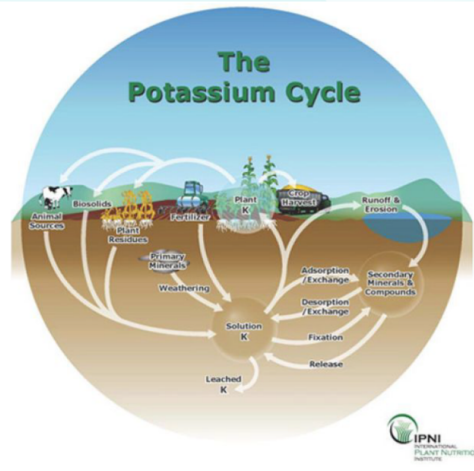
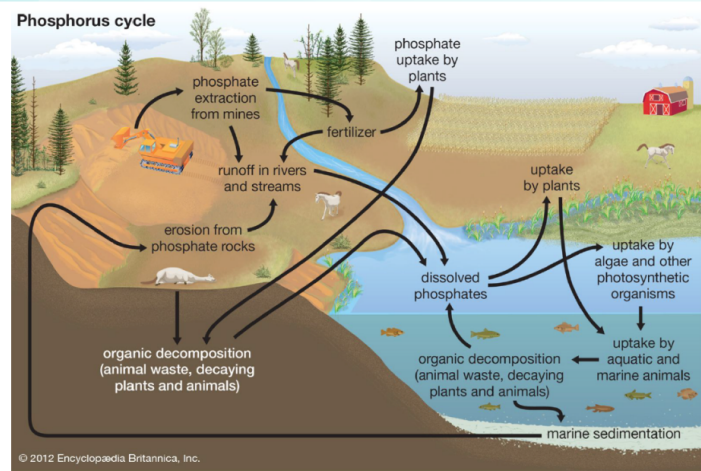




Outflows and nitrogen cascade

Introduction



What is one of the main differences between phosphorus, potassium and nitrogen?

Nitrate goes from the biosphere to the environment by nitrate leaching, gaseous emissions.

Nitrate leaching

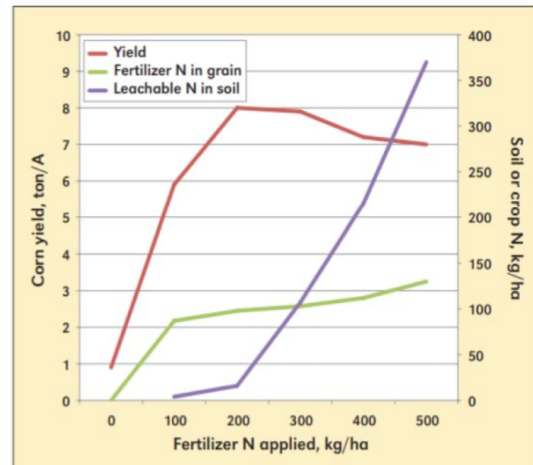
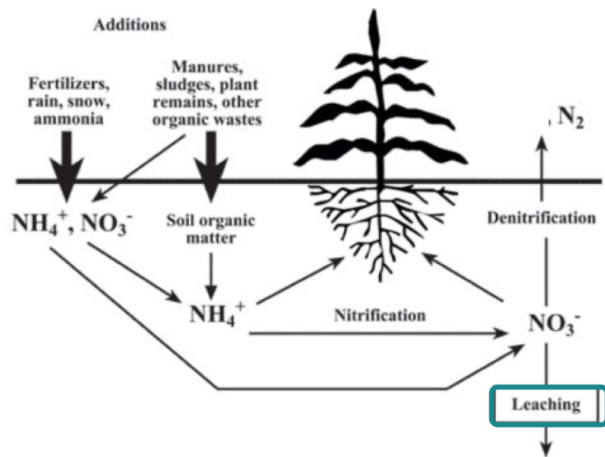


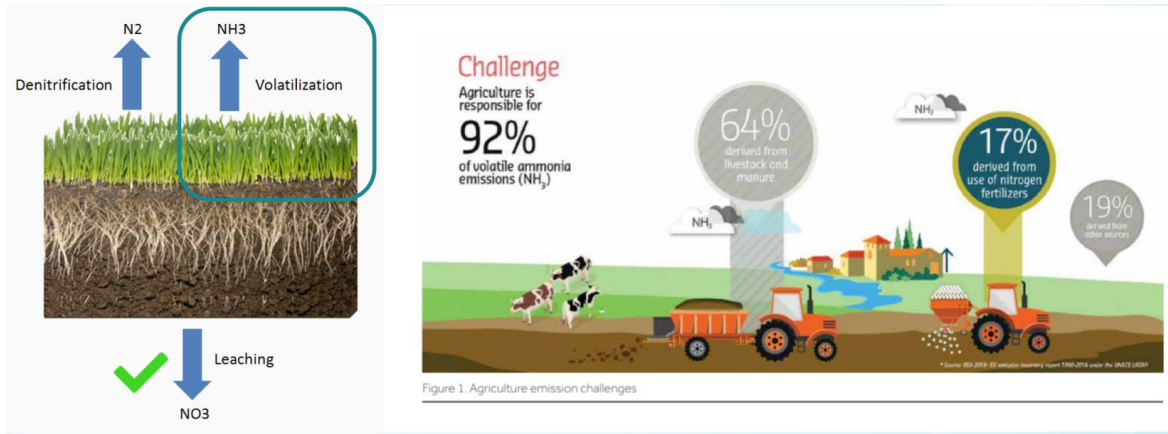
Figure 4. Nitrogen fertilizer added beyond the capacity of crops to recover it increases the risk for nitrate leaching. Broadbent and Rauschkolb, 1977.

Nitrate leaching is highly dependent on rainfall, soil type and soil nitrogen content.

Video to watch

https://www.youtube.com/watch?v=-6e_iF9d2F0

Ammonia volatilization



The presence of ammoniacal nitrogen in a solution in contact with air systematically leads to the volatilization of ammonia.

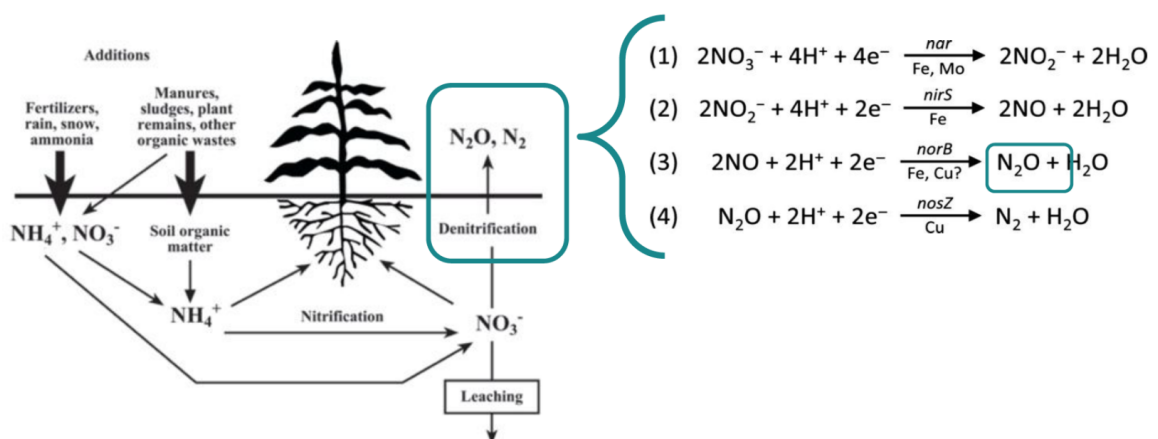
Volatilization depends very strongly on the physical and chemical conditions of the environment.

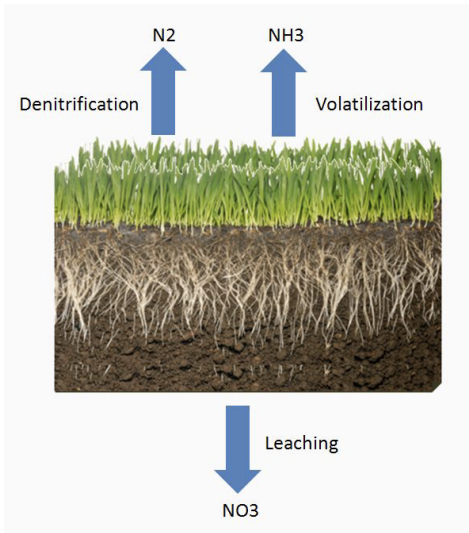
- the nitrogen content of the substrate in contact with the air ;
- the proportion of nitrogen present in the form of ammonia ;
- the contact surface between the solution containing ammoniacal nitrogen and the atmosphere ;
- the dispersion of the air in contact with the emission zone.

Soil If urea is hydrolyzed by urease at the soil surface, part of the NH₃ that is released may be lost to the air.

Soil If urea is hydrolyzed by urease within the soil, the NH₃ that is released reacts with soil water to form NH₄⁺, which adheres to soil components.

Nitrogen oxides and nitrous oxide emissions





The parameters which are likely to intervene to regulate the proportion of nitrous oxide formed during denitrification are :

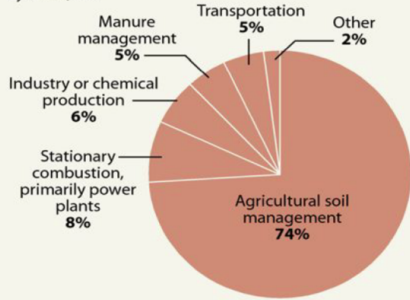
- the pH of the environment ;
- the nitrate concentration ;
- the soil aeration, often characterized by the water saturation rate ;
- the availability of reducing agents.

Where Does N₂O Come From?

Agriculture, particularly fertilized soil and animal waste, accounts for about three quarters of U.S. nitrous oxide emissions.

U.S. NITROUS OXIDE EMISSIONS

By source, 2017



SOURCE: EPA

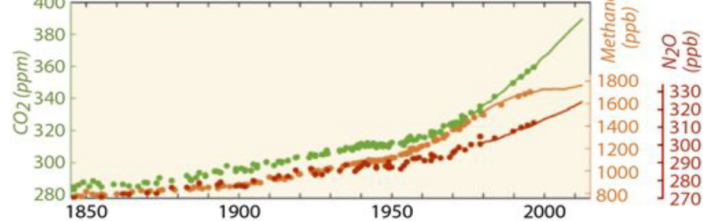
PAUL HORN / InsideClimate News

N₂O Emissions Have Been Rising

Like other greenhouse gases, nitrous oxide emissions have been rising since the start of the industrial era. The majority of N₂O emissions come from fertilized soil and animal waste.

GLOBALLY AVERAGED GREENHOUSE GAS CONCENTRATIONS

Parts per million (CO₂) and parts per billion (methane, N₂O)



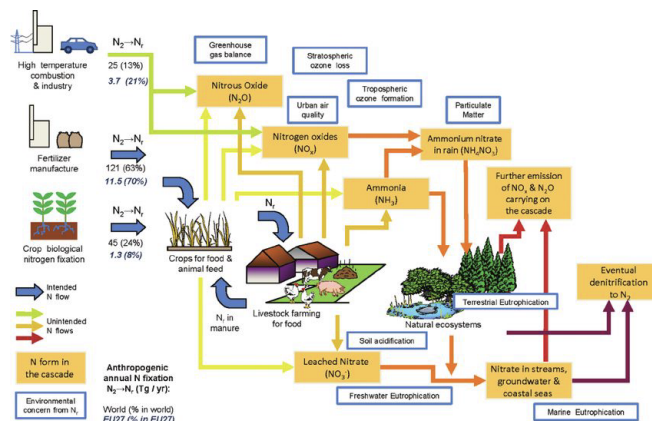
SOURCE: IPCC AR 5

InsideClimate News

In addition to nitrous oxide emissions, there are nitric oxide emissions, rather observed in dry environments, and associated with nitrification situations.

Nitrogen oxides, mainly NO_x (NO₂ and NO) and nitrous oxide (N₂O) are emitted during nitrification and/or denitrification reactions, **both in the field and in livestock buildings** (bedding, effluent storage areas).

The nitrogen cascade



Simplified view of the nitrogen cascade, highlighting the major anthropogenic sources of reactive nitrogen (Nr) from atmospheric dinitrogen (N₂), the main pollutant forms of Nr (orange boxes) and nine main environmental concerns (blue boxes). Estimates of anthropogenic N fixation for the world (Tg /yr for 2005, in black) are compared with estimates for Europe (Tg /yr for 2000, in blue italic). Blue arrows represent intended anthropogenic Nr flows; all the other arrows are unintended flows.

QCM

1) Nitrogen is characterized by a great ability to leave the soil-plant-animal cycle

- **True**
- False

2) Nitrate leaching losses increase when fertilizer applications are in excess of the crop need.

- **True**
- False

3) What is the physical and chemical condition of the environment on which the volatilization of ammonia depends?

- **the nitrogen content of the substrate in contact with the air.**
- **the proportion of nitrogen present in the form of ammonia.**
- the proportion of nitrogen present in the form of nitrate.
- **the contact surface between the solution containing ammoniacal nitrogen and the atmosphere.**
- the soil aeration.
- **the dispersion of the air in contact with the emission zone.**

1. Medias

[cf. EV14_NitrogenCycle_Video4.mp4]

[cf. EV14_NitrogenCycle_Video4.mp3]