

# Biosphere

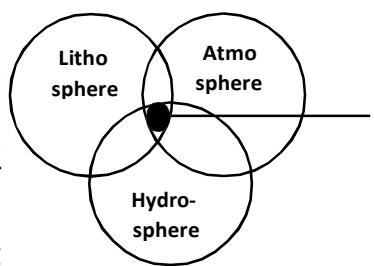
Lesson No.	Title	Activity
14	Biosphere	Try to find out that which kind of weather and climate is found in your area.

## Meaning

Due to its sphere shape, earth is also known as living planet or ‘sphere’ of ‘life’. This sphere contains those qualities atmosphere, lithosphere and hydrosphere. They all enable the life to exist on this planet. But this is a very small portion of the earth where life exists. Beyond this narrow space of the earth, there is no life forms found. It happens due to right mixture of many things – energy, some living beings and some non-living things and their interaction. For millions of years, nature has provided some checks and balances which sustain these life forms without any problems.

## Biosphere and Its Limits

- Biosphere refers to the narrow zone of the earth in which all life forms exist.
- Life becomes possible in this zone because all the three essentials things which are required for sustenance of life are found in a right mixture.
- They are land (lithosphere), air (atmosphere) and water (hydrosphere).
- It extends vertically into the atmosphere to about 10km, downward into the ocean to depths of about 10.4 km and into about 27,000 ft of the earth’s surface where maximum living organism have been found.
- There are some life forms which are found in extreme conditions.



## Components of Biosphere

### Abiotic Components

- These components broadly consist of all non-living elements which are essential for the survival of all living organisms.
- These are lithosphere (solid part of the earth crust), (ii) atmosphere and (iii) hydrosphere.
- Mineral nutrients, certain gases and water are the three basic requirements of organic life. Soils and sediments constitute the chief reservoir of mineral nutrients.
- Atmosphere constitutes the chief reservoir of gases essential for organic life.

### Biotic Components

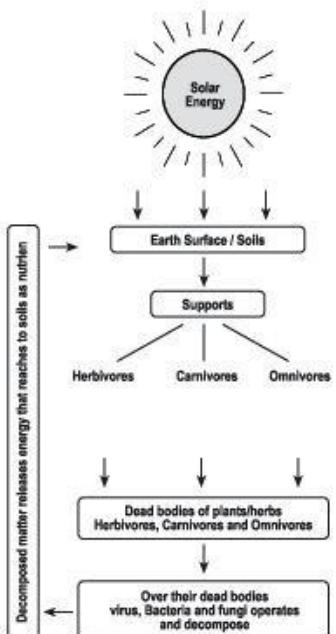
- Plants:** Plants are most important among biotic components. They are the only primary producers as they produce their own food through the process of photo synthesis and hence are called autotrophs.
- Animals:** The animals are the main consumers. Therefore, animals are heterotrophs. There are three main functions of animals: (i) to use organic matter made available by plants as food. (ii) to transform the food into energy and (iii) to utilise the energy for growth and development.
- Micro-organisms:** These consist of a variety of micro-bacteria, fungi etc. Their numbers are unlimited and are popularly known as decomposers.

### Energy

- This is the third and vital component of the biosphere without which life could not have been possible on this planet.
- It is essential for generation and reproduction of all biological life on this planet.

### Ecology and Ecosystem

- Ecology is the study of interactions between the organisms and their environment.
- An ecosystem can be defined as a system of regularly interacting and interdependent components forming a unified whole.



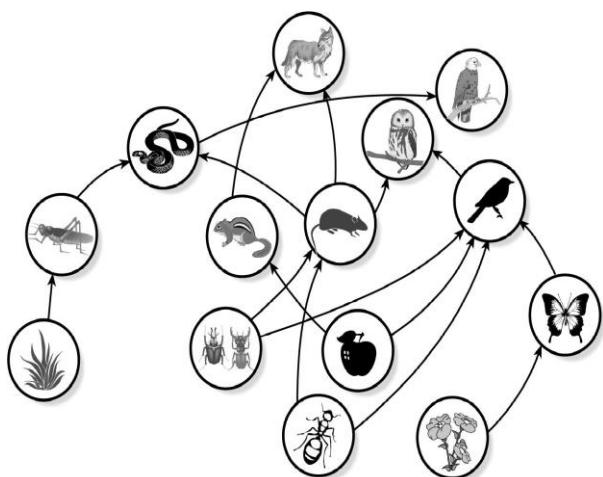
- The word eco-system is a short form of ecological system. The term was first used by A.G. Tansley in 1935.

## Flow of Energy in the Ecosystem

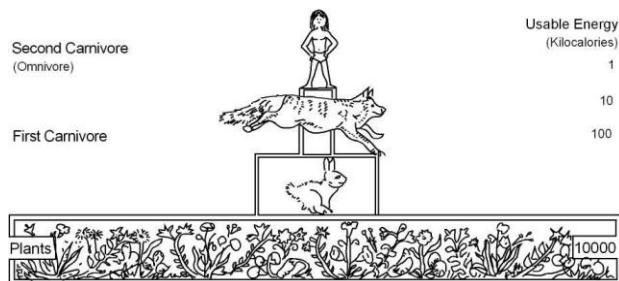
- Continuous interaction between components and sub-components involves the flow of energy and cycling of mineral nutrients.
- In this process transfer of energy takes place from one level to another (trophic level). Therefore, trophic level is the level or the stage at which food energy passes from one group to another.
- There are broadly two groups of living organisms- Autotrophs and heterotrophs. Heterotrophs are further sub-divided into herbivores, carnivores and omnivores. Herbivores are plant eating animals, carnivores are flesh eating animals and omnivores are both plant and animal eaters organisms.

## Food Chain

- Food chain can be defined as a sequence of transfer of energy from organisms in one trophic level to those in another trophic level.
- Sun is the major source of energy. It helps in the growth of plants on the soil and water bodies.
- Several inter-connected and overlapping food chains present a complicated patterns. Such patterns are called food web.



- Omnivores are at the top level of the food chain which receives their energy from all the three levels. So, in a food chain the members at the successive higher levels becomes smaller in number.
- When the numbers at successive levels are plotted, they assume the shape of a pyramid, hence it is called food pyramid or pyramid of numbers.



## Natural / Bio-geochemical Cycles

Biogeochemical cycles (biological, geological and chemical interactions) are the movement and circulation of soluble inorganic substances (nutrients) derived from soil and atmospheric phases of inorganic substances through organic phase of various biotic components.

## The Hydrological Cycle

- This cycle helps in exchange of water between air, land, sea, living plants and animals. Solar energy is used to drive the hydrological cycle.
- Massive evaporation of water from the oceans, cloud formation and rainfall gives us our supply and reserves of fresh water.

## The Nitrogen Cycle

- Nitrogen and its compounds are essential for life processes in the biosphere. There is continuous exchange of nitrogen within the ecosystem operating the nitrogen cycle.
- The organic residues in soil are taken up by various soil micro-organisms who break down soil nitrate into nitrogen by denitrification process while others transform nitrogen into soluble nitrogen compounds.

## Carbon Cycle

- The atmosphere is the minor reservoir of carbon. Hydrosphere is the major reservoir which contains approximately 50 times more as that of atmosphere.
- The cycle operates in the form of carbon dioxide exchanging among the atmosphere, biosphere and the oceans.

## Types of Ecosystem

Ecosystem can be classified into various types on various basis. The most widely used and simple classification is on the basis of habitats.

## Terrestrial Ecosystems

- The terrestrial ecosystems are the major source of food and raw material for human beings.
- The plant and animal communities are more diversified than aquatic eco-systems. Land organisms have a greater range of tolerance water is a limiting factor.
- As far as productivity is concerned, terrestrial ecosystems are more productive than aquatic

ecosystem.

- Major sub-types are (i) upland or mountain eco-system (ii) low land eco-system (iii) desert eco-system etc.

### Aquatic Eco-system

- This ecosystem refers to the 71% of the water present on the earth.
- It's further divided into various sub-types - fresh water, estuarine and marine.
- Again these ecosystems can be further subdivided into smaller ones.
- The limiting factors are the depth upto which sunlight can penetrate, the availability of nutrients and the concentration of dissolved oxygen.
- Estuarine ecosystems are the most productive of aquatic eco-systems. In marine ecosystems, shallow continental shelves are more productive than open oceans.

### Global Climatic Change

#### Green House Effects and Global Warming

- Global warming refers to a gradual rise of atmospheric temperature and consequent changes in the radiation balance mainly due to human action leading to climatic change at different levels – local, regional and global.
- As per recent estimates, it has been found that the surface air temperature over the past 100 years has increased by about  $0.5^{\circ}\text{C}$  to  $0.7^{\circ}\text{C}$ . It is happening due to green house effect.
- Burning of fossil fuels and fire woods, large fleet of automobiles and number of factories emit carbon dioxides.
- Growing paddies, livestock, waste dumps and coal mining are the major source of methane. The use of aerosols as coolants in refrigerators and air conditioning devices release chlorofluorocarbons

#### Consequences of green house effect

- It is estimated that if the present rate of increase in  $\text{CO}_2$  level continues, it will result in rise of atmospheric temperature by  $2^{\circ}\text{C}$  to  $3^{\circ}\text{C}$  by end of 21<sup>st</sup> century.
- Because of increased concentration of  $\text{CO}_2$  and due to much warmer tropical oceans, there may occur more cyclones and hurricanes.
- A slight increase in global temperature can adversely affect the world food production.
- The biological productivity of the ocean would also decrease due to warming of the surface layer.

#### Control and Remedial Measures of Green House Effect

- Cut in the consumption of fossil fuels

- Development of alternative efficient fuels.
- Development of hydro-electric and thermal power
- Restriction on the emission of dangerous  $\text{CO}_2$ , CFCs etc
- Limiting the driving days in megacities
- Use of solar energy
- Promote Biogas plants for domestic use
- Enhancing afforestation

### Ozone Layer Depletion

- Ozone is found in the form of a thin layer in the stratosphere between 15 to 48 kilometre.
- It strongly absorbs ultraviolet radiation from the sun.
- It is depleting which mainly caused by chlorofluorocarbons (CFCs), halons, methyl chloroform and carbon tetrachlorides.
- A hole in the layer has developed over Antarctic since 1979 and that hole has persisted for a longer and longer time every year.
- Countries during Montreal Protocol of 1987 and London Conference of 1992 were agreed that the developed countries would totally ban CFC production by 2000 and the developing countries by 2010AD.
- All over the world research efforts are continuing for development of substitutes of CFC as coolants for refrigerators and air conditioners.

### Acid Rain

- The term 'acid rain' refers to the deposition of wet or dry acidic materials from the atmosphere on the earth's surface.
- Although most conspicuously associated with rainfall, the pollutants may fall on the earth's surface either in the form of snow, sleet, hail or fog or in the dry form of gases or particulate matter.
- Sulphuric acid and nitric acid is considered as the principal agents responsible for acid rain.

### Sustainable Development

Brundtland Commission defined sustainable development as "meeting the needs of the present generation without compromising the ability of future generation to meet their own needs."

#### Strategies to be adopted for Sustainable Development

- Reviving growth
- Ensuring a sustainable level of population:
- Meeting essential human needs: Changing the quality of growth
- Conserving and enhancing the resources base
- Reorienting technology and managing risk
- Merging environment and economics in decision making

**Evaluate Yourself**

1. Differentiate between abiotic and biotic component of biosphere.
2. Explain the flow of energy with the help of illustration.
3. Define sustainable development. Suggest strategies to adopt sustainable development.