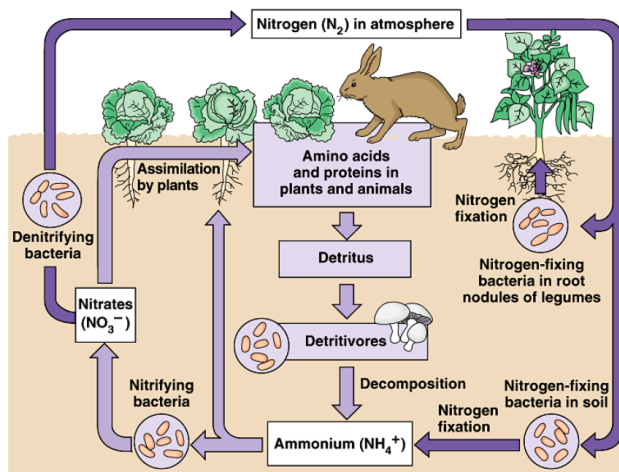


Nitrogen Cycle Key Definitions



Nitrogen Fixation: Nitrogen Fixation is the conversion of atmospheric nitrogen (N_2) into reactive compounds such as ammonia (NH_3) and nitrate (NO_3^-). The breaking of the bonds between the nitrogen atoms requires a great deal of energy and occurs naturally in two primary ways: abiotic fixation (lightning, cosmic radiation) and biotic fixation (aerobic* and anaerobic** bacteria).

*aerobic -need oxygen to live

**anaerobic- live without oxygen

Nitrification: Nitrification is the process by which ammonia is oxidized to nitrite ions (NO_2^-) and then to nitrate ions (NO_3^-), which is the form most usable by plants. The two groups of microorganisms involved in the process are Nitrosomas and Nitrobacter. Nitrosomas oxidize ammonia to nitrite and Nitrobacter oxidize nitrite to nitrate.

$NH_3 \rightarrow$ (Nitrosomas bacteria) $\rightarrow NO_2^-$

$NO_2^- \rightarrow$ (Nitrobacter bacteria) $\rightarrow NO_3^-$

Assimilation: Nitrates are the form of nitrogen most commonly assimilated by plants through root hairs. Since heterotrophic* organisms cannot readily absorb nitrogen as plants do, they rely on acquiring nitrogen-based compounds through the food they eat. Since plants are the base of the food chain, the nitrogen-based compounds they have assimilated into their tissue will continue to pass from one organism to another (through consumption) as matter and energy transfers through the ecosystem's food web.

*heterotrophs- organisms that cannot make their own food (animals)

*autotrophs- organisms that make their own food (plants)

Ammonification: In ammonification, a host of decomposing microorganisms, such as bacteria and fungi, break down nitrogenous wastes and organic matter found in animal waste and dead plants and animals and convert it to inorganic ammonia (NH_3) for absorption by plants as ammonium ions. Therefore, decomposition rates affect the level of nutrients available to primary producers.

Denitrification: Denitrification is the process by which nitrates are reduced to gaseous nitrogen (N_2) and lost to the atmosphere. This process occurs by anaerobic bacteria in anaerobic environments. Farmers with waterlogged fields and soils that have high clay content are especially vulnerable to nitrogen losses due to denitrification.

$NO_3^- \rightarrow$ (anaerobic bacteria) $\rightarrow N_2$ (gas)

Nitrogen Cycle

Follow Up Questions:

1. Which moves in the game represent the following processes:
 - a. Ammonification:
 - b. Nitrification:
 - c. Nitrogen Fixation:
 - d. Denitrification:
 - e. Assimilation:

2. Why can't plants just absorb nitrogen from the atmosphere since it makes up 78% of the air? How DOES nitrogen move out of the air and into plants?

3. Some plants have nodules in their roots where nitrogen fixing bacteria live symbiotically. What would be the benefit to the bacteria? To the plant?

4. How do organisms use nitrogen in their bodies? Why do we need it anyway??

5. In the course of the nitrogen cycle, did any of the nitrogen atoms get created? Or destroyed? Or converted into another type of atom? Would this be a closed or open system? Explain.

6. Suggest reasons why natural systems do not result in toxic amounts of nitrogen (like eutrophication) and yet with anthropogenic (human) influence we do see toxic nitrogen levels.

7. What are the benefits of nitrogen fertilizer use? What are the drawbacks?