

ENVIRONMENTAL SCIENCE (EVS)

Module I

ECOSYSTEM

Syllabus - *Structure of ecosystem, ecological pyramid, Biotic & Abiotic components, Food chain and food web, Aquatic (Lentic and Lotic) and terrestrial ecosystem. Carbon, Nitrogen, Sulphur, Phosphorus cycle. Global Warming-Causes, effects, process, Green House Effect, Ozone depletion, acid rain.*

An **Eco system** is a community of living organisms interacting with each other and their non-living environment. Eco system has biotic and abiotic factors

Every ecosystem has the following four structural components:

Producers: - Producers are those living members of the ecosystem that utilize sunlight as their energy-source and simple inorganic materials like water, carbon dioxide and salts to produce their own food.







Consumers: Consumers are those living organisms that ingest other organisms and are, therefore, called heterotrophs. They derive their food directly or indirectly from the producers or the green plants. Consumers can be Primary, Secondary or Tertiary.

Decomposers: They are also the living components, chiefly the bacteria and fungi, that break down the complex compounds of dead protoplasm of producers and consumers, absorb some of the decomposition products, and release simple substances usable by the producers.

Abiotic Substances or Components: The abiotic component consists of two things: the materials and the energy. The materials are like water, minerals atmospheric gases, and salts. They also include some organic matter, such as the amino acids and other products of decay of living things.

Living organisms in ecosystems are called
biotic

Grouped as:

Producers	Consumers	Decomposers
Make their own food	Eat other organisms for food	Break down dead material
 	 	 

Ecosystem

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graph TD; Ecosystem[Ecosystem] --> Abiotic[Abiotic Factors]; Ecosystem --> Biotic[Biotic Factors]; Biotic --> Producers[Producers]; Biotic --> Consumers[Consumers]; Biotic --> Decomposers[Decomposers]; Consumers --> Primary["Primary (Herbivores)"]; Consumers --> Secondary["Secondary (Pri. Carnivores)"]; Consumers --> Tertiary["Tertiary (Sec. Carnivores)"];
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Abiotic Factors

Biotic Factors

Producers

Consumers

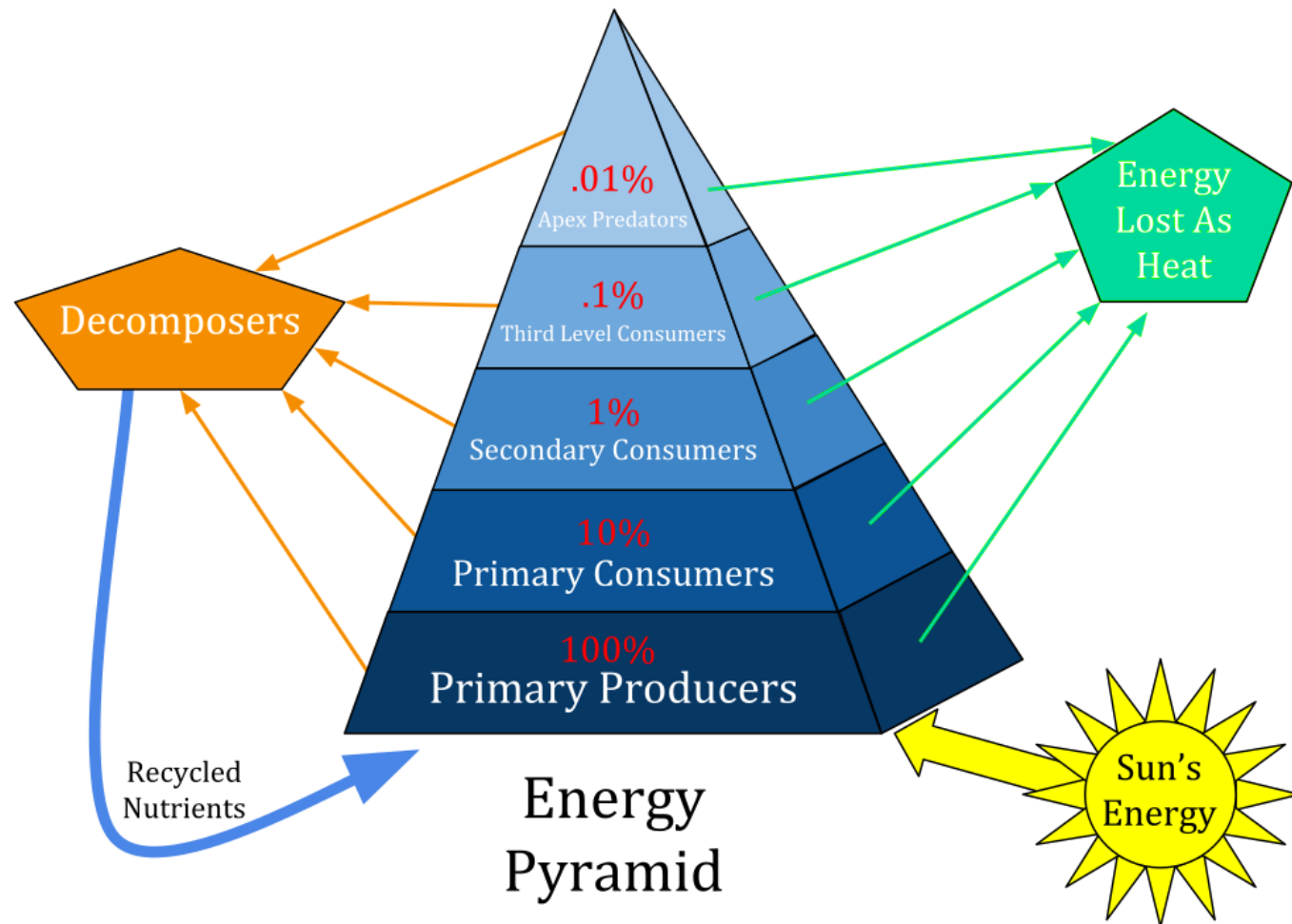
Decomposers

**Primary
(Herbivores)**

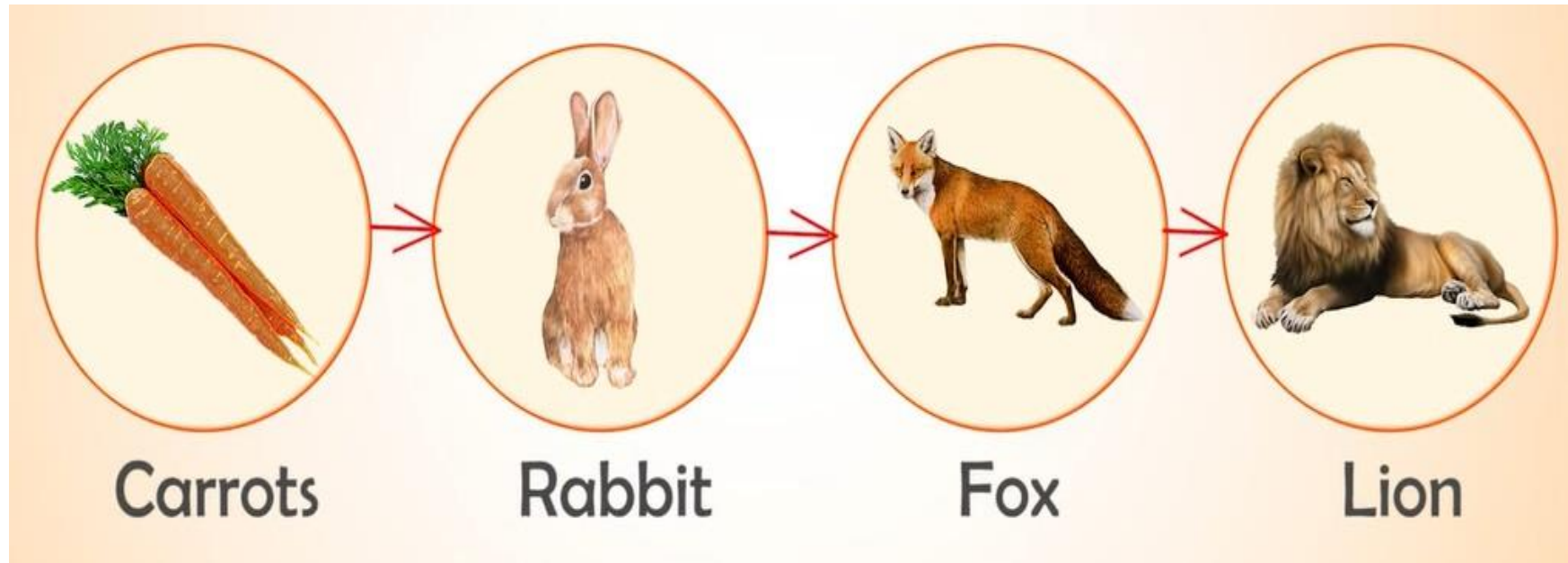
**Secondary
(Pri. Carnivores)**

**Tertiary
(Sec. Carnivores)**

An **Ecological pyramid** is a graphical representation of the relationship between the different living organisms at different trophic levels. These pyramids are in the shape of actual pyramids with the base being the broadest, which is covered by the lowest trophic level

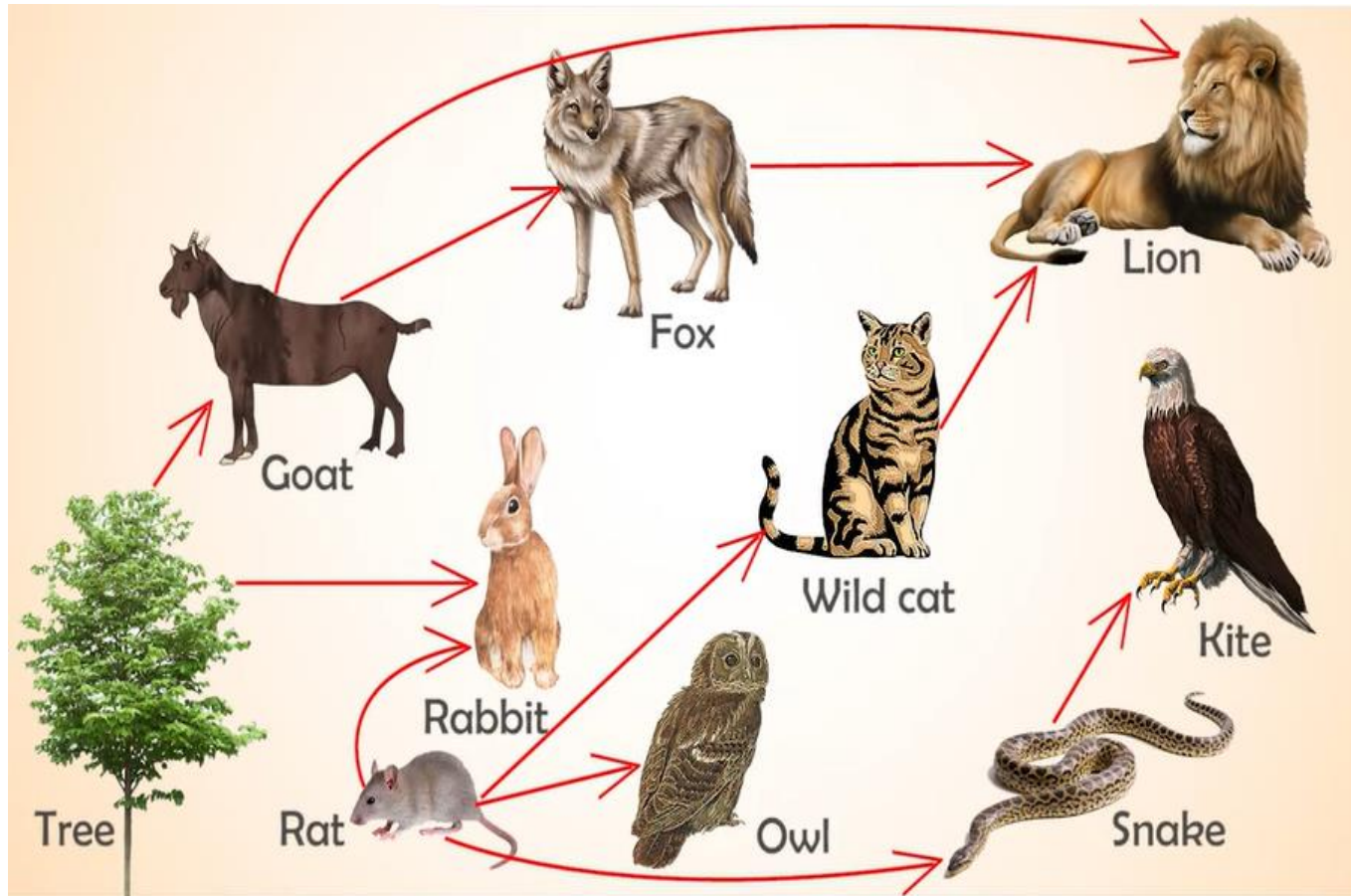


Food Chain - A food chain describes how energy and nutrients move through an ecosystem. At the basic level there are plants that produce the energy, then it moves up to higher-level organisms like herbivores. In the food chain, energy is transferred from one living organism through another in the form of food.



Food Chain

Food web is the natural interconnection of food chain and a graphical representation of what-eats-what in an ecological community.



Interconnecting food chains are called food web

Aquatic and terrestrial ecosystem. - Ecosystem existing in water bodies are called **Aquatic ecosystem**. The aquatic ecosystem may be marine (Seen in ocean-Salt water) or fresh water ecosystem. In addition to this, the aquatic ecosystem is classified into **lentic and lotic ecosystem**. A Lotic ecosystem has flowing waters. Eg. streams, rivers, springs etc. A Lentic ecosystem has still waters. Eg. - ponds, basin marshes, reservoirs, lakes etc,

Lentic Systems (Still water)

Lake



Pond



Bog



Swamp



Marsh

Lotic Systems (Running Water)



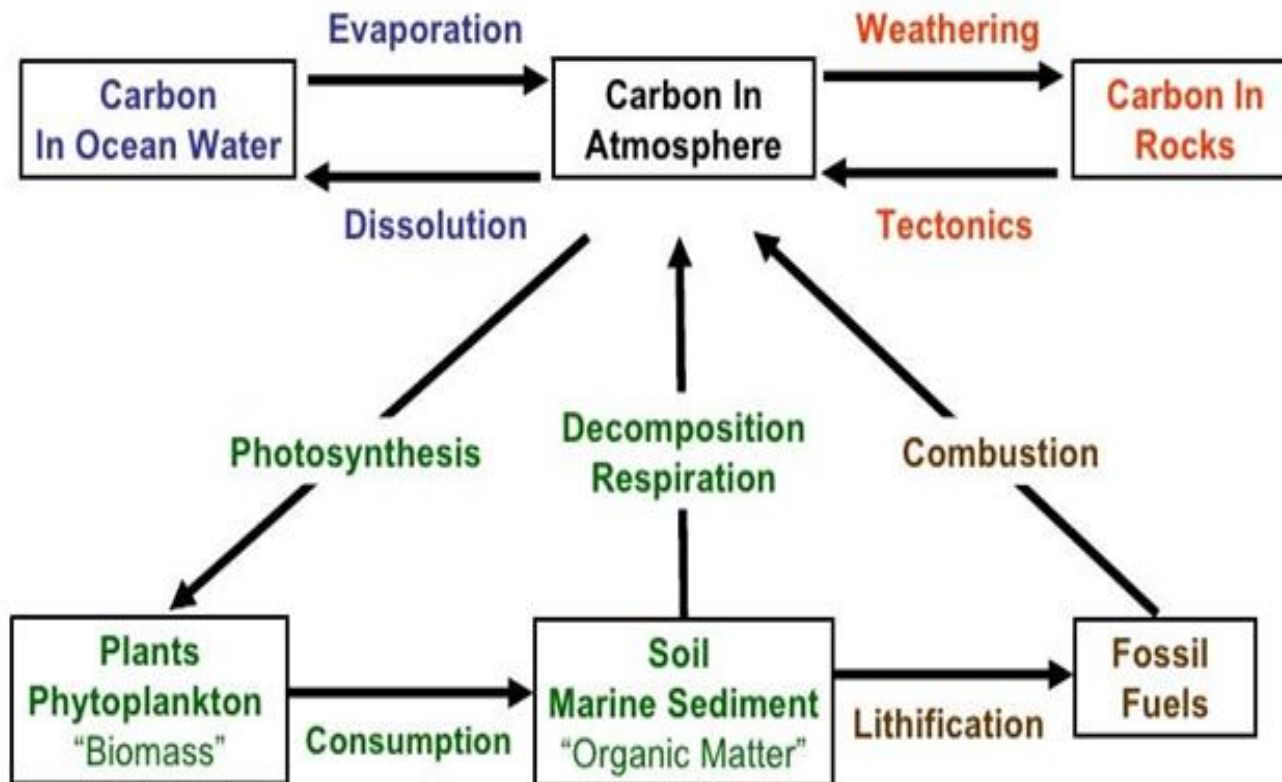
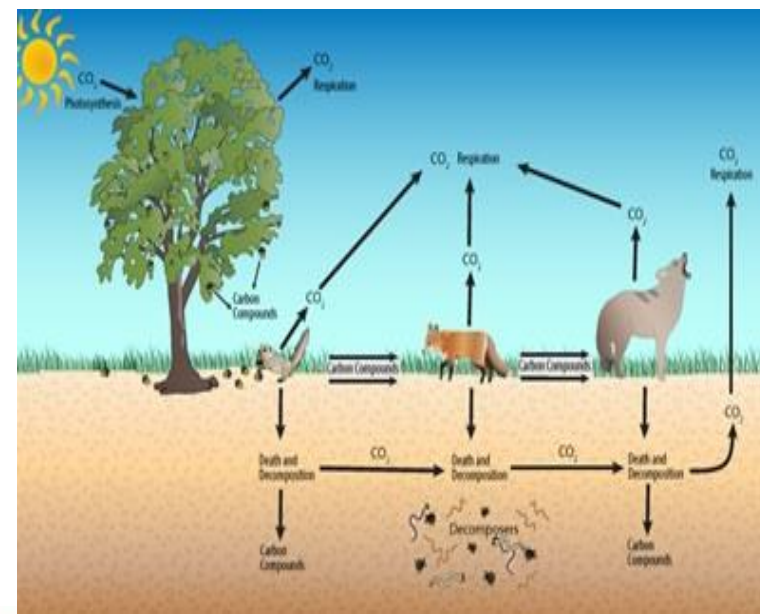
- Rivers, streams, creeks



A **terrestrial ecosystem** is a land-based community of organisms and the interactions of biotic and abiotic components in a given area. Examples forests, tropical rainforests, grasslands, and deserts.

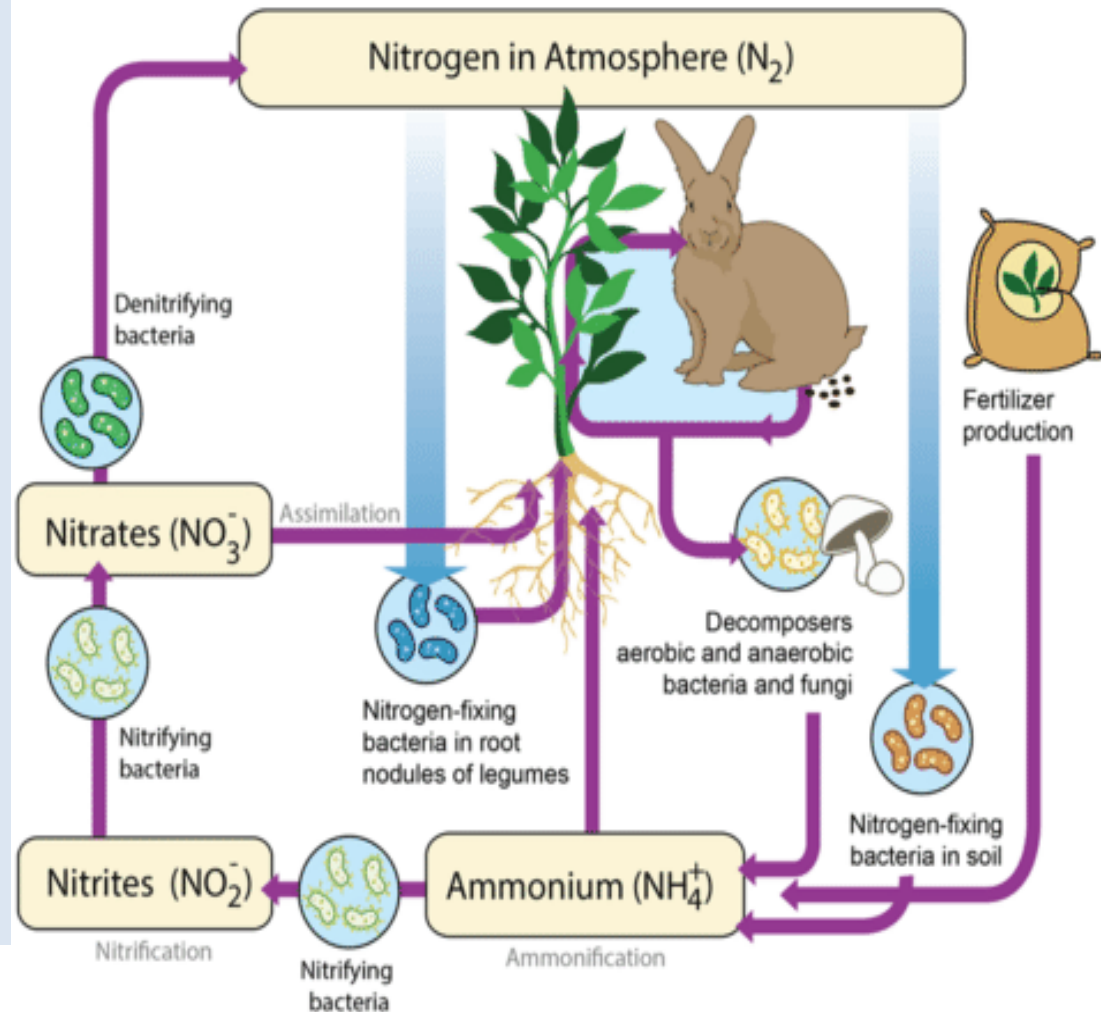


The **carbon cycle** is nature's way of reusing carbon atoms, which travel from the atmosphere into organisms in the Earth and then back into the atmosphere over and over again

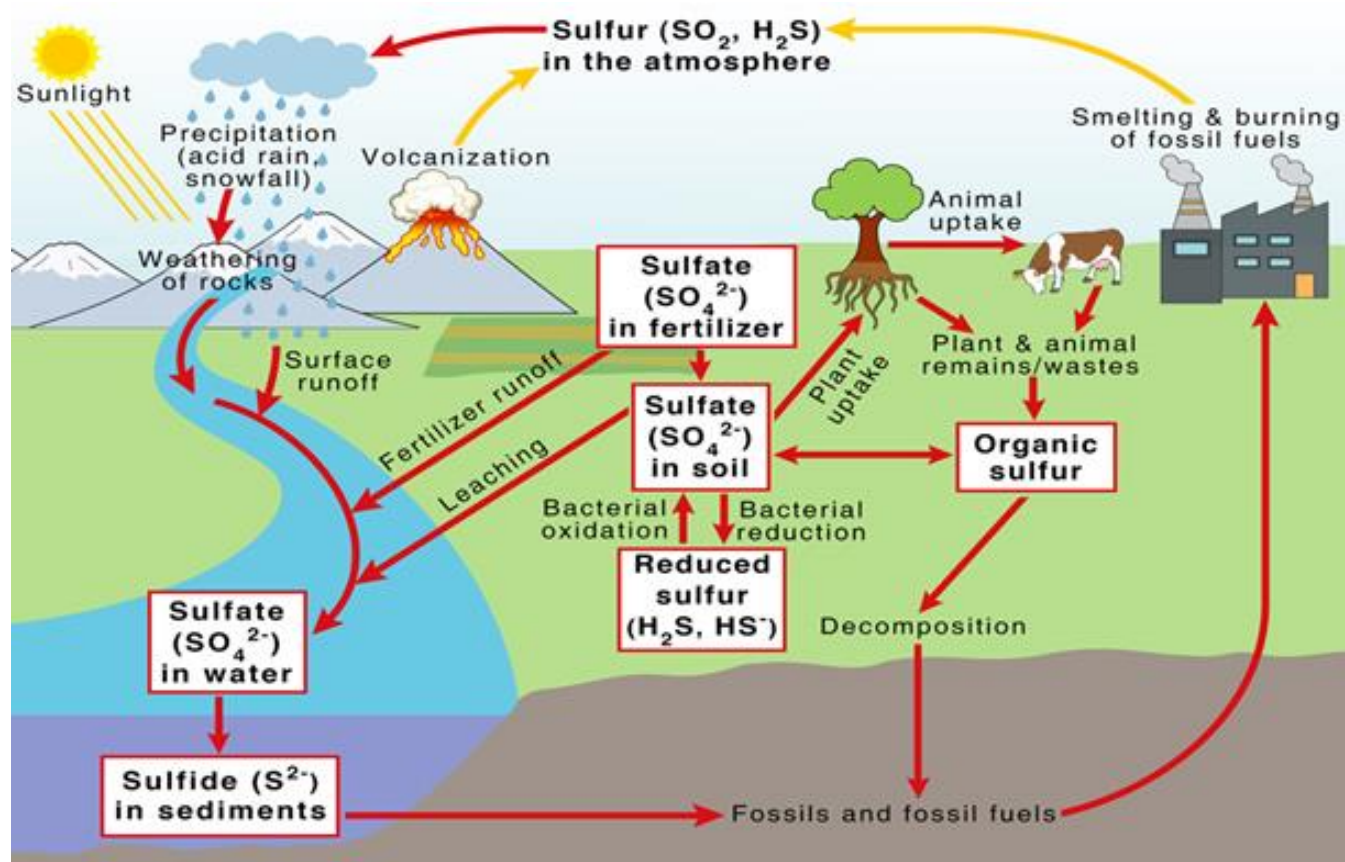


The nitrogen cycle is the biogeochemical cycle by **which nitrogen is converted into multiple chemical forms** as it circulates among atmosphere, terrestrial, and marine ecosystems.

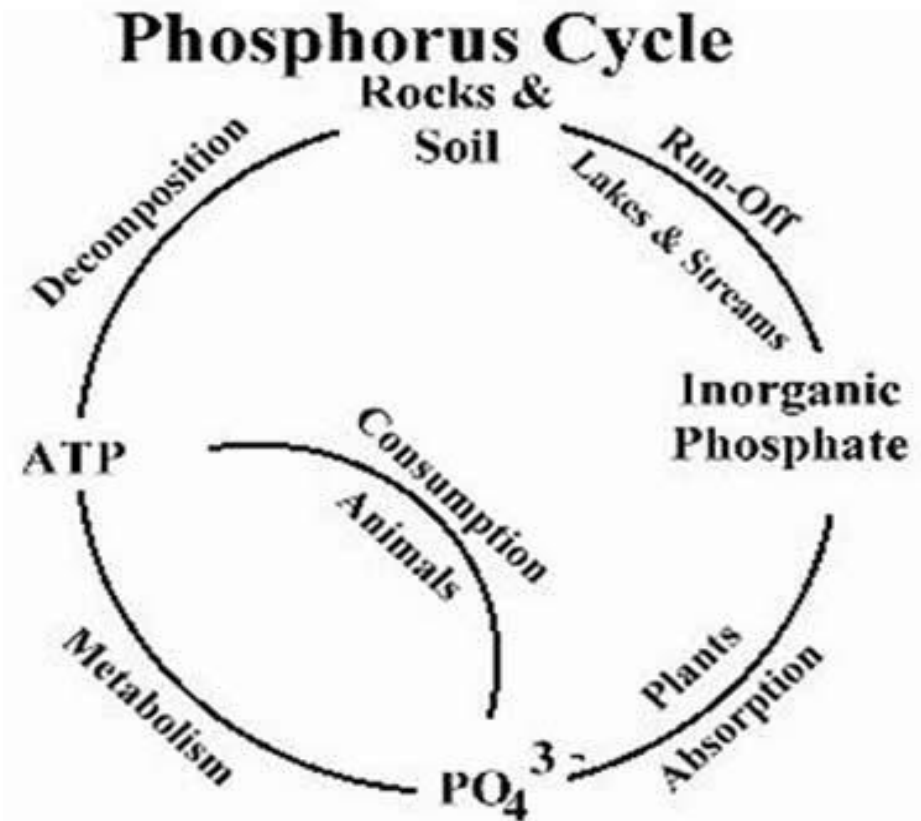
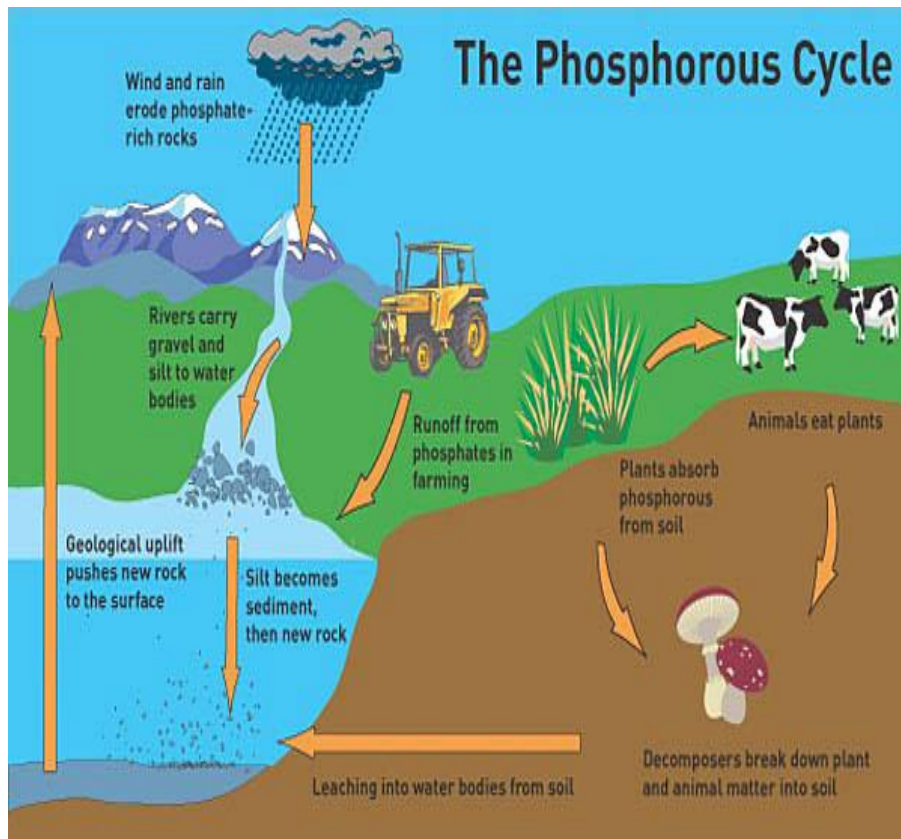
The conversion of nitrogen can be carried out through both biological and physical processes. Important processes in the nitrogen cycle include **fixation, ammonification, nitrification and denitrification.**



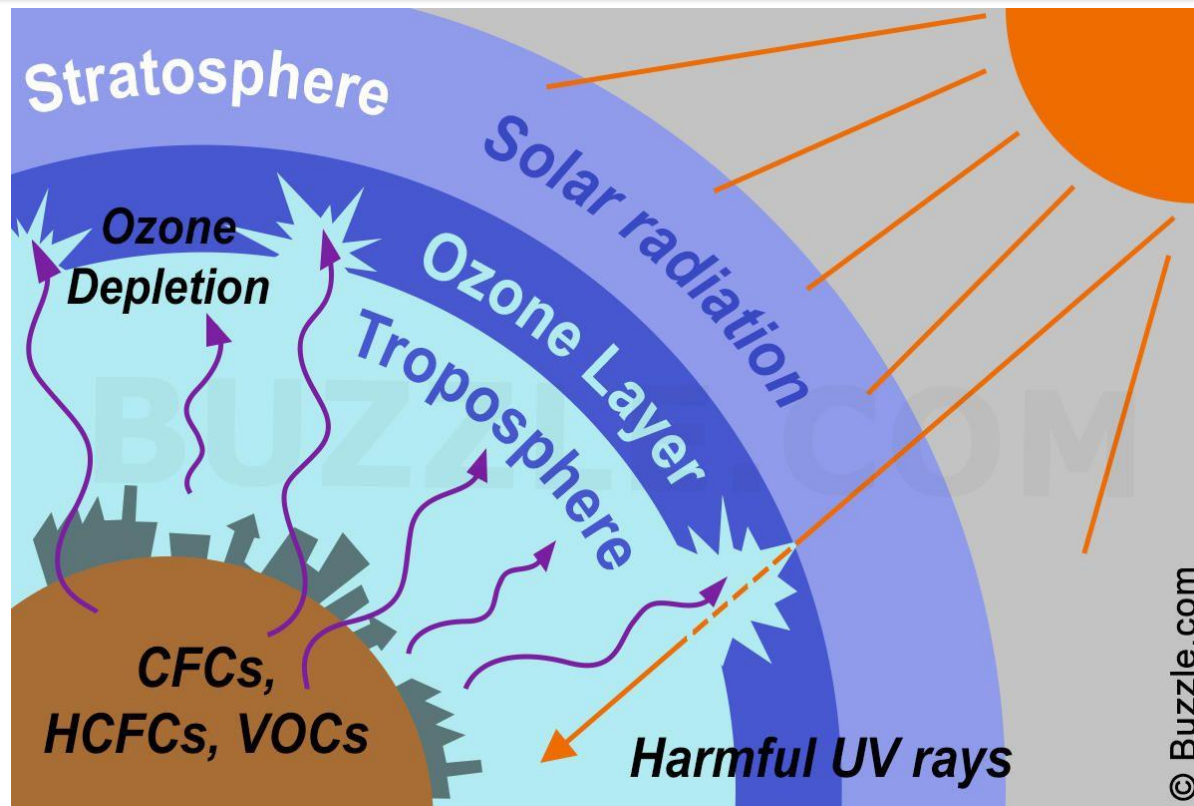
The **sulfur cycle** is a biogeochemical cycle in which the sulfur moves between rocks, waterways and living systems. The global sulfur cycle involves the transformations of sulfur species through different oxidation states, which play an important role in both geological and biological processes.



The **phosphorus cycle** is the biogeochemical cycle that describes the movement of phosphorus through the lithosphere, hydrosphere, and biosphere. Unlike many other biogeochemical cycles, the atmosphere does not play a significant role in the movement of phosphorus, because phosphorus and phosphorus-based compounds are usually solids.

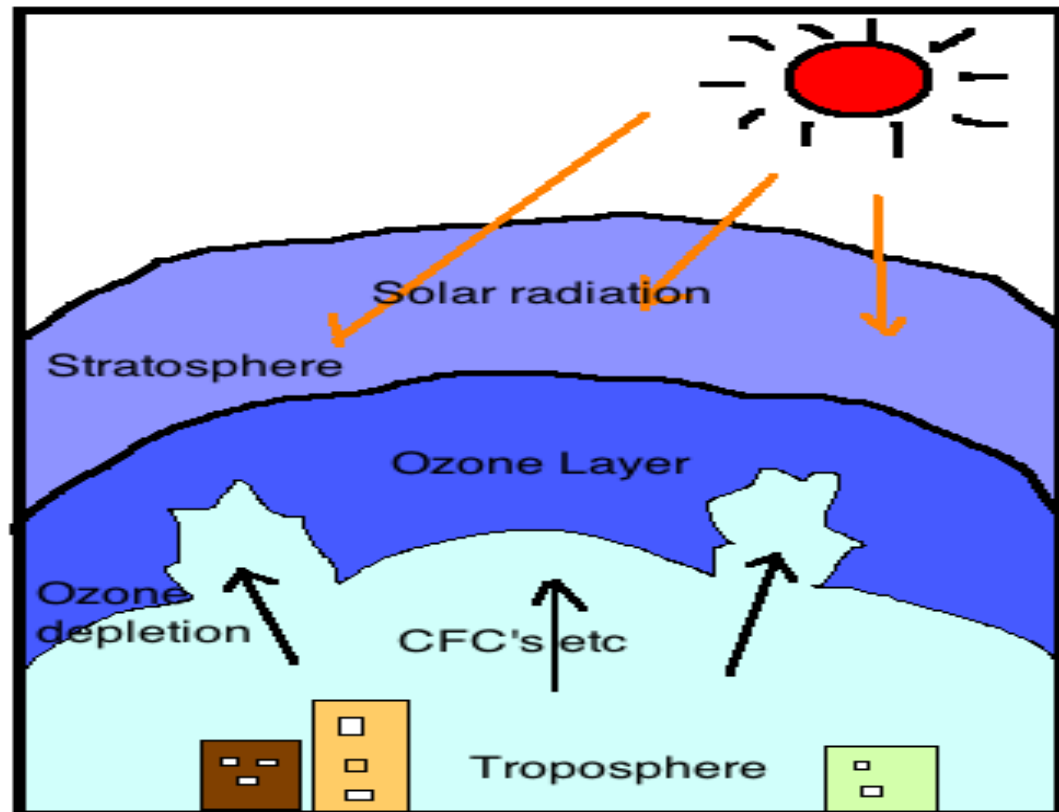


Ozone depletion - Decreasing the concentration of ozone in the stratosphere is called ozone depletion. Ozone is formed in the stratosphere by the interaction of U V radiation on atmospheric oxygen. The ozone layer in the atmosphere absorbs U V radiation from the sun and other stars.



Depletion of ozone in the stratosphere is caused by oxides of nitrogen and chloro fluoro carbons (CFC or Freons). CFC is very stable in the troposphere and decompose in the stratosphere to form chlorine free radical. The chlorine free radical damage the ozone in the stratosphere.

Due to the depletion in ozone UV rays directly reach the earth surface. The UV radiation leads to Sun burn, Cataract, Brain cancer, Global warming, and destroy the vegetation



Green house effect - The warming up of the earth's surface and atmosphere due to the blanketing effect of CO₂ and certain other gases in the atmosphere is called **green house effect**. The CO₂ absorbs the IR radiations reflected from the earth surface and re-emitted back to the earth's surface.



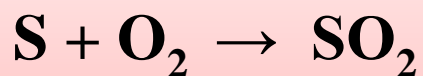
Global warming is the heating of Earth's climate system due to human activities, primarily due to fossil fuel burning, which increases heat-trapping greenhouse gas in Earth's atmosphere.

Other green house gases are water vapor, methane, CFC, ozone and nitrous oxide. About 50% of green house effect is due to carbon dioxide gas.

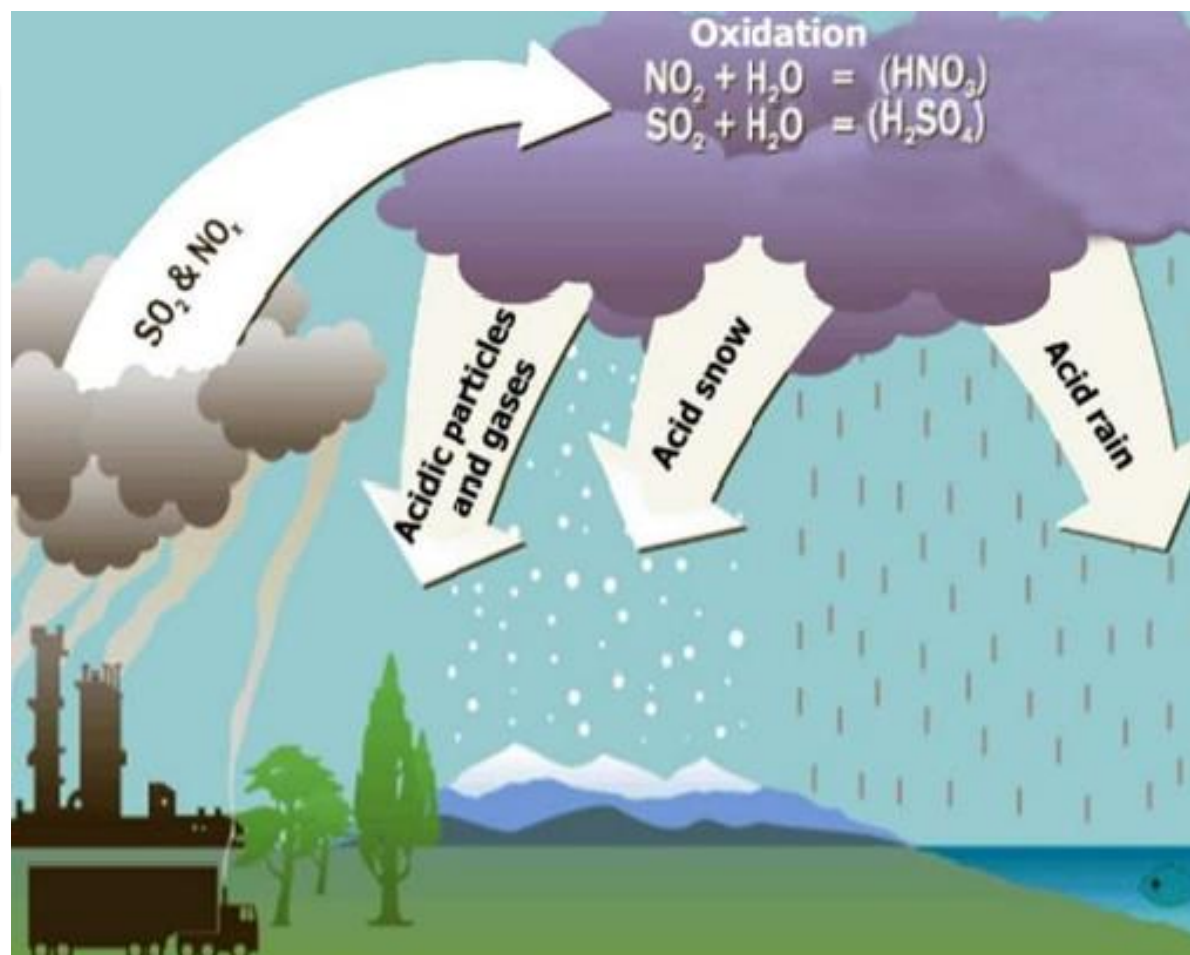
Consequences of Green house effect and global warming

1. Melting of polar ice, which leads to flood and increase in sea level
2. Increasing the incidence of infectious diseases.
3. Occurrence of skin cancer, and melanoma due to rise in temperature.
4. Change in the pattern of rain fall and in the ocean current.
5. Forest area may turn into desert.
6. Saline water from sea may intrude in to rivers.

Acid rain – The presence of harmful acids (pH 5.6 – 3.5) in rain water is called Acid rain. The acids, mainly H_2SO_4 and HNO_3 formed in the atmosphere from the oxides of nitrogen and oxides of sulphur are falling down as constituents of rain.



Oxides of Nitrogen and Sulphur are discharged into the atmosphere due to the combustion of fossil fuels.



Acid rain cause

1. Irritation to eyes and mucus membrane.
2. Damaging crops and forests.
3. Cause damage to fresh water life
4. Corroding metals, and machinery.
5. Causes damage to buildings, statues, limestone and marble.
6. Affects lungs, skin and hair.

Acid rain can be controlled by

- 1) Using low sulphur fuels.
- 2) Controlling automobile emission.
- 3) Controlling the release of acidic gases in to the atmosphere