**Unit-2 A**

# ECOSYSTEM

## Structure of an ecosystem

The structure of an ecosystem explains the relationship between the abiotic (nonliving) and the biotic (living) components.

**1. Biotic Structure**

- The plants, animals and microorganisms present in an ecosystem from the biotic component.
- These organisms have different nutritional behaviour and status in the ecosystems and are accordingly known as Producers or Consumers, based on how they get their food.

**2. A biotic structure**

- The physical and chemical components of an ecosystem constitute its abiotic structure.
- It includes climatic factors, edaphic (soil) factors, geographical factors, energy, nutrients and toxic substances

**Producers:**

- Producers are mainly the green plants, which can synthesize their food themselves by making use of carbon dioxide present in the air and water in the presence of sunlight by involving chlorophyll, the green pigment present in the leaves, through the process of photosynthesis. These are also known as photo autotrophs (auto=self; troph=food, photo=light).
- There are some microorganisms also which can produce organic matter to some extent through oxidation of certain chemicals in the absence of sunlight. These are known as chemosynthetic organisms or chemo-autotophs.

**Consumers:**

- All organisms which get their organic food by feeding upon other organisms are called consumers. Consumers are further classified as

Herbivores: They feed directly on producers and hence also known as primary consumers. e.g. rabbit, insect, man.

Carnivores: They feed on other consumers. If they feed on herbivores they are called secondary consumers (e.g. frog) and if they feed on the carnivores (snake, big fish etc.) they are known as tertiary carnivores/consumers.

Omnivores: They feed on both plants and animals. Eg: human, rat, fox, many birds.

Detritivores: They feed on the parts of dead organisms, wastes of living organisms, their castoffs and partially decomposed matter e.g. beetles, termites, ants, crabs, earthworms etc.

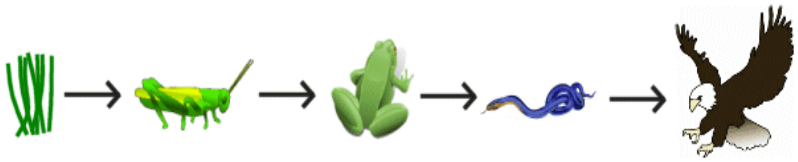
**Decomposers:**

- Decomposers derive their nutrition by breaking down the complex organic molecules to simpler organic compounds and ultimately into inorganic nutrients. Various bacteria and fungi are decomposers.

## Function of an ecosystem

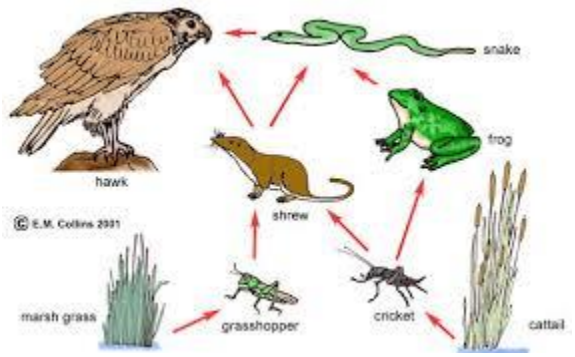
**Food Chain**:

- The sequence of eating and being eaten in an ecosystem is known as food chain. All organisms, living or dead are potential food for some other organism and thus, there is essentially no waste in the functioning of a natural ecosystem. A caterpillar eats a plant leaf, a sparrow eats the caterpillar, a cat or a hawk eats the sparrow and when they all die, they are all consumed by microorganism like bacteria or fungi which break down the organic matter and convert it into simple inorganic substances that can again be used by the plants.
    - Grass - grasshopper – frog – snake – hawk.
    - Phytoplankton – water fleas – small fish – big fish.



**Food Web:**

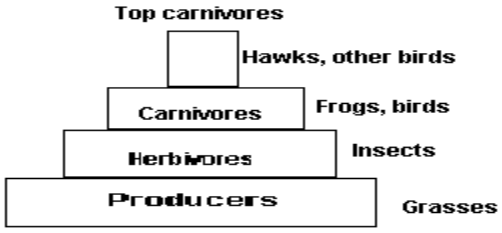
- Food web is a network of food chains where different types of organisms are connected at different trophic levels, so that there are a number of options of eating and being eaten at each trophic level.



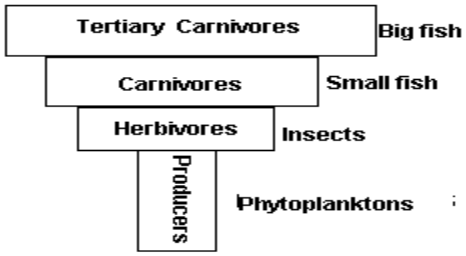

**Ecological Pyramids**:

- Graphic representation of trophic structure and function of an ecosystem, starting with producers at the base and successive trophic levels forming the apex is known as an ecological pyramid. These are three types.

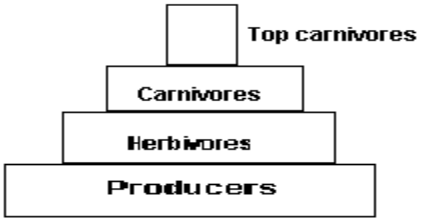
Pyramid of numbers: It represents the number of individual organisms at each trophic level.




Pyramid of biomass: It is based upon the total biomass at each trophic level in a food chain.

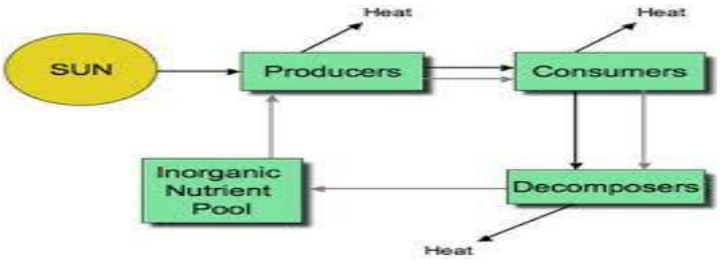



Pyramid of energy: The amount of energy present at each trophic level is considered for this type of pyramid.




**Energy Flow in an Ecosystem:**

- Flow of energy in an ecosystem takes place through the food chain and it is this energy flow which keeps the ecosystem going. The most important feature of this energy flow is that it is unidirectional or one-way flow. Unlike the nutrients, (like carbon, nitrogen, phosphorus etc.) energy is not reused in the food chain. Also, the flow of energy follows the two laws of Thermodynamics




## Ecological Succession

- Ecological succession is defined as an orderly process of changes in the community structure and function with time mediated through modifications in the physical environment and ultimately culminating in a stabilized ecosystem known as climax.

- Ecological successions starting on different types of areas are named differently as follows:
  **Hydrarch or Hydrosere**: Starting in watery area like pond, swamp, bog.
  **Mesarch:** starting in an area of adequate moisture.
  **Xerarch or Xerosere**: Starting in a dry area with little moisture.

Process of Succession:

- The process of succession takes place in a systematic order of sequential steps as follows:

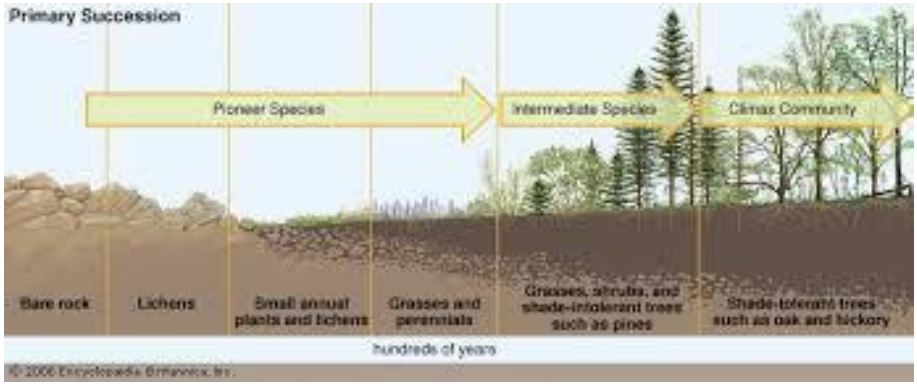
Nudation: It is the development of a bare area, without any life form. The bare area may be caused due to several anthropogenic activities.

Invasion: It is the successful establishment of one or more species on a bare area through dispersal or migration, followed by ecesis or establishment.

Competition: As the number of individuals grows there is competition, for space, water and nutrition. They influence each other in a number of ways, known as coaction.

Reaction: The living organisms have a strong influence on the environment which is modified to a large extent and this is known as reaction.

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



**Unit-2 B** # BIODIVERSITY

**Definition:**

- Biodiversity refers to the variety and variability among all groups of living organisms and the ecosystem complexes in which they occur. It is classified as

Genetic diversity:

- Genetic Diversity is the basic source of biodiversity. The genes found in organisms can form enormous number of combinations each of which gives rise to some variability.
- For example, all rice varieties belong to the species oryza sativa, but there are thousands of wild and cultivated verities of rice which show variations at the genetic level and differ in their color, size, shape, aroma and nutrient content of the grain. This is the genetic diversity of rice

Species diversity:

- Species Diversity is the variability found within the population of a species or between different species of a community.

Ecosystem diversity:

- Ecosystem diversity is the diversity of ecological complexity showing variations in trophic structure, food-webs, nutrient cycling etc.
- The ecosystems also show variations with respect to physical parameters like moisture, temperature, altitude, precipitation etc.

## Bio-geographical classification of India

Biogeography comprising of phyto-geography and zoogeography deals with the aspects of plants and animals. There are around ten bio-geographical regions in India.

| S.NO | Bio-geographic Zone | Biotic province | Flora | Fauna |
|---|---|---|---|---|
| 1 | Trans Himalayan zone | Upper Himalayas | Deodars | Snow leopard, Musk deer |
| 2 | Himalayan | North-West Himalayas<br>West Himalayas<br>central Himalayas<br>East Himalayas | Deodars, pine | Black buck and Tibetan ass |
| 3 | Desert | Thar | Date palm | Snakes & Salmanders |
| 4 | Semi arid | Gujarat | Zyzipus & Date palm | Asiatic lion |

| | | | | |
|---|---|---|---|---|
| 5 | Gangetic plain | Ganga zone | Mango, Jack, Pepel, Baniyan, Bamboo | Elephants, Tigers, Leopards, Bears, Antelops, Sloth, crocodiles |
| 6 | North-East | Brahmaputra | Spices, Pepel, Baniyan | Rhino |
| 7 | Deccan | South India | Neem, Eucalyptus, Teak | Tiger, Deer, |
| 8 | Western ghats | South west India | Teak, Salwood, Oak | Snakes, Tortoise, Elephants |
| 9 | coastal | South India coast | Cashew, coconut, Casurina | Turtles, Aligators |
| 10 | Island | Andaman and Nicobar | Spices, Cashew | Dolphin |

## Hot –Spots of Indian diversity

- **Biological diversity** – or biodiversity – is the term given to the variety of life on Earth. It is the variety within and between all species of plants, animals and micro-organisms and the ecosystems within which they live and interact.
- The political boundaries of India encompass a wide range of eco-zone like desert, high mountains, highlands, tropical and temperate forests, swamplands, plains, grasslands, areas surrounding rivers, as well as island archipelago. It hosts 3 biodiversity hotspots (i.e) the Western Ghats, the Himalayas and the Indo-Burma region.

| Hot-spot zone | Biotic province | Important Flora | Important Fauna |
|---|---|---|---|
| Indo- Burma | Brahmaputra valley & North-Eastern hills | Bamboo, Sal, Jack fruit, tuna Chestnut, Castor | Elephant, Rhinoceros, Yalk, Deer, Porcupine, White-eared night heron, Grey-crowned Crocias |
| Western Ghats | Malabar Coast, Western Ghat Mountains | Sheesham, Peepal, Tuna, Bahera, | Tortoise, Frog, Lizards, Snakes, Elephants |
| Himalayan | North-west Himalayas, West Himalayas, Central Himalayas, East Himalayas | Pine, Deodar, Cork tree, Sal, Butea, | Wild bear, Sambar, Leopard, Sikkim stag, Musk deer. |

## Values of Bio-diversity

- The value of biodiversity in terms of its commercial utility, ecological services, social and aesthetic value is enormous.

Consumptive use value:

- These are direct use values where the biodiversity product can be harvested and consumed directly e.g. fuel, food, drug, fibre etc. About 75% of the world's population depends upon plants or plant extracts for medicines. Our forests have been used since ages for fuel wood.

Productive use values:

- These includes the products like tusks of elephants, musk musk deer, silk from silk-worm, wool from sheep, fur of many animals, lac from lac insects etc.

Social value:

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

Ethical value:

- It involves ethical issues like "all life must be preserved". It is based on the concept of "live and let Live".

Aesthetic value:

- People from far and wide spend a lot of time and money to visit wilderness areas where they can enjoy the aesthetic value of biodiversity.

Option values:

- These values include the potential of biodiversity. There is a possibility that we may have some potential cure AIDS or cancer existing within the depths of a marine ecosystem or a tropical forest.

## Threats to Biodiversity

- Extinction or elimination of a species is a natural process of evolution. In the geologic period the earth has experienced mass extinctions. During evolution, species have died out and have been replaced by others. The process of extinction has become particularly fast in the recent years of human civilization. The major causes of extinction is

Loss of Habitat:

- Destruction and loss of natural habitat is the single largest cause of biodiversity loss. Billions of hectares of forests and grasslands have been cleared over the past 10,000 years for conversion into agriculture lands, pastures, settlement areas or development projects.

Poaching:

- Illegal trade of wildlife products by killing prohibited endangered animals i.e. poaching is another threat to wildlife. Despite international ban on trade in products from endangered

species, smuggling of wild life items like furs, hides, horns, tusks, live specimens and herbal products worth millions of dollars per year continues.

Man-Wildlife conflict :

- Instances of man animal conflicts keep on coming to lime light from several states in our country. Dwindling habitats of tigers, elephants and bears due to shrinking forest cover compels them to move outside the forest and attack the field or sometimes even humans. In Sambalpur, Orissa 195 humans were killed in the last 5 years by elephants.
- In retaliation the villagers killed 98 elephants and badly injured 30 elephants.
- Several instances of killing of elephants in the border regions of Kote-Chamarajanagar belt in Mysore have been reported recently.
- In the early 2004, a man-eating tiger was reported to kill 16 Nepalese people and one 4-year old child inside the Royal Chitwan National Park of Kathmandu.

## Conservation of Biodiversity

- The enormous value of biodiversity due to their genetic, commercial, medical, esthetic, ecological and optional importance emphasizes the need to conserve biodiversity. There are two approaches of biodiversity conservation:

In situ conservation (within habitat):

- This is achieved by protection of wild flora and fauna in nature itself. At present in our country we have:

7 major Biosphere reserves: Nanda Devi (U.P.), Nokrek (Meghalaya), Manas

80 National Parks:

| National park | State | Wild life |
|---|---|---|
| Khaziranga | Assam | Single horned Rhino |
| Gir | Gujarat | Asiatic lion |
| Bandipur | Karnataka | Elephants |
| Periyar | Kerala | Elephants, Tigers |
| Sariska | Rajasthan | Tiger |

420 wild-life sanctuaries and

120 Botanical gardens

They totally cover 4% of the geographic area.

Ex situ conservation (outside habitats):

- This is done by establishment of gene banks, seed banks, zoos, botanical gardens, culture collections etc. In India we have

NBPGR: National burea of plant genetic research institute

NBAGR: National burea of animal genetic research institute

Tissue culture labs. Working towards Ex-situ conservation units.