

## Soil Micro and Macro Biology

### Soil Food Web

The soil **food web** is the community of organisms living all or part of their lives in the soil. An incredible diversity of organisms make up the soil food web. They range in size from the tiniest one-celled bacteria, algae, fungi, and protozoa, to the more complex nematodes and the visible earthworms, insects, small vertebrates, and plants. Organisms live in the tiny environments within and between soil particles. Differences over short distances in pH, moisture, pore size, and the types of food available create a broad range of **habitats**.

As soil organisms eat, grow, and move through the soil, they make it possible to have clean water, clean air, healthy plants, and moderated water flow. Soil organic matter is the storehouse for the energy and nutrients used by plants and other organisms. Bacteria, fungi, and other soil dwellers transform and release nutrients from organic matter. This process, known as **decomposition**, makes nutrients stored in organic matter available to plants and to other soil organisms. All plants – grass, trees, shrubs, agricultural crops – depend on decomposition and the food web for their nutrition.

### Soil organisms

The organisms of the food web are not uniformly distributed through the soil. Each species and group exists where they can find appropriate space, nutrients, and moisture. They occur wherever organic matter occurs – mostly in the top few inches of soil.

Many species of **arthropods** make their home in soil. Arthropods range in size from microscopic to several inches in length. They include insects, such as springtails, beetles, and ants; crustaceans such as sowbugs; arachnids such as spiders and mites; myriapods, such as centipedes and millipedes; and scorpions.

Nearly every soil is home to many different arthropod species. A single square yard of soil will contain 500 to 200,000 individual arthropods, depending upon the soil type, plant community, and management system. Several thousand different species may live in a square mile of forest soil. Most soil-dwelling arthropods eat fungi, worms, or other arthropods. As they feed, arthropods aerate and mix the soil and regulate the population size of other soil organisms. Some arthropods shred dead plant residue and expose more of its surface area to bacteria, thereby speeding up the process of decomposition.

Earthworms make a major contribution to the process of decomposition in the soil. They dramatically alter soil structure, water movement, and plant growth. They are not essential to all healthy soil systems, but their presence is usually an indicator of healthy soil. Earthworms perform several beneficial functions. They derive their nutrition from fungi and bacteria, and they promote the activity of these organisms by shredding and increasing the surface area of organic matter and making it more available to small organisms. As they eat bacteria and plant residue, they excrete casts that become part of the soil. Earthworms carry organic matter down through deeper soil layers as they burrow. Their burrows increase the air and water holding capacity of the soil. A large proportion of soil passes through the guts of earthworms, and they can turn over the top six inches of soil in ten to twenty years.

While arthropods and earthworms can be found and readily observed in the soil, other important soil dwellers are too small to be seen without a microscope. These microorganisms are an important part of the soil food web as well. Nematodes are tiny, non-segmented worms that help to release nutrients in forms plants can use. They also move bacteria and fungi through the soil. Bacteria are important in converting organic matter into forms of energy that other organisms can use and retaining nutrients such as nitrogen in the soil ecosystem. Without microorganisms, dead organic matter would pile high on Earth's surface.