



2015

International  
Year of Soils

# August... Soils Support Health



## Overview

### Soils support medicine development

Soil biodiversity is immense. It dwarfs above-ground diversity. One gram of soil can hold:

- 10,000 to 50,000 species,
- 3 billion bacteria,
- a plethora of fungi, protozoa, algae and other organisms,
- If you removed the bacteria from an acre-6 inches of soil they would weigh about the same as 2.5 cows.

Society through antiquity has found medicines in nature (for example aspirin, morphine).

### Soils support healthy environments

Soil is used as a disposal site for waste water and organic/inorganic toxic solids/solutes.

Common soil pollutants include oil, residuals of pesticides, tars, PCB, dioxins, and heavy metals (cadmium, lead, chromium, copper, zinc, mercury, arsenic).

### Soils support healthy food

The soil is the ultimate source of nutrition for plants and other organisms, including humans. About 95% of our food is grown in soil.

The soil must supply 14 nutrients. A lack of any one nutrient can limit plant growth. The healthiest food comes from soils that can supply all nutrients in the right amounts. Eleven of those elements make up 99.9% of the atoms in the human body.

Soil is an important aspect of food security. Nutrient deficiencies in soil can promote adverse health affects.

## Science

### Soils support medicine development

To deal with the immense biodiversity, microorganisms exude chemicals that inhibit the growth of other microorganisms. Science has been able to develop these into pharmaceuticals. These are called anti-microbial compounds and include:

- antifungal,
- antibacterial,
- anticancer, and
- antidepressant chemicals.

### Soils support healthy environments

The soil is a bioreactor and a chemical reactor. It purifies water by removing chemicals through:

- chemical reactions and biochemical reactions. These include
  - Hydrolysis,
  - Acetogenesis,
  - Methanogenesis, and
  - Enzymes such as deoxygenases that break aromatic compounds;
- physically filtering contaminants.

The soil bioreactor can help eliminate polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), chloroethenes and some pharmaceuticals – the process is called bioremediation of soil

### Soils support healthy food

Iron deficiency is most common and affects up to 5 billion people. An Iodine deficiency in the soil can cause goiter and neuropsychological disorders. Zinc and copper deficiencies in the soil can lead to stunted growth and heart disease. An excess of some nutrients can also be toxic (i.e. Fe, Zn, Cu)

## Benefits

### Soils support medicine development

The soil has and is producing a wide range of pharmaceuticals. The genus *Streptomyces* has been the 'workhorse' producing over 500 new medicines with an estimated potential to produce 120,000 more. Some better known medicines for animals and humans are:

- Choramphenicol<sup>1</sup> – the first antibacterial produced on a large scale
- Migrastatin<sup>1</sup> – an anticancer drug
- Ivermectin<sup>1</sup> - an antiparasitic drug
- Tetracycline<sup>1</sup> – first-line therapy for Lyme disease and Chlamydia

In 1952 Dr. Selman Waksman was awarded the Nobel Prize in medicine for the discovery of Streptomycin<sup>1</sup> – the first pharmaceutical with the potential to fight tuberculosis

<sup>1</sup> World Health Organization's List of Essential Medicines

### Soils support healthy environments

An example of a benefit is the discovery that some bacteria possess enzymes called reductive dehalogenases allowing microbes to decompose oil polluted areas that are oxygen depleted

### Soils support healthy food

Healthy soil improves plant vigor, which improves plant nutrition, reduces costs associated with food production, and improves crop yield. Healthy soil makes nutritious food more available and affordable.

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