

Soil – the hidden world beneath our feet

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Soils are at the foundation of all terrestrial plant ecosystems and land based economies. It takes thousands of years to form just centimetres of this finite resource. According to the Food and Agriculture Organisation (FAO), one-third of global soils are degraded.

Besides being a nutrient source for plants, soils act like a giant sponge, filtering water and storing carbon. There is more carbon stored in global soils, than in all plant and animal life combined.

Soils are derived from mineral rock and organic matter. They traverse a continuum from mostly mineral, think of beach sand, to, composed entirely from organic matter, e.g. peat.

When we speak of organic matter, we are talking about carbon. The organic component of mineral soils can vary but most improved pasture or cultivated land contains less than 5% organic matter.

Wet peat soils have the capacity to store at least twice as much carbon as an equivalent-sized woodland. This is the motivation behind recent rewetting proposals to offset carbon emissions.

As with the above-ground food web, the soil food web starts with plants, mainly discarded leaves, roots and exudates: 'juices' that plants secrete into the soil.

Plant-derived organic matter in varying stages of decomposition is



Most life in mineral soil is concentrated around plant roots – the rhizosphere.



Soils contain more than a quarter of all living organisms.

the food supply for soil organisms, who consume and decompose it, or consume something that lives on it.

These organisms produce or become organic waste themselves. All this activity is concentrated in the area immediately around plant roots, the rhizosphere.

Organic matter

Availability of organic matter (food), supports soil communities and nutrient cycling in soils, and in turn supports plant growth. The microscopic populations of the below-ground food web, e.g. microbes, fungi, protozoa, springtails, nematodes, and mites, are countless. They are the first levels of feeders in the soil, mobilising N, P and other nutrients. A complex diversity exists within each of the soil fauna groups.

For example, the thousands of known species of soil nematode can be categorised into at least five feeding groups that include bacterial feeders, fungal feeders, plant feeders, parasites and predators.

Larger soil organisms, such as soil feeding earthworms, while much fewer in species (28 in Ireland) play a less direct yet essential role in nutrient release, as well as a vital role for soil structure and aeration.

While much organic matter is food for soil organisms and in turn plants, humus (organic matter in an advanced state of decomposition) can be stored in the soil as a long term carbon resource.

All sources of organic matter are not equal. Slurry is an easily broken down source of organic matter because of the absence of bulky carbon rich organic waste. Due to this labile nature, slurry comes with an increased potential for leaching into water sources.

Traditionally, composted farmyard manure was spread on land to enhance soil fertility. This has available nutrients which can be immediately tapped by soil fauna, as well as higher C:N organic matter (straw usually).

The manure soaked straw is broken down slowly, acting as a slow release fertiliser and contributing to that long term humic carbon store in soils. This is where the organic principle of "feeding the soil rather than the plant" originates.

*Soil science modules and principles are taught to Horticulture students at Kildalton and the Botanic Gardens at levels 5, 6, and at level 7, in conjunction with SETU.