

INTRODUCTION TO ENVIRONMENTAL STUDIES

- **Definition, Scope and importance of Environmental Studies**
- **Multidisciplinary nature of environmental studies**
- **Component of Environment: Atmosphere, Hydrosphere, Lithosphere, Biosphere**
- **Biogeochemical cycles: Carbon cycle and Nitrogen cycle**
- **Concept of sustainability and sustainable development.**

ENVIRONMENT

- The word 'environment' is derived from the French word 'environ' which means to encircle or surround.
- In simple words 'environment' is the surrounding of an organism, which includes air, water, land and its resources, flora and fauna and their interrelationships.
- Surrounding external conditions influencing development or growth of people, animal or plants; living or working conditions etc.

ENVIRONMENTAL STUDIES

- Environment means the surrounding things and conditions affecting the plants and animals.
- **Environment:** is defined as sum total of all conditions that surround a particular organism at a particular point of time in space.
- Environment: is defined as "all the physical, chemical, biological factors external to the organisms, that governs the growth and development.
- Environment: is defined as "the aggregate of all external conditions and influences affecting life and development of an organism"

Environment literally means Surrounding in which we are living. Environment includes all those things on which we are directly or indirectly dependent for our survival, whether it is living component like animals, plants or non-living component like soil, air water.

Environmental Protection Act (1986) defined "Environment as the sum total of water, air and land, their interrelationship among themselves and with the human beings, other living beings and property."

Meaning of Environmental Studies:

Environmental studies are the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

SCOPE AND IMPORTANCE OF ENVIRONMENTAL STUDIES

The disciplines included in environmental education are Environmental sciences, Environmental engineering and Environmental management.

(a) Environmental Science:

It deals with the scientific study of environmental system (**air, water, soil and land**), the inherent or induced changes on organisms and the environmental damages incurred as a result of human interaction with the environment.

(b) Environmental Engineering:

It deals with the study of technical processes involved in the protection of environment from the potentially deleterious effects of human activity and improving the environmental quality for the health and well beings of humans.

(c) Environmental Management:

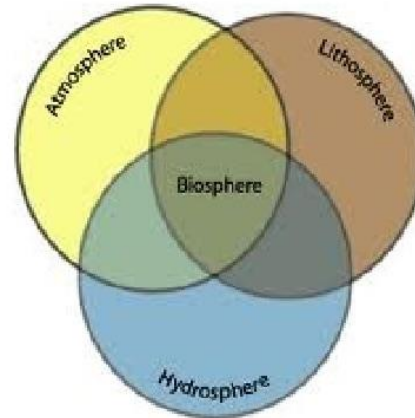
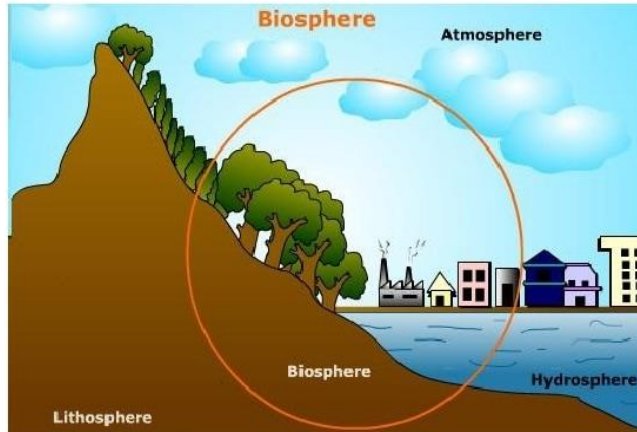
It promotes due regard for physical, social and economic environment of the enterprise or projects. It encourages planned investment at the start of the production chain rather than forced investment in cleaning up at the end.

It generally covers the areas as environment and enterprise objectives, scope, and structure of the environment, interaction of nature, society and the enterprise, environment impact assessment, economics of pollution, prevention, environmental management standards etc.

SCOPE OF ENVIRONMENTAL STUDIES

- Everything around us forms our environment and our lives depend on keeping its important systems as intact as possible.
- It deals with many like conservation of natural resources, ecological aspects, pollution of the surrounding natural resources.
- Controlling the pollution
- Briefly, the environment has four realms i.e.
 1. Atmosphere(air)
 2. Hydrosphere(water)
 3. Lithosphere(land)
 4. Biosphere (all living species)

SCOPE OF ENVIRONMENT



Atmosphere : Virtual Ocean of Air

Hydrosphere : The surface of Earth filled with any form of Water

Lithosphere : Outer shell of the Earth composed of crust and the rigid outer most mantle

Biosphere : The place on earth where life exists

The importance of environmental studies are as follows:

1. To clarify modern environmental concept like how to conserve biodiversity.
2. To know the more sustainable way of living.
3. To use natural resources more efficiently.
4. To know the behavior of organism under natural conditions.
5. To know the interrelationship between organisms in populations and communities.
6. To aware and educate people regarding environmental issues and problems at local, national and international levels.

OBJECTIVE OF ENVIRONMENTAL STUDIES

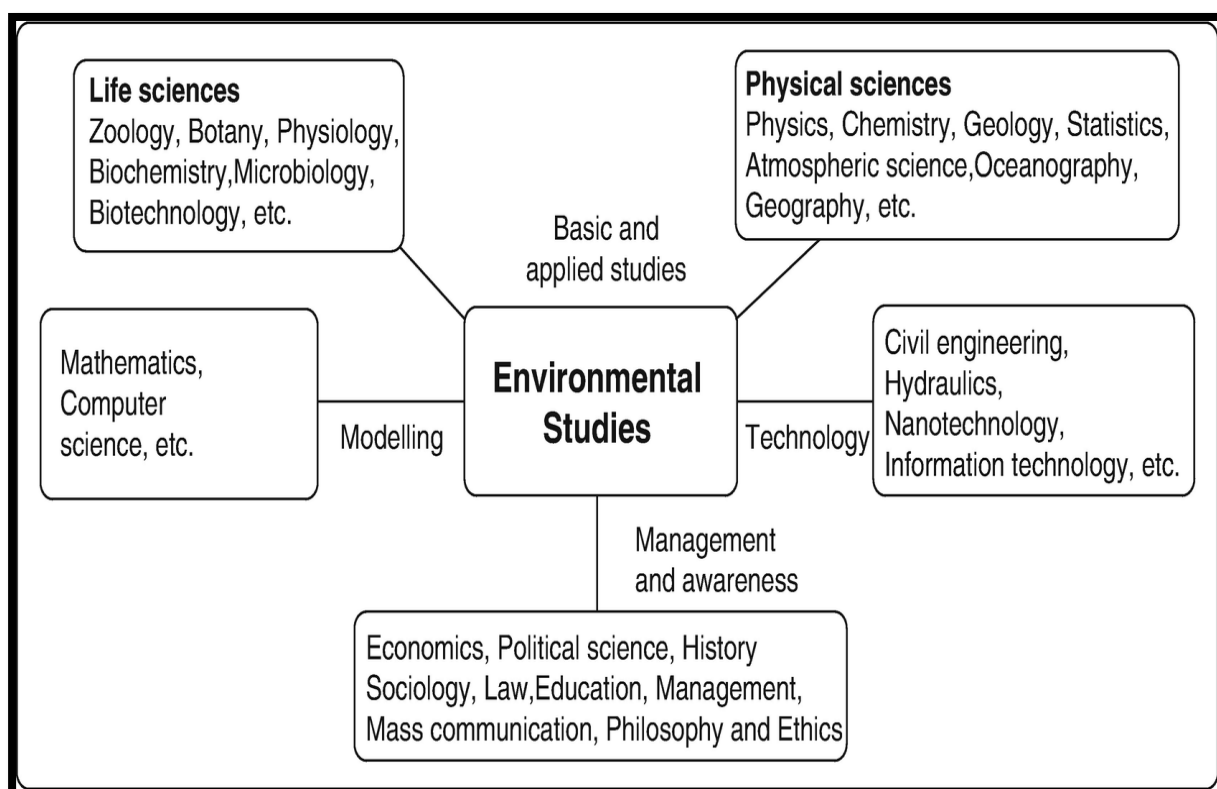
- To increase awareness and sensitivity to the environment among the people.

- To increase the knowledge of the environment.
- To improve attitude towards the environment.
- To acquire skills for solving environmental problems.
- To increase participation and develop a sense of responsibility.

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Because, the environment is complex and actually made up of many different environments, including natural, constructed and cultural environments, environmental studies are the interdisciplinary examination of how biology, geology, politics policy studies, law, geology, religion engineering, chemistry and economics combine to inform the consideration of humanity's effects on the natural world.

It is essentially a multidisciplinary approach and its components include Biology, Geology, Chemistry, Physics, Engineering, Sociology, Health Sciences, Anthropology, Economics, Statistics and Philosophy. It is essentially a multidisciplinary approach.



MAJOR GLOBAL ENVIRONMENTAL PROBLEMS

- Global warming
- Ozone Layer Depletion

- Acid Rain
- Deforestation
- Loss of Biodiversity
- Water Pollution
- Desertification
- Waste disposal
- Rapid population growth
- Depletion of non-renewable energy sources
- Food and water shortage

There are several governmental & non-governmental organizations working towards environmental protection in our country. Few well known organizations are:

- **BSI** - Botanical Survey of India
- **ZSI** - Zoological Survey of India
- **BNHS** - Bombay Natural History Society
- **WWFI** - World Wide Fund for Nature India etc.

COMPONENT OF ENVIRONMENT:

The environment is defined as the whole physical and biological system surrounding man and other organisms along with various factors influencing them. The factors are soil, air, water, light, temperature etc. These are called Abiotic factors. Besides the abiotic factors, the environment is very much influenced by biotic factors which include all forms of life like plants, animals, microorganisms etc.

The four basic components of the non-living physical environment are:

1. Atmosphere
2. Hydrosphere
3. Lithosphere
4. Biosphere

The four major components of environment include **Lithosphere**, **Hydrosphere**, **Atmosphere** and **Biosphere**, corresponding to rocks, water, air and life respectively.

1. ATMOSPHERE

The gaseous envelope surrounding the earth is called Atmosphere. All living organisms on this earth depend on the atmosphere for their survival. It provides us the air we breathe and protect us from the harmful effects of the sun's ray. Without this blanket of protection, we would be baked alive by the heat of the sun during day and get frozen during night. So it is this mass of air that has made the temperature on the earth liveable.

Composition of Atmosphere:

Atmosphere contains 78% nitrogen, 21% oxygen, 0.03% carbon dioxide and other gases like argon, hydrogen, helium, neon and ozone.

Importance of atmosphere:

- It protects the earth from the harmful radiation from the sun.
- It also serves as a store house for the water vapor which leads to precipitation over land and sea.
- The atmospheric elements determine the **weather** and **climate** of the place.

Weather:

Weather is this hour-to-hour, day to day condition of the atmosphere. A hot or humid weather may make one irritable. A pleasant, breezy weather may make one cheerful and even plan for an outing. Weather can change dramatically from day to day.

Climate:

The average weather condition of a place for a longer period of time represents the climate of a place.

Structure of atmosphere:

Depending on the various parameter like temperature, pressure, density of the atmosphere, it is divided into different layers. Density is the highest on the earth's surface and decreases rapidly upwards. Five layers are:

1. Troposphere
2. Stratosphere
3. Mesosphere
4. Thermosphere

5. Exosphere

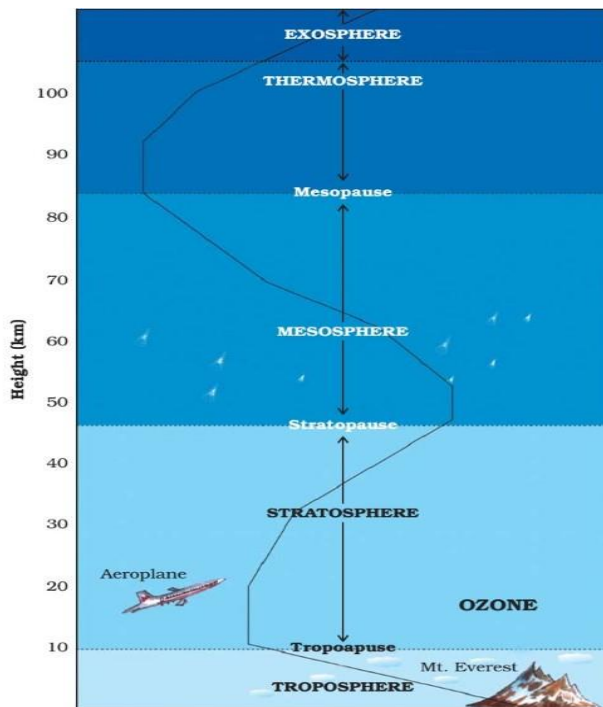
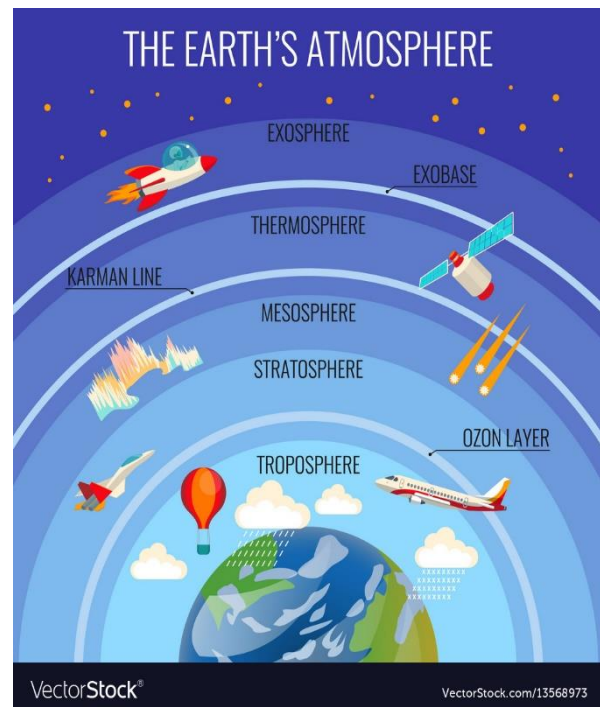


Fig. 4.2: Layers of Atmosphere



1. Troposphere:

- Lower most layer of the atmosphere, where living organisms exist.
- It extends up to 8km at poles and 18km at the equators which contains 70% of the atmospheric mass and extends up to 10-12 km distance.
- Temperature decrease with altitude.
- Density of this layer decreases with altitude.
- The air we breathe exists here.
- Almost all the weather phenomena like rainfall, fog and hailstorm occur in this layer, hence it is the most significant layer.

2. Stratosphere:

- It lies beyond the troposphere, and the ozone separating the two layers is called tropopause.
- It extends up to a height of 50km.
- It possesses an ozone layer arranged at a height between 16 to 30kms.
- Ozone layer absorbs, UV radiation waves and prevent them from reaching the earth.
- Clouds are almost absent and very little dust or water vapor present in this layer.

3. Mesosphere:

- It is the third layer over the stratosphere.
- It extends up to the height of the 80 km.
- Temperature decreases with the height, reaching up to the -100°C at the height of 80 km.
- Meteorites burn up in this layer on entering from the space.

4. Thermosphere:

- It is the fourth layer, located between 80 to 400km.
- In thermosphere temperature rises very rapidly with increasing height.
- Ionosphere is a part of this layer.
- It is an electrically charged layer and enables wireless communication.
- This layer helps in radio transmission. In fact, radio waves transmitted from the earth are reflected back to the earth by this layer.

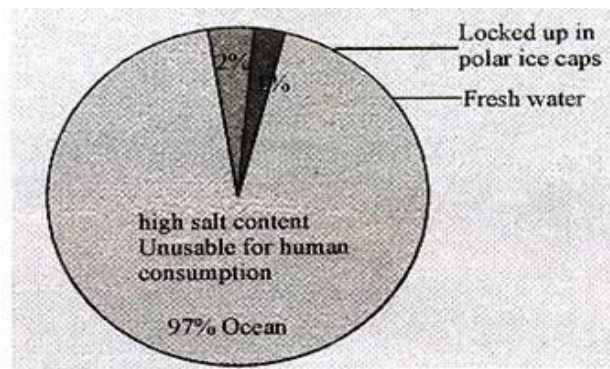
5. Exosphere:

- It is the uppermost layer of the atmosphere.
- It extends up to the height of the 1600km.
- It gradually merges with the outer space.
- This layer has very thin air. Light gases like helium and hydrogen float into the space from here.

2. HYDROSPHERE

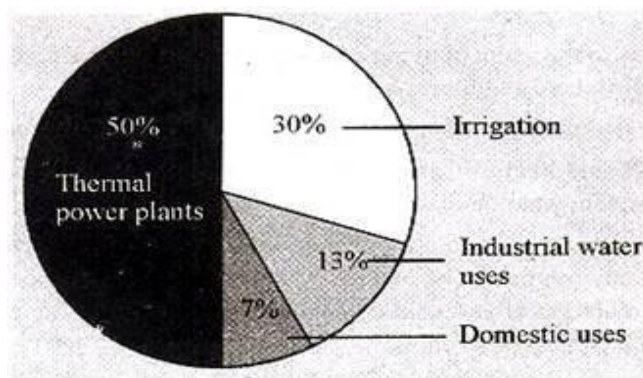
It includes all types of water resources such as oceans, seas, rivers, lakes, streams, reservoirs, glaciers and ground waters. The distribution of earth's water supply.

- Very important part of the earth's surface, about 70% of total area is covered with water.
- Oceans constitute 97% of all water available on the earth and fresh water forms the rest 3%.
- Water exists in liquid, solid and gaseous (water vapor) form.

*Figure 1.1*

As can be seen, only 1 % of the total water supply is available as fresh water in the form of rivers, lakes, streams and ground water for human consumption and other uses.

The extent of the use of available fresh water for various purposes is shown in the following figure -1.2.

*Figure 1.2. Major use of fresh water*

IMPORTANCE OF HYDROSPHERE

- Water, the universal solvent is used for metabolism, growth, and reproduction by living organisms.
- Water is useful to organisms as a medium of living.
- Oceans are an important natural resource.
- They are also source of many products of our use.
- They regulate the climate of a region.
- Oceans are a food resource, source of petroleum, gas and energy.
- Oceans also play an important role in trade and transportation.
- Water is used for agriculture as well as industries.

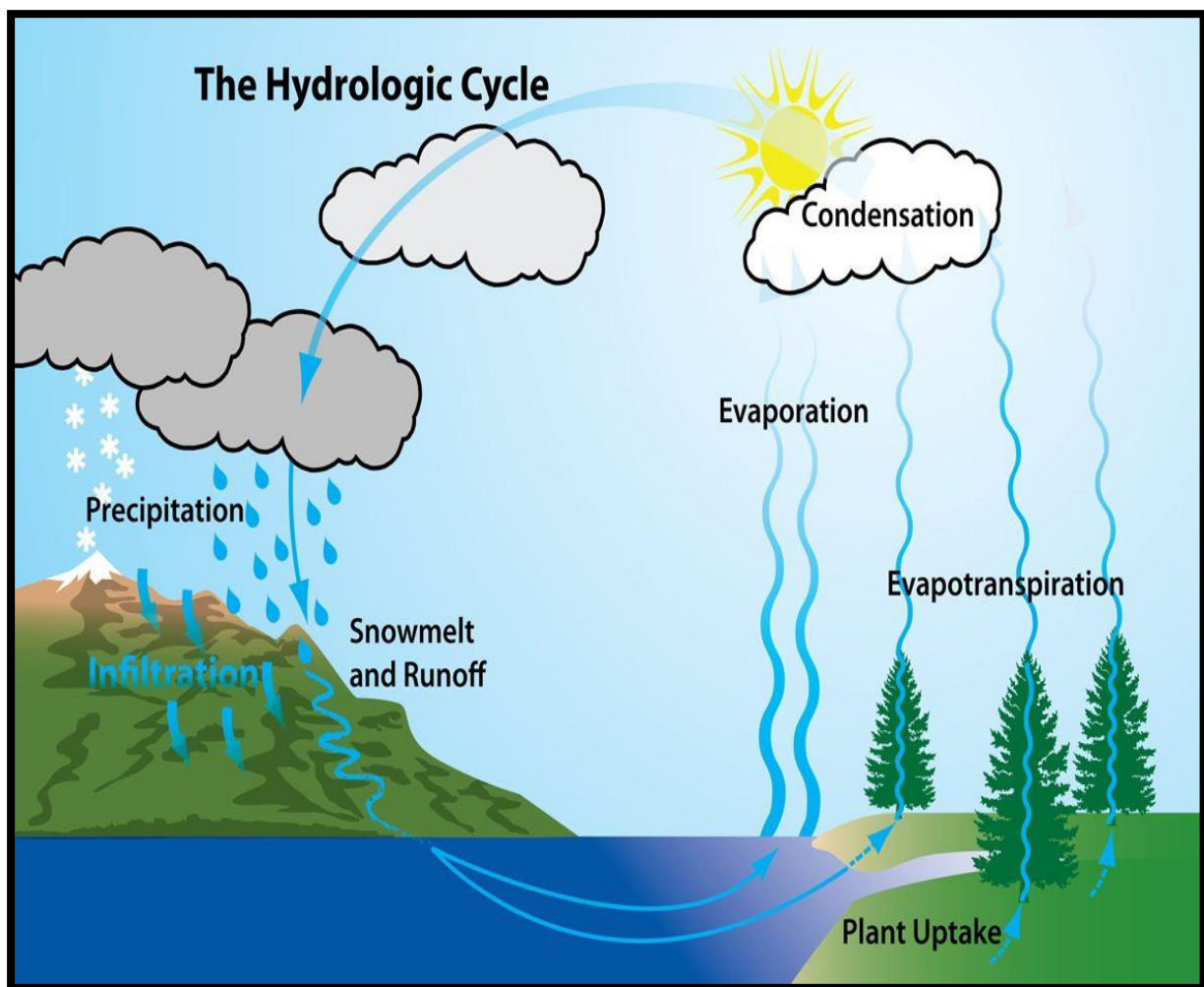
HYDROLOGICAL CYCLE/ WATER CYCLE

The continuous exchange of water between the oceans, atmosphere and the biosphere through evaporation (including transpiration), condensation and precipitation is known as hydrological cycle.

What is the Water Cycle?

The water cycle is an important Biogeochemical Cycle involved in the flow or circulation of water through different levels of the ecosystem. The water cycle is defined as a natural process of constantly recycling the water in the atmosphere. It is also known as the hydrological cycle or the hydrologic cycle.

During the process of the water cycle between the earth and the atmosphere, water changes into three states of matter – solid, liquid and gas.



Stages of Water Cycle

Evaporation

This is the initial stage of the water cycle.

The process by which water from its liquid state changes to vapor, a gaseous state, is termed as evaporation.

Condensation

When the evaporated water vapor loses its thermal energy, it becomes liquid through the process of condensation. Formation of clouds are examples of condensation.

Precipitation

Rain, snow, sleet, or hail are all examples of Precipitation. After the condensation, atmospheric water vapor forms sufficiently large water droplets and falls back to the earth with the help of gravity.

Deposition or Collection

This is the final stage of the water cycle. Deposition occurs when evaporated water vapor falls back to earth as precipitation. This water may fall back into the different water bodies, including oceans, rivers, ponds, lakes and even end up on the land, which in turn becomes a part of the groundwater.

Overall, the water cycle process describes how water is balanced in the atmosphere. It also plays an important role in ensuring the availability of water for all living organisms and also it has a great impact on our environment.

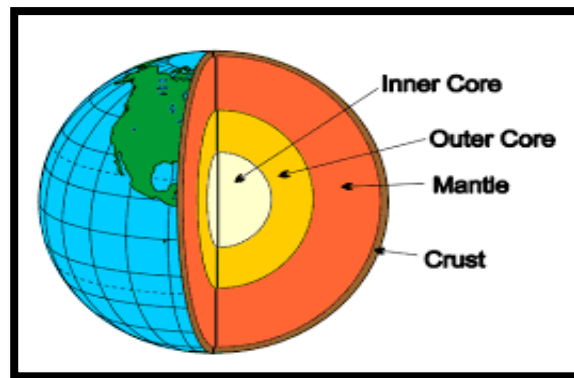
3. LITHOSPHERE

- Lithosphere refers to the layers of rock material on the earth's surface, both on the continents and ocean floors. It is the uppermost layer of the earth crust, which is made up of soil, minerals, rocks and other organic and inorganic matter.
- There are three major landforms i.e. mountains, plateaus and plains.
- An uplifted portion of the earth's surface is called **a hill** or **a mountain**.

Structure of Earth:

The structure of the earth is divided into three major components: **the crust, the mantle, and the core**. Each layer has a unique chemical composition, physical state, and can impact life on Earth's surface. Movement in the mantle caused by variations in heat from the core, cause the plates to shift, which can cause earthquakes and volcanic eruptions. These natural

hazards then change our landscape, and in some cases, threaten lives and property.

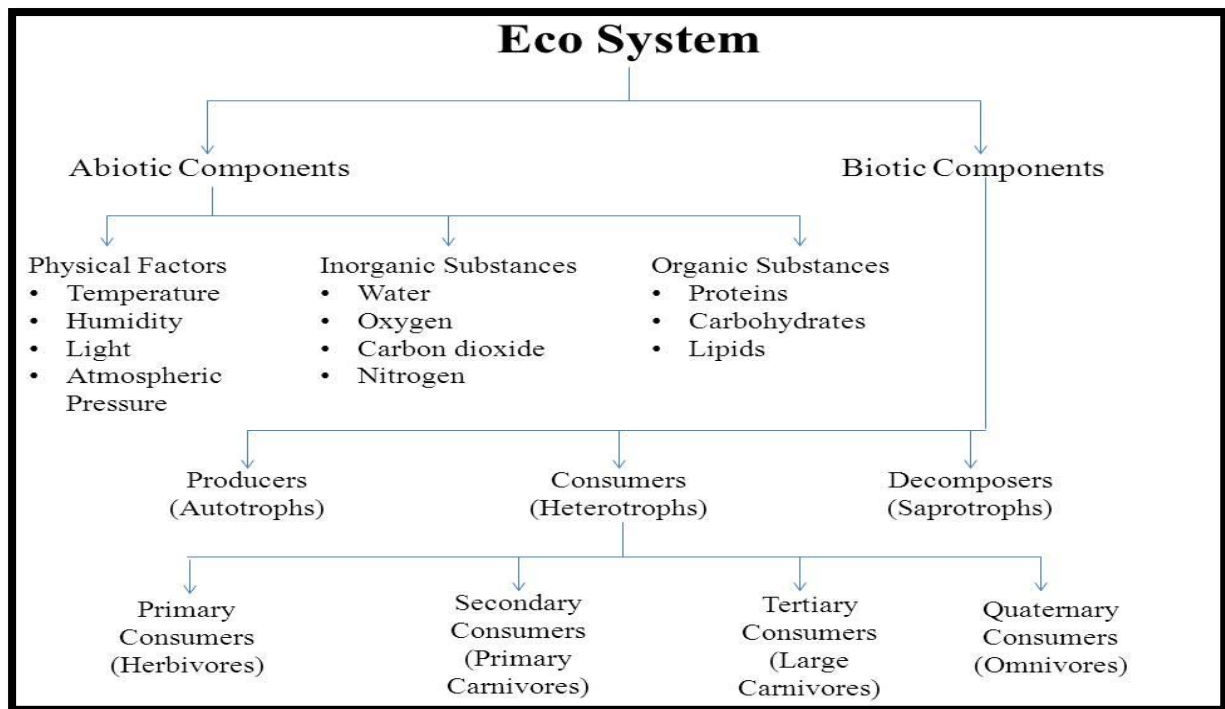


IMPORTANCE OF LITHOSPHERE

- Soil is medium of living for plants & animals.
- Plants obtain water & minerals from soil.
- The forest, grasslands and deserts over the earth are distributed on the basis of the kinds of the soil.
- It is the source of minerals like silicate, copper, lead, gold, carbonate etc.
- It is also a source of fuels as coal and oil.
- Various landforms (mountains, plateaus, valleys, plains) are an important factor that determines the climate of an area.

4. BIOSPHERE

- It is the part of the earth in which all life forms exist. The organisms comprising the biosphere are mostly found in the relatively narrow zones of contact(interface) between the atmosphere, lithosphere and hydrosphere.
- Life is possible only in this layer.
- Plants and animals live on land, sea/water, and sea shores. Whereas they live, they interact with the non-living components of other three realms to form complex ecosystems.
- Thus ecosystem comprises of the living(biotic) and non-living(abiotic) components.
- The two major components of the ecosystem:
 - (a) Abiotic components
 - (b) Biotic components.



Sample Food Chains

Trophic Level	Grassland Biome	Pond Biome	Ocean Biome
Primary Producer	grass	algae	phytoplankton
Primary Consumer	grasshopper	mosquito larva	zooplankton
Secondary Consumer	rat	dragonfly larva	fish
Tertiary Consumer	snake	fish	seal
Quaternary Consumer	hawk	raccoon	white shark

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IMPORTANCE OF BIOSPHERE

- Plants and animals provide food required for human metabolism.
- Provide food for all forms of life and form food chains in nature.
- Useful as a source of energy (biomass, fuel wood, organic matter etc.)

- Provide timber & other construction material.
- Forest resource is a source of food, medicines, honey, lac leather etc.)
- Forest regulate climate & rainfall.
- Forest purifies air.
- Forest prevent soil erosion.
- Forest provides habitat for plants, animals and microorganisms.

BIOGEOCHEMICAL CYCLES

“Biogeochemical cycles mainly refer to the movement of nutrients and other elements between biotic and abiotic factors.”

The term biogeochemical is derived from “bio” meaning biosphere, “geo” meaning the geological components and “chemical” meaning the elements that move through a cycle.

The matter on Earth is conserved and present in the form of atoms. Since matter can neither be created nor destroyed, it is recycled in the earth’s system in various forms.

The cycle starts by absorbing the chemical elements by the organisms and is returned to the air, water and soil through decomposition

These cycles are largely energized by solar insolation.

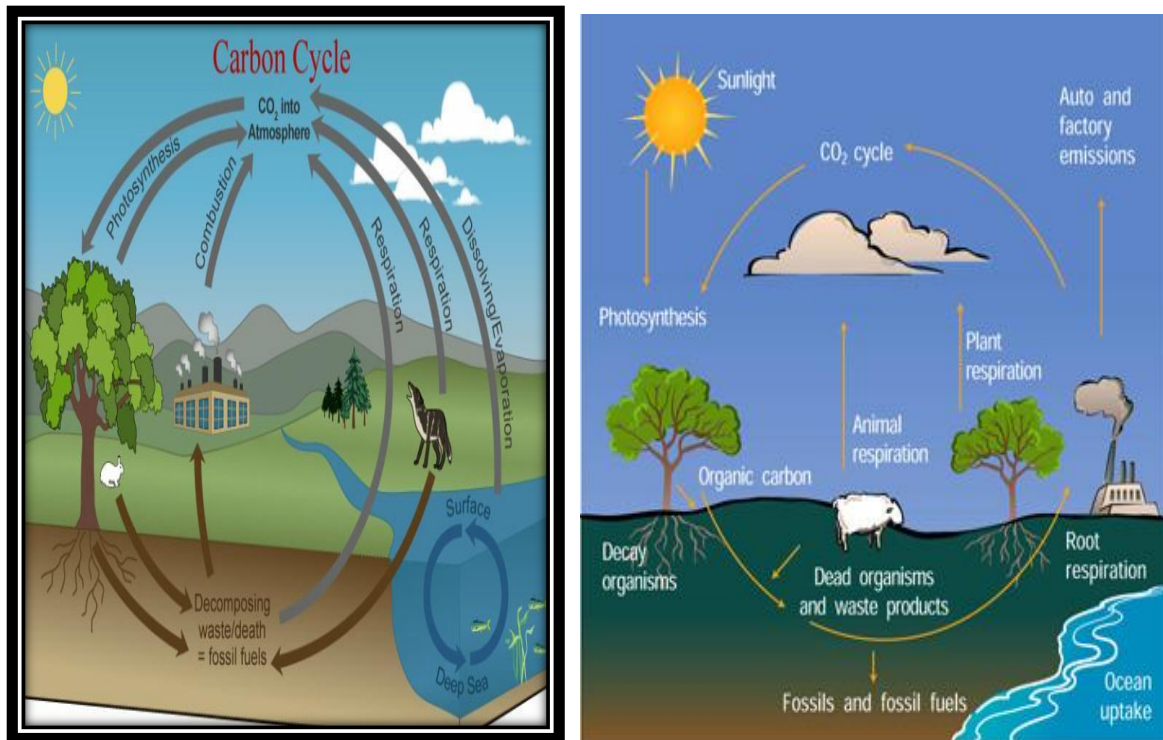
These biogeochemical cycles are:

1. **Water cycle**
2. **Carbon cycle**
3. **Nitrogen cycle**
4. **Oxygen cycle etc.**

1. CARBON CYCLE

The carbon found in organic compounds is indicated in both the abiotic and biotic parts of the ecosystem. Carbon is a building block of both plant and animal tissues. In the atmosphere, carbon occurs as carbon dioxide (CO₂). In the presence of sunlight, plants take up carbon dioxide from the atmosphere through their leaves. The plants combine carbon dioxide with water, which is absorbed by their roots from the soil. In the presence of sunlight, they are able to form carbohydrates that contain carbon. This process is known **photosynthesis**.

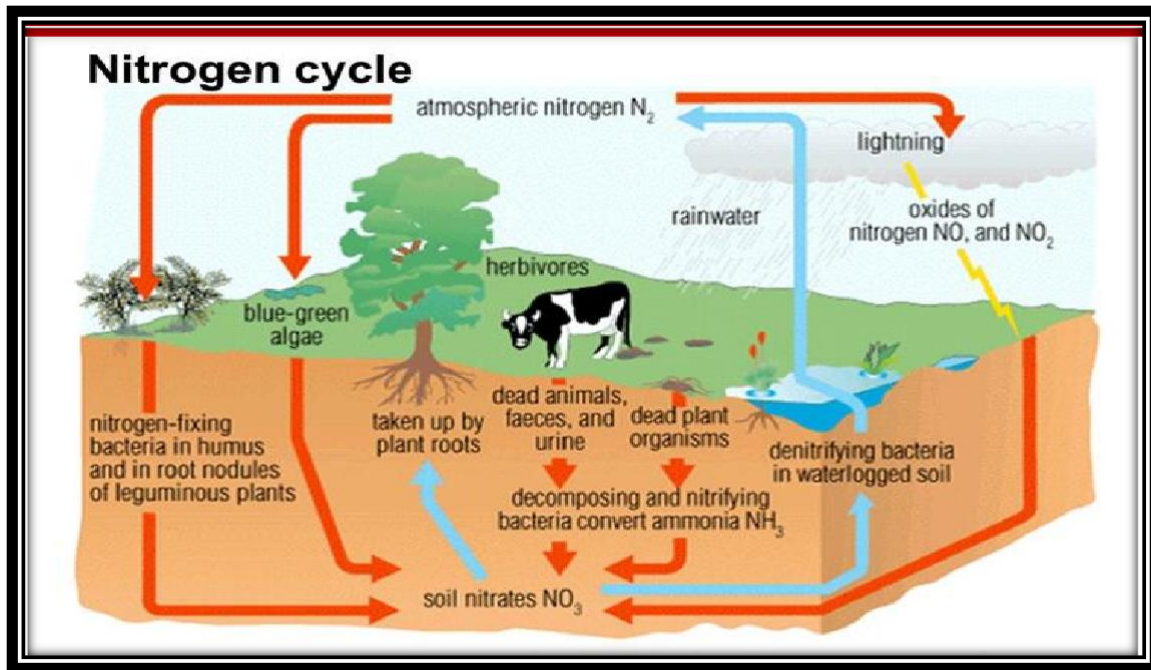
HERBIVORES feed on plant materials, which is used by them for energy and for their growth. Both plants and animals release carbon dioxide during respiration. When plants and animals die, they return their carbon to the soil. These processes complete the carbon cycle



- Carbon enters into the living world in the form of carbon dioxide through the process of photosynthesis as carbohydrates.
- This organic compounds (food) are then passed from the producers to the consumers (herbivores & carnivores)
- This carbon finally returned back to the surrounding medium by the process of respiration or decomposition of dead bodies of plant and animals by decomposers.
- Carbon is also recycled during burning of fossil fuels.

2. NITROGEN CYCLE

Carnivores feed on herbivores that, in turn, feed on plants. When animals defecate, this waste material is broken down by worms and insects, mostly beetles and ants. These small “**soil animals**” break the waste materials into smaller bits on which microscopic bacteria and fungi.

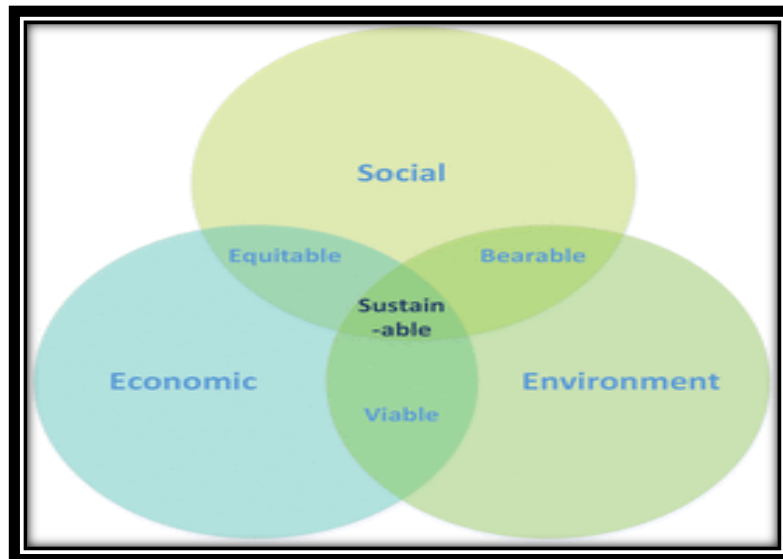


- Nitrogen is present in the atmosphere in its elemental form and as such it cannot be utilized by living organisms.
- This elemental form of nitrogen is converted into a combined state with elements like H, C, O by certain bacteria so that it can be readily used by plants.
- Nitrogen is continuously entering into the air by the action of microorganisms like denitrifying bacteria and finally returned back to the cycle through the action of lightning and electrification.

CONCEPT OF SUSTAINABILITY

The way in which sustainability is used nowadays is based on the English term “sustainability,” which is an expression of the possibility of a certain matter to be supported. Sustainability is seen as a paradigm for thinking about the future in which environmental, societal, and economic considerations are balanced in the pursuit of an improved quality of life. The ideals and principles behind it lay on broad concepts such as intergenerational equity, gender equity, social tolerance, poverty alleviation, environmental preservation and restoration, natural resource conservation, and building just and peaceful societies.

So to achieve true sustainability we need to balance economic, social and environmental sustainability factors in equal harmony. These may be defined as:



- **Environmental Sustainability:** Environmental sustainability means that we are living within the means of our natural resources. To live in true environmental sustainability, we need to ensure that we are consuming our natural resources, such as materials, energy fuels, land, water etc., at a sustainable rate. Some resources are more abundant than others and therefore we need to consider material scarcity, the damage to environment from extraction of these materials and if the resource can be kept within Circular Economy principles. Environmental sustainability should not be confused with full sustainability, which also need to balance economic and social factors.
- **Economic Sustainability:** Economic sustainability requires that a business or country uses its resources efficiently and responsibly so that it can operate in a sustainable manner to consistently produce an operational profit. Without an operational profit a business cannot sustain its activities. Without acting responsibly and using its resources efficiently a company will not be able to sustain its activities in the long term.
- **Social Sustainability:** Social sustainability is the ability of society, or any social system, to persistently achieve a good social well-being. Achieving social sustainability ensures that the social well-being of a country, an organization, or a community can be maintained in the long term.

