

Anthropogenic nitrogen cycle



Nitrogen use in manufacturing & processing



Blanketing :

Nitrogen gas can be used to flush wine bottles both before and after filling.

<https://www.generon.com/nitrogen-for-wine-sparging-bottling-blanketing/>



Nitrogen generator in Beverage processing & packaging

On the picture : Juice cartons on packaging production line

<https://www.peakgas.com/Articles-and-News/article/basic-nitrogen-facts-uses-and-onsite-gas-generation>

The most important use is for fertilizer



Starter fertilizer can enhance growth and yield by improving access of immobile nutrients

<https://www.mississippi-crops.com/2020/03/20/top-five-management-strategies-to-improve-corn-profitability/>

Nitrogen and fertilizer

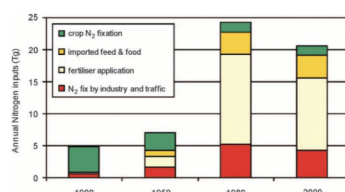


Figure SPIM.3 Estimated trend of anthropogenic reactive nitrogen inputs to the European Union (EU-27) (Gg N₂ yr⁻¹) (Gg equals 1 million tonnes)

The natural process of fixation of atmospheric nitrogen has been amplified by man through an increasing use of industrial fixation of atmospheric nitrogen.

The Haber-Bosch process

Video to watch :

https://www.youtube.com/watch?v=o1_D4FscMnU

The modern nitrogen cycle

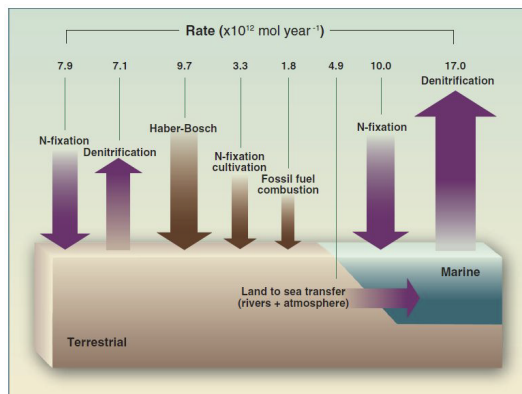


Fig. 4. Rates of nitrogen flux in the modern nitrogen cycle depend on the efficiency of the transformations between reservoirs. Arrow size reflects relative size of the flux. The dark brown arrows represent anthropogenic inputs (25, 45, 52, 53, 68, 69).

NH_4^+ production : $9,5 \times 10^{12} \text{ mol}$

Fossil fuel combustion : $1.8 \times 10^{12} \text{ mol}$

Anthropogenic sources contribute double the natural rate of terrestrial nitrogen fixation.

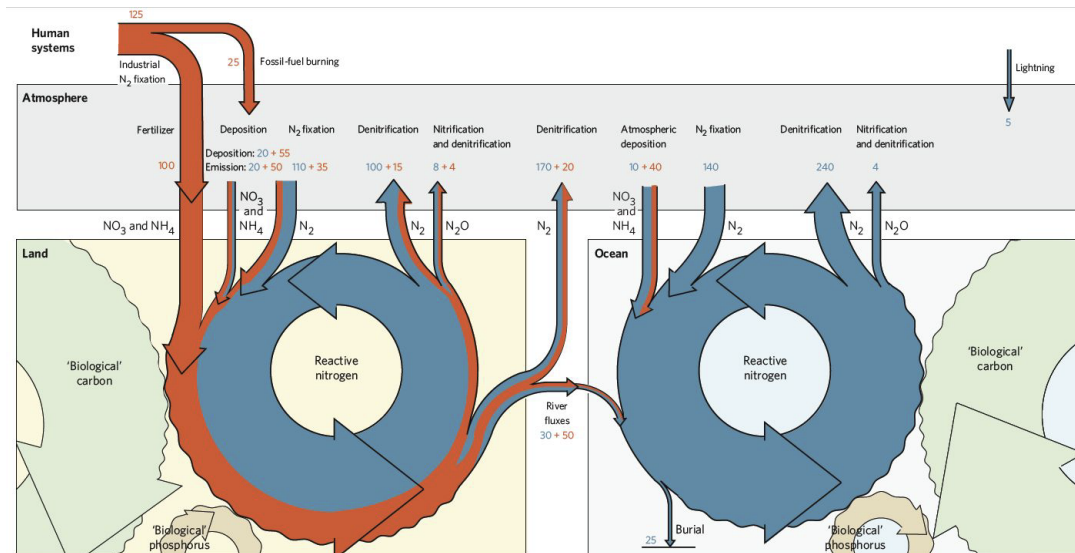
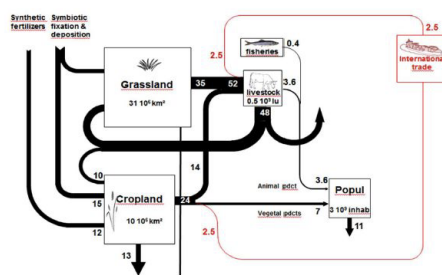


Figure 1 | Depiction of the global nitrogen cycle on land and in the ocean. Major processes that transform molecular nitrogen into reactive nitrogen, and back, are shown. Also shown is the tight coupling between the nitrogen cycles on land and in the ocean with those of carbon and

phosphorus. Blue fluxes denote 'natural' (unperturbed) fluxes; orange fluxes denote anthropogenic perturbation. The numbers (in Tg N per year) are values for the 1990s (refs 13, 21). Few of these flux estimates are known to better than $\pm 20\%$, and many have uncertainties of $\pm 50\%$ and larger^{13,21}.

Nitrogen and the agro-food system

World, 1961 TgN/yr



World, 2009 TgN/yr

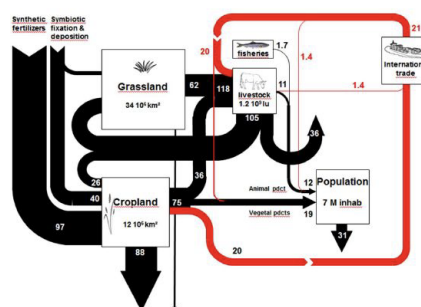


Figure 1. Generalized representation of N transfers through the world agro-food system (GRAFS) in 1961 and 2009.

Why does livestock farming produce large quantities of nitrogen-rich effluents ?

1. Conclusion

QCM

1) What is the Haber-Bosh process?

- A process that transforms air into fertilizer.
- **A process to fix atmospheric dinitrogen in the form of ammonia.**
- A process that converts ammonia into nitrate.
- **A process that permit to have available nitrogen in sufficient quantity to allow its industrialization.**

2) What are the anthropogenic sources of the nitrogen cycle?

- **Fossil fuel combustion**
- **Industrial fixation**
- Deforestation
- **Crops and livestock**
- Building construction

2. Medias

[cf. EV14_NitrogenCycle_Video3.mp4]

[cf. EV14_NitrogenCycle_Video3.mp3]