Soils are Living

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Soil Organisms and Their Role in Soil Productivity

Soil is alive. There are more species of organisms in the soil than there are aboveground. These organisms include everything from badgers and gophers to bacteria and viruses that are invisible to the naked eye. A single handful of soil contains millions of individual living organisms. Many of the ecosystem services provided by soil are actually performed by soil organisms.

One of the most important functions that soil organisms perform is decomposition. Without decomposition, all the plants and animals that ever died would be piled up on top of the ground. Microorganisms break down animal wastes, fallen leaves, and the dead plants and animals. This process releases the carbon and nutrients used by the plants and animals back to the environment in forms that future generations of plants and animals can use. This is called nutrient cycling. Decomposition is just one way that soil organisms contribute to nutrient cycling. Microorganisms are also the agents that remove much of the algae-producting nutrients from water when we think of the filtering services of soil. Some microorganisms also capture nitrogen from the atmosphere; this can be done independently or in partnership (through symbiosis) with leguminous plants. **Legumes**, like green beans and alfalfa, allow certain soil bacteria to live in their roots – to benefit from nitrogen that the bacteria captures from the air.

Soil microorganisms are a lot like other living things—they have waste products. These wastes are very beneficial to soil. The wastes of the decomposition process provide the dark color that indicates a soil is rich in nutrients. The dark color also helps soils absorb sunlight and warm up. Microorganisms' wastes can also act like sticky glues and help individual sand, silt, and clay particles to stick together, giving the soil structure. Strong structure is essential to having big pores for water, air, and roots to move through and for giving the soil stability against compaction and erosion when used for walking, building, or agriculture. In addition to gluing soil particles together, some microorganisms have long filaments that wrap around the soil particles to help hold them together.

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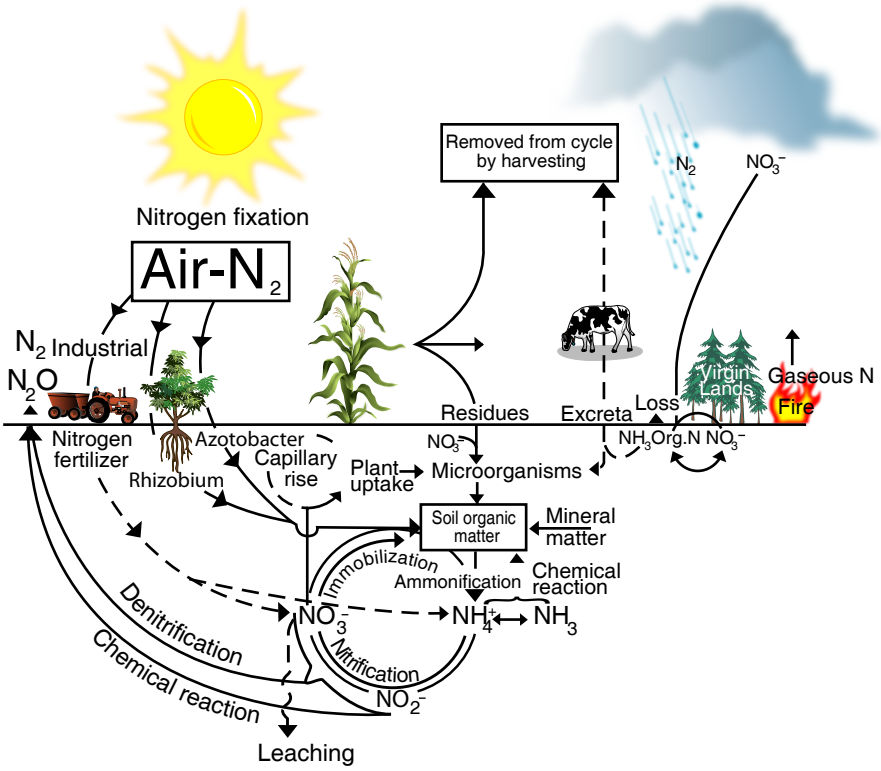
And, members of the soil macro and microorganism populations interact with each other, as well as with plants and insects in the soil. There are some beneficial interactions, such as with the legumes, and there are some antagonistic interactions, such as crop diseases. In a healthy soil, with a diverse community, beneficial species can out-compete the disease-causing (pathogenic) species, resulting in less disease pressure. Soil scientists have developed methods to capture the chemicals these disease fighting microorganisms use and create medicines from them. Some examples of medicine from soil organisms are penicillin and streptomycin. When the population of organisms is diminished or loses diversity, the ability of soil to perform ecosystem services is greatly reduced.

After seeing all the roles that microorganisms have in soil, it is easy to envision that there are many different organisms. Different plant communities and soil minerals allow different microorganism populations to flourish. In fact, each soil has a complex and unique community of organisms. This community can be used like a fingerprint in **soil forensics** as each individual community can be very distinct. The community in a soil found at a crime scene can give clues about where the criminals or victims have been. The soil at archeological sites can give many clues about the ancient society.

Recap

There are millions of organisms large and small that live in the soil and perform many important roles. It is important to maintain healthy soils by protecting soil from disturbance and organic matter loss. This ensures plenty of shelter and food for soil organisms, so that belowground diversity remains high and the soil microorganisms can provide us with ecosystem services.



The nitrogen cycle involves many microbial conversions of various forms of nitrogen. Some conversions make nitrogen available for plant growth while others lead to nitrogen losses and potential environmental problems. **Credit:** Know Soil, Know Life, modified from http://ohioline.osu.edu/aex-fact/0463.html modified from http://ohioline.osu.edu/aex-fact/0463.html

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