

APPENDIX II – DESIGNATIONS FOR SOIL HORIZONS AND LAYERS

Four kinds of symbols are used in combination as a shorthand to designate key properties and interpretations about soil horizons and layers:

- **Capital letters** are used to designate master horizons and layers.
- **Lower case letters** are used as suffixes to indicate specific characteristics of the master horizon and layer;
- **Arabic numerals** are used both as suffixes to indicate vertical subdivisions within a horizon or layer and as prefixes to indicate discontinuities.
- **Notation marks** are used to convey additional, subsidiary details regarding the horizon or layer.

Note: *Genetic horizons* are not the equivalent of the *diagnostic horizons* of the U.S. Soil Taxonomy. Designations of genetic horizons express a qualitative judgment (an interpretation derived from morphology and other soil properties) of pedogenesis believed to have taken place. Diagnostic horizons are quantitatively defined features used to differentiate between taxa in U.S. system of Soil Taxonomy. Horizon symbols indicate the direction of presumed pedogenesis while diagnostic horizons indicate the magnitude of that expression.

Master Horizons and Layers

O horizons – Organic soil materials (other than Limnic materials). Any mineral content is commonly a small percentage by volume and < 80% by weight.

A horizons – Mineral soil formed at the surface or below an O horizon, that exhibits little or no remnant rock structure, and one or more of:

- i) an accumulation of humified organic matter intimately mixed with the mineral fraction, and not dominated by properties characteristic of E or B horizons;
- ii) have properties resulting from cultivation, pasturing, or similar kinds of disturbance.
- iii) morphology resulting from surficial processes different from the underlying B or C horizon. (Excludes recent eolian or alluvial deposits that retain primary stratification).

E horizons – Mineral soil in which the main feature is some loss of silicate clay, iron, aluminum, organic matter, or some combination of these, leaving a net concentration of sand and silt particles of quartz or other resistant materials; little or no remnant rock structure; typically lighter in color (higher color value or chroma) and coarser texture than overlying mineral layers.

B horizons – Mineral soil, typically formed below an O, A, or E horizon that exhibits little or no remnant rock structure, and has one or more of the following:

- i) illuvial accumulation of silicate clay, iron, aluminum, humus, carbonates, gypsum, silica, or salt more soluble than gypsum (one or more);
- ii) evidence of removal, addition or transformation of carbonates, gypsum or more soluble salts;
- iii) residual concentrations of oxides, sesquioxides, and silicate clays (one or more);
- iv) sesquioxide coatings (that make the horizon conspicuously lower in color value, higher in chroma, or redder in hue than overlying and underlying horizons without apparent illuviation of iron);
- v) alterations that form silicate clays or liberate oxides (or both) and that form pedogenic structure;
- (vi) brittleness; or
- (vii) Strong gleying in the presence of aquic conditions (or artificial drainage); layers with gleying but no other pedogenic change and are not B horizons. Most B horizons are or were subsurface horizons. Some formed at the surface by the accumulation of evaporates. Cemented and brittle layers that have other evidence of pedogenesis are included as B horizons.

C horizons – Horizons or layers of mineral soil, soft bedrock (excluding Cemented to Indurated bedrock unless highly fractured); little affected by pedogenic processes and lack properties of O, A, E, or B horizons. The material of C horizon may or may not be the parent material of the solum above. The C horizon may have been modified even if there is no evidence of pedogenesis.

L (Limnic) horizon, layers, or materials – Limnic soil materials are sediments deposited in a body of water (subaqueous) and dominated by organic materials from aquatic plants (e.g., algae, diatoms), animal fragments and fecal material; may contain lesser amounts of clayey mineral material (Schoeneberger et al., 2012). L horizons include coprogenous earth (sedimentary peat), diatomaceous earth, and marl. They have subordinate suffixes of co, di, or ma - not used with other suffixes (USDA, 2006).

M layers – Root-limiting subsoil layers of nearly continuous, horizontally oriented, human-manufactured materials (e.g., geotextile liners, asphalt, concrete, rubber, and plastic). USDA, 2006 (Keys to Soil Taxonomy; 10th ed).

R layers – Continuous, coherent hard bedrock (e.g., granite, basalt, quartzite and indurated limestone or sandstone that is sufficiently coherent to make hand digging impractical - i.e., ≥ Strongly Cemented Cmentation Classes; Soil Survey Staff, 1993).

W layer – A layer of liquid water (W; e.g., water beneath a floating sphagnum bog), or permanently frozen ice (Wf; e.g., permanent permafrost) within or beneath the soil, but excludes layers of water and ice above the soil. (Schoeneberger et al, 2002).

Transitional Horizons

Two main kinds and one special convention for transitional horizons are recognized:

- i) The horizon is dominated by properties of one master horizon but has subordinate properties of another. Two capital letter symbols are used in combination, identifying each of the contributing Master horizons (AB, EB, BE, BC, etc.). The master horizon symbol listed first designates the kind of master horizon whose properties dominate the transitional horizon, with the second capital letter identifying the horizon whose properties are present but secondary.
- ii) Distinct (discrete) parts of two horizons occur in the same layer. Each master horizon is identified by the appropriate capital letter, which are then separated by a virgule (/), as in E/B, B/E, or B/C. The first symbol is that of the dominant horizon material (makes up the greater volume).
- iii) A special convention is used for lamellae (E and Bt) or thin E horizons within a Bhorizon (B and E).

AB – A horizon with characteristics of both an overlying A horizon and an underlying B horizon, but which is more like the A than the B.

AE – A horizon with characteristics of both an overlying A horizon and an underlying E horizon, but which is more like the A than the E.

AC – A horizon with characteristics of both an overlying A horizon and an underlying C horizon, but which is more like the A than the C.

EA – A horizon with characteristics of both an overlying A horizon and an underlying E horizon, but which is more like the E than the A.

EB – A horizon with characteristics of both an overlying E horizon and an underlying B horizon, but which is more like the E than the B.

EC – A horizon with characteristics of both an overlying E horizon and an underlying C horizon, but which is more like the E than the C.

BA – A horizon with characteristics of both an overlying A horizon and an underlying B horizon, but which is more like the B than the A.

BE – A horizon with characteristics of both an overlying E horizon and an underlying B horizon, but which is more like the B than the E.

BC – A horizon with characteristics of both an overlying B horizon and an underlying C horizon, but which is more like the B than the C.

CB – A horizon with characteristics of both an overlying B horizon and an underlying C horizon, but which is more like the C than the B.

CA – A horizon with characteristics of both an overlying A horizon and an underlying C horizon, but which is more like the C than the A.

E/A – A horizon comprised of discrete, intermingled bodies of E and A horizon components; E material dominates with lesser but distinct bodies of A material present.

E/B – A horizon comprised of discrete, intermingled bodies of E and B horizon components; E material dominates with lesser but distinct bodies of B material present.

E and Bt – Presence of thin, heavier textured lamellae (Bt material) within a predominantly E horizon with less clay.

B and E – Presence of thin, lighter textured elluviated (E) material within a predominantly heavier textured Bt horizon (e.g., thick lamellae or other B horizon material).

B/A – A horizon comprised of discrete, intermingled bodies of B and A horizon components; B material dominates with lesser but distinct bodies of A material present.

B/E – A horizon comprised of discrete, intermingled bodies of E and B horizon components; B material dominates with lesser but distinct bodies of E material present.

B/C – A horizon comprised of discrete, intermingled bodies of B and C horizon components; B material dominates with lesser but distinct bodies of C material present.

C/B – A horizon comprised of discrete, intermingled bodies of C and B horizon components; C material dominates with lesser but distinct bodies of B material present.

C/A – A horizon comprised of discrete, intermingled bodies of C and A horizon components; C material dominates with lesser but distinct bodies of A material present.

Horizon suffixes (Subordinate Distinctions) Within Master Horizons and Layers

a – Highly decomposed organic matter where rubbed fiber content averages <17% (by volume); used only with O master horizon. Refer to also **e**, **i**.

aa – Accumulation of anhydrite (CaSO_4). (*Proposed, but not accepted*)

b – Buried genetic horizons in a mineral soil (not used with organic materials or to separate organic from mineral materials).

- c** – Concretions or nodules with significant accumulations of cemented bodies enriched with iron, aluminum, manganese or titanium [cement not specified by this suffix except that it excludes a predominance of silica (refer to **q**); not used for carbonates (calcite, dolomite), or soluble salts (refer to **z**).
- co** – Coprogenous earth (used only with L master horizon); organic materials deposited under water and dominated by fecal material from aquatic animals.
- d** – Physical root restriction due to high bulk density, either natural (e.g., dense lodgment till) or human-induced (e.g., plow pan).
- di** – Diatomaceous earth (used only with L master horizon); materials deposited under water and dominated by siliceous diatom remains.
- e** – Moderately (intermediately) decomposed organic matter; rubbed fiber content is 17 to < 40% (by volume); used only with O master horizon. Refer to also **a**, **i**.
- f** – Permafrost (permanently frozen subsurface soil or ice); excludes seasonally frozen layers or dry permafrost (refer to **ff**).
- ff** – Dry permafrost (permanently frozen soil and does not contain enough ice to be cemented by ice - no continuous ice bodies (refer to **f**); not used for seasonally frozen soil.
- g** – Strong gley (iron has been reduced and pedogenically removed, or in which iron has been preserved in a reduced state because of saturation with stagnant water; typically ≤ 2 chroma colors and may also have other redoximorphic features. (Not used for geogenic colors inherited from original parent material, such as grey shale).
- h** – Illuvial organic matter (OM) accumulation; with B master horizon: indicates accumulation of illuvial, amorphous, dispersible organic matter-sesquioxide complexes that coat sand grains and silt particles and may fill pores. Use Bhs for significant accumulation of sesquioxides and moist chroma color and value of ≤ 3 .
- i** – Slightly decomposed organic material; rubbed fiber content is > 40% (by volume); used only with O master horizon. Refer to also **a**, **3**.
- j** – Jarosite accumulation, $KFe_3(SO_4)_2(OH)_6$; e.g., acid sulfate soils.
- jj** – Evidence of cryoturbation; e.g., irregular or broken horizon boundaries, sorted rock fragments (patterned ground), or organic matter especially in lower boundary between the active layer and a permafrost layer.
- k** – Visible accumulation of pedogenic carbonates, commonly calcium carbonate ($CaCO_3$); < 50% (by volume - estimated).
- kk** – Major accumulation (e.g., horizon engulfment) by secondary (pedogenic) carbonates, commonly calcium carbonate ($CaCO_3$). Major accumulations of visible $CaCO_3$ (plugged soil fabric > 50% by volume - estimated; corresponds to Stage III or higher carbonate morphogenetic stages - Gile, et al, 1966).
- m** – Continuous or nearly continuous pedogenic cementation or induration of the soil matrix (> 90% cemented, even if fractured); physically root restrictive. Dominant cement type can be indicated by additional letter combinations: carbonates (km or kkm), silica (qm), carbonates and silica (kqm), iron (sm), gypsum (yym), or salts more soluble than gypsum (zm).
- ma** – Marl (used only with L master horizon); sediments deposited under water and dominated by a mixture of mineral clay and carbonates (e.g., $CaCO_2$); typically gray or beige in color.
- n** – Pedogenic, exchangeable sodium accumulation.
- o** – Residual accumulation of sesquioxides.
- p** – Tillage or other disturbance of the surface layer by cultivation, pasturing, etc.; use Op for disturbed organic surface, Ap for disturbed mineral surface even if the layer clearly was originally an E, B, C, etc.
- q** – Accumulation of secondary (pedogenic) silica.
- r** – Weathered or soft bedrock (root restrictive saprolite or soft bedrock such as weathered rock, or partly consolidated sandstone, siltstone or shale). Materials are sufficiently incoherent to permit hand digging with a spade (Excavation Difficulty classes are *Low to High*). Used with C master horizon.
- s** – Significant illuvial accumulation of amorphous, dispersible sesquioxides and organic matter complexes; moist color value or chroma of the horizon are ≥ 4 . Used with the B master horizon; used with h, as in Bhs, if moist color value and chroma are ≤ 3 .
- se** – Presence of sulfides (in mineral or organic horizons). Typically dark colors (e.g., value ≤ 4 , chroma ≤ 2); may have a sulfurous odor.
- ss** – Presence of slickensides; e.g., oblique shear faces of 20-60° off horizontal; caused by shrink-swell action of clays. Commonly, wedge-shaped peds and seasonal surface cracks are also present.
- t** – Accumulation of silicate clays (i.e., clay films, lamellae, or clay bridging in some part of the horizon) that either has formed in the horizon and is subsequently translocated or has been moved into it by illuviation.
- u** – Presence of human-manufactured materials (artifacts); e.g., asphalt, bricks, plastic, glass, metals, construction debris, garbage.

- v** – Plinthite which is composed of iron-rich, humus-poor, reddish mineral material that is firm or very firm when moist and that hardens irreversibly when exposed to the atmosphere under repeated wetting and drying.
- w** – Incipient color or pedogenic structure development in a horizon but with minimal illuvial accumulation of materials. Used only with B horizons; excluded from use with transition horizons; e.g., AC.

- x** – Fragipan or fragic characteristics (pedogenically developed brittleness, firmness, bleached prisms, or high bulk density; root restrictive).
- y** – Accumulation of gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$); < 50% by vol. (estimated).
- yy** – Dominance of gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$); $\approx \geq 50\%$ by vol. (estimated); light colored (e.g., value > 7, chroma ≤ 4). May be pedogenically derived or inherited transformation of primary gypsum from parent material.
- z** – Pedogenic accumulation of salts more soluble than gypsum (e.g., NaCl).