Regulating Services – Atmospheric Composition And Climate Regulation Part 2

Nitrous oxide

The flux of nitrous oxide (N_2O) from terrestrial ecosystems is predominately biologically controlled through the processes of nitrification and denitrification. Global emissions of N_2O, which has a GWP 298 times that of CO_2, are estimated to be 19 million tonnes per year, 36 % of which is attributed to anthropogenic activities, mainly from agriculture.

About 55 % of natural emissions, and most of the anthropogenic emissions, are released from terrestrial ecosystems. Most of the N_2O produced by nitrification results from the activity of ammonia-oxidising bacteria and archaea. Denitrification is a multi-step process in which each step is carried out by a distinct group of microbes widely distributed across diverse phylogenetic lineages. It is estimated that for every tonne (1 000 kg) of reactive nitrogen deposited on Earth, 10 - 15 kg are emitted as N_2O through nitrification and denitrification. The substrates for N_2O production (ammonium and nitrate) enter soils via natural biological nitrogen fixation, chemical fixation (lightning and fertiliser production), rainfall, or from the decomposition of plant and animal waste.

Climate change and feedback responses

There is limited evidence available as to whether the feedback response of climate change will increase (positive feedback) or decrease (negative feedback) GHG emissions. Current evidence suggests that global warming will positively influence the physiological response of the soil biota, and lead to increased decomposition of SOC, resulting in higher respiration rates and levels of CO_2 released into the atmosphere.

Mitigation

While biota act as a source of GHGs, they can also play a major role in mitigation, through careful manipulation and management of soils. Switching land uses (from arable to forestry) or management practices (from tillage and high input of nitrogen fertilisers to a no-tillage and low input system), where appropriate, will lead to low energy decomposition pathways, dominated by fungal communities and oligotrophic bacteria, favouring slower rates of carbon turnover and less CO_2 being released from soils. Such a conversion would also reduce CH_4 flux. Furthermore, it has been proposed that an annual increase of 0.004 % of C stored in soils (4 grammes of carbon for every 1 000 grammes of carbon currently stored in soils) would almost completely neutralise the predicted increase in GHG emissions, thus allowing countries to remain within the +2 °C limit in atmospheric warming. Practically, this increase would only be achievable in managed soils, resulting in less mitigation potential because of the emissions associated to the management practices; however, the issues clearly demonstrate the importance of preserving and increasing soil carbon stocks.

In agriculture, reduced-tillage practices support the activities of earthworms and other soil fauna as well as fungal communities, and promote C sequestration and nitrogen (N) cycling. Similarly, the conversion of croplands into permanent pastures and the manipulation of plant diversity could be used to reduce the amounts of carbon released from soils.

Soil Lovers say: ***Changes In Land Management Have A Great Potential For Further Reducing N_2O Emissions***

Ref: **A Global Atlas of Soil Biodiversity p103**