

ECOSYSTEM

- Ecosystem is the functional unit of nature where living organisms interact amongst themselves and also with the surroundings physical environment. **Ecosystem- Structure and Function**
- There are two basic categories of ecosystem, namely the terrestrial and the aquatic.
- Terrestrial ecosystem - forest, grassland, desert etc.
- Aquatic ecosystem - ponds, lake, river estuary etc.
- The biotic and abiotic factors of ecosystem work in integrated manner for flow of energy within the components of ecosystem.
- Interaction of biotic and abiotic components results in a physical structure that is characteristic for each type of ecosystem.
- The vertical distribution of different species occupying different levels is called stratification.
- For example, trees occupy top vertical strata or layer of a forest, shrubs the second and herbs and grasses occupy the bottom layers.
- The functional components of ecosystem are- ○ **Productivity** ○ **Decomposition** ○ **Energy flow** ○ **Nutrient cycling**

Pond as an ecosystem

- The abiotic components are the water with all the dissolved inorganic and organic substances and the rich soil deposit at the bottom of the pond.
- The solar input, the cycle of temperature, day-length and other climatic conditions regulate the rate of function of the entire pond.
- The autotrophic components include the phytoplankton, some algae and the floating, submerged and marginal plants found at the edges.
- The consumers are represented by the zooplankton, the free swimming and bottom dwelling forms.
- The decomposers are the fungi, bacteria and flagellates especially abundant in the bottom of the pond.

PRODUCTIVITY

- In ecology, productivity refers to the rate of formation of biomass in the ecosystem. ○ It can also be referred to as the energy accumulated in the plants by photosynthesis. ○ There are two types of productivity, namely:
1.Primary Productivity 2.Secondary Productivity
- Primary productivity is defined as the amount of biomass or organic matter produced per unit area over a period time by plants during photosynthesis.
- Primary productivity is expressed in terms of weight or energy
- Primary productivity can be divided into

a) Gross primary productivity (GPP)

b) Net primary productivity (NPP).

- Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis.

- The solar energy trapped by the photosynthetic organism is called gross primary productivity
- Gross primary productivity minus respiration losses (R), is the net primary productivity (NPP).

$$GPP - R = NPP$$

- It is the net energy stored in the plants. This energy serves as food for the animals that feed on plants.
- Secondary productivity is defined as the rate of formation of new organic matter by consumers.

DECOMPOSITION

- Decomposition is the process by which the complex organic substances breakdown into simpler substances by the action of microorganisms.
- Dead plant remains such as leaves, bark, flowers and dead remains of animals, including fecal matter is called **detritus**.
- Detritus is the raw material for decomposition.
- **Detritivores** are the organisms that break down detritus into smaller particles. Example- millipedes, dung flies, wood lice, burying beetles.
- The important steps in the process of decomposition are
- 1.Fragmentation, 2.Leaching, 3.Catabolism, 4.Humification, 5.Mineralisation

Fragmentation

- It is the initial stage of decomposition.
- Fragmentation means the breakdown of detritus into smaller pieces by the detritivores

Leaching

- The fragmented particles may contain a lot of water-soluble nutrients which are inorganic in nature.
- The process by which water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts is called as leaching.

Catabolism

- The process by which bacterial and fungal enzymes degrade detritus into simpler inorganic substances called as catabolism.
- #### Humification
- It is the accumulation of a dark coloured amorphous substance called humus.

Mineralisation.

- The humus is further degraded by some microbes and release of inorganic nutrients occur by the process known as mineralisation.

Factors affecting the rate of decomposition

1. **Chemical composition**
 - Decomposition rate will be slow when detritus is rich in lignin and chitin
 - Rate of decomposition increases when detritus is rich in nitrogen and water soluble substances like sugars.
2. **Climatic conditions**
 - Warm and moist environment favour decomposition and low temperature and anaerobiosis (life in the absence of free oxygen) inhibit decomposition.

ENERGY FLOW

- All living organisms are directly or indirectly dependent on producers, for their food.
- There is a unidirectional flow of energy from the sun to producers and then to consumers.
- Photo synthetically active radiation (PAR) is responsible for the synthesis of food by plants.
- Animals obtain their food from plants, so they are called consumers.
- Animals feed on green plants are called primary consumers or herbivores.
- The animals eat herbivores are called secondary consumers or primary carnivores. Example- goat
- The animals which feed on primary carnivores are called tertiary consumers or secondary carnivores. Example- man.
- Based on the source of their nutrition or food, organisms occupy a specific place in the food chain that is known as their **trophic level**.
- Producers belong to the first trophic level, herbivores (primary consumer) to the second and carnivores (secondary consumer) to the third trophic level.
- **Food chain** is the flow of energy from one trophic level to another trophic level by eating and being eaten. Eg. **Grass --> goat --> man**
- Food chain is the flow of energy from one trophic level to another trophic level by eating and being eaten. Food chain is two types-
 - **Grazing food chain (GFC)**
 - **Detritus food chain (DFC)**
- Food chain which starts from producers and ends on carnivores through herbivores is called grazing food chain. **Grass --> goat --> man**
- Food chain which starts from dead organic matter and passes through organisms feeding on detritus is called detritus food chain.
- Detritus are decomposers which meet their energy and nutrient requirements by degrading dead organic matter or detritus, these are also known as saprotrophs.
- The interconnected matrix of food chain is called **food web**.
- For example- specific herbivore of one food chain may serve as food of carnivores in another food chain.
- Each trophic level has a certain mass of living material at a particular time called as the **standing crop**.

- The standing crop is measured as the mass of living organisms (biomass) or the number in a unit area.

ECOLOGICAL PYRAMIDS

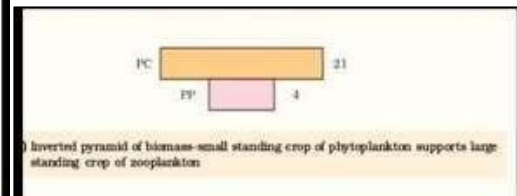
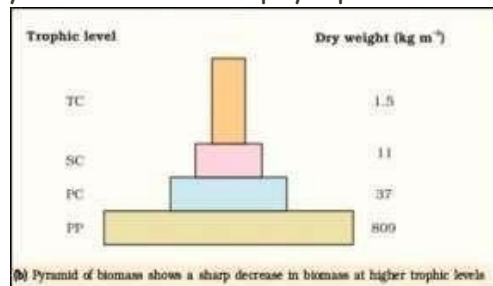
- An ecological pyramid is a graphical representation of the relationship between the different living organisms at different trophic levels.
- The base of a pyramid is broad and it narrows down at the apex.
- The base of each pyramid represents the producers or the first trophic level while the apex represents tertiary or top level consumer.
- The three ecological pyramids that are usually studied are

a) Pyramids of number

- Represents the number of individuals per unit area at various trophic levels with producer at base and various consumers at successively higher levels.
- It is generally upright.
- A pyramid of number in case of a big tree is generally inverted because number of insects feeding on that tree generally exceeds in number.

b) Pyramids of biomass-

- represent the biomass in various trophic levels.
- A pyramid of biomass is upright except in aquatic food chain involving short lived plankton.
- A pyramid of biomass in sea is generally inverted because biomass of fishes generally exceeds that of phytoplankton



- c) **Pyramids of energy-**
 - It gives graphic representation of amount of energy trapped by different trophic levels per unit area.
 - Pyramid of energy is always upright, can never be inverted, because energy flows from producer level to the consumer level. Limitations of ecological pyramids
- It does not taken into account the same species belonging to two or more trophic levels.
- It assumes a simple food chain, something that almost never exists in nature
- It does not accommodate a food web.
- Saprophytes are not given any place in ecological pyramids.