USDA United States Department of Agriculture
Natural Resources Conservation Service

Soil Taxonomy

A Basic System of Soil Classification for Making and Interpreting Soil Surveys

Second Edition, 1999

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Complicated

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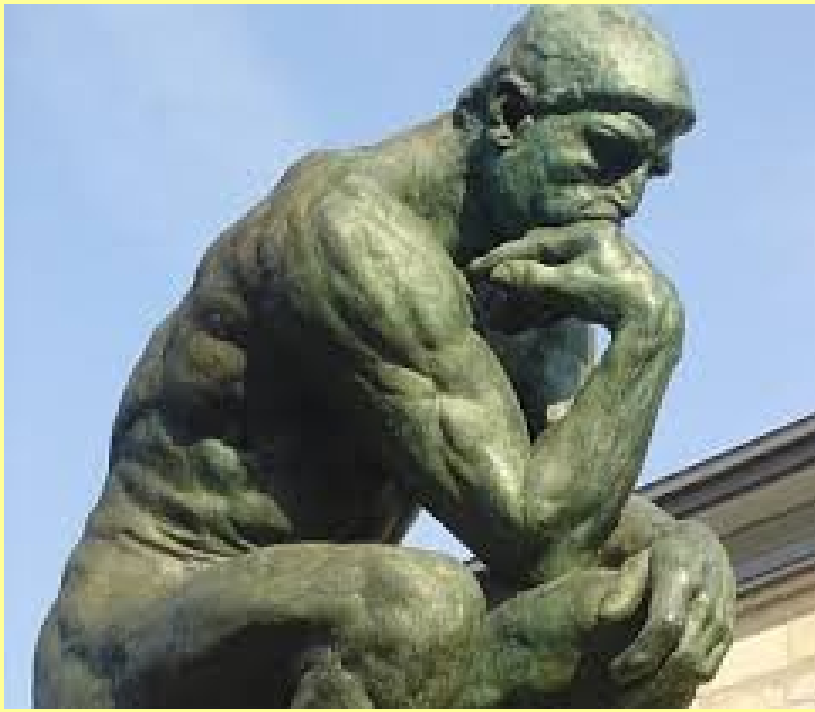
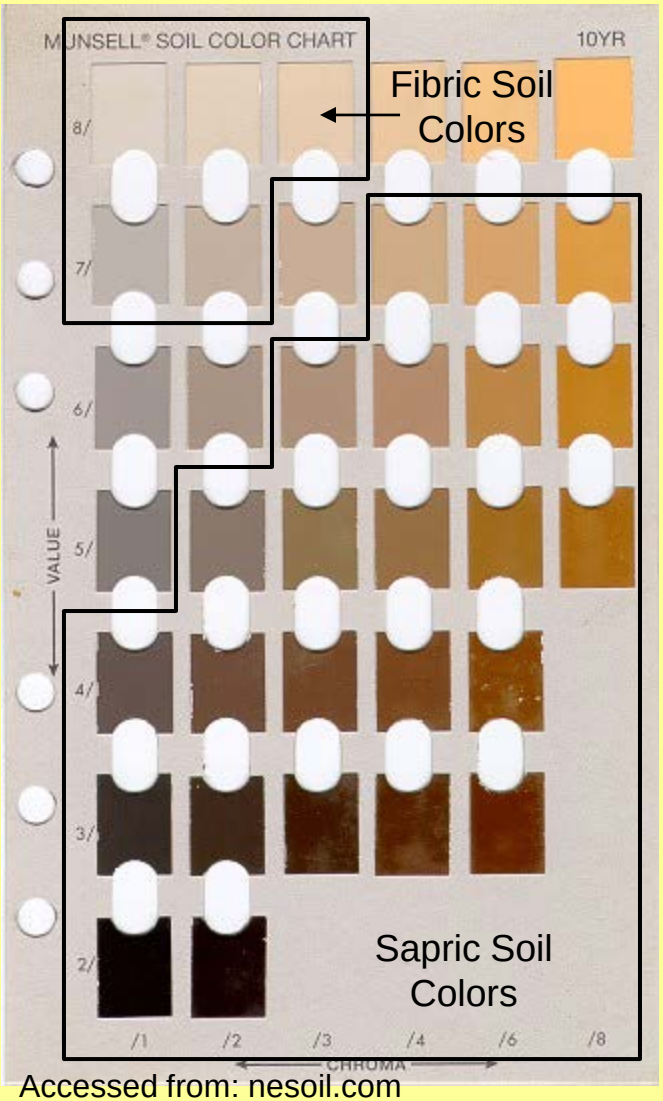


Application of Soil Taxonomy started with the 7th Approximation (1960) more than 50 years ago.

Maybe it is time to **"rethink"** Soil Taxonomy.



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ORGANIC SOIL MATERIALS AND SOIL CARBON

When do you use sapric?

When do you use muck?

When do we use hemic?

When do we use mucky peat?

When do we use fibric?

When do we use peat?

Why do we use different SOC contents to define mineral vs organic soil materials in wet soils compared to unsaturated soils?

Mineral soil material (less than 2.0 mm in diameter) ***either:***

1. Is saturated with water for less than 30 days (cumulative) per year in normal years and contains less than 20 percent (by weight) organic carbon; *or*
2. Is saturated with water for 30 days or more (cumulative) in normal years (or is artificially drained) and, excluding live roots, has an organic carbon content (by weight) of:
   a. Less than 18 percent if the mineral fraction contains 60 percent or more clay; *or*
   b. Less than 12 percent if the mineral fraction contains no clay; *or*
   c. Less than 12 + (clay percentage multiplied by 0.1) Percent.

Folistic Epipedon

Is an Ap horizon that, when mixed to a depth of 25 cm, has an organic-carbon content (by weight) of:

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.

In Soil Taxonomy

1) The terms peat and muck are only used in one place:

   "Material that has more organic carbon than in item 2 has been called peat or muck."

2) The terms sapric, hemic, and fibric are defined only for Histosols

2. Is an Ap horizon that, when mixed to a depth of 25 cm, has an organic-carbon content (by weight) of:

   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 (defined in chapter 2). Item 2 provides for a histic epipedon that is an Ap horizon consisting of mineral soil material. A histic epipedon consisting of mineral soil material can also be part of a mollic or umbric epipedon.

Melanic Epipedon

Required Characteristics

The melanic epipedon has *both* of the following:

1. An upper boundary at, or within 30 cm of, either the mineral soil surface or the upper boundary of an organic layer with andic soil properties (defined below), whichever is shallower; *and*

2. In layers with a cumulative thickness of 30 cm or more within a total thickness of 40 cm, *all* of the following:

   a. Andic soil properties throughout; *and*

   b. A color value, moist, and chroma of 2 or less throughout and a melanic index of 1.70 or less throughout; *and*

   c. 6 percent or more organic carbon as a weighted average and 4 percent or more organic carbon in all layers.

Mollic Epipedon

Required Characteristics

The mollic epipedon consists of mineral soil materials and, after mixing of the upper 18 cm of the mineral soil or of the whole mineral soil if its depth to a densic, lithic, or paralithic contact, a petrocalcic horizon, or a duripan (all defined below) is less than 18 cm, has the following properties:

1. When dry, *either or both*:

   a. Structural units with a diameter of 30 cm or less or secondary structure with a diameter of 30 cm or less; *or*

   b. A moderately hard or softer rupture-resistance class; *and*

2. Rock structure, including fine stratifications (5 mm or less thick), in less than one-half of the volume of all parts; *and*

3. *One* of the following:

   a. *Both* of the following:

      (1) Dominant colors with a value of 3 or less, moist, and of 5 or less, dry; *and*

      (2) Dominant colors with chroma of 3 or less, moist; *or*

   b. A fine-earth fraction that has a calcium carbonate equivalent of 15 to 40 percent and colors with a value and chroma of 3 or less, moist; *or*

   c. A fine-earth fraction that has a calcium carbonate equivalent of 40 percent or more and a color value, moist, of 5 or less; *and*

4. A base saturation (by NH_4OAc) of 50 percent or more throughout; *and*

5. An organic-carbon content of:

   a. 2.5 percent or more if the epipedon has a color value, moist, of 4 or 5; *or*

   b. 0.6 percent (absolute) more than that of the C horizon (if one occurs) if the mollic epipedon has a color value less than 1 unit lower or chroma less than 2 units lower (both moist and dry) than the C horizon; *or*

   c. 0.6 percent or more and the epipedon does not meet the qualifications in 5-a or 5-b above; *and*

6. The minimum thickness of the epipedon is as follows:

   a. 25 cm if:

      (1) The texture class of the epipedon is loamy fine sand or coarser throughout; *or*

      (2) There are no underlying diagnostic horizons (defined below) and the organic-carbon content of the underlying materials decreases irregularly with increasing depth; *or*

      (3) *Any* of the following, if present, are 75 cm or more below the mineral soil surface:

         (a) The upper boundary of the shallowest of any identifiable secondary carbonates or a calcic horizon, petrocalcic horizon, duripan, or fragipan (defined below); *and/or*

         (b) The lower boundary of the deepest of an argillic, cambic, natric, oxic, or spodic horizon; *or*

   b. 10 cm if the epipedon has a texture class finer than loamy fine sand (when mixed) and it is directly above a densic, lithic, or paralithic contact, a petrocalcic horizon, or a duripan; *or*

   c. 18 to 25 cm and the thickness is one-third or more of the total thickness between the mineral soil surface and:

      (1) The upper boundary of the shallowest of any identifiable secondary carbonates or a calcic horizon, petrocalcic horizon, duripan, or fragipan; *and/or*

      (2) The lower boundary of the deepest of an argillic, cambic, natric, oxic, or spodic horizon; *or*

   d. 18 cm if none of the above conditions apply; *and*

7. Phosphate:

   a. Content less than 1,500 milligrams per kilogram by citric-acid extraction; *or*

   b. Content decreasing irregularly with increasing depth below the epipedon; *or*

   c. Nodules are within the epipedon; *and*

8. Some part of the epipedon is moist for 90 days or more (cumulative) in normal years during times when the soil temperature at a depth of 50 cm is 5 °C or higher, if the soil is not irrigated; *and*

9. The *n* value (defined below) is less than 0.7.

Ochric Epipedon

The ochric epipedon fails to meet the definitions for any of the other seven epipedons because it is too thin or too dry, has too high a color value or chroma, contains too little organic carbon, has too high an *n* value or melanic index, or is both massive and hard or harder when dry. Many ochric epipedons have either a color value of 4 or more, moist, and 6 or more, dry, or chroma of 4 or more, or they include an A or Ap horizon that has both low color values and low chroma but is too thin to be recognized as a mollic or umbric epipedon (and has less than 15 percent calcium carbonate equivalent in the fine-earth fraction). Ochric epipedons also include horizons of organic materials that are too thin to meet the requirements for a histic or folistic epipedon.

The ochric epipedon includes eluvial horizons that are at or near the soil surface, and it extends to the first underlying diagnostic illuvial horizon (defined below as an argillic, kandic, natric, or spodic horizon). If the underlying horizon is a B horizon of alteration (defined below as a cambic or oxic horizon) and there is no surface horizon that is appreciably darkened by humus, the lower limit of the ochric epipedon is the lower boundary of the plow layer or an equivalent depth (18 cm) in a soil that has not been plowed. Actually, the same horizon in an unplowed soil may be both part of the epipedon and part of the cambic horizon; the ochric epipedon and the subsurface diagnostic horizons are not all mutually exclusive. The ochric epipedon does not have rock structure and does not include finely stratified fresh sediments, nor can it be an Ap horizon directly overlying such deposits.

Plaggen Epipedon

The plaggen epipedon is a human-made surface layer 50 cm or more thick that has been produced by long-continued manuring.

A plaggen epipedon can be identified by several means. Commonly, it contains artifacts, such as bits of brick and pottery, throughout its depth. There may be chunks of diverse materials, such as black sand and light gray sand, as large as the size held by a spade. The plaggen epipedon normally shows spade marks throughout its depth and also remnants of thin stratified beds of sand that were probably produced on the soil surface by beating rains and were later buried by spading. A map unit delineation of soils with plaggen epipedons would tend to have straight-sided rectangular bodies that are higher than the adjacent soils by as much as or more than the thickness of the plaggen epipedon.

Required Characteristics

The plaggen epipedon consists of mineral soil materials and has the following:

1. Locally raised land surfaces; *and* one or both of the following:

   a. Artifacts; *or*

   b. Spade marks below a depth of 30 cm; *and*

2. Colors with a value of 4 or less, moist, 5 or less, dry, and chroma of 2 or less; *and*

3. An organic-carbon content of 0.6 percent or more; *and*

4. A thickness of 50 cm or more; *and*

5. Some part of the epipedon that is moist for 90 days or more (cumulative) in normal years during times when the soil temperature at a depth of 50 cm is 5 °C or higher, if the soil is not irrigated.

Umbric Epipedon

Required Characteristics

The umbric epipedon consists of mineral soil materials and, after mixing of the upper 18 cm of the mineral soil or of the whole mineral soil if its depth to a densic, lithic, or paralithic contact, a petrocalcic horizon, or a duripan (all defined below) is less than 18 cm, has the following properties:

1. When dry, *either or both*:

   a. Structural units with a diameter of 30 cm or less or secondary structure with a diameter of 30 cm or less; *or*

   b. A moderately hard or softer rupture-resistance class; *and*

2. Rock structure, including fine stratifications (5 mm or less thick), in less than one-half of the volume of all parts; *and*

3. *Both* of the following:

   a. Dominant colors with a value of 3 or less, moist, and of 5 or less, dry; *and*

   b. Dominant colors with chroma of 3 or less, moist; *and*

2. Is an Ap horizon that, when mixed to a depth of 25 cm, has an organic-carbon content (by weight) of:

   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.

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2. Rock structure, including fine stratifications (5 mm or less thick), in less than one-half of the volume of all parts; *and*

3. *Both* of the following:

   a. Dominant colors with a value of 3 or less, moist, and of 5 or less, dry; *and*

   b. Dominant colors with chroma of 3 or less, moist; *and*

Mollic epipedon: Color, crushed, & smoothed has a value 3 or less moist & chroma 3 or less moist (3/3 or darker). Dry color must have a value of 5 or less. Thickness is at least 18 cm and one-third of the depth from the soil surface to the lower boundary of the diagnostic subsurface horizon if that depth is <75 cm. Otherwise, at least 25 cm thick. Base saturation >50% throughout.

Soil Classification Field Guide Workgroup

to advise and assist in the development of a “Field Classification Guide for Soils.”

“There are several instances of circular reasoning in the use of the keys. For example, you must identify the particle-size class to identify soil order. But you must identify control section before you can identify PSC, which means you must know the classification all the way to subgroups before you can identify the control section. And the introduction to PSC and contrasting and substitute PSC is barely comprehendible to experienced soil scientists.”

“If we want to simplify Soil Taxonomy, these are issues that I think should be addressed.”

John Galbraith

Sandy Hapludalf?

or

Udipsamment?

It depends on 3% difference in clay

Sandy Hapludalf?

or

Udipsamment?

It depends on 3% difference in clay

But why not an Inceptisol?

Cambic Horizons in Pennsylvania Soils

Edward J. Ciolkosz and William J. Waltman[1]

Sandy Texture

Soil Taxonomy (Soil Surv. Staff, 1996) excludes color Bw horizons in well-drained soils with very sandy textures from cambic horizons. In order for a soil horizon to qualify as a cambic horizon, its texture must be very fine sand, loamy very fine sand, or finer. Guy D. Smith's rationale for this requirement was that he wanted to group all the sandy soils together in Entisols (Psamments) for interpretation reasons and that color Bs in sandy soils may develop very rapidly, and only indicate very weak pedogenesis (Brasfield, 1983). The second reason is illogical because the concept of the cambic horizon is a very weakly developed B. The lack of logic in the textural exclusion also is pointed out by the fact that acid, sandy, Woodfordian age outwash or dune soils are classified as Entisols while mine soils 40 years old are classified as Inceptisols (Ciolkosz et al., 1985). Pedologically it also is somewhat illogical that if sandy soils have less than 35% rock fragments, they are classified as Entisols; but if they have greater than 35% rock fragments, they are classified as Inceptisols. It is most logical that A-C soils should be classified as Entisols (no cambic) while all A-Bw-C soils should be classified as Inceptisols (cambic). Therefore, the texture requirement in most cases is not a useful criteria in the definition of the cambic horizon, and *Soil Taxonomy* should be amended to exclude this requirement in the definition of the cambic horizon.

Just some other questions to rethink about

Why Aridisols?

We don’t have Udisols, Xerisols, etc.

Why aren’t all of the wet soils put in a single order?

Why use moisture regimes at the suborder level?

Family level makes much more sense (I think)