ENVIRONMENTAL SCIENCE AND ENGINEERING

UNIT-I: ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

Introduction of environment:

Environment means different things to different people. To some it means home: to others it may refer to a village, a city a country or the whole world. It is formed by combining two words, viz., **'environ'** and **'ment'** meaning **'encircle'** or **'all round'**.

Definitions of Environment

Environment is defined as, "the sum of total of all the living and non – living things around us influencing one another".

TYPES OF ENVIRONMENT

Environment can be divided into two categories

1. Natural environment
2. Man – environment

1. Natural environment

Natural environment is characterized by natural components. All biotic (living) and abiotic components (non-living) are created through a natural process. Creation of these biotic and abiotic components do not require any human support.

Example: soil, water, air, tree, radiations, noise, etc.,

2. Man – environment

Man is the most powerful environmental agent. He modifies the environment using modern technologies, according to his needs to a great extent. Thus the man-made environment is created by man.

Example: House, road, schools, railway lines, parks, etc.,

SCOPE AND IMPORTANCE OF ENVIRONMENT

Environmental studies discipline has multiple and multilevel scopes. This study is important and necessary not only for children but also foe everyone: literate or illiterate: employee or non – employee etc., the scopes are summarized as follows:

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 programmers in terms of social, economic, ecological, and aesthetic factors

IMPORTANCE OF ENVIRONMENTAL STUDY

Environmental study is based upon a comprehensive view of various environmental systems. It aims to make

the citizens competent to do scientific work to find out practical solutions to current environmental problems.

1. World population is increasing at an alarming rate especially in developing countries.
2. The natural resources endownent in the earth are limited
3. The methods and techniques of exploiting natural resources are advanced
4. The resources are over-exploited and there is no foresight of leaving the resources to the future generations.
5. The unplanned exploitation of natural resources lead to pollution of all types and at all levels
6. The pollution and degraded environment seriously affect the health of all living things on earth, including man
7. Education and training are needed to save the biodiversity and species extinction
8. The urban areas, coupled with industries, are the major sources of pollution.

PUBLIC AWARNESS TO ENVIRONMENTAL ISSUES/STUDIES

Need For Public Awareness:

The United Nations Conference on Environment and Development held at Reo de Janeiro in 1992 (popularly known as „Earth Summit") and world summit on sustainable development at Johannesburg in 2002, have highlighted the key issues of global environmental concern. They have attracted the attention of people.

Any government at its own cannot achieve the goals of clear environment until the public participate in action. Public participation is possible only when the public is aware about the ecological and environmental issues. Eg. Ban- the littering of polythene.

Methods to propagate environmental Awareness:

1. Among students through education introducing environmental studies in the curriculum.
2. Among public through mass media- environmental programmmes through TV, radio etc.
3. Among decision makers, planners, leaders etc.

Role of NGOs

1. Advise the government in interacting with ground level people
2. Organize public meetings to create environmental awareness

Eg. Recent report of „centre for science and environment" on permissible limits of pesticides in cola drinks.

Public awareness is needed in the area

1. Study of natural resources-conservation and management
2. Ecology and biodiversity conservation
3. Environmental Pollution and prevention
4. Social issues related to development and environment
5. Human population and environment

CONCEPT OF ECOSYSTEM

Living organisms cannot be isolated from their non-living environment because the later provides materials and energy for the survival of the farmer. An ecosystem is therefore defined as a natural functional ecological unit comprising of living organisms and their non-living environment that interact to form a stable self supporting system.

Eg. Pond, lake, desert, grassland, forest, etc.

ECOSYSTEMS

Ecology – earnest Haeckal- 1869 –derived from "oikos" – home , logy – study-deals with the study of organisms in their natural home interacting with their surroundings.

Ecosystem – Tansley (1935) – self regulating group of biotic communities of species interacting with one another and with their non- living environment exchanging energy and matter

ECOSYSTEM CHARACTERISTICS

Structural features – composition and organization of biological communities and abiotic components constitute – Structure of Ecosystem

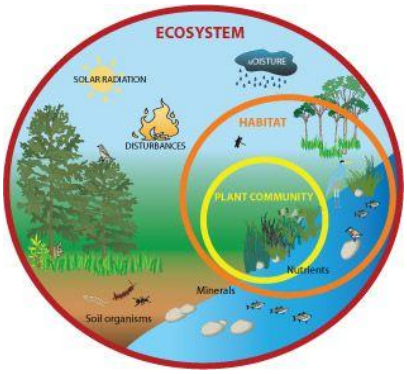
Biotic structure – Plants, animals, microorganisms – form biotic components – nutritional behavior and status in the ecosystem – producers or consumers – how do they get their food.

STRUCTURE OF ECOSYSTEM

1. Abiotic or non-living components or physical components
2. Biotic or Living components
3. Energy components.

Abiotic Components:

Abiotic components enter the body of living directly or indirectly take part in metabolic activities and return to environment.



Abiotic components are as follows

1. Atmosphere – The cover of air that envelopes the earth is known as atmosphere. Compostion – Nitrogen-78%, oxygen- 2%, other gases- 1%
2. Lithosphere or Interior of Earth – Solid Earth – Radius 6371- density -5.5
3. Hydrosphere – 97% earth is water is in oceans fresh water-3% 97% earth"s water is in oceans – Fresh water – 3%.

STRUCTURE OF ATMOSPHERE

Five Layers

1. Troposphere – lower portion – extends from 0-18 kms, temperature-2.
2. Stratosphere -18- 50 kms- Temperature (-2ºC to -56ºC) - Ozone layer3.
3. Mesosphere- extends from 50-85 kms- Temperature drops to (-95ºC)4.
4. Ionosphere or Thermosphere – extends up to 500 kms. Temperature – raises up to 1200ºC5.
5. Exosphere – extends up to 1600 km- temperature very high due to solar radiation

Functions of Atmosphere:
It maintains heat balance on the earth by absorbing IR radiation.

Oxygen– support life on living organism.
Co_2 - essential for photosynthetic activity of plants.
N_2 - essential nutrient for plant growth.

Interior of Earth or Lithosphere:

Three major Zones

1. Crust – top most layer- solid thickness 30 – 40 Km in continents and 5– 6 km in oceans.
   Rocks of the earth crust– 3 types– Igneous, Sedimentary, Metamorphic.
2. Mantle – average density 3.3 – Thickness – 2860 – density increases with depth.
3. Core – outer core – solid, inner core – liquid). Depth – 2900 km from the surface of the earth – density -12 – not exact composition.

Functions of Lithosphere:

1. It is home for human beings and wild life
2. It is store house of minerals and organic matter

Functions of Ecosystems - Ecosystem characteristics

Biotic structure – Plants, animals , microorganisms – form biotic components – nutritional behavior and status in the ecosystem – producers or consumers – how do they get their food.

Producers – Photosynthesis – photoautotroph (auto – self, photo- light) Chemotrops or Chemosynthetic organisms – Chemicals

Consumers – feeding upon other organisms

Types – Herbivores – Plant eating animals – primary consumers Eg ; rabbit

Carnivores – Feed on consumers – Secondary Consumers - feed on other carnivores – Tertiary/Consumers.

Omnivores – feed on both plants and animals – eg. Humans, rat, fox.

Detritivores - (Detritus feeder or Saprotrophs) – feed on dead on organisms or decomposed matter eg; beetles, termites, ants , crabs, earthworms.
Decomposers – nutrition breaking down in to complex organic molecules to simpler organicorganic compounds – bacteria and fungi.

Abiotic Structure – physical and chemical components of an ecosystem.

Physical factors – sunlight, temperature, annual rainfall, soil type, water availability, water currents etc. – strong influence on the ecosystem.

Chemical factors: major essential nutrients – C, N, P, H, O, S.

Biotic Components – Abiotic components and vice versa – linked through – energy flow, matter cycling

Functional Attributes.

1. Food chain, Food web and trophic structure.
2. Energy flow
3. Cycling of Nutrients (Biogeochemical cycles)
4. Primary and secondary production
5. Ecosystem development programme

Food Chains

Sequence of eating and being eaten in an ecosystem.

Grass → Grasshopper → Frog → snake → Hawk

(Grassland Ecosystem)
Grazing food chains – Starts with green plants.

Grass → Rabbit → Fox

Phytoplanktons → Zooplanktons → Small fish → Carnivores(fish)

Food Web

An interlocked food chain is called as a food web. (Network of food Chains)

ENERGY FLOW IN ECOSYSTEM

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.

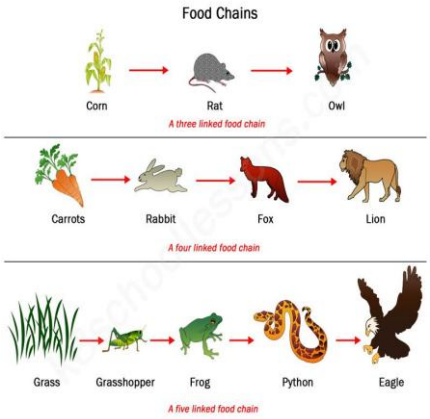
The process of energy flow involves transfer of energy from autotrophs to various components of heterotrophs and help in maintaining bio diversity. The main source of energy in the ecosystem is sunlight. About 80% of energy is lost during flow of energy from one trophic level to the next one.

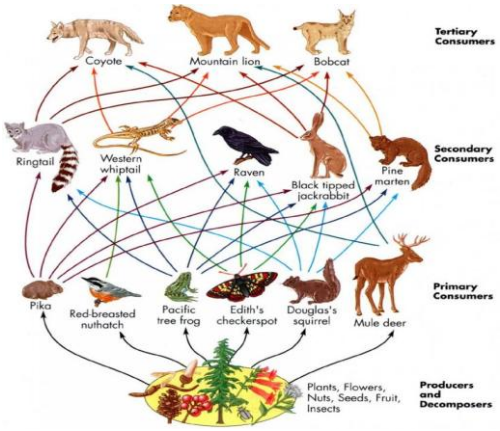
Sun → Producer → Herbivores → Carnivores → Top carnivores → Decomposers

FOOD CHAIN

Plants by photosynthesis convert solar energy into protoplasm. Small herbivores consume the vegetable matter and convert into animal matter which in turn eaten by large carnivores. This sequence of eaten and being eaten, produces transfer of food energy known as food chain.

Producer → Primary consumer → Secondary consumer → Tertiary consumer → Decomposer





FOOD WEB:

The food relationship between various organisms is being depicted by linking all the possible prey and predators of different food level. In an ecosystem linking of feeding habit relations will provide a food web.

Difference between food chain and food web

- In a linear food chains, if one species gets affected or becomes extinct, then the species in the subsequent trophic levels are also affected.
- But, in a food web, if one species get affected, it does not affect other tropic levels so seriously.
- There are number of options available at each trophic level.

ECOLOGICAL PYRAMIDS:

The energy biomass and number of organisms gradually decreases from the producer level to the consumer level. The total mass of herbivores in an ecosystem will generally be less than the total mass of plants. Similarly the total mass of carnivores will be less than the total mass of herbivores. The graphical representation of the number, biomass and energy of various energy levels is called ecological pyramid. In any ecological pyramid the producer forms the base and the successive levels form the tires which can make the apex. The ecological pyramids represent the tropic structure and also tropic function of the ecosystem.

Types of ecological pyramids:

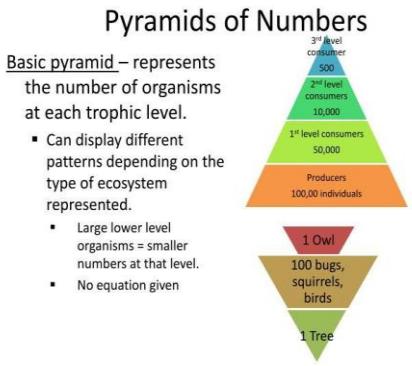
a) Pyramid of numbers

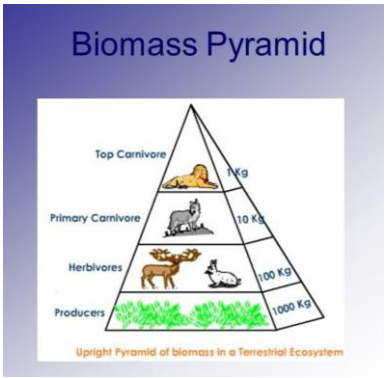
b) Pyramid of biomass

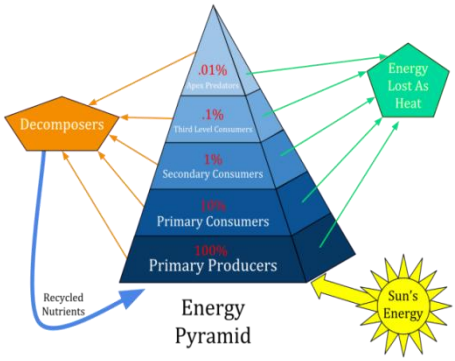
c) Pyramid of energy

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 pyramid of number ignores the biomass of organisms and it also does not indicate the energy transferred or the use of energy by the groups involved.
- The grassland ecosystem provides a typical example for pyramid of number.







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.
- For example, the total biomass of the producers ingested by herbivores is more than the total biomass of the herbivores in an ecosystem.
- Likewise, the total biomass of the primary carnivores (or secondary consumer) will be less than the herbivores and so on.

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.

ECOLOGICAL SUCCESSION

In an area one community may be replaced by another community or by a series of communities. Thus the progressive replacement of one community by another till the development of stable community in a particular area is called ecological succession.

Stages of ecological succession

1. Pioneer community

First group of organism, which establish their community in the area is called 'Pioneer' Community.

2. Seres (or) Seral stage

Various developmental stages of a community is called 'seres'.

Types of ecological succession

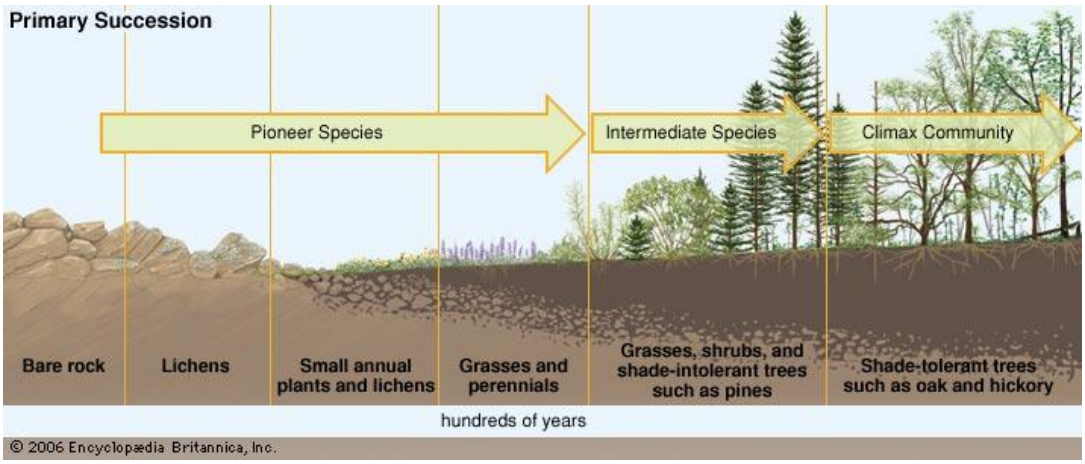
Primary succession: It involves the gradual establishment of biotic communities on a lifeless ground.

(a) Hydrarch (or) Hydrosere: Establishment starts in a watery area like pond and lake.

(b) Xerarch or Xerosere: Establishment starts in a dry area like, desert and rock.

2. **Secondary succession:** It involves the establishment of biotic communities in an area, where some type of biotic

community is already present.



Process of Ecological Succession

1. **Nudation**: It is the development of a bare area without any life form.
2. **Invasion:** It is the establishment of one or more species on a bare area through migration followed by establishment.

(a) Migration: Migration of seeds is brought about by wind, water or birds.

(b) Establishment: The seeds then germinate and grow on the land and establishes their pioneer communities.

c) Competition. As the number of individual species grows , there is a competition with the same species and between different species for space, water and nutrients.

d) Reaction. The living organisms take water, nutrients and grow & modify the environment is known as reaction. This modification becomes unsuitable for existing species and favours some new species, which replace the existing species. This leads to seral communities.

e) **Stabilization.** It leads to stable community, which is in equilibrium with the environment.

MAJOR TYPES OF ECOSYSTEMS

a. FOREST ECOSYSTEM

Definition: It is a natural ecosystem consisting of dense growth of trees and wild animals

Tropical rain forests → found near the equator, high temperature, have broad leaf trees like sandal, lion, tiger

Tropical deciduous forest → Found away from equator, warm climate, deciduous trees like maple, oak, deer, fox, rabbit etc.

Temperate rain forests → adequate rainfall areas, coniferous trees like pines, firs, squirrels, fox, cats, bear etc.

Temperate deciduous forest → found in moderate temp., trees like oak, hickory, animals – deer, fox, bear etc.

Tropical scrub forests → dry climate for longer time, small deciduous trees & shrubs, animals – deer, forx etc.

Characteristics of forest ecosystem:

- Characterized by warm temperature, adequate rainfall
- Maintain climate & rainfall
- Support many wild animals & protect biodiversity
- Soil is rich in minerals, so support growth of trees
- Penetration of light is poor so conversion of organic matter is very fast

Characteristics:

Abiotic: soil, sun light, temperature etc Biotic: forest trees, shrubs and animals

I. Abiotic Components → abiotic components are physical components present in soil & atmosphere (Ex) tempereature, light, rainfall, minerals

II. Biotic Components

1. **Producers** → plants absorbs sunlight & produce food by photosynthesis. Ex-trees, shrubs, plants
2. **Consumers**

Primary consumers → Called herbivores/plant eaters- depend on plants for food. Ex. Insects, rat, goat, deer, cow, horse etc

Secondary consumers → Called primary carnivores/meat eaters. Depend on herbivores for food Ex. Frog, birds, cat, snakes, foxes etc.

Tertiary consumers → Called Secondary carnivores, feed on secondary consumers. Ex. Tigers, lions etc.

Decomposers: fungi, bacteria

GRASSLAND ECOSYSTEM:

Dominated by grass –few shrubs and trees are also found – rainfall average but erratic – overgrazing leads to desertification.

Three types – depending on the climate

1. Tropical grass lands – found near the boarders of tropical rain forests.
   Eg. Savannas in Africa. Animals– Zebra, giraffes etc. – fires are common in dry seasons – termite mounds produce methane – leads to fire – high in photosynthesis – deliberate burning leads to release of high CO2 – global warming.
2. Temperate grasslands – flat and gentle slopes of hills. Very cold winter and very hot summer

- dry summer fires do not allow shrubs and trees to grow – soil is quite fertile – cleaned for agriculture.

3. Polar grasslands – found in arctic polar region – organism – arctic wolf, fox, etc. – Athick layer of ice remains frozen under the soil surface throughout the year – known as permafrost – summer insects and birds appear

Components:

Structural Components:

I. Abiotic Components → abiotic components are physical components present in soil & atmosphere (Ex) tempereature, light, rainfall, minerals

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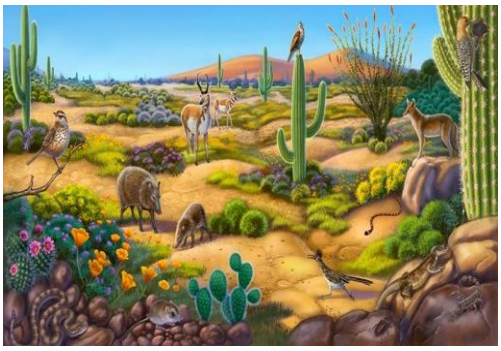
Decomposers → Organisms which feed on dead organisms, plants & animals & decompose into simpler compounds Ex.

C. DESERT ECOSYSTEM

Desert occupies about 35% of our world's land area. It is characterised by less than 25 cm rainfall. The atmosphere is dry and hence it is a poor insulator.

Types:

1. Tropical desert-found in Africa-Sahara and Rajasthan – Thar
2. Temperate desert-south California-Majave
3. Cold desert-China-Gobi desert



Characteristics:

1. Air isdry
2. Climate ishot
3. Annual rainfall is less than 25 cm
4. Vegetation is poor

Structure and functions of the desert Ecosystems

I. Abiotic Components - Eg. Temperature, rainfall, sunlight, water, etc.

II. Biotic Components

1. Producers Eg. Shrubs, bushes, some grasses and few trees.

In deserts mostly Succulent (e.g., cacti) plants are found available. They have waxy layer on the outside to protect them from the sun.

2. Consumers Eg. Squirrels, mice, foxes, rabbits, deer and reptiles

These animals dig holes in the ground to live in. Most of the animals can extract water from the seeds they eat.

AQUATIC ECOSYSTEM

Definition

Deals with water bodies and biotic communities present in them- Classified as fresh water and marine ecosystems. Fresh water systems are classified as lentic and lotic ecosystems.

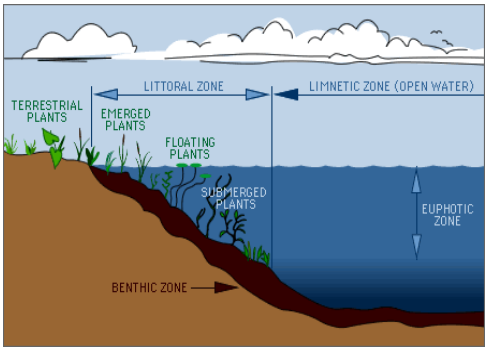
Types:

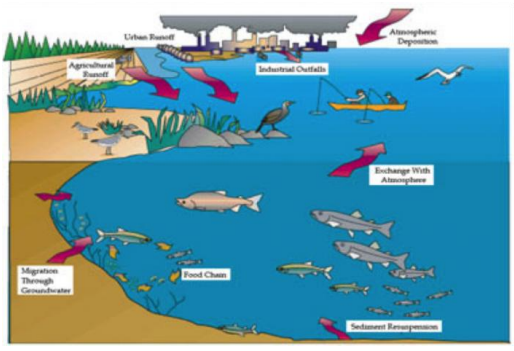
1. **Pond ecosystem:** Small fresh water ecosystem – seasonal in nature

– organisms: algae, aquatic plants, insects, fishes etc. Ponds are very often exposed to anthropo genic pressure like cloth washing, bathing, cattle bathing, swimming etc.

2. **Lake ecosystem:** Big fresh water ecosystem –

Zonation or stratification, Especially during summer is a common one.





Top layer – shallow, warm, prone to anthropogenic activities –

Littoral Zone - Second layer – enough sunlight, high primary productivity

Limnetic zone Third layer – very poor or no sunlight –

Profundal zone Eg. Dal lake in Srinagar, Naini lake in Nainital

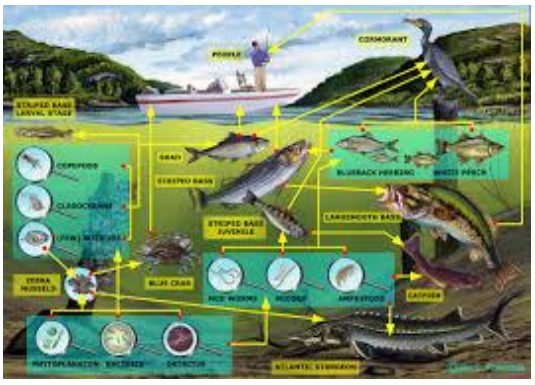
Organisms: planktons – phytoplankton eg. Algae – zooplankton eg. Rotifers Nektons – that swims in water eg. Fishes Neustons – that float on the surface of water Benthos – that attached to sediments eg. Snails

Types of lakes: Many types- oligotrophic lakes – with less nutrient content – Eutrophic lakes – with very high nutrient content due to fertilizer contamination – desert salt lakes – that contains high saline water due to over evaporation – volcanic lakes – formed by water emitted from magma due to volcanic eruptions – dystrophic lakes – that contains highly acidic water (low pH) – endemic lakes – lakes that contain many endemic species etc.

3. **Streams**: fresh water ecosystem where water current plays a major role. Oxygen and nutrient content are uniform. Stream organisms have to face extreme difference in climatic conditions but they do not suffer from oxygen deficiency as pond and lake organisms. This is because large surface area of running water provides more oxygen supply. The animals have very narrow range of tolerance towards oxygen deficiency. Thus stream are worst victims of industrial pollution.

River ecosystem: large streams flowing from mountain highlands are rivers.

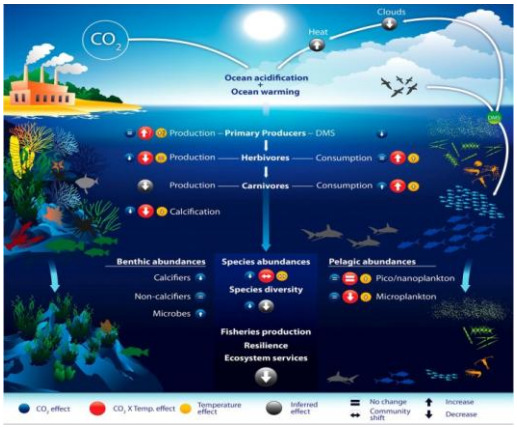
Three phases: 1. mountain high lands – rushing down water fall of water – large quantity of dissolved oxygen – plants attached to rocks and fishes that require more oxygen are found. 2. Second phase – gentle slopes of hills – warmer – supports the growth of plants and fishes that require less oxygen are seen. 3. Third phase: river shapes the land – lots of silts, nutrients are brought – deposited in plains and delta – very rich in biodiversity.



4. **Oceans**: Gigantic reservoirs of water covering >70% of earth surface – 2,50,000 species – huge variety of sea products, drugs etc. – provide Fe, Mg, oils, natural gas, and etc. – major sinks of carbon di oxide – regulate biochemical cycles.

Two zones: coastal zone – warm, nutrient rich, shallow – high sunlight – high primary productivity.

Open sea – away from continental shelf – vertically divided in to zones. 1. euphotic zone – abundant sunlight 2. bathyal zone – dim sunlight 3.abyssal one dark zone – world‟s largest ecological unit.



Characteristic features of Ocean Ecosystem

1. It occupies a large surface area with saline water & rich in biodiversity
2. Since ship, submarines can sail in ocean, commercial activities may be carried out.
3. It moderates the temperature of the earth.

Structure and function of Ocean Ecosystems

Abiotic Components - Eg. Temperature, light, NaCl, K, Ca, and Mg Salts, alkalinity.

Biotic Components

1. Producers - Eg. Phytoplanktons (diatoms, unicellular algae, etc.) and marine plants (sea weeds, chlorophyceal, phaeophyceae).

2. **Consumers –**

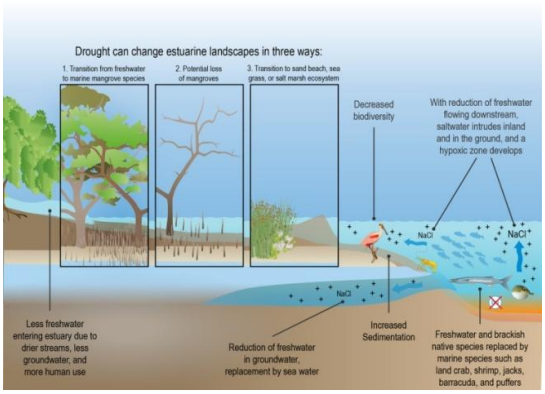
Primary Consumer - Eg. Crustaceans, moiluscs, fish**.**

Secondary Consumer - Eg. Herring sahd, mackerel

Tertiary Consumer – Eg. Cod, Haddock, etc.,

Decomposers - Eg. Bacteria and some fungi

Estuary: coastal area where river meet ocean – strongly affected by tidal actions – very rich in nutrients – very rich in biodiversity also – organisms are highly tolerant – many species are endemic – high food productivity – however to be protected from pollution.



Characteristics:

Structural Components:

Abiotic: pH, nutrients, D.O, temp, climatic conditions, etc. Biotic:
Phytoplankton, fishes, snails insects, birds, etc.

Energy flow:

Phytoplankton → Insects → small fishes → huge fishes

INTRODUCTION TO BIODIVERSITY

Biodiversity is the abbreviated word for "biological diversity" (bio - life or living organisms, diversity-variety). Thus biodiversity is the total variety of life on our planet, the total number of races, varieties and species. The sum of total of various types of microbes, plants and animals (producers, consumers and decomposers) in a system.

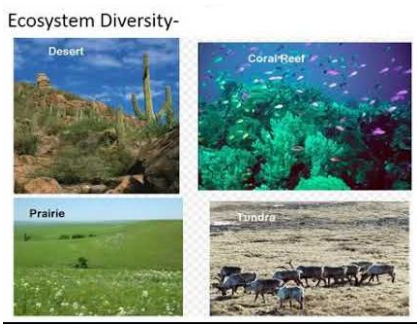


Biomes can be considered life zones, environment with similar climatic, topographic and soil conditions and roughly comparable biological communities (Eg. Grassland, forest). The biomes shelter an astounding variety of living organisms (from driest desert to dripping rainforest, from highest mountain to deepest ocean trenches, life occurs in a marvelous spectrum of size, shape, colour and inter relationship). The variety of living organisms, the biodiversity, makes the world beautiful.

There are 1.4 million species known presently. But based on new discoveries, by research expeditions, mainly in tropics, taxonomists estimate there are between 350 million different species may be alive today. Insects make up more than one half of all known species and may comprise more than 90% of all species on earth

The concept of biodiversity may be analyzed in 3 different levels. They are

- **Ecosystem or ecological diversity** → Diversity at the ecological or habitat level is ecosystem diversity. Eg. River ecosystem.
- **Species diversity** - diversity between different species. (ex) plant species = apple, mango, grapes, animal species = lion, tiger, elephant etc.
- **Genetic diversity** - Diversity within the species is genetic diversity.(ex) teak wood varieties, Indian, Burma, Malaysians

Biodiversity Hotspots:

Most of the world's biodiversity are near the equator especially tropical rain forest and coral reefs. Of the entire world species, only 10 -15% live in North America and Europe.

The Malaysian Peninsula, for instance, has at least 8000 species of flowing plants, while Britain, with an area twice as large, has only 1400 species. South America has 200 000species of plants.

Areas isolated by water, desert or mountain can also have high conc. of unique species and biodiversity. New Zealand, South Africa and California are all mid-latitude area isolated by barriers that prevent mixing up of biological communities from other region and produce rich, unusual collection of species

Significance of Biodiversity:

Biosphere is a life supporting system to the human race. Each species in the biosphere has its own significance.

It is the combination of different organisms that enables the biosphere to sustain human race.
Biodiversity is vital for a healthy biosphere.
Biodiversity is must for the stability and proper functioning of the biosphere
Besides these biodiversity is so important due to having consumptive use values, productive use values, social values, ethical values and aesthetic values

Benefits of biodiversity:

We benefit from other organism in many ways. Even in significant organisms can play irreplaceable roles in ecological systems or the source of genes or drugs that some day become indispensable.

Food: Many wild plant species could make important contributions to human food suppliers either as they are or as a source of material to improve domestic crops. About 80,000 edible plants could be used by human.

Drugs and medicine: Living organisms provides many useful drugs and medicines. The United Nations Development Programme derived from developing world plants, animals and microbes to be more than $30 billion per year.

Eg. For natural medicinal products Penicillin – fungus is the source – Antibiotic Quinine – chincona bark - Malaria treatment Morphine – poppy bark – Analgesic

Twenty years before, once the drugs were not introduced, childhood leukemia was fatal. Now the remission rate for childhood leukemia is 99%.

Productive values

Biodiversity products have obtained a commercial value. These products are marketed and sold. These products may be derived from the animals and plants.

Social Values

Social value of the biodiversity refers to the manner in which the bio-resources are used to the society. These values are associated with the social life, religion and spiritual aspects of the people.

Holy plants

Many plants are considered as the holy plants in our country. Examples: Tulsi, peepal, lotus,

Aesthetic value

The beautiful nature of plants and animals insist us to protect the biodiversity. The most important aesthetic value of biodiversity is eco-tourism.

Optional values

The optional values are the potentials of biodiversity that are presently unknown and need to be known. The optional values of biodiversity suggests that any species may be proved to be a valuable species after someday.

Ecological benefits:

Human life is inextricably linked to ecological services provided by other organisms. Soil formation, waste disposal, air and water purification, solar energy absorption, nutrient cycling and food production all depend on biodiversity. In many environments, high diversity may help biological communities to withstand environmental stress better and to recover more quickly than those with fewer species

Threats to biodiversity:

1. **HABITAT LOSS:** Loss of population of interbreeding organism.

Factors influencing Habitat Loss: ***Deforestation:***

- Forest & grasslands are cleared for agricultural lands or developmental projects.
- Many species disintegrate due to loss of natural habitat.

Destruction of wetlands:

- Wetlands are destroyed due to pollution, draining etc.

Developmental activities:

- Construction of dams in forest, industrial effluents kill birds & aquatic organisms.

Habitat fragmentation:

- Habitat is divided into small & scattered
- So, many animal & birds are vanishing.

Raw materials:

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

Production of Drugs:

- Pharmaceutical companies collect wild plants for drugs production.
- So, no of medicinal plants are on the verge of extinction.

Illegal Trade:

Trade on wild life reduces bio-diversity




Killing / Hunting of animals is poaching.

Types:

Subsistence Poaching - killing animals for surviving.
Commercial Poaching - hunting animals for selling

Factors influencing Poaching:

- Human Population: increase in population increases pressure on forest resources.
- Commercial activities: Smuggling of wild life products for high profit.
- Wildlife products=Furs, horns, tusk, live specimen, herbal products.
- Importers of wild life = Europe, North America, Japan, Taiwan, Hong Kong

Examples:

- Male gorilla for its body parts
- Blue morpho butterfly – making attractive trays
- Snowy large egret – used for white feather in
- ladies hat.US
- Elephant feet – for making Ash trays
- Elephant – for ivory
- Bengal tiger – soled for $1,00,000 in foreign market
- Dynamite fishing – high tech fishing, exhaust
- marine life. Sea horses, Sea turtles

Hunting: Over harvesting is responsible for depletion or extinction of many species.

Eg. The American passenger pigeon was the world's most abundant bird. In spite of this vast population, market hunting and habitat destruction caused the entire population to crash within 20 years.

Fragmentation;

Habitat fragmentation reduces the biodiversity because many animals like bears and large cats require large territories to subsist. Some forest birds reproduce only in deep forest or habitat far from human settlement. A large island for example, can support more individuals of given species and therefore less likely to suffer extinction due to genetic problems and natural catastrophes.

2. <u>MAN-WILDLIFE CONFLICTS:</u>

<u>Examples:</u>

Sambalpur – orissa:195 humans were killed by elephants, In retaliation- 98 elephants were killed, 30 injured by villagers.

Kote – Chamrajanagar –Mysore: Sugarcane & cotton crop, explosives

Royal Chitwan National Park – Kathmandu Man-eating tiger killed 16 Nepalese, 4 yrs child

Sanjay Gandhi National Park – Mumbai Leopards killed– 14 persons

Factors Influencing man-animal conflicts:

1. Shrinking of forest compels wildlife to move outside the forest
2. Electric wiring around crops
3. Animals suffer pain and attack humans
4. Female wildlife attack human more to safe its cubs.

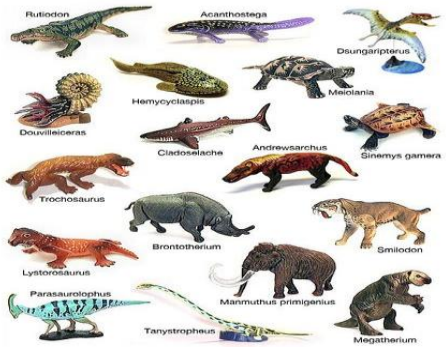
5. Forest dept. don't cultivate foods for wild
6. Cash compensation by Government – 400/- per quintal. But market price 2400/-
7. Garbage near human settlement attract wild



HOT- SPOTS OF BIODIVERSITY

The hot spots are the geographic areas which posses high endemic species. An area is designated as a hot spot when it contains at least 0.5% of plant species as endemic.
Area of hot spot: There are 25 Hotspots of biodiversity on worldwide. Out of which 2 are present in India.
Eastern Himalayas → Nepal , Bhutan, Indo-Burma region,30% of endemic species
Western Ghats → Srilanka region, ex – Maharastra, Karnataka, tamilandu, kerela. 1500 endemic species .
Plants → Ternstroemia japonics, hypericumAnimals → Blue bird, lizard, hawk

ENDANGERED & ENDEMIC SPECIES OF INDIA:
Species are classified into various types:
Extinct species → No longer found in the world
Endangered species → A species is said to be endangered when its no has been reduced to a critical level. Unless it is protected it is in danger of extinction.
Vulnerable species → when its population is facing continuous decline due to habitat loss.
Rare species → when it is localized within restricted area.



ENDANGERED SPECIES OF INDIA:

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Important Endangered Species:

Reptiles → Tortoise, green sea turtle, gharial, python
Birds → Peacock, Siberian white crane, pelican, Indian Bustard

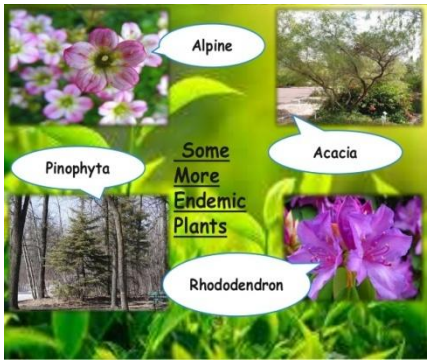
Mammals → Indian wolf, red fox, tiger, Indian lion, golden cat, desert cat. Primates → lion tailed monkey, capped monkey, golden monkey
Plants → medicinal plants, sandal wood tree

Factors affecting Endangered Species:

- Pollution: Human disposal in nature. Travel through food chain and leads to death
- Over-exploitation: over usage of natural resources & poaching leads to extinct of wild life
- Climate change: ozone depletion, flood etc, threatens organisms and ecosystem
- Remedial Measures:
- CITES – Convention on International Trade in Endangered Species is signed
- 2900 and other 900 endangered species are restricted for trade.

ENDEMIC SPECIES:

The species, which are found only in a particular region are known as endemic species.
62% of endemic species are found in Himalayas and Western Ghats



Fauna:

- Animals present in a particular region or period is Fauna.
- 62% amphibians & 50% lizards are endemic to Western Ghats.
- (ex) Monitor lizards, reticulated python, Indian salamander, viviparous toad.

Flora:

- Plants present in a particular region or period is Flora
- (ex) Sapria himalayana, ovaria lurida, pteridophyta, angiosperms etc.

Factors affecting endemic species: Habitat loss, fragmentation, pollution

Conservation of biodiversity:

In general biodiversity is generally disturbed by human activities. Definition : The management of biosphere for the sustainable benefit to meet the needs of future generation.

Advantages or Need of Biodiversity:

- Recreation, tourism, Drugs, herbs, food, important raw materials, preserves plants & animals, hence leads to life supporting systems.

Types of Biodiversity Conservation:

- In-situ conservation (within habitat)
- Ex-situ conservation (outside habitat)In-situ or on-site conversion

In-situ conservation:

- Conservation of species in its natural habitat, in place where the species normally occurs
- The strategy involves establishing small or large protected areas, called protected areas

Today in world, there are 9800 protected areas and 1500 national parks


Spioenkop Nature Reserve (South Africa)

Methods of In-Situ conservation:

Biosphere reserves – 7
National Parks - 80
Willife sanctuaries - 420
Gene sanctuaries - 120

Methods:

1. Nature or biosphere reserves (Eg) Nilgiri Bio reserve
2. National parks and sanctuaries (Eg) Mudumalai, vedanthangal
3. On farm and home garden conservation for plants, vegetables and fruits to maintain traditional crop varieties.

1. Biosphere Reserves:

- Covers area of more than 5000 sq. km. • Protect species for long time

(eg)	Nanda devi	U.P
	Nokrek	Meghalaya
	Nilgiri	Kerala, TN, Karnataka
	Manas	Assam
	Sunderbans	West Bengal
	Gulf of Mannar	TN

Role of Biosphere reserves:

- Protects endangered species
- Site of recreation & tourism
- Useful for education & research purpose
- Gives long term survival

2. Wildlife Sanctuaries:

Conserve animals & Birds only(examples)
Mudumalai wildlife sanctuary –TN
Vedanthangal Bird sanctuary - TN
Sultanpur Bird sanctuary - Haryana

Role of wildlife Sanctuaries: Protects animals only Harvesting of timber, Collection of forest products

Restrictions: Killing, hunting, shooting of wildlife is prohibited

3. National Park:

- Covers area of about 100 to 500 sq.kms
- Conserves wildlife & environment

(eg) Gir National Park - Gujarat, Periyar -Kerala, Dudwa – UP, Sariska - Rajasthan

Role of National Park:

- For tourism without affecting environment
- Protect, propagate & develop wild life

4. Gene Sanctuary: - Conserve Plants

Examples: Citrus sanctuary – North India Pitcher plant -North India

5. Other Projects for conservation of animals:

Examples:- Gir Lion Project, Crocodile Breeding Project, Project Elephant, Project Tiger etc.

Merits of In-situ conservation:

- Very cheap & convenient method
- Species adjust to floods, drought, forest fires etc.

Demerits

Large area is needed, Maintenance is not proper due to pollution and lack of staff.

Ex- situ conservation:

- It involves maintenance and breeding of endangered plant and animal species under partially or wholly controlled conditions in zoos, gardens and laboratories

The crucial issue for conservation is to identify those species which are more at risk of extinction.

Methods:

1. Long term captive breeding
2. Shortage term propagation and release
3. Animal translocation and re introductions
4. Seed bank
5. Reproductive technology



Methods of Ex-situ conservation:

1. **NBPGR** National Bureau of Plant Genetic Resources → uses cryo technique

   Cryo Technique: Preservation of seeds, vegetables, fruits, crops, etc by using liquid nitrogen at -196º C

2. **NBAGR** :National Burea of Animal Genetic Resources → preserves semen of bovine animals

3. **NFPRCR**: National Facility for Plants Tissue Culture Repository → preserves crops or trees by tissue culture

Merits

- Survival / life span of species increase by special care
- Species are assured for food, water, shelter etc
- Endangered species are preserved

Demerits

- Expensive method Freedom of wildlife is lost
- Animal can't survive in natural environment