

Nitrogen cycle

The atmospheric phase is predominant in the global nitrogen cycle. In nitrogen cycle, nitrogen is converted between its various chemical forms. This transformation can be carried out by both biological and non-biological processes. The important processes in the nitrogen cycle include nitrogen fixation, ammonification, nitrification, and denitrification. *Nitrogen fixation* involves the conversion of N_2 by bacteria to ammonium ions. Atmospheric nitrogen is also fixed by lightning discharges during storms and reaches the ground as nitric acid dissolved in rainwater, but only about 3–4% of fixed nitrogen derives from this pathway. *Ammonification* involves decomposition of organic nitrogen to ammonium ions. In *nitrification*, ammonium ion is converted to nitrite and nitrate by nitrifying bacteria. *Denitrification* is the reduction of nitrates into nitrogen gas. This process is performed by bacterial species such as *Pseudomonas* and *Clostridium* in anaerobic conditions.

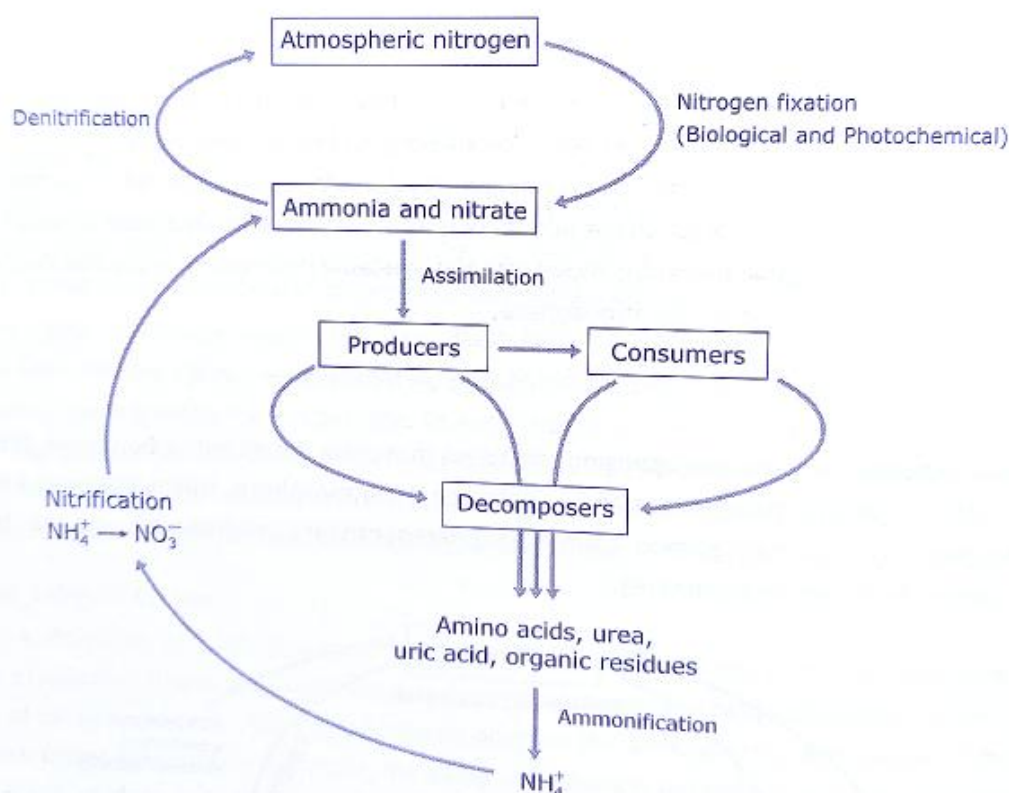


Figure 5.11 Nitrogen cycle.

Phosphorus cycle

The principal stocks of phosphorus occur in rocks and ocean sediments and in dissolved form in rivers, lakes and ocean water. Weathering of rocks gradually adds phosphorus to soil; some leaches into groundwater and surface water and may eventually reach the sea. The phosphorus cycle may be described as an 'open' cycle because of the general tendency for mineral phosphorus to be carried from the land to the oceans. A typical phosphorus atom, released from the rocks by chemical weathering, may enter and cycle within the terrestrial community for years, or centuries before it is carried via groundwater into a stream, where it takes part in the nutrient spiraling.

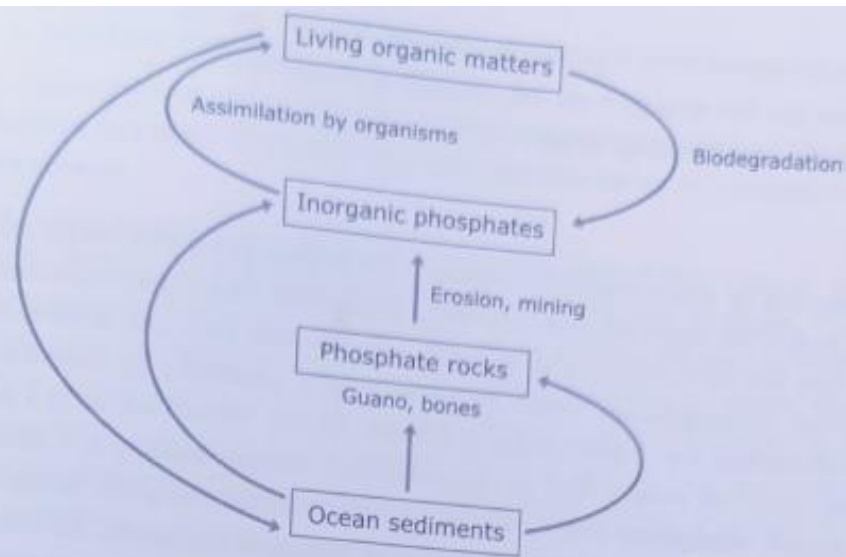


Figure 5.12 Phosphorus cycle.

Sulfur cycle

In the global phosphorus cycle, the lithospheric phase is predominant, whereas in the nitrogen cycle, atmospheric phase is more important. Sulfur, by contrast, has atmospheric and lithospheric phases of similar magnitude. Three natural biogeochemical processes release sulfur into the atmosphere:

- The formation of the volatile compound dimethylsulfide,
- Anaerobic respiration by sulfate-reducing bacteria and
- Volcanic activity.

The weathering of rocks provides about half the sulfur draining off the land into rivers and lakes, the remainder deriving from atmospheric sources. The available sulfur taken up by plants, passed along food chains and, via decomposition processes, becomes available again to the plants. The combustion of fossil fuels is the major human activity to the global sulfur cycle.

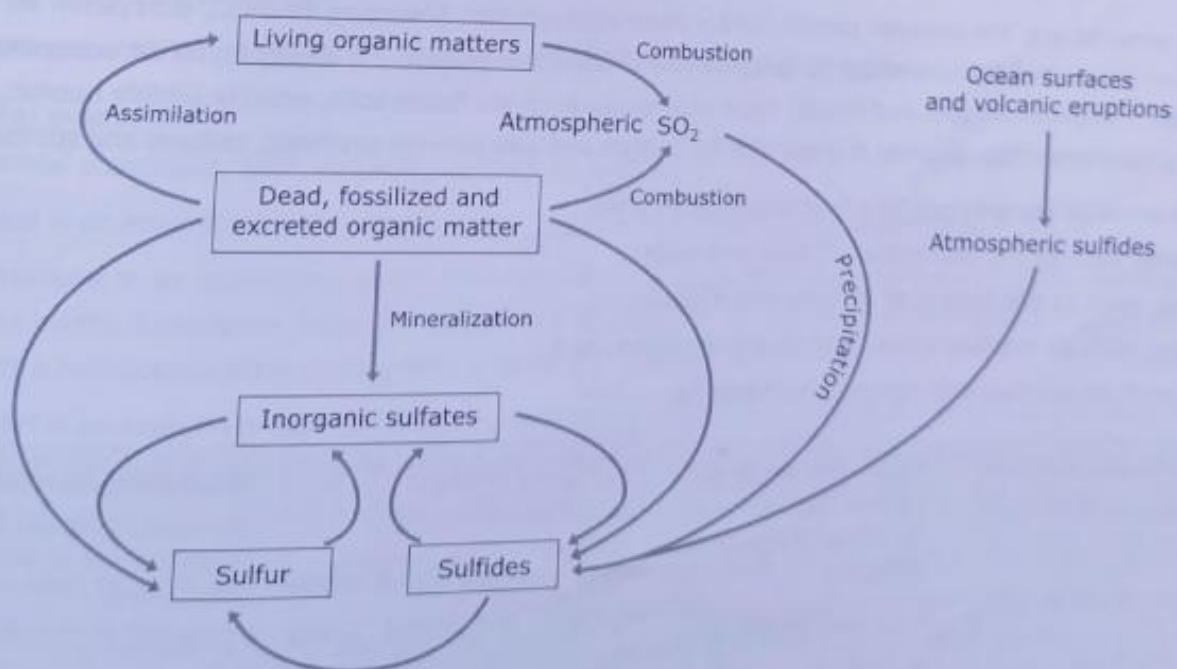


Figure 5.13 Sulfur cycle.

To summarize

In the flow of energy and inorganic nutrients through the ecosystem, a few generalizations can be made:

1. The ultimate source of energy (for most ecosystems) is the Sun.
2. The ultimate fate of energy in ecosystems is to be lost as heat.

- ecology
3. Energy and nutrients are passed from organism to organism through the food chain as one organism eats another.
 4. Decomposers remove the last energy from the remains of organisms.
 5. Inorganic nutrients are cycled, energy is not.