GOLD NUGGET

Regulating Services – Atmospheric Composition And Climate Regulation Part 1

Climate change

Climate change is most likely the greatest challenge that humans will face this century. The role of microbiota in determining the Earth's atmospheric composition, and hence climate, started with the origin of life. From the first molecules of oxygen produced by marine cyanobacteria 3.5 thousand million years ago, to the production of methane by archaea in the warm, carbon-rich swamps of the Carboniferous period, microbial processes have long been key drivers of, and responders to, climate change. Throughout the history of our living planet, microbes have been the main modulators in determining atmospheric concentrations of greenhouse gases (GHG), including carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O).

Carbon dioxide

The amount of CO2 in the atmosphere is determined by the balance between photosynthesis, which consumes CO2, and respiration, which produces CO2. It is estimated that ~ 120 thousand million tonnes of CO2 are removed from the atmosphere by photosynthesis each year. This is approximately balanced by ~ 119 thousand million tonnes emitted into the atmosphere by autotrophic and heterotrophic (microbial) respiration.

Soils can act as either a source or a sink of atmospheric carbon. Globally, soils contain a vast amount of organic carbon (~ 1 550 thousand million tonnes), which is more than the total carbon contained in vegetation and the atmosphere combined. An additional 750 thousand million tonnes of carbon is contained in inorganic forms in soils. These soil carbon stocks are not static, but dynamic over time, with accumulation occurring through plant and animal inputs, and losses via decomposition of soil organic carbon (SOC) leading to the release of CO2 into the atmosphere. Agriculture and other land-use changes, such as deforestation, that cause soil disturbance, greatly accelerate the decomposition of SOC and thus increase net emissions of CO2 to the atmosphere. Since industrial activities began (1760 - 1840), it has been estimated that 40 - 90 thousand million tonnes of SOC have been released. This is significant considering that the release of 1 thousand million tonnes of soil carbon can result in a 0.5 ppmv (parts per million by volume) increase in atmospheric CO2.

Methane

Methane (CH4) is the second most important greenhouse gas, with a global warming potential estimated to be 25 times higher than that of CO2. Terrestrial CH4 emissions are under even greater microbial control than that of CO2. Natural emissions (~ 250 million tonnes a year) that primarily (~ 95 %) originate from terrestrial ecosystems, including natural wetlands, result from the activity of a group of microbes known as archaea through the process of methanogenesis. Soil arthropods contribute ~ 20 million tonnes of CH4 every year. These are exceeded by anthropogenic emissions (~ 320 million tonnes per year) from rice cultivation, livestock farming, landfill and fossil-fuel extraction that (with the exception of fossil-fuel extraction) promote abundance and activity of methanogenic biota.

To be continued…

***Soil Lovers say:** Regenerative Farming Plays A Major Role in Carbon Storage*

***Ref:* A Global Atlas of Soil Biodiversity p102**