Summary of Changes to Keys to Soil Taxonomy January 2014

Chapter and page numbers refer to the published and full format version of the Keys to Soil Taxonomy, eleventh edition, 2010.

Foreword

- A sentence was added to reflect publication of the twelfth edition to coincide with the 20th World Congress of Soil Science in Korea.
- The following amendments were highlighted as changes for the twelfth edition: Anhydrite in soils of the UAE, improvement in classification of Mollisols of Argentine Pampas, and ICOMANTH.
- The sentence encouraging use of soil taxonomy internationally was changed to represent the leadership of NRCS Soil Science Division. The name of the Soil Science Division director was updated.

Chapter 1 – The Soils That We Classify

- Definition of Soil, P.1 – Added references to the 1975 and 1999 editions of Soil Taxonomy and a Literature Cited section. Corrected the 200 cm limit for classification as an arbitrary but practical limit for soil survey and not classification per se. Added mention of some densic materials (noncemented bedrocks) to the sentence on series differentiae. Edited several sentences on the distinctions between soil and nonsoil as well as the dynamic nature of some soil properties.
- Buried Soils, P.2 – Three paragraphs were shorted to one with two sentences. The first sentence contains a new simplified definition and the second sentence contains the link to chapter 4 where the rules for classification of buried soils resides. The new definition still includes a surface mantle of new soil material but with a simple minimum thickness of 50 cm or more. A layer of human-transported material 50 cm or more thick was added as a new option for buried soils. The surface mantle of new soil material was moved immediately below under a new header. The sliding scale of 30 to 50 cm for the possible thickness of the surface mantle of new soil material (in soils with thin sola) was deleted. The definition was clarified and distinguished from human-transported material by stating that the surface mantle of new soil material is a layer of naturally-deposited mineral material.

Chapter 2 – Differentiae for Mineral Soils and Organic Soils

- Distinction Between Mineral Soils and Organic Soils, P.3-4 – Revised the sentences in the third paragraph to clarify the concepts.
- Soil Surface and Mineral Soil Surface, P.4 – Added two new sections preceding the definition of mineral soils to define their use throughout the Keys to Soil Taxonomy.

Chapter 3 – Horizons and Characteristics Diagnostic for the Higher Categories

- Anthropic epipedon, P.5-6 – Added a narrative definition that precedes the required characteristics. Modified the first sentence introducing the required characteristics and added two new sentences. Replaced the list of 5 root-limiting layer with the phrase “root-limiting layer” and redirected the reference to the formal definitions contained in chapter 17. The required characteristics were revised to remove mixing to 18 cm, color, organic-carbon content, and phosphate content as criteria, evidences of forming from human activity were added, and the criteria for minimum thickness was simplified.
- Mollic and umbric epipedons, P.7-8 – Changed “dominant colors” from plural to singular and added footnote 1 at first usage (in the mollic epipedon) to identify the Soil Survey Manual (SSM) as the source document (SSM) for the definition. The criteria for phosphate content was removed from both epipedons. Changed geomorphic position in newly renumbered item 9 of the umbric epipedon from "raised surfaces" to "locally raised landforms"
- Plaggen epipedon, P.8 – Edits were made to the narrative definition that precedes the required characteristics. In the required characteristics: changed geomorphic position in item 1 from "land surfaces" to "landforms" produced by long-term additions of manure; changed item 1a to clarify that artifacts do not include standard agricultural amendments or incidental litter and included an example of each; Changed item 4 to add human-transported material to the required thickness.

- Agric horizon, P.9 – In the required characteristics, items 1.a and 1.b are renumbered as items 1 and 2, respectively.
- Anhydritic horizon, P.10 – Added the brief description and required characteristics for this new diagnostic horizon immediately preceding the argillic horizon.
- Cambic horizon, P.11 – Changed one occurrence of the phrase "chroma of 0" to "neutral colors with no hue (N) and zero chroma" in required characteristic 2.a.(3)(a) to clarify the Munsell color chips that are possible with the criterion.
- Kandic horizon, P.12
  - Replaced the phrase "surface horizon" with "overlying horizon" in item 2 to clarify that kandic horizons can occur at significant depths below the soil surface.
  - Replaced text that used particle-size classes as proxies for soil texture in criterion for the depth to the horizon (item 2.b.(1)) with 6 sandy soil texture classes, in order to clarify the concept.
- Natric horizon, P.13 – Revised item 5.b. to replace the phrase "exchange acidity" with "extractable acidity" for consistency with Albic subgroups of Natraqualfs, laboratory methods of the KSSL, and the NASIS database. Changed the word "if" to "and", to clarify that both of the chemical criteria are required for this option of the natric horizon.
- Ortstein, P.13 – Added two sentences taken verbatim from the second edition of soil taxonomy which defines continuous orstein and the evidence for its lateral continuity.
- Oxic horizon, P.13
  - Converted the units for the size fraction of weatherable minerals in item 3 from microns to millimeters for consistency with other criteria.
  - Replaced the phrase "surface horizon" with "overlying horizon" in item 5 to clarify that oxic horizons can occur at significant depths below the soil surface.
- Petrogypsic horizon, P.14 – Clarified the wording of the range of cementation classes involved in the text.
- Abrupt textural change, P.15 – The technical criteria were deleted from the narrative definition and placed into a set of required characteristics. A new item in the criteria requires a minimum noncarbonate clay content of 8 percent in the diagnostic textural subsurface horizon. These revisions allow its use in 5 "pale" great groups, all Abruptic subgroups, and 3 "pale" subgroups which may have any mineral epipedon and other diagnostic textural subsurface horizons besides just an argillic horizon.
- Anhydrous Conditions, P.16 – Replaced the word "cemented" with "impregnated" to avoid the implication that ice is a pedogenic cementing agent.
- Interfingering of Albic Materials, P.17 – Corrected the omission of the kandic horizon in item 1 of the required characteristics.
- Linear Extensibility (LE), P.18 – Added a reference to the formal definition of "root-limiting layers" contained in chapter 17.
- Fibers, P.21 – Changed the word "coarse" to "wood" in three statements about wood fragments. Changed 2 cm to 20 mm to match the units of measurement for diameter used elsewhere in the Keys and in the NASIS metadata. Replaced the words "gravel, stones, and boulders" with the words "rock fragments", in the definition of fibers.
- Aquic Conditions, P.24
  - In the elements of aquic conditions, revised item 1. c. (2) (b) for anthric saturation to add manganese to the criterion for redox concentrations to support the narrative about anthraquic conditions in the last paragraph of the section.
  - In the elements of aquic conditions, revised item 1. c. (2) (c) for anthric saturation to correct the usage of dithionite-citrate for consistent usage elsewhere in the KST.
  - In the elements of aquic conditions for reduction, added the chemical symbol for reduced iron (Fe^{2+}) to the explanation of the indicator dye alpha,alpha-dipyridyl. Added a sentence on use of IRIS tubes to document reduction in soils with very low levels of total iron.
- Permafrost, P.26 – Replaced the word "cemented" with "impregnated" to avoid the implication that ice is a pedogenic cementing agent.
- Characteristics Diagnostic for Human-Altered and Human-Transported Soils, P.30 – Added this section to contain the following new characteristics and criteria: Anthropogenic landforms and microfeatures, Artifacts, Human-altered material, Human-transported material, Manufactured layer, Manufactured layer contact, and Subgroups for Human-altered and Human-transported Soils.

- Literature Cited, P.30 – Added reference to the Field Methods in Archaeology by Hester et. al. for a usage in the narrative definition of the anthropic epipedon. Revised references to the Soil Survey Laboratory Methods Manual, Soil Taxonomy, and the Soil Survey Manual to the current citation format. Added the National Soil Survey Handbook, Part 629 as a new reference needed for anthropogenic landforms and microfeatures.

Chapter 4 – Identification of the Taxonomic Class of a Soil

- First and second paragraphs, P.31 – Added several sentences about the assumptions for using the keys, added mention of the Field Book for Describing and Sampling Soils, chapter 18, and the appendix, and expanded the topic of conventions for rounding numbers. Added a "Literature Cited" section at the end of the chapter which contains the recommended citations for both the Soil Survey Manual and the Field Book for Describing and Sampling Soils.
- Key to Soil Orders, P.33 – Replaced text that used particle-size classes as proxies for soil texture in criteria for the spodic horizon (of items C.3.a.(4), C.3.b.(2), and C.3.c.(2) (a)) with 6 sandy soil texture classes, in order to clarify the concept.
- Footnote 1, P.32 – Corrected the wording of footnote 1 to match the identical footnote (2) in chapter 2.
- Key to Soil Orders, P.33 – Added the anhydritic horizon to item G.1.c. as a diagnostic horizon for classifying Aridisols.
- Key to Soil Orders, P.33 – Replaced text that used particle-size classes as proxies for soil texture in criterion for the epipedon (of item H.1.a) with 6 sandy soil texture classes, in order to clarify the concept.
- Key to Soil Orders, P.34 – Added the folistic epipedon to item K.2.b (1) as a diagnostic horizon for classifying Inceptisols. Reorganized item K.2.b. into 3 subitems for clarity.

Chapter 5 – Alfisols

- Key to Suborders, P.35 – Deleted the phrase "(other than anthraquic conditions)" from item JA. This phrase prevented Alfisols which have human-induced controlled flood irrigation from classifying in Aqualfs. Anthraquic conditions can be created in soils which have any prior moisture status or moisture regime.
- Key to Great Groups, P.35 – For the great group Albaqualfs italicized the conjunction "and" between the two criteria. Added equivalent units for the saturated hydraulic conductivity limit in micrometers per second. Corrected the abbreviation for saturated hydraulic conductivity to "K_{sat}."
- Rhodic subgroups, P.56-70 – Incorporated change in the critical zone thickness for the subgroups Rhodic Kandiudalfs, Rhodic Kanhapludalfs, Rhodic Paleudalfs, Rhodic Kandiustalfs, Rhodic Kanhaplustalfs, and Rhodic Paleustalfs. This completes the requested amendment for Rhodic subgroups submitted by the Raleigh, NC soil survey regional office, dated 4-30-2010.
- Arenic and Grossarenic subgroups, P.36-75 – Replaced text that used particle-size classes as proxies for soil texture in the criteria of 27 Arenic and 9 Grossarenic subgroups, with 6 sandy soil texture classes, in order to clarify the concept.
- Aquandic and Vitrandic subgroups, P.36-75 – Corrected the fraction statements in 6 Aquandic subgroups and 12 Vitrandic subgroups from "fragments coarser than 2.0 mm" to "particles 2.0 mm or larger in diameter."
- Paleustalfs, P.59 – Modified item JCF 3. to clarify position in the profile for criterion on clay content and to add to add a new criterion for the abrupt textural change.
- Aridic Glossic Natrustalfs, P.67 – Deleted number 6 from item JCCM 1.b. in the phrase for normal years.
- Palexeralfs, P.71 – Modified item JDF 3. to clarify position in the profile for criterion on clay content and to add to add a new criterion for the abrupt textural change.
- Abruptic Haplic Durixeralfs, P.71 – Modified item JDAD 1. to clarify position in the profile for criterion on clay content and to add a new criterion for the abrupt textural change.
- Abruptic Durixeralfs, P.72 – Modified item JDAE to clarify position in the profile for criterion on clay content and to add a new criterion for the abrupt textural change.
- Haplic Palexeralfs, P.76 – Modified item JDFP to move the phrase "in the fine-earth fraction" into the 2 sets of parentheses in item 2.

Chapter 6 – Andisols

No changes.

Chapter 7 – Aridisols

- Paleargids, P.97 – Modified item GEC 1. to clarify position in the profile for criterion on clay content and to add to add a new criterion for the abrupt textural change.
- Arenic subgroups, P.98-104 – Replaced text that used particle-size classes as proxies for soil texture in the criteria of 6 Arenic subgroups, with 6 sandy soil texture classes, in order to clarify the concept.
- Vitrandic and Vitrixerandic subgroups, P.99-122 – Corrected the fraction statements in 21 Vitrandic subgroups and 21 Vitrixerandic subgroups, from "fragments coarser than 2.0 mm" to "particles 2.0 mm or larger in diameter."
- Key to Great Groups for Cambids, P.108 – Deleted the great group of Anthracambids along with the underlying subgroup of Typic Anthracambids.
- Fluventic subgroups, P.109-111 – Added exclusionary statements in key to subgroups for 1 Fluventic subgroup of Aquicambids and 3 Fluventic subgroups of Haplocambids to prevent soils formed in 50 cm or more of human-transported material from classifying in "fluv" taxa.
- Key to Subgroups for Haplocambids, P.111 – Added new subgroup of Anthropic Haplocambids (new item code GGCT) between the Fluventic and Xeric subgroups.
- Abruptic Xeric Argidurids, P.116 – Modified item GCBC 1. to clarify position in the profile for criterion on clay content and to add a new criterion for the abrupt textural change.
- Abruptic Argidurids, P.116 – Modified item GCBD to clarify position in the profile for criterion on clay content and to add a new criterion for the abrupt textural change.
- Key to Subgroups for Aquisalids and Haplosalids, P.122 – Added new Anhydritic subgroups to both great groups. Anhydritic Aquisalids (new item code GBAA) is the first subgroup in key for the Aquisalids. Anhydritic Haplosalids (new item code GBBC) is the third subgroup in key for the Haplosalids (inserted between the Petrogypsic and Gypsic subgroups).

Chapter 8 – Entisols

- Key to Suborders, P.123
  - Changed two occurrences in Aquents of the phrase "chroma of 0" to "neutral colors with no hue (N) and zero chroma" to clarify the Munsell color chips that are possible with the criterion.
  - Deleted the suborder of Arents with item code LC and changed item codes for all subsequent suborders (Psamments, Fluvents, and Orthents) and their great groups and subgroups.
  - Added exclusionary statements to the suborder of Fluvents with new item code LD to prevent soils formed in 50 cm or more of human-transported material or surface mantles of new soil material not derived from alluvial deposition from classifying in Fluvents.
  - Added item LD.1. to exclude soils occurring on anthropogenic landforms or microfeatures from classifying in Fluvents.
  - Corrected an omission in item LE 3.b. to add the gelic soil temperature regime for the coldest Fluvents.
- Aquandic and Vitrandic subgroups, P.124-138 – Corrected the fraction statements of 3 Aquandic subgroups and 11 Vitrandic ("vitr) subgroups (excluding 3 subgroups in Psamments) from "fragments coarser than 2.0 mm" to "particles 2.0 mm or larger in diameter."
- Key to Great Groups for Aquents, P.127 – Added exclusionary statements in key to great groups for Aquents to prevent soils formed in 50 cm or more of human-transported material or surface mantles of new soil material not derived from alluvial deposition from classifying in Fluvaquents. Added item LBF.1. to exclude soils occurring on anthropogenic landforms or microfeatures from classifying in Fluvaquents.
- Key to Great Groups for Arents, P.127 – Deleted the key to remove the great groups along with the following underlying subgroups on pages 127 and 128:
  - Torriarents
    - Sodic Torriarents
    - Duric Torriarents
    - Haplic Torriarents
  - Udarents
    - Alfic Udarents
    - Ultic Udarents
    - Mollic Udarents
    - Haplic Udarents

    - Ustarents
        - Haplic Ustarents
    - Xerarents
        - Sodic Xerarents
        - Duric Xerarents
        - Alfic Xerarents
        - Haplic Xerarents
- Aquic subgroups of Udi-, Usti-, and Xerofluvents, P.130-133 – Changed six occurrences in Aquic (Aqu-) subgroups of the phrase "chroma of 0" to "neutral colors with no hue (N) and zero chroma" to clarify the Munsell color chips that are possible with the criterion.
- Key to Subgroups of Torriorthents, P.135 – Added the new extragrade subgroup of Anthraltic Torriorthents (new item code LECG) for the reclassification of the now obsolete Torriarents. It is added preceding the Vitrandic subgroup.
- Key to Subgroups of Udorthents, P.135 – Added the new extragrade subgroups of Anthrodensic Sodic, Anthrodensic, and Anthroportic Udorthents (new item codes LEFB, LEFC, and LEFD) for the reclassification of the now obsolete Udarents. They are added preceding the Vitrandic subgroup.
- Key to Subgroups of Ustorthents, P.136 – Added the new extragrade subgroups of Anthrodensic and Anthroportic Ustorthents (new item codes LEEF and LEEG) for the reclassification of the now obsolete Ustarents. They are added preceding the Aquic subgroup.
- Key to Subgroups of Xerorthents, P.138 – Added the new extragrade subgroups of Anthraltic Sodic and Anthraltic Xerorthents (new item codes LEDB and LEDC) for the reclassification of the now obsolete Xerarents. They are added preceding the Vitrandic subgroup.
- Key to Subgroups of Udipsamments, P.141 – Deleted the intergrade subgroup of Plagganthreptic Udipsamments and added the new extragrade subgroup of Haploplaggic Udipsamments (new item code LCFF).
- Key to Great Groups for Wassents, P.142 – Added an exclusionary statement in key to great groups for Wassents to prevent soils formed in 50 cm or more of human-transported material from classifying in Fluviwassents.
- Key to Great Groups for Wassents, P.142 – Corrected wording in criteria for great group of Frasiwassents to clarify EC measurement are made in a 1:5 (soil:water), by volume, supernatant.
- Dystric Xerorthents, P.138 – Added a reference to the formal definition of "root-limiting layers" contained in chapter 17.
- Dystric Xeropsamments, P.142 – Added a reference to the formal definition of "root-limiting layers" contained in chapter 17.
- Fluventic Frasiwassents, P.143 – Added an exclusionary statement in key to subgroups for Frasiwassents to prevent soils formed in 50 cm or more of human-transported material from classifying in subgroup of Fluventic Frasiwassents.
- Fluventic Psammowassents, P.143 – Added an exclusionary statement in key to subgroups for Psammowassents to prevent soils formed in 50 cm or more of human-transported material from classifying in subgroup of Fluventic Psammowassents.
- Fluventic Sulfiwassents, P.144 – Added an exclusionary statement in key to subgroups for Sulfiwassents to prevent soils formed in 50 cm or more of human-transported material from classifying in subgroup of Fluventic Sulfiwassents.

Chapter 9 – Gelisols

- Sphagnic Fibristels, P.145 – Added (by volume) to criteria for *Sphagnum* fiber content.
- Key to Great Groups for Orthels, P.146 – Simplified Historthels (item ACA) by substituting the presence of a histic epipedon to exclude folistic epipedons from meeting the criteria.
- Fluvaquentic and Fluventic subgroups, P.146-148 – Added exclusionary statements in key to subgroups for 6 Fluvaquentic and 2 Fluventic subgroups to prevent soils formed in 50 cm or more of human-transported material from classifying in "fluv" taxa.
- Nitric Anhyorthels, P.147 – Reorganized the complex single criterion into one item for the minimum nitrate concentration and a second item for the critical product of horizon thickness times nitrate concentration. Corrected the units for nitrate concentration in item 1 from cmol(-)/L to the units reported by the KSSL

(mmol(-)/L). Converted critical value from 12 to 118 to match the corrected units and the original intent of ICOMPAS circular letter No. 1 of January 18, 1994.

- Vitrandic subgroups, P.147-153 – Corrected the fraction statements of 5 Vitrandic subgroups from "fragments coarser than 2.0 mm" to "particles 2.0 mm or larger in diameter."
- Key to Great Groups for Turbels, P.150 – Clarified Histoturbels (item ABA) by adding the saturation requirement for the histic epipedon to exclude folistic epipedons from meeting the criteria.
- Nitric Anhyturbels, P.151 – Reorganized the complex single criterion into one item for the minimum nitrate concentration and a second item for the critical product of horizon thickness times nitrate concentration. Corrected the units for nitrate concentration in item 1 from cmol(-)/L to the units reported by the KSSL (mmol(-)/L). Converted critical value from 12 to 118 to match the corrected units and the original intent of ICOMPAS circular letter No. 1 of January 18, 1994.

Chapter 10 – Histosols

- Fluvaquentic subgroups, P.155-158 – Added exclusionary statements in key to subgroups for 7 Fluvaquentic subgroups to prevent soils formed in 50 cm or more of human-transported material from classifying in "fluv" taxa.
- Key to Great Groups for Wassists, P.159 – Corrected wording in criteria for great group of Frasiwassists to clarify that EC measurements are made in a 1:5 (soil:water), by volume, supernatant.

Chapter 11 – Inceptisols

- Key to Suborders, P.161 – Deleted the suborder of Anthrepts with item code KB and changed item codes for all subsequent suborders (Gelepts, Cryepts, Ustepts, Xerepts, and Udepts) and their great groups and subgroups.
- Key to Great Groups for Anthrepts, P.161 – Deleted the key to remove the two great groups along with the following underlying subgroups:
  - Plagganthrepts
    - Typic Plagganthrepts
  - Haplanthrepts
    - Typic Haplanthrepts
- Aquandic and Vitrandic subgroups, P.162-195 – Corrected the fraction statements of 16 Aquandic subgroups and 22 Vitrandic ("vitr) subgroups from "fragments coarser than 2.0 mm" to "particles 2.0 mm or larger in diameter."
- Fluvaquentic, Fluventic, and Cumulic subgroups, P.162-195 – Added exclusionary statements in key to subgroups for 12 Fluvaquentic, 20 Fluventic, and 3 Cumulic subgroups to prevent soils formed in 50 cm or more of human-transported material from classifying in these taxa.
- Key to Great Groups for Udepts, P.175 – In the great group of Eutrudepts, revised item KGE.1. to clarify that free carbonates are throughout and revised item KGE.2. to add a reference to the formal definition of "root-limiting layers" contained in chapter 17.
- Arenic Eutrudepts, P.179 – Replaced text that used particle-size classes as proxies for soil texture in the criteria, with 6 sandy soil texture classes, in order to clarify the concept.
- Torrertic Dystrustepts, P.184 – Deleted number 6 from item KEDB 1.b. in the phrase for normal years.

Chapter 12 - Mollisols

- Key to Suborders, P.197 – Changed one occurrence in Aquolls of the phrase "chroma of 0" to "neutral colors with no hue (N) and zero chroma" to clarify the Munsell color chips that are possible with the criterion.
- Arenic and Grossarenic subgroups, P.199 & 210 – Replaced text that used particle-size classes as proxies for soil texture in the criteria of 2 Arenic and 1 Grossarenic subgroup, with 6 sandy soil texture classes, in order to clarify the concept.
- Aquandic and Vitrandic subgroups, P.199-239 – Corrected the fraction statements of 4 Aquandic subgroups and 17 Vitrandic ("vitr) subgroups from "fragments coarser than 2.0 mm" to "particles 2.0 mm or larger in diameter."
- Abruptic Argiaquolls, P.199 – Modified item IBED to clarify position in the profile for criterion on clay content and to add a new criterion for the abrupt textural change.

- Fluvaquentic, Fluventic, and Cumulic subgroups, P.201-238 – Added exclusionary statements in key to subgroups for 8 Fluvaquentic, 7 Fluventic, and 9 Cumulic subgroups to prevent soils formed in 50 cm or more of human-transported material from classifying in these taxa.
- Key to Subgroups for Natraquolls, P.202 – Add new subgroup of Petrocalcic Natraquolls with item code IBCA preceding the Vertic subgroup and change item codes for all subsequent subgroups.
- Abruptic Argicryolls, P.203 – Modified item IEDE to clarify position in the profile for criterion on clay content and to add a new criterion for the abrupt textural change.
- Abruptic Palecryolls, P.206 – Modified item IECC to clarify position in the profile for criterion on clay content and to add a new criterion for the abrupt textural change.
- Typic Haplogelolls, P.207 – Corrected error in item code to IDAG.
- Key to Great Groups for Udolls, P.207 – Changed item IHB.3. of criteria to remove sandy textures as an option for Calciudolls. Changed item IHC.1. of criteria to remove a petrocalcic horizon within 150 cm of the mineral soil surface as an option for Paleudolls.
- Key to Subgroups for Argiudolls, P.208 – Added new subgroup of Petrocalcic Argiudolls with item code IHDB following the Lithic subgroup and change item codes for all subsequent subgroups.
- Abruptic Argiudolls, P.210 – Modified item IHDP to clarify position in the profile for criterion on clay content and to add a new criterion for the abrupt textural change.
- Key to Subgroups for Calciudolls, P.210 – Added new subgroup of Anthropic Petrocalcic Calciudolls following the Vertic subgroup and change item codes for the Aquic, Fluventic, and Typic subgroups.
- Key to Subgroups for Hapludolls, P.211 – Added new subgroup of Petrocalcic Hapludolls with item code IHFB following the Lithic subgroup and change item codes for all subsequent subgroups.
- Key to Subgroups for Natrudolls, P.214 – Added new subgroup of Abruptic Natrudolls following the Leptic subgroup and change item codes for the Glossic, Calcic, and Typic subgroups.
- Key to Subgroups for Paleudolls, P.214 – Deleted the subgroup of Petrocalcic Paleudolls with item code IHCB and changed item codes for all subsequent subgroups.
- Paleustolls, P.215 – Modified item IGD.2.b. to clarify position in the profile for criterion on clay content and to add to add a new criterion for the abrupt textural change.
- Aridic Lithic Haplustolls, P.221 – Deleted number 6 from item IGGC 1.b. in the phrase for normal years.
- Key to Subgroups for Paleustolls, P.228-230 – Corrected errors in the wording of the moisture requirement for the frigid Torrertic, Calcidic, and Aridic Paleustolls.
- Palexerolls, P.231 – Modified item IFC.2.b. to clarify position in the profile for criterion on clay content and to add to add a new criterion for the abrupt textural change.
- Paleargidic Durixerolls, P.234 – Modified item IFAE 2. to clarify position in the profile for criterion on clay content and to add a new criterion for the abrupt textural change.
- Abruptic Argiduridic Durixerolls, P.234 – Modified item IFAF to clarify position in the profile for criterion on clay content and to add a new criterion for the abrupt textural change.
- Haplic Palexerollic Durixerolls, P.235 – Modified item IFAK 1. to clarify position in the profile for criterion on clay content and to add a new criterion for the abrupt textural change.
- Palexerollic Durixerolls, P.235 – Modified item IFAL to clarify position in the profile for criterion on clay content and to add a new criterion for the abrupt textural change.

Chapter 13 – Oxisols

No changes.

Chapter 14 – Spodosols

- Arenic and Grossarenic subgroups, P.257-263 – Replaced text that used particle-size classes as proxies for soil texture in the criteria of 6 Arenic and 3 Grossarenic subgroups, with 6 sandy soil texture classes, in order to clarify the concept.
- Key to Subgroups for Fragiaquods, P.259 – Deleted the intergrade subgroup of Plagganthreptic Fragiaquods and added the new extragrade subgroup of Haploplaggic Fragiaquods with same item code. The minimum thickness of the epipedon was decreased from 30 to 25 cm to match the other Haploplaggic subgroups.
- Key to Subgroups for Haplohumods, P.262 – Deleted the intergrade subgroup of Plagganthreptic Haplohumods and added the new extragrade subgroup of Haploplaggic Haplohumods with same item code.

The minimum thickness of the epipedon was decreased from 30 to 25 cm to match the other Haploplaggic subgroups.

- Key to Subgroups for Alorthods, P.263 – Deleted the intergrade subgroup of Plagganthreptic Alorthods and added the new extragrade subgroup of Haploplaggic Alorthods with same item code. The minimum thickness of the epipedon was decreased from 30 to 25 cm to match the other Haploplaggic subgroups.
- Key to Subgroups for Fragiorthods, P.263 – Deleted the intergrade subgroup of Plagganthreptic Fragiorthods and added the new extragrade subgroup of Haploplaggic Fragiorthods with same item code. The minimum thickness of the epipedon was decreased from 30 to 25 cm to match the other Haploplaggic subgroups.
- Entic subgroups of Fragiorthods and Haplorthods, P.263-265 – Added the phrase "all of the following" to criterion 1 of subgroups Entic Fragiorthods (CECG), Entic Lithic Haplorthods (CEEA), Aquentic Haplorthods (CEEE), and Entic Haplorthods (CEEP) to clarify the requirements.

Chapter 15 – Ultisols

- Key to Great Groups, P.267 – For the great group Albaquults added equivalent units for the saturated hydraulic conductivity limit in micrometers per second. Corrected the abbreviation for saturated hydraulic conductivity to "$K_{sat.}$"
- Arenic and Grossarenic subgroups, P.268-286 – Replaced text that used particle-size classes as proxies for soil texture in the criteria of 28 Arenic and 10 Grossarenic subgroups, with 6 sandy soil texture classes, in order to clarify the concept.
- Aquandic subgroups, P.270 & 277 – Corrected the fraction statements of 2 Aquandic subgroups from "fragments coarser than 2.0 mm" to "particles 2.0 mm or larger in diameter."
- Rhodic Kandiustults, P.283 – Corrected an inappropriate change made in June 2009 to the critical zone thickness required for the dark, red colors in the subgroup of Rhodic Kandiustults. The corrected thickness value of 75 cm for this subgroup now parallels the similar taxon of Rhodic Kandiustalfs (in Alfisols).

Chapter 16 – Vertisols

Key to Suborders and Key to Subgroups, P.287-298 – In the Aquerts suborder and Aquic subgroups deleted 8 occurrences of the chemical symbol for ferrous iron (Fe^{2+}) for consistency with other chapters.

Chapter 17 – Families and Series Differentiae and Names

- Family Differentiae for Mineral Soils and Mineral Layers of Some Organic Soils, P.299
  - Added human-altered and human-transported material classes to the list of family differentiae between particle-size classes and mineralogy classes.
  - Added the new section on these classes to its respective place on page 305 between the last strongly contrasting particle-size class (71.) and the section for mineralogy classes. The 12 classes in keying sequence are:
    - methanogenic
    - asphaltic
    - concretic
    - gypsifactic
    - combustic
    - ashifactic
    - pyrocarbonic
    - artifactic
    - pauciartifactic
    - dredgic
    - spolic
    - araric
- Definition of Particle-Size Classes and Their Substitutes for Mineral Soils, P.299
  - In the second paragraph, expanded the second sentence stating that pedological classifications separate sand and silt at 20, 50, or 63 microns.
  - In the second paragraph, added a new sentence specifying that USDA and soil taxonomy use 50 microns as the functional diameter for separation.
  - In the third paragraph, corrected the number of narrowly defined particle-size classes (from 11 to 10).

- In the third paragraph, added sentences on the origin of rock fragments, pararock fragments, and artifacts. Also added a sentence on the treatment of some artifacts as rock fragments for assignment of particle-size classes. Added a new footnote number one (1) pertaining to artifact cohesion and artifact persistence.

- Root-limiting layers, P.300 – Clarified that continuous ortstein must be 90 percent or more cemented and have lateral continuity. Added the manufactured layer to the list of root-limiting layers.
- Control Section for Particle-Size Classes and Their Substitutes, P.302-303
  - Changed footnote number 1 (defines the term "pumicelike") to footnote number 2.
  - Corrected the fraction statements in items A.1 and A.2 of the key from "more than 2.0 mm in diameter" to "2 mm or larger in diameter."
  - Added "plus any artifacts 2 mm or larger in diameter which are both cohesive and persistent" to the criteria for the sandy-skeletal, loamy-skeletal, and clayey-skeletal particle-size classes (items C.1 through C.3) to account for artifacts which are equivalent in function to rock fragments.
  - Added the text "and artifacts 2 to 75 mm in diameter which are both cohesive and persistent" to the criteria for the coarse-loamy, fine-loamy, coarse-silty, and fine-silty particle-size classes (items C.6 through C.9) to account for artifacts which are equivalent in function to rock fragments.
  - Replaced the text on percent very fine sand content of less than 50 percent, with the 6 possible texture classes that are required in the sandy-skeletal (item C.1) and sandy (item C.4) particle-size classes.
- Key to Mineralogy Classes, P.306-307
  - Added the anhydritic mineralogy class to section C, item 1.
  - Corrected 6 occurrences of the term "dithionite-citrate" for consistence usage in the KST.
  - Revised the beginning statements in sections B, C, D, and E for consistency and clarity.
  - Simplified the criteria for the isotic mineralogy class in section D of the Key to Mineralogy Classes to match the same criteria in section E.
- Key to Cation-Exchange Activity Classes, P.307-308 – Added extensive revisions to the text for the section. Corrected an error in the guidance for use of cation-exchange activity classes in soils having strongly contrasting particle-size classes. The class "loamy over clayey" was an obsolete choice and was revised to "fine-loamy over clayey." Arranged the text under subheadings of Use of-, Control Section for-, and Key to the Cation-exchange activity classes. These revisions improved the appearance and clarity of the section.
- Calcareous and Reaction Classes of Mineral Soils, P.308-309 – Reorganized the section to separate and clarify the lists of excluded taxa which do not use either the calcareous class or the two reaction classes (acid, nonacid). Added the new anhydritic mineralogy class to families excluded from using the calcareous class or the acid and nonacid reaction classes. Edited the existing subheading and added two new ones that are specific to the calcareous class, the reaction classes, and the allic class. Corrected an error in tense at the end of the 4th sentence, 1st paragraph.
- Soil Depth Classes, P.310 and 313 – Clarified that continuous ortstein must be 90 percent or more cemented and have lateral continuity. Added the manufactured layer to the lists of root-limiting layers.
- Key to Particle-Size Classes of Histosols and Histels, P.311
  - Changed section heading to "Key to Particle-size Classes of Organic Soils."
  - Replaced the text on percent very fine sand content of less than 50 percent in item A.2. with the 6 possible texture classes that are required in the fine-earth fraction.
  - Added "plus any artifacts 2 mm or larger in diameter which are both cohesive and persistent" to the criteria for the loamy-skeletal and clayey-skeletal particle-size classes (items A.3 and A.4) to account for artifacts which are equivalent in function to rock fragments.
- Mineralogy Classes of Histosols, P.312 – In the required characteristics for the Ferrihumic mineralogy class joined items 1 and 2 since both are required. Added the phrase "extractable by dithionite-citrate" to item 2 to clarify the method for measuring the content of free iron oxide.
- Control Section for the Differentiation of Series, P.313 – Revised the first paragraph for clarity. Added the manufactured layer and manufactured layer contact to the list of layers used to define series. Added the manufactured layer to items A4. B2., and C2 in the Key to Control Section for the Differentiation of Series.

Chapter 18 – Designations for Horizons and Layers

- Master Horizons and Layers, P.315-316
  - Revised definitions for the O, A, E, and B horizons to reconcile concepts with suffixes i, g, and z.
  - Added anhydrite to items 1 and 2 of list of evidences for the master B horizon.

- Deleted the word “subsoil” (technically the B horizon) from the definition of the master layer M.

- Suffix Symbols, P.317-319
  - Revised the definition of suffix symbol ‘b’ to permit its use in organic soils.
  - Added new suffix symbol ‘se’ for presence of sulfides.
  - Revised definition of suffix ‘u’ for examples of artifacts.
  - Revised color examples used in definition of suffix ‘yy’.
  - Added a sentence to definitions of suffixes ‘y’ and ‘yy’ to allow use for anhydrite.
- Conventions for Using Letter Suffixes, P.319
  - Revised the wording of convention 4 for using letter suffixes to clarify the listing precedence when symbols c, g, and f are used with the other listed symbols in the rule.
  - Revised the wording of convention 5 to permit suffix symbol b to be used in organic soils.
  - Deleted final sentence in the section and reinserted as new convention 6 without a qualifying condition.
  - Convention 6 is renumbered to 7 with the addition of suffix yy to the list of symbols.
- Vertical Subdivision, P.319 – Replaced 3 occurrences of the obsolete phrase "Arabic numerals" (first used in 1962 supplement to the SSM) with the word "numbers."
- Discontinuities, P.320 – Clarified the final sentence in the section pertaining to the examples of different designations for organic vs. mineral or limnic materials. Replaced 3 occurrences of the obsolete phrase "Arabic numerals" (first used in 1962 supplement to the SSM) with the word "numbers."
- Use of the Prime Symbol, P.320-321 – Corrected example of the horizon sequence using the prime symbol when vertical subdivisions are involved. Replaced 3 occurrences of the obsolete phrase "Arabic numerals" (first used in 1962 supplement to the SSM) with the word "numbers."
- Use of the Caret Symbol, P.321– Replaced one occurrence of the obsolete phrase "Arabic numerals" (first used in 1962 supplement to the SSM) with the word "numbers."
- Literature Cited, P.321 – Added two references by Fanning and others on sulfidization.
- Added the section named "Sample Horizon and Layer Sequences" taken from the revised version of chapter 3 of the SSM preceding the Literature Cited section.

Appendix on Laboratory Methods for Soil Taxonomy

- Revised first paragraph to add a new reference, update existing references, and mention the Charles E. Kellogg Soil Survey Laboratory (KSSL) and NCSS soil characterization database.
- In the section on Data Elements Used in Classifying Soils, a conversion was added for concentration in non-SI unit of measure (%) to SI unit of measure (g kg-1).
- Physical Analyses section, P.323-324
  - Deleted the paragraph on Atterberg limits since they are not used as criteria in soil taxonomy.
  - Added a new paragraph on particle-size distribution and how the data are used in soil taxonomy. Included statements concerning field-moist measurement for soils suspected of having andic soil properties and dispersion in aqueous ethanol solutions for soil samples high in gypsum.
  - Modified the paragraph on water retention difference (WRD) to be only water content (retention) at 1500 kPa tension.
  - Added sentences to bulk density, linear extensibility, and water content (retention) to describe how the data are used in soil taxonomy.
- Chemical Analyses section, P.324-326
  - Corrected several typographical errors.
  - Reorganized the chemical analyses section by grouping similar analytes and resulting calculations under new six new subsection headings. Modified the paragraphs on all the analytes to clarify how the data are used as criteria in soil taxonomy.
  - In new subsection for Ion Exchange and Extractable Cations updated 2 sentences in the paragraphs on base saturation about extractable calcium when calcium minerals are present.
  - In new subsection for Soil pH added new paragraphs for saturated paste and oxidized pH methods. Edited existing sentences on 1:1 water and 1:2 $CaCl_2$ pH methods.
    - In new subsection on Sulfur and Extractable Anions added a new paragraph for nitrate concentration which is used as criteria for Nitric subgroups of Gelisols and a new paragraph for total sulfur which is used for sulfidic materials. Added a sentence to the paragraph for phosphate retention to mention the alternate name of the analyte. Replaced the second sentence on water-soluble sulfate with two new

sentences about the about the new procedure used at the KSSL for measuring water-soluble sulfate in percent on a dry mass basis.
    - In new subsection on Carbonates and Calcium Sulfates added a new paragraph for anhydrite content.
    - In new subsection on Soluble Salts added a new paragraph for electrical conductivity 1:1, which is used as criteria to classify Halic subgroups of Haplosaprists. Added a new paragraph for electrical conductivity 1:5, by volume, which is used as criteria to separate taxa for subaqueous soils in freshwater vs. brackish environments. Corrected error in the sentence about the use of exchangeable sodium percentage (ESP).
    - Deleted the paragraph on nitrogen content since it is not used as criteria in soil taxonomy.
    - Deleted the paragraphs on sodium-pyrophosphate-extractable iron and aluminum and total salts since they are not used as criteria in soil taxonomy. They were applicable to the spodic and salic horizons, respectively, prior to publication of the 2nd edition of Soil Taxonomy in 1999.
    - Deleted the paragraph on water-soluble cations and anions since they apply only to sodium adsorption ratio and water-soluble sulfate. These data already include general statements on how they are determined in the laboratory.
- Created a new "Organic Analyses" section
    - Moved existing paragraph for color of sodium-pyrophosphate extract, melanic index, and organic carbon into the new section.
    - Shorted the paragraph on melanic index by deleting two sentences detailing the lab method.
    - Added new paragraphs for fiber content and organic matter content.
- Mineral Analyses section, P.326-327
    - Added a new sentence to the paragraph on petrographic analysis to clarify the categories for glass-coated grains.
    - Changed the reference document cited for a complete list of minerals to the Soil Survey Laboratory Information Manual (Soil Survey Staff, 2011).
- Other Information Useful in Classifying Soil section, P.327-328
    - Revised the next-to-last paragraph to clarify the use of calculated CEC7 to clay ratios in taxonomic classification.
    - Deleted the last paragraph about ratio of CEC-8.2 to 1500 kPa water content since it represents an undefined dataset and is unreferenced in SSIR laboratory manuals.
- Literature Cited section, P.328
    - Deleted the reference to the Annual Book of ASTM Standards since it was used only in the deleted paragraph on Atterberg limits.
    - Deleted the reference by Kimble et al., 1993 since it is no longer current with KSSL methods and is not widely available.
    - Updated reference for version 5 of the Soil Survey Laboratory Methods Manual
    - Added references for the *Soil Survey Manual* and the *Soil Survey Laboratory Information Manual*.
    - Added 2 references to document the recognition and measurement of anhydrite in soils.