Science & Math

Soils and nutrient cycling in the rain forest

Image 1. The buttress roots of a fig tree in the rain forest of Taman Negara National Park in Malaysia. Photo by: Bernard Dupont via Wikimedia Commons

By Mongabay

Nutrient cycling is the movement of nutrients through an ecosystem. The nutrient cycle is an essential part of all ecosystems. To understand how nutrient cycling works in a rain forest ecosystem, it is important to know the basic makeup of rain forest soils. Understanding forest soils also helps to explain why clearing rain forest lands for agriculture does not work.

Soil Composition

More than two-thirds of the world's rain forests are considered "wet deserts." In the Amazon region, three-fourths of the rain forest fits this description. "Wet desert" rain forests grow in laterite soils. These soils are red and yellow and clay-like. They are also acidic and low in nutrients.

Many tropical forest soils are very old. Amazonian soils almost completely lack minerals like phosphorus, potassium, calcium and magnesium. The soils are, however, rich in aluminum oxide and iron oxide. These materials give tropical soils their reddish or yellowish color. They also make the soil toxic in high quantities. Yet the forests growing out of these soils are so lush. How can this be?

Early European settlers in the tropics were convinced that the soil must be extremely fertile. Even scientists at the time believed this. The settlers cut down large patches of forest to create farmland. Crops grew well on the cleared land — but only for one to four years. Then, mysteriously, harvests turned bad. Large amounts of fertilizer were needed to grow anything at all. The settlers did not understand why their crops died. The answer involves the rapid nutrient cycling that happens in the rain forest.

Nutrient Cycling

The settlers were used to temperate forests. They did not realize that rainforests have an entirely different ecosystem. In temperate forests, like those found across Europe, most of the nutrients live in the soil. In the rain forest, in comparison,

almost all the nutrients are locked up in living vegetation, dead wood, and decaying leaves. Decaying material is recycled incredibly quickly. Its nutrients are taken up so quickly, in fact, that hardly any nutrients reach the soil. That is why the soil is nearly infertile.

There are many decomposers in the rain forest. They include bacteria, fungi and termites. Decomposers break down dead and decaying things. In doing so, they can take up their nutrients. Virtually all matter is rapidly processed in the rain forest, even fecal matter and sweat.

Insects discover dung and utilize it within seconds. Butterflies, beetles and flies will swarm over the new dung, covering it. Dung beetles roll portions of the waste into balls to feed their larvae. Insects are not only attracted to dung as a source of energy but often for the nutrients it contains, such as calcium salts.

As vegetation dies, the nutrients are quickly broken down. Almost immediately, the nutrients are absorbed by plants. A fungi, mycorrhizae, attaches to plant roots. It is specialized to help roots take up nutrients from the soil. In return, plants provide the fungi with sugars and give them shelter in their roots. Studies have also shown that mycorrhizae can help a tree resist drought and disease.