GOLD NUGGET

Distribution Patterns – Soil Biodiversity At The Extremes
Part 1

The Critical Zone

The concept of 'critical zone' is becoming central to ecological thinking, and is defined as the area above and below the soil surface that is critical to life on Earth. Generally, the belowground portion of the critical zone is defined by plant roots; therefore, the critical zone in forests is thought of as being several metres deep. However, in drylands, the situation may be very different. Most precipitation events are less than 5 mm, meaning that most microbial activity, nutrient cycling, and other processes crucial to ecosystem functioning, also occur at soil surfaces which are dominated by biocrusts. Therefore, in dryland regions, the biocrusts may well define the critical zone.

Biodiversity at the soil surface

Soil organisms are distributed not only horizontally across different ecosystems on Earth, but also vertically, from the surface to the deeper soil layers, passing through the aggregates. The most evident and visible example of soil biodiversity on the superficial layer of soil are biological crusts. Biological soil crusts, or biocrusts, are found in most ecosystems where plant cover is limited. This includes hot, cool, and polar deserts, as well as steppe and sub-humid regions.

Biocrusts are communities of microorganisms: bacteria, cyanobacteria, fungi and green algae together with macroscopic lichens and mosses that cover most of the soil surfaces between the plants. The biodiversity found in biocrusts often far exceeds that of the plant community in which they are embedded, as they contain hundreds to thousands of species, whereas most plant communities contain fewer than 100 species.

Biocrusts play many essential roles in the ecosystems in which they occur and, as the biomass of the biocrust organisms increases, their influence on ecosystem processes increases as well. All biocrust organisms are integral to the formation and stabilisation of soils, and are believed to have been playing this role since they first appeared on land about one thousand million years ago. They accelerate soil weathering, altering soil pH by secreting acids and ions ($Ca2+$ and $OH-$). They also delay evaporation of soil moisture, thereby increasing rock and soil weathering by increasing the length of time these materials are wet.

Biocrusts are vital in soil stabilisation, especially in regions with low cover of other soil stabilisers, such as plants. Stabilisation is mostly a result of cyanobacterial and fungal filaments moving through the soil, as well as across its surface, leaving behind a trail of the sticky, mucilaginous sheath material that binds soil particles together. Lichens and mosses also protect the soil surface from exposure to wind or water, reducing the detachment of soil particles. Combined, biocrust organisms greatly reduce or even eliminate soil erosion in dryland regions. Biocrusts play other ecosystem roles as well. Cyanobacteria, green algae, lichens and mosses are all photosynthetic and, thus, contribute crucial carbon (C) to dryland soils. Carbon content is often very low in these soils and can limit microbial activity, thus slowing nutrient transformation and decomposition. The contribution of C by biocrusts can be substantial, often equivalent to the soil being covered by a vascular plant leaf. Nitrogen is also contributed to soils by free-living and lichenised cyanobacteria, and it is often the dominant source of this often-limiting nutrient. The nitrogen contribution by biocrusts has been estimated to be of global significance.

Farming Secrets says: ***Knowing Facts About Soil Health Gives Important Advantages***

Ref: **A Global Atlas of Soil Biodiversity p73**