other Usterts which have a salic horizon that has its upper boundary within 100 cm of the mineral soil surface.

**Salusterts**

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

**Gypsiusterts**

EED. Other Usterts which have a calcic or petrocalcic horizon that has its upper boundary within 100 cm of the mineral soil surface.

**Calciusterts**

EEE. Other Usterts.

**Haplusterts**

**Calciusterts**

Definition

Calciusterts are the Usterts which:

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

2. Do not have both:

1. An electrical conductivity of the saturation extract of less than 4.0 dS/m at 25°C; and

2. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water) in more than 50 percent of the soil volume between the mineral soil surface and a depth of 50 cm in each pedon; and

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

Key to subgroups

EEDA. Calciusterts that have a lithic contact within 50 cm of the mineral soil surface.

**Lithic Calciusterts**

EEDB. Other Calciusterts that have, throughout a layer 15 cm or more thick within 100 cm of the mineral soil surface, an electrical conductivity of 15 dS/m or more (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years.

**Halic Calciusterts**

EEDC. Other Calciusterts that have, in one or more horizons within 100 cm of the mineral 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 Calciusterts**

EEDD. Other Calciusterts which have a petrocalcic horizon that has its upper boundary within 100 cm of the mineral soil surface.

**Petrocalcic Calciusterts**

EEDE. Other Calciusterts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 210 or more cumulative days per year.

**Aridic Calciusterts**

EEDF. Other Calciusterts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for less than 150 cumulative days per year.

**Udic Calciusterts**

EEDG. Other Calciusterts that have a lithic or paralithic contact, or the upper boundary of a duripan, within 100 cm of the mineral soil surface.

**Leptic Calciusterts**

EEDH. Other Calciusterts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.

**Entic Calciusterts**

EEDI. Other Calciusterts that have, in one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Calciusterts**

EEDJ. Other Calciusterts.

**Typic Calciusterts**

Definition of Typic Calciusterts

Typic Calciusterts are the Calciusterts which:

1. Do not have a lithic or paralithic contact, or the upper boundary of a duripan or petrocalcic horizon, within 100 cm of the mineral soil surface;

2. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface;

3. If not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 150 to 210 cumulative days per year;

4. Have, throughout all layers 15 cm or more thick within 100 cm of the mineral soil surface, an electrical conductivity of less than 15 dS/m (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years;

5. Have, in all horizons within 100 cm of the mineral soil surface, an exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than 13) for 6 or more months per year in 6 or more out of 10 years; and

6. Have, in all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Dystrusterts**

Definition

Dystrusterts are the Usterts that have, in 50 percent or more of the soil volume between the mineral soil surface and a depth of 50 cm, both:

1. An electrical conductivity of the saturation extract of less than 4.0 dS/m at 25°C; and

2. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water).

Key to subgroups

EEAA. Dystrusterts that have a lithic contact within 50 cm of the mineral soil surface.

**Lithic Dystrusterts**

EEAB. Other Dystrusterts that have, in one or more horizons within 100 cm of the mineral soil surface, aquic conditions for some time in most years (or artificial drainage) *and either*

1. Redoximorphic features; *or*

2. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Dystrusterts**

EEAC. Other Dystrusterts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 210 or more cumulative days per year.

**Aridic Dystrusterts**

EEAD. Other Dystrusterts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for less than 150 cumulative days.

**Udic Dystrusterts**

EEAE. Other Dystrusterts that have a lithic or paralithic contact, or the upper boundary of a duripan, within 100 cm of the mineral soil surface.

**Leptic Dystrusterts**

EEAF. Other Dystrusterts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.

**Entic Dystrusterts**

EEAG. Other Dystrusterts that have, in one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Dystrusterts**

EEAH. Other Dystrusterts.

**Typic Dystrusterts**

Definition of Typic Dystrusterts

Typic Dystrusterts are the Dystrusterts which:

1. Do not have a lithic or paralithic contact, or the upper boundary of a duripan, within 100 cm of the mineral soil surface;

2. Do not, in any horizon within 100 cm of the mineral soil surface, have aquic conditions (or artificial drainage) and either

a. Redoximorphic features; or

c. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;

3. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface;

4. If not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 150 to 210 cumulative days per year; and

5. Have, in all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Gypsiusterts**

Definition

Gypsiusterts are the Usterts which:

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

2. Do not have both:

a. An electrical conductivity of the saturation extract of less than 4.0 dS/m at 25°C; and

b. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water) in more than 50 percent of the soil volume between the mineral soil surface and a depth of 50 cm in each pedon; and

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

Key to subgroups

EECA. Gypsiusterts that have a lithic contact within 50 cm of the mineral soil surface.
**Lithic Gypsiusterts**

EECB. Other Gypsiusterts that have, throughout a layer 15 cm or more thick within 100 cm of the mineral soil surface, an electrical conductivity of 15 dS/m or more (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years.
**Halic Gypsiusterts**

EECC. Other Gypsiusterts that have, in one or more horizons within 100 cm of the mineral 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 Gypsiusterts**

EECD. Other Gypsiusterts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 210 or more cumulative days per year.
**Aridic Gypsiusterts**

EECE. Other Gypsiusterts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for less than 150 cumulative days per year.
**Udic Gypsiusterts**

EECF. Other Gypsiusterts that have a lithic or paralithic contact, or the upper boundary of a duripan or a petrocalcic horizon, within 100 cm of the mineral soil surface.
**Leptic Gypsiusterts**

EECG. Other Gypsiusterts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.
**Entic Gypsiusterts**

EECH. Other Gypsiusterts that have, in one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.
**Chromic Gypsiusterts**

EECI. Other Gypsiusterts.
**Typic Gypsiusterts**

Definition of Typic Gypsiusterts

Typic Gypsiusterts are the Gypsiusterts which:

1. Do not have a lithic or paralithic contact, or the upper boundary of a duripan or a petrocalcic horizon, within 100 cm of the mineral soil surface;

2. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface;

3. Have, throughout all layers 15 cm or more thick within 100 cm of the mineral soil surface, an electrical conductivity of less than 15 dS/m (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years;

4. Have, in all horizons within 100 cm of the mineral soil surface, an exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than 13) for 6 or more months per year in 6 or more out of 10 years;

5. If not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 150 to 210 cumulative days per year; and

6. Have, in all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Haplusterts**

Definition

Haplusterts are the Usterts which:

1. Do not have both:

a. An electrical conductivity of the saturation extract of less than 4.0 dS/m at 25°C; and

b. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water) in more than 50 percent of the soil volume between the mineral soil surface and a depth of 50 cm in each pedon; and

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

Key to subgroups

EEEA. Haplusterts that have a lithic contact within 50 cm of the mineral soil surface.

**Lithic Haplusterts**

EEEB. Other Haplusterts that have, throughout a layer 15 cm or more thick within 100 cm of the mineral soil surface, an electrical conductivity of 15 dS/m or more (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years.

**Halic Haplusterts**

EEEC. Other Haplusterts that have, in one or more horizons within 100 cm of the mineral 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 Haplusterts**

EEED. Other Haplusterts which have a petrocalcic horizon that has its upper boundary within 100 cm of the mineral soil surface.

**Petrocalcic Haplusterts**

EEEE. Other Haplusterts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 210 or more cumulative days per year.

**Aridic Haplusterts**

EEEF. Other Haplusterts which have *both*:

1. A lithic or paralithic contact within 100 cm of the mineral soil surface; *and*

2. If not irrigated during the year, cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for less than 150 cumulative days per year

**Leptic Udic Haplusterts**

EEEG. Other Haplusterts which have *both*:

1. A layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface; *and*

2. If not irrigated during the year, cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for less than 150 cumulative days per year

**Entic Udic Haplusterts**

EEEH. Other Haplusterts which have *both*:

1. In one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

c. A chroma of 3 or more; *and*

2. If not irrigated during the year, cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for less than 150 cumulative days per year

**Chromic Udic Haplusterts**

EEEI. Other Haplusterts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for less than 150 cumulative days per year.

**Udic Haplusterts**

EEEJ. Other Haplusterts that have a lithic or paralithic contact, or the upper boundary of a duripan, within 100 cm of the mineral soil surface.

**Leptic Haplusterts**

EEEK. Other Haplusterts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.

**Entic Haplusterts**

EEEL. Other Haplusterts that have, in one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Haplusterts**

EEEM. Other Haplusterts.

**Typic Haplusterts**

Definition of Typic Haplusterts

Typic Haplusterts are the Haplusterts which:

1. Do not have a lithic or paralithic contact, or the upper boundary of a duripan or petrocalcic horizon, within 100 cm of the mineral soil surface;

2. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface;

3. Have, throughout all layers 15 cm or more thick within 100 cm of the mineral soil surface, an electrical conductivity of less than 15 dS/m or more (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years;

4. Have, in all horizons within 100 cm of the mineral soil surface, an exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than

13) for 6 or more months per year in 6 or more out of 10 years;

5. If not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 150 to 210 cumulative days per year; and

6. Have, in all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Salusterts**

Definition

Salusterts are the Usterts which:

1. Have a salic horizon that have its upper boundary within 100 cm of the mineral soil surface; and

2. Do not have both:

a. An electrical conductivity of the saturation extract of less than 4.0 dS/m at 25°C; and

b. A pH value of 4.5 or less in 0.01 M $CaCl_2$ (5.0 or less in 1:1 water) in more than 50 percent of the soil volume between the mineral soil surface and a depth of 50 cm in each pedon.

Key to subgroups

EEBA. Salusterts that have a lithic contact within 50 cm of the mineral soil surface.

**Lithic Salusterts**

EEBB. Other Salusterts that have, in one or more horizons within 100 cm of the mineral 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 Salusterts**

EEBC. Other Salusterts that have, in one or more horizons within 100 cm of the mineral soil surface, aquic conditions for some time in most years (or artificial drainage) *and either*

1. Redoximorphic features; *or*

2. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Salusterts**

EEBD. Other Salusterts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 210 or more cumulative days per year.

**Aridic Salusterts**

EEBE. Other Salusterts that have a lithic or paralithic contact, or the upper boundary of a duripan or petrocalcic horizon, within 100 cm of the mineral soil surface.

**Leptic Salusterts**

EEBF. Other Salusterts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.

**Entic Salusterts**

EEBG. Other Salusterts that have, in one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Salusterts**

EEBH. Other Salusterts.

**Typic Salusterts**

Definition of Typic Salusterts

Typic Salusterts are the Salusterts which:

1. Do not have a lithic or paralithic contact, or the upper boundary of a duripan or petrocalcic horizon, within 100 cm of the mineral soil surface;

2. Do not, in any horizon within 100 cm of the mineral soil surface, have aquic conditions (or artificial drainage) and either

a. Redoximorphic features; or

b. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;

3. Do not, if not irrigated during the year, have cracks in 6 or more out of 10 years that are 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 210 or more cumulative days per year;

4. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface;

5. Have, in all horizons within 100 cm of the mineral soil surface, an exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than 13) for 6 or more months per year in 6 or more out of 10 years;

6. Have, in all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Xererts**

Definition

Xererts are the Vertisols which:

1. Do not have a cryic soil temperature regime;

2. Do not, in any horizon between 40 and 50 cm from the mineral soil surface, have aquic conditions (or artificial drainage) and any of the following:

a. In more than half of each pedon, either on faces of peds or in the matrix if peds are absent, 50 percent or more chroma of either:

(1) Two or less if redox concentrations are present; or

(2) One or less if redox concentrations are absent; or

b. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated; and

3. In 6 or more out of 10 years, have both:

a. A thermic, mesic, or frigid soil temperature regime; and

b. If not irrigated during the year, cracks that remain both

(1) Five mm or more wide throughout a layer 25 cm or more thick 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.

Key to great groups

ECA. Xererts which have a duripan that has its upper boundary within 100 cm of the mineral soil surface.
**Durixererts**

ECB. Other Xererts which have a calcic or petrocalcic horizon that has its upper boundary within 100 cm of the mineral soil surface.
**Calcixererts**

ECC. Other Xererts.
**Haploxererts**

**Calcixererts**

Definition

Calcixererts are the Xererts that:

1. Have a calcic or petrocalcic horizon with an upper boundary within 100 cm of the mineral soil surface; and

2. Do not have a duripan with an upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

ECBA. Calcixererts that have a lithic contact within 50 cm of the mineral soil surface.
**Lithic Calcixererts**

ECBB. Other Calcixererts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that remain 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 180 or more consecutive days.
**Aridic Calcixererts**

ECBC. Other Calcixererts which have a petrocalcic horizon that has its upper boundary within 100 cm of the mineral soil surface.
**Petrocalcic Calcixererts**

ECBD. Other Calcixererts that have a lithic or paralithic contact within 100 cm of the mineral soil surface.
**Leptic Calcixererts**

ECBE. Other Calcixererts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.
**Entic Calcixererts**

ECBF. Other Calcixererts that have, in one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.
**Chromic Calcixererts**

ECBG. Other Calcixererts.
**Typic Calcixererts**

Definition of Typic Calcixererts

Typic Calcixererts are the Calcixererts which:

1. Do not that have a lithic or paralithic contact within 100 cm of the mineral soil surface;

2. Do not, if not irrigated during the year, have cracks in 6 or more out of 10 years that remain 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 180 or more consecutive days;

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

4. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface; and

5. Have, in all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Durixererts**

Definition

Durixererts are the Xererts which have a duripan that has its upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

ECAA. Durixererts that have, throughout a layer 15 cm or more thick above the duripan, an electrical conductivity of 15 dS/m or more (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years.
**Halic Durixererts**

ECAB. Other Durixererts that have, in one or more horizons above the duripan, 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 Durixererts**

ECAC. Other Durixererts that have, in one or more horizons above the duripan, aquic conditions for some time in most years (or artificial drainage) *and either*

1. Redoximorphic features; *or*

2. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Durixererts**

ECAD. Other Durixererts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that remain 5 mm or more wide, throughout a layer 25 cm or more thick above the duripan, for 180 or more consecutive days.
**Aridic Durixererts**

ECAE. Other Durixererts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that remain 5 mm or more wide, throughout a layer 25 cm or more thick above the duripan, for less than 90 consecutive days.
**Udic Durixererts**

ECAF. Other Durixererts which have a duripan that is not indurated in any subhorizon.
**Haplic Durixererts**

ECAG. Other Durixererts that have, in one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Durixererts**

ECAH. Other Durixererts.
**Typic Durixererts**

Definition of Typic Durixererts

Typic Durixererts are the Durixererts which:

1. Do not, in any horizon above the duripan, have aquic conditions (or artificial drainage) and either

a. Redoximorphic features; or

b. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;

2. Have, throughout all layers 15 cm or more thick above the duripan, an electrical conductivity of less than 15 dS/m (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years;

3. Have, in all horizons above the duripan, an exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than 13) for 6 or more months per year in 6 or more out of 10 years;

4. If not irrigated during the year, have cracks in 6 or more out of 10 years that remain 5 mm or more wide, throughout a layer 25 cm or more thick above the duripan, for 90 to 180 consecutive days;

5. Have a duripan that is either platy or massive, and is also indurated in some subhorizon; and

6. Have, in all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less.

**Haploxererts**

Definition

Haploxererts are the Xererts which do not have a duripan or a calcic or petrocalcic horizon that has its upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

ECCA. Haploxererts that have a lithic contact within 50 cm of the mineral soil surface.
**Lithic Haploxererts**

ECCB. Other Haploxererts that have, throughout a layer 15 cm or more thick within 100 cm of the mineral soil surface, an electrical conductivity of 15 dS/m or more (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years.
**Halic Haploxererts**

ECCC. Haploxererts that have, in one or more horizons within 100 cm of the mineral 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 Haploxererts**

ECCD. Other Haploxererts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that remain 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 180 or more consecutive days.
**Aridic Haploxererts**

ECCE. Other Haploxererts that have, in one or more horizons within 100 cm of the mineral soil surface, aquic conditions for some time in most years (or artificial drainage) *and either*

1. Redoximorphic features; *or*

2. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated.

**Aquic Haploxererts**

ECCF. Other Haploxererts which, if not irrigated during the year, have cracks in 6 or more out of 10 years that remain 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for less than 90 consecutive days.

**Udic Haploxererts**

ECCG. Other Haploxererts that have a lithic or paralithic contact within 100 cm of the mineral soil surface.

**Leptic Haploxererts**

ECCH. Other Haploxererts which have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface.

**Entic Haploxererts**

ECCI. Other Haploxererts that have, in one or more horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

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

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

3. A chroma of 3 or more.

**Chromic Haploxererts**

ECCJ. Other Haploxererts.

**Typic Haploxererts**

Definition of Typic Haploxererts

Typic Haploxererts are the Haploxererts which:

1. Do not have a lithic or paralithic contact within 100 cm of the mineral soil surface;

2. Do not, in any horizon within 100 cm of the mineral soil surface, have aquic conditions (or artificial drainage) and either

a. Redoximorphic features; or

b. Enough active ferrous iron to give a positive reaction to $\alpha,\alpha'$-dipyridyl at a time when the soil is not being irrigated;

3. Do not have a layer 25 cm or more thick that contains less than 27 percent clay in its fine-earth fraction and has its upper boundary within 100 cm of the mineral soil surface;

4. Have, throughout all layers 15 cm or more thick within 100 cm of the mineral soil surface, an electrical conductivity of less than 15 dS/m (1:1 soil:water) for 6 or more months per year in 6 or more out of 10 years;

5. Have, in all horizons within 100 cm of the mineral soil surface, an exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than 13) for 6 or more months per year in 6 or more out of 10 years;

6. If not irrigated during the year, have cracks in 6 or more out of 10 years that remain 5 mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 90 or more but less than 180 consecutive days; and

7. Have, in all horizons within 30 cm of the mineral soil surface, 50 percent or more colors as follows:

a. A color value, moist, of 3 or less; or

b. A color value, dry, of 5 or less; or

c. A chroma of 2 or less."

## 615.91 Spodosol amendment

The International Committee on Spodosols (ICOMOD) was established in 1981 and chaired initially by F. Ted Miller, then by Robert V. Rourke (since 1986). The mandate of the committee was to evaluate current criteria and to propose changes that would improve the classification of these important soils. The committee's mandate was to:

1. Evaluate chemical criteria for defining spodic horizons;

2. Evaluate thickness requirements;

3. Improve the classification of Aquods;

4. Propose criteria that would adequately distinguish Spodosols from Andepts (Andisols); and

5. Recommend changes in the classification of Spodosols and define appropriate taxa as well as the diagnostic properties required for their definition.

The following changes are required in *Soil Taxonomy* to accommodate the revisions proposed by ICOMOD.

Pages 29-32, Spodic horizon. Replace whole *Spodic horizon* section with the following:

"**Spodic horizon**

The spodic horizon is an illuvial layer with 85 percent or more *spodic materials* (defined below). Spodic materials contain illuvial active amorphous materials composed of organic matter and aluminum with or without iron. The term "active" is used here to describe materials that have a high pH-dependent charge, a large surface area, and high water retention. In uncultivated soils the spodic horizon normally lies below an albic horizon (a light-colored eluvial horizon defined below); less commonly, it is either under an ochric epipedon that does not meet the color requirements of an albic horizon, or under an umbric epipedon. In some soils the spodic horizon is at the surface of the mineral soil directly below a thin O horizon. In cultivated soils it generally occurs directly below the Ap horizon. Spodic materials may remain in some cultivated soils where the spodic horizon has been destroyed. Plate 4C shows a soil with a spodic horizon under an albic horizon.

Genesis

Spodic horizons form only in a humid environment. They are commonly associated with cold or temperate climates but also occur in hot climates. They are not found in an arid environment, although some occur in Mediterranean climates that have long, dry summers.

The types of vegetation and litter covering these soils are important for the formation of spodic horizons. In cool climates spodic horizons occur in soils that have had a heath vegetation (*Erica* and *Calluna*) or forest (broadleaf or coniferous). In a mixed forest, the spodic horizon is usually more strongly expressed under certain species such as hemlock (*Tsuga canadensis*) or kauri (*Agathis australis*) than under others. In warm climates spodic horizons occur under savanna, palm trees, and mixed forests.

A spodic horizon forms mostly in sandy, sandy-skeletal, coarse-loamy, loamy-skeletal, or coarse-silty materials or in andic soil materials (all defined below), but it occasionally develops in finer-textured material. Some spodic horizons which are not associated with an albic horizon may have been overlooked in the past. If parent materials are rich in clay, however, the formation of a spodic horizon is likely to be delayed until eluviation or weathering has reduced the clay content below a critical level. A spodic horizon then forms in the eluvial horizon, and the underlying argillic horizon is either destroyed or moved to greater depth as the spodic horizon thickens. There seems to be an antagonism between a spodic horizon and phyllosilicates. If a spodic horizon and an argillic horizon occur in the same soil, they are usually separated by an eluvial horizon (E') as shown in plate 7B, but under heath vegetation a spodic horizon may rest directly on, and may tongue into, an argillic horizon. In calcareous parent material, a spodic horizon does not begin to develop until carbonates have been leached from the upper part of the soil. A spodic horizon can form either in relatively fresh parent material containing abundant weatherable minerals, or in nearly pure quartz sand.

A spodic horizon can form either in a well-drained soil or in a soil with a shallow, fluctuating groundwater level. If the water table remains within the spodic horizon for long periods, the horizon may contain little or no iron. A spodic horizon does not seem to develop in a soil that is permanently saturated with water.

Under optimum conditions a spodic horizon can form within a few hundred years. Its biological destruction can be equally rapid, at least in some cultivated soils where lime and fertilizers are applied. Plate 1B illustrates the partial destruction of a spodic horizon.

Most spodic horizons are horizons in which organic matter, aluminum, and iron have accumulated. As far as is known, aluminum is always present and may be essential. Almost all spodic horizons have a maximum content of organic matter, iron, or aluminum in their upper few centimeters, although iron may be absent in some, or the iron and aluminum maxima may be below the organic-matter maximum, and the aluminum maximum may be below the iron maximum. Most spodic horizons have a hue o 7.5YR or redder. The presence of a hue of 7.5YR or redder in a spodic horizon that does not contain iron, the persistence of the hue after reduction if iron is present, and, if iron is absent, the destruction of the color by ignition, all suggest that organic compounds are important for the color of the spodic horizon.

The mobile sesquioxides[13] in spodic horizons can result from the dissolution of primary minerals and from cycling by plants. In eluvial horizons that overlie spodic horizons, the aluminosilicates appear pitted as by solution. Pitting is particularly evident on mafic minerals. A well-developed spodic horizon, however, may be the upper mineral horizon, overlain only by an O horizon. Although mixing of horizons by animals or by falling trees can usually be demonstrated in such a soil, more than one source of the materials accumulated in the spodic horizon is possible.

Some older theories concerning the formation of spodic horizons postulated a mutual flocculation of positively charged colloidal sesquioxides and negatively charged colloidal organic matter. Others assumed a flocculation of sesquioxides or of organic matter by changes in redox potential or pH with depth.

According to newer theories, an association between organic matter and iron and aluminum is formed by chelation and electrostatic bonding. The compounds thus formed are soluble if the sesquioxide concentration is low, but they are precipitated when the sesquioxide concentration reaches a critical level. Other research has demonstrated that large amounts of inorganic aluminum and iron in a Spodosol can be translocated as a sol from an *A* to a *B* horizon before complexing with organic matter.

Consequently, if solutions of organic compounds or sols that are moving through the soil pick up sesquioxides from primary minerals and from part of the spodic horizon, the compounds are eventually precipitated somewhere in the spodic horizon. The movement can be either downward due to gravity, or it can be lateral or upward. Upward movement due to capillary forces is suggested by the black, humus-rich subhorizon above and on the sides of tongues of the *E* horizon which commonly penetrate at various angles into the spodic horizon. Immobilization of sesquioxides may also be the result of a hydrolysis of the organometallic complex induced by changes in pH or by biological destruction of organic ligands. Some of the specific properties of the immobilized material which becomes the active fraction of a spodic horizon are (1) high concentrations of carboxyl and hydroxyl sites that are destroyed on heating, and (2) solubilization of organic matter and

[13] The term *sesquioxides*, as used here, refers to compounds of iron and aluminum.

sesquioxides on treatment with a strong complexing agent such as ammonium oxalate.

Distinctions between spodic horizons and andic soil materials

The central concept of andic soil materials is that of a soil developing in weatherable, silica-rich parent materials, such as volcanic ejecta or volcaniclastic materials, which have a colloidal fraction dominated by short-range-order minerals or aluminum-humus complexes. Under some environmental conditions, a weathering of primary aluminosilicates in parent materials of nonvolcanic origin may also lead to the formation of short-range-order minerals. The dominant process in most soils with andic soil materials is one of weathering and mineral transformation. Translocation within the soil and accumulation of the translocated compounds is normally minimal.

The central concept of soils with spodic horizons is one of aluminum, or aluminum and iron, and organic matter illuviating and precipitating when critical levels are reached.

Some areas, for example in Alaska, periodically receive volcanic ejecta. These areas also have climatic and vegetative conditions conducive to the formation of spodic materials. The soils in these areas of Alaska exhibit features of both andic and spodic materials. Because it represents evidence of eluviation, the albic horizon is used to separate Andisols from Spodosols; however, a volcanic ash layer should not be mistaken for an albic horizon.

Distinctions between spodic and argillic horizons

Argillic horizons are illuvial, and so are spodic horizons. Discrete crystalline clay particles are moved from an eluvial to an illuvial horizon to form an argillic horizon. Consequently, the clays in the eluvial and illuvial horizons of a soil that has an argillic horizon are similar, except where one kind of clay mineral has moved preferentially to others. The silica-sesquioxide ($SiO_2$ to $R_2O_3$) ratio of the whole soil is at a minimum in the argillic horizon, but that of the clay fraction remains virtually constant throughout the profile. In soils that have a spodic horizon, the dominant processes are dissolution of primary minerals in any eluvial horizon, movement of iron, aluminum, and organic matter, and precipitation of complexes of amorphous organic matter and metal. Typically, the clay mineralogy in the eluvial horizon differs greatly from that in the illuvial horizons, and the $SiO_2$-to-$R_2O_3$ ratio, both in the whole soil and in the clay fraction, is at a minimum in the spodic horizon.

In a particle-size separation, at least some of the illuviated iron and aluminum is dispersed and becomes part of the measured clay fraction.[14] Consequently data commonly show a clay maximum in the spodic horizon. Both the spodic and the argillic horizon may be a horizon of accumulation of free iron. In well-drained soils with an argillic horizon, the ratio of free iron to clay tends to be constant in all horizons, but in soils with a spodic horizon this ratio tends to be variable.

There are large differences in micromorphology between an argillic and a spodic horizon. The birefringent crystalline clay coatings of the argillic horizon differ sharply from the isotropic amorphous coatings of the spodic horizon (compare plates 3A and 3B with plates 5A and 5B). Most spodic horizons, however, contain some illuviated crystalline clay.

Distinctions between spodic and cambic horizons

A cambic horizon can be formed either by alteration of parent materials in place, resulting in the release of iron and formation of structure, or by solution and removal of carbonates; there is not enough illuviation to form a spodic horizon. Two situations are possible in which a spodic and a cambic horizon might be confused in the field. A cambic horizon may grade laterally by imperceptible stages into a spodic horizon as a result of increasing accumulation of organic-matter-sesquioxide complexes. A very weakly developed spodic horizon, however, contains more organic-matter-sesquioxide complexes relative to phyllosilicates than a cambic horizon, and the two kinds of horizons can be separated either on the basis of their morphology or by chemical techniques described below in the section on spodic materials.

It may be difficult to distinguish a spodic horizon from a cambic horizon in a soil that has developed in pyroclastic materials in a cool, perhumid climatic region. Under those conditions, part of the amorphous mineral material in a cambic horizon may form complexes with organic matter which are similar to those of a spodic horizon. In this situation, a distinction may be made on the basis of evidence of eluviation and the typical color pattern of a spodic horizon. If an overlying eluvial (albic) horizon is present in more than 50 percent of the pedon, it can be inferred that the underlying horizon is illuvial. Likewise, the presence of a spodic horizon is suggested if, in a freely drained soil, there is an abrupt boundary between an Ap horizon and an underlying horizon that contains 85 percent or more spodic materials.

Morphology

A typical spodic horizon is easily recognized in the field by its color and structure. Most commonly it has a *particle-size class* (defined below) that is sandy, sandy-skeletal, coarse-loamy, loamy-skeletal, or coarse-silty. The upper boundary of the horizon is commonly abrupt, and its hue, color value, and chroma change markedly with depth within a few

[14] The illuvial material of some spodic horizons disperses readily in one but not in another dispersing agent. Consequently, different methods may give different results. In some spodic horizons, the apparent silt accumulation is more pronounced than the clay accumulation.

centimeters of its upper boundary. The lowest color value, the reddest hue, and the lowest chroma occur in the upper part of the horizon. The lower part of the spodic horizon, or the horizon directly below it, has a higher chroma or a yellower hue than the main part, or has some combination of these colors. Structure is either absent or is granular, platy, blocky, or prismatic. Cracked coatings of an isotropic amorphous mixture of organic matter, iron, and aluminum can be detected on mineral sand grains in a sandy or coarse-loamy spodic horizon viewed under a 40- to 60-power lens. Figure 38 (Ch. 16) is a scanning electron micrograph that shows highly magnified cracked coatings.

Commonly, cracked coatings are dominant in the lower part of the spodic horizon. If the coatings are very thick, the horizon may be a cemented ortstein. In a dry soil the coatings may be cracked (plate 5B). Plate 5B shows a cemented spodic horizon in thin section. Clay films are not present on peds or in pores within a spodic horizon. Coatings on sand grains in a spodic horizon may not, however, be distinguishable under a hand lens from thin clay coatings in an argillic horizon.

If an albic horizon overlies a spodic horizon, there is seldom any difficulty in determining that the spodic horizon is of illuvial origin. Commonly there is a second maximum of organic carbon in the spodic horizon. In some tropical and subtropical areas, the albic horizon may be extremely thick and the spodic horizon may occur at a depth of 200 cm or more below the mineral soil surface. The presence of organic carbon and the characteristics of the exchange complex distinguish a cemented spodic horizon (ortstein) from the ironstone layer (*petroferric contact*, defined below) at a lithological discontinuity below many soils. In undisturbed soils without an albic horizon there is commonly a thin, dark eluvial horizon in which many of the sand grains are free of humus and of sesquioxide coatings. Many spodic horizons, however, are so close to the mineral soil surface that the horizons overlying them are easily destroyed by plowing or even by the disturbances associated with logging. In some soils, the albic or other overlying horizons seem to have been mixed with the spodic horizon by falling trees or by animals, or they may never have existed. In a disturbed soil it may be difficult or impossible to establish the illuvial nature of the spodic horizon although it has all the morphological, chemical and physical properties of a spodic horizon, which is clearly illuvial. To keep like things together in the classification, the presence of an overlying eluvial horizon is not required in the definition of a spodic horizon, although its identification is facilitated by the presence of an eluvial horizon.

Identification

A spodic horizon normally underlies an O, A, Ap, or E horizon. The hue and chroma may remain constant with increasing depth if the horizon is thin and overlies a *lithic* or *paralithic contact* (defined below). Generally the subhorizon with the reddest hue or the lowest chroma, or both, is near the top of the spodic horizon. The hue becomes yellower or the chroma higher, or both, within subhorizons of the spodic horizon or in an underlying BC, C, E', or Bx horizon.

Spodic horizons must contain at least 85 percent spodic materials. There are many useful clues from field evidence to help identify spodic materials. Among these are an albic horizon in 50 percent or more of the pedon and amorphous aluminum (or aluminum and iron) which, when present in sufficient amounts, provides color clues to the existence of spodic materials. These colors are listed in the section on spodic materials. However, spodic materials cannot be positively identified from field evidence alone. They must also have a pH value of 5.9 or less and an organic-carbon content of 0.6 percent or more. Not all soils with spodic materials have albic horizons. When albic horizons are absent, spodic materials must still meet specific color requirements and have at least one additional feature. Such features can be morphological or chemical, or both. The additional morphological features include: (1) ortstein that has a horizontal continuity through 50 percent or more of the pedon and a very firm or firmer consistence, and (2) cracked coatings on ten percent or more of the sand grains. In some soils the presence of isotropic cracked coatings (plate 5B) may have to be confirmed with the aid of a petrographic microscope. Optical identification may not be feasible if there are significant inclusions of mica or of other anisotropic clay, or if the presence of volcanic glass or other pyroclastic materials leads one to suspect a cambic horizon containing amorphous clay.

If a pedon does not have an albic horizon, ortstein, or sand grains with cracked coatings, then the definition of spodic materials requires that specific color and chemical criteria must be met. Two chemical criteria are used to evaluate spodic materials; if at least one of these, in addition to the color requirements, is satisfied, the definition of spodic materials is met.

The first chemical criterion is that the percentages of ammonium-oxalate-extractable aluminum plus one half the ammonium-oxalate-extractable iron in spodic materials must total 0.50 or more and must be two times or more the amounts present in an overlying umbric (or subhorizon of an umbric) epipedon, or an ochric epipedon or albic horizon. The increase in ammonium-oxalate-extractable iron and aluminum from an A and/or E horizon to a B horizon is indicative of the illuvial process. Ammonium oxalate will extract both iron and aluminum associated with humus and inorganic amorphous compounds, and it will also dissolve magnetite and ferrihydrite, both of which contribute to the ammonium-oxalate-extractable iron values. Ferrihydrite is believed to be associated with both spodic and nonspodic materials in soils associated with wetness.

The second chemical criterion is that the optical-density-of-oxalate-extract (ODOE) value should be 0.25 or more, and at least double from an eluvial to the spodic horizon. This method

assumes that the ODOE results mostly from extracted fulvic acids. When there are significantly higher quantities in an illuvial horizon than in an eluvial horizon, it is concluded that spodic materials are present.

Thickness of the spodic horizon

For a variety of reasons some spodic horizons are thin or otherwise weakly developed. Some soils, particularly those on calcareous parent materials in cool, humid climates, have two horizons of accumulation, the upper of which contains an accumulation of amorphous materials, while the lower contains phyllosilicates. The two are separated by an eluvial horizon. This sequence of horizons is defined below as a bisequum. In this situation a spodic horizon has formed, or begun to form, in a clay-depleted eluvial horizon. Other spodic horizons are thin because they rest on a fragipan or on a lithic or paralithic contact. In very cold, humid climates, any illuvial horizon is normally dominated by organic matter and amorphous sesquioxides, and it may be thin. Very thin horizons of accumulation are easily destroyed by plowing, trampling by livestock, or logging. To prevent such minor disturbances from changing the classification of a soil, a minimum depth to the lower boundary of the spodic horizon is required for the Spodosol order, depending on the *soil temperature regime* (defined below). If the soil temperature regime is mesic or warmer, the spodic horizon must extend to a depth of 25 cm from the mineral soil surface, unless the soil is less than 25 cm deep. For soils that have either a cryic or a pergelic soil temperature regime, or a frigid soil temperature regime and a spodic horizon with coarse-loamy, loamy-skeletal, or finer particle size, depth limits are waived because in these soils there is less prospect of a serious disturbance of significant areas than in sandy and warmer soils. For soils that have, within 25 cm of the mineral soil surface, a duripan or a fragipan, or a petroferric, paralithic, or lithic contact, depth limits are also waived. If these soils are disturbed, the whole soil is altered and its classification is likely to be affected.

Summary of the limits of a spodic horizon

A spodic horizon is normally a subsurface horizon underlying an O, A, Ap, or E horizon. It may, however, meet the definition of an umbric epipedon.

A spodic horizon must have 85 percent or more spodic materials (described below) in a layer 2.5 cm or more thick that is not part of any Ap horizon."

Page 63. Preceding section on *Sulfidic materials*, add new section, *Spodic materials*, to read as follows:

"Spodic materials

Spodic materials have formed in an illuvial horizon that normally underlies a histic, umbric, or ochric epipedon or an albic horizon. In most undisturbed areas spodic materials underlie an albic horizon. They may occur within an umbric epipedon or Ap horizon.

A horizon consisting of spodic materials normally has an optical-density-of-oxalate-extract (ODOE) value of 0.25 or more, and a value at least two times as high as the ODOE value for an overlying eluvial horizon. This increase in ODOE value indicates an accumulation of translocated organic materials in an illuvial horizon. Soils with spodic materials show evidence that both organic materials and aluminum, with or without iron, have been moved from an eluvial to an illuvial horizon. The morphological, chemical, and physical properties of spodic materials are as follows.

Definition of spodic materials

Spodic materials are mineral soil materials that do not have all the properties of an argillic or a kandic horizon, are dominated by illuvial active amorphous materials composed of organic matter and aluminum, with or without iron, and have both:

1. A pH in water (1:1) of 5.9 or less and an organic-carbon content of 0.6 percent or more; and

2. One or more of the following:

a. An overlying albic horizon which extends horizontally through 50 percent or more of each pedon, and have, directly under the albic horizon, colors, moist (crushed and smoothed sample), as follows:

(1) A hue of 5YR or redder; or

(2) A hue of 7.5YR, color value of 5 or less, and chroma of 4 or less; or

(3) A hue of 10YR or neutral and a color value and chroma of 2 or less; or

(4) A color of 10YR 3/1; or

b. One of the colors listed above or a hue of 7.5YR, color value, moist, of 5 or less, and chroma of 5 or 6, moist (crushed and smoothed sample), and one or more of the following morphologic or chemical properties:

(1) Cementation by organic matter and aluminum, with or without iron, in 50 percent or more of each pedon, and very firm or firmer consistence in the cemented part; or

(2) Ten percent or more cracked coatings on sand grains; or

(3) Aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.50 or more, and half that amount or less in an overlying umbric (or subhorizon of an umbric)

epipedon, or an ochric epipedon or albic horizon; or

(4) An optical-density-of-oxalate-extract (ODOE) value of 0.25 or more, and a value half as high or lower in an overlying umbric (or subhorizon of an umbric) epipedon, or an ochric epipedon or albic horizon."

Page 92, Key to orders, item A.2.c (refer to NSTH 615.60). Change item 2.c to item 3 to read as follows:

"3. 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."

Page 92, Key to orders (refer to NSTH 615.60). Change items B and C to read as follows (also change the initial letter B to C in the keys to suborders, great groups and subgroups of Andisols):

"B. Other soils which do not have a plaggen epipedon or an argillic or a kandic horizon above a spodic horizon, *and* have *one or more* of the following:

1. A spodic horizon, an albic horizon in 50 percent or more of each pedon, and a cryic or pergelic soil temperature regime; *or*

2. An Ap horizon containing 85 percent or more spodic materials; *or*

3. A spodic horizon with *all* the following characteristics:

a. *One or more* of the following:

(1) A thickness of 10 cm or more; *or*

(2) An overlying Ap horizon; *or*

(3) Cementation in 50 percent or more of each pedon; *or*

(4) A coarse-loamy, loamy-skeletal, or finer particle size, and a frigid temperature regime in the soil; *or*

(5) A cryic or pergelic temperature regime in the soil; *and*

b. An upper boundary within the following depths from the mineral soil surface: *either*

(1) Less than 50 cm; *or*

(2) Less than 200 cm if the soil has a sandy particle size between the mineral soil surface and the spodic horizon; *and*

c. A lower boundary as follows:

(1) *Either* at a depth of 25 cm or more below the mineral soil surface, *or* at the top of a duripan or fragipan, or at a lithic, paralithic, or petroferric contact, whichever is shallowest; *or*

(2) At any depth,

(a) If the spodic horizon has a coarse-loamy, loamy-skeletal, or finer particle size, and the soil has a frigid temperature regime, *or*

(b) If the soil has a cryic or pergelic temperature regime; *and*

d. *Either*:

(1) A directly overlying albic horizon in 50 percent or more of each pedon, *or*

(2) No andic soil properties in 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.

**Spodosols**

C. Other soils that have andic soil properties in 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.

**Andisols**"

Page 96, Definition, column 1 (refer to NSTH p. 615-179). Change items 5 and 7 to read as follows:

"5. Do not have a spodic horizon overlying an argillic or a kandic horizon, nor an Ap horizon consisting of spodic materials; and

7. 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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact, duripan, or petrocalcic horizon, if shallower than 60 cm."

Page 96, Limits between Alfisols and soils of other orders (refer to NSTH p. 615-179). Change items 1 and 7 to read as follows:

"1. To distinguish Alfisols from Andisols, Alfisols must 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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact, duripan, or petrocalcic horizon if shallower than 60 cm.

7. To distinguish Alfisols from Spodosols, Alfisols must not have a spodic horizon above the argillic or kandic horizon, nor an Ap horizon consisting of spodic materials."

NSTH 615.60, p. 615-186, Haplocryands. Delete item CBFH and change item CBFI to CBFH.

NSTH 615.60, p. 615-186, Definition of Haplocryands. Delete item 8.

NSTH 615.60, p. 615-188, Vitricryands. Delete item CBEE and change items CBEF-CBEG to CBEE-CBEF.

NSTH 615.60, p. 615-188, Definition of Vitricryands. Delete item 5 and renumber item 6 as 5.

NSTH 615.60, p. 615-200, Udivitrands. Delete item CEBD and change item CEBE to CEBD.

NSTH 615.60, p. 615-200, Definition of Udivitrands. Delete item 4.

NSTH 615.60, p. 615-203, Vitrixerands. Delete item CDAD and change items CDAE-CDAI to CDAD-CDAH.

NSTH 615.60, p. 615-203, Definition of Vitrixerands. Delete item 4 and renumber item 5-6 as 4-5.

Page 155, Definition, item 1. After "Do not have", insert "an Ap horizon consisting of spodic materials, or".

Page 156, Definition, (refer to NSTH p. 615-203). Change item 4 to read as follows:

"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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact, duripan, or petrocalcic horizon if shallower than 60 cm."

Page 156, Limits between Aridisols and soils of other orders (refer to NSTH p. 615-203). Change items 2 and 8 to read as follows:

"2. To distinguish Aridisols from Andisols, Aridisols must 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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact, duripan, or petrocalcic horizon if shallower than 60 cm.

8. To distinguish Aridisols from Spodosols, Aridisols must not have a spodic horizon, nor an Ap horizon consisting of spodic materials."

Page 179, Definition, item 2. After "Do not have", insert "an Ap horizon consisting of spodic materials, or".

Page 180, Definition (refer to NSTH p. 615-204). Change item 4 to read as follows:

"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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact if shallower than 60 cm."

Page 180, Limits between Entisols and soils of other orders (refer to NSTH p. 615-204). Change items 2 and 8 to read as follows:

"2. To distinguish Entisols from Andisols, Entisols must 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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact if shallower than 60 cm.

8. To distinguish Entisols from Spodosols, Entisols must not have a spodic horizon, nor an Ap horizon consisting of spodic materials."

NSTH 615.62, p. 615-266, Psammaquents (*Soil Taxonomy* p. 186). Change item KAEB to read as follows:

"KAEB. Other Psammaquents which have a horizon 5 cm or more thick, either below an Ap horizon or at a depth of 18 cm or more from the mineral soil surface, whichever is deeper, that has *one or more* of the following:

1. In 25 percent or more of each pedon, cementation by organic matter and aluminum, with or without iron; *or*

2. Aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.25 or more,

and half that amount or less in an overlying horizon; *or*

3. An ODOE value of 0.12 or more, and a value half as high or lower in an overlying horizon.

**Spodic Psammaquents"**

NSTH 615.62, p. 615-266, Definition of Typic Psammaquents (*Soil Taxonomy* p. 186). Change item 3 to read as follows:

"3. Do not have a horizon 5 cm or more thick, either below an Ap horizon or at a depth of 18 cm or more from the mineral soil surface, whichever is deeper, that has *one or more* of the following:

a. In 25 percent or more of each pedon, cementation by organic matter and aluminum, with or without iron; *or*

b. Aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.25 or more, and half that amount or less in an overlying horizon; *or*

c. An ODOE value of 0.12 or more, and a value half as high or lower in an overlying horizon."

Page 186, Description of subgroups, Spodic Psammaquents. Change the first sentence to read as follows:

"These soils have a weak accumulation of amorphous materials, mostly humus."

615.62, p. 615-277, Cryopsamments (*Soil Taxonomy* p. 202). Change item KCAE to read as follows:

"KCAE. Other Cryopsamments which have a horizon 5 cm or more thick that has *one or more* of the following:

1. In 25 percent or more of each pedon, cementation by organic matter and aluminum, with or without iron; *or*

2. Aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.25 or more, and half that amount or less in an overlying horizon; *or*

3. An ODOE value of 0.12 or more, and a value half as high or lower in an overlying horizon.

**Spodic Cryopsamments"**

NSTH 615.62, p. 615-277, Definition of Typic Cryopsamments (*Soil Taxonomy* p. 202). Change item 6 to read as follows:

"6. Do not have a horizon 5 cm or more thick, either below an Ap horizon or at a depth of 18 cm or more from the mineral soil surface, whichever is deeper, that has *one or more* of the following:

a. In 25 percent or more of each pedon, cementation by organic matter and aluminum, with or without iron; *or*

b. Aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.25 or more, and half that amount or less in an overlying horizon; *or*

c. An ODOE value of 0.12 or more, and a value half as high or lower in an overlying horizon."

Page 202, Description of subgroups, Typic Cryopsamments, line 4. Delete "that do not have a distinct albic horizon" and substitute "that do not have a weak accumulation of amorphous materials".

Page 203, Description of subgroups, Spodic Cryopsamments. Change first sentence to read as follows:

"These soils have a weak accumulation of amorphous materials."

NSTH 615.62, pp. 615-277/278 (and NSTH 615.72), Quartzipsamments (*Soil Taxonomy* p. 204). Delete item KCCB and change items KCCC-KCCN to KCCB-KCCM.

NSTH 615.62, p. 615-278, Quartzipsamments (*Soil Taxonomy* p. 204). Change new item KCCL to read as follows:

"KCCL. Other Quartzipsamments which have a horizon 5 cm or more thick, either below an Ap horizon or at a depth of 18 cm or more from the mineral soil surface, whichever is deeper, that has *one or more* of the following:

1. In 25 percent or more of each pedon, cementation by organic matter and aluminum, with or without iron; *or*

2. Aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.25 or more, and half that amount or less in an overlying horizon; *or*

3. An ODOE value of 0.12 or more, and a value half as high or lower in an overlying horizon.

**Spodic Quartzipsamments"**

Page 204, Description of subgroups, Spodic Quartzipsamments. Change first sentence to read as follows:

"These soils have a weak accumulation of amorphous materials."

NSTH 615.62, p. 615-279, Udipsamments (*Soil Taxonomy* p. 206). Change item KCDD to read as follows:

"KCDD. Other Udipsamments which have a horizon 5 cm or more thick, either below an Ap horizon or at a depth of 18 cm or more from the mineral soil surface, whichever is deeper, that has *one or more* of the following:

1. In 25 percent or more of each pedon, cementation by organic matter and aluminum, with or without iron; *or*

2. Aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.25 or more, and half that amount or less in an overlying horizon; *or*

3. An ODOE value of 0.12 or more, and a value half as high or lower in an overlying horizon.

**Spodic Udipsamments"**

NSTH 615.62, p. 615-279, Definition of Typic Udipsamments (*Soil Taxonomy* p. 206). Change item 5 to read as follows:

"5. Do not have a horizon 5 cm or more thick, either below an Ap horizon or at a depth of 18 cm or more from the mineral soil surface, whichever is deeper, that has *one or more* of the following:

a. In 25 percent or more of each pedon, cementation by organic matter and aluminum, with or without iron; *or*

b. Aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.25 or more, and half that amount or less in an overlying horizon; *or*

c. An ODOE value of 0.12 or more, and a value half as high or lower in an overlying horizon; and"

Page 206, Description of subgroups, Typic Udipsamments, lines 3-5. Delete "do not have an albic horizon that has a weak accumulation of amorphous materials below it" and substitute "do not have a weak accumulation of amorphous material".

Page 206, Description of subgroups, Typic Udipsamments, lines 14-18. Change sentence to read as follows:

"Soils that have weak accumulations of amorphous materials are considered intergrades to Spodosols."

Page 207, Description of subgroups, Spodic Udipsamments. Delete first two sentences and substitute the following sentence:

"These soils have weak accumulations of amorphous materials."

Page 212, Definition (refer to NSTH p. 615-204). Change item 3 to read as follows:

"3. 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."

Page 227, Definition, item 1.a. After "Do not have", insert "an Ap horizon consisting of spodic materials, or".

Page 228, Definition, item 1 (refer to NSTH p. 615-204). Change item g to read as follows:

"g. 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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact, duripan, or petrocalcic horizon if shallower than 60 cm."

Page 228, Limits between Inceptisols and other orders (refer to NSTH p. 615-204). Change item 2 to read as follows:

"2. To distinguish Inceptisols from Andisols, Inceptisols must 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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact, duripan, or petrocalcic horizon if shallower than 60 cm."

Page 229, Limits between Inceptisols and other orders, item 8 (refer to NSTH p. 615-204). Change item *a* to read as follows:

"a. An Ap horizon consisting of spodic materials or a spodic horizon, unless it is a buried horizon;".

Page 271, Definition (refer to NSTH p. 615-204). Change item 3 to read as follows:

"3. 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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact, duripan, or petrocalcic horizon if shallower than 60 cm;"

Page 272, Definition (refer to NSTH p. 615-13). Change item 6 to read as follows:

"6. Do not have an Ap horizon consisting of spodic materials, nor a spodic horizon that has its upper boundary within 200 cm of the mineral soil surface."

Page 272, Limits between Mollisols and soils of other orders (refer to NSTH p. 615-204). Change item 2 to read as follows:

"2. To distinguish Mollisols from Andisols, Mollisols must 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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact, duripan, or petrocalcic horizon if shallower than 60 cm."

Page 272, Limits between Mollisols and soils of other orders (refer to NSTH p. 615-13). Change item 8 to read as follows:

"8. To distinguish Mollisols from Spodosols, Mollisols must not have an Ap horizon consisting of spodic materials, nor a spodic horizon that has

its upper boundary within 200 cm of the mineral soil surface."

Page 323, Definition (refer to NSTH pp. 615-123/205). Change items 2 and 3 to read as follows:

"2. Do not have an Ap horizon consisting of spodic materials, nor a spodic horizon that has its upper boundary within 200 cm of the mineral soil surface.

3. 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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact, duripan, or petrocalcic horizon if shallower than 60 cm."

Page 333, Spodosols. Delete whole chapter on Spodosols and replace with the following:

## "CHAPTER 16
## SPODOSOLS[1]

The feature that is common to most Spodosols (plates 4C and 7B) is the presence of a spodic horizon, one in which amorphous mixtures of organic matter and aluminum, with or without iron, have accumulated. The spodic horizon may be destroyed by cultivation, yet spodic materials may still be present. In undisturbed soils there is normally an overlying eluvial horizon, generally with a gray to light gray color similar to that of uncoated quartz. In some Spodosols this horizon is too thin to be preserved after cultivation, while in others it is very thick. Below the spodic horizon there may be a fragipan or another sequum that has an argillic horizon. A few Spodosols have a placic horizon either on a spodic horizon or on a fragipan, or within the spodic horizon. Some Spodosols have layers thicker than a placic horizon that are cemented by sesquioxides and organic matter (ortstein).

Most Spodosols have few clay-sized phyllosilicates. Their particle-size class is mostly sandy, sandy-skeletal, coarse-loamy, loamy-skeletal, or coarse-silty.

Spodosols are most extensive in cool, humid or perhumid climates. But they have also formed in hot, humid tropical regions and other warm, humid areas, where they occur mostly in quartz-rich sands that have a fluctuating level of ground water. In many of the latter soils, the silt and sand fractions contain very few weatherable minerals and the albic horizons tend to be thick. However, soils with an albic horizon 200 cm or more thick are excluded from Spodosols and grouped with the Entisols. Some of the very deep spodic horizons may be buried, but it seems likely that others have formed at great depths because the overlying soil materials have very little iron and aluminum that could precipitate the organic carbon. In some the source of aluminum may be the ground water. Exclusion of a soil from Spodosols if the albic horizon is very thick is largely pragmatic. The chemical and physical properties of many Spodosols and Andisols are very similar. However, the definition of spodic materials is based on the concept of organic matter and aluminum, with or without iron, accumulating by illuviation.

In the United States most Spodosols occur in late-Pleistocene or Holocene deposits. They are common in Alaska, in the higher mountains of the West, in the Great Lakes states, in the Northeast, and along the Atlantic coast. Most are covered with coniferous or, less commonly, hardwood forests if they are not cultivated or grazed. In tropical areas the vegetation may be rain forest, palms, or a savanna that probably is anthropic.

The moisture regime of Spodosols is mostly udic, but a few have a xeric regime. Some have aquic conditions. They may have any soil temperature regime.

Spodosols are naturally infertile soils, but they can be highly responsive to good management. Under cultivation, particularly if lime and nitrogen is applied, the spodic horizon may be biologically destroyed.

### Definition

Spodosols are mineral soils which do not have a plaggen epipedon or an argillic or a kandic horizon above a spodic horizon, and have one or more of the following:

1. A spodic horizon, an albic horizon in 50 percent or more of each pedon, and a cryic or pergelic soil temperature regime; or

2. An Ap horizon containing 85 percent or more spodic materials; or

3. A spodic horizon that has all the following properties:

a. One or more of the following:

(1) A thickness of 10 cm or more; or

(2) An overlying Ap horizon; or

(3) Cementation in 50 percent or more of each pedon; or

(4) A coarse-loamy, loamy-skeletal, or finer particle size and a frigid temperature regime in the soil; or

(5) A cryic or pergelic temperature regime in the soil; and

b. An upper boundary within the following depths from the mineral soil surface: either

(1) Less than 50 cm; or

(2) Less than 200 cm if the soil has a sandy particle size between the mineral soil surface and the spodic horizon; and

c. A lower boundary as follows:

(1) Either at a depth of 25 cm or more below the mineral soil surface, or at the top

[1] This chapter on Spodosols was rewritten in 1992 following the recommendations of the International Committee on the Classification of Spodosols (ICOMOD), chaired initially by F. Ted Miller, then by Robert V. Rourke (since 1986).

of a duripan or fragipan, or at a lithic, paralithic, or petroferric contact, whichever is shallowest; or

(2) At any depth,

(a) If the spodic horizon has a coarse-loamy, loamy-skeletal, or finer particle size and the soil has a frigid temperature regime, or

(b) If the soil has either a cryic or pergelic temperature regime; and

d. Either:

(1) A directly overlying albic horizon in 50 percent or more of each pedon, or

(2) No andic soil properties in 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.

KEY TO SUBORDERS

BA. Spodosols that have aquic conditions for some time in most years (or artificial drainage) in one or more horizons within 50 cm of the mineral soil surface, *and one or both* of the following:

1. A histic epipedon; *or*

2. Within 50 cm of the mineral soil surface, redoximorphic features in an albic or spodic horizon.

**Aquods**

BB. Other Spodosols that have a cryic or pergelic soil temperature regime.

**Cryods**

BC. Other Spodosols that have 6 percent or more organic carbon in a layer 10 cm or more thick within the spodic horizon.

**Humods**

BD. Other Spodosols.

**Orthods**

**Aquods**

Aquods are the Spodosols of wet locations, characterized either by a shallow fluctuating water table or an extremely humid climate. If the soil temperature regime is mesic or isomesic or warmer, most of them have a nearly white albic horizon thick enough to persist under cultivation or, in the wettest Aquods, a black surface horizon resting on a dark reddish brown spodic horizon that is virtually free of iron. Others have a placic horizon or a duripan, or are cemented by an amorphous mixture of sesquioxides and organic matter.

The Aquods that do not have a placic horizon normally have a transitional horizon between the albic horizon and the spodic horizon, a feature virtually unique to these soils.

Aquods have formed mainly in sandy materials of Pleistocene age. They may have any temperature regime. Water-loving plants of a very wide variety, ranging from sphagnum in cold areas to palms in the tropics, grow on these soils. In the United States relatively few Aquods are cultivated except in New Jersey and Florida.

Definition

Aquods are the Spodosols that have aquic conditions for some time in most years (or artificial drainage) in one or more horizons within 50 cm of the mineral soil surface, and one or both of the following:

1. A histic epipedon; or

2. Within 50 cm of the mineral soil surface, redoximorphic features in an albic or spodic horizon.

Key to great groups

BAA. Aquods that have a cryic or pergelic soil temperature regime.

**Cryaquods**

BAB. Other Aquods that have less than 0.10 percent iron (by ammonium oxalate) in 75 percent or more of the spodic horizon.

**Alaquods**

BAC. Other Aquods that have a fragipan.

**Fragiaquods**

BAD. Other Aquods that have a placic horizon within 100 cm of the mineral soil surface in 50 percent or more of each pedon.

**Placaquods**

BAE. Other Aquods which have, in 90 percent or more of each pedon, a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.

**Duraquods**

BAF. Other Aquods that have episaturation.

**Epiaquods**

BAG. Other Aquods.

**Endoaquods**

**Alaquods**

These soils occur primarily in the southeastern part of the United States. Their water table generally fluctuates and in the process reduces iron and moves it out of the soil. The spodic horizon of Alaquods consists mostly of an accumulation of organic matter and aluminum and often shows few or no redoximorphic features. The albic horizon in the drier Alaquods is normally thick. The wettest of these soils have no albic horizon, but generally have uncoated

sand grains above the spodic horizon. Alaquods normally have a sandy particle size. Because of their high humus content, however, some of them feel and behave like loamy soils. They were considered Ground-Water Podzol soils in the 1938 classification.

Definition

Alaquods are the Aquods which:

1. Have less than 0.10 percent iron (by ammonium oxalate) in 75 percent or more of the spodic horizon; and

2. Do not have a cryic or pergelic soil temperature regime.

Key to subgroups

BABA. Alaquods that have a lithic contact within 50 cm of the mineral soil surface.
**Lithic Alaquods**

BABB. Other Alaquods which have, in 90 percent or more of each pedon, a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.
**Duric Alaquods**

BABC. Other Alaquods that have a histic epipedon.
**Histic Alaquods**

BABD. Other Alaquods which have *both*:

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

2. A sandy particle size throughout a layer extending from the mineral soil surface to the top of the spodic horizon at a depth of 75 to 125 cm.
**Alfic Arenic Alaquods**

BABE. Other Alaquods that have *both*:

1. An argillic or a kandic horizon within 200 cm of the mineral soil surface; *and*

2. A sandy particle size throughout a layer extending from the mineral soil surface to the top of the spodic horizon at a depth of 75 to 125 cm.
**Arenic Ultic Alaquods**

BABF. Other Alaquods that have a sandy particle size throughout a layer extending from the mineral soil surface to the top of the spodic horizon at a depth of 75 to 125 cm.
**Arenic Alaquods**

BABG. Other Alaquods that have a sandy particle size throughout a layer extending from the mineral soil surface to the top of the spodic horizon at a depth of 125 cm or more.
**Grossarenic Alaquods**

BABH. Other Alaquods which have, within 200 cm of the mineral soil surface, an argillic or a kandic horizon that has a base saturation of 35 percent or more (by sum of cations) in some part.
**Alfic Alaquods**

BABI. Other Alaquods that have an argillic or a kandic horizon within 200 cm of the mineral soil surface.
**Ultic Alaquods**

BABJ. Other Alaquods that have an ochric epipedon.
**Aeric Alaquods**

BABK. Other Alaquods.
**Typic Alaquods**

Definition of Typic Alaquods

Typic Alaquods are the Alaquods which:

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

2. Do not, in 90 percent or more of each pedon, have any cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface;

3. Do not have a histic or an ochric epipedon;

4. Do not have an argillic or a kandic horizon; and

5. Do not have a sandy particle size throughout a layer extending from the mineral soil surface to the top of the spodic horizon at a depth of 75 cm or more.

**Cryaquods**

These Aquods occur in cold climates, mainly of high latitudes. Because they are both cold and wet, they have been given low priority for study. Most are covered with coniferous forest or a tundra vegetation. Aquic conditions persist during much of the growing season.

Definition

Cryaquods are the Aquods that have a cryic or pergelic soil temperature regime.

Description of a Typic Cryaquod

The following is a description of a soil that represents the central concept, or typic subgroup, of Cryaquods. This soil, in the Susitna Valley of Alaska, is at the edge of a large bog. The vegetation is principally moss, with scattered sedges, dwarf willows, and other low shrubs. The site has a mean annual air temperature of about 2°C, a mean summer air temperature of about 13°C, and a mean annual precipitation of about 550 mm. The colors described below are those of the moist soil.

Oi 0-15 cm. Black (10YR 2/1) mat of partly decomposed moss, leaves, twigs, and other plant parts; many roots; very strongly acid; abrupt wavy boundary.

E 15-30 cm. Gray (10YR 5/1) sandy loam; massive; nonsticky, nonplastic; few roots; few pockets of silt loam; very strongly acid; abrupt wavy boundary.

Bsc 30-51 cm. Very dusky red (2.5YR 2/2) loamy sand; massive; loose; many fine and medium hard concretions; very strongly acid; abrupt wavy boundary. The material is nearly white after ignition.

Bsm 51-65 cm. Very dusky red (2.5YR 2/2) sand; a few thin black bands and streaks; strongly cemented; very strongly acid.

Key to subgroups

BAAA. Cryaquods that have a lithic contact within 50 cm of the mineral soil surface.
**Lithic Cryaquods**

BAAB. Other Cryaquods that have a mean annual soil temperature of 0°C or less.
**Pergelic Cryaquods**

BAAC. Other Cryaquods that have a placic horizon within 100 cm of the mineral soil surface in 50 percent or more of each pedon.
**Placic Cryaquods**

BAAD. Other Cryaquods which have, in 90 percent or more of each pedon, a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.
**Duric Cryaquods**

BAAE. Other Cryaquods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.
**Andic Cryaquods**

BAAF. Other Cryaquods that do not have a spodic horizon 10 cm or more thick in 50 percent or more of each pedon.
**Entic Cryaquods**

BAAG. Other Cryaquods.
**Typic Cryaquods**

Definition of Typic Cryaquods

Typic Cryaquods are the Cryaquods which:

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

2. Do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower;

3. Do not, in 50 percent or more of each pedon, have a placic horizon within 100 cm of the mineral soil surface;

4. Do not, in 90 percent or more of each pedon, have a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface;

5. Have a mean annual soil temperature of more than 0°C; and

6. Have a spodic horizon 10 cm or more thick in 50 percent or more of each pedon.

**Duraquods**

These Aquods have a cemented soil layer which is frequently a combination of iron and/or aluminum and organic matter; in some of these soils silica is also a cementing agent. Duraquods are seasonally saturated above the cemented soil layer but not necessarily below it. In the United States, these soils occur mostly in the Northwest and in Michigan; they are also known to occur in New Zealand under the kauri pine. The cemented soil layer in Duraquods severely restricts plant rooting. Currently few of these soils are recognized. They had no clear equivalent in the 1938 classification.

Definition

Duraquods are the Aquods which:

1. Have, in 90 percent or more of each pedon, a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface;

2. Have 0.10 percent or more iron (by ammonium oxalate) in 75 percent or more of the spodic horizon;

3. Do not have a cryic or pergelic temperature regime;

4. Do not have a fragipan; and

5. Do not have a placic horizon within 100 cm of the mineral soil surface in 50 percent or more of each pedon.

Key to subgroups

BAEA. Duraquods that have a histic epipedon.
**Histic Duraquods**

BAEB. Other Duraquods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.
**Andic Duraquods**

BAEC. Other Duraquods.
**Typic Duraquods**

Definition of Typic Duraquods

Typic Duraquods are the Duraquods which:

1. Do not have a histic epipedon; and

2. Do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Endoaquods**

These Aquods do not have a perched water table. They have a considerable accumulation of iron in addition to aluminum and organic carbon in the spodic horizon. The spodic horizon shows few to many redoximorphic features and is commonly brown to dark reddish brown. Most Endoaquods have an albic horizon; some of the wettest do not, but normally have uncoated sand grains above the spodic horizon. Endoaquods were considered Ground-Water Podzol soils in the 1938 classification.

Definition

Endoaquods are the Aquods which:

1. Have endosaturation;

2. Have 0.10 percent or more iron (by ammonium oxalate) in 75 percent or more of the spodic horizon;

3. Do not have a cryic or pergelic temperature regime;

4. Do not have a fragipan;

5. Do not have a placic horizon within 100 cm of the mineral soil surface in 50 percent or more of each pedon; and

6. Do not, in 90 percent or more of each pedon, have a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

BAGA. Endoaquods that have a histic epipedon.
**Histic Endoaquods**

BAGB. Other Endoaquods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.
**Andic Endoaquods**

BAGC. Other Endoaquods that have an argillic or a kandic horizon within 200 cm of the mineral soil surface.
**Argic Endoaquods**

BAGD. Other Endoaquods that have an umbric epipedon.
**Umbric Endoaquods**

BAGE. Other Endoaquods.
**Typic Endoaquods**

Definition of Typic Endoaquods

Typic Endoaquods are the Endoaquods which:

1. Do not have a histic or umbric epipedon;

2. Do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; and

3. Do not have an argillic or a kandic horizon underlying the spodic horizon.

**Epiaquods**

These Aquods have a perched water table above one or more relatively impermeable layers. Epiaquods normally contain a considerable accumulation of iron in addition to aluminum and organic matter. The relatively impermeable layers normally have little pedogenic alteration.

Definition

Epiaquods are the Aquods which:

1. Have episaturation;

2. Have 0.10 percent or more iron (by ammonium oxalate) in 75 percent or more of the spodic horizon;

3. Do not have a cryic or pergelic temperature regime;

4. Do not have a fragipan;

5. Do not have a placic horizon within 100 cm of the mineral soil surface in 50 percent or more of each pedon; and

6. Do not, in 90 percent or more of each pedon, have a cemented soil layer that does not slake in water after drying and has its upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

BAFA. Epiaquods that have a lithic contact within 50 cm of the mineral soil surface.
**Lithic Epiaquods**

BAFB. Epiaquods that have a histic epipedon.
**Histic Epiaquods**

BAFC. Other Epiaquods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.
**Andic Epiaquods**

BAFD. Other Epiaquods which have, within 200 cm of the mineral soil surface, an argillic or a kandic horizon that has a base saturation of 35 percent or more (by sum of cations) in some part.
**Alfic Epiaquods**

BAFE. Other Epiaquods that have an argillic or a kandic horizon within 200 cm of the mineral soil surface.
**Ultic Epiaquods**

BAFF. Other Epiaquods that have an umbric epipedon.
**Umbric Epiaquods**

BAFG. Other Epiaquods.
**Typic Epiaquods**

Definition of Typic Epiaquods

Typic Epiaquods are the Epiaquods which:

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

2. Do not have a histic or an umbric epipedon;

3. Do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; and

4. Do not have an argillic or a kandic horizon underlying the spodic horizon.

**Fragiaquods**

These are the Aquods that have a fragipan below the spodic horizon, normally at a depth of 40 to 75 cm below the mineral soil surface. Plant roots are shallow, and the soil clinging to the roots of falling trees has in many areas developed a microrelief of 20 to 50 cm. The soil temperature regime is normally frigid. These soils are nearly level, but few of them are cultivated except for production of hay; most are forested. Fragiaquods are not extensive in the United States. They were considered to be Podzol soils in the 1938 classification.

Definition

Fragiaquods are the Aquods which:

1. Have a fragipan;

2. Have 0.10 percent or more iron (by ammonium oxalate) in 75 percent or more of the spodic horizon; and

3. Do not have a cryic or pergelic temperature regime.

Key to subgroups

BACA. Fragiaquods that have a histic epipedon.
**Histic Fragiaquods**

BACB. Other Fragiaquods which have a surface horizon more than 30 cm thick that meets all the requirements for a plaggen epipedon except thickness.
**Plaggeptic Fragiaquods**

BACC. Other Fragiaquods which have, within 200 cm of the mineral soil surface, an argillic or a kandic horizon.
**Argic Fragiaquods**

BACD. Other Fragiaquods.
**Typic Fragiaquods**

Definition of Typic Fragiaquods

Typic Fragiaquods are the Endoaquods which:

1. Do not have a histic epipedon;

2. Do not have a surface horizon more than 30 cm thick that meets all the requirements for a plaggen epipedon except thickness; and

3. Do not, within 200 cm of the mineral soil surface, have an argillic or a kandic horizon that has a base saturation of 35 percent or more (by sum of cations) in any part.

**Placaquods**

These are the Aquods which have an involute placic horizon. The horizons above the placic horizon have low-contrast mottles that are probably caused by organic matter. Placaquods are known to occur only in perhumid oceanic climates. Many have, or used to have, sphagnum and heath vegetation.

Definition

Placaquods are the Aquods which:

1. Have a placic horizon within 100 cm of the mineral soil surface in 50 percent or more of each pedon;

2. Have 0.10 percent or more iron (by ammonium oxalate) in 75 percent or more of the spodic horizon;

3. Do not have a cryic or pergelic temperature regime; and

4. Do not have a fragipan.

Key to subgroups

BADA. Placaquods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.
**Andic Placaquods**

BADB. Other Placaquods.
**Typic Placaquods**

Definition of Typic Placaquods

Typic Placaquods are the Endoaquods which do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Cryods**

Cryods are the Spodosols of high latitudes and/or high elevations. In the United States they occur mostly in southeast Alaska and in the mountains of Washington and Oregon; some are found in the mountains of New York and northern New England. Many Cryods have formed in volcanic ash or glacial drift, and some in residuum or colluvium on mountain slopes. They commonly have an O horizon over a very thin or intermittent albic horizon, which overlies a well-developed spodic horizon. Some have a placic horizon, ortstein, or other cemented soil layer within 100 cm of the mineral soil surface. In many Cryods, the organic-carbon content in the upper part of the spodic horizon is relatively high. Vegetation is mostly coniferous forest or alpine tundra.

Definition

Cryods are the Spodosols which:

1. Have a cryic or pergelic temperature regime;

2. Do not have both aquic conditions within 50 cm of the mineral soil surface (or artificial drainage) and either of the following:

a. A histic epipedon; or

b. Within 50 cm of the mineral soil surface, redoximorphic features in an albic or spodic horizon.

Pedon 109 illustrates a Humicryod.

Key to great groups

BBA. Cryods that have a placic horizon within 100 cm of the mineral soil surface in 50 percent or more of each pedon.
**Placocryods**

BBB. Other Cryods which have, in 90 percent or more of each pedon, a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.

**Duricryods**

BBC. Other Cryods that have 6 percent or more organic carbon throughout a layer 10 cm or more thick within the spodic horizon.

**Humicryods**

BBD. Other Cryods.

**Haplocryods**

**Duricryods**

These are the Cryods that have, either within or below the spodic horizon, a cemented horizon which is considered ortstein if it is more than 2.5 cm thick and part of the spodic horizon. In the United States these soils are known to occur in Washington State, and they probably exist in other cold regions of the world.

Definition

Duricryods are the Cryods which:

1. Have, in 90 percent or more of each pedon, a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface; and

2. Do not have a placic horizon within 100 cm of the mineral soil surface in 50 percent or more of each pedon.

Key to subgroups

BBBA. Duricryods which have *both*:

1. 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*

2. Andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Aquandic Duricryods**

BBBB. Other Duricryods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Andic Duricryods**

BBBC. Other Duricryods that 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).

**Aquic Duricryods**

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

**Oxyaquic Duricryods**

BBBE. Other Duricryods that have 6 percent or more organic carbon throughout a layer 10 cm or more thick within the spodic horizon.

**Humic Duricryods**

BBBF. Other Duricryods.

**Typic Duricryods**

Definition of Typic Duricryods

Typic Duricryods are the Duricryods which:

1. Do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower;

2. Do not have 6 percent or more organic carbon throughout a layer 10 cm or more thick within the spodic horizon;

3. Do not, in one or more horizons within 75 cm of the mineral soil surface, have redoximorphic features, and also aquic conditions for some time in most years (or artificial drainage); and

4. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years.

**Haplocryods**

These are the Cryods of high latitudes or high elevations that do not have a fragipan, a placic horizon, or other cemented soil layers, and do not have a very high organic-matter content in the spodic horizon. The horizons are mostly thin but may be strongly contrasting. The base of the spodic horizon is generally less than 50 cm below the mineral soil surface. Some Haplocryods have permafrost at varying depths below the spodic horizon. Others have, below the spodic horizon, another sequum with an argillic or a kandic horizon. In the United States these soils occur mostly in Alaska and in the higher mountains of the West and Northeast.

Definition

Haplocryods are the Cryods which:

1. Do not have 6 percent or more organic carbon throughout a layer 10 cm or more thick within the spodic horizon;

2. Do not, in 50 percent or more of each pedon, have a placic horizon within 100 cm of the mineral soil surface; and

3. Do not, in 90 percent or more of each pedon, have a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.

Pedon 111 is an example of a Haplocryod.

Key to subgroups

BBDA. Haplocryods that have a lithic contact within 50 cm of the mineral soil surface.

**Lithic Haplocryods**

BBDB. Other Haplocryods that have a mean annual soil temperature of 0°C or less.

**Pergelic Haplocryods**

BBDC. Other Haplocryods which have *both*:

1. 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*

2. Andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Aquandic Haplocryods**

BBDD. Other Haplocryods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Andic Haplocryods**

BBDE. Other Haplocryods that 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).

**Aquic Haplocryods**

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

**Oxyaquic Haplocryods**

BBDG. Other Haplocryods that have 1.1 percent or less organic carbon in the upper 10 cm of the spodic horizon.

**Entic Haplocryods**

BBDH. Other Haplocryods.

**Typic Haplocryods**

Definition of Typic Haplocryods

Typic Haplocryods are the Haplocryods which:

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

2. Do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower;

3. Do not, in one or more horizons within 75 cm of the mineral soil surface, have redoximorphic features, and also aquic conditions for some time in most years (or artificial drainage);

4. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;

5. Have a mean annual soil temperature higher than 0°C; and

6. Have 1.2 percent or more organic carbon in the upper 10 cm of the spodic horizon.

**Humicryods**

Humicryods are Cryods of high latitudes or high elevations. In the United States they occur mostly in southeast Alaska and in the mountains of Washington and Oregon; some are found in the higher mountains of the Northeast. They commonly have a thick O horizon over a very thin or intermittent albic horizon, which overlies a dark-colored spodic horizon. Humicryods have a high organic-carbon content in the upper part of the spodic horizon. Vegetation is commonly coniferous forest or alpine tundra.

Definition

Humicryods are the Cryods which:

1. Have 6 percent or more organic carbon throughout a layer 10 cm or more thick within the spodic horizon;

2. Do not, in 50 percent or more of each pedon, have a placic horizon within 100 cm of the mineral soil surface; and

3. Do not, in 90 percent or more of each pedon, have a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

BBCA. Humicryods that have a lithic contact within 50 cm of the mineral soil surface.

**Lithic Humicryods**

BBCB. Other Humicryods that have a mean annual soil temperature of 0°C or less.

**Pergelic Humicryods**

BBCC. Other Humicryods which have *both*:

1. 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*

2. Andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Aquandic Humicryods**

BBBD. Other Humicryods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Andic Humicryods**

BBBE. Other Humicryods that 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).

**Aquic Humicryods**

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

**Oxyaquic Humicryods**

BBCG. Other Humicryods.

**Typic Humicryods**

Definition of Typic Humicryods

Typic Humicryods are the Humicryods which:

1. Have a mean annual soil temperature higher than 0°C;

2. Are not saturated with water in any layer within 100 cm of the mineral soil surface for 1 month or more per year in 6 or more out of 10 years;

3. Do not, in one or more horizons within 75 cm of the mineral soil surface, have redoximorphic features, and also aquic conditions for some time in most years (or artificial drainage);

4. Do not have a lithic contact within 50 cm of the mineral soil surface; and

5. Do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Placocryods**

These Cryods have a placic horizon, normally within the spodic horizon. In the United States they are only known to occur in Alaska, and they are thought to be rare elsewhere in the world.

Definition

Placocryods are the Cryods that have a placic horizon within 100 cm of the mineral soil surface in 50 percent or more of each pedon.

Key to subgroups

BBAA. Placocryods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Andic Placocryods**

BBAB. Other Placocryods that have 6 percent or more organic carbon in a layer 10 cm or more thick within the spodic horizon.

**Humic Placocryods**

BBAC. Other Placocryods.

**Typic Placocryods**

Definition of Typic Placocryods

Typic Placocryods are the Placocryods which:

1. Do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; and

2. Do not have 6 percent or more organic carbon in a layer 10 cm or more thick within the spodic horizon.

**Humods**

Humods (plate 4C) are the relatively freely drained Spodosols that have a large accumulation of organic carbon in the spodic horizon. The undisturbed soil may have either a thin, intermittent or a distinct, continuous albic horizon over a spodic horizon which in its upper part is nearly black and has a reddish hue. The hue normally becomes yellower with depth.

Humods are derived predominantly from Pleistocene or Holocene sediments. In the United States they have developed mainly under coniferous forests. In western Europe they are common in areas of sandy materials where heather (*Calluna vulgaris*) is, or used to be, a dominant plant. In tropical regions most Humods have supported a rain forest.

The soils of this suborder are not extensive in the United States. They are known to occur in the Pacific Northwest, mostly in small areas, and may exist in the Southeast. The Humods were mostly considered Podzol soils in the 1938 classification.

Definition

Humods are the Spodosols which:

1. Have 6 percent or more organic carbon in a layer 10 cm or more thick within the spodic horizon;

2. Do not have a cryic or pergelic temperature regime; and

3. Do not have both aquic conditions within 50 cm of the mineral soil surface (or artificial drainage) and either of the following:

a. A histic epipedon; or

b. Within 50 cm of the mineral soil surface, redoximorphic features in an albic or spodic horizon.

Key to great groups

BCA. Humods that have a placic horizon within 100 cm of the mineral soil surface in 50 percent or more of each pedon.

**Placohumods**

BCB. Other Humods which have, in 90 percent or more of each pedon, a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.

**Durihumods**

BCC. Other Humods that have a fragipan.

**Fragihumods**

BCD. Other Humods.

**Haplohumods**

**Durihumods**

These are the Humods with a layer that is cemented, normally with sesquioxides and organic matter, but in some areas also with silica. These soils are not common in the United States, but occur in some areas in the Pacific Northwest and the Southeast.

Definition

Durihumods are the Humods which:

1. Have, in 90 percent or more of each pedon, a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface; and

2. Do not, in 50 percent or more of each pedon, have a placic horizon within 100 cm of the mineral soil surface.

Key to subgroups

BCBA. Durihumods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.
**Andic Durihumods**

BCBB. Other Durihumods.
**Typic Durihumods**

Definition of Typic Durihumods

Typic Durihumods are the Durihumods which do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Fragihumods**

These Humods have a fragipan below the spodic horizon, and do not have a placic horizon. They are not known to occur in the United States, and the classification of subgroups has not been developed.

Definition

Fragihumods are the Humods which:

1. Have a fragipan;

2. Do not, in 50 percent or more of each pedon, have a placic horizon within 100 cm of the mineral soil surface; and

3. Do not, in 90 percent or more of each pedon, have a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

BCCA. All Fragihumods (provisional).
**Typic Fragihumods**

**Haplohumods**

Haplohumods are the Humods of cool, moist coastal regions (plate 4C). They occur in the Pacific Northwest of the United States, particularly in sandy sediments, and in western Europe where most of them at some time had a heather *(Calluna vulgaris)* vegetation. Generally, if undisturbed, they have an umbric epipedon and an albic horizon overlying a spodic horizon with a reddish hue and a black upper subhorizon rich in organic carbon. They were considered Podzol soils in the 1938 classification.

Definition

Haplohumods are the Humods which:

1. Do not have a fragipan;

2. Do not, in 50 percent or more of each pedon, have a placic horizon within 100 cm of the mineral soil surface; and

3. Do not, in 90 percent or more of each pedon, have a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

BCDA. Haplohumods that have a lithic contact within 50 cm of the mineral soil surface.
**Lithic Haplohumods**

BCDB. Other Haplohumods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.
**Andic Haplohumods**

BCDC. Other Haplohumods which have a surface horizon more than 30 cm thick that meets all the requirements for a plaggen epipedon except thickness.
**Plaggeptic Haplohumods**

BCDD. Other Haplohumods.
**Typic Haplohumods**

Definition of Typic Haplohumods

Typic Haplohumods are the Haplohumods which:

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

2. Do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; and

3. Do not have a surface horizon more than 30 cm thick that meets all the requirements for a plaggen epipedon except thickness.

**Placohumods**

These are the Humods that have a placic horizon within the spodic horizon. They are probably rare in the world but are known to occur in eastern Canada and are also found in parts of western Europe, where their vegetation is, or used to be, heather. They were considered to be Podzol soils in the 1938 classification.

Definition

Placohumods are the Humods that have a placic horizon within 100 cm of the mineral soil surface in 50 percent or more of each pedon.

Key to subgroups

BCAA. Placohumods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Andic Placohumods**

BCAB. Other Placohumods.

**Typic Placohumods**

Definition of Typic Placohumods

Typic Placohumods are the Placohumods which do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Orthods**

Orthods (plate 7B) are the relatively freely drained Spodosols that have a horizon of accumulation containing aluminum, or aluminum and iron, and organic carbon. They are the most common Spodosols in the northern parts of Europe and the United States. They have formed predominantly in coarse, acid Pleistocene or Holocene deposits under a mostly coniferous forest vegetation. If undisturbed, Orthods normally have an *O*, an albic, and a spodic horizon, and they may have a fragipan. Some of these soils, however, have been mixed by roots of falling trees or by animals and have a very thin albic horizon or none. Under cultivation the albic horizon is very commonly mixed with part of the spodic horizon. In the United States, the moisture regime of Orthods is predominantly udic, but a few have a xeric regime. Their soil temperature regimes range from frigid to hyperthermic. The Orthods are extensive in the southeastern United States, the Northeast, the Great Lakes states, and the mountains of the West.

Definition

Orthods are the Spodosols which:

1. Do not have 6 percent or more organic carbon in a layer 10 cm or more thick within the spodic horizon;

2. Do not have a cryic or pergelic temperature regime; and

3. Do not have both aquic conditions within 50 cm of the mineral soil surface (or artificial drainage) and either of the following:

   a. A histic epipedon; or

   b. Within 50 cm of the mineral soil surface, redoximorphic features in an albic or spodic horizon.

Key to great groups

BDA. Orthods that have, in 50 percent or more of each pedon, a placic horizon within 100 cm of the mineral soil surface.

**Placorthods**

BDB. Other Orthods which have, in 90 percent or more of each pedon, a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.

**Durorthods**

BDC. Other Orthods that have a fragipan.

**Fragiorthods**

BDD. Other Orthods that have less than 0.10 percent iron (by ammonium oxalate) in 75 percent or more of the spodic horizon.

**Alorthods**

BDE. Other Orthods.

**Haplorthods**

**Alorthods**

These are the Orthods that have a relatively high accumulation of aluminum compared to iron. They have formed predominantly in sandy sediments. The low accumulations of iron are due either to intense leaching or to parent materials low in iron. Alorthods normally have a thick albic horizon and an ochric epipedon. They are more common in warm climates than in cool environments. In the United States they occur mainly in the Southeast.

Definition

Alorthods are the Orthods which:

1. Have less than 0.10 percent iron (by ammonium oxalate) in 75 percent or more of the spodic horizon;

2. Do not, in 50 percent or more of each pedon, have a placic horizon within 100 cm of the mineral soil surface;

3. Do not have a fragipan; and

4. Do not, in 90 percent or more of each pedon, have a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

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

**Oxyaquic Alorthods**

BDDB. Other Alorthods that have *both*:

   1. A sandy particle size throughout a layer extending from the mineral soil surface to the top of the spodic horizon at a depth of 75 to 125 cm; *and*

   2. An argillic or a kandic horizon below the spodic horizon.

**Arenic Ultic Alorthods**

BDDC. Other Alorthods that have a sandy particle size throughout a layer extending from the mineral soil surface to the top of the spodic horizon at a depth of 75 to 125 cm.

**Arenic Alorthods**

BDDD. Other Alorthods that have *both*:

1. A sandy particle size throughout a layer extending from the mineral soil surface to the top of the spodic horizon at a depth of 125 cm or more; *and*

2. In 10 percent or more of each pedon, less than 3 percent organic carbon in the upper 2 cm of the spodic horizon.

**Grossarenic Entic Alorthods**

BDDE. Other Alorthods that have, in 10 percent or more of each pedon, less than 3 percent organic carbon in the upper 2 cm of the spodic horizon.

**Entic Alorthods**

BDDF. Other Alorthods that have a sandy particle size throughout a layer extending from the mineral soil surface to the top of the spodic horizon at a depth of 125 cm or more.

**Grossarenic Alorthods**

BDDG. Other Alorthods which have a surface horizon 30 cm or more thick that meets all the requirements for a plaggen epipedon except thickness.

**Plaggeptic Alorthods**

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

**Alfic Alorthods**

BDDI. Other Alorthods that have an argillic or a kandic horizon within 200 cm of the mineral soil surface.

**Ultic Alorthods**

BDDJ. Other Alorthods.

**Typic Alorthods**

Definition of Typic Alorthods

Typic Alorthods are the Alorthods which:

1. Are not saturated with water, in any layer within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years;

2. Do not have a sandy particle size throughout a layer extending from the mineral soil surface to the top of the spodic horizon at a depth of 75 cm;

3. Do not have an argillic or a kandic horizon;

4. Do not have a surface horizon 30 cm or more thick that meets all the requirements for a plaggen epipedon except thickness;

5. Do not have an argillic or a kandic horizon within 200 cm of the mineral soil surface; and

6. Have, in 10 percent or more of each pedon, 3 percent or more organic carbon in the upper 2 cm of the spodic horizon.

**Durorthods**

These are the Orthods that have a cemented soil layer. They have formed in sandy and loamy sediments. The cemented soil layers are often composed of spodic materials, and many of them occur within 50 cm of the mineral soil surface. The cementing agents are often combinations of iron, aluminum, and organic matter, but silica may be an important cementing agent in some of these soils.

Definition

Durorthods are the Orthods which:

1. Have, in 90 percent or more of each pedon, a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface; and

2. Do not, in 50 percent or more of each pedon, have a placic horizon within 100 cm of the mineral soil surface.

Key to subgroups

BDBA. Durorthods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Andic Durorthods**

BDBB. Other Durorthods.

**Typic Durorthods**

Definition of Typic Durorthods

Typic Durorthods are the Durorthods which do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Fragiorthods**

Fragiorthods are the Orthods that have a fragipan below the spodic horizon. They have formed mainly in loamy sediments, but some occur in sandy sediments containing a considerable amount of fine and very fine sand. The fragipan may be thick, or it may have formed in the eluvial (E') horizon of a lower sequum which overlies an argillic horizon. Generally a lighter-colored eluvial horizon has developed above the fragipan, presumably because of the lateral movement of ground water. Trees growing in Fragiorthods are normally shallow-rooted and are sometimes blown down, which causes a mixing of soil horizons above the fragipan. As a consequence, many of these soils have a weakly expressed albic horizon or none, or a thin, intermittent albic horizon below a part of the spodic horizon. A distinct microrelief is a normal feature of these soils, unless they have been smoothed by cultivation. In the United States, soil temperature regimes of Fragiorthods are mostly frigid, but some are mesic bordering on frigid. These soils were included with Podzol soils and Brown Podzolic soils in the 1938 classification.

Definition

Fragiorthods are the Orthods which:

1. Have a fragipan;

2. Do not, in 50 percent or more of each pedon, have a placic horizon within 100 cm of the mineral soil surface; and

3. Do not, in 90 percent or more of each pedon, have a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

BDCA. Fragiorthods that 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).
**Aquic Fragiorthods**

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

BDCC. Other Fragiorthods which have a surface horizon 30 cm or more thick that meets all the requirements for a plaggen epipedon except thickness.
**Plaggeptic Fragiorthods**

BDCD. Other Fragiorthods which have, within 200 cm of the mineral soil surface, an argillic or a kandic horizon that has a base saturation of 35 percent or more (by sum of cations) in some part.
**Alfic Fragiorthods**

BDCE. Other Fragiorthods that have an argillic or a kandic horizon within 200 cm of the mineral soil surface.
**Ultic Fragiorthods**

BDCF. Other Fragiorthods which have a spodic horizon that does not have *any* of the following:

1. A texture of very fine sand or finer, a thickness of more than 10 cm, and a weighted average of 1.2 percent or more organic carbon in the upper 10 cm; *nor*

2. A coarse-loamy or loamy-skeletal particle size, and a color value, moist, and chroma of 3 or less (crushed and smoothed sample) in the upper 7.5 cm; *nor*

3. A sandy-skeletal or sandy particle size, and a color value, moist, and chroma of 3 or less (crushed and smoothed sample) in the upper 2.5 cm.

**Entic Fragiorthods**

BDCG. Other Fragiorthods.
**Typic Fragiorthods**

Definition of Typic Fragiorthods

Typic Fragiorthods are the Fragiorthods which:

1. Do not, in any horizon within 75 cm of the mineral soil surface, have redoximorphic features and also aquic conditions (or artificial drainage);

2. Are not saturated with water, in any layer within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years;

3. Do not have a surface horizon 30 cm or more thick that meets all the requirements for a plaggen epipedon except thickness;

4. Do not have an argillic or a kandic horizon within 200 cm of the mineral soil surface; and

5. Have a spodic horizon with one or more of the following:

a. A texture of very fine sand or finer, a thickness of more than 10 cm, and a weighted average of 1.2 percent or more organic carbon in the upper 10 cm; or

b. A coarse-loamy or loamy-skeletal particle size, and a color value, moist, and chroma of 3 or less (crushed and smoothed sample) in the upper 7.5 cm; or

c. A sandy-skeletal or sandy particle size, and a color value, moist, and chroma of 3 or less (crushed and smoothed sample) in the upper 2.5 cm.

**Haplorthods**

These are the relatively freely drained Orthods that have either an albic and a spodic horizon or, under cultivation, commonly only a spodic horizon below an Ap horizon. The spodic horizon may rest on a lower sequum with an argillic or a kandic horizon (plate 7B), or on relatively unaltered unconsolidated materials, or on rock. Their soil temperature regime is frigid or warmer, and their moisture regime is predominantly udic. Most Haplorthods have, or used to have, a forest vegetation mainly of conifers but also hardwood trees in some areas. A majority of these soils have formed in sandy sediments or in materials weathered from sandstone or quartzite. Haplorthods were considered Podzol soils or Brown Podzolic soils in the 1938 classification.

Definition

Haplorthods are the Orthods which:

1. Do not have less than 0.10 percent iron (by ammonium oxalate) in 75 percent or more of the spodic horizon;

2. Do not, in 50 percent or more of each pedon, have a placic horizon within 100 cm of the mineral soil surface;

3. Do not have a fragipan; and

4. Do not, in 90 percent or more of each pedon, have a cemented soil layer that does not slake in water after air-drying and has its upper boundary within 100 cm of the mineral soil surface.

Key to subgroups

BDEA. Haplorthods which have *both*:

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

2. A spodic horizon that does not have *any* of the following:

a. A texture of very fine sand or finer, a thickness of more than 10 cm, and a weighted average of 1.2 percent or more organic carbon in the upper 10 cm; *nor*

b. A coarse-loamy or loamy-skeletal particle size, and a color value, moist, and chroma of 3 or less (crushed and smoothed sample) in the upper 7.5 cm; *nor*

c. A sandy-skeletal or sandy particle size, and a color value, moist, and chroma of 3 or less (crushed and smoothed sample) in the upper 2.5 cm.

**Entic Lithic Haplorthods**

BDEB. Other Haplorthods that have a lithic contact within 50 cm of the mineral soil surface.

**Lithic Haplorthods**

BDEC. Other Haplorthods which have *both*:

1. 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*

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

**Aqualfic Haplorthods**

BDED. Other Haplorthods which have *both*:

1. 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*

2. A spodic horizon that does not have *any* of the following:

a. A texture of very fine sand or finer, a thickness of more than 10 cm, and a weighted average of 1.2 percent or more organic carbon in the upper 10 cm; *nor*

b. A coarse-loamy or loamy-skeletal particle size, and a color value, moist, and chroma of 3 or less (crushed and smoothed sample) in the upper 7.5 cm; *nor*

c. A sandy-skeletal or sandy particle size, and a color value, moist, and chroma of 3 or less (crushed and smoothed sample) in the upper 2.5 cm.

**Aquentic Haplorthods**

BDEE. Other Haplorthods that 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).

**Aquic Haplorthods**

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

**Oxyaquic Haplorthods**

BDEG. Other Haplorthods which have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower.

**Andic Haplorthods**

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

**Alfic Haplorthods**

BDEI. Other Haplorthods that have an argillic or a kandic horizon within 200 cm of the mineral soil surface.

**Ultic Haplorthods**

BDEJ. Other Haplorthods which have a spodic horizon that does not have *any* of the following:

1. A texture of very fine sand or finer, a thickness of more than 10 cm, and a weighted average of 1.2 percent or more organic carbon in the upper 10 cm; *nor*

2. A coarse-loamy or loamy-skeletal particle size, and a color value, moist, and chroma of 3 or less (crushed and smoothed sample) in the upper 7.5 cm; *nor*

3. A sandy-skeletal or sandy particle size, and a color value, moist, and chroma of 3 or less (crushed and smoothed sample) in the upper 2.5 cm.

**Entic Haplorthods**

BDEK. Other Haplorthods.

**Typic Haplorthods**

Definition of Typic Haplorthods

Typic Haplorthods are the Haplorthods which:

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

2. Do not, in any horizon within 75 cm of the mineral soil surface, have redoximorphic features and also aquic conditions (or artificial drainage);

3. Are not saturated with water, in any layer within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years;

4. Do not have an argillic or a kandic horizon within 200 cm of the mineral soil surface;

5. Do not have andic soil properties throughout horizons that have a total thickness of 25 cm or more within 75 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; and

6. Have a spodic horizon with one or more of the following:

a. A texture of very fine sand or finer, a thickness of more than 10 cm, and a weighted average of 1.2 percent or more organic carbon in the upper 10 cm; or

b. A coarse-loamy or loamy-skeletal particle size, and a color value, moist, and chroma of 3 or less (crushed and smoothed sample) in the upper 7.5 cm; or

c. A sandy-skeletal or sandy particle size, and a color value, moist, and chroma of 3 or less (crushed and smoothed sample) in the upper 2.5 cm.

**Placorthods**

These are the Orthods that have a placic horizon within 100 cm of the mineral soil surface. They are not known to occur in the continental United States and are thought to be rare elsewhere in the world.

Definition

Placorthods are the Orthods that have a placic horizon within 100 cm of the mineral soil surface in 50 percent or more of each pedon.

Key to subgroups

BDAA. All Placorthods (provisional).
**Typic Placorthods"**

Page 349, Definition, item 2 (refer to NSTH p. 615-389). After "Do not have", insert "an Ap horizon consisting of spodic materials, or".

Page 349, Definition (refer to NSTH pp. 615-205/389). Change item 3 to read as follows:

"3. 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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact, duripan, or petrocalcic horizon if shallower than 60 cm."

Page 349, Limits between Ultisols and soils of other orders (refer to NSTH p. 615-205). Change items 2 and 8 to read as follows:

"2. To distinguish Ultisols from Andisols, Ultisols must 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 either a depth of 60 cm from the shallower of the above, or a lithic or paralithic contact, duripan, or petrocalcic horizon if shallower than 60 cm.

8. To distinguish Ultisols from Spodosols, Ultisols must not have an Ap horizon consisting of spodic materials, nor a spodic horizon that has its upper boundary within 200 cm of the mineral soil surface."

NSTH 615.62, p. 376, Paleudults (*Soil Taxonomy* p. 364). Change item GCEB to read as follows:

"GCEB. Other Paleudults which have a horizon 5 cm or more thick, either below an Ap horizon or at a depth of 18 cm or more from the mineral soil surface, whichever is deeper, that has *one or more* of the following:

1. In 25 percent or more of each pedon, cementation by organic matter and aluminum, with or without iron; *or*

2. Aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.25 or more, and half that amount or less in an overlying horizon; *or*

3. An ODOE value of 0.12 or more, and a value half as high or lower in an overlying horizon.

**Spodic Paleudults**

NSTH 615.62, p. 376, Definition of Typic Paleudults (*Soil Taxonomy* p. 364). Change item 7 to read as follows:

"7. Do not have a horizon 5 cm or more thick, either below an Ap horizon or at a depth of 18 cm or more from the mineral soil surface, whichever is deeper, that has *one or more* of the following:

a. In 25 percent or more of each pedon, cementation by organic matter and aluminum, with or without iron; *or*

b. Aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling 0.25 or more, and half that amount or less in an overlying horizon; *or*

c. An ODOE value of 0.12 or more, and a value half as high or lower in an overlying horizon;"

Page 366, Description of subgroups, Spodic Paleudults. Change the description to read as follows:

"**Spodic Paleudults**.--Soils in this subgroup are bisequal. They have an upper horizon that has weak accumulation of amorphous materials and also a lower argillic horizon. In these soils, the horizons above the argillic horizon are sand or loamy sand and are generally thick, approaching or exceeding a total thickness of 50 cm."

Page 384, Modifiers that replace the names of particle-size classes. Replace the 4 descriptive paragraphs with the following 3 paragraphs:

"There are two situations in which particle-size class names are not used. In one, the name is redundant. Psamments and Psammaquents are sandy by definition, so no particle-size modifier is used in the family names of those soils.

In the second situation particle-size analysis is difficult to apply, which is the case with soil materials that are derived from volcanic ejecta and/or have a high content of sequioxides and organic matter. Normal particle-size classes do not characterize these components adequately, especially as they often cannot be readily dispersed and the results of dispersion are variable. Consequently, normal particle-size class names are not used for those parts of soils that have andic soil properties or a high amount of volcanic glass, as is the case with Andisols

and many andic and vitrandic subgroups of other soil orders. In addition, most Cryods and Cryaquods and a few other Spodosols that are not identified in andic subgroups have andic soil properties in some horizons within the particle-size control section, and particle-size class names are not used for these horizons.[16]

The following is a list of modifiers used as substitutes for particle-size class names, together with the criteria for each. These criteria combine particle-size and mineralogical properties and take the place of both."

**615.92 Diagnostic horizons**

Some soils have both a melanic and an umbric epipedon, and the following change is made to allow for more than one kind of mineral epipedon in the same soil:

NSTH 615.08, p. 615-15. Delete paragraph added under item (a).

**615.93 Definition of the mollic epipedon**

The epipedons of some soils that have been classified as Calciaquolls actually have color values, dry, of more than 5. Their color value, moist, is 3 or less, and their organic-carbon content is higher than 0.6 percent. These soils are commonly associated with Mollisols in the Great Plains of the United States. The following change is made in the dry-color-value criterion for soils with 15 to 40 percent calcium carbonate equivalent in the fine-earth fraction to retain their classification as Calciaquolls.

Page 15, Mollic epipedon, column 1, Properties, item 2. Change "Unless there is more than 40 percent finely divided lime" to "Unless the fine-earth fraction has 15 percent or more calcium carbonate equivalent".

Page 15, Mollic epipedon, Properties, column 2, lines 35-39. Delete paragraph and replace with the following:

"If the fine-earth fraction has 15 to 40 percent calcium carbonate equivalent, the limit for the color value, dry, is waived. If it has 40 percent or more calcium carbonate equivalent, the limit for the color value, dry, is waived and the color value, moist, is 5 or less. These changes are necessary because finely divided lime acts as a white pigment."

Page 15, Properties, column 2, item 4. Change first paragraph to read as follows:

"4. The organic-carbon content is either 0.6 percent or more throughout the thickness of the mollic epipedon, or 2.5 percent or more in layers that have a color value, moist, of 4 or 5 and a fine earth-fraction with a calcium carbonate equivalent of 40 percent or more."

**615.94 Definition of the histic epipedon**

There have been problems in applying some of the criteria of the histic epipedon. Specifically, criterion 4, which allows for mixing, is difficult to apply and deviates from the intent of *Soil Taxonomy*.

The intent of *Soil Taxonomy* is to keep cultivated soils in the same taxonomic class as their uncultivated equivalents. However, when two unlike materials such as an organic layer and a mineral layer are mixed by plowing, the mixed horizon exhibits properties that cannot be predicted by combining and averaging out laboratory data for the different layers. In an artificial "mixing" of a mineral and an organic layer based on laboratory data, compaction or oxidation are not taken into consideration.

Pages 17/18, Histic epipedon. Delete text and replace with new text to read as follows:

"The histic epipedon is normally at the soil surface, although it may be buried. It consists of organic soil material (peat or muck) if the soil has not been plowed. If the soil has been plowed, the epipedon normally has a high content of organic matter that results from mixing organic soil material with some mineral material. The histic epipedon either has aquic conditions for some time in most years or has been artificially drained.

The histic epipedon, therefore, can be defined as a layer (one or more horizons) that has aquic conditions for some time in most years (or is artificially drained), and either:

1. Consists of organic soil material which:

a. Is 20 to 60 cm thick and either contains 75 percent or more (by volume) sphagnum fibers or has a bulk density, moist, of less than 0.1; or

b. Is 20 to 40 cm thick and has an organic-carbon content (by weight) of:

(1) 18 percent or more if the mineral fraction contains 60 percent or more clay; or

(2) 12 percent or more if the mineral fraction contains no clay; or

(3) 12 + (clay percentage multiplied by 0.1) percent or more if the mineral fraction contains less than 60 percent clay; or

2. Is an Ap horizon which, when mixed to a depth of 25 cm, has an organic-carbon content (by weight) of:

[16] Particle-size class names are applied, although with reservations, to spodic horizons that do not have andic soil properties but contain significant amounts of organic matter. Somewhat different classes probably should be used for most families of Spodosols, because some series that otherwise seem reasonably homogeneous are split at the family level by the particle-size classes. But alternatives have not yet been sufficiently tested.

a. 16 percent or more if the mineral fraction contains 60 percent or more clay; or

b. 8 percent or more if the mineral fraction contains no clay; or

c. 8 + (clay percentage divided by 7.5) percent or more if the mineral fraction contains less than 60 percent clay.

Most histic epipedons consist of organic soil material as defined in chapter 4. Item 2 provides for histic epipedons that are Ap horizons consisting of mineral soil material.

Pedon 8 illustrates a soil that has a histic epipedon. Its surface layer to a depth of 30 cm has 29 percent organic carbon and constitutes the histic epipedon."

**615.95 Table 7, additions and deletions**

The following changes required in Table 7 result from implementing the recommendations from ICOMAQ, ICOMOD, and ICOMERT.

Pages 86/87, Table 7. Delete the suborder, Ferrods, and the following great groups:

"Ochraqualfs, Haplaquands, Haplaquents, Tropaquents, Haplaquepts, Haplaquolls, Haplaquods, Sideraquods, Tropaquods, Cryohumods, Tropohumods, Cryorthods, Ochraquults, Chromuderts, Pelluderts, Chromusterts, Pellusterts, Chromoxererts, Pelloxererts".

Pages 86/87, Table 7. Add the following suborders and great groups in proper sequence:

"Endoaqualfs
Epiaqualfs
Endoaquands
Epiaquands
Endoaquents
Epiaquents
Medifolists
Sulfisaprists
Sulfohemists
Endoaquepts
Epiaquepts
Sulfochrepts
Endoaquolls
Epiaquolls
Alaquods
Endoaquods
Epiaquods
Cryods
    Duricryods
    Haplocryods
    Humicryods
    Placocryods
Durihumods
Alorthods
Durorthods
Endoaquults
Epiaquults
Aquerts
    Calciaquerts
    Duraquerts
    Dystraquerts
    Epiaquerts
    Endoaquerts
    Natraquerts
    Salaquerts
Cryerts
    Haplocryerts
    Humicryerts
Calcitorrerts
Gypsitorrerts
Haplotorrerts
Salitorrerts
Dystruderts
Hapluderts
Calciusterts
Dystrusterts
Gypsiusterts
Haplusterts
Salusterts
Calcixererts
Durixererts
Haploxererts".

**615.96 Key to Ultisols**

The purpose of this amendment is to simplify the key to the soil order of Ultisols. According to the Guy Smith Interviews, the original intent of the "tongues of albic material" statement was to keep in the Alfisol order some Glossudalfs that have a base saturation slightly below the limit between Alfisols and Ultisols. Soils with this combination of characteristics are very rare in the United States. The criterion allowing for their inclusion among Alfisols unnecessarily complicates the keys, and the soils in question probably should be included in the order of Ultisols.

The color criteria also complicate the keys. Originally, it was thought that the redder soils were older and more weathered. However, this is not always true. Their redness is often related to their content of hematite relative to goethite, landscape position, and internal drainage, rather than to any pedogenic age or degree of weathering.

Page 92, Key to soil orders, Ultisols (refer to NSTH p. 615-179). Change item G to read as follows:

"G. Other soils that have *either*:

1. An argillic or a kandic horizon, but no fragipan, and a base saturation (by sum of cations) of less than 35 percent at one of the following depths:

a. If the epipedon has a sandy or sandy-skeletal particle size throughout, *either*:

(1) 125 cm below the upper boundary of the argillic horizon (but no deeper than 200 cm below the mineral soil surface), or 180 cm below the mineral soil surface, whichever is deeper; *or*

(2) At a lithic, paralithic, or petroferric contact if shallower; *or*

b. The shallowest of the following depths:

(1) 125 cm below the upper boundary of the argillic or kandic horizon; *or*

(2) 180 cm below the mineral soil surface; *or*

(3) At a lithic, paralithic, or petroferric contact; *or*

2. A fragipan and *both* of the following:

a. Either an argillic or a kandic horizon above, within, or below it, or clay films more than 1 mm thick in one or more of its subhorizons; *and*

b. A base saturation (by sum of cations) of less than 35 percent at the shallowest of the following depths:

(1) 75 cm below the upper boundary of the fragipan; *or*

(2) 200 cm below the mineral soil surface; *or*

(3) At a lithic, paralithic, or petroferric contact.

**Ultisols**, p.

**615.97 Subgroups of Andisols**

Mollic and umbric subgroups were recognized in the new order of Andisols, using the presence of a mollic or of an umbric epipedon as distinguishing criteria. It has been pointed out, however, that the distinction between mollic and umbric epipedons has little relevance to the classification of Andisols because base saturation measurements in andic materials have little meaning[2]. For that reason, the mollic and umbric subgroups are being combined into a *humic* subgroup.

Most of the Haploxerands in the United States have, undried, 1500 kPa water retention of less than 30 percent. This is considered typical of Haploxerands. Therefore, the *vitric* subgroups are deleted.

Many soil series in the great groups of Udivitrands and Vitricryands have either mollic or umbric epipedons or argillic horizons, but have been included in subgroups that do not have these horizons. Because the presence or absence of these diagnostic horizons is important for the management of these soils, new subgroups are being added. These new subgroups are extensive in the Pacific Northwest of the United States.

The following changes are needed to accommodate these revisions of the Andisol order.

NSTH 615.60, p. 615-188, Vitricryands. Change items CBED-CBEE to CBEE-CBEF and item CBEF to CBEH, and add new items CBED and CBEG to read as follows:

"CBED. Other Vitricryands that have a xeric moisture regime and a mollic or umbric epipedon.

**Humic Xeric Vitricryands**

CBEG. Other Vitricryands that have a mollic or umbric epipedon.

**Humic Vitricryands"**

NSTH 615.60, p. 615-188, Definition of Typic Vitricryands. Add item 6 to read as follows:

"6. Do not have a mollic or umbric epipedon."

NSTH 615.60, p. 615-198, column 2, Durustands. Delete item CFAE and change items CFAC and CFAD to read as follows:

"CFAC. Other Durustands that have a melanic, mollic, or umbric epipedon.

**Humic Durustands**

CFAD. Other Durustands.

**Typic Durustands"**

NSTH 615.60, p. 615-199, Definition of Typic Durustands. Change item 3 to read as follows:

"3. Do not have a melanic, mollic, or umbric epipedon."

NSTH 615.60, p. 615-199, column 2, Haplustands. Delete item CFBM and change items CFBK and CFBL to read as follows:

"CFBK. Other Haplustands that have a melanic, mollic, or umbric epipedon.

**Humic Haplustands**

CFBL. Other Haplustands.

**Typic Haplustands"**

NSTH 615.60, p. 615-200, Definition of Typic Haplustands. Change item 10 to read as follows:

"10. Do not have a melanic, mollic, or umbric epipedon."

NSTH 615.60, p. 615-200, Udivitrands. Change item CEBD to CEBG and add new items CEBD, CEBE, and CEBF to read as follows:

"CEBD. Other Udivitrands which have *both*:

1. An argillic or a kandic horizon that has its upper boundary within 125 cm of the mineral soil surface, or of the upper boundary 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 of the argillic or kandic horizon.

**Ultic Udivitrands**

[2] Parfitt, R. L., and B. Clayden. 1991. ANDISOLS - A View of the New Order in Soil Taxonomy.

CEBE. Other Udivitrands which have an argillic or a kandic horizon that has its upper boundary within 125 cm of the mineral soil surface, or of the upper boundary of an organic layer with andic soil properties, whichever is shallower.
**Alfic Udivitrands**

CEBF. Other Udivitrands that have a melanic, mollic, or umbric epipedon.
**Humic Udivitrands"**

NSTH 615.60, p. 615-200, Definition of Typic Udivitrands. Add items 4 and 5 to read as follows:

"4. Do not have an argillic or a kandic horizon that has its upper boundary within 125 cm of the mineral soil surface, or of the upper boundary of an organic layer with andic soil properties, whichever is shallower; and

5. Do not have a melanic, mollic, or umbric epipedon."

NSTH 615.60, p. 615-201, Ustivitrands. Delete item BEAG and change items BEAE and BEAF to read as follows:

"BEAE. Other Ustivitrands that have a melanic, mollic, or umbric epipedon.
**Humic Ustivitrands**

BEAF. Other Ustivitrands.
**Typic Ustivitrands"**

NSTH 615.60, p. 615-201, Definition of Typic Ustivitrands. Change item 5 to read as follows:

"5. Do not have a melanic, mollic, or umbric epipedon."

NSTH 615.60, p. 615-202, Haploxerands. Delete items CDCC, CDCD, and CDCK, change items CDCE-CDCJ to CDCC-CDCH and CDCL to CDCI, and change new items CDCF and CDCH to read as follows:

"CDCF. Other Haploxerands which have *both*:

1. A mollic or umbric epipedon; *and*

2. An argillic or a kandic horizon that has its upper boundary within 125 cm of the mineral soil surface, or of the upper boundary of an organic layer with andic soil properties, whichever is shallower.
**Alfic Humic Haploxerands**

CDCH. Other Haploxerands that have a mollic or umbric epipedon.
**Humic Haploxerands"**

NSTH 615.60, p. 615-202, Definition of Typic Haploxerands. Delete item 3 and renumber items 4-7 as 3-6.

NSTH 615.60, p. 615-203, Vitrixerands. Delete item CDAG, change item CDAH to CDAG, and change items CDAD and CDAF to read as follows:

"CDAD. Other Vitrixerands which have *both*:

1. A melanic, mollic, or umbric epipedon; and

2. An argillic or a kandic horizon that has its upper boundary within 125 cm of the mineral soil surface, or of the upper boundary of an organic layer with andic soil properties, whichever is shallower.
**Alfic Humic Vitrixerands**

CDAF. Other Vitrixerands that have a melanic, mollic, or umbric epipedon.
**Humic Vitrixerands"**

NSTH 615.60, p. 615-203, Definition of Typic Vitrixerands. Change items 4 and 5 to read as follows:

"4. Do not have an argillic or a kandic horizon that has its upper boundary within 125 cm of the mineral soil surface, or of the upper boundary of an organic layer with andic soil properties, whichever is shallower; and

5. Do not have a melanic, mollic, or umbric epipedon."

## 615.98 Names of subgroups of Aridisols

To correct an error in the naming of subgroups, the following changes are made:

NSTH 615.62, p. 615-242, Durargids, item FABF (*Soil Taxonomy* p. 158). Change subgroup modifier from "Vitrustandic" to "Ustivitrandic".

NSTH 615.62, p. 615-257, Camborthids, item FBFN (*Soil Taxonomy* p. 171). Change subgroup modifier from "Vitrustandic" to "Ustivitrandic".

NSTH 615.62, p. 615-259, Durorthids, item FBCD (*Soil Taxonomy* p. 174). Change subgroup modifier from "Vitrustandic" to "Ustivitrandic".

## 615.99 Subgroups of Ustifluvents and Ustorthents

NSTH 615.62, p. 615-270, Ustifluvents (*Soil Taxonomy* p. 192). Change KDCE-KDCF to KDCG-KDCH, and add new items KDCE and KDCF to read as follows:

"KDCE. Other Ustifluvents 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 Ustifluvents**

KDCF. Other Ustifluvents 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 that is dry, in 6 or more out or 10 years, in some or all parts for less than 105 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 less than four tenths of the cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

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 dry in some or all parts for less than 120 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

**Udic Ustifluvents"**

NSTH 615.62, p. 615-270, Definition of Typic Ustifluvents (*Soil Taxonomy* p. 192). Add new item 6 to read as follows:

"6. If neither irrigated nor fallowed to store moisture, have one of the following:

a. A frigid soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for 105 or more cumulative days per year, but is not dry in all parts for four tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; or

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

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for 120 or more and moist 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."

NSTH 615.62, page 615-276, Ustorthents (*Soil Taxonomy* p. 200). Change KEFG-KEFH to KEFI-KEFJ and add new items KEFG and KEFH to read as follows:

"KEFG. Other Ustorthents 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 Ustorthents**

KEFH. Other Ustorthents 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 some or all parts for less than 105 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 less than four tenths of the cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

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 dry in some or all parts for less than 120 cumulative days per years when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

**Udic Ustorthents"**

NSTH 615.62, p. 615-276, Definition of Typic Ustorthents (*Soil Taxonomy* p. 200). Add new item 8 to read as follows:

"8. If neither irrigated nor fallowed to store moisture, have one of the following:

a. A frigid soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for 105 or more cumulative days per year, but is not dry in all parts for four tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; or

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

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for 120 or more and moist 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."

**615.100 Folists**

Page 218, Folists, Key to great groups. Add new item AAD to read as follows:

"AAD. Other Folists.
**Medifolists"**

Page 219. Preceding Tropofolists, add new section to read as follows:

"**Medifolists**

Definition

Medifolists are the Folists that have a mesic or warmer non-*iso* temperature regime.

Key to subgroups

AADA. Medifolists that have a lithic contact within 100 cm of the soil surface.
**Lithic Medifolists**

AADB. Other Medifolists.
**Typic Medifolists**

Definition of Typic Medifolists

Typic Medifolists are the Medifolists that do not have a lithic contact within 100 cm of the soil surface."

**615.101 Subgroups of Ustochrepts.**

The following additional subgroups of Ustochrepts are intended to make more meaningful separations possible.

NSTH 615.62, p 615-302, Ustochrepts, item JDEB (*Soil Taxonomy* p. 254). Change item 1 to read as follows:

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

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

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

NSTH 615.62, pp. 615-302/303, Ustochrepts (*Soil Taxonomy* p. 254). Change items JDEC-JDEG to JDED-JDEH, JDEH to JDEK, JDEI to JDEO, and JDEJ-JDEK to JDEQ-JDER. Add items JDEC, JDEI, JDEJ, JDEL, JDEM, JDEN, and JDEP; and change items JDEO and JDEQ to read as follows:

"JDEC. Other Ustochrepts which have *both*:

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

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

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

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is moist

in some or all parts for less than 180 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C; *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.

**Torrertic Ustochrepts**

JDEI. Other Ustochrepts which have:

1. *Either* 0.2 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*

2. A slope of less than 25 percent; *and*

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

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

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

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

**Torrifluventic Ustochrepts**

JDEJ. Other Ustochrepts which have:

1. *Either* 0.2 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*

2. A slope of less than 25 percent; *and*

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

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

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

**Udifluventic Ustochrepts**

JDEL. Other Ustochrepts which have *both*:

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

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

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

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

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which,

in 6 or more out of 10 years, is moist in some or all parts for less than 180 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

**Calciorthidic Ustochrepts**

JDEM. Other Ustochrepts which have *both*:

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

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

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

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

**Calcic Udic Ustochrepts**

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

**Calcic Ustochrepts**

JDEO. Other Ustochrepts 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 Ustochrepts**

JDEP. Other Ustochrepts that have a base saturation (by sum of cations) of 60 percent or less in all horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm or a lithic or paralithic contact, whichever is shallower.

**Dystric Ustochrepts**

JDEQ. Other Ustochrepts 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 some or all parts for less than 105 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 less than four tenths of the cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

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 dry in some or all parts for less than 120 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

**Udic Ustochrepts**

NSTH 615.62, p. 615-303, Definition of Typic Ustochrepts (*Soil Taxonomy* p. 254). Change item 6, delete item 8, and add new items 8 and 9 to read as follows:

"5. If neither irrigated nor fallowed to store moisture, have one of the following:

a. A frigid soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for 105 or more cumulative days per year, but is not dry in all parts for four tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; or

b. A mesic or thermic soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some part for four to six tenths of the cumulative days per year when the

temperature at a depth of 50 cm below the soil surface is higher than 5°C; or

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for 120 or more and moist 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;

7. Have a base saturation (by sum of cations) of more than 60 percent in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm or a lithic or paralithic contact, whichever is shallower; and

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

**615.102 Arenic subgroup of Argiborolls**

NSTH 615.62 p. 615-317, Argiborolls (*Soil Taxonomy* p. 282). Change items HEDB-HEDS to HEDC-HEDT and add new item HEDB to read as follows:

"HEDB. Other Argiborolls 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 below the mineral soil surface.

**Arenic Argiborolls**"

NSTH 615.62 p. 615-319, Definition of Typic Argiborolls (*Soil Taxonomy* p. 282). Add item 10 to read as follows:

"10. 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 below the mineral soil surface."

**615.103 Udic subgroup of Calciborolls**

NSTH 615.62 p. 615-320, Calciborolls (*Soil Taxonomy* p. 285). Change HEFF to HEFG, and add new item HEFF to read as follows:

"HEFF. Other Calciborolls that have a udic moisture regime.

**Udic Calciborolls**"

NSTH 615.62 p. 615-320, Definition of Typic Calciborolls (*Soil Taxonomy* p. 285). Add new item 6 to read as follows:

"6. Do not have a udic moisture regime."

**615.104 Pachic subgroup of Argiudolls**

NSTH 615.62 p. 615-328, Argiudolls (refer to NSTH 615.85 & *Soil Taxonomy* p. 296). Change items HGCI-HGCK to HGCJ-HGCL, and add new item HGCI to read as follows:

"HGCI. Other Argiudolls that have a mollic epipedon 50 cm or more thick with a texture finer than loamy fine sand.

**Pachic Argiudolls**"

NSTH 615.62, p. 615-329, Definition of Typic Argiudolls (refer to NSTH 615.85 & *Soil Taxonomy* p. 296). Add new item 9 to read as follows:

"8. Do not have a mollic epipedon 50 cm or more thick with a texture finer than loamy fine sand."

**615.105 Cumulic subgroups of Mollisols**

A number of soils classified as Mollisols on stable landscape positions have organic carbon percentages higher than 0.3 percent at a depth of 125 cm from the mineral soil surface. The following amendment deletes the requirement of more than 0.3 percent organic carbon at 125 cm depth from the keys to cumulic subgroups of most Mollisols. In the field, most of these soils were classified in pachic subgroups. This revision will allow them to remain in pachic subgroups.

NSTH 615.62, p. 615-321, Cryoborolls (*Soil Taxonomy* p. 286). Change item HEBO to read as follows:

"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.

**Cumulic Cryoborolls**"

Page 287, Description of subgroups. Change description of Cumulic Cryoborolls to read as follows:

"**Cumulic Cryoborolls.**--Soils in this subgroup have a thick mollic epipedon, and their content of organic carbon decreases irregularly with increasing depth. They have formed in positions where they receive fresh sediments at a rate slow enough for this material to become incorporated in the mollic epipedon. They are on flood plains or have concave slopes. Some of them have redoximorphic features and seasonal ground water at depth. These soils are rare in the United States. They are used for summer grazing, hay, or short-season crops."

NSTH 615.62, p. 615-323, Haploborolls (*Soil Taxonomy* p. 288). Change items HEGH and HEGI to read as follows:

"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 a concave shape; *and*

4. *Either* a chroma of 1 or less (crushed and smoothed sample) in the upper 18 cm of the mollic epipedon, after mixing, or in an Ap horizon 18 cm or more thick, *or* a moisture control section that is moist in some or all of its parts throughout the year in 6 or more out of 10 years.

**Cumulic Udic Haploborolls**

HEGI. 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 a concave shape.

**Cumulic Haploborolls"**

NSTH 615.62, p. 615-338, Haplustolls (*Soil Taxonomy* p. 303). Change item HFGM to read as follows:

"HFGM. 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.

**Cumulic Haplustolls"**

NSTH 615.62, p. 615-348, Haploxerolls (*Soil Taxonomy* p. 316). Change items HDFG and HDFH to read as follows:

"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. A base saturation (by sum of cations) of 75 percent or less in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm or a lithic or paralithic contact, whichever is shallower.

**Cumulic Ultic Haploxerolls**

HDFH. 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.

**Cumulic Haploxerolls"**

Page 318, Description of subgroups, Cumulic Haploxerolls. In line 6 delete "either", and in lines 7 and 8 delete " or remains relatively high in all layers".

Page 318, Description of subgroups, Cumulic Ultic Haploxerolls. Change section to read as follows:

"**Cumulic Ultic Haploxerolls**.--These soils have a thick mollic epipedon and a base saturation of 75 percent or less in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm. Their organic-carbon content decreases irregularly with increasing depth. They are permitted but not required to have a cambic horizon, accumulations of secondary carbonates at a shallow depth, or shallow ground water and redox depletions of low chroma. Most of them are nearly level soils on flood plains and are used for cultivated crops. They are rare in the United States."

**615.106 Lithic Ruptic-Entic Haplustolls**

This subgroup is being deleted because of the difficulties in applying its criteria and the absence of series.

NSTH 615.62, p. 615-336, Haplustolls (*Soil Taxonomy* p. 304). Delete item HFGB and change items HFGC-HFGZa to HFGB-HFGZ.

Page 305, Description of subgroups. Delete whole section on Lithic Ruptic-Entic Haplustolls.

**615.107 Ultic subgroups of Xerolls**

Many Xerolls are cultivated and treated with acidifying fertilizers. Some of these soils qualify as ultic subgroups where they have been fertilized, but as typic subgroups under natural conditions. The following amendment has the purpose of keeping these soils in the same subgroups. Its net effect is to delete the Ap horizon, or an equivalent thickness, from the part of the soil considered for ultic subgroups.

NSTH 615.62, pp. 615-343/344/345, Argixerolls (*Soil Taxonomy* p. 311). Change items HDEA, HDEJ, HDEL, and HDET to read as follows:

"HDEA. Argixerolls that have *both*:

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

2. A base saturation (by sum of cations) of 75 percent or less in one or more horizons between either the mineral soil surface or an Ap horizon, whichever is deeper, and the lithic contact.

**Lithic Ultic Argixerolls**

HDEJ. Other Argixerolls that have *both*:

1. A mollic epipedon 50 cm or more thick with a texture finer than loamy fine sand; *and*

2. A base saturation (by sum of cations) of 75 percent or less in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm or a lithic or paralithic contact, whichever is shallower.

**Pachic Ultic Argixerolls**

HDEL. (See *Wet soils amendment* above.)

HDET. Other Argixerolls that have a base saturation (by sum of cations) of 75 percent or less in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm or a lithic or paralithic contact, whichever is shallower.

**Ultic Argixerolls**"

NSTH 615.62, page 615-345, Definition of Typic Argixerolls (*Soil Taxonomy* p. 311). Change item 9 to read as follows:

"9. Have a base saturation (by sum of cations) of more than 75 percent in all horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm or a lithic or paralithic contact, whichever is shallower;"

Page 313, Description of subgroups, Pachic Ultic Argixerolls. Change first sentence to read as follows:

"Soils in this subgroup have a thick mollic epipedon that commonly includes part of the argillic horizon, and they have a base saturation of 75 percent or less in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm."

Page 313, Description of subgroups, Ultic Argixerolls. Change first sentence to read as follows:

"These soils have a base saturation of 75 percent or less in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm, but otherwise are like Typic Argixerolls in their defined properties."

NSTH 615.62, pp. 615-348/349/350, Haploxerolls (*Soil Taxonomy* p. 316). Change items HDFA, HDFG, HDFJ, HDFN, HDFZa, and HDFZb to read as follows:

"HDFA. Haploxerolls that have *both*:

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

2. A base saturation (by sum of cations) of 75 percent or less in one or more horizons between either the mineral soil surface or an Ap horizon, whichever is deeper, and the lithic contact.

**Lithic Ultic Haploxerolls**

HDFG. (See *Cumulic subgroups of Mollisols* amendment above.)

HDFJ. Other Haploxerolls that have *both*:

1. A mollic epipedon 50 cm or more thick with a texture finer than loamy fine sand; *and*

2. A base saturation (by sum of cations) of 75 percent or less in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm or a lithic or paralithic contact, whichever is shallower.

**Pachic Ultic Haploxerolls**

HDFN. (See *Wet soils amendment* above.)

HDFZa. Other Haploxerolls which:

1. Do not have a cambic horizon and do not, in the lower part of the mollic epipedon, meet the requirements for a cambic horizon except color; *and*

2. Have a base saturation (by sum of cations) of 75 percent or less in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm or a lithic or paralithic contact, whichever is shallower.

**Entic Ultic Haploxerolls**

HDFZb. Other Haploxerolls that have a base saturation (by sum of cations) of 75 percent or less in one or more horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a

depth of 75 cm or a lithic or paralithic contact, whichever is shallower.

**Ultic Haploxerolls"**

NSTH 615.62, p. 615-350, Definition of Typic Haploxerolls. Change item 9 to read as follows:

"9. Have a base saturation (by sum of cations) of more than 75 percent in all horizons between either an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and either a depth of 75 cm or a lithic or paralithic contact, whichever is shallower;"

Page 317, Description of subgroups, Aquultic Haploxerolls, lines 3-5. Delete "in some part of the upper 75 cm of soil." and replace with "one or more horizons between an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm."

Page 318, Description of subgroups, Entic Ultic Haploxerolls, lines 3-4. Delete "some part of the upper soil to a depth of 75 cm" and replace with "one or more horizons between an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm".

Page 318, Description of subgroups, Pachic Ultic Haploxerolls, lines 4-5. Delete "some part of the soil within 75 cm of the surface" and replace with "one or more horizons between an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm".

## 615.108 Udic subgroups of ustic suborders

The current criteria for udic subgroups of soils with an ustic moisture regime and a hyperthermic, isomesic, or warmer *iso* temperature regime are flawed. Most or all of these soils have a soil temperature at a depth of 50 cm that exceeds 8°C at all times. Since the 90-day moisture criterion is the same as for the udic moisture regime, it is impossible to classify a soil into this subgroup. Nine series in the United States have a hyperthermic, isomesic, or warmer *iso* soil temperature regime and are presently classified in udic subgroups of soils with an ustic moisture regime. All of these soil series would have to be reclassified if the following change in number of days, dry, were not made.

NSTH 615.62, pp. 615-228/383. Change the limit "90 days or less" to "less than 120 cumulative days" in the following subgroup criteria and typic subgroup definitions:

Udertic Haplustalfs
Udic Haplustalfs
Typic Haplustalfs

Udic Kandiustalfs
Typic Kandiustalfs

Udic Kanhaplustalfs
Typic Kanhaplustalfs

Udertic Paleustalfs
Udic Paleustalfs
Typic Paleustalfs

Udic Rhodustalfs
Typic Rhodustalfs

Udertic Argiustolls
Udic Argiustolls
Typic Argiustolls

Udertic Calciustolls
Udic Calciustolls
Typic Calciustolls

Udertic Haplustolls
Udorthentic Haplustolls
Udic Haplustolls
Typic Haplustolls

Udertic Paleustolls
Udic Paleustolls
Typic Paleustolls

Udandic Kandiustults
Udic Kandiustults
Typic Kandiustults

Udandic Kanhaplustults
Udic Kanhaplustults
Typic Kanhaplustults.

## 615.109 Aeric Albaquults

NSTH 615.62, p. 615-365, Albaquults (*Soil Taxonomy* p. 352). Change item GACB to read as follows:

"GACB. Albaquults that have 50 percent or more chroma of 3 or more in one or more horizons between either the A or Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm.

**Aeric Albaquults"**

NSTH 615.62, p. 615-365, Definition of Typic Albaquults (*Soil Taxonomy* p. 352). Change definition to read as follows:

"Typic Albaquults are the Albaquults that:

1. Have more than 50 percent chroma of 2 or less in all horizons between either the A or Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm; and

2. Do not have either:

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."

Page 352, column 1, Description of subgroups (Albaquults). Change descriptions of Typic and Aeric Albaquults subgroups to read as follows:

"**Typic Albaquults**.--These are the Albaquults that have 50 percent or more chroma of 2 or less in all horizons between either the A or Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm. They occur on the coastal plains of the southeastern United States and are of moderate extent.

**Aeric Albaquults**.--These soils are of small extent in the United States. They have the colors on faces of peds that are definitive for the suborder, but they have 50 percent or more chroma of 3 or more in one or more horizons between either the A or Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm."

## 615.110 Key to Palexerults

When the *Pale* great groups of Ultisols were updated in NSTH 615.38(a), the requirement "have an argillic horizon that has less than 10 percent weatherable minerals in the 20 to 200 micron fraction in its upper 50 cm" was deleted from all *Pale* great groups except Palexerults. The following revision makes the criteria for Palexerults consistent with those of the other *Pale* great groups.

Page 372, Key to great groups. Change item GEA to read as follows:

"GEA. Xerults which:

1. Do not have a lithic or paralithic contact within 150 cm of the mineral soil surface; *and*

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

a. Do not have a clay decrease with increasing depth of 20 percent or more (relative) from the maximum clay content; *or*

b. Have 5 percent or more (by volume) skeletans on faces of peds, or 5 percent or more (by volume) plinthite, or both, in the layer that has a 20 percent lower clay content *and*, below that layer, a clay increase of 3 percent or more (absolute).

**Palexerults, page 373**"

Page 373, column 2, Palexerults, line 2. Delete " and few weatherable minerals".

Page 373, Definition of Palexerults. Change definition to read as follows:

"Palexerults are the Xerults that:

1. Do not have a lithic or paralithic contact within 150 cm of the mineral soil surface; and

2. Within 150 cm of the mineral soil surface, either

a. Do not have a clay decrease with increasing depth of 20 percent or more (relative) from the maximum clay content; or

b. Have 5 percent or more (by volume) skeletans on faces of peds in the layer that has a 20 percent lower clay content and, below that layer, a clay increase of 3 percent or more (absolute)."

## 615.111 Definitions of *Fragmental*, *Pumiceous*, and *Cindery*

This amendment makes the definitions of fragmental, pumiceous, and cindery particle-size classes more consistent and easier to apply. The revision removes the volume-of-filled-interstices criterion. Thus, skeletal classes are now defined as having 35 percent or more (by volume) rock fragments; the fine-earth fraction makes up 10 percent or more of the total volume.

Page 50, column 1. Change item "Fragmental" to read as follows:

"Fragmental.--90 percent or more (by volume) rock fragments and voids; less than 10 percent (by volume) particles less than 2.0 mm in diameter."

Page 383, column 2, Definition of classes. Change item "Fragmental" to read as follows:

"Fragmental.--90 percent or more (by volume) rock fragments and voids; less than 10 percent (by volume) particles less than 2.0 mm in diameter."

Page 384, column 1. Delete line 1 and replace with "the fine-earth fraction constitutes 10 percent or more of the total volume;"

Page 384, column 1, Loamy-skeletal. Delete "enough fine earth to fill interstices larger than 1 mm" and replace with "the fine-earth fraction constitutes 10 percent or more of the total volume".

Page 384, column 1, Clayey-skeletal. Delete "enough fine earth to fill interstices larger than 1 mm" and replace with "the fine-earth fraction constitutes 10 percent or more of the total volume".

NSTH 615.60, p. 615-206, column 1. Delete lines 2 and 3 and replace with "These classes have a fine-earth component of less than 10 percent of the total volume."

NSTH 615.60, p. 615-206, column 1. Delete lines 22-24 and replace with "These classes have a fine-earth component of 10 percent or more of the total volume."

## 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.