

Soil and Health

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Soils' contribution to (1) food production (amount and quality), (2) cycling of carbon, nutrients, and water, and (3) overall environment health including plants, human and other organisms are the direct beneficial effects of soil on health. While human and other living organisms exposure to potentially toxic compounds and pathogens in soils are the direct adverse effects of soils on health.

We count on soils for enhancing food quality and safety, providing safe habitat for soil microorganisms, maintaining or enhancing our air quality by minimizing greenhouse or other potentially toxic gas release, protecting our groundwater by filtering potentially toxic substances and disease organisms from wastewater, and protecting our surface water by sequestering or degrading potentially problematic substances including nutrients and disease organisms moving with runoff water.

Soils can be a sink, interacting medium, or a source for many potential pollutants including agricultural inputs (nutrients, pesticides), waste, spills, leaks, aerial deposition, and greenhouse gases (CO_2 , CH_4 , N_2O). Thus healthy soils capable of functioning well are vital to our health and future well-being through their impact on food production, food safety, human and ecosystem health and climate change. Soil health is defined as the capacity of a living soil to function, within natural or managed ecosystems boundaries, to (1) sustain plant and animal productivity, (2) maintain or enhance water and air quality, and (3) promote plant and animal health. It is clear that the combination of an increasing population and decreasing area of per-capita cultivated land puts our soils under ever-increasing pressure to enhance food production. Thus protecting soil health should be a critical component in our effort to sustainable intensification of existing croplands.

Humans may assimilate beneficial or toxic compounds and pathogens in soil through direct (soil-human) or indirect pathways (for example, soil-food-human or soil-water-human, etc.). The environmental consequences of beneficial and toxic substances in soils are related to their bioavailability. The bioavailability of a substance is related to the possibility for that substance to cause an effect, either positive or negative, on an organism. Thus the bioavailability of a given substance in soils is controlled more by its chemical form than its total concentration in soil. A major challenge for those examining effects of soil on health will be developing accurate and sensitive methods for the determination of the soil health as well as the bioavailability of beneficial and toxic substances in soil to various end points in order to better understand their direct or indirect effects on human and ecosystem health. Responsibility of soil scientists is to work together with expertise in other disciplines to design strategies that can optimize the benefits of soils to overall ecosystem health and to minimize any negative impacts.

Reference: Doran, J. W. 2002. Soil health and global sustainability: translating science into practice. *Agriculture, Ecosystems Environ.* 88, 119–127.