

Universal Soil Classification System

A working Group of the International Union of Soil Sciences

Jon Hempel

Chair

International Union of Soil Sciences Universal Soil
Classification Working Group

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“ **A classification system should be dynamic**, in the sense that it should be continuously used and in the process **continuously tested**.

You must remember that a classification is a creation of man and is a reflection of the state of knowledge at that time and the uses that were intended at that time. Both of these may and will change and **the system should be able to accommodate these changes. If not it, becomes decadent.**”

Guy Smith

USC Vision

- To use the most up to date information, data and technology to *enhance* Soil Classification

USC Mission

- To work with all sectors of the Soil Science community to improve soil classification tools

IUSS Council Approval of USC Working Group

from the minutes of IUSS Council, Brisbane,
AU, August 2010

- The **Working Group on Universal Soil Classification** was agreed with a time limit of 8 years (2018) and a review of progress towards an agreed Soil Classification System after 4 years (2014), with an interim document report in 2012.

Core Working Group Membership

- Jon Hempel, Director-National Soil Survey Center, Lincoln, NE (Chair)
- Erika Micheli, Head Department of Soil Science and Agricultural Chemistry Szent Istvan University Gödöllő, Hungary (Co-Chair)
- Alex McBratney, University of Sydney, Sydney, AU
- Ben Harms, Department of Natural Resources, Indooroopilly, QLD, AU
- Curtis Monger, New Mexico State University
- **Didas Kimaro, Sokoine University of Agriculture, Morogoro, Tanzania**
- Ganlin Zhang, Chinese Academy of Sciences, Nanzing, China
- Humberto Santos, Embrapa Solos, Rio de Janeiro, Brazil
- **James Bockheim, University of Wisconsin-Madison, Madison, Wisconsin**
- John Galbraith, Virginia Tech University, Blacksburg, VA
- Luca Montanarella, Action Leader, Joint Research Center, Ispra, Italy
- Lucia Anjos, Federal Rural University of Rio de Janeiro (UFRRJ), Soils Department, Rio de Janeiro, Brazil
- Peter Schad, Department of Ecology and Ecosystem Sciences, Technische Universität, München, Germany
- Pavel Krasilnikov, Institute of Biology, Karelia Research Center RAS, Petrozavodsk, Russia
- Phillip Owens, Assistant Professor, Department of Agronomy, Purdue University, West Lafayette, IN
- Sergey V. Goryachkin, Institute of Geography, Russian Academy of Sciences, Moscow, Russia
- **Thomas Reinsch, World Soil Resources National Leader, Beltsville, MD**

Ways forward for a Universal Soil Classification System

- Very positive responses from many sectors of soil scientific community
- IUSS Backing (President, Sec. General, Deputy Sec. General, incoming pres, chair of Divisions)
- **Classification system that are already 'universal' will continue to improve**
- We will not start from scratch
- Funding

Considerations for a Universal Soil Classification System

- Simplification
- Enable others???
- Anthropogenic concerns (erosion, compaction, drainage, siltation, etc)
- Numeric/continuous classification

Global Soil Partnership

Pillar 5: Harmonization of methods, measurements and indicator for the sustainable management and protection of soil resources



While the availability of soil data and information is dealt with in [Pillar 4](#), it needs to be emphasized that information about soils must first be gathered in a harmonized way; otherwise, experiences cannot be shared and combined.

This is of utmost importance, for example, to utilize soil information for policy development and the building of observation systems. Harmonization and establishing guidelines and standards should not be a goal per se of the GSP. Standardization always implies a cost for the various stakeholders and therefore a clear cost/benefit analysis needs to be provided to justify any standardization activity. Many standards for soil measurements, observations, data collection and data management exist. The GSP will act to federate and facilitate a partnership among various actors to develop synergies and cost savings for all partners.

Ongoing efforts as well as standards developed by the International Union of Soil Sciences (IUSS) and by other regional and national standardization committees and institutions, need to be brought within a common framework to reduce duplication of efforts and the proliferation of standards and methods (both laboratory and field) that are often not compatible. A well-documented example of lack of coordination and political will is soil classification, with still two (or more) main systems used in many parts of the world that are difficult to compare (correlate) and harmonize (like the US Soil Taxonomy of USDA and the World Reference Base (WRB) of the International Union of Soil Sciences (IUSS) endorsed by FAO).

The recent initiative towards development of a common Universal Soil Classification (USC) should be facilitated by the GSP to provide a common platform for such a future system.

As Pillar 5 is directly related to [Pillar 4](#) on soil information, it was agreed at the [Soil Information GSP Workshop](#) (March 2012) to develop a joint plan of action for both pillars. In this regard, a drafting committee including representatives from all the regions of the world is developing the draft plan of action that then will be submitted for consideration by all the partners working in this field.

Building a Framework for Moving Forward

Soil Mesotaxa-Soil Great Groups

EVIDENCE

greatest international
commonality,
data availability,
manageable number

Task Groups-Major Categories

- Soil Classification Issues
- Diagnostic and Soil Profile Information Harmonization
- Important Information Relating to Soil Classification

Soil Classification Issues

- Hydromorphic Soils-Chair: Cornie van Huysteen
- Acid Sulfate Soils-Chair: Ben Harms
- Anthropogenic Soil-Chair: Ganlin Zhang
- Tropical Soils-Chair: Lucia Anjos
- Cold Soils-Chair: Sergey Goryachkin
- Salt Affected Soils-Chair: Erika Micheli
- Development of a Horizon Classification System

Diagnostic and Soil Profile Information Harmonization

- Evaluate diagnostic criteria from existing systems
 - Prepare a dataset of options
 - Chair: Erika Micheli
- Compare guidelines for field profile descriptions (redox, structure, color, consistency, texture, etc.)
 - Propose a standardized nomenclature
 - Chair: Joe Chiaretti

Important Information Relating to Soil Classification

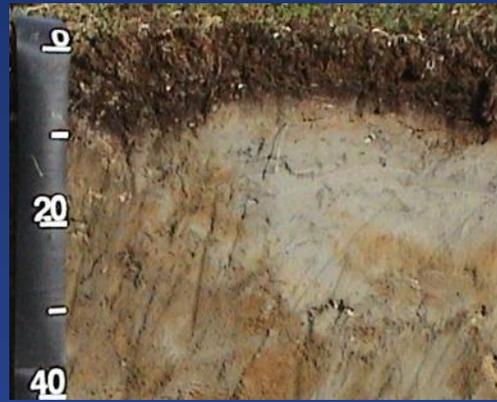
- Dual (parallel) nomenclature that includes and accommodates both a scientific and non-technical language (English lay / Texas vernacular)
 - Chair: John Galbraith

Diagnostic and Soil Profile Information Harmonization

- Compare and compile horizon nomenclature, designations, definitions
 - Propose a standardized nomenclature
 - Chair: Curtis Monger and Lucia Anjos
- Development of a horizon classification system
 - R&D a process to logically group characterization data
 - Chair: Alex McBratney

Contemporary soil classification systems (including Soil Taxonomy) are very poor for topsoil assessments

Ochric horizon is a “garbage can” for different topsoil types



USC should take into account the real diversity of topsoils of the world

Important Information Relating to Soil Classification

- Recommend laboratory methods and correlation rules
 - ?????
- Explore other diagnostics (e.g. soil biology)
 - ?????
- Explore other observation methods (e.g. spectroscopy, gamma radiometrics)
 - Chair: Alex McBratney

Important Information Relating to Soil Classification

- **Moisture and Temperature Regimes**
 - Define potentials for the development of soil moisture and temperature regimes.
 - Chair: Phillip Owens
- Define potential users interested in soil classification wider than traditional users
 - Are there users other than SS that would use soil classification
 - Chair: Luca Montaneralla

Objective of the “Diagnostics” Task Group

- Select diagnostics which are the commonly accepted main distinguishing of set of properties of soil classes.
- Provide a numerical evaluation of the concepts, definitions and criteria for the diagnostics
- Make conclusions and recommendations for modifying (simplifying), diagnostics elements.

Numerical Classification

- Much conceptual development in numerical classification and associated IT development since late 50's
- Availability of national and international databases of more than 10^5 - 10^6 observations will make numerical classification of horizons and profiles feasible at national and international levels

Numerical Classification

- Working on developing and defining measures of taxonomic distance for 'pedotaxa'- WRB and ST
- Numerical classification of horizons – large NRCS database



[http://soils.usda.gov/technical/classification/UnivSoil
_Classification_System](http://soils.usda.gov/technical/classification/UnivSoil_Classification_System)