Unit I
INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

Environment is derived from the French word **Environ** which means to encircle or surroundings.

Definition: **The sum of total of all the living and non-living things around us influencing one another**.

As per environment (protection) act 1986 defines environment as **sum total of water air and land inter relationships among themselves and also with human beings other living organisms and property.**

Environmental Science: Is the study of the environment its biotic and a biotic components and their inter relationship.

Environmental engineering: The application of engineering principles to protect and improve the quality of environment and protect public health and welfare.

TYPES OF ENVIRONMENT

Environment can be divided into two categories:

i) NATURAL ENVIRONMENT
ii) MAN-MADE ENVIRONMENT

NATURAL ENVIRONMENT

Natural environment is characterized by natural components. All biotic (living) and abiotic components (non-living) are created through natural process. Creation of these biotic and abiotic components do not require any human support.
Example: Soil, water, Air etc.,

MAN-MADE ENVIRONMENT

Man is the most powerful environment agent. Thus the man-made environment is created by man.
Example: House, Road, School etc.

COMPONENTS OF ENVIRONMENT

1. BIOTIC COMPONENTS

The living components of the environment are called biotic components.
Example: Animals, plants, Micro organisms.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

BIOSPHERE

The biological environment, where the living organism lives and interacts with physical environment is celled biosphere.

2. ABIOTIC COMPONENTS

The non-living components of the environment are called abiotic components.

Lithosphere: The soil or the rock components is called lithosphere.

Hydrosphere: The aqueous envelope of the earth is called hydrosphere.

Atmosphere: The cover of air, that envelope the earth is known as atmosphere. Atmosphere consist of following five concentric layers,

S.NO	REGION	ALTITUDE IN KMS	TEMP CHENGE IN 0C	CHEMICAL CONSTITUENTS
1.	TROPOSHERE	0-18	15 TO -56	N2, H20, CO2, O2
2.	STRATOSPHERE	11-50	-56 T0 -2	O3
3.	MESOSPHERE	50-85	-2 TO -92	NO+, O2+.
4.	THERMOSHERE	85-500	-92 TO 1200	NO+, O+, O2+
5.	EXOSPHERE	UPTO 1600	HIGH	H2, He.

3. ENERGY COMPONENTS:

The components of energy, flows across biotic and abiotic components, which play an important role to maintain the life of living organisms.

Example: solar energy, nuclear energy, geochemical energy , thermo electrical energy,

Scope of environmental studies:

Environmental study is an important tool to educate the people for preserving quality environment . the main scope of environmental studies include ,

1. To get an awareness and sensitivity to the total environment and its related problems.
2. To motivate the active participation in environmental protection and improvement.
3. To develop skills for identifying and solving environmental problems.
4. To know the necessity of conservation of natural resources.
5. To evaluate environmental programmes in terms of social, economic, ecological and aesthetic factors.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

Importance (or) Significance of environmental studies:

There are some major issues like global warming, depletion of ozone layer, dwindling forests and energy resources, loss of global biodiversity etc., that are going to affect the mankind. To sole the problems, the knowledge of environmental studies is very important.

1. By environmental studies, people will understand the concept of "need of development without destruction of environment".
2. Through environmental studies, people can gain the knowledge of different types of environment and the effects of different environmental hazards.
3. Environmental studies inform the people about their effective role in protecting the environment by demanding changes in laws and enforcement systems.
4. Environmental studies have a direct relation to the quality of life we life.
5. Environmental studies develop a concern and respect for the environment.

Need for public awareness:

Increasing population, urbanization and poverty have generated pressure on the natural resources and lead to a degradation of the environment. To protect or prevent the environment from the pollution, supreme court has ordered and initiated the environmental awareness to the public through government and non- government agencies to take part to protect our environment.

Importance of public or community participation:

Environmental pollution cannot be removed by the laws alone. The proper implementation and especially public participation are the important aspects, which should be given importance and stress. The public participation is useful in law making process and controlling the pollution activities. Thus the public participation plays a major role in the effective environmental management.

Types of public participation:

Public participation in the decision making process can be at any stage and of various forms.

(i) Pressure group: The public pressure group may be formed to influence the government on one hand and the industries on the other hand.

(ii) Watch dog: The public can act as watch dog to protect to protect the interests of public against environmental hazardous activities.

(iii) Advisory council: The public can also act as advisory council and agencies, which is constituted to keep the environment suitable for living.

(iv) Enforcing the environmental laws: The services of public can be utilized to enforce the environmental laws. if necessary the member of public should conduct public interest litigations.

Thus many countries have accepted concept of public participation in environmental management.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

KATHIR COLLEGE OF ENGINEERING

ECOSYSTEM AND BIODIVERSITY

ECOSYSTEM:

A group of organisms interacting among themselves and with their environment is known as ecosystem.

For example: Pond, lake, desert, grassland, forest, etc

Ecology: -Study of the distribution and abundance of organisms, the flows of energy and materials between abiotic and biotic components of ecosystems.

(Or)

Ecology: Study of Ecosystems is known as ecology.

Types of ecosystem:

There are two types of ecosystem. They are as follows,

1. Natural ecosystem

2. Artificial ecosystem

1. Natural ecosystem is naturally available and self regulatory and solar driven systems. Example: A pond River, Lake, Forest.

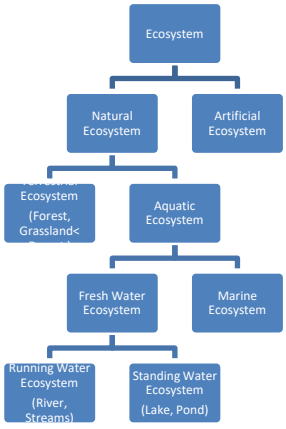
Natural ecosystem is further classified into two types. They are as follows,

(i) Aquatic ecosystem: A pond, River, Ocean, Lake

Aquatic Ecosystem can be further classified into

(ii) Terrestrial Ecosystem: Forest, Grassland, Desert

2. Artificial ecosystem is human engineered ecosystem not self regulatory and depend on human interventions to meet their energy requirements. Example: Dam Garden, Aquarium, Zoo, Paddy fields.



Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

STRUCTURE AND FUNCTION OF AN ECOSYSTEM

The structure of an ecosystem has two major components

A. Biotic component (living)

B. Abiotic Component (Non-living)

A. BIOTIC COMPONENT (LIVING)

The living organisms or members in an ecosystem collectively form its community called biotic components.

Member of Biotic components

a. Producer (plants)

b. Consumer (animals)

c. Decomposer (Micro-organisms)

a. Producer

They prepare their own food through photosynthesis.

For examples: Plants, trees etc

b. consumer

They directly or indirectly depend on the producer for their food.

They are three types.

1. Primary consumer (Herbivore – plant eater)

They directly depend on the producer for their food.

For example: Insects, rat, goat, cow, horse, etc

2. Secondary consumer (primary carnivore – meat eaters)

They directly depend upon the primary consumer for their food.

For example: Cat, Snakes, Foxes, Frog, etc

3. Tertiary consumer (Secondary carnivore – meat eaters)

They directly depend upon the primary carnivores for their food.

For example: Tigers, lions, etc.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

c. Decomposer

They attack the dead bodies of producers and consumers and decompose them into simpler compounds (Inorganic and organic matters).

For example: Bacteria and Fungi

B. ABIOTIC COMPONENT (NON-LIVING)

The Non-living organisms or members in an ecosystem collectively form its community called abiotic components.

Member of Abiotic components

There are two

a. Physical components

They are useful for the growth and maintenance of its member.

For example: Air water, soil sunlight, etc.

b. Chemical components

They are the sources of essential nutrients.

For example: Inorganic substance (Al, Co, Zn, Cu, C, H,O, etc) and Organic substance .

(Proteins, Carbohydrates, etc)

Function of an ecosystem

It refers to interaction between the biotic and a biotic constituents, involves three types of function

1. Primary function

Plant Prepare their food through photosynthesis.

2. Secondary function

The energy is distributed to all the consumers through food cycle.

3. Tertiary function

All living organisms die one day and decomposed to useful nutrients and the nutrient cycle is maintained.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

Energy flow:

Energy is defined as the capacity to do work. For living organisms, it is the basic force responsible for running all the metabolic activities. The flow of energy from producer level to top consumer level is called energy flow.

The flow of energy in an ecosystem is **unidirectional**. It flows from producer level to consumer level and never in the reverse direction.

The process of energy flow involves transfer of energy from autotrophs to various components of heterotrophs and help in maintaining bio diversity. The main source of energy in the ecosystem is sunlight. About 80% of energy is lost during flow of energy from one tropic level to the next one.

Sun→ Producer → Herbivores → Carnivores → Top carnivores→ Decomposers

Energy flow follows by the laws of thermodynamics.

I law: energy can neither be created nor destroyed, but it can be converted from one form to another.

Explanation:

Main source of energy is sun. Plant convert light energy into chemical energy through a process called photosynthesis.

Eg photosynthesis

$6CO_2 + 12\ H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

II law: whenever energy is transformed there is a loss of energy through the release of heat.

Explanation:

There is a loss of energy in the form of heat as it moves from producer to consumer.

Eg RESPIRATION

$C_6H_{12}O_6 + 6O_2 + 6H_2O \rightarrow 6CO_2 + 12\ H_2O + heat$

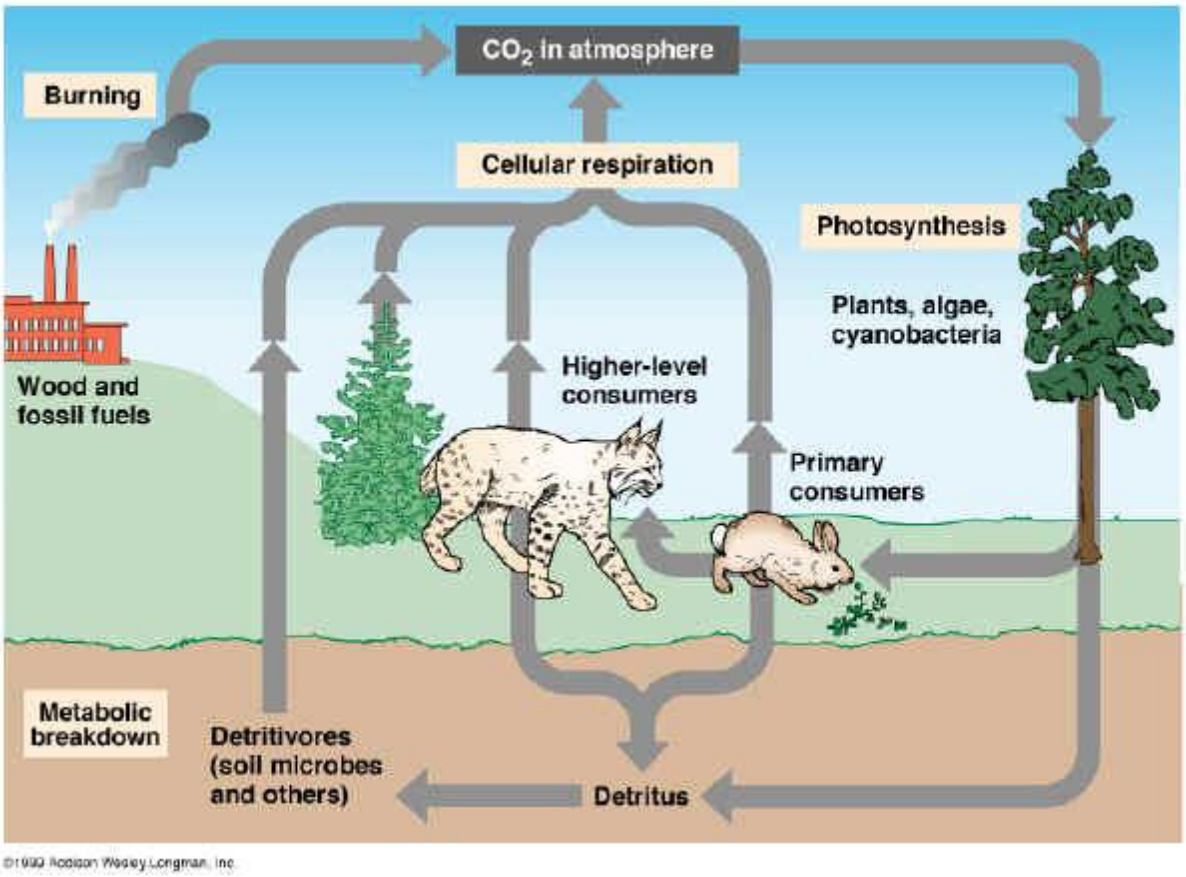
NUTRIENT CYCLE OR BIOGEOCHEMICAL CYCLE:

The cyclic movements of nutrients between biotic and abiotic components are referred as "BIOGEOCHEMICAL CYCLES".

CARBON CYCLE:

The cyclic movements of carbon between biotic and abiotic components are referred as carbon cycle.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.



Carbon EXISTS in abiotic environment as:

1. Carbon dioxide [CO2 (gas)] in the atmosphere
   - dissolves in H2O to form HCO3-
2. Carbonate rocks (limestone & coral = CaCO3)
3. Deposits of coal, petroleum, and natural gas
   - derived from once living things
4. Dead organic matter (humus in the soil)

Carbon ENTERS biotic environment through:

1. Photosynthesis: changes light energy to chemical energy

Carbon RETURNS to atmosphere by:

1. Respiration CO2
2. Decomposition / Decay
3. Burning

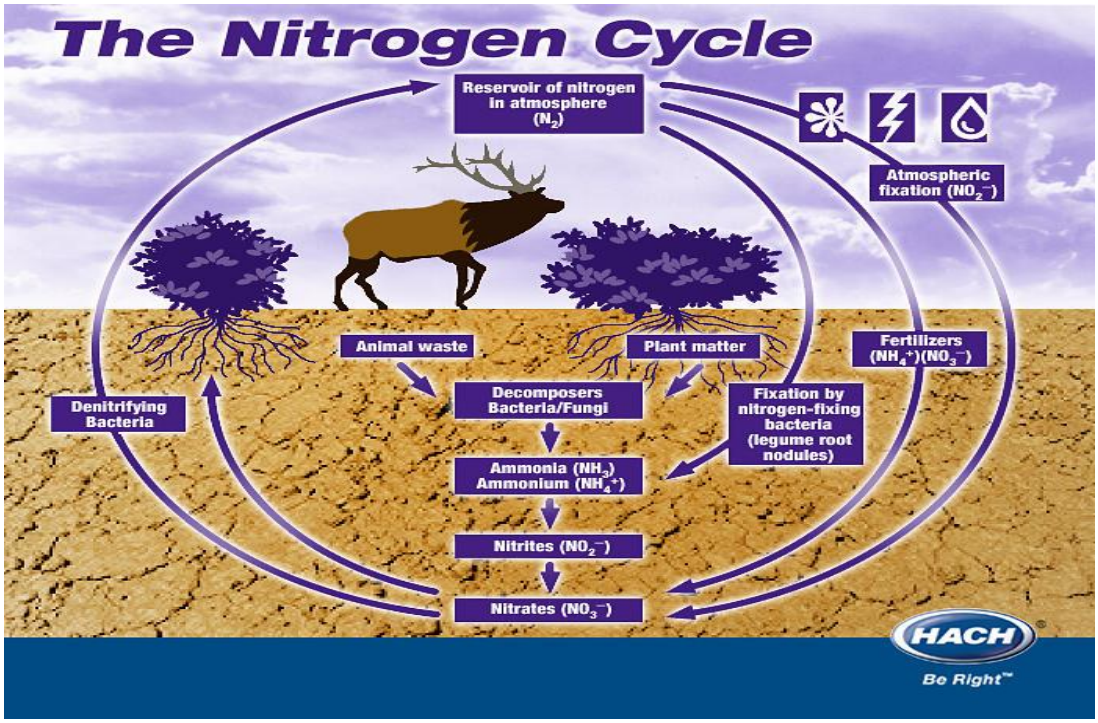
Carbon Cycle and Humans:

1. Removal of photosynthesizing plants
2. Combustion of fossil fuels

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

NITROGEN CYCLE:

The cyclic movements of nitrogen between biotic and abiotic components are referred as nitrogen cycle.



79% of air is N2 gas
N is essential to plants and animals
Plants and animals can't use N2 gas
Usable N: ammonia (NH3) or nitrate (NO3-)

Conversion of atmospheric N2 to NH3 and NO3-:

Nitrogen fixation

1. Aquatic ecosystems: blue-green algae
2. Terrestrial ecosystems: bacteria on root nodules of legumes (peas, beans, alfalfa, clover)
3. Lightening

Assimilation:

Plants take nitrogen from the soil by absorption through their roots in the form of either nitrate ions or ammonium ions. Most nitrogen obtained by terrestrial animals can be traced back to the eating of plants at some stage of the food chain.

Ammonification:

When a plant or animal dies or an animal expels waste, the initial form of nitrogen is organic. Bacteria or fungi convert the organic nitrogen within the remains back into ammonium (NH_4^+), a process called Ammonification or mineralization.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

Nitrification:

Nitrification is the process by which ammonium (NH_4^+) or ammonia (NH_3) is oxidized into nitrite (NO_2^-) by ammonia-oxidizing bacteria or AOB, often *Nitrosomonas* and the NO_2^- further oxidized into nitrate (NO_3^-) by nitrite-oxidizing bacteria or NOB, often *Nitrobacter*.

Denitrification:

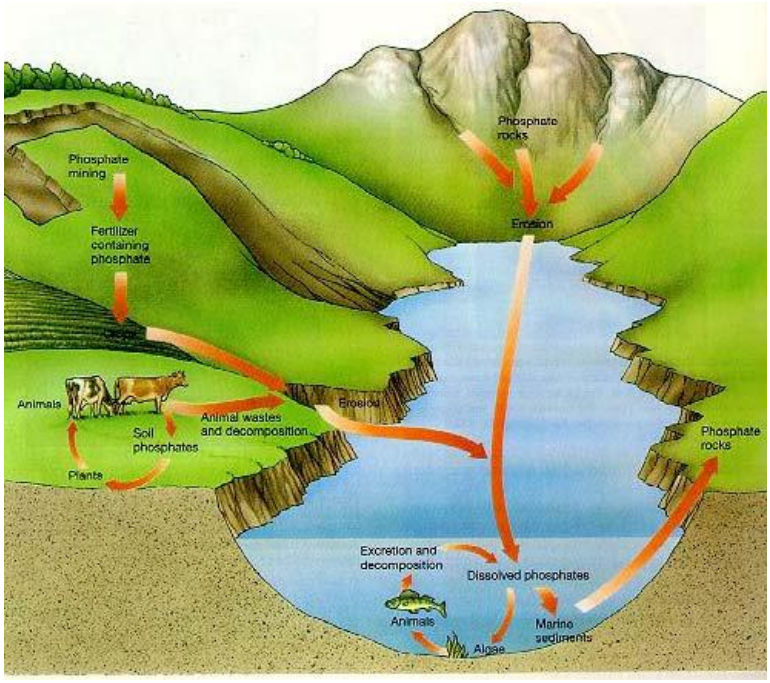
Denitrification is the reduction of nitrates back into the largely inert nitrogen gas (N_2), completing the nitrogen cycle. This process is performed by bacterial species such as *Pseudomonas* and *Clostridium* in anaerobic conditions

Nitrogen returns to atmosphere by:
1. Denitrifying bacteria

Nitrogen Cycle and Humans:
1. Nitrogen required for genetic materials (DNA, RNA, amino acids)

PHOSPHORUS CYCLE:

The cyclic movements of phosphorus between biotic and abiotic components are referred as phosphorus cycle.



Major environmental reservoir: <u>rocks</u>
1. <u>Leaching</u>: water dissolves phosphates in rocks and carries to lake, stream, etc.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

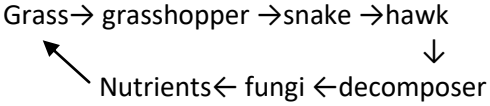
2. Dissolved phosphate: used by plants and passed through food chain
3. Animals return phosphorus to environment by:
* Excretion
* Death and decay
Some returns to terrestrial environment through geologic processes and via seabirds. Guano

Phosphorus Cycle and Humans:

1. Phosphates mined for fertilizers returns P to soil
2. Erosion: P in soil and rocks washed away into water systems.

FOOD CHAIN

A food chain may be defined as," The process of eating and being eaten in an ecosystem".



Types of food chain,

There are two types of food chain. They are as follows,

Grazing food chain:

A food chain in which a Primary consumer feeding on producer is – Grazing pathway
Grasshopper – grass
Rabbit - grass
Cow – grass

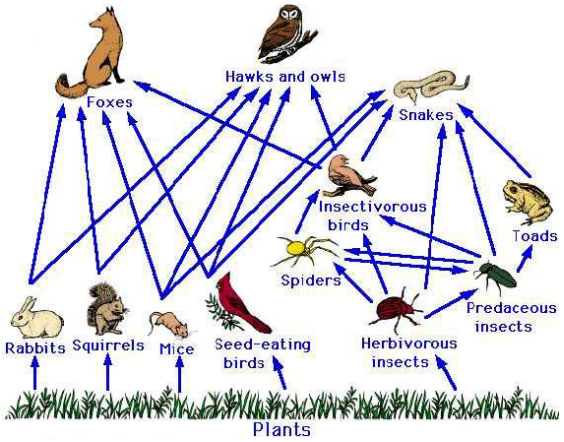
Detritus food chain:

Primary consumer feeds on dead matter is called as – detritus pathway and the consumer are called as detritivores.
Eg: bacteria, algae, fungi, insects, worms & some birds.
Dead matter – detrivores CO_2 + H_2O + inorg elements

Food web:

Interlocking pattern of several interlinked food chains is termed as FOOD WEB.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.



Ecological Pyramids:

Definition:

It is graphical representation of structure and function of each tropic levels of an ecosystem.

Types of Ecological Pyramids

The ecological pyramids may be of following three kinds

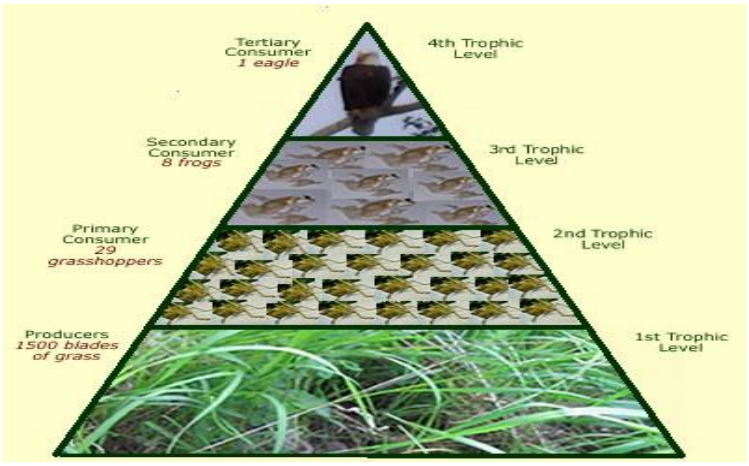
- Pyramid of number
- Pyramid of biomass
- Pyramid of energy

Pyramid of number

It depicts the number of individual organisms at different tropic levels of food chain. The animals at the lower end (base of pyramid) of the chain are the most abundant. Successive links of carnivores decrease rapidly in number until there are very few carnivores at the top.

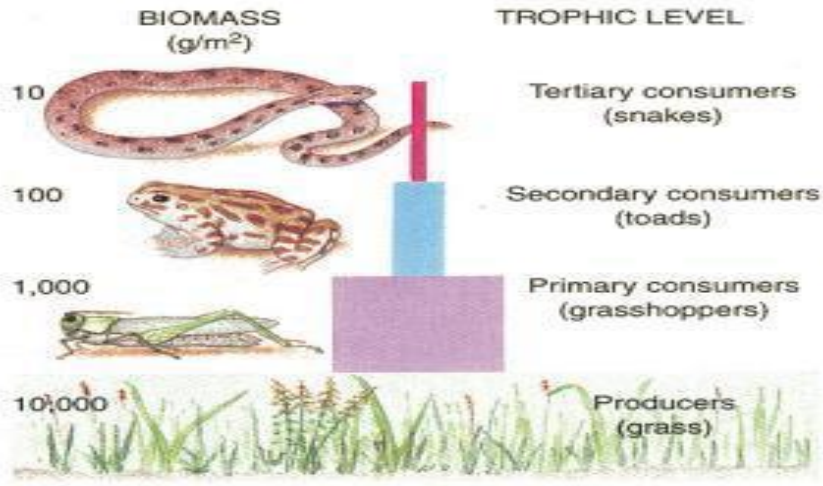
The grassland ecosystem provides a typical example for pyramid of number.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.



Pyramid of biomass

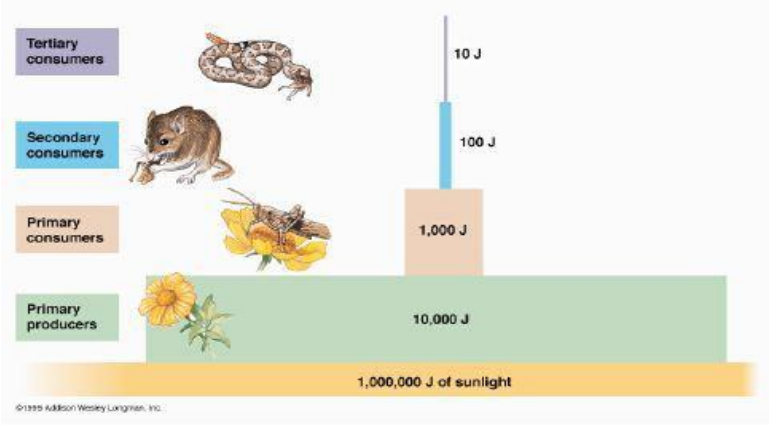
The biomass of the members of the food chain present at any one time forms the pyramid of the biomass. Pyramid of biomass indicates decrease of biomass in each tropical level from base to apex.



Pyramid of energy

When production is considered in terms of energy, the pyramid indicates not only the amount of energy flow at each level the actual role the various organisms play in the transfer of energy. the pyramid of energy is constructed is the quantity of organisms produced per unit time.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.



ECOLOGICAL SUCCESSION

In a particular area, one community of species may be replaced by another community; the progressive replacement of one community by another till the development of stable community in a particular area is called as ecological succession.

Stages of ecological succession

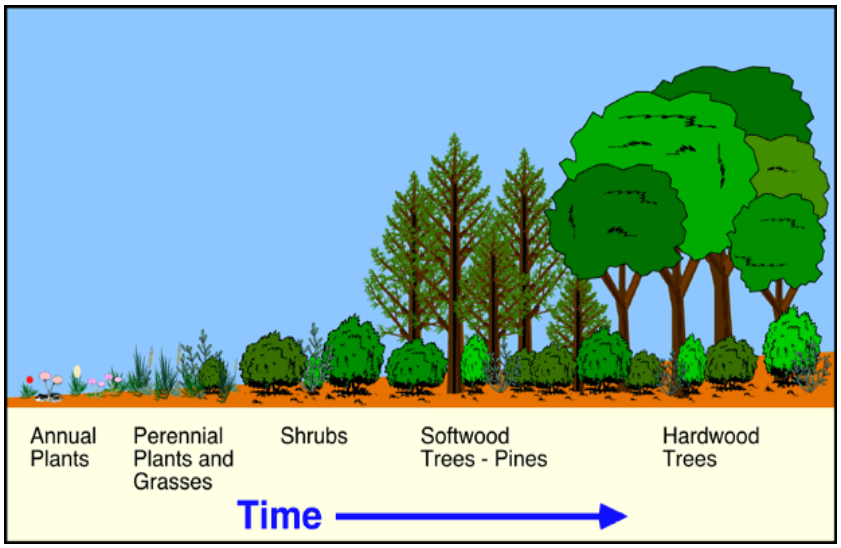
1. Pioneer community: the first group of organisms, which establish their community in the area is called pioneer community.
2. Seres or Seral community: The various development stages of a community is called seres.

TYPES OF SUCCESSION

Primary succession

If an area in any of the basic environments (such as terrestrial, fresh-water or marine) is established by organisms for the first time, the succession is called primary succession.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.



Ecological successions starting on different types of areas or substrata are named differently
a. **hydrarch or hydrosere**: Starting in watery area like pond, swamp, bog
b. **Mesarh**: staring in an area of adequate moisture
c. Xerarch or xerosere: Starting in dry area with little moisture
They can be of three types:
(i) Lithosere: starting on rock
(ii) Psammosere: starting on sand
(iii) Halo sere: starting on saline soil

Secondary succession

It involves the establishment of biotic communities in an area , where some type of biotic community is already present.

Process of succession:
The process of succession takes place in a systematic order
1. Nudation:
It is a development of a bare area without any life forms. It may be caused due to ,
(i) Topographic factor: landslides, volcanic eruption
(ii) Climatic factor: drought, glaciers, food
(iii) Biotic factor: overgrazing, disease outbreak, agricultural/industrial Activities
II.Invasion:
It is successful establishment of one or more species on a bare area through dispersal or migration followed by establishment.
Dispersal of the seeds, spores is brought about by wind, water, insects or birds. Then the seeds germinate and grow on the land as growth and reproduction start these pioneer species increase in number and form groups or aggregations.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

III. Competition and coaction:

As the number of individuals grows there is competition, both inter specific and intra specific for space, water and nutrition they influence each other in a number of ways known as coaction.

IV: Reaction:

The living organisms grow, use water and nutrients from the substratum and in turn they have a strong influence on the environment which is modified to a large extent and this is known as reaction the modifications are very often such that they become unsuitable for the existing species and favor some new species which replace them. Thus reaction leads to several seral communities.

V: Stabilization:

The succession ultimately culminates in a more or less stable community called climax which is in equilibrium with the environment.

STRUCTURE AND FUNCTION OF DIFFERENT ECOSYSTEMS

FOREST ECOSYSTEM

A forest ecosystem is the one in which a tall and dense trees grow that support many animals and birds.

Forest occupies 40% of the world's land.

Total land area is 19% in India.

Depending upon the climatic conditions forests can be classified in to various types

1. Tropical rain forests:

They are evergreen broad forests found near the equator they are characterized by high temperature high humidity and high rain fall, all of which favor the growth of trees. Through out the year climate is uniform they have broad leaf trees like and sandal and the animals like lion, tiger, monkey, bats, toads, snakes, chameleons and insects are present very large flowers are present . eg: silent valley in Kerala.

2. Tropical deciduous forest:

They are found a little away form the equator and characterized by warm climate round the year, rain occurs only during monsoon. A large part of the year remains dry and therefore difference types of deciduous trees like maple, oak, and hickory who lose their leaves during dry season are found here animals like deer, fox, rabbit, and rat are present here.

3. Tropical scrub forests:

They are found in areas where the dry season is ever longer. Here small deciduous trees shrubs and animals like deer fox are found.

4. Temperate rain forests:

They are found in temperate areas with adequate rainfall they are dominated by coniferous trees like, pines firs, redwoods, and animals like squirrels fox, cats, bear etc.

5. Temperate deciduous forests:

They are found in areas with moderate temperatures there is a marked seasonality with long summer cold but severe winter and abundant rainfall throughout the year the major trees include broad leaf deciduous trees like oak, hickory, poplar etc.

Characteristic of forest ecosystem:

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

1. Warm temperate, adequate rainfall which make the generation of number of Ponds lakes etc,
2. Forest support many wild animals protect biodiversity
3. Soil is rich in organic matter and nutrients which support the growth of all species
4. Since penetration of sun light is so poor the conversion of organic matter in to nutrients is very fast.

STRUCTURE AND FUNCTION OF FOREST ECOSYSTEM

The structure of an ecosystem has two major components

A. Biotic component (living)

B. Abiotic Component (Non-living)

A. BIOTIC COMPONENT (LIVING)

The living organisms or members in an ecosystem collectively form its community called biotic components.

Member of Biotic components

a. Producer (plants)

b. Consumer (animals)

c. Decomposer (Micro-organisms)

a. Producer

They prepare their own food through photosynthesis.

For examples: trees, shrubs, ground vegetation.

b. consumer

They directly or indirectly depend on the producer for their food.

They are three types.

1. Primary consumer (Herbivore – plant eater)

They directly depend on the producer for their food.

For example: ants, flies, insects, mice, deer, and squirrels.

2. Secondary consumer (primary carnivore – meat eaters)

They directly depend upon the primary consumer for their food.

For example: snakes, birds, fox

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

3. Tertiary consumer (Secondary carnivore – meat eaters)

They directly depend upon the primary carnivores for their food.

For example: Tigers, lions, etc.

c. Decomposer

They attack the dead bodies of producers and consumers and decompose them into simpler compounds (Inorganic and organic matters).

For example: Bacteria and Fungi

B. ABIOTIC COMPONENT (NON-LIVING)

The Non-living organisms or members in an ecosystem collectively form its community called abiotic components.

EXAMPLE: temp, light, rainfall, minerals chemical components

GRASSLAND ECOSYSTEM

- 20% of earth surface.
- It improves the production of grasslands.
- Overgrazing leads to desertification.

There are three types of grasslands

- A. Tropical grasslands
- B. Temperate grasslands
- C. Polar grasslands

Tropical grasslands

They has high temperature and moderate rain fall, 40-100cm.They have tall grasses with scatters shrubs. They are the shelter for animals like zebras, giraffes and African elephant. Savanna grassland in Africa is good example for tropical grassland.

Temperate grasslands:

Cold in winters and hot in summers, annual precipitation is less and falls unevenly throughout the year. *Pampas* in South America and *Veldt* in Africa are examples for temperate grasslands.

Polar grasslands:

It is also known as *arctic polar region*. Severe cold, strong winds along with ice and snow. They have animals like arctic fox.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

Characteristic grasslands:
1. Plain land occupied by grasses
2. Soil is rich in nutrients &org matter
3. Has tall grasses used for grazing
4. Has low uneven rainfall (erratic)

STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEM

The structure of an ecosystem has two major components

A. Biotic component (living)

B. Abiotic Component (Non-living)

A. BIOTIC COMPONENT (LIVING)

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Member of Biotic components

a. Producer (plants)

b. Consumer (animals)

c. Decomposer (Micro-organisms)

a. Producer

They prepare their own food through photosynthesis.

For examples: grasses, forbs, shrubs.

b. consumer

They directly or indirectly depend on the producer for their food.

They are three types.

1. Primary consumer (Herbivore – plant eater)

They directly depend on the producer for their food.

For example: cows, buffaloes, sheep, and deer

2. Secondary consumer (primary carnivore – meat eaters)

They directly depend upon the primary consumer for their food.

For example: snakes, lizards, birds, fox, and jackals.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

3. Tertiary consumer (Secondary carnivore – meat eaters)

They directly depend upon the primary carnivores for their food.

For example: hawks, eagle.

c. Decomposer

They attack the dead bodies of producers and consumers and decompose them into simpler compounds (Inorganic and organic matters).

For example: Bacteria and Fungi

B. ABIOTIC COMPONENT (NON-LIVING)

The Non-living organisms or members in an ecosystem collectively form its community called abiotic components.

EXAMPLE: temp, light, rainfall, minerals chemical components.

DESERT ECOSYSTEM

- Desert is a dry place with unpredictable and infrequent precipitation.
- Desert occupies about 35% of world's land area.
- It is characterizes by 25 cm rain fall.
- The atmosphere is dry.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

TROPICAL DESERTS	TEMPERATE DESERTS	COLD DESERTS
Temperatures are high around year	Day time temperature are high in summer & low in winter	Winters are too cold, summers are too hot
There is very little rainfall during 1 or 2 months of a year.	There is more precipitation than tropical deserts	Precipitation is too low
These driest places on the earth have few plants along with wind blown sands and rocks Ex: *Sahara* desert	It consists of drought resistant shrubs, cacti and few animals *Majave* desert	Small shrubs *Gobi* desert

STRUCTURE AND FUNCTION OF DESERT ECOSYSTEM

The structure of an ecosystem has two major components

A. Biotic component (living)

B. Abiotic Component (Non-living)

A. BIOTIC COMPONENT (LIVING)

The living organisms or members in an ecosystem collectively form its community called biotic components.

Member of Biotic components

a. Producer (plants)

b. Consumer (animals)

c. Decomposer (Micro-organisms)

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

a. Producer

They prepare their own food through photosynthesis.

For examples: shrubs.

b. consumer

They directly or indirectly depend on the producer for their food.

They are three types.

1. Primary consumer (Herbivore – plant eater)

They directly depend on the producer for their food.

For example: Squirrels, camel

2. Secondary consumer (primary carnivore – meat eaters)

They directly depend upon the primary consumer for their food.

For example: snakes fox.

3. Tertiary consumer (Secondary carnivore – meat eaters)

They directly depend upon the primary carnivores for their food.

For example: hawks, eagle.

c. Decomposer

They attack the dead bodies of producers and consumers and decompose them into simpler compounds (Inorganic and organic matters).

For example: Bacteria and Fungi

B. ABIOTIC COMPONENT (NON-LIVING)

The Non-living organisms or members in an ecosystem collectively form its community called abiotic components.

EXAMPLE: temp, light, rainfall, minerals chemical components.

WATER or AQUATIC ECOSYSTEMS

The aquatic system deals with water bodies. The major types of organism found in this ecosystem.

1. Fresh water ecosystem: Pond, river, stream &lake.

2. Salt water ecosystem: oceans and estuaries.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

POND ECOSYSTEM:

It contains algae, plants, insects& fish.

Characteristic:

1. Pond is temporary

2. Seasonal

3. Get polluted easily.

STRUCTURE AND FUNCTION OF POND ECOSYSTEM

The structure of an ecosystem has two major components

A. Biotic component (living)

B. Abiotic Component (Non-living)

A. BIOTIC COMPONENT (LIVING)

The living organisms or members in an ecosystem collectively form its community called biotic components.

Member of Biotic components

a. Producer (plants)

b. Consumer (Fish)

c. Decomposer (Micro-organisms)

a. Producer

They prepare their own food through photosynthesis.

For examples: phytoplankton

b. consumer

They directly or indirectly depend on the producer for their food.

They are three types.

1. Primary consumer (Herbivore – plant eater)

They directly depend on the producer for their food.

For example: zooplankton

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

2. Secondary consumer (primary carnivore – meat eaters)

They directly depend upon the primary consumer for their food.

For example: small fish

3. Tertiary consumer (Secondary carnivore – meat eaters)

They directly depend upon the primary carnivores for their food.

For example: big fish

c. Decomposer

They attack the dead bodies of producers and consumers and decompose them into simpler compounds (Inorganic and organic matters).

For example: Bacteria and Fungi

B. ABIOTIC COMPONENT (NON-LIVING)

The Non-living organisms or members in an ecosystem collectively form its community called abiotic components.

EXAMPLE: temp, light, rainfall, minerals chemical components.

LAKE ECOSYSTEM:

Lakes are natural shallow water bodies.

Characteristic:

1. Permanent water body.

2. It helps in irrigation and drinking.

3. It is fresh water body.

Zones of Lake Ecosystem:

- Littoral zone

  The light penetrates, allowing aquatic plants to grow.

- Limnetic zone

  The open water area where light does not generally penetrate all the way to the bottom

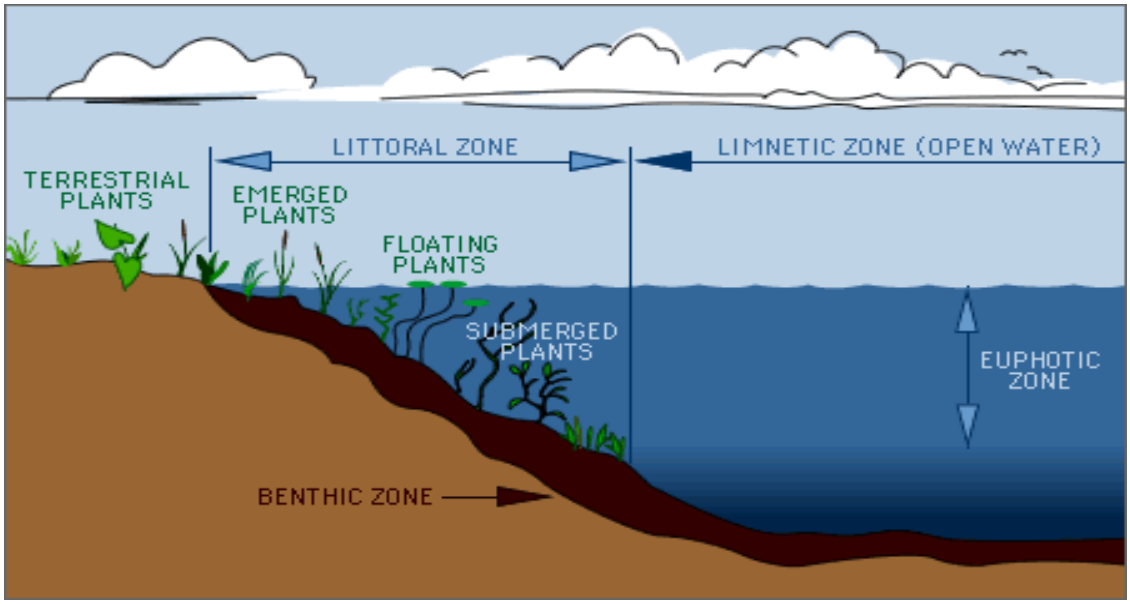
- Euphotic zone

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

The layer from the surface down to the depth where light levels become too low for photosynthesis

- Benthic zone

The bottom sediment



Types of lakes:

(a) Oligotrophic lakes which have low nutrient concentrations.
(b) Eutrophic lakes which are over nourished by nutrients like nitrogen and phosphorus, usually as a result of agricultural run-off or municipal sewage discharge. They are covered with "algal blooms" e.g. Dal lake.
(c) Dystrophic lakes that have low pH, high acid content and brown waters e.g. bog lakes.
(d) Endemic lakes that are very ancient, deep and have endemic fauna which are restricted only to that lake e.g. the Lake Baikal in Russia.
(e) Artificial lakes or impoundments that are created due to construction of dams e.g. Govindsagar Lake at Bhakra-Nangal.

STRUCTURE AND FUNCTION OF LAKE ECOSYSTEM

The structure of an ecosystem has two major components

A. Biotic component (living)

B. Abiotic Component (Non-living)

A. BIOTIC COMPONENT (LIVING)

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

The living organisms or members in an ecosystem collectively form its community called biotic components.

Member of Biotic components

a. Producer (plants)

b. Consumer (Fish)

c. Decomposer (Micro-organisms)

a. Producer

They prepare their own food through photosynthesis.

For examples: phytoplankton

b. consumer

They directly or indirectly depend on the producer for their food.

They are three types.

1. Primary consumer (Herbivore – plant eater)

They directly depend on the producer for their food.

For example: zooplankton

2. Secondary consumer (primary carnivore – meat eaters)

They directly depend upon the primary consumer for their food.

For example: small fish

3. Tertiary consumer (Secondary carnivore – meat eaters)

They directly depend upon the primary carnivores for their food.

For example: big fish

c. Decomposer

They attack the dead bodies of producers and consumers and decompose them into simpler compounds (Inorganic and organic matters).

For example: Bacteria and Fungi

B. ABIOTIC COMPONENT (NON-LIVING)

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S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

The Non-living organisms or members in an ecosystem collectively form its community called abiotic components.

EXAMPLE: temp, light, rainfall, minerals chemical components.

RIVER ECOSYSTEM or STREAM ECOSYSTEM:

It is a fresh, flowing water ecosystem. Well oxygenated.

1. It is fresh water ecosystem.

2. Flowing water.

3. DO is high.

4. Rich in nutrients.

STRUCTURE AND FUNCTION OF RIVER ECOSYSTEM

The structure of an ecosystem has two major components

A. Biotic component (living)

B. Abiotic Component (Non-living)

A. BIOTIC COMPONENT (LIVING)

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c. Decomposer (Micro-organisms)

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For examples: phytoplankton

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For example: zooplankton

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For example: small fish

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For example: Bacteria and Fungi

B. ABIOTIC COMPONENT (NON-LIVING)

The Non-living organisms or members in an ecosystem collectively form its community called abiotic components.

Marine ecosystems :(Ocean ecosystem)

- 70% of the earth's surface
- It play a key role in the survival of about 2, 50,000 marine species, serving as food for humans and other organisms, give a huge variety of sea-products and drugs.
- Oceans provide us iron, phosphorus, magnesium, oil, natural gas, sand and gravel.
- Oceans are the major sinks of carbon dioxide and play an important role in regulating many biogeochemical cycles and hydrological cycle, thereby regulating the earth's climate.

The oceans have two major life zones: (Fig: 5)

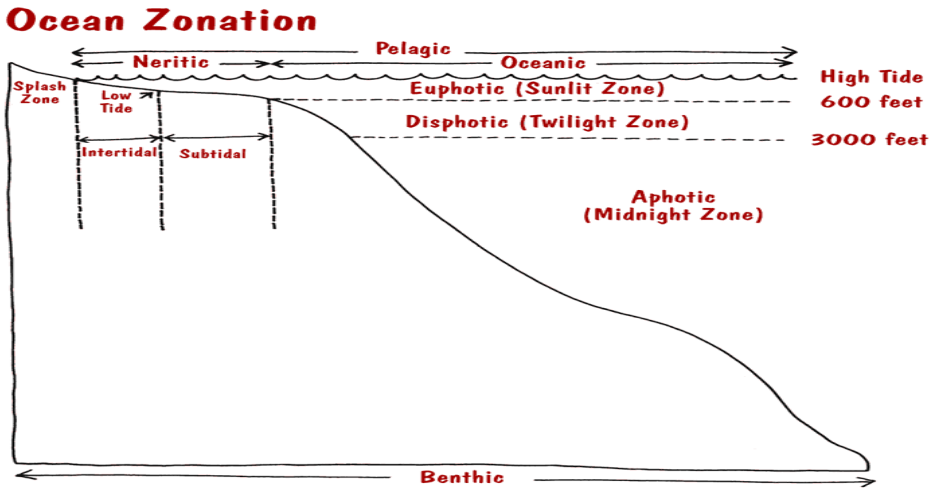
Coastal zone: It is relatively warm, nutrient rich shallow water. Due to high nutrients and ample sunlight this is the zone of high primary productivity.

Open sea: It is the deeper part of the ocean, away from the continental shelf. It is vertically divided into three regions:

- ✓ **Euphotic zone** which receives abundant light and shows high photosynthetic activity.
- ✓ **Bathyal zone** receives dim light and is usually geologically active.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

- ✓ **Abyssal zone** is the dark zone, 2000 to 5000 meters deep. The abyssal zone has no primary source of energy i.e. solar energy. It is the world's largest ecological unit but it is an incomplete ecosystem.
- ✓ The ocean bottom is the **benthic zone**
- ✓ Water itself (or the water column) is the **pelagic zone**.
- ✓ **Neritic zone** is that part of the pelagic zone that extends from the high tide line to an ocean bottom less than 600 feet deep.
- ✓ Water deeper than 600 feet is called the **oceanic zone.**
- ✓ **Sunlit zone**, enough light penetrates to support photosynthesis.
- ✓ **Twilight zone** where very small amounts of light penetrate.
- ✓ Ninety percent of the space in the ocean lies in the **midnight zone which** is entirely devoid of light.



STRUCTURE AND FUNCTION OF OCEAN ECOSYSTEM

The structure of an ecosystem has two major components

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B. Abiotic Component (Non-living)

A. BIOTIC COMPONENT (LIVING)

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Member of Biotic components

a. Producer (plants)

b. Consumer (Fish)

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

c. Decomposer (Micro-organisms)

a. Producer

They prepare their own food through photosynthesis.

For examples: phytoplankton

b. consumer

They directly or indirectly depend on the producer for their food.

They are three types.

1. Primary consumer (Herbivore – plant eater)

They directly depend on the producer for their food.

For example: zooplankton

2. Secondary consumer (primary carnivore – meat eaters)

They directly depend upon the primary consumer for their food.

For example: small fish

3. Tertiary consumer (Secondary carnivore – meat eaters)

They directly depend upon the primary carnivores for their food.

For example: big fish

c. Decomposer

They attack the dead bodies of producers and consumers and decompose them into simpler compounds (Inorganic and organic matters).

For example: Bacteria and Fungi

B. ABIOTIC COMPONENT (NON-LIVING)

The Non-living organisms or members in an ecosystem collectively form its community called abiotic components.

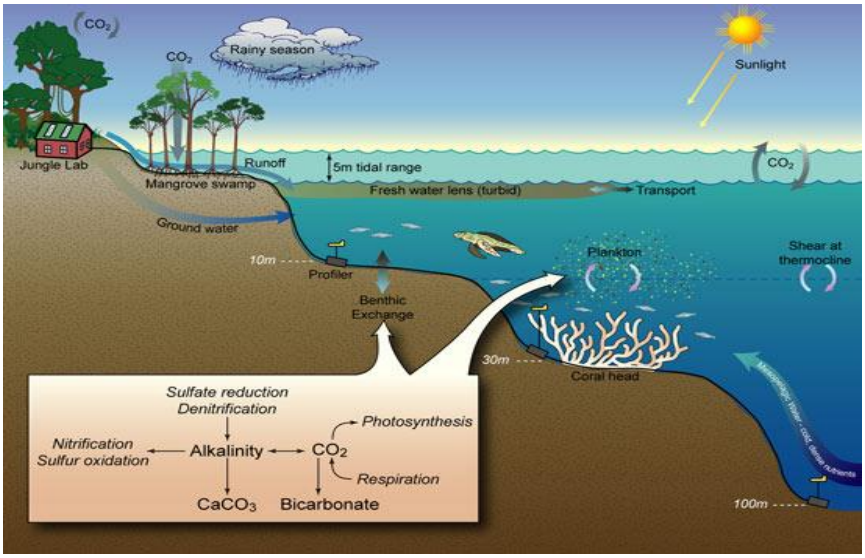
ESTUARINE ECOSYSTEM:

An estuary is a partially enclosed coastal area at the mouth of river, where river joins the sea.

Characteristic:

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

1. Estuaries are transition zone.
2. Water characteristic are periodically changed.
3. The living organism in this ecosystem has tolerance.
4. Salinity is highest during the summer
5. Salinity is lowest during the winter.



STRUCTURE AND FUNCTION OF ESTUARINE ECOSYSTEM

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S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

Biodiversity

Bio means 'life' and diversity means 'variety'

Definition:

Biodiversity is defined as , the variety and variability among all groups of living organism and the ecosystem in which they occur.

Classification:

Genetic diversity

Genetic diversity is the diversity within species ie., variation of genes within the species.eg.,rice varieties.

Teak wood trees: Indian teak, Burma teak, malasian teak.

Species diversity

Species diversity is the diversity between different species. The sum of varieties of all the living organisms at the species level is known as species diversity.

Species richness is the simplest measure of biodiversity and is simply a count of the number of different species in a given area.

Plant species: Apple, mango, graphs, wheat

Animal species: lion, tiger, elephant, deer.

Community or ecosystem diversity:

- The diversity at the ecological or habitat level is known as ecosystem diversity. A large region with different ecosystem can be considered as ecosystem diversity.
- Eg. River ecosystem.

Values of Bio-Diversity

Consumptive value:

These are direct use values where the biodiversity product can be harvested and consumed directly e.g. fuel, food, drugs, fibre etc.

Drugs and medicines:

About 75% of the world's population Depends upon plants or plant extracts for medicines.The wonder drug Penicillin used as an antibiotic is derived from a fungus called "Penicillium''.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

Quinine, the cure for malaria is obtained from the bark of Cinchona tree,

Digitalin is obtained from foxglove (Digitalis) which is an effective cure for heart disease.

Vinblastin and vincristine, two anticancer drugs, have been obtained from Periwinkle (Catharanthus) plant, which possesses anticancer alkaloids.

Fuel:

Our forests have been used since ages for fuel wood. The fossil fuels coal, petroleum and natural gas are also products of fossilized biodiversity.

Productive Values:

These are the commercially usable values where the product is marketed and sold. These may include the animal products like tusks of elephants, musk from musk deer, silk from silk-worm, wool from sheep, and leather from all animals.

Social Values/Ethical values:

These are the values associated with the social life, customs, religion and aspects of the people.

Holy plants: Many of the plants are considered holy plants in our country like *Tulsi,*Mango, Lotus, Neem etc.

Holy animals: Many of the Animals are considered holy animals in our country like cow, snake, peacock etc.

Aesthetic value:

People from far and wide spend a lot of time and money to visit beautiful areas where they can enjoy the aesthetic value of biodiversity and this type of tourism is now known as ecotourism.

The pleasant music of world birds, colour of flowers, peacock, and butterfly are important aesthetic value.

Ethical value:

It involves ethical value like ‘’all life must be preserved”.

The ethical value means that a species may or may not be used, but its existence in nature gives us pleasure.

Eg. The river ganga, neem, tulsi etc.,

Optional values:

The optional values of biodiversity suggest that any species may be proved to be a valuable after someday.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

Eg. Growing technology field is searching a species for causing the diseases of cancer and AIDS.

Hot spots of Bio-Diversity

The hotspots are the geographic areas which posses high endemic species.

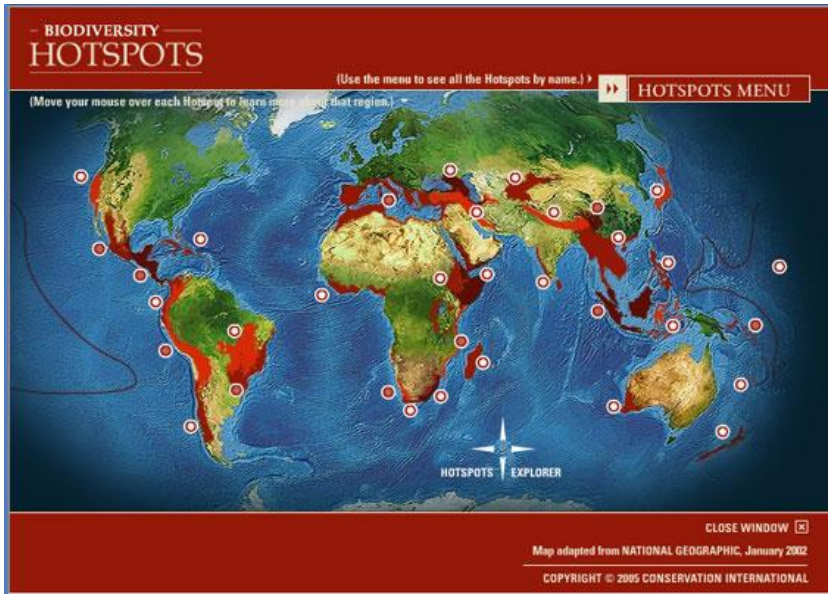
There are 25 hot spots at global level. Out of 25, two are present in India, namely the Eastern Himalayas and Western Ghats.

Nearly 70% of the bird species in this hotspot are endemic. These are the areas of high diversity, endemism and are also threatened by human activities.

About 40% of terrestrial plants and 25% of vertebrate species are endemic and found in these hotspots.

It has been estimated that 50,000 endemic plants, which comprise 20% of global plant life, probably occur in only 18 hotspots in the world.

Countries which have a relatively large proportion of these biodiversity hotspots are referred to as mega-diversity nations.



A biodiversity hotspot is a biogeographic region with a significant reservoir of biodiversity that is threatened with destruction.
An area is designated as a hot spot when it contains at least 0.5% of plant species as endemic. There are 25 such hot spots of biodiversity on a global level, out of which two are present in India.
These are: Indo- Burma (earlier The Eastern Himalayas),The western Ghats & Sri Lanka.
These hot spots covering less than 2% of the world's land area are found to have about 50% of the terrestrial biodiversity.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

2.14.1 Criteria for determining hot-spots

1. No. of Endemic Species i.e. the species which are found nowhere else.
2. Degree of threat, which is measured in terms of Habitat loss.

The Indian hot spots are not only rich in floral wealth and endemic species of plants but also reptiles, amphibians, swallow tailed butterflies and some mammals.

(a) Eastern Himalayas:

a. They display an ultra-varied topography that fosters species diversity and endemism.
b. Certain species like Sapria himalayana, a parasitic angiosperm was sighted only twice in this region in the last 70 years.
c. Out of the world's recorded flora 30% are endemic to India of which 35,000 are in the Himalayas.

(b) Western Ghats:

a. It extends along a 17,000 Km^2 strip of forests in Maharashtra, Karnataka, Tamil Nadu and Kerala and has 40% of the total endemic plant species.
b. 62% amphibians and 50% lizards are endemic to Western Ghats.
c. The major centers of diversity are Agastyamalai Hills and Silent Valley-_the New Amambalam Reserve Basin.
d. It is reported that only 6.8% of the original forests are existing today while the rest has been deforested or degraded.
e. Although the hotspots are characterized by endemism, interestingly, a few species are common to both the hotspots in India.

Threats to Bio-Diversity

Any disturbance in an natural ecosystem tent to reduce its biodiversity.

Causes of threats:

a. Habitat loss:

- The loss of population is caused by habitat loss. Habitat loss threatened a wide range of animals and plants.

Factors affecting habitat loss:

1. Deforestation:

Forest and grasslands have been cleared for conversion into agricultural lands or settlement areas or development project, so thousands of species loss their habitat.

2. Destruction of wetlands:

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

The wetlands and mangroves are destroyed due to the draining, filling and pollution which cause huge biodiversity loss.

3. Habitat fragmentation:

The habitat is divided into small and scattered patches. This is called as Habitat fragmentation .due to these wild animals and song birds are vanishing.

4. Raw material:

For the production of hybrid seeds the wild plants are used as raw materials.

5. Production of drugs:

Many pharmaceutical companies collect wild plant for the production of drugs.

6. Illegal trade:

Illegal trade on wild life also reduces the biodiversity.

7. Development activities:

Construction of massive dams in the forest area and discharge of industrial effluents kills the birds and other aquatic organism.

b. Poaching of wildlife:

Poaching means killing of animals or commercial hunting. It leads to loss of animal biodiversity.

1. Subsidence poaching:

Killing animals to provide enough food for their survival

2. Commercial poaching:

Hunting and killing animals to sell their products

c. Man-wildlife conflicts:

When wildlife starts causing immense damage man-wildlife conflicts arise.

Eg.,

1.In Orissa, 199 humans were killed in the last 5 years by elephants.

2. In Mysore several elephants were killed because of massive damage done by the elephants to the sugarcane crops.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

Endangered Species of India

IUCN-INTERNATIONAL UNION OF CONSERVATION OF NATURAL RESOURCES, the species classified into various types,

1. Extinct species:

A species is said to be extinct, when it is no longer found in the world.

2. Endangered species:

When its number has been reduced to a critical level, unless it is protected and conserved, it is in immediate danger of extinction.

3. Vulnerable species:

A species is said to be vulnerable, when its population is facing continuous decline due to habitat destruction.

4. Rare species:

A species is said to be rare, when it is localized within restricted area or they are scattered over a more extensive area. Such species are not endangered or vulnerable.

Conservation of Bio-Diversity

The act or process of conserving, the protection, preservation, management or restoration of wildlife and of natural resources such as forests, soil, and water

Conservation of our natural resources has the following three specific objectives:

(i) To maintain essential ecological processes and life-supporting systems.

(ii) To preserve the diversity of species or the range of genetic material found in the organisms on the planet.

(iii) To ensure sustainable utilization of species and ecosystems, to support millions of rural communities as well as the major industries all over the world.

There are two approaches of biodiversity conservation:

(a) In situ conservation (within habitat): This is achieved by protection of wild flora and fauna in nature itself, e.g. Biosphere Reserves, National Parks, Sanctuaries, Reserve Forests etc.

(b) **Ex situ conservation** (outside habitats) this is done by establishment of gene banks, seed banks, zoo, botanical gardens, culture collections etc.

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

1. IN-SITU CONSERVATION:

It involves protection of plants and animals within its natural habitat are called in-situ conservation.
For example: Biosphere reserves, National parks, wildlife sanctuaries, Gene sanctuary, etc

Methods of in-situ conservation

a. Biosphere

It covers large area, more than 5000 sq. km.
For example
1. Nanda devi-U.P.
2. Manas – Assam
3. Gulf of mannar – Tamil Nadu
4. Nilgiri – Karnataka, kerala, tamil nadu

b. National park

It covers small area about 500 sq. km
For example
1. Gir national park - Gujarat
2. Bandipur – Karnataka

3. Corbett – U.P.
4. Kanha – M.P.
5. Periyar - kerala

c. Wild life sanctuaries

It is a reserved area for the conservation of animals only. There are 492 wildlife sanctuary in India.
For example
1. Ghana Bird sanctuary – Rajasthan
2. Vedanthangal Bird sanctuary – Tamil Nadu
3. Muthumalai wildlife sanctuary – Tamil Nadu
4. Wild ass sanctuary - Gujarat

d. Gene Sanctuary

It is an area for the conservation of plants only.
For example
1. Gene sanctuary for citrus – North India
2. Gene sanctuary for pitcher plant – North India

Advantages of In-situ

It is very cheap and convenient method.
The species gets adjusted to the natural disasters.

Disadvantages of in-situ

Large surface area is needed to conserve biodiversity.
Maintenance of the habitat is not proper, due to shortage of staff and pollution.

2. EX-SITU CONSERVATION

Prepared by,
S.David selvaraj.
AP, Dept of Chemistry.
KCE, Coimbatore.

It involves protection of plants and animals outside the natural habitat are called in-situ conservation.
For example: Botanical gardens, Zoological gardens, seed bank, tissue & cell cultures
Etc

Methods of ex-situ conservation

1. National Bureau of plant Genetic resources (NBPGR)
It is located in New Delhi.

It uses cryo preservation techniques to preserve agricultural and horticultural crops
Cryo preservation techniques
The variety of agricultural and horticultural crops has been preserved by using liquid nitrogen at -196^{o} C.

2. National Bureau of animal Genetic resources (NBAGR)
It is located at karnal, Haryana
It is used to preserve the semen of domesticated bovine animals.
3. National facility for plant tissue culture repository (NFPTCR)
It is used to conserve the variety of plants or trees by tissue culture. It is created within the NBPGR.
Advantages of Ex-situ
Survival of endangered species
Longer the life span
Disadvantages of ex-situ
It is expensive method
The freedom of wildlife is lost
The animals cannot survive in natural environment.

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S.David selvaraj.
AP, Dept of Chemistry.
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