GOLD NUGGET

Soils – An Introduction To Geographical And Temporal Distribution

Soils are among the most diverse habitats on Earth, and determination of the forces that operate at different scales that drive this diversity is one of the greatest challenges in soil ecology. Environmental factors work at the local scale of organic particles and plant roots, but also at the level of plant communities and, at more regional scales, related to topography and vegetation systems. Disturbance operates at all these scales and is an important factor for maintaining a high degree of habitat diversity in soil.

Therefore, organisms that normally compete, can coexist by being spatially separated. Many soil organisms utilise similar resources in the soil and there is an apparent contradiction between the high species richness and the low degree of resource specialisation. This high level of coexistence among species in the soil can only be understood when realizing the exceptionally large degree of spatial heterogeneity and microhabitat diversity in the soil. Soil may appear homogeneous when viewed on a large scale, but becomes more heterogeneous when approaching the scale of individual organisms.

Many soil organisms operate at the level of aggregated particles, and the stability of these aggregates are important when three-dimensional networks of water and air-filled pores are formed in the soil. Recent work using scanners has demonstrated a spatial distribution of potential microbial resources at the nanometre scale in microaggregates (10 - 100 µm in size), demonstrating an enormous spatial complexity which helps explain the high microbial diversity of soils. Soil microbes contribute to this complexity by producing fungal hyphae and sticky substances that bind organic and mineral particles together into aggregates.

Certain properties (e.g. soil structure) influence plant distribution, and the activity of plants are important in shaping soil communities. For instance, substances exuded by roots result in high microbial activity at the root surface (the rhizosphere effect) and such gradients of resources (nutrients, aeration, redox potential) in soils can be steep and change rapidly over time. Other environmental factors work on much longer time scales.

Variation in litter quality and exudation patterns among plants also influence soil organisms, and spatial patterns of soil communities are often reflected in spatial plant distribution patterns. The activity of soil communities can also shape plant communities. For instance, macrofauna, such as termites or ants, redistribute resources, such as organic matter, in the landscape, which has profound effects on vegetation patterns.

Abiotic drivers, such as climate, pH and soil moisture, are often important factors in shaping soil communities on larger scales, but plant functional traits may also be important. For instance, fast-growing plant communities are usually associated with soil microbial communities that are dominated by bacteria, while fungi dominate in soils of slow-growing plant communities.

On continental scales, pH is one of the most important factors shaping soil microbial communities, and this factor alone explains most of the variation in microbial soil communities, ranging from tropical forests and grasslands to temperate and boreal forests.

The aim of the next series of Gold Nuggets is to present the biotic and abiotic factors that influence the spatial and temporal patterns of soil communities.

Farming Secrets says: ***Plants Drive The System***

Ref: **A Global Atlas of Soil Biodiversity p 67**