What is Soil?

This definition is from the Soil Science Glossary (Soil Science Society of America).

soil - (i) The unconsolidated mineral or organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. (ii) The unconsolidated mineral or organic matter on the surface of the earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time. A product-soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics.

This definition is from Soil Taxonomy, second edition.

soil - Soil is a natural body comprised of solids (minerals and organic matter), liquid, and gases that occurs on the land surface, occupies space, and is characterized by one or both of the following: horizons, or layers, that are distinguishable from the initial material as a result of additions, losses, transfers, and transformations of energy and matter or the ability to support rooted plants in a natural environment.

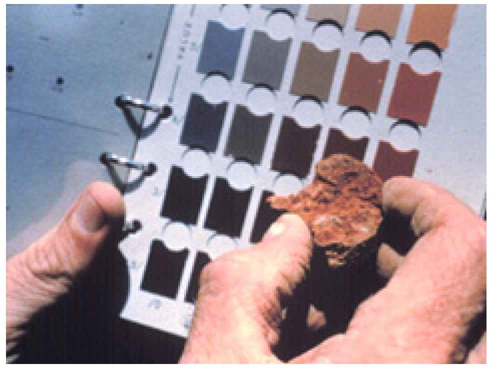
The upper limit of soil is the boundary between soil and air, shallow water, live plants, or plant materials that have not begun to decompose. Areas are not considered to have soil if the surface is permanently covered by water too deep (typically more than 2.5 meters) for the growth of rooted plants.

The lower boundary that separates soil from the nonsoil underneath is most difficult to define. Soil consists of horizons near the earth's surface that, in contrast to the underlying parent material, have been altered by the interactions of climate, relief, and living organisms over time. Commonly, soil grades at its lower boundary to hard rock or to earthy materials virtually devoid of animals, roots, or other marks of biological activity. For purposes of classification, the lower boundary of soil is arbitrarily set at 200 cm.

What is Soil Survey?

This definition is from the Soil Science Glossary (Soil Science Society of America).

soil survey - (i) The systematic examination, description, classification, and mapping of soils in an area. Soil surveys are classified according to the kind and intensity of field examination. (ii) The program of the National Cooperative Soil Survey that includes developing and implementing standards for describing, classifying, mapping, writing, and publishing information about soils of a specific area.



Careers in Soil Science

What is a soil scientist?

A soil scientist studies the upper few meters of the earth's crust in terms of its physical and chemical properties; distribution, genesis and morphology; and biological components. A soil scientist needs a strong background in the physical and biological sciences and mathematics.

What is soil science?

Soil science is the science dealing with soils as a natural resource on the surface of the earth including soil formation, classification, and mapping; physical, chemical, biological, and fertility properties of soils; and these properties in relation to the use and management of the soils.

Soils play multiple roles in the quality of life throughout the world. Soils are not only the resource for food production, but they are the support for our structures, the medium for waste disposal, they maintain our playgrounds, distribute and store water and nutrients, and support our environment. They support more life beneath their surface than exists above. They facilitate the life cycle of growth, sustenance and decay. They influence the worldwide distribution of plants, animals, and people.

What does a soil scientist do?

Soil scientists work for federal and state governments, universities, and the private sector. The job of a soil scientist includes collection of soil data, consultation, investigation, evaluation, interpretation, planning or inspection relating to soil science. This career includes many different assignments and involves making recommendations about many resource areas.

A soil scientist needs good observation skills to be able to analyze and determine the characteristics of different types of soils. Soil types are complex and the geographical areas a soil scientist may survey are varied. Aerial photos or various satellite images are often used to research the areas. Computer skills and geographic information systems help the scientist to analyze the multiple facets of geomorphology, topography, vegetation, and climate to discover the patterns left on the landscape.

Soil scientists work in both the office and field. The work may require walking over rough and uneven land and using shovels and spades to gather samples or examine a soil pit exposure.

Soil scientists work in a variety of activities that apply soil science knowledge. This work is often done with non-soil science professionals. A soil scientist's job may involve:

- conducting general and detailed soil surveys
- determining the hydric (wetness) characteristics of the soil
- recommending soil management programs
- helping to design hydrologic plans in suburban areas
- monitoring the effects of farm, ranch, or forest activities on soil productivity
- giving technical advice used to help plan land management programs
- predicting the effect of land management options on natural resources
- preparing reports describing land and soil characteristics
- advising land managers of capabilities and limitations of soils (e.g., timber sales, watershed rehabilitation projects, transportation planning, soil productivity, military maneuvers, recreation development)
- training other personnel
- preparing technical papers and attending professional soil science meetings
- conducting research in public and private research institutions
- managing soils for crop production, forest products and erosion control management.
- evaluating nutrient and water availability to crops
- managing soils for landscape design, mine reclamation, and site restoration
- investigating forest soils, wetlands, environmental endangerment, ecological status, and archeological sites

- assessing application of wastes including non-hazardous process wastes (residue and sludge management)
- conducting studies on soil stability, moisture retention or drainage, sustainability, and environmental impact
- assessing environmental hazards, including hazardous waste sites that involve soil investigation techniques, evaluation of chemical fate and transport phenomena, and remediation alternatives
- regulating the use of land and soil resources by private and public interests (government agencies)

These are some of the activities which soil scientists regularly practice. This work is most often conducted in coordination with other professionals with lesser training and knowledge of soil systems.

Well-trained soil scientists are in high demand for a wide array of professional positions with public agencies or private firms. Here are some specific examples of positions currently held by soil science graduates from one just university over the past 10 years.

- Wetland specialist
- Watershed technician
- Hydrologist with Board of Health
- Environmental technician
- State soil and water quality specialist
- Soil Conservationist
- County Agricultural Agent
- Landscaping business
- Farming
- On-site evaluation
- Crop consultant
- Soil scientist, mapping and interpretation, U.S. Department of Agriculture
- Research technician
- Conservation planner
- District marketing manager for an agricultural firm
- County conservationist
- Crop production specialist
- Research scientist

What kind of people become soil scientists?

People that become soil scientists usually have one or more of the following characteristics:

- love of science
- enjoy working outdoors
- enthusiasm for maps and relationships in nature
- desire to be an integral in environmental decisions related to soil conservation, land use, water quality, or waste management
- willingness to communicate their knowledge about soils and the environment to all aspects of society

- hunger for answers to questions and solutions to problems in agricultural and environmental settings
- desire to contribute to the success of others

How do people become soil scientists?

Most soil scientists have earned at least a bachelor degree from a major agricultural university. At many universities, two choices are available for specialized training in soils. The Soil Science option prepares students to enter the agricultural sector as farm advisors, crop consultants, soil and water conservationists, or as representatives of agricultural companies. The Environmental Soil Science option prepares soil scientists for careers in environmental positions dealing with water quality concerns, remediation of contaminants or for on-site evaluation of soil properties in construction, waste disposal, or recreational facilities.

Where do you find career opportunities?

Soil Science Society of America - www.soils.org/

National Society of Consulting Soil Scientists - www.nscss.org/jobs.html

U.S. Consortium of Soil Science Associations - www.soilsassociation.org

Office of Personnel Management - www.usajobs.opm.gov/

Soil Formation and Soil Classification

Most soils are given a name, which generally comes from the locale where the soil was first mapped. Named soils are referred to as **soil series**.

Soil survey reports include the soil survey maps and the names and descriptions of the soils in a report area. These **soil survey reports** are published by the National Cooperative Soil Survey and are available to everyone.

Soils are named and classified on the basis of physical and chemical properties in their horizons (layers). **"Soil Taxonomy"** uses color, texture, structure, and other properties of the surface two meters to key the soil into a classification system to help people use soil information. This system also provides a common language for scientists.

Soils and their horizons differ from one another, depending on how and when they formed. Soil scientists use five soil factors to explain how soils form and to help them predict where different soils may occur. The scientists also allow for additions and removal of soil material and for activities and changes within the soil that continue each day.

Parent material. Few soils weather directly from the underlying rocks. These "residual" soils have the same general chemistry as the original rocks. More commonly, soils form in materials that have moved in from elsewhere. Materials may have moved many miles or only a few feet. Windblown "loess" is common in the Midwest. It buries "glacial till" in many areas. Glacial till is material ground up and moved by a glacier. The material in which soils form is called "parent material." In the lower part of the soils, these materials may be relatively unchanged from when they were deposited by moving water, ice, or wind.

Sediments along rivers have different textures, depending on whether the stream moves quickly or slowly. Fast-moving water leaves gravel, rocks, and sand. Slow-moving water and lakes leave fine textured material (clay and silt) when sediments in the water settle out.

Climate. Soils vary, depending on the climate. Temperature and moisture amounts cause different patterns of weathering and leaching. Wind redistributes sand and other particles especially in arid regions. The amount, intensity, timing, and kind of precipitation influence soil formation. Seasonal and daily changes in temperature affect moisture effectiveness, biological activity, rates of chemical reactions, and kinds of vegetation.

Topography. Slope and aspect affect the moisture and temperature of soil. Steep slopes facing the sun are warmer, just like the south-facing side of a house. Steep soils may be eroded and lose their topsoil as they form. Thus, they may be thinner than the more nearly level soils that receive deposits from areas upslope. Deeper, darker colored soils may be expected on the bottom land.

Biological factors. Plants, animals, micro-organisms, and humans affect soil formation. Animals and micro-organisms mix soils and form burrows and pores. Plant roots open channels in the soils. Different types of roots have different effects on soils. Grass roots are "fibrous" near the soil surface and easily decompose, adding organic matter. Taproots open pathways through dense layers. Micro-organisms affect chemical exchanges between roots and soil. Humans can mix the soil so extensively that the soil material is again considered parent material.

The native vegetation depends on climate, topography, and biological factors plus many soil factors such as soil density, depth, chemistry, temperature, and moisture. Leaves from plants fall to the surface and decompose on the soil. Organisms decompose these leaves and mix them with the upper part of the soil. Trees and shrubs have large roots that may grow to considerable depths.

Time. Time for all these factors to interact with the soil is also a factor. Over time, soils exhibit features that reflect the other forming factors. Soil formation processes are continuous. Recently deposited material, such as the deposition from a flood, exhibits no features from soil development activities. The previous soil surface and underlying horizons become buried. The time clock resets for these soils. Terraces above the active floodplain, while genetically similar to the floodplain, are older land surfaces and exhibit more development features.

The soil forming factors continue to affect soils even on "stable" landscapes. Materials are deposited on their surface, and materials are blown or washed away from the surface. Additions, removals, and alterations are slow or rapid, depending on climate, landscape position, and biological activity.