ICOMANTH Circular Letter #5 available at http://clic.cses.vt.edu/icomanth/

International Committee for the Classification of Anthropogenic Soils
(ICOMANTH)

Circular Letter #5 released May 25, 2004

Comments and Responses due September 1, 2004

Introduction


- Sections I - V propose changes to the USDA-NRCS system, and will be officially submitted unless amended by feedback from this Circular Letter. The USDA-NRCS system is defined here to include Soil Taxonomy (Soil Survey Staff, 1999), Keys to Soil Taxonomy (Soil Survey Staff, 2003), the Soil Survey Manual (SSM) (Soil Survey Division Staff, 1993), the National Soil Survey Handbook (NSSH) (USDA-NRCS, 2003), and the Field Book for Describing and Sampling Soils (Schoeneberger et al., 2002).

- Section VI provides examples of applications of the proposed changes.

- Section VII references responses to Circular Letter #4.

- Section VIII provides the rationale behind some of the decisions in this Circular Letter.

- Section IX poses questions to the readers.

Future Circular Letters will deal with defining new diagnostic materials, conditions, or horizons, and proposing new classes in Soil Taxonomy for human-altered and -transported soils. Class separations for human-altered and -transported soils that have been made in the World Reference Base (WRB) (Kosse, 1994; Rossiter and Burghardt, 2003) and other taxonomic systems may be used as a reference. Several of these articles are included on Version 1.0 of the Anthropogenic Soils CD-ROM (Galbraith et al., 2002), available from ICOMANTH at http://clic.cses.vt.edu/icomanth/.

Purpose

The term “anthropogenic soil” has been defined in many different ways (Galbraith et al., 2002, Ch. 2 to 14). An excellent summary of the use of “anthropogenic soil” and the categories that have been devised for these soils was presented at the IUSS meeting in Bangkok in 2002 (Dudal, et al., 2002). The term has been variably used for soils formed in human-transported materials, soils formed in human-manufactured materials, soils that have had all diagnostic horizons destroyed in-situ by singular or periodic human chemical and mechanical disturbance, soils in excavated areas, and soils such as paddy soils whose ongoing genesis is strongly influenced by nearly continuous human activity. ICOMANTH will focus on discussion and description of most of these kinds of soils, regardless of whether they meet all definitions of anthropogenic soils. However, ICOMANTH will not attempt to classify contaminated soils, the soils that contain materials that pose a known health or safety risk to those who attempt to habitate, farm, sample, analyze, or map them. Since contaminated soils may be described and their location identified without contact if due precautions are used, ICOMANTH will suggest terms for their description. Published information about health hazards and contaminated soils occur on Version 1.0 of the Anthropogenic Soils CD-ROM (Galbraith et al., 2002, Ch. 19).
Section I. Proposed New Terms for Human-altered and -transported Soils:

Some human-altered and -transported soils cannot be adequately described with the existing set of terms and materials found in the USDA-NRCS system. ICOMANTH proposes the following terms for addition to the USDA-NRCS system:

A). Human transported materials (HTM) – any material (artifacts, organic materials, soil, rock, or sediment) moved horizontally into a pedon from a source area outside of that pedon by directed (intentional) human activity, usually with the aid of machinery (from humanus; akin to Latin homo human being + Latin transportare, from trans- + portare to carry).

HTM is a kind of parent material and should be recognized as such. According to NSSH Part 618.40, “Parent material is the unconsolidated material, mineral or organic, from which the soil develops.” and “Soil properties and landscape information infer parent material.” Therefore ICOMANTH proposed that HTM be added as a new term for specific kind of parent material in the NSSH Part 629.02 (c) [http://soils.usda.gov/technical/handbook/contents/part629glossary1.html] and defined as: “human-transported material – Unsorted, unconsolidated artifacts and/or earthy materials deposited by directed human activity without subsequent reworking by wind, gravity, water, or ice. Types include: a heterogeneous mixture of artifacts and/or clay, silt, sand, and gravel, stones, and boulders of various lithologies aerially deposited and imbedded within a finer matrix that can be any texture (similar to a diamicton); and unconsolidated, elasic material subaerially deposited by running water, including artifacts and/or gravel, sand, silt, clay, and various mixtures of these (similar to alluvium). HTM can be reworked by wind, gravity, water, and ice to become a glacial diamicton, colluvium or alluvium.”

Although HTM may be directly or indirectly transported due to human activity, indirectly transported materials will not be considered HTM. Directly transported materials include earthy and manufactured materials. Indirectly transported materials include dust from mining, road traffic, farming, or manufacturing; smokestack and combustion emissions.

Directly transported and deposited materials results in the creation of a constructional type of landform as defined in the NSSH Part 629.02 (c): “anthropogenic feature - An artificial feature on the land surface, having a characteristic shape and range in composition, composed of unconsolidated earthy, organic materials, artificial materials, or rock, that is the direct result of human manipulation or activities; can be either constructional (e.g., artificial levee) or destructional (quarry).” Such constructional features are alluded to in Soil Taxonomy in the description of the epipedons, but are not used as evidence for class placement (Soil Survey Staff, 1999, p. 26-28). Indirectly transported materials do not create constructional landforms within a short amount of time.

In June, 2003 the National Cooperative Soil Survey Standing Committee on Standards produced a report concerning recommendations in ICOMANTH Circular Letter #4 (posted on the ICOMANTH web site (http://clic.cses.vt.edu/icomanth/circlet.htm). According to the National Cooperative Soil Survey Standing Committee on Standards:
In June, 2003 the National Cooperative Soil Survey Standing Committee on Standards produced a report concerning recommendations in ICOMANTH Circular Letter #4 (posted on the ICOMANTH web site (http://clic.cses.vt.edu/icomanth/)). According to the National Cooperative Soil Survey Standing Committee on Standards:

"The experience from our testing of the circular letter proposals with existing Official Series Descriptions revealed a progression from easily identified HTM on one end of a continuum of human-influenced soils to more difficult identification and lack of agreement on the other end of the continuum."

<table>
<thead>
<tr>
<th>Fill with artifacts throughout</th>
<th>Clean fill over fill with artifacts</th>
<th>Clean Fill over buried Natural Soil</th>
<th>Clean Fill (Deep)</th>
</tr>
</thead>
</table>

Increasing Difficulty (decreasing agreement)

Because of the range of difficulty in identifying HTM from specific properties observed and described within the soil, the identification of HTM as a parent material will be left to the judgment of soil scientists, based on soil properties, analogous information, and expertise. This would be no different than the current methods used by soil scientists when identifying a lithologic discontinuity (Keys to Soil Taxonomy, p. 32) or different types of glacial till from glacial outwash (NSSH Part 629.02 (e)). Some clues to the identification of HTM on constructional anthropogenic features (and not in active floodplain, avalanche, or landslide deposits) include:

1) Artifacts (defined below); or
2) Easily weatherable minerals or rock fragments, or masses of soft, secondary minerals that have abrupt contact edges with dissimilar soil material; or
3) Easily weathered masses of soft, secondary minerals rock fragments that occur in common or greater abundance in near-surface horizons; or
4) Freshly fractured rock fragments with splintered or sharp edges; or
5) Mechanically abraded mineral grain faces; or
6) Bridging voids between rock fragments; or
7) Randomly oriented rock fragments; or
8) Random lithochromic motting; or
9) Masses of contrasting parent materials in the same horizon or layer that have differences in texture, and/or type and percent of rock fragments; or
10) Dark colored (value and chroma 3 or less), high carbon rock fragments such as coal or carbonaceous shale; or
11) Abrupt layer boundary or boundaries (excluding the lower boundary of a plow layer) not associated with processes that produce diagnostic horizons such as natric, kandic, argillic, fragipan, duripan, petrocalcic, petroferric contact, petrogypse, placic, or spodic horizons; or
12) A layer of anthropogenically-compacted dense materials or isolated fragments of dense materials; or
13) Random magnetic orientation within the soil matrix of a single horizon or layer; or
14) Irregular distribution of organic carbon not associated with natural flooding, avalanche, or landslide events, leaching or podzolization; or
15) Scars or scrape marks left by mechanical tools during excavation or deposition events; or
16) Fine stratification of materials on constructional anthropogenic features, or
17) Historical evidence or observation of human transportation.
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B) Artifacts - Something created (or modified) by humans usually for a practical purpose (from Latin *arte* by skill + *factum* to do). Artifacts are already mentioned in Soil Taxonomy in the description of the epipedons (Soil Survey Staff, 1999, p. 26-28) but are not defined. The spade marks described for the plaggen epipodin in Soil Taxonomy (p. 26) is one example. Therefore ICOMANTH proposed that the term “artifacts” be added to the appropriate place in the Soil Survey Manual, chapter 3, found on-line at: http://soils.usda.gov/technical/manual/), as well as the descriptive information in the sections under “Artifact Categories” described below.

The proposed definition for artifacts is: “artifacts - something created (or modified) by humans, usually for a practical purpose as part of a manufacturing, excavation, or construction process. Examples include: wood products, liquid petroleum products, coal combustion by-products, asphalt, fibers and fabrics, bricks, cinder blocks, concrete, plastic, glass, rubber, paper cardboard, iron and steel, altered metals and minerals, sanitary and medical waste, garbage and landfill waste, and scrape marks and freshly-broken rock surfaces left in the soil or on bedrock by machinery and equipment. Types include particulate artifacts, discrete artifacts, and liners (defined separately).”

Artifacts in or on the soil should be described if they are deposited within or on top of the soil and become part of the soil and are durable enough to persist (resist weathering and leaching) for a few decades or more, or else the descriptions become outdated and soil series concepts become based on transient properties. Artifacts may be added to the soil and occur in or on the soil as particulate-sized, discrete objects, or continuous liner artifacts. From a practical purpose, artifacts that become part of the soil should be first split into categories that relate to human safety concerns, and then into size and continuity categories that relate to their properties and behavior as part of the soil (Table 1). These categories are defined below and may lend themselves to the creation of new differentiae and new classes in Soil Taxonomy in the future.

Table 1. Artifact identification matrix.

<table>
<thead>
<tr>
<th></th>
<th>Particulate</th>
<th>Discrete</th>
<th>Liners†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innocuous</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Noxious</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

† (from Latin *linea*, made of flax and a limit (from Latin *limit* boundary) or a restraint (a device that restricts movement))

Artifact Categories:

1) Human-safety Categories:

These categories describe the degree of risk to humans who live on or work with these soils. Soils with a high amount of dangerous or harmful artifacts will not be fully characterized or classified by ICOMANTH, but may need to be described and identified as being harmful using the following terms to be added to the Soil Survey Manual.

a) “Innocuous artifacts - Harmless; producing no injury (from Latin *innocuous*, from *in-* + *nocere*). These artifacts have not been documented to cause harm to humans unless they have sharp edges. Examples include untreated wood products, iron, bricks and cinder blocks, concrete, plastic, glass, rubber, organic fibers, inorganic fibers, unprinted paper and cardboard, and some mineral and
metal products. Any sharp innocuous artifacts (or natural objects) can cause injury, but the materials themselves are still considered innocuous.”

b) “Noxious artifacts - Potentially harmful or destructive to living beings unless dealt with carefully; dangerous, involving danger; able to or likely to inflict injury or harm regardless of their shape (from Latin innocuus, from noxa. Harm). The harm may be immediate or long-term, or through direct or indirect contact. Examples include Arsenic-treated wood products, batteries, waste and garbage, radioactive fallout, liquid petroleum products, asphalt, coal ash, paper printed with metallic ink, and some mineral and metal products.” The specific artifact categories that are presumed to be noxious have been underlined in Part 2) above. The potential for risk or harm of chemicals and some particulate artifacts can be determined based on comparison with USEPA standards for maximum contaminant and health advisory levels (http://www.epa.gov/).

2) General Size and Continuity Categories:

These categories describe the size and degree of lateral continuity of the artifacts so that interpretations can be made based on their properties.

a) “Particulate artifacts - Artifacts < 2mm in size are proposed to be considered part of the fine earth fraction of soils and are found in or on the soil but not arranged or compacted into a layer to impede soil, roots, or water. Examples include sand topdressing, municipal sludge residue, coal ash, and detritus of larger artifacts.”

b) “Discrete artifacts - Artifacts ≥ 2mm are considered to be fragments found in the soil but not arranged or compacted into a layer to impede soil, roots, or water. Examples include bricks, concrete, wood products, iron rods, asphalt, and discontinuous or broken pieces of liners.”

These specific examples of discrete artifacts can be used as description and database entries, or the exact type of artifact may be described (underlined categories are considered noxious as described in Section II below):

- Treated Wood Products
- Untreated Wood Products
- Liquid Petroleum Products
- Coal Combustion By-products
- Asphalt
- Organic Fibers
- Inorganic Fibers
- Bricks
- Cinder Blocks
- Concrete
- Plastic
- Glass
- Rubber products
- Printed Paper (such as magazines, advertisements, packaging, and newspapers)
- Unprinted Paper and Cardboard
- Iron and Steel
Sanitary and Medical Waste
Garbage and Landfill Waste
Other Metal Products† (name of the dominant metal/s may be added in the description in parentheses, or the major types estimated separately)
Other Mineral Products† (the name of the mineral should be added in the description in parentheses, or the major types estimated separately)
† These materials should be identified clearly so they can be correlated to the correct human-safety category below.

c) “Liners – Artifacts that form continuous or nearly-continuous layer or membrane buried in the subsoil or substratum at a depth of 18 cm or more and used for structural support or as a soil, roots, or water barrier. Liners 1 cm or more thick are described as a soil layers. Thinner liners are described as a special feature at the base of the horizon overlying the liner. Liners are arranged or constructed to impede soil, roots, or water. Therefore a horizontally-placed liner determines the lower rooting depth of the soil, in the same way that a lithic, paralithic, or densic contact does. Examples of continuous horizontal liners include asphalt, poured concrete, plastic or rubber sheeting, and geotextile fabric (polyethylene) that have been covered by human-transported material.”

Horizontal liners occur underneath a variety of HTM in landfills, buildings, roadbeds, runways, under wetlands, or other special use areas. Vertical liners are not considered here. Liners are soil-, root-and sometimes water-limiting when emplaced and affect the depth class and available water holding capacity of the soil. Rubber liners are used for small projects such as fishponds but are unlikely materials for larger projects. The following are examples of liners:

Asphalt - A dark bituminous substance that is obtained as a residue in petroleum refining and that consists chiefly of hydrocarbons, and an asphalthic composition used for pavements and as a waterproof cement (from Greek asphaltos). The degree of density decreases as the asphalt weathers and the byproducts are leached or consumed as a C source by microorganisms.

Concrete - A hard strong building material made by mixing a cementing material (as “Portland cement”) and a mineral aggregate (as sand and gravel) with sufficient water to cause the cement to set and bind the entire mass (from Latin concreto, to grow together). Also “reinforced” concrete: concrete in which metal (as steel) is embedded so that the two materials act together in resisting

Plastic – Any of numerous organic synthetic or processed materials that are mostly thermoplastic or thermosetting polymers of high molecular weight and that can be made into objects, films, or filaments (from Greek plastikos, from plastsein to mold, form).

Geotextile – A woven or knit fabric such as polyethylene used in the earth or underground, typically made of durable artifact materials (from Greek ge-, geO-, from ge, earth and from Latin texere, woven).

Rubber – an elastic substance made from the milky sap of certain tropical plants or made synthetically by chemical processes (India rubber).
3) Consistence may be described using the existing terms (SSM Table 3-14 and NSSH 618.27 (i)) for rupture resistance such as, plasticity, toughness, and/or manner of failure if that property is determined to be helpful to understanding the nature of the artifacts. Only those terms determined to be appropriate for the artifact being described are recommended for use.

4) Buried artifacts made up of decomposable natural organic materials should be identified as such so that the soil can be properly interpreted for subsidence and methane gas production problems.

5) The excavation difficulty of liners may be described if that is important to soil interpretations (see Table 3-21 of the SSM – Excavation Difficulty Classes).

Section II. Proposed Modification to Existing Definitions of Fragments:

According to the NSSH 618.27 (a):

"Fragments are unattached cemented pieces of bedrock, bedrock-like material, durinodes, concretions, and nodules 2 mm or larger in diameter; and woody material 20 mm or larger in organic soils.

Fragments are separated into three types: rock fragments, pararock fragments, and wood fragments."

ICOMANTH proposes that the definition be modified to read (changes in bold italics and strikethrough text):

"Fragments are unattached cemented pieces of bedrock, bedrock-like material, discrete artifacts, durinodes, concretions, and nodules 2 mm or larger in diameter; and woody material 20 mm or larger in organic soils.

Fragments are separated into three four types: rock fragments, pararock fragments, discrete artifact fragments, and wood fragments."

NOTE: The term “discrete artifact” is described in Section I above.

Section III: Proposed Additions to Existing Texture Terms:

1) ICOMANTH proposes that particulate artifacts be added to the Soil Survey Manual as a Texture Modifier (and also NSSH Exhibit 618-15 and part 618.67 (h) (2) (vi)) and defined as: “Particulate artifactual -- material that contains 15 percent or more by volume particulate artifacts.” following the example for Gypsiferous.

2) ICOMANTH proposes that the term “discrete artifacts” be used as a “term used in lieu of texture” (NSSH Exhibit 618-15) for layers made up or 90 percent or more discrete artifacts.

3) ICOMANTH proposes that the following terms be added to the Soil Survey Manual as Texture Modifiers (and to NSSH Exhibit 618-15 and part 618.27 (j) (3)) for discrete artifacts following the example for non-flat fragment classes. NOTE: The term “discrete artifact” is described in Section I above.
ICOMANTH proposes adding the following terms for discrete artifact size classes following the example for non-flat rock fragments in NSSH 618.27 (j) (3):

<table>
<thead>
<tr>
<th>Name</th>
<th>Diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine</td>
<td>2-75</td>
</tr>
<tr>
<td>Medium</td>
<td>75-250</td>
</tr>
<tr>
<td>Coarse</td>
<td>250-600</td>
</tr>
<tr>
<td>Very Coarse</td>
<td>≥ 600</td>
</tr>
</tbody>
</table>

4) ICOMANTH proposes the following terms be added as a texture modifiers to help identify important interpretive considerations in soils that contain a significant amount of discrete artifacts by volume.

"Urbic – For horizons and layers with ≥ 15% by volume discrete artifact fragments of all kinds (from Latin urbanus, of, relating to, characteristic of, or constituting a city)."

For soil descriptions, the rock fragments and artifacts are each described separately. When appropriate, compound texture modifiers can be used such as “very urbic gravelly sandy loam.” This is analogous to current conventions for compound modifier use such as: “channery mucky clay” or “gravelly ashy loam” (see NSSH 618.67 (h)(2)(iii) for example).

ICOMANTH proposes adding the following Table (2) to the Soil Survey Manual to illustrate the use of terms when high volumes of discrete artifacts are found in a horizon or layer.

Table 2. Proposed new texture modifiers for artifacts.

<table>
<thead>
<tr>
<th>% vol artifacts</th>
<th>Modifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to &lt; 15%</td>
<td>N/A</td>
</tr>
<tr>
<td>15 to &lt; 35%</td>
<td>Urbic†</td>
</tr>
<tr>
<td>≥ 35% to &lt; 60%</td>
<td>Very urbic†</td>
</tr>
<tr>
<td>&gt; 60% to &lt; 90%</td>
<td>Extremely urbic†</td>
</tr>
<tr>
<td>&gt; 90%</td>
<td>Discrete Artifacts†</td>
</tr>
</tbody>
</table>

† New terms for NSSH exhibit 618-15

5) ICOMANTH proposes the following terms be added as new “terms in lieu of texture” (NSSH Exhibit 618-15) to identify the most common types of liners. These materials are described in detail in Section 1 above.

  a. Concrete
  b. Asphalt
  c. Plastic
  d. Geotextile
  e. Rubber
Section IV: Procedures for Making Detailed Description of Artifacts:

The terms identified in Section I to III may be used in soil horizon and layer descriptions, soil databases, and in official soil series description ranges of properties. ICOMANTH proposes that in narrative soil horizon and layer descriptions:

1) Particulate artifacts should be described by the:
   a. % by weight (estimated or measured),
   b. human-safety category, and
   c. specific identity (if possible and if important for interpreting or classifying the soil).

3) Discrete artifacts should be described by the:
   a. percent volume (estimated or measured),
   b. human-safety category (for minerals, metals, and other artifacts where the safety category is not obvious),
   c. size-class,
   d. rupture-resistance term (if important), and
   e. specific identity (different kinds may be grouped if they produce the same interpretation or classification).

4) Liners should be described by the:
   a. continuity estimated distance between vertical gaps or cracks (if any), and
   b. specific identity as “terms used in lieu of texture” (NSSH Exhibit 618-15).

Section V: Proposed New Horizon Designations:

ICOMANTH proposes the following additions to the existing horizon designations. These terms will allow full description of most human-transported and -altered soils, entry of those descriptive elements into existing USDA-NRCS databases, and can be used in the establishment of new soil series (NSSH 614.06).

A) Prefix – ICOMANTH proposes the “prime” symbol (’) be used to identify horizons and layers of HTM, following the example of the numerical prefixes used for discontinuities (Keys to Soil Taxonomy, Ch. 18, SSM Ch. 3, and Field Book for Describing Soils, 2nd Ed. p. 2-4).

The current terminology in (Keys to Soil Taxonomy, Ch. 18) states that:

- “Arabic numerals are used as prefixes to horizon designations (preceding the letters A, E, B, C, and R) to indicate discontinuities in mineral soils.”
- “A discontinuity is a difference in the materials from which the horizons have formed and/or a significant difference in age, unless that difference in age is indicated by the suffix b.”
- “Where a soil has formed entirely in one kind of material, the whole profile is understood to be material 1 and the number prefix is omitted from the symbol.”

ICOMANTH proposes a change in the description to read (changes in bold text):

- “Arabic numerals are used as prefixes to horizon designations (preceding the letters A, E, B, C, and R) to indicate discontinuities in mineral soils. The “prime” symbol is used as a prefix to horizon designations (preceding the letters A, E, B, I, C, and R) to indicate human-constructed discontinuities in mineral or organic soils caused by
the deposition of HTM. The prime in the prefix position is not to be confused with the prime used in the suffix position.”

- “A natural discontinuity is a difference in the materials from which the horizons have formed and/or a significant difference in age, unless that difference in age is indicated by the suffix b. A human-constructed discontinuity is one that forms when humans transport and deposit materials on top of an existing pedon or any other base.”

- “Where a soil has formed entirely in one kind of material, the whole profile is understood to be material 1 and the number prefix is omitted from the symbol. For human-created discontinuities, however, all horizons and layers formed in HTM are indicated by the use of the prime as a prefix.”

B) Master horizon - ICOMANTH proposes that liners be added to the NSSH 618.33, SSM (Ch. 3), and the Keys to Soil Taxonomy (Ch. 18) as a new master horizon or layer. The uppercase letter “M” would be used to identify physically root-limiting subsoil layers defined as liners in Section I above. Root-limiting liners are described as being continuous (90 percent or more cemented and has lateral continuity), following the example of the orstein layers in Soil Taxonomy (Soil Survey Staff, 1999, p. 45). Because of this continuity, roots can penetrate only along vertical fractures with a horizontal spacing of 10 cm or more. There is no minimum thickness. The M horizon follows the conventions used in the SSM for the O, L, and W horizons that reflect a type of material (Soil Survey Staff, 2003, Ch. 18, p. 314).

The M should not be used in combinations with other master horizon letters for transitional horizons but could be used in combination horizons such as M/C or Bt/M. The specific liner material is identified in the pedon description as one of several new “terms in lieu of texture” (NSSH Exhibit 618-15) described in Section III above. For example:

‘2Md — 23 to 28 in (56 to 70 cm); very dark gray (10YR 3/1) asphalt; structureless, massive; extremely firm; no roots; no pores; few cracks about 100 cm apart; 65% crushed sandstone pebbles; neutral; abrupt smooth boundary (5 to 9 inches thick).

C) Suffixes – ICOMANTH proposes that the lowercase letter “u” be used to identify horizons or layers that contain an observable amount \(0 \leq x < 15\%\) volume) discrete artifacts as defined in Section I above. Higher amounts of discrete artifacts are identified by the texture modifiers as described in Section III above. The “u” suffix would also be used to identify horizons and layers with an observable amount \(0 \leq x < 15\%\) by weight) of the fine-earth fraction particulate artifacts as defined in Section I above. Higher amounts of particulate artifacts are identified by the proposed “particulate” texture modifier described in Section III above.

**Section VI. Example Use of New Designations and Terms in Descriptions:**

A) Demonstrated Use of New Horizon Designations on Hypothetical Profiles

Table 3 compares 5 different hypothetical natural and human-altered or -transported soil profiles, with proposed changes in prefix, master letter, and suffix designations. These profiles compare the conventional USDA-NRCS system to one using new prefix, master horizon, and suffixes (identified by footnotes).
Table 3. Hypothetical human-altered or -transported soil profiles. Assume that each horizon or layer is 25 cm thick unless otherwise stated.

<table>
<thead>
<tr>
<th>Profile 1</th>
<th>Profile 2</th>
<th>Profile 3</th>
<th>Profile 4</th>
<th>Profile 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil deeply cultivated to 75 cm but not transported</td>
<td>Soil buried by HTM from similar on-site material</td>
<td>Soil buried by HTM from off-site soil material</td>
<td>Soil buried by HTM containing a few artifacts and on-site soil material</td>
<td>Soil with HTM over a geotextile liner over landfill material</td>
</tr>
<tr>
<td>0 cm HTM</td>
<td>75 cm HTM</td>
<td>75 cm HTM</td>
<td>75 cm HTM</td>
<td>200 cm HTM</td>
</tr>
</tbody>
</table>

Conventional USDA-NRCS system

<table>
<thead>
<tr>
<th>Ap</th>
<th>A</th>
<th>A</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>C1</td>
<td>Bw</td>
<td>AC</td>
</tr>
<tr>
<td>C2</td>
<td>C2</td>
<td>C</td>
<td>Cd</td>
</tr>
<tr>
<td>Cky</td>
<td>Cky</td>
<td>2BAb</td>
<td>Bbb1</td>
</tr>
<tr>
<td>Ckyz (&gt; 1m thick)</td>
<td>Ckyz (&gt; 1m thick)</td>
<td>2Bbb</td>
<td>Bbb2</td>
</tr>
<tr>
<td>2Cr</td>
<td>BC (&gt; 50 cm thick)</td>
<td>3C3</td>
<td></td>
</tr>
</tbody>
</table>

System proposed by ICOMANTH

<table>
<thead>
<tr>
<th>Ap</th>
<th>'A</th>
<th>'A</th>
<th>'Au</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>'C1</td>
<td>'Bw</td>
<td>'ACu</td>
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<td>C2</td>
<td>'C2</td>
<td>'C</td>
<td>'Cdu</td>
</tr>
<tr>
<td>Cky</td>
<td>Cky</td>
<td>2BAb</td>
<td>Bbb1</td>
</tr>
<tr>
<td>Ckyz (&gt; 1m thick)</td>
<td>Ckyz (&gt; 1m thick)</td>
<td>2Bbb</td>
<td>Bbb2</td>
</tr>
<tr>
<td>2Cr</td>
<td>BC</td>
<td>'2C1</td>
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B) Demonstrated Use of New Horizon Designations, Fragment Types, and Texture Modifiers in a Hypothetical Profile Description

The following soil description is a hypothetical example of the use of the proposals in Sections I to V. New designations occur as **bold italic text**.

Table 4. A hypothetical pedon formed in HTM over a buried natural soil.

'Ap -- 0 to 26 cm; reddish brown (2.5YR 4/4) loam; common, common fine distinct dusky red (10R 3/4) lithochromic mottles; weak coarse subangular blocky structure; friable; common fine and medium plus few coarse roots; no pores; 5 percent sandstone pebbles; moderately acid; clear wavy boundary.

'Cu1 -- 26 to 50 cm; reddish brown (2.5YR 4/4) loam; few, medium distinct dusky red (10R 3/4) lithochromic mottles; structureless, massive; firm; common fine and medium plus few coarse roots; few very fine pores; 5 percent sandstone pebbles; 3 percent medium, brick fragments; slightly acid; clear wavy boundary.

'Cu2 -- 50 to 79 cm; reddish brown (2.5YR 4/4) gravelly loam; common, medium distinct dusky red (10R 3/4) lithochromic mottles; structureless, massive; firm; common fine and medium plus few coarse roots; no pores; 15 percent sandstone gravel, 5 percent sandstone cobbles; 8 percent medium brick and concrete fragments; neutral; clear wavy boundary.

'C -- 79 to 117 cm; reddish brown (2.5YR 4/4) urbic gravelly loam; common, medium distinct dusky red (10R 3/4) lithochromic mottles; structureless, massive; firm; few fine and medium roots; no pores; 15 percent sandstone gravel, 5 percent sandstone cobbles, and 15 percent coarse concrete fragments, 5 percent medium brick fragments; slightly alkaline; abrupt smooth boundary.
Ab -- 117 to 126 cm; dark brown (2.5YR 3/3) loam; moderate medium granular structure; very friable; common fine and medium roots; few very fine pores; moderately acid; clear wavy boundary.

Btb -- 126 to 200 cm; reddish brown (2.5YR 5/4) clay loam; moderate medium subangular blocky structure; friable; common clay films on ped surfaces; few fine and medium roots; common very fine pores; moderately acid.

C) Demonstrated Use of New Horizon Designations, Fragment Types, and Texture Modifiers on Official Series Descriptions (OSD)

In June, 2003 the National Cooperative Soil Survey Standing Committee on Standards reviewed a set of four official series descriptions from human-altered and-transported soils to see how they would be affected by the new horizon designation and texture modifications proposed by ICOMANTH circular Letter #4 (posted on the ICOMANTH web site at http://clic.csres.vt.edu/icomanth/circlet.htm). The four example OSDs are listed below in their original and revised versions, with comments by the Committee on Standards at the beginning of each OSD. Modifications proposed by ICOMANTH appear in bold italic text.

1) Laguardia Series – This soil is formed in thick deposits (entire 2 meter profile) of fill material with human artifacts throughout. This soil is easily identified as HTM by considering the evidence in the individual horizons themselves.

**Original version:**

Ap-- 0 to 8 inches; brown (10YR 4/3) gravelly sandy loam; (10YR 6/3) dry; weak very fine subangular blocky structure; friable; few very fine and medium roots; 15 percent brick and concrete fragments, 5 percent asphalt, and 5 percent glass gravel sized fragments, and 5 percent cobble-sized rock fragments; neutral; gradual wavy boundary. (2 to 12 inches thick.)

Bw-- 8 to 26 inches; brown (10YR 4/3) very gravelly coarse sandy loam; weak very fine subangular blocky structure; friable; few very fine roots; 25 percent brick and concrete, 5 percent asphalt, 5 percent metal, and 5 percent plastic gravel sized fragments and 5 percent cobble-sized rock fragments; neutral; gradual wavy boundary. (1 to 20 inches thick.)

C-- 26 to 79 inches; brown (10YR 4/3) very gravelly coarse sandy loam; structureless massive with compaction related plate-like divisions; very friable; few very fine roots; 25 percent brick and concrete, 10 percent asphalt, 5 percent glass, 5 percent metal, and 5 percent plastic gravel sized fragments and 7 percent cobble-sized rock fragments; neutral.

**Revised version:**

'Ap -- 0 to 8 inches; brown (10YR 4/3) *urbic* sandy loam; (10YR 6/3) dry; weak very fine subangular blocky structure; friable; few very fine and medium roots; 5 percent cobbles; 15 percent fine brick and concrete fragments, 5 percent fine glass fragments, and 5 percent fine asphalt fragments; neutral; gradual wavy boundary. (2 to 12 inches thick.)
ICOMANTH Circular Letter #5 available at http://clic.cses.vt.edu/icomanth/

'Bw -- 8 to 26 inches; brown (10YR 4/3) very urbic coarse sandy loam; weak very fine subangular blocky structure; friable; few very fine roots; 5 percent cobbles; 25 percent fine brick and concrete, 5 percent fine asphalt, 5 percent fine, noxious metal, and 5 percent fine plastic fragments; neutral; gradual wavy boundary. (1 to 20 inches thick.)

'C -- 26 to 79 inches; brown (10YR 4/3) very urbic coarse sandy loam; structureless massive with compaction related plate-like divisions; very friable; few very fine roots; 7 percent cobbles; 25 percent fine brick and concrete, 10 percent fine asphalt, 5 percent fine glass, 5 percent fine noxious metal, and 5 percent fine plastic fragments; neutral.

2) **Greatkills Series** – This soil is a landfill. Note that because of the “artifact-free” nature of the cap, no human artifacts are described in the upper 2 horizons. Unlike the Laguardia soil, the 2 uppermost horizons do not have obvious morphology to indicate HTM. In soils like these, the evidence of human influence must be inferred from the relation to the material below.

**Original version:**

A-- 0 to 2 inches; dark brown (7.5YR 3/2) coarse sandy loam; weak medium granular structure; very friable; many very fine and fine plus common medium and coarse roots; common coarse 3/4 inch thick, hollow Phragmites rhizomes; 10 percent gravel rock fragments; neutral; abrupt smooth boundary. (1 to 7 inches thick)

Bw-- 2 to 7 inches; dark reddish brown (5YR 3/4) gravelly coarse sandy loam; weak medium subangular blocky and platy structure; friable; common fine roots; common coarse rhizomes; 20 percent gravel rock fragments; neutral; clear wavy boundary. (3 to 8 inches thick)

BC-- 7 to 12 inches; dark reddish brown (5YR 3/4) gravelly coarse sandy loam; weak medium platy structure; firm; few very fine roots; common coarse rhizomes; 20 percent gravel rock fragments; 5 percent pieces of broken glass bottles; neutral; clear wavy boundary. (3 to 8 inches thick)

2C-- 12 to 80 inches; dark brown (7.5YR 4/4) extremely cobbly loam; massive; friable; few medium and coarse roots; few common rhizomes to a depth of 60 inches; 5 percent cobble rock fragments; 15 percent decomposable cobble-sized coarse fragments such as wood, iron, cardboard, and paper; 40 percent non-decomposable cobble-sized coarse fragments such as bricks, concrete, rugs, plastic bags, glass bottles, plastic toys and objects, and rubber pipes; few stone-sized coarse fragments of concrete and tires; neutral; clear smooth boundary.

**Revised version:**

'A-- 0 to 2 inches; dark brown (7.5YR 3/2) coarse sandy loam; weak medium granular structure; very friable; many very fine and fine plus common medium and coarse roots; common coarse 3/4 inch thick, hollow Phragmites rhizomes; 10 percent gravel; neutral; abrupt smooth boundary. (1 to 7 inches thick)

'Bw-- 2 to 7 inches; dark reddish brown (5YR 3/4) gravelly coarse sandy loam; weak medium subangular blocky and platy structure; friable; common fine roots; common coarse rhizomes; 20 percent gravel; neutral; clear wavy boundary. (3 to 8 inches thick)
‘BCu-- 7 to 12 inches; dark reddish brown (5YR 3/4) gravelly coarse sandy loam; weak medium platy structure; firm; few very fine roots; common coarse rhizomes; 20 percent gravel; 5 percent fine broken glass bottle fragments; neutral; clear wavy boundary. (3 to 8 inches thick)

‘2C-- 12 to 80 inches; dark brown (7.5YR 4/4) urbic loam; massive; friable; few medium and coarse roots; few coarse rhizomes to a depth of 60 inches; 5 percent cobbles; 15 percent medium innocuous wood, cardboard, and paper; 40 percent medium iron, bricks, concrete, rugs, plastic bags, glass bottles, plastic toys and objects, and rubber pipe fragments; and 2 percent coarse concrete fragments and tires; neutral; clear smooth boundary.

3) Bagger Series – This soil is forming in locally derived fill (due to land leveling) with a buried soil below. Here it is more difficult to discern that this is fill material from evidence in the pedon alone. The buried soil provides a good clue, but with no human artifacts present, you need to consider additional clues outside of the soil itself (like local land leveling practices) to infer the nature of the upper mantle as human transported.

Original version:

Ap--0 to 9 inches; mixed pale brown and yellowish brown (10YR 6/3, 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine, fine and medium roots; many very fine and fine interstitial pores; about 10 percent by volume 2 to 35 mm hardpan fragments which can be broken by hand; hardpan fragments have same color as soil matrix; neutral (pH 7.2); gradual smooth boundary. (4 to 12 inches thick)

2C1--9 to 16 inches; mixed light gray, white and brown (2.5Y 7/2, 8/2; 7.5Y 5/4) light sandy clay loam, grayish brown and brown (2.5Y 5/2; 7.5YR 4/4) moist; massive; hard, friable, sticky and slightly plastic; few very fine roots; common very fine and fine interstitial pores; common thin silica colloids bridging sand grains; about 10 percent by volume 2 to 35 mm hardpan fragments which can be broken by hand; hardpan fragments have same color as matrix; fragments of Bt (argillie) dark brown (7.5YR 4/4) moist clay and clay loam; about 5 percent by volume black (N 4/) Fe-Mn soft concretion ranging up to 5 mm in diameter; slightly calcareous with lime segregated in few fine filaments, moderately alkaline (pH 8.0); clear wavy boundary. (0 to 20 inches thick)

3C2--16 to 30 inches; mixed pale brown and brown (10YR 6/3, 7.5YR 5/4) loamy sand and sandy loam, dark brown (10YR 4/3, 7.5YR 4/4) moist; massive; hard, friable, nonsticky and slightly sticky and nonplastic and slightly plastic; few very fine roots; common very fine interstitial pores; about 3 percent by volume Bt (argillie) fragments having many very fine tubular pores and common thin clay films lining the tubular pores and common thin silica colloids bridging sand grains; in small pockets 20 percent by volume 2 to 5 mm gravels encased by loamy sand fill; about 25 percent by volume 5 to 35 mm hardpan fragments within small pockets in the lower 2/3 of the horizon having the same color as the horizon matrix; few black (N 2/) 2 to 5 mm Fe-Mn flakes; mildly alkaline (pH 7.5); abrupt smooth boundary. (0 to 20 inches thick)

4Ab--30 to 35 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; common fine distinct yellowish red (5YR 5/6) mottles, dark reddish brown
ICOMANTH Circular Letter #5 available at http://clic.cses.vt.edu/icomanth/
(5YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common
very fine roots; common very fine tubular and interstitial pores; 1/4 inch organic
residue at top of horizon, few black (N 2/0) 1 to 5 mm Fe-Mn concretions; medium acid
(pH 6.0); gradual wavy boundary. (0 to 10 inches thick)

4C3--35 to 49 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; hard,
friable, slightly sticky and slightly plastic; few very fine roots; common very fine, fine
and medium tubular and common very fine and fine interstitial pores; few black (N 2/0)
1 to 5 mm Fe-Mn concretions; mildly alkaline (pH 7.5); clear wavy boundary. (0 to 20
inches thick)

4Cq--49 to 60 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish
brown (10YR 4/4) moist; massive; very hard, firm, slightly sticky and slightly plastic;
no roots; few very fine interstitial pores; weakly cemented with silica; moderately
alkaline (pH 8.0)

Revised version:

'4p--0 to 9 inches; mixed pale brown and yellowish brown (10YR 6/3, 5/4) sandy loam, dark
yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and slightly
plastic; common very fine, fine and medium roots; many very fine and fine interstitial
pores; about 10 percent by volume 2 to 35 mm hardpan fragments which can be
broken by hand; hardpan fragments have same color as soil matrix; neutral (pH 7.2);
gradiant smooth boundary. (4 to 12 inches thick)

'2C1--9 to 16 inches; mixed light gray, white and brown (2.5Y 7/2, 8/2; 7.5Y 5/4) light sandy
clay loam, grayish brown and brown (2.5Y 5/2; 7.5Y 4/4) moist; massive; hard,
friable, sticky and slightly plastic; few very fine roots; common very fine and fine
interstitial pores; common thin silica colloids bridging sand grains; about 10 percent
by volume 2 to 35 mm hardpan fragments which can be broken by hand; hardpan
fragments have same color as matrix; fragments of Bt (argillie) dark brown (7.5YR
4/4) moist clay and clay loam; about 5 percent by volume black (N 4/) Fe-Mn soft
concretion ranging up to 5 mm in diameter; slightly calcareous with lime segregated in
few fine filaments, moderately alkaline (pH 8.0); clear wavy boundary. (0 to 20 inches
thick)

'3C2--16 to 30 inches; mixed pale brown and brown (10YR 6/3, 7.5YR 5/4) loamy sand and
sandy loam, dark brown (10YR 4/3, 7.5YR 4/4) moist; massive; hard, friable,
nonsticky and slightly sticky and nonplastic and slightly plastic; few very fine roots;
common very fine interstitial pores; about 3 percent by volume Bt (argillie) fragments
having many very fine tubular pores and common thin clay films lining the tubular
pores and common thin silica colloids bridging sand grains; in small pockets 20
percent by volume 2 to 5 mm gravels encased by loamy sand fill; about 25 percent by
volume 5 to 35 mm hardpan fragments within small pockets in the lower 2/3 of the
horizon having the same color as the horizon matrix; few black (N 2/0) 2 to 5 mm Fe-
Mn flakes; mildly alkaline (pH 7.5); abrupt smooth boundary. (0 to 20 inches thick)

4Ab--30 to 35 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2)
moist; common fine distinct yellowish red (5YR 5/6) mottles, dark reddish brown
(5YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common
very fine roots; common very fine tubular and interstitial pores; 1/4 inch organic
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residue at top of horizon, few black (N 2/) 1 to 5 mm Fe-Mn concretions; medium acid (pH 6.0); gradual wavy boundary. (0 to 10 inches thick)

4C'3--35 to 49 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine, fine and medium tubular and common very fine and fine interstitial pores; few black (N 2/) 1 to 5 mm Fe-Mn concretions; mildly alkaline (pH 7.5); clear wavy boundary. (0 to 20 inches thick)

4Cq--49 to 60 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; no roots; few very fine interstitial pores; weakly cemented with silica; moderately alkaline (pH 8.0)

4) **Quonal Series** - This non-HTM soil illustrates the difficulty of inferring whether a soil contains HTM in the absence of artifacts. This soil has been deeply plowed to break up a durpan, but has little lateral movement of soil material and so it probably does not qualify as HTM as described above. Distinguishing the morphology of a non-transported but deeply plowed soil such as Quonal from a soil formed in thick HTM without artifacts (such as a mined soil like Blocker, Scheline, or Ironbridge, not included here) will encourage recording soil descriptions more detailed than the current OSD’s. (NOTE: If the electrical conductivity, sodium adsorption ratio; or pH had been described in horizon 2Bkqmb, or if any scrape-marks had been described across the top of the truncated durpan, there may have been enough morphological evidence of human-transportation of materials. As described, this soil should remain in the Arents suborder).

**Original version and revised version are the same:**

Ap1--0 to 7 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak fine, medium and coarse subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; common very fine and fine tubular pores; strongly effervescent, carbonates are disseminated; electrical conductivity is 0.5 decisiemens per meter; sodium adsorption ratio is 2; moderately alkaline (pH 8.3); gradual smooth boundary.

Ap2--7 to 9 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; massive; extremely hard, firm, sticky and plastic; few very fine and fine roots; few very fine and fine tubular pores; few thin clay films in pores of displaced fragments of a natic horizon; strongly effervescent, carbonates are disseminated; electrical conductivity is 3.1 decisiemens per meter; sodium adsorption ratio is 6; very strongly alkaline (pH 9.3); gradual smooth boundary.

Ap3--9 to 16 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; massive; extremely hard, firm, sticky and plastic; few fine and very fine roots; common fine and very fine tubular pores; few thin clay films in pores of displaced fragments of a natic horizon; strongly effervescent, carbonates are disseminated; electrical conductivity is 4.1 decisiemens per meter; sodium adsorption ratio is 12; common fine and medium faint very dark grayish brown (10YR 3/2) moist, relict redox depletions; very strongly alkaline (pH 9.2); gradual smooth boundary.

Ap4--16 to 20 inches; light yellowish brown (10YR 6/4) clay, dark yellowish brown (10YR 4/4) moist; massive; extremely hard, firm, sticky and plastic; few thin clay films on displaced fragments of a natic horizon; strongly effervescent, carbonates are
Ap5--20 to 32 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; extremely hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; common thin and moderately thick clay films coating faces of and in pores of displaced fragments of a natric horizon; strongly effervescent, carbonates are disseminated; electrical conductivity is 5.9 decisiemens per meter; sodium adsorption ratio is 35; common medium faint dark brown (10YR 3/3) relict redox depletions; very strongly alkaline (pH 9.7); clear wavy boundary.

Ap6--32 to 41 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; strong fine and medium angular blocky structure; extremely hard, firm, sticky and plastic; common very fine tubular pores; few thin clay films in pores of displaced fragments of a natric horizon; 15 percent very fine and fine subangular blocky duripan fragments that are extremely hard and extremely firm; violently effervescent, carbonates are disseminated and segregated as many moderately thick coats on faces of peds and as many fine and medium filaments; electrical conductivity is 7.4 decisiemens per meter; sodium adsorption ratio is 50; very strongly alkaline (pH 9.9); abrupt wavy boundary. (The combined thickness of the Ap horizons is 40 to 60 inches).

2Bkqmb--41 to 44 inches; light yellowish brown (10YR 6/4) strongly silica and lime cemented duripan with 50 percent discontinuous 1/8 inch thick laminar cap, and with fractures 4 to 8 inches apart, dark yellowish brown (10YR 4/4) moist; massive; extremely hard, slightly rigid; strongly effervescent, carbonates are disseminated and segregated as many fine and medium threads and many moderately thick coats in fractures; brittle when wet; clear wavy boundary. (2 to 20 inches thick).

2Bkb1--44 to 50 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine tubular pores; violently effervescent, carbonates are disseminated and segregated as many fine and medium filaments and as many moderately thick coats on faces of peds; electrical conductivity is 0.9 decisiemens per meter; sodium adsorption ratio is 4; moderately alkaline (pH 8.3); gradual wavy boundary. (0 to 16 inches thick).

2Bkb2--50 to 62 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; medium fine angular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine tubular pores; few thin and moderately thick clay films lining pores and on ped faces; strongly effervescent, carbonates are disseminated and segregated as few thin filaments and many moderately thick coats on faces of peds; electrical conductivity is 0.8 decisiemens per meter; sodium adsorption ratio is 2; moderately alkaline (pH 8.0).

Section VII. Responses to Questions in Circular Letter #4

The answers to Questions posed in Circular Letter #4 are posted to the ICOMANTH web site (http://clic.cses.vt.edu/icipamth/circllet.htm). Ad-hoc comments that did not answer the posed questions were considered but not summarized.
1) Why do we define terms for noxious artifacts if we do not intend to sample or classify contaminated soils? Soil scientists must be able to describe these materials in order to communicate their presence and interpret the use of the soil. They can be described and their volume estimated by remote methods if needed.

2) Why was the term “urbic” used as a texture modifier? The term urbic was proposed by Fanning and Fanning (1989) to describe specific types of artifacts in the soil. The use of the term “urbic” is proposed here for use as a texture modifier because most soils that contain artifacts do so because of waste disposal and earth-movement associated with urban and suburban development. In addition, the term “urbic” starts with the same lower case letter that is proposed as the suffix “u” to indicate a smaller amount of artifact fragments. The term “artifacts” could have been used instead. The size and volume categories of the artifacts listed in Section II and III should allow the physical properties of discrete artifacts to be identified as part of the texture, as is done for natural rock fragments.

3) Why are rock fragments and artifacts described separately? Reader feedback indicated that preference. From a practical purpose, it is still uncertain how artifacts behave as they weather and if they have none or some limited water-holding and nutrient-supply capacities.

4) Why were the terms “urbic” and “garbic” dropped? After receiving feedback about the use of the terms “urbic” and “garbic” as types of materials with significant artifact content, the terms were set aside until diagnostic materials or horizons are proposed. Garbic material (originally introduced in Fanning and Fanning, 1989) may be reintroduced later, but the present intent of ICOMANTH is to avoid intense study and classification of contaminated soils, and many types of garbage and landfill materials are contaminated or generate methane gas. The discussion on the upper limit of contamination or garbic material is still undetermined. As a reminder, garbic materials are artifacts of refuse such as worthless or useless parts, rubbish, garbage, wasted food, leftovers, scraps, and trash associated with habitation and business waste (from Middle English offal, food waste; from Latin vastus waste). These artifacts would normally be deposited in landfills.

5) What is the practical need to define particulate artifacts separately from discrete artifacts? The size of the particulate artifacts mean they have much greater surface area and thus behave physically as many fine-earth particles do and are subject to more intense weathering than larger discrete artifacts.

6) Why is the anthropogenic landform discussed in Section I as part of the identification of HTM when it cannot be used as a differentia for identifying the classification of a soil? Identification of a landform and parent materials are interpretive judgments made by the soil scientist in the field and thus belongs as part of the pedon description. The information may be used to identify the presence of HTM as a parent material, just as the occurrence of a stratified layer on a hilltop may be used to identify the parent material as glacial outwash or ancient alluvium.

7) Why were the general artifact categories in Section I created? The general categories are used to separate artifacts into six simple size and continuity and human safety groups that can be described and interpreted with some uniformity. Specific examples were listed as suggestions to soil scientists of which artifacts could be grouped in order to shorten
8) Why are the artifacts now organized differently than proposed in Circular Letter #4?
   - Several respondents indicated that the issue of safety for the surveyors and the people living near contaminated soils was a more important concern than other properties of artifacts in the soil.
   - Other categories of artifacts were modified or eliminated to fit better into the existing USDA-NRCS system.
   - Identifying which artifacts are organic or inorganic was faulty in the case of plastic and rubber, and could not be consistently applied.
   - The durability category was dropped because non-durable artifacts should probably not be described in a soil. Artifacts that weather rapidly would not behave as long-term soil properties, nor could the artifacts that are not durable be easily sampled or analyzed as part of the soil.
   - The durability (ease of decomposition and rupture-resistance) may provide important interpretative information and thus those properties can be described by the soil scientists if they feel it is an important soil property.
   - Sections IV to VI demonstrate the ease in using the modified categories.

9) How can a soil scientist tell if an artifact is noxious or not? The specific examples of artifact categories that are typically noxious have been underlined in Section I. Some metals and minerals may have to be identified as noxious in the description if their human-safety category is not evident. The USEPA regulations may provide some guidelines as well.

10) What can be done to describe noxious material or the material below a liner? It can be described as in other soil materials that occur within 200 cm if it can be observed. This might include compacted crushed stone or “base material” or might include material in a landfill. In soils placed over buried buildings, the liner would be the last horizon described, as is often true for soils over extremely cemented, unweathered bedrock.

11) How should artifacts be described if they do not fit into one of the specific example categories? Any artifact can be directly identified in the description. However, the example categories could provide some consistency in the terminology used and could eventually be added as a variable in NASIS.

12) Why was the “prime” prefix chosen to identify HTM instead of the Master Letter H as previously discussed? Feedback from Circular Letter #4 suggested that the use of a Master Horizon would break from the traditional use of Master Letters in the USDA-NRCS system when naming transitional horizons. Confusion would arise from adding a master letter that had no consistent describable properties or degree of development other than being transported. For example:
   a. The master letters O, L, R, W, and some C (Cr) horizons represent a type of material that can be defined and a central concept developed. HTM are too variable in properties to be identified that distinctly.
   b. The master letters A, B, E, and some C horizons denote some degree of pedogenesis that results in an accumulation and/or loss. HTM are too variable to denote a degree of pedogenesis because they can vary from artifacts to redeposited diagnostic horizon materials to dredged sediment or bedrock.
   c. The master letters (except for O, L, R, W, and some C (Cr)) are used in combination with other master letters when their properties are combinations of two master letter
horizon materials or they are transitional to other genetic master horizons. HTM are a type of parent material and thus they cannot be used in combination with other master letters. Therefore it would be impossible to identify them if a new master letter were used, and it would be impossible to identify their degree of pedogenic development unless you used a completely new set of master letters that were the equivalent of the A, B, E, and C.

The use of the prime as a prefix avoids these conflicts while identifying of the HTM.

13) Why is the Master Letter M not used as part of a transitional horizon? Most commonly there is just one capital letter designation used for a horizon. Current provisions for using multiple designations allow for the recognition of horizons that are dominantly like one form of master horizon, but which have subordinate properties of another. Two types, transitional (e.g. EB,) or combination (e.g. B/E) horizons are recognized. The M layers would be restricted to materials and thus would behave like the O, L, and W master letters. Those letters are also not used in transitional horizons. M -- Concrete liner, This follows the precedent of using the O, R, L and W horizons in combination horizons but not with other master letters for transitional horizons.

14) How does climate affect durability of artifacts? Weathering affects durability and weathering is dependent on several soil forming factors. The decision to identify a piece of brick as durable or not can thus be left up to the soil scientist. Unbaked adobe bricks may be durable in the desert but rapidly degradable in the tropics.

15) Should humans survey and classify soils that have safety concerns? Some respondents indicated that humans should not describe or classify soils with safety issues. However, if they can describe safely under certain conditions, then some descriptive information about them is better than none at all. Therefore, some designations were defined here so that noxious artifacts could be described. At a later date, ICOMANTH will decide how to apply this information to Soil Taxonomy and at what level it should be recognized. A set of mineralogy classes may be appropriate.

Section IX. Questions for Circular Letter #6:

Please submit numbered answers that correspond to the following questions:

1) What final changes should be made to Sections I through V of Circular Letter #5 before official ICOMANTH proposal to the USDA-NRCS system? Indicate changes by editing the parts in question and replacing them with a better suggestion. Please reply by: a) printing Sections I through V, marking edits, and mailing in the papers as soon as possible, or b) downloading an electronic copy of this circular from the ICOMANTH web site (http://clic.cses.vt.edu/icomanth/) and making edits and changes electronically and sending them back as email attachments.

2) Should dense materials and contacts created by humans be considered as artifacts?
3) Should asphalt and coal ash be considered noxious artifacts?
4) What should be the maximum percentage of noxious particulate or volume of discrete artifacts allowed in soils that are to be classified in Soil Taxonomy?
5) Should the standards established by USEPA for maximum contaminant and health advisory levels (http://www.epa.gov/) and for work-related safety by the US Occupational Safety & Health Administration (http://www.osha.gov) be used to identify soils that are safety risks to soil scientists and others? If so, how should that be done?
6) How can we identify soils that occur in pits and excavations (destructional anthropogenic landforms) as human-altered?
   2 Technical Officer Land Classification, AGL, FAO. Viale delle Terme di Caracalla, 00100 Rome, Italy.
   3 Soil Scientist, c/o AGL, FAO. Viale delle Terme di Caracalla, 00100 Rome, Italy.


**ICOMANTH Contact Information is found at** http://clic.cses.vt.edu/icomanth/ **and below:**

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