GOLD NUGGET

Regulating Services – Atmospheric Composition And Climate Regulation Part 3

The Phosphorus Cycle And Soil Biodiversity

The phosphorus (P) cycle describes the movement of phosphorus through the soil, water and living organisms. The atmosphere does not play a significant role in this cycle. Phosphorus is an essential nutrient for all organisms since it is incorporated into many molecules that are essential for life, such as DNA.

Phosphorus occurs in both organic and inorganic forms. Soil P chemistry is very complex, with more than 200 possible forms of P compounds being affected by a variety of biological, physical and chemical factors. The relative amounts of each form of phosphorus vary greatly among soils, with the total amount of P in a clayey soil being up to ten times greater than in a sandy soil.

Soil organic P comprises many different compounds, the majority of which are of microbial origin. Organic P is locked up in the soil and is generally not available for plant uptake until the organic materials are decomposed and the phosphorus released via the mineralisation process. Mineralisation is carried out by soil microorganisms (e.g. bacteria) and, similar to nitrogen, the rate of P release is affected by abiotic factors, such as soil moisture, composition of organic material, oxygen concentration and pH.

Mineralisation and immobilisation occur simultaneously in the soil. If the P content is high enough to fulfil the requirements of the microbial population, mineralisation will be the dominant process.

Soil phosphorus losses to the environment through runoff and/or leaching may create agricultural issues. Insufficient soil P can result in:

- delayed crop maturity,
- reduced flower development,
- low seed quality and
- decreased crop yield.

Runoff is a result of soil-bound P being carried away by water (soil erosion). Leaching is the removal of P from the soil by the movement of vertical water. Microbial mineralisation allows the slow release of P into the soil during the growing season, thus making it available for plant uptake. This process reduces the need for fertiliser applications as well as the risk of runoff and leaching.

The inorganic P content is regulated by other mechanisms. Adsorption is the chemical binding of P to soil particles, which makes it unavailable to plants. Desorption is the release of adsorbed P from its bound state into the soil solution, where it becomes accessible to roots.

The P cycle is also indirectly regulated by soil organisms other than microbes, such as protists and nematodes that feed on bacteria and fungi responsible for the mineralisation processes. It has been shown that the elimination of nematodes reduces nutrient mineralisation and consequently causes a decrease in phosphorus uptake by plants.

Soil Lovers say: ***A Healthy Biodiverse Soil Food Web Ensures The Cycling Of Phosphorus***

Ref: **A Global Atlas of Soil Biodiversity p105**