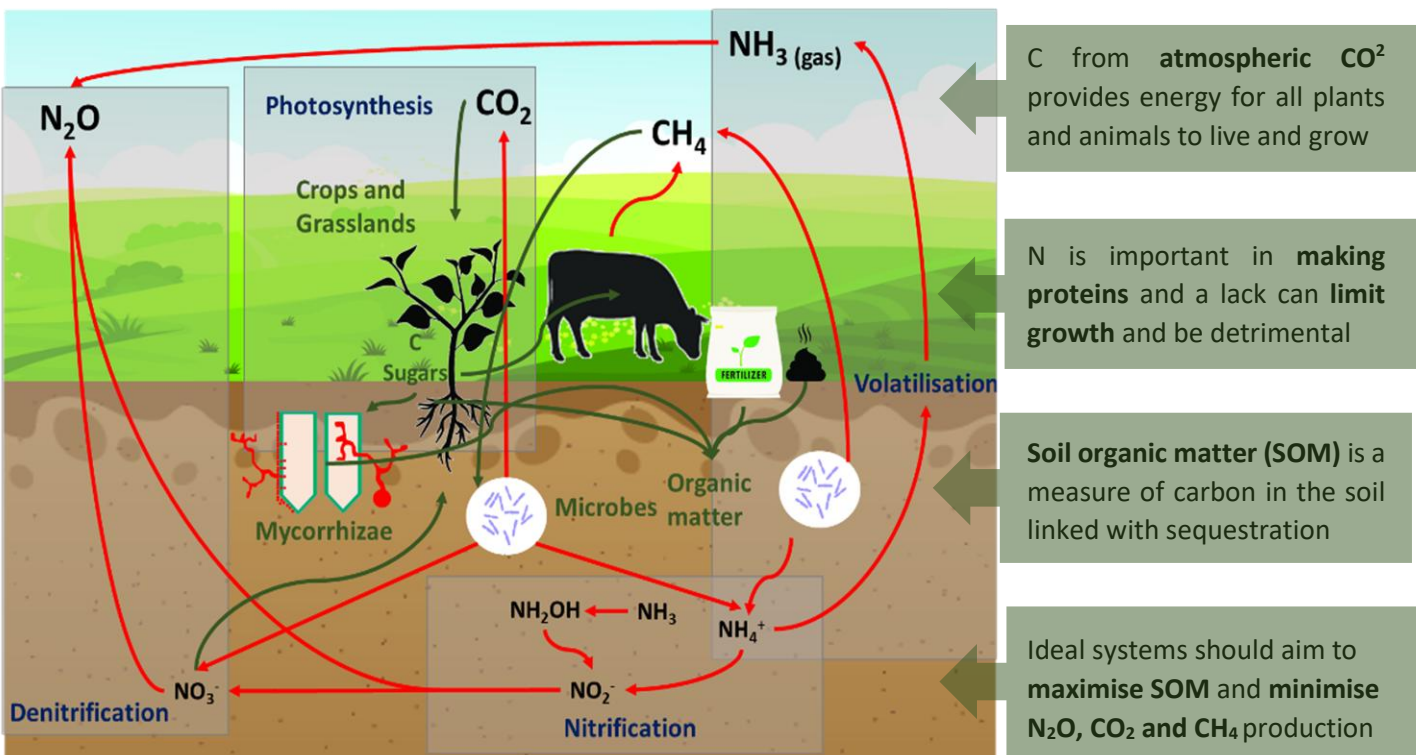


Carbon and Nitrogen Cycles in Agriculture – August 2022

Nitrogen (N) and carbon (C) cycles are essential for life and ecosystem functionality



Changing The Cycle

Intensive Agricultural, **practices**, change these cycles

- 1) **Heavy fertiliser use** boosts plant growth but delivers more N for **conversion into N₂O** and polluting N in environments
- 2) High livestock stocking leads to increased **CH₄ production** through enteric fermentation
- 3) Crops with no, or minimal, mycorrhizal interactions **store less C within SOM**
- 4) **Ploughing soils** releases stored C as CO₂ and disrupts mycorrhiza/root systems and ecosystems
- 5) **Short rotation crops and pastures** don't have long enough to store C and efficiently utilise N

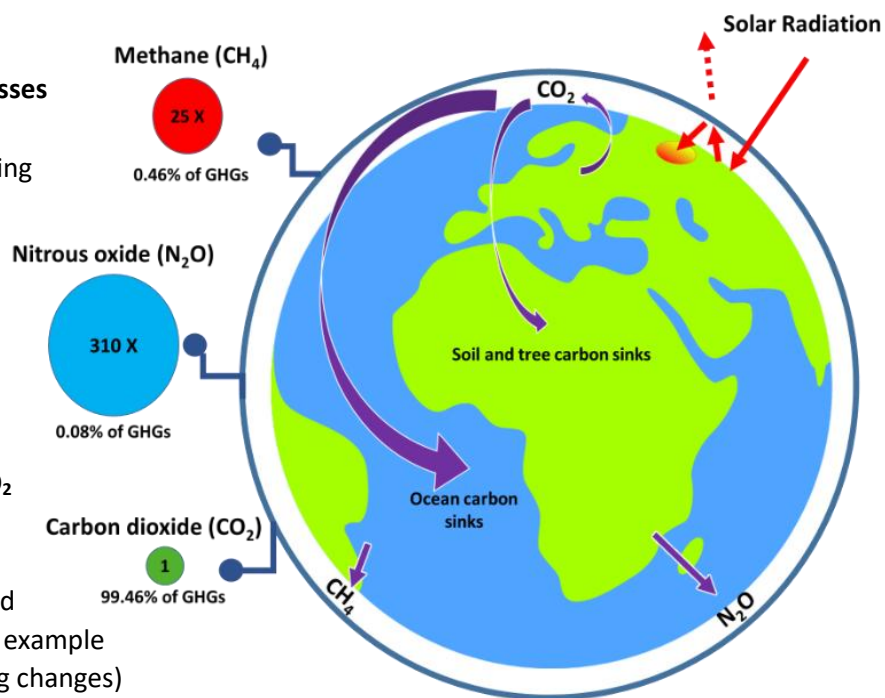


But **traditional and sustainable agricultural practices** try to work by understanding these cycles

- 1) **Long-term perennial and permanent** plants work better with mycorrhizae **storing more C** and **needing less N** fertilisation to grow lowering available N for **microbial N₂O production**
- 2) Precise **rotational grazing** uses land more effectively maximising meat/milk production compared to **CH₄ produced** reducing **N fertiliser use overall**
- 3) **Biofuel production** can produce C neutral energy steadying the increase of CO₂ in the C cycle
- 4) **Precision fertiliser usage**, using what is needed where it's needed lowers N for N₂O production
- 5) **Composting/anaerobic digestion** of wastes cycles N and C back reducing agricultural emissions

Cycles and Emissions

- C and N cycles release **greenhouse gasses (GHG)**
- GHGs trap energy from the sun warming the planet
- **Methane and nitrous oxide trap more energy** than CO_2
- CO_2 lasts in the atmosphere for **hundreds of years**
- CH_4 and N_2O last around **10 and 100 years in the atmosphere**
- We link all GHGs to CO_2 using their **CO_2 equivalent** environmental impacts
- C and N cycle emissions can be effected by **carbon sinks** and improved **uptake and utilisation efficiency** (for example plant and animal breeding and feeding changes)



Opportunities in Agriculture

Agriculture has **high emission** but the **best prospects to improve soil and plant-based carbon sinks**

Practices that shift C and N cycles include **species-rich grasslands, riparian buffers, zero/min tillage, cover cropping, agroforestry, legume use and recycling farm wastes** to name a few

Improving C and N use/emissions can **help public goods** like **biodiversity, air quality and water quality**

Agriculture is a big emitter of N_2O but reducing fertiliser use could improve this massively

Global **N use efficiency of crops is 18 - 50%** suggesting huge room for improvements

>50 % of N fertiliser is being cycled back damagingly into systems via **volatilisation, nitrification, denitrification and leaching and runoff**

