AN ABBREVIATED KEY TO THE SOIL ORDERS[1,2]

SOILS WITH--

1. A. permafrost at <1 m; OR
   B. gelic materials at <1m and permafrost at <2m

GELISOLS

2. organic materials that are—
   A. 2/3 of thickness over lithic/paralithic contact, with no mineral horizons >10 cm; OR
   B. saturated >30 days/year, AND are >60 cm thick if fibrous OR >40 cm thick if sapric

HISTOSOLS

3. a spodic horizon >10 cm thick (with certain depth requirements)

SPODOSOLS

4. andic soil properties in 60% of the soil within 60 cm of the surface or a lithic/paralithic contact

ANDISOLS

5. an oxic horizon within 150 cm of soil surface AND no kandic horizon; OR
   >40% clay in top 18 cm AND kandic horizon with low weatherable minerals within 1 m of surface

OXISOLS

6. a layer >25 cm thick within 1 m of surface with slickensides or wedge-shaped peds, AND
   >30% clay in all horizons to depth of 50 cm or a lithic/paralithic contact, AND
   periodic cracking at soil surface

VERTISOLS

7. aridic moisture regime AND ochric epidpedon AND one of following within 1 m of surface: cambic, gypsic, calcic, petrocalcic, petrogypsic, natric, OR argillic

ARIDISOLS

8. argillic or kandic horizon AND % BS (ECEC) <35% at a depth of 125 below the top of argillic/kandic or 180 below soil surface or at a lithic/paralithic contact

ULTISOLS

9. mollic epipedon AND %BS (pH 7)>50% in ALL horizons to 180 cm depth or to lithic/paralithic contact

MOLLISOLS

10. argillic, kandic, or natric horizon, OR fragipan with clay films in some part

ALFISOLS

11. cambic, calcic, gypsic, petrocalcic, OR petrogypsic horizon within 1 m of surface OR oxic or spodic horizon within 2 m of surface, OR sulfuric horizon

INCEPTISOLS

12. All other soils

ENTISOLS

[1] Key should be used by STOPPING at first order that appears to match criteria listed. Subsequent orders may ALSO match criteria, but FIRST one selected is correct.

[2] This key does NOT specify all criteria needed for classifying soils at the order level (i.e., it only works about 85% of the time). Refer to "Keys to Soil Taxonomy" for complete criteria…

KEY TO ***ULTISOL*** SUBORDERS:

Ultisols that have aquic conditions for some time in normal 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 chroma of 2 or less either on faces of peds or in the matrix; *or*
    b. 50 percent or more redox depletions with 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,alphadipyridyl at a time when the soil is not being irrigated.

Aquults

Other Ultisols that have *one or both* of the following:

1. 0.9 percent (by weighted average) or more organic carbon in the upper 15 cm of the argillic or kandic horizon; *or*
2. 12 kg/m_2 or more organic carbon between the mineral soil surface and a depth of 100 cm.

Humults

Other Ultisols that have a udic soil moisture regime.

Udults

Other Ultisols that have an ustic soil moisture regime.

Ustults

Other Ultisols.

Xerults

KEY TO ***UDULT*** GREAT GROUPS

Udults that have one or more horizons within 150 cm of the mineral soil surface in which plinthite either forms a continuous phase or constitutes one-half or more of the volume.

Plinthudults

Other Udults that have a fragipan within 100 cm of the mineral soil surface.

Fragiudults

Other Udults that:

1. Do not have a densic, lithic, paralithic, or petroferric contact within 150 cm of the mineral soil surface; *and*
2. Have a kandic horizon; *and*
3. Within 150 cm of the mineral soil surface, *either*:
    a. With increasing depth, do not have a clay decrease 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) in the fine-earth fraction.

Kandiudults

Other Udults that have a kandic horizon.

Kanhapludults

Other Udults that:

1. Do not have a densic, lithic, paralithic, or petroferric contact within 150 cm of the mineral soil surface; *and*
2. Within 150 cm of the mineral soil surface, *either*:
    a. With increasing depth, do not have a clay decrease 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) in the fine-earth fraction.

Paleudults

Other Udults that have *both*:

1. An epipedon that has a color value, moist, of 3 or less throughout; *and*
2. In all subhorizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon if it is less than 100 cm thick, more than 50 percent colors that have *all* of the following:
    a. Hue of 2.5YR or redder; *and*
    b. A value, moist, of 3 or less; *and*
    c. A dry value no more than 1 unit higher than the moist value.

Rhodudults

Other Udults.

Hapludults

KEY TO ***AQUULT*** GREAT GROUPS

Endoaquults

SERIES KEY TO KANDIUDULTS AND KANHAPLUDUTS OF THE GEORGIA PIEDMONT:

Kanhapludults that meet sandy or sandy-skeletal particle-size class criteria throughout a layer extending from the mineral soil surface to the top of a kandic horizon at a depth of 50 to 100 cm.

Arenic Kanhapludults

JEWELL **LOAMY, SILICEOUS, THERMIC ARENIC KANHAPLUDULTS**

Other Kanhapludults that in normal years are saturated with water in one or more layers within 100 cm of the mineral soil surface for *either or both*:

1. 20 or more consecutive days, *or* 30 or more cumulative days; *and*
2. Have redox depletions with chroma of less than or equal to 2 within the depth 75-100 cm of the surface.

Oxyaquic Kanhapludults

I. Series with FINE particle size family:

A. Soils with kaolinitic mineralogy, *and* a dominant hue of 2.5YR in kandic horizon *and* dense, brittle, fragic properties in some part of the Bt:

CATAULA **FINE, KAOLINITIC, THERMIC OXYAQUIC KANHAPLUDULTS**

B. Soils with kaolinitic mineralogy, *and* dominant hues of 5YR or yellower in the kandic horizon:

HARD LABOR **FINE, KAOLINITIC, THERMIC OXYAQUIC KANHAPLUDULTS**

C. Soils with mixed mineralogy; on stream terraces.

WHISTLESTOP **FINE, MIXED, THERMIC OXYAQUIC KANHAPLUDULTS**

II. Soils with FINE-LOAMY particle size family:

ALCOVY **FINE-LOAMY, SILICEOUS, THERMIC OXYAQUIC KANHAPLUDULTS**

Other Kanhapludults that have, in all subhorizons in the upper 75 cm of the kandic horizon or throughout the entire kandic horizon if it is less than 75 cm thick, more than 50 percent colors that have *all* of the following:

1. Hue of 2.5YR or redder; *and*
2. A value, moist, of 3 or less; *and*
3. A dry value no more than 1 unit higher than the moist value.

Rhodic Kanhapludults

I. Series with > 150 cm to a lithic contact, and depth to C horizon of > 100 cm:

A. Soils formed in residuum:

LLOYD **FINE, KAOLINITIC, THERMIC RHODIC KANHAPLUDULTS**

B. Soils formed in old alluvium on terraces:

HIWASSEE **FINE, KAOLINITIC, THERMIC RHODIC KANHAPLUDULTS**

II. Series with a parlithic contact at <100 cm:

GWINNETT **FINE, KAOLINITIC, THERMIC RHODIC KANHAPLUDULTS**

Other Kanhapludults.

Typic Kanhapludults

All series below are in the **FINE, KAOLINITIC, THERMIC TYPIC KANHAPLUDULTS** family:

I. Soils with lithic contact at 50-100 cm: SAW

II. Soils with paralithic contact at < 100 cm: BETHLEHEM

III. Soils of the Carolina Slate Belt containing > 30% silt in the particle size control section:

A. Soils with Bt horizon < 60 cm thick: LAURENS

B. Soils with Bt > 60 cm thick; Bt color 5YR or redder: GEORGEVILLE

C. Soils with Bt > 60 cm thick; Bt color 7.5YR or yellower: HERNDON

IV. Micaceous soils with many mica flakes in the lower Bt and BC horizons: MADISON

V. Soils with thickness of Bt horizon > 60 cm:

A. Soils with matrix color in Bt of 7.5YR or yellower: APPLING

B. Soils with Bt of 5YR or redder: CECIL

VI. Soils with thickness of Bt horizon < 60 cm:

A. Soils with matrix color in Bt of 7.5YR or yellower: WEDOWEE

B. Soils with Bt of 5YR or redder: PACOLET

Kandiudults:

DAVIDSON **FINE, KAOLINITIC, THERMIC RHODIC KANDIUDULTS**

KEY TO PARTICLE SIZE CONTROL SECTIONS

A. For mineral soils that have a root-limiting layer within 36 cm of the mineral soil surface:
From the mineral soil to the root-limiting layer; or

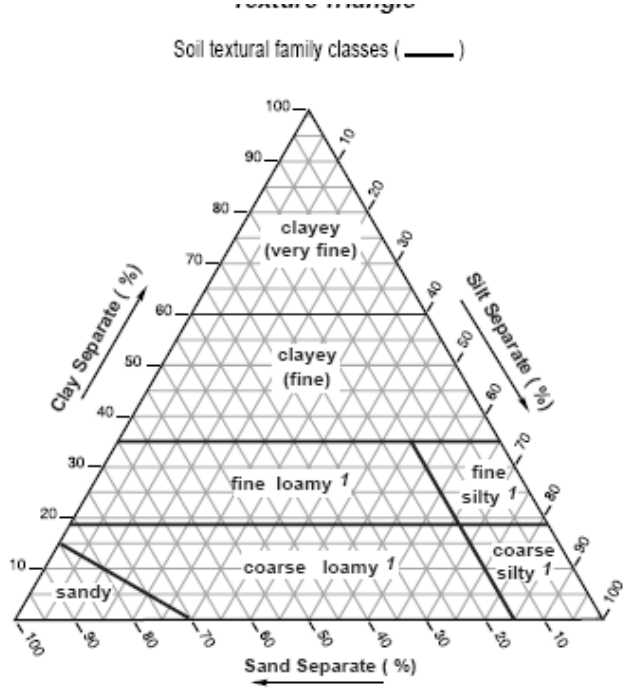
B. For those Alfisols, Ultisols, and great groups of Aridisols and Mollisols that have an argillic, kandic, or natric horizon that has its **upper boundary within 100 cm of the mineral soil surface** and its lower boundary at a depth of 25 cm or more below the mineral soil surface or that are in a Grossarenic or Arenic subgroup:
Either the entire argillic, kandic, or natric horizon if 50 cm or less thick, or the upper 50 cm of the horizon if more than 50 cm thick; or

C. For those Alfisols, Ultisols, and great groups of Aridisols and Mollisols have an argillic, kandic, or natric horizon that has its **upper boundary at a depth of 100 cm or more from the mineral surface** and that are not in a Grossarenic or Arenic subgroup:
Between 25 cm from the mineral soil surface and 100 cm below the mineral soil surface or a root-limiting layer, whichever is shallower; or

D. For other soils that have an argillic or natric horizon that has its lower boundary at a depth of less than 25 cm from the mineral soil surface:
Between the upper boundary of the argillic or natric horizon and a depth of 100 cm below the mineral soil surface or a root-limiting layer, whichever is shallower; or

E. All other mineral soils:
Between 25 cm below the mineral soil surface and either 100 cm below the mineral soil surface or a root limiting layer, whichever is shallower.

PARTICLE SIZE FAMILIES



1 Very fine sand fraction (0.05 – 0.1 mm) is treated as silt for Soil Taxonomy family groupings; coarse fragments are considered the equivalent of coarse sand in the boundary between silty and loamy classes.

For soils that are <50 cm to root-limiting layer, or are in a Lithic, Arenic, or Grossarenic subgroup:

<35% clay in control section: ***"loamy"***
≥35% clay in control section: ***"clayey"***

Soils that are >50 cm to a root-limiting layer use the following family names:
< 35% clay: use triangle at left
35-60% clay in control section: ***"fine"***
>60% clay in control section: ***"very fine"***

NOTE that clay loam textures (28-40% clay) may be in either "fine-loamy" or "fine" families (cutoff is 35%)

Control sections that have >35% fragments use the following family names:
--sand or loamy sand textures***: "sandy-skeletal"***
--<35% clay: ***"loamy-skeletal"***
--≥35% clay: ***"clayey-skeletal"***

Family particle size name is NOT used with "psamments" ("sandy" family is implied)

Plant Sciences Farm Pit, lower backslope, 17% slope

		> 2 mm	clay	sand	text class	STR	color	<2 chroma deplets?	c films?	OC	CEC pH7)	BS
Ap	0-14	31	9	71	gr sl	1GR	10YR 4/4	N	N	1.1	31	70
BE	14-30	21	12	61	gr sl	1SBK	7.5YR 6/6	N	N	0.6	18	48
Bt1	30-60	16	31	44	gr cl	1SBK	5YR 5/6	N	Y	0.2	17	54
Bt2	60-78	6	50	28	c	2SBK	5YR 5/8	N	Y	0.1	15	21
Bt3	78-97	4	44	33	c	2SBK	5YR 5/8	N	Y	0.1	14	17
Bt4	97-120	7	37	38	cl	2SBK	7.5YR 4/6	Y	Y	0.1	15	9
BC	120-155	8	28	46	scl	1SBK	10YR 6/8	Y	Y	0.1	13	12
											per 100 g clay	

Whitehall Pit, lower BS/Footslope, 11% slope

		> 2 mm	clay	sand	text class	STR	color	<2 chroma deplets?	c films?	OC	CEC pH7)	BS
A	0-10	8	10	70	sl	1GR	5YR 4/4	N	N	1.2	25	45
Bt1	10-52	2	41	40	c	2SBK	2.5YR 4/6	N	Y	0.2	14	32
Bt2	52-110	6	37	45	sc	2SBK	2.5YR 4/6	N	Y	0.1	13	25
BC	110-170	12	33	48	scl	1SBK	2.5YR 3/6	N	Y	0.1	12	18
											per 100 g clay	

Aquults: Key to Great Groups

Aquults that have one or more horizons within 150 cm of the mineral soil surface in which plinthite either forms a continuous phase or constitutes one-half or more of the volume.

Plinthaquults

Other Aquults that have a fragipan within 100 cm of the mineral soil surface.

Fragiaquults

Other Aquults that have an abrupt textural change between the ochric epipedon or albic horizon and the argillic or kandic horizon and have a saturated hydraulic conductivity of 0.4 cm/hr or slower (moderately low or lower Ksat class) in the argillic or kandic horizon.

Albaquults

Other Aquults that:

1. Do not have a densic, lithic, paralithic, or petroferric contact within 150 cm of the mineral soil surface; and
2. Have a kandic horizon; and
3. Within 150 cm of the mineral soil surface, either:
    a. With increasing depth, do not have a clay decrease of 20 percent or more (relative) from the maximum clay content; or
    b. Have 5 percent or more (by volume) clay depletions on faces of peds in the layer that has a 20 percent lower clay content and, below that layer, a clay increase of 3 percent or more (absolute) in the fine-earth fraction.

Kandiaquults

Other Aquults that have a kandic horizon.

Kanhaplaquults

Other Aquults that:

1. Do not have a densic, lithic, paralithic, or petroferric contact within 150 cm of the mineral soil surface; and
2. Within 150 cm of the mineral soil surface, either:
    a. With increasing depth, do not have a clay decrease of 20 percent or more (relative) from the maximum clay content; *or*
    b. Have 5 percent or more (by volume) clay depletions on faces of peds in the layer that has a 20 percent lower clay content *and*, below that layer, a clay increase of 3 percent or more (absolute) in the fine-earth fraction.

Paleaquults

Other Aquults that have an umbric or mollic epipedon.

Umbraquults

Other Aquults that have episaturation.

Epiaquults

Other Aquults.

Endoaquults

Classes of soil temperature:

Pergelic - mean annual soil temperature <0^{o} C; permafrost at a shallow depth.

Cryic - mean annual soil temperature between 0 and 8^{o} C and mean summer soil temperature is <15 ^{o}

Frigid - mean annual soil temperature between 0 and 8 ^{o} C and mean summer temperature >15 ^{o}

Mesic - mean annual soil temperature between 8 and 15 ^{o} C; corn and winter wheat

Thermic - mean annual soil temperature between 15 and 22 ^{o} C; cotton and yellow pine

Hyperthermic - mean annual soil temperature is 22 ^{o} C or higher; citrus

"iso-" prefix is used if the mean summer and mean winter soil temperature differ by less than 6^{o} C

Soil Moisture Regimes:

Aridic: MCS dry >180 d, moist for < 90 d
no cropping possible; little soil development
Xeric: MCS dry >90 d, moist >180 d; winter rain/dry summer
Mediterranean; winter crops; some soil development
Ustic: MCS dry >90 d, moist >180 d; summer/uniform rain
cotton, irrigated crops; some soil development
Udic: MCS dry for < 90 d; typically uniform rain
corn cultivation; optimum soil development
Perudic: udic, with monthly PPT>monthly ET
cooler or very high rainfall
Aquic: redox features (<2 chroma) directly below A

MCS: moisture control section: 10-30 for most textures; 20-80 cm for sandy soils.

A fragipan must have *all* of the following characteristics:
1. The layer is 15 cm or more thick; *and*
2. The layer shows evidence of pedogenesis within the horizon or, at a minimum, on the faces of structural units; *and*
3. The layer has very coarse prismatic, columnar, or blocky structure of any grade, has weak structure of any size, or is massive. Separations between structural units that allow roots to enter have an average spacing of 10 cm or more on the horizontal dimensions; *and*
4. Air-dry fragments of the natural soil fabric, 5 to 10 cm in diameter, from more than 50 percent of the layer slake when they are submerged in water; *and*
5. The layer has, in 60 percent or more of the volume, a firm or firmer rupture-resistance class, a brittle manner of failure at or near field capacity, and virtually no roots; *and*
6. The layer is not effervescent (in dilute HCl).

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 in a layer 2.5 cm or more thick that is not part of any Ap horizon.

Spodic materials are mineral soil materials that do not have all of the properties of an argillic or kandic horizon; are dominated by active amorphous materials that are illuvial and are composed of organic matter and aluminum, with or without iron; and have *both* of the following:
1. A pH value in water (1:1) of 5.9 or less and an organic carbon content of 0.6 percent or more; *and*
2. *One or both* of the following:
    a. An overlying albic horizon that extends horizontally through 50 percent or more of each pedon and, directly under the albic horizon, colors, moist (crushed and smoothed sample), as follows:
        (1) Hue of 5YR or redder; *or*
        (2) Hue of 7.5YR, color value of 5 or less, and chroma of 4 or less; *or*
        (3) 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. With or without an albic horizon and one of the colors listed above or hue of 7.5YR, color value, moist, of 5 or less, chroma of 5 or 6 (crushed and smoothed sample), and *one or more* of the following morphological or chemical properties:
        (1) Cementation by organic matter and aluminum, with or without iron, in 50 percent or more of each pedon and a very firm or firmer rupture-resistance class in the cemented part; *or*
        (2) 10 percent or more cracked coatings on sand grains; *or*
        (3) Al + 1/2 Fe 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, 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, ochric epipedon, or albic horizon.