GOLD NUGGET

Distribution Patterns – Soil Biodiversity Over Time

Soil biodiversity is not static. Populations of soil organisms change constantly over time, with changes in the structure and diversity of soil communities occurring over timescales of days to seasons, and even decades to millennia. A common feature of microbial populations in soil is that their abundance can change very rapidly, even over hours or days. Such rapid changes are caused by several factors, including predator-prey relationships and pulses in resource supply. After periods of drought, for example, sudden increases in soil water availability following rainfall events cause spectacular boosts in microbial growth and associated pulses of nitrogen mineralisation and carbon dioxide release from soil. The release of carbon-rich exudates into soil from roots also causes rapid increases in microbial growth, and the time taken from photosynthesis to the transfer of photosynthetic carbon to roots, mycorrhizal fungi and free-living soil microorganisms can take just hours in grassland or days in forests. Also, much of this photosynthetic carbon is lost from soil by heterotrophic respiration within a matter of hours or days, which points to the great importance of root exudation for short-term microbial dynamics in soil.

Pulses in root exudation can also be triggered by defoliation events, or when roots are attacked by root herbivores, which stimulates microbial activity and nitrogen mineralisation in the soil surrounding the root, increasing plant nutrient uptake and growth. The following zones have abundant living communities that may vary over short periods of time: detritusphere (interface between soil and litter), rhizosphere (interface between soil and plant roots), mycorrhizosphere (interface between mycorrhizal hyphae and soil), mycosphere (interface between fungal hyphae and soil) and drilosphere (interface between earthworm burrows and soil). For example, microbial processes increase by a factor of two when temperature increases by about 10 °C. Therefore, soil microorganism will be less active during the night than during the day. Other indirect effects may also influence the daily rhythms of microbial behaviour. For example, plants assimilate carbon during the day and release some carbohydrates into the soil by root exudation at night.

Soil communities also change in abundance and composition throughout seasons and years, caused by seasonal and inter-annual changes in precipitation and temperature, disturbance events linked to land use, and also the seasonality of plant growth. In some situations, seasonal shifts in soil communities are relatively distinct, for example in alpine soils where microbial communities display a complete turnover between winter and summer, with taxonomically and functionally distinct communities occurring at both times.

In other situations, however, communities can be very complex and apparently chaotic over time. In agricultural soils, for example, seasonal and inter-annual patterns in soil animal and microbial communities vary with land use and agronomic practices, including crop type and fertiliser regimes, as well as with soil type. Furthermore, effects of agronomic practices on soil organisms are likely to vary considerably at different times of the year, meaning that careful thought needs to go into how soil biodiversity is evaluated in field experiments to determine the effects of land management practices on the biology and functioning of soil. Moreover, seasonal and inter-annual patterns of soil biodiversity are complicated by the fact that many soil organisms can undergo long periods of inactivity when conditions are unfavourable, which allows them to tolerate periods of harsh soil conditions.

Farming Secrets says: ***Learn The Unseen Movements Of Soil Microbes***

Ref: **A Global Atlas of Soil Biodiversity p74**