Soil: Earth's living skin

Soil is one of the significant support systems for human life. Understanding its relevance to the Earth's processes will help us address the increasing pressures on our planet's land and water supplies.

By DR ALFRED HARTEMINK

Soil is a major support system of human life and welfare. It provides anchorage for roots, holds water long enough for plants to make use of it and holds nutrients, making them accessible to support life. It is home to a myriad of micro-organisms that accomplish a suite of biochemical transformations from fixing atmospheric nitrogen to the decomposition of organic matter; most biodiversity is in the soil, not above ground.

A different perspective on planet Earth is now revealed by technological advances that show earth processes and systems at scales at which they operate. We can now see and measure from the molecular scale to the global, in time spans from nanoseconds to millennia. These observations have been built into models of earth processes that predict the outcomes of present trends and management options. Rather than relying on trial-and-error, predictive models underpin decision- and policy-making with the potential to improve and protect soil quality for future generations.

Soil is integral to:

Climate: through mediation of the water cycle, carbon storage and emission of greenhouse gases (water vapor, CO_2, NO_x and methane).

Water cycle: soil is a key link and buffer system in the world's hydrological cycle. About 60% of freshwater is green water, held in the soil and available to plants. Soil also regulates streams and groundwater flows that support wetlands, irrigation, and domestic and industrial water supplies.

Waste and nutrient cycles: nutrients released by weathering or fixed from the air are recycled; toxins are neutralized. Disturbance of the cycle may bring about eutrophication or pollution of soils and water or, on the other hand, depletion of nutrients that threatens livelihoods across the world.

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Erosion: loss of the soil cover can lead to the stripping of the Earth's living skin with all its irreplaceable functions. Erosion is not all bad; much of our most fertile soil in deltas, alluvial and loess plains are products of past erosion. However, when wind and water erosion is accelerated by mismanagement, it leads to alarming soil degradation and diminished air and water quality.

Key issues in soil science

Expand knowledge base

Soil science has greatly contributed to the exponential increase in agricultural production and the feeding, housing, and clothing of the people of the world. There are great challenges ahead for soil science as burgeoning human populations and aspirations increase pressures on land and water. The spatial and temporal characterization of soil and its functioning within ecosystems is vital for our understanding of the earth as a global system. Wise use of natural resources requires an expanding knowledge base that accommodates the dynamics of a rapidly changing world; where to focus is a big question.

Link soil science to the Earth sciences

Great benefits can be expected with further integration between traditional fields, for example the regolith (between soil at the surface and the solid geology below) and the influence of land-use and management on soil characteristics across a range of spatial scales. Substantial new work is needed to bridge the gaps; the crux is how this can be achieved most effectively.

Integrate knowledge

The pedosphere (soil) is the link between the atmosphere and the other ground-based spheres (geosphere, biosphere, hydrosphere) and we need to increase interaction between the many different groups and show that soil is important to all the other spheres.

Communicate better with society

Relevant, science-based information is needed so that informed decisions can be made and this will demand more effective interaction with policy-makers. We are also looking for radio and TV programs, plays, pictures, press and internet ventures. Better communication should attract students, for the future of soil science will depend on them. ■

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