

# Soil is the key to Earth's history (and future)

May 21 2019, by Derek Lynch

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Credit: AI-generated image ([disclaimer](#))

The English language is full of phrases—from "bogged down" to "feet of clay" and "dirt cheap"—that reflect how we appreciate the diversity of soil, but value it little.

Soil retains a special place in many cultures. In Ireland, where I grew up, patches of what is known as "hungry ground" are thought to retain the memory of the Irish Famine in the 1800s, and you are advised to carry

bread while you cross them. To poet Patrick Kavanagh, the clay of soils sealed the hopeless fate of lonely Irish bachelor farmers: "[Clay is the word and clay is the flesh](#) Where the potato-gatherers like mechanised scarecrows move."

But is [soil](#) valueless like dirt or replete with mystery? Is it just dirt, or a cathedral of evolutionary and cultural memory? Like an elder among us, soil holds records of our planet's past and the possibilities of its future sustainability.

## A repository of memory

Like a library, soil houses stories written from the microscopic to the landscape scale of human and evolutionary history. Our enormous recent impacts, from [the global nitrogen cycle](#) to our use of atomic weapons, can be read as elemental and isotopic traces in soil.

One quarter of all the world's biodiversity can be found in soil; it is where many [plants, bacteria and fungi evolved together](#). In many cases, plants and soil microbes established mutually beneficial relationships, communicating with each other by sending signals through the soil in a complex dating game. Butterflies and beetles and some bees, too, [evolved to need the soil for certain stages of their life cycle](#).



Functions of soil. Credit: [Food and Agriculture Organization of the United Nations](http://www.fao.org/soils-2015)

Soil also remembers its natural vegetation—as seeds that can be used to help restore the native plant diversity and ecosystem, [even in an urban lawn setting](#). For plants, [the memory of their interaction with soil microbes](#) may even be transmitted to their offspring.

## Ecosystem services

In our urgent search for solutions to climate change, we have realized soils are key to turning back the carbon clock and [reversing CO<sub>2</sub>](#)

[accumulation in the atmosphere](#). Thus we are recognizing soils as far more than just an anchor for growing [plants](#), but as the irreplaceable "skin of the Earth" providing economic, environmental and social services that are essential for life.

Now more than ever, the science of soil reflects this appreciation of soil's keystone role in preserving biodiversity, reversing [climate change](#) and sustaining life on Earth.

## Understanding soil

The history of soil science has often been [a story of international collaboration](#), including the recent production of [a global soil carbon map](#) and [an atlas of soil biodiversity](#), both wonderful examples of important global advances in soil science.



Québec farmer Sebastien Angers (standing) invites Laval University researcher Caroline Halde and French Masters intern Nathan Rondeau to assess the soil quality under a cover crop in spring 2019. Credit: Derek Lynch, Author provided

Rapid advances in application of molecular techniques are helping us understand in much greater detail the relationships between soil organisms and the many essential functions they perform. Importantly, too, we are learning much more about soil's resilience, such as how it responds to, and may recover from, [the stresses imposed by human activities or a changing climate](#).

We are learning more about the services provided by soils in cities, and [the unique stresses imposed upon them](#). According to Canadian soil scientist Henry Janzen, a fundamental goal of soil science and key to global sustainability [is to extract the memories hidden in soil](#).

## **Managing farm soils**

Intensive farming systems are a major driver of land degradation and soil losses, and [declines in the abundance and diversity of animals and plants](#). Applying our improved understanding of soil, an urgent challenge is to develop and support farming systems that are sustainable ecologically while also providing humanity sufficient supplies of food and fibre.

Farmers, as land managers, are on the front lines of this challenge. [Many take an agro-ecological approach](#) and consider themselves stewards or caretakers of plant diversity and the soil as much as solely producers of crops.

For example, farmers who plant mixtures of flowering cover crops

(buckwheat, phacelia, sweet clover, vetch etc.) benefit pollinators. The crop also protects the soil by keeping it covered over winter. As it decomposes, the abundant cover crop residue improves the soil's structure and biological activity, while releasing nutrients to the following cash crop.

We need to cherish and learn from soil now more than ever. It holds the keys to our planet's past and future.

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