UNIT-1
Chapter 1

Ecology-An Introduction

Environment: The sum total of all the physical and biotic conditions which influence the response of an organism.

Habitat: The place where organism lives (Address of an organism).

The environment consist of two parts biotic and abiotic environment.

The conditions which surrounds and affect the life of an organism are called the factors or environmental or ecological factors.

Ecology: (Gr. Oikos=home; logos= discourse) the branch of biology which deals with the study of interaction between organism and their environment.

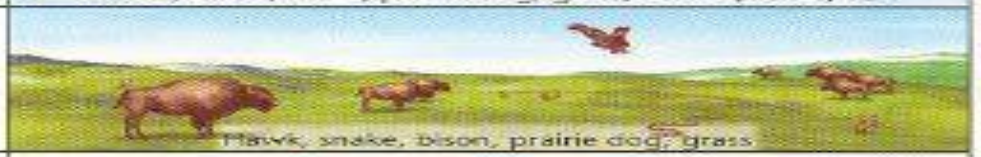
Term ecology was coined by Reiter (1868).

- Alexander von Humboldt is considered as father of Ecology.
- Prof. Ramdeo Mishra (1908-1998) is known as father of Indian Ecology.
- Life and environment are interdependent so ecology is also called environmental biology or Bionomics.
- The ecological factors are categorized into following groups:

1. Climatic factors like light, temperature, wind, humidity , rainfall etc.
2. Edaphic factors related to soil like soil water, soil air etc.
3. Biotic factors like bacteria, fungi, plants, animals, etc.

Levels of Ecological Organizations

13 **FIGURE 1–21 LEVELS OF ORGANIZATION**

Biosphere	The part of Earth that contains all ecosystems	
Ecosystem	Community and its nonliving surroundings	
Community	Populations that live together in a defined area	
Population	Group of organisms of one type that live in the same area	 Bison herd
Organism	Individual living thing	 Bison
Groups of Cells	Tissues, organs, and organ systems	 Nervous tissue Brain Nervous system
Cells	Smallest functional unit of life	 Nerve cell
Molecules	Groups of atoms; smallest unit of most chemical compounds	 Water DNA

Biosphere: It is the part of the planet with living organisms and include most of the Earth, including part of the oceans and the atmosphere.

Ecosystem: It includes all the living organisms in an area and the nonliving aspects of the environment. An ecosystem is made up of biotic and abiotic factors in an area.

Community: It is all the populations of different species that live in the same area and interact with one another.

Population: It is a group of organisms belonging to the same species that live in the same area and interact with one another.

Species: It is a group of individuals that are genetically related and can breed to produce fertile young individual.

At Cellular level: The individuals of species have multiple organs, which in turn are composed of tissue. The tissues are made up of cells, which in turn are composed of organelles.

At Atomic Levels: The cells are made up of molecule. The molecule are composed of atoms.

Branches of Ecology:

A) On the basis of ecological group:

1 . Autecology: It deals with the ecological study of one species of organism. It include life history, behaviour, home range, etc. of a single species.

2. Synecology: it deals with the ecological studies of a group or groups of organisms (communities) or entire ecosystem. It include the overall energy and material flow through the systems. Synecology is further divided into :

i) **Population Ecology:** it deals with the study of pattern of growth , structure and regulation of populations of microbes, plants or animals. It is also known as **demecology**.

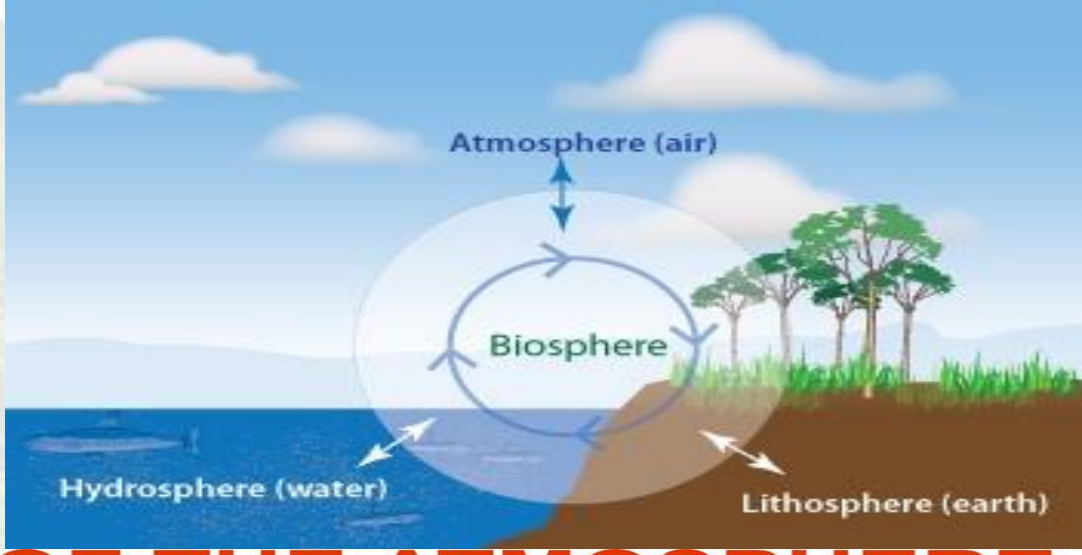
ii) **Community Ecology:** it deals with the study of the organization and functioning of communities, which are assemblage of interacting populations.

iii) **Ecosystem Ecology:** it deals with the study of energy budgets, biogeographical cycles feeding and behavioural aspects of the ecological communities.

Worlds first Earth Summit in Rio de Janeiro was held on 5th June 1992.

Components of Environment: it consist of four components

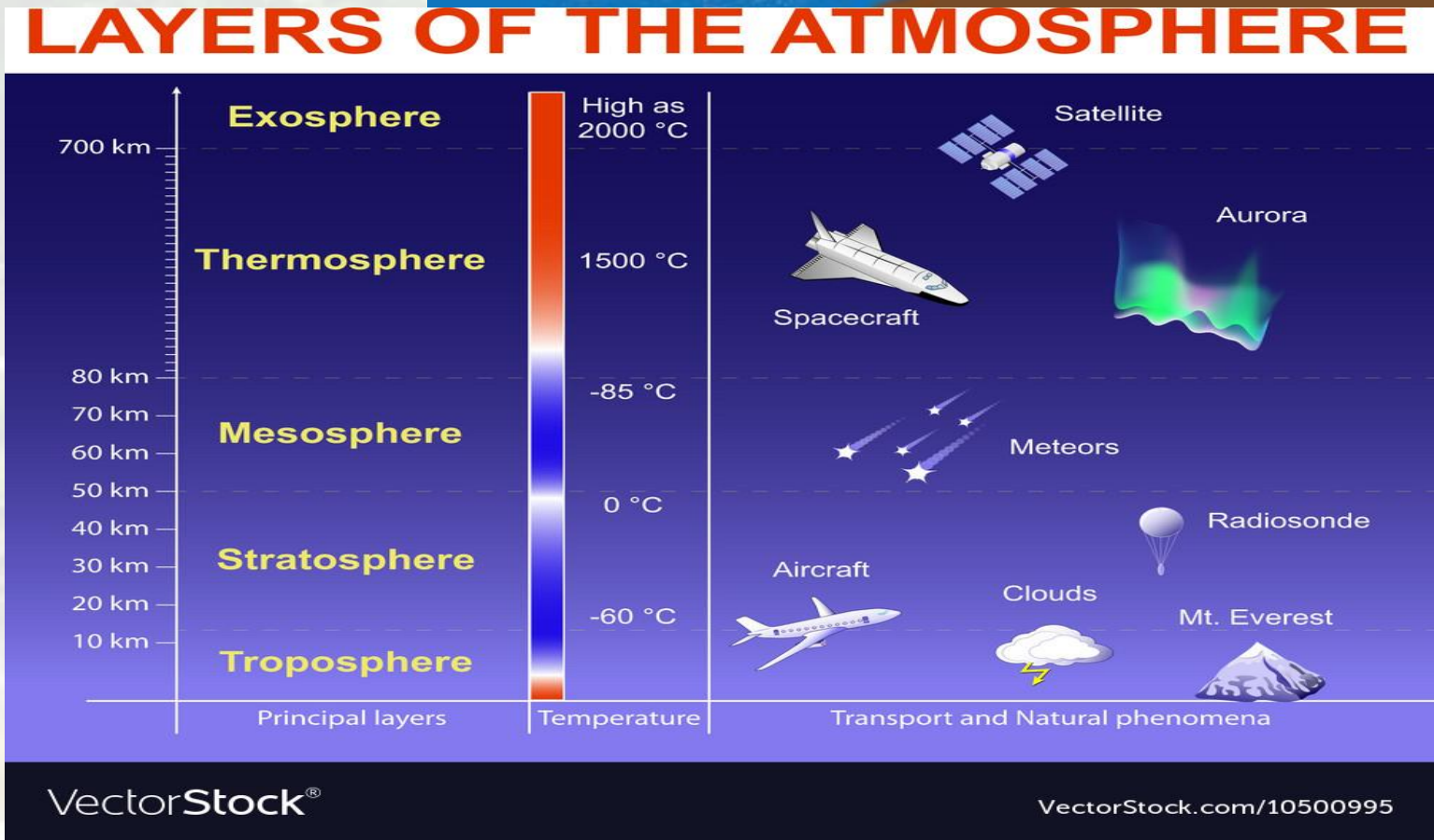
1) Atmosphere (Air)
2) Hydrosphere (Water)
3) Lithosphere (Soil)
4) Biosphere (Living organism)



Atmosphere (Air)

Consist of different layers

i) Troposphere
ii) Stratosphere
iii) Mesosphere
iv) Thermosphere
v) Exosphere



Chapter 2
Soil

- The word soil originated from Latin word solium (seat) or solum (soil, ground).
- Generally known as skin of Earth.
- Pedology (Gk. Pedon= soil or earth) is the study of soil as a natural body.
- Edaphology: (Gk. Edaphos- Soil or ground) the study of soil from the stand point of higher plant.
- According to Schimper's second law, soil determine the local distribution of plants either directly of in relation to other factors.
- Warming classified plant as lithophytes (on rocks), chasmophytes (rock fissures), psamaophytes (sandy soil), halophytes (saline soil) and oxylophytes on acidic soil.

Origin and formation of Soil

Weathering :

(1) Physical weathering,

(2) Chemical weathering, and

(3) Biological weathering or biogeochemical weathering.

1. Physical Weathering:

Physical weathering of rocks is a mechanical process which is brought about by a number of factors, such as:

(A) Temperature,

(B) Water,

(C) Wind.

(A) Temperature:

It causes breakdown of rocks in the following ways:

(i) Differential expansion and contraction of materials:

Minerals composing the rock show different degrees of expansion (coefficient of expansion). These minerals expand in the high temperature of day and contract when the temperature falls. The differential expansion and contraction of different minerals set up internal tension and produce cracks in the rocks and thus the rocks weather into finer and finer particles.

(ii) Exfoliation:

The arrangement of layers in rock is called stratification. Layer differentiation is not common in all types of rocks. The upper layer of rocks expand and contract faster than those of deeper region. The temperature changes bring about separation and disintegration of the layers of rocks. This process is known as exfoliation.

(iii) Frost action:

Sometimes, temperature of rocks reaches below freezing point. This causes accumulation and freezing of water in the crevices and rock joints. In freezing water expands to about 9 per cent of its original volume and exerts a pressure of approximately 150 tons per square feet which is more than enough to break the rocks.

(B) Water:

Water causes weathering of rocks in the following ways:

(i) Rain:

Natural water falling either in the form of rain drops or as hail storm on the surface of rocks with beating effect bring about abrasion of massive rocks into smaller particles.

(ii) Running water:

Rapidly flowing water rolls the heavy rock masses (rock boulders) along the bottom of stream and grinds them into finer particles.

(iii) Wave action:

It is most active in sea shores. The water waves striking with great force on the rock surface break and grind the rock into pieces.

(iv) Glacier formation:

At mountain tops, ice formation takes place in the winter season. When the summer approaches, ice starts melting and glaciers (huge sliding masses of ice) move downwardly on the slopes. In the glacier movement, the rocks are corroded and finally broken into sand particles

(C) Wind:

Rapid stormy wind carrying suspended sand particles causes the abrasion of exposed rock.

2. Chemical Weathering:

Chemical weathering brings about disappearance of original rock minerals either completely or partly. In this process secondary products may be formed from parent materials. This process IS also known as chemical transformation. Presence of moisture and air is very essential in the chemical weathering. This is why chemical weathering is not so effective in desert.

The chemical weathering takes place in the following ways:

(i) Solution:

Solvent action of water helps in the weathering of rocks. It dissolves soluble minerals of rocks. Solution helps in the removal of weathered materials but total loss is negligible Solvent action is increased in presence of CO_2 and organic acids formed by decomposing dead organic remains of plants and animals. Sodium, potassium, calcium and magnesium are easily removed from rocks in dissolved state.

(ii) Hydrolysis:

It is essentially an exchange of constituent parts between water and rock minerals. When water reacts with strong base it produces hydroxides. The soluble products of hydrolysis are usually removed by water. Sometimes soluble products may react with insoluble ones and form clays. Hydroxides in presence of CO_2 change to carbonates and bicarbonates. Water in ionized state acts as a weak acid on siliceous matter, e.g.,

$KAlSi_3O_8 + HOH \rightarrow HAlSi_3O_8 + KOH$

$2HAlSi_3O_8 + 8HOH \rightarrow Al_2O_3.\ 3H_2O + 6H_2SiO_3$

(iii) Oxidation:

It means addition of oxygen to mineral compounds. The reaction produces oxides which when dissolve in water weaken the rock and bring about weathering. Iron, aluminum foil, manganese oxides and sulphides are easily oxidized.

$$4FeO + O_2 \rightarrow 2Fe_2O_3$$

(Ferrous oxide) (Ferric oxide)

(iv) Reduction:

It means removal of oxygen from minerals, e.g.,

$$2Fe_2O_3 \longrightarrow 4FeO + O_2$$

Reduction takes place in the deep zone where oxygen is not available.

(v) Carbonation:

It occurs simultaneously with hydrolysis. In this process, CO_2 unites with water to produce carbonic acid which is a weak acid.

The carbonic acid reacts with hydroxides of soil forming minerals and forms insoluble carbonates. Sometimes it dissolves minerals and thus weakens the rock promoting thereby the weathering. Carbonation of hydroxides results in the formation of carbonates and bicarbonates, e.g.

$$CO_2 + H_2O \rightarrow H_2CO_3 \text{ (Carbonic acid)}$$

$$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O \xrightarrow{CO_2} Ca(HCO_3)_2$$

3. Biological Weathering:

Many organisms play important roles in the weathering of rocks through physical and chemical means important organisms concerned with the decomposition of rocks are lichens, bacteria, fungi, higher plants, nematodes and other soil microbes. Lichens and some other organism's in presence of moisture secrete carbonic acid which corrodes the rock.

The presence of roots on the surface of rock exerts a considerable pressure by which rocks are broken into smaller fragments. The root exudates also weaken the rocks and weather them to a small extent. Joffe (1949) states that there is no biogeochemical weathering. According to him, it is either physical or chemical weathering by biological agencies.