The ways in which an elementor, in some cases, a compound such as water moves between its various living and nonliving forms and locations is called a biogeochemical cycle. This name reflects the importance of chemistry and geology as well as biology in helping us understand these cycles.

Biogeochemical is a pathway by which a chemical substance moves through biotic (biosphere) and abiotic (lithosphere, atmosphere, and hydrosphere) compartments of Earth. The set of changes that occur to the chemical that brings it back to the starting point, which can be repeated.

Ecological systems have many biogeochemical cycles operating as a part of the system, for example the water cycle, the carbon cycle, the nitrogen cycle, etc. All chemical elements occurring in organisms are part of biogeochemical cycles. In addition to being a part of living organisms, these chemical elements also cycle through abiotic factors of ecosystems such as water (hydrosphere), land (lithosphere), and/or the air (atmosphere).

The living factors of the planet can be referred to collectively as the biosphere. All the nutrients—such as carbon, nitrogen, oxygen, phosphorus, and sulfur—used in ecosystems by living organisms are a part of a closed system; therefore, these chemicals are recycled instead of being lost and replenished constantly such as in an open system.

Which biogeochemical cycles are key to life?

Water makes up more than half of our bodies, but humans cannot live by water alone. Instead, there are some other chemical elements that keep our bodies running and are part of biogeochemical cycles: carbon (C), hydrogen (H), nitrogen (N), oxygen (O), phosphorous (P) and sulfur (S). These are the building blocks of life, and are used for essential processes, such as metabolism, the formation of amino acids, cell respiration and the building of tissues.

These cycles don't happen in isolation, and the water cycle is a particularly important driver of other biogeochemical cycles. For example, the movement of water is critical for the leaching of nitrogen and phosphate into rivers, lakes.

The most well-known and important biogeochemical cycles are:

Carbon Cycle:

The carbon cycle is the biogeochemical cycle by which carbon is exchanged among the biosphere, pedosphere, geosphere, hydrosphere, and atmosphere of the Earth. Carbon is the backbone of life on Earth. We are made of carbon, we eat carbon, and our civilizations, our economies, our homes, our means of transport are built on carbon.

Carbon is found in the atmosphere in the form of carbon dioxide (CO_2), as it is found in the compounds that form the bodies of wild and marine biology and their structures, and in the soil within the organic matter and humus, and in the hydrosphere as (CO_3^{-2}, HCO_3) dissolved in water Also, it is found in the lithosphere of limestone ($CaCO_3$) and dolomite $CaMg(CO_3)_2$ and fossil fuels (coal, oil, and natural gas) and that carbon is contained within the organic matter (organic carbon) and within the inorganic material (non organic carbon).

The carbon cycle begins with taking green plants (products) carbon dioxide from the atmosphere in the process of photosynthesis to produce organic compounds and in the plant also breathing is done, that results in CO_2 gas which returns to the atmosphere, and then is used in the building process Photosynthesis so that the cycle is completed by returning to the plant.

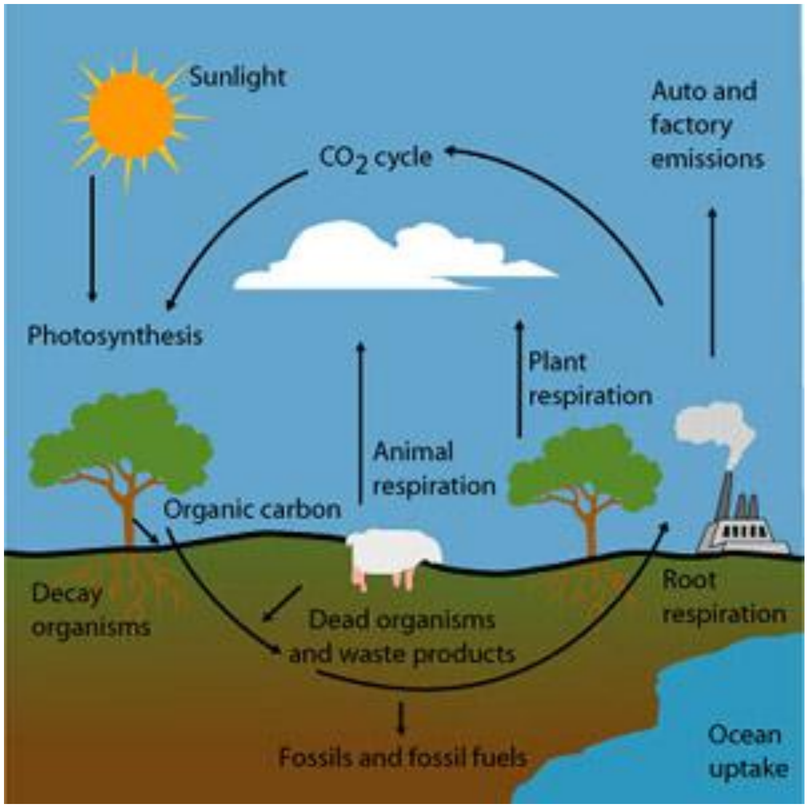


Fig (1): Carbon Cycle

The carbon cycle is closely related to CO_2 The carbon cycle often follows more complex paths; After the carbon gained by the plant turns into organic materials, the animals (consumables) feed on it, the process of digesting, absorbing and representing the organic materials contributes to building animal tissues. Accordingly, the carbon atoms in the plant become part of the composition of the cells of the animal's body that feed on them.

Carbon can be returned to the atmosphere through the breathing process, resulting in carbon dioxide. And the remaining carbon in the cells and tissues of the consuming living organisms loses part of it through its secretions and excreta. After its death, carbon devolves into the organic matter from which it can return to the atmosphere due to the processes of aerobic decomposition by microorganisms. **<u>This process is called a rapid carbon cycle</u>**

There is a portion of organic carbon that does not pass cycles of this type and quickly, as it can track a longer pathway; In marine animals, carbon is included in the formation of solid parts, such as the shells of mollusks, in the form of calcium carbonate. After long periods of time, carbon deposits in the limestone rocks of the marine sediments of these shells. A large portion of CO_2dissolves in sea, ocean and lake waters, which can lead to sedimentation of limestone, **carbon fixation**. These rocks are subjected to chemical weathering processes, which leads to the return of a portion of the installed carbon to the atmosphere in the form of CO_2. **This is called a slow carbon cycle.**

Nitrogen cycle:

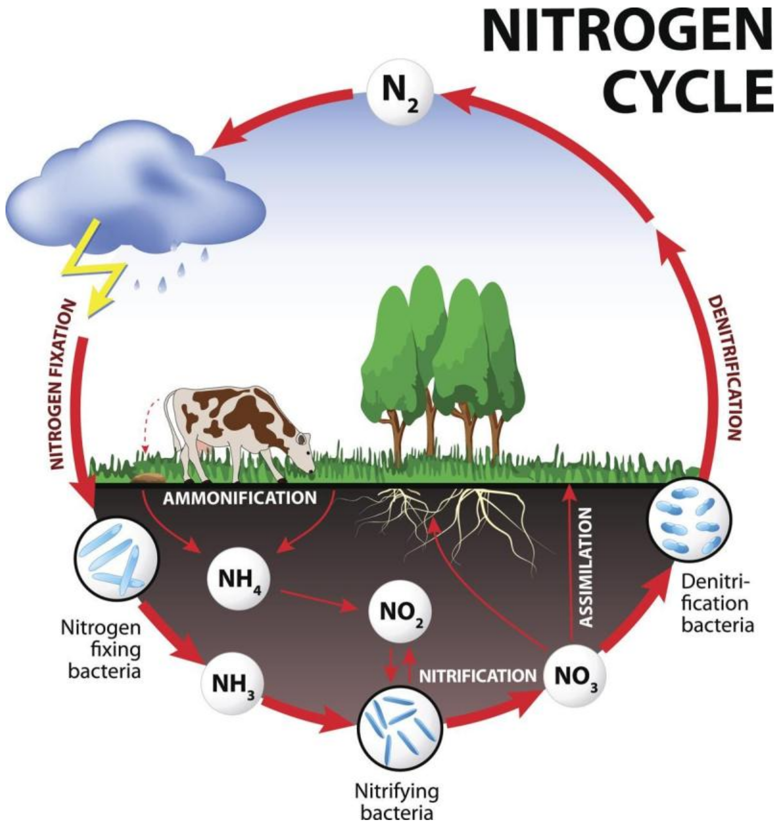
circulation of nitrogen in various forms through nature. Nitrogen, a component of proteins and nucleic acids, is essential to life on Earth. Although 78 percent by volume of the atmosphere is nitrogen gas, this abundant reservoir exists in a form unusable by most organisms. Through a series of microbial transformations, however, nitrogen is made available to plants, which in turn ultimately sustain all animal life.

Nitrogen fixation is a process by which molecular nitrogen in the air is converted into ammonia NH_3 or related nitrogenous compounds in soil. Atmospheric nitrogen is molecular dinitrogen, a relatively nonreactive molecule that is metabolically useless to all but a few microorganisms. Biological nitrogen fixation converts N_2 into ammonia, which is metabolized by most organisms.

After the death of plants and animals, they are exposed to decomposition by certain bacteria and fungi. These microorganisms produce ammonia NH_3 from nitrogen compounds in the dead organic matter and in animal body waste. Then the plants absorb some ammonia and use it to make proteins and other substances necessary for life. The ammonia that is not absorbed by the plants turns into nitrate (NO_3 compounds) by nitrifying bacteria.

There are two types of nitrifying bacteria: **nitrite bacteria** that convert ammonia into nitrites (NO2 compounds) and **nitrate bacteria**, which convert nitrites into nitrates. Plants absorb most of the nitrates and use them in the same way as ammonia. As for animals, they obtain nitrogen from eating plants or other animals that eat plants.

Although nitrogen fixation takes nitrogen from the air, a reverse process called nitrogen restoration returns almost the same amount of nitrogen to the air. Bacteria returning nitrogen turn some nitrates in the soil into gaseous nitrogen or N_2O oxide, but the fixed nitrogen may circulate several times between living and soil before returning the nitrogen back to the atmosphere.



Fig(2): Nitrogen Cycle

Some human activities impede the nitrogen cycle. For example, the industry takes large amounts of nitrogen to produce fertilizers. Fertilizers provide many benefits, but excess quantities are swept from farmland to waterways, contaminated with that water. In addition to this, the combustion of gasoline and some other fuels produces nitrogen compounds that contribute to plant pollution.

The nitrogen cycle is considered one of the most important because the nitrogen is fed by the plant, which is considered the beginning of the food chain.