12 Orders of Soil Taxonomy

Alfisols

Alfisols are in semiarid to moist areas.

These soils result from weathering processes that leach clay minerals and other constituents out of the surface layer and into the subsoil, where they can hold and supply moisture and nutrients to plants. They formed primarily under forest or mixed vegetative cover and are productive for most crops.

Alfisols make up about 10% of the world's ice-free land surface.

Andisols

Andisols form from weathering processes that generate minerals with little orderly crystalline structure. These minerals can result in an unusually high water- and nutrient-holding capacity.

As a group, Andisols tend to be highly productive soils. They include weakly weathered soils with much volcanic glass as well as more strongly weathered soils. They are common in cool areas with moderate to high precipitation, especially those areas associated with volcanic materials.

Andisols make up about 1% of the world's ice-free land surface.

Aridisols

Aridisols are soils that are too dry for the growth of mesophytic plants. The lack of moisture greatly restricts the intensity of weathering processes and limits most soil development processes to the upper part of the soils. Aridisols often accumulate gypsum, salt, calcium carbonate, and other materials that are easily leached from soils in more humid environments.

Aridisols are common in the deserts of the world.

Aridisols make up about 12% of the world's ice-free land surface.

Entisols

Entisols are soils that show little or no evidence of pedogenic horizon development.

Entisols occur in areas of recently deposited parent materials or in areas where erosion or deposition rates are faster than the rate of soil development; such as dunes, steep slopes, and flood plains. They occur in many environments.

Entisols make up about 16% of the world's ice-free land surface.

Gelisols

Gelisols are soils that have permafrost near the soil surface and/or have evidence of cryoturbation (frost churning) and/or ice segregation.

Gelisols are common in the higher latitudes or at high elevations.

Gelisols make up about 9% of the world's ice-free land surface.

Histosols

Histosols have a high content of organic matter and no permafrost. Most are saturated year round, but a few are freely drained. Histosols are commonly called bogs, moors, peats, or mucks.

Histosols form in decomposed plant remains that accumulate in water, forest litter, or moss faster than they decay. If these soils are drained and exposed to air, microbial decomposition is accelerated and the soils may subside dramatically.

Histosols make up about 1% of the world's ice-free land surface.

Inceptisols

Inceptisols are soils of semiarid to humid environments that generally exhibit only moderate degrees of soil weathering and development.

Inceptisols have a wide range in characteristics and occur in a wide variety of climates.

Inceptisols make up about 17% of the world's ice-free land surface.

Mollisols

Mollisols are soils that have a dark colored surface horizon relatively high in content of organic matter. The soils are base rich throughout and therefore are quite fertile.

Mollisols characteristically form under grass in climates that have a moderate to pronounced seasonal moisture deficit. They are extensive soils on the steppes of Europe, Asia, North America, and South America.

Mollisols make up about 7% of the world's ice-free land surface.

Oxisols

Oxisols are highly weathered soils of tropical and subtropical regions. They are dominated by low activity minerals, such as quartz, kaolinite, and iron oxides. They tend to have indistinct horizons.

Oxisols characteristically occur on land surfaces that have been stable for a long time. They have low natural fertility as well as a low capacity to retain additions of lime and fertilizer.

Oxisols make up about 8% of the world's ice-free land surface.

Spodosols

Spodosols formed from weathering processes that strip organic matter combined with aluminum (with or without iron) from the surface layer and deposit them in the subsoil. In undisturbed areas, a gray eluvial horizon that has the color of uncoated quartz overlies a reddish brown or black subsoil.

Spodosols commonly occur in areas of coarse-textured deposits under coniferous forests of humid regions. They tend to be acid and infertile.

Spodosols make up about 4% of the world's ice-free land surface.

Ultisols

Ultisols are soils in humid areas. They formed from fairly intense weathering and leaching processes that result in a clay-enriched subsoil dominated by minerals, such as quartz, kaolinite, and iron oxides.

Ultisols are typically acid soils in which most nutrients are concentrated in the upper few inches. They have a moderately low capacity to retain additions of lime and fertilizer.

Ultisols make up about 8% of the world's ice-free land surface.

Vertisols

Vertisols have a high content of expanding clay minerals. They undergo pronounced changes in volume with changes in moisture. They have cracks that open and close periodically, and that show evidence of soil movement in the profile.

Because they swell when wet, vertisols transmit water very slowly and have undergone little leaching. They tend to be fairly high in natural fertility.

Vertisols make up about 2% of the world's ice-free land surface.

Mapping Our World of Soils

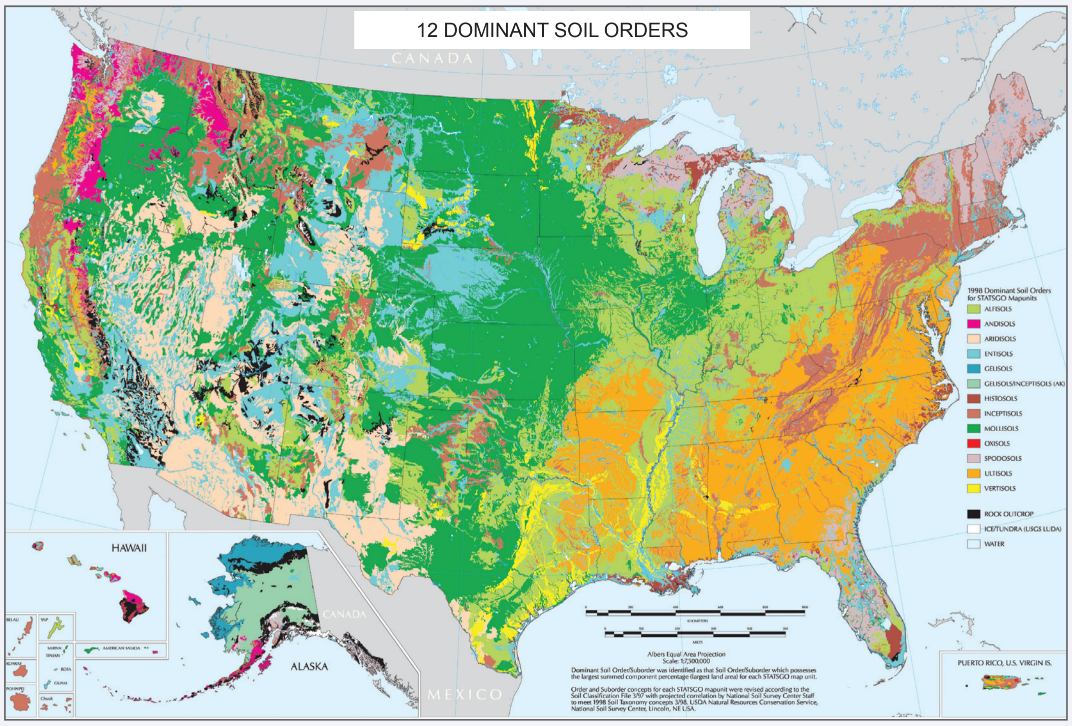
What is Soil Taxonomy?

In order to map soils, they must be classified! There are several soil classification systems around the world. In the United States, the USDA-NRCS Soil Taxonomy system is used. It is hierarchical and follows a *dichotomous key*, so that any given soil can only be classified into one group.

The soil taxonomy is composed of six levels and is designed to classify any soil in the world.

- The highest level is *soil orders* (similar to kingdoms in the Linnaeus system of classifying organisms).
- Each order is based on one important diagnostic feature with the key feature based on its significant effect on the land use or management of all soils in that order.
- The orders also represent different weathering intensities or degrees of soil formation.
- At the lowest level are the series (species level in the Linnaeus system).
- A soil series is the same as the common name of the soil, much in the way that the white oak is the common name for *Quercus alba* L.
- A soil series is defined based on a range of properties and is named for the location near where it was first identified.

dichotomous key- A key used to classify an item in which each stage presents two options, with a direction to another stage in the key, until the lowest level is reached.



Soil Mapping and Surveys

While classifying and describing a soil gives us much information, soils exist in a three-dimensional landscape, so soils surveys were designed to convey this spatial information. The heart of a soil survey is the soil map showing, by county, the spatial distribution and variability of soils on the landscape.

How are soils mapped?

Soil scientists prepare the maps in the field using pits, core samples, or trenches to examine the soils. They outline the extent of different soils using aerial photography base maps that help identify landscape positions, landforms and vegetation patterns that are directly related to soil types.

Soil mapping is a detailed descriptive process that begins with an understanding of the soil-landscape relations, field investigation, and cartography.

Surveys

Soil surveys help us understand how soils differ and how they behave under various land management systems. The key soil properties determine the suitability of a soil for use in recreation, crop production, range and wildlife, forestry, and engineering projects, and the best conservation management practices for water and wind erosion control.

Soil surveys are inventories of the soil resources in a geographic area and include:

- ***morphologic*** descriptions of a soil profile (including soil color, patterns, horizons, depth, structure, redox features, roots, pores, etc.)
- ***physical*** properties (% of sand, silt, and clay; moist consistence, bulk density, porosity, etc.)
- ***chemical*** properties (pH, lime content, organic carbon levels, cation exchange capacity, salinity, etc)
- ***site characteristics*** (landform, parent material, water table depth, percent slope, GPS location, vegetation, etc)
- ***soil classification*** (soil taxonomy, land capability classification, engineering uses)
- ***predictive interpretations*** for land use (crops, range, waste disposal, roads, buildings, wildlife habitat, lawns, etc)

http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

Why Collect Data and Create Maps and Surveys?

Collecting data on soils and developing maps is only the first step in relating soils to landscapes and land use. Once the data are collected, interpretation begins. The data can be used for many things – from determining how much fertilizer is needed to grow a given crop to determining soil and site suitability for a shopping mall. Four common interpretations are:

- **Land Capability Classes –** soil is categorized according to its suitability for agricultural uses.
- **Hydric Soils –** identifying hydric soils is useful for preserving wetlands under the Clean Water Act.
- **Prime Farmland –** Interpreting soil data to identify prime farmland is of major importance because we depend on it for most of our food and fiber needs. As such, this identification is used to create an inventory of these lands – both for use and for protection from other uses.
- **Ecological Site Assessments –** the soil and natural vegetation it supports are grouped into communities for use in decisions about wildlife and range management.

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Why are Soils different?

Soils differ from one part of the world to another, even from one part of a backyard to another. They differ because of where and how they formed. Five major factors interact to create different types of soils:

Climate – temperature and moisture influence the speed of chemical and biological reactions, which help control how fast rocks weather and dead organisms decompose. Soils develop faster in warm, moist climates and slowest in cold or arid ones.

Organisms – Plants, roots, animals, and bacteria – these and other organisms speed up the weathering of large particles into smaller ones, the accumulation of organic matter in the soil, and formation of soil structure.

Relief (landscape) **–** The shape of the land and the direction it faces make a difference in how much sunlight the soils get and how much water it retains. Deeper soils form at the bottom of a hill because gravity and water move soil particles down the slope.

Parent Material – Every soil "inherits" traits from the parent material from which it formed. For example, soils that form from limestone are rich in calcium and soils that form from materials at the bottom of lakes are high in clay.

Time – All of the above factors work together over time. Older soils differ from younger soils because they have had longer to develop. The longer it ages, the more different it looks from its parent material. Because soil is dynamic, its components – minerals, water, air, organic matter, and organisms – constantly change.

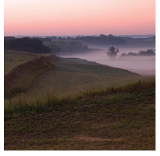
The five major factors are **ClORPT** for short, and the greater the difference in **ClORPT**, the more pronounced the difference in soil and classification will be.


Climate


Organisms


Relief


Parental material


Time

What's Your State Soil?

Find your State Soil at the USDA website: http://soils.usda.gov/gallery/state_soils/

You may be familiar with your state bird, flower or tree. These are animals and plants that are common or particularly important to a state. And since all animals and plants depend on soil, every state has an "Official State Soil" as well. State soils are soils with a special historical or agricultural significance for the state. Some are also named because of their extent or special location in the state.

Learn More At:

www.soils4teachers.org | www.soils4students.org | www.soils.org

Poster produced by the Soil Science Society of America
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Photos: Soil Profiles, USDA-NRCS. Know Soil, Know Life, Soil! Get the Inside Scoop, Soil Science Society of America. A special thank you to the USDA-NRCS for providing the 12 Orders of Soil Taxonomy images and the 12 Dominant Soil Orders Map.