

An Overview: Soil Health

Healthy soils are filled with life, and protecting them ensures farmers can continue to grow abundant, nutritious crops.

The Basics

- // **What:** Soil is a complex ecosystem containing minerals; living plants and animals; beneficial bacteria; and organic matter. Soil forms the foundation for our ability to grow healthy crops, but by some estimates, nearly half of the topsoil on the planet has been lost in the past 150 years.
- // **Why:** Healthy soils not only produce more food, but they also retain water during drought, filter pollutants, prevent flooding, absorb greenhouse gases and support a rich diversity of life. But, a better understanding of this important ecosystem can also help us unlock the secrets of producing healthier crops more sustainably.
- // **How:** Innovations like genetically modified (GM) technologies that allow for conservation tillage helps protect and restore soil. Identifying beneficial bacteria in soil that helps plants grow and protect them from pests can increase soil fertility, improve crop production and contribute to agricultural sustainability.



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of the Earth's soils are considered healthy enough to be suitable for farming.¹

The Background

Soil is made up of air, water, beneficial bacteria and fungi, nutrients from decaying plants, organic matter and minerals. There are three basic types of soil particles, categorized by size: sand, silt and clay. Healthy soils are porous, so air and water move freely through them. Healthy soils contain more nutrients and retain more water, protecting against drought and flooding. They also absorb greenhouse gases and filter pollutants in the environment. It can take thousands of years to accumulate a small layer of topsoil. Protecting the soil we have is critical to ensuring farmers can grow healthy crops. In recent years, scientists have increased their understanding of soil to identify innovative ways we can enhance it for the benefit of healthy crops and sustainability.

The Highlights

Not all soils are alike – and healthy soils are the most precious of all.

- // Soil covers most of the world's total land surface, but only about 11 percent of Earth's soils are considered healthy enough to be perfectly suitable for farming.²
- // Tropical rainforests are lush environments, but their deeper soil is acidic and low in minerals. That's why, when rainforests are cleared for farming and the nutrient-rich topsoil is depleted, they are unable to regenerate.³
- // Because 95 percent of our food is produced on a small fraction of Earth's soils, we must protect healthy soils to secure our future food supply.⁴

A lot is happening underneath your feet.

- // Healthy soils aren't just substrates where crops grow. They also contain millions of species living in the soil microbiome, most of which have never been identified.⁵
- // Beneficial soil microbes constantly interact within their environment. They help plants by transferring vital nutrients or protecting against pests to improve plant health.
- // Microbial populations are hyper-local, and a specific mix of microbes in the soil may be required for plants to germinate, grow or thrive.⁶

References

1. FAO. <http://www.fao.org/docrep/u8480e/u8480e0b.htm>

2. Ibid.

3. Wild Madagascar. <http://www.wildmadagascar.org/overview/rainforests2.html>

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The Highlights

Soil management is the key to sustainable agriculture.

- // Soil degradation is a global problem. Thankfully, soil carbon is a renewable resource, so we can develop management practices that offset and eventually help restore degraded soils.⁷
- // Management practices like low-till farming and using cover crops help keep soil healthy by reducing erosion and improving the soil's ability to store carbon.⁸
- // Unlike past practices that disrupted the soil structure and left topsoil exposed, modern soil management, enabled by innovations like GM crops and biologicals, is focused on preserving the soil to keep it healthy and productive.⁹
- // Low-tillage farming practices and integrated weed management programs can help preserve soil organic matter, nutrients and moisture and reduce erosion. They also cut down fuel and energy use and costs.

Research is being done to understand how soil health can improve through microorganisms.

- // Beneficial soil organisms can help protect plants in two ways: by selectively eliminating harmful pathogenic microbes, or by stimulating the plant's own defense mechanisms.¹⁰
- // Scientists are only beginning to understand how beneficial microorganisms can protect and improve the health of crops. They work in a way that's similar to how probiotics work in people.¹¹
- // Bayer has taken a lead in research and development for the future of soil health. Bayer formed a new company that is studying the soil microbiome. This company is exploring how microbes can aid in nitrogen fixation, which may help reduce our dependence on synthetic fertilizers.
- // The use of "donor" microbes may one day allow drought-sensitive crops to thrive in drier areas, or even help kick-start the restoration of an entirely new healthy soil ecosystem.¹²

Key Things to Remember

- // Soil is a complex ecosystem made up of air, water, decaying plants, organic matter and minerals. There are three basic types of soil particles, categorized by size: sand, silt and clay. Most soils include a combination of all three different particle types.
- // Healthy soil is important to have because it can support a variety of living organisms, contain more nutrients, retain more water, absorb greenhouse gases and filter pollutants in the environment.
- // Keeping soil healthy is important to maintain resilience of soils and support our future food supply. It can take thousands of years to newly form a small layer of topsoil after being eroded.

References

7. Yale Environment 360. https://e360.yale.edu/features/soil_as_carbon_storehouse_new_weapon_in_climate_fight

8. USDA. <https://www.ars.usda.gov/news-events/news/research-news/2010/no-till-farming-improves-soil-stability/>

9. SARE. <https://www.sare.org/Learning-Center/Books/Building-Soils-for-Better-Crops-3rd-Edition/Text-Version/Introduction/Soil-Health-Integral-to-Sustainable-Agriculture>

10. The Scientist (2013). <https://www.the-scientist.com/?articles.view/articleNo/33703/title/Fighting-Microbes-with-Microbes/>