# ENVIRONMENTAL POLLUTION AND CONTROL

## ENVIRONMENT

- The term environment refers to ones sorroundings.
- The physical and biological factors along with their chemical interactions that affect an organism or a group of organisms.
- The **environment** is the biotic and abiotic surrounding of an organism or population, and consequently includes the factors that have an influence in their survival, development and evolution. The environment can vary in scale from microscopic to global in extent. Examples include the marine environment, the atmospheric environment and the terrestrial environment.
- The sum total of all surroundings of a living organism, including natural forces and other living things, which provide conditions for development and growth as well as of danger and damage.

## ENVIRONMENTAL SEGMENTS

The environment consists of various segments such as atmosphere, hydrosphere, lithosphere and biosphere.

## Atmosphere

The following points highlight the vital role played by atmosphere in the survival of life in this planet.

• The atmosphere is the protective blanket of gases which is surrounding the earth. It protects the earth from the hostile environment of outer space.

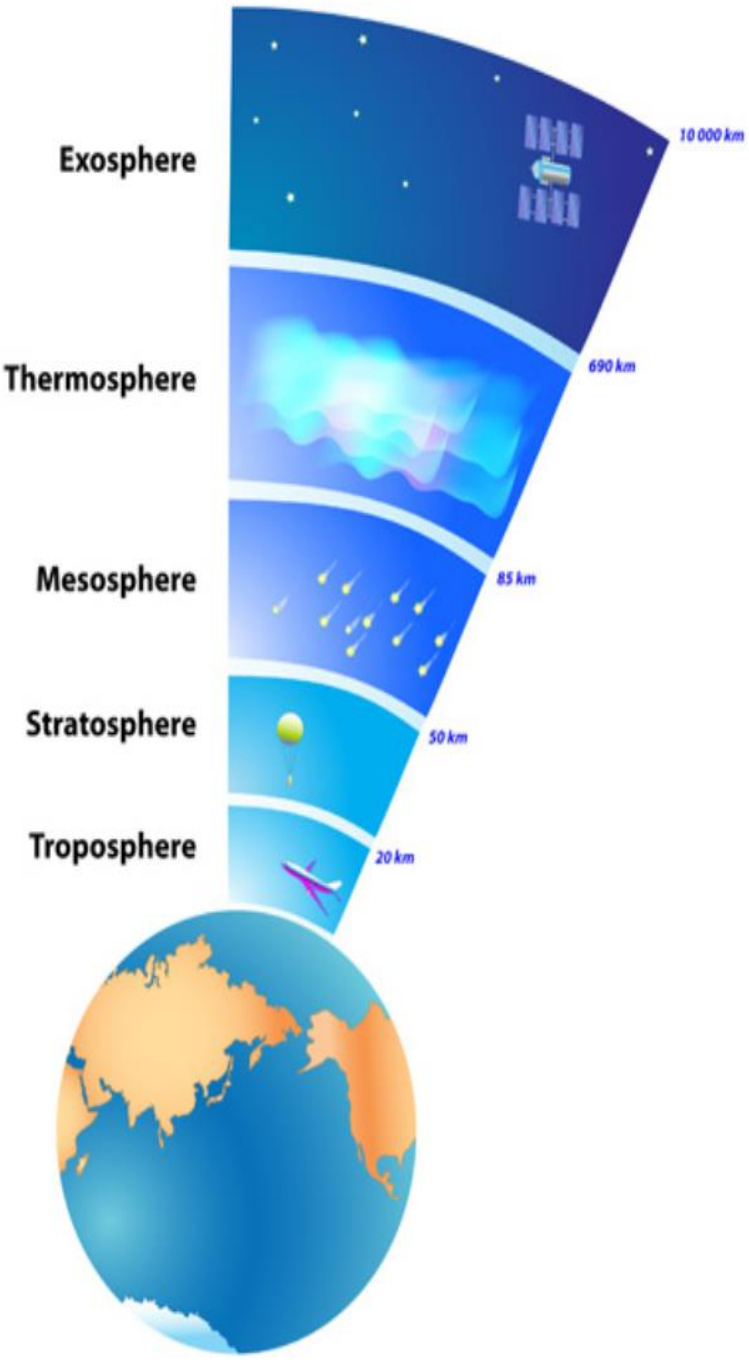
• It absorbs IR radiations emitted by the sun and reemitted from the earth and thus controls the temperature of the earth.

• It allows transmission of significant amounts of radiation only in the regions of 300 – 2500 nm (near UV, Visible, and near IR) and 0.01 – 40 meters (radio waves). i.e it filters tissue damaging UV radiation below 300 nm.

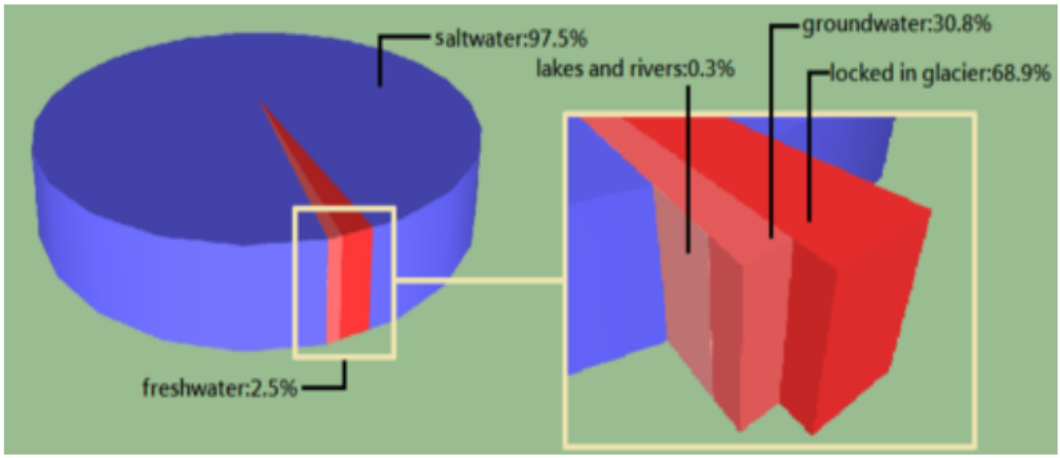
• It acts as a source for $CO_2$ for plant photosynthesis and $O_2$ for respiration

• It acts as a source for nitrogen for nitrogen fixing bacteria and ammonia producing plants.

• The atmosphere transports water from ocean to land.


Exosphere
10 000 km
Thermosphere
690 km
Mesosphere
85 km
Stratosphere
50 km
Troposphere
20 km

# Hydrosphere




The hydrosphere is a collective term given to all different forms of water.

It includes all types of water resources such as oceans, seas, rivers, lakes, streams, reservoirs, glaciers and ground waters.

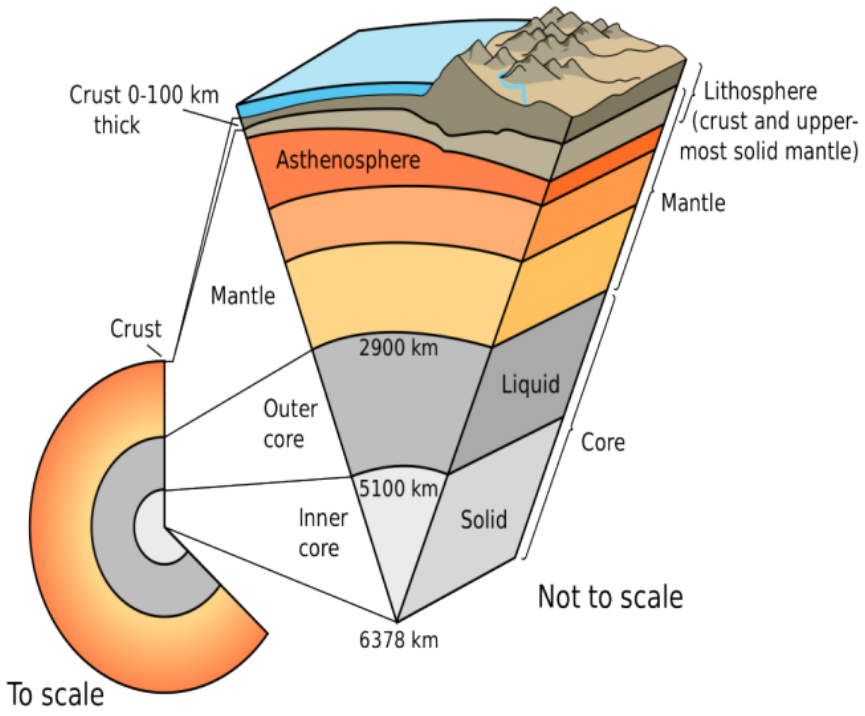
A hydrosphere is the total amount of water on a planet. The hydrosphere includes water that is on the surface of the planet, underground, and in the air. A planet's hydrosphere can be liquid, vapor,or ice.

On Earth, liquid water exists on the surface in the form of oceans, lakes and rivers. It also exists below ground—as groundwater, in wells and aquifers. Water vapor is most visible as clouds and fog.

The frozen part of Earth's hydrosphere is made of ice: glaciers, ice caps and icebergs. The frozen part of the hydrosphere has its own name, the cryosphere.

Water moves through the hydrosphere in a cycle. Water collects in clouds, then falls to Earth in the form of rain or snow. This water collects in rivers, lakes and oceans. Then it evaporates into the atmosphere to start the cycle all over again. This is called the water cycle.

## Lithosphere




The lithosphere is the solid, outer part of the Earth.
The lithosphere includes the brittle upper portion of the mantle and the crust, the outermost layers of Earth's structure. It is bounded by the atmosphere above and the asthenosphere (another part of the upper mantle) below.

The lithosphere is the most rigid of Earth's layers. Although the rocks of the lithosphere are still considered elastic, they are not viscous. The asthenosphere *is* viscous, and the lithosphere-asthenosphere boundary (LAB) is the point where geologists and rheologists—scientists who study the flow of matter—mark the difference in ductility between the two layers of the upper mantle. Ductility measures a solid material's ability to deform or stretch under stress. The lithosphere is far less ductile than the asthenosphere. The elasticity and ductility of the lithosphere depends on temperature, stress, and the curvature of the Earth itself.

The lithosphere is also the coolest of Earth's layers. In fact, some definitions of the lithosphere stress its ability to conduct heat associated with the convection taking place in the plastic mantle below the lithosphere.

## Biosphere

• The biosphere refers to the realm of living organisms and their interactions with the environment (VIZ: atmosphere, hydrosphere and lithosphere)

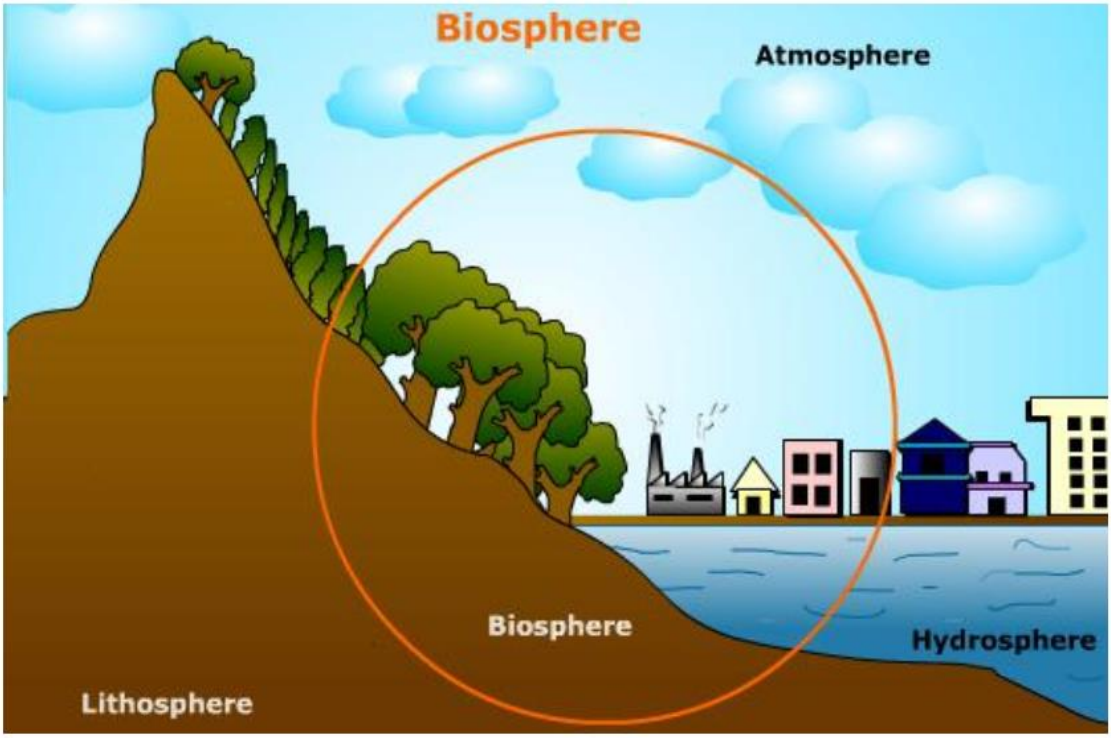
• The biosphere is very large and complex and is divided into smaller units called ecosystems.

• Plants, animals and microorganisms which live in a definite zone along with physical factors such as soil, water and air constitute an ecosystem.

• Within each ecosystems there are dynamic inter relationships between living forms and their physical environment

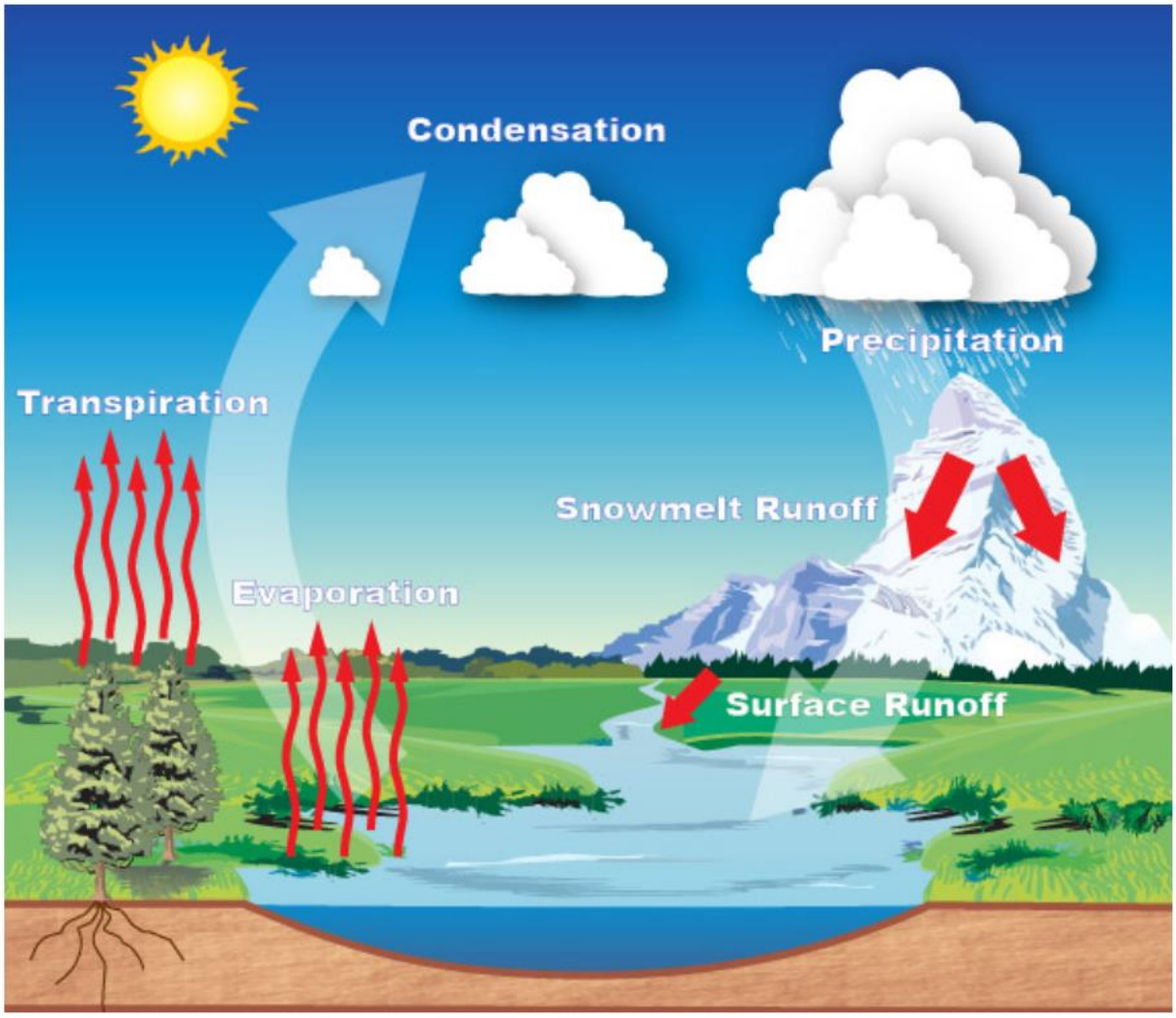
• These inter relationships manifest as natural cycles.(hydrologic cycle, oxygen cycle, nitrogen cycle, phosphorous cycle and sulphur cycle),

• The natural cycles operate in a balanced manner providing a continuous circulation of essential constituents necessary for life and this stabilizes and sustains the life processes on earth.



## Hydrologic cycle

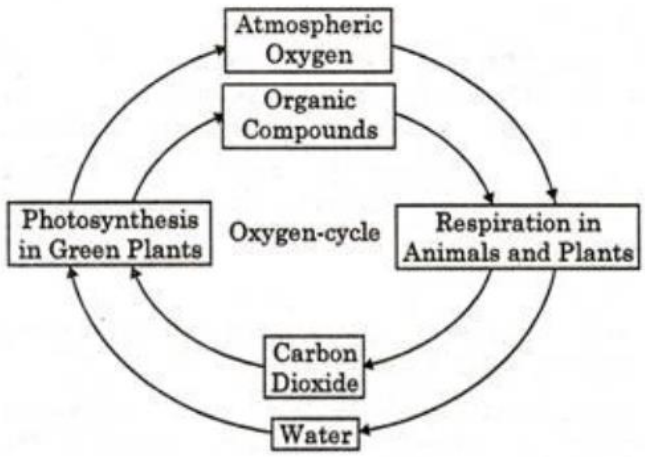
The hydrologic cycle involves a continuous exchange of water between sea, atmosphere, land and living animals through massive evaporation of water from the ocean, cloud formation and precipitation




The land surface and water surfaces on earth lose water by evaporation by solar energy. evaporation of water from ocean exceeds precipitation by rain into seas by 10% . This 10% excess which precipitates on land balances the hydrological cycle. Some of the precipitated rain seeps into the soil as ground water. Ground water moves up by capillary action and there by maintains a continuous supply of water to the surface layer of soil. The water from the surface layer of the soil is absorbed by plants, which in turn is returned to atmosphere through transpiration. Surface water or runoff flows into streams, rivers, lakes and catchment areas or reservoirs. Animals also take water which is also returned to the atmosphere through

evaporation. Thus there is always a balanced continuous cycling of water between earths surface and atmosphere.

## Oxygen Cycle




Oxygen-Cycle

## Nitrogen Cycle

Nitrogen cycle refers to the incorporation of N2 from the atmosphere into living matter and chemically bound nitrogen in soil, water and then back into the atmosphere again.

Nitrogen Fixation

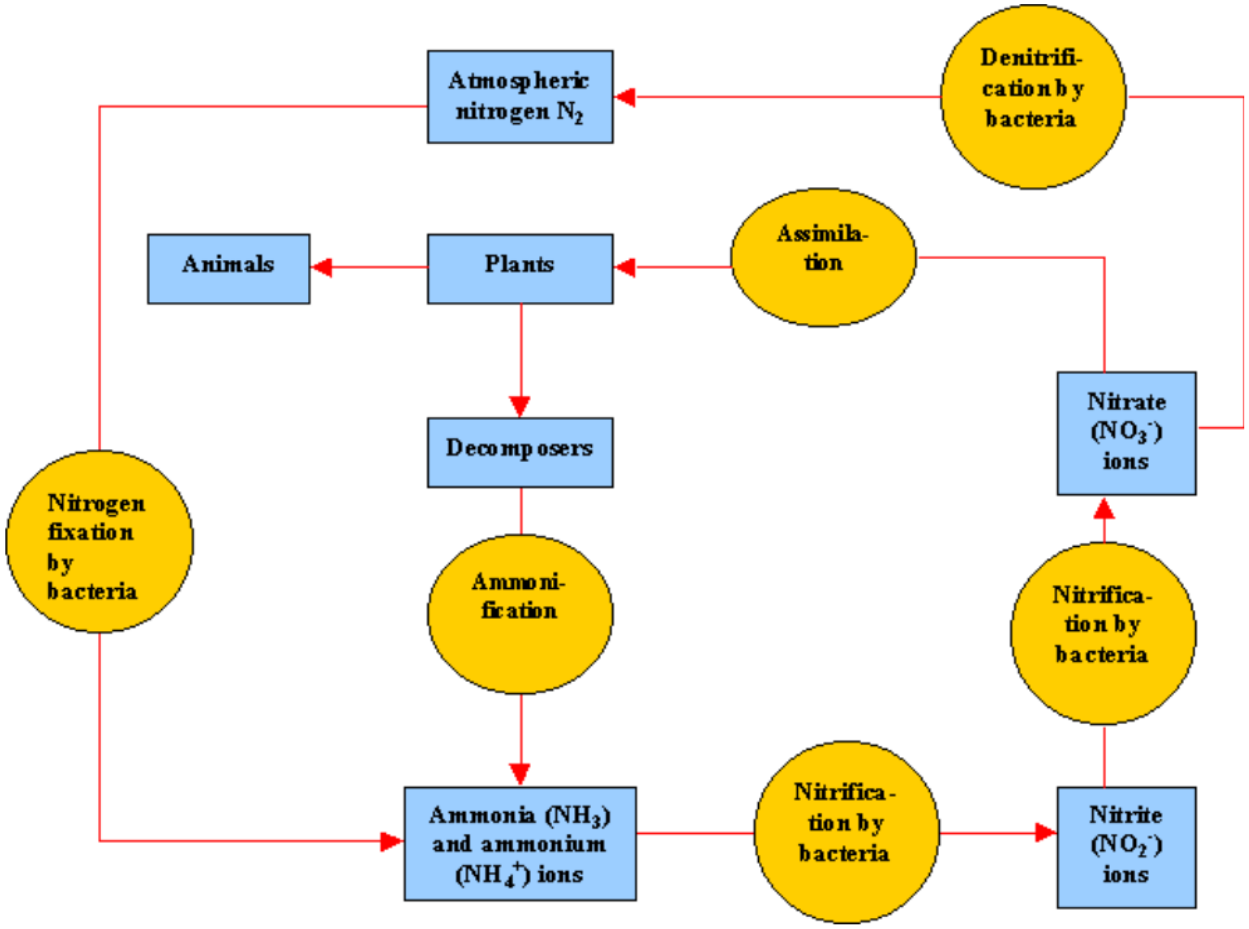
In this step the atmospheric nitrogen is chemically bound to form ammonia by bacteria and algae. Biological nitrogen fixation is mediated by organisms like Rhizobium that live a symbiotic relation with nodules on the roots of particular species of plants. These organisms are capable of catalysing the conversion of atmospheric nitrogen into forms usable by plants.

Nitrification

It is the conversion of N(-III ) to N(V) catalysed by Nitrosomonas and Nitrobacter. Nitrification is important in nature, since nitrogen is absorbed by plants primarily as nitrate. Even when nitrogen is applied in the form of ammonium salts as fertilisers, the ammonia is microbially oxidized to nitrate so that it can be assimilated by plants.

Denitrification

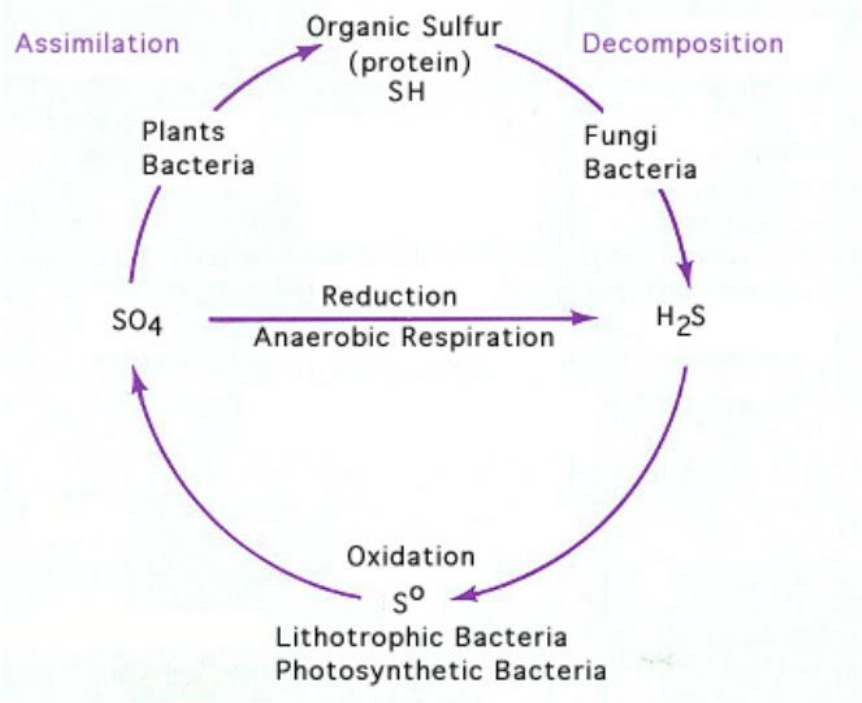
There are involves several steps. A number of heterotrophic bacteria including species of Pseudomonas and several types of denitrification reactions. One of these is the reduction of nitrate to form nitrogen gas. The process Anchromobacter mediate these processes. In this process N2 gas is produced from chemically fixed n



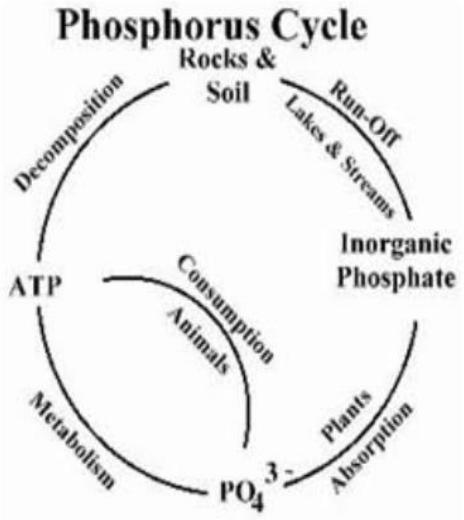

## Sulphur Cycle

Sulphur is one of the components that make up proteins and vitamins. Proteins consist of amino acids that contain sulphur atoms. Sulphur is important for the functioning of proteins and enzymes in plants, and in animals that depend upon plants for sulphur. Plants absorb sulphur when it is dissolved in water. Animals consume these plants, so that they take up enough sulphur tomaintaintheirhealth.

Most of the earth's sulphur is tied up in rocks and salts or buried deep in the ocean in oceanic sediments. Sulphur can also be found in the atmosphere. It enters the atmosphere through both natural and human sources. Natural recourses can be for instance volcanic eruptions, bacterial processes, evaporation from water, or decaying organisms. When sulphur enters the atmosphere through human activity, this is mainly a consequence of industrial processes where sulphur dioxide ($SO_2$) and hydrogen sulphide ($H_2S$) gases are emitted on a wide scale. When sulphur dioxide enters the atmosphere it will react with oxygen to produce sulphur trioxide gas ($SO_3$), or with other chemicals in the atmosphere, to produce sulphur salts. Sulphur dioxide may also react with water to produce sulphuric acid ($H_2SO_4$). Sulphuric acid may also be produced from demethylsulphide, which is emitted to the atmosphere by plankton species. All these particles will settle back onto earth, or react with rain and fall back onto earth as acid deposition. The particles will then be absorbed by plants again and are released back into the atmosphere, so that the sulphur cycle will start over again.



## Phosphorous Cycle




The **phosphorus cycle** is the biogeochemical cycle that describes the movement of phosphorus through the lithosphere, hydrosphere, and biosphere. Phosphorus is an essential nutrient for plants and animals. Phosphorus is a limiting nutrient for aquatic organisms. Phosphorus forms parts of important life-sustaining molecules that are very common in the biosphere. Phosphorus does not enter the atmosphere, remaining mostly on land and in rock and soil minerals. Eighty percent of the mined phosphorus is used to make fertilizers. Phosphates from fertilizers, sewage and detergents can cause pollution in lakes and streams. Over enrichment of phosphate in both fresh and inshore marine waters can lead to massive algae blooms which, when they die and decay, leads to eutrophication of fresh waters only.