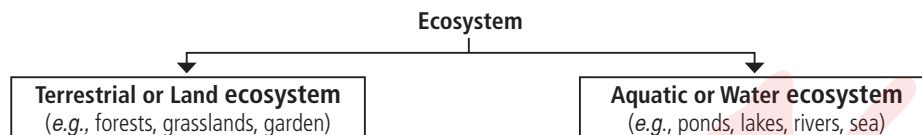


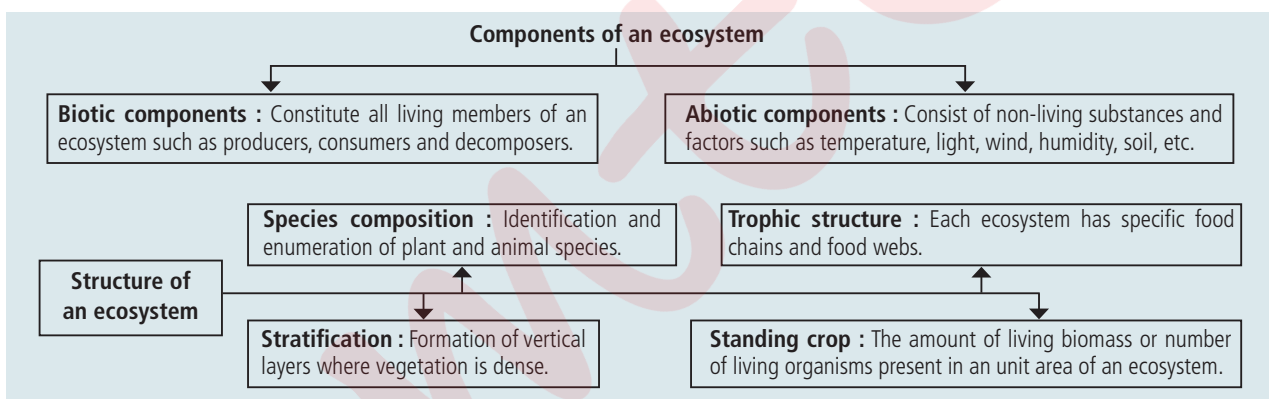
ECOSYSTEM

At a Glance

- ➔ **Ecosystem** is a self regulated and self sustaining structural and functional unit of nature (biosphere), consisting of a community of living beings and its physical environment both interacting and exchanging materials between them.
- ➔ The term ecosystem was coined by **Tansley** in 1935.



- ➔ A **natural ecosystem** is one which develops in nature without human support or interference, e.g., forest, marine ecosystem.
- ➔ An **anthropogenic** or **artificial** or **man-made ecosystem** is the one which is created and maintained by human beings, e.g., agriculture, garden, aquarium, etc. Agriculture or agroecosystem is the largest manmade ecosystem.
- ➔ An ecosystem is made up of two types of components; biotic and abiotic.



PRODUCTIVITY

- ➔ The rate of biomass production *i.e.*, the rate at which sunlight is captured by producers for the synthesis of energy rich organic compounds is called productivity. It is of following types:
- ➔ **Primary productivity**: It is the amount of biomass or organic matter produced per unit area over a time period by plants through photosynthesis. The rate of energy production by green plants per unit area per unit time is the **gross primary productivity (GPP)**. A considerable amount of GPP is utilised by plants in respiration (R). The energy left after respiration and stored as organic matter in the producers per unit time and area is called **net primary productivity (NPP)**.
$$NPP = GPP - R$$
- ➔ **Secondary productivity** refers to the synthesis of organic matter by consumers. It depends upon loss of energy due to respiration and predation, while transferring energy from one trophic level to next.

DECOMPOSITION

- ➔ It is physical and chemical breakdown of complex organic remains (**detritus**) with the help of organisms called **decomposers**. The decomposers (e.g., bacteria, fungi) excrete digestive enzymes over the detritus.

- Decomposition is dependent on **oxygen availability**. It also depends on the **chemical composition** of detritus and **climatic conditions**. Decomposition is **faster** when detritus is rich in nitrogen and sugars and slower when detritus is rich in lignin and chitin. **Warm and moist environment** favours decomposition.
- Decomposition completely disposes off the whole detritus. It involves the following processes:
 - (i) **Fragmentation of detritus** : It involves feeding of detritivores on larger pieces and smaller fragments are left. Pulverisation occurs and part of the detritus comes out undigested. Due to fragmentation, left over detritus comes to have large surface area.
 - (ii) **Catabolism**: Decomposers excrete digestive enzymes over the detritus. It changes insoluble complex organic substances into simple and soluble organic compounds and inorganic substances.
 - (iii) **Leaching** : Soluble substances formed during decomposition are subjected to leaching or passage to deeper layers of soil by percolating water.
- Decomposition process gives rise to two products, **humus** and **inorganic nutrients**.
- **Humification** is the process of formation of humus from detritus or organic remains.
- **Mineralisation** is the release of inorganic substances, both non-mineral and minerals from organic matter.

TROPHIC LEVELS

- A trophic level is a step or division of food chain which is characterised by the method of obtaining its food. The number of trophic levels is equal to the number of steps in the food chain.

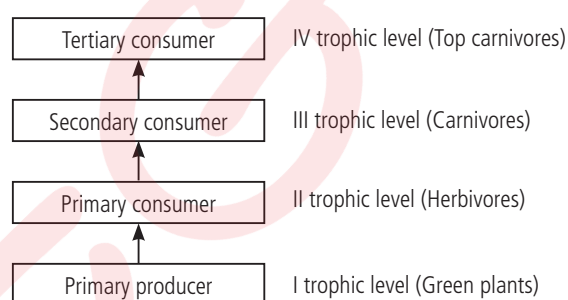


Fig.: Trophic levels in an ecosystem

- The two fundamental trophic levels are **producers** and **consumers**. **Decomposers** form the last or detritus trophic level. **Parasites** do not have any fixed trophic level since they feed on producers, herbivores and carnivores of various levels, e.g., aphids, ticks, mites, etc.

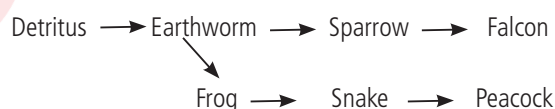
- Organisms of one trophic level have the same food habit. A group of species belonging to a trophic level which exploits a common resource base in a similar fashion is known as **guild**, e.g., nectar feeding birds.

FOOD CHAIN

- A food chain is defined as a sequence of group of organisms in which there is transfer of food energy through a series of repeated process of eating and being eaten.
- A food chain is generally straight and there is a progressive reduction in available biomass. The number of steps in a food chain is limited to four or five and at each step a large portion of the energy is lost as heat. In a food chain, there is **unidirectional flow of energy**.

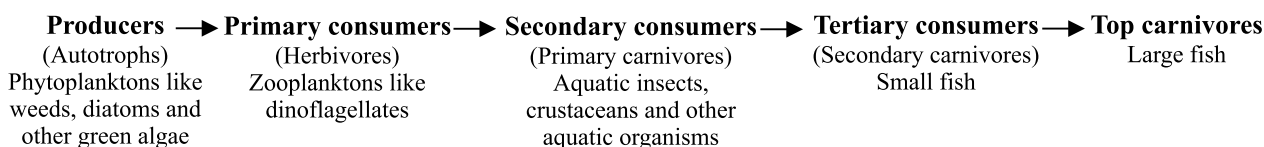
TYPES OF FOOD CHAIN

- (i) **Detritus food chain (DFC)** begins with detritus or dead organic matter. Detritivores and decomposers feed over it. Therefore, food energy present in detritus passes into them. Detritivores and decomposers are consumed by smaller carnivores which in turn become food for larger carnivores and so on. A common detritus food chain with earthworm as detritivore is:



- (ii) **Grazing food chain (GFC)** is the most common food chain. It is also called **predator food chain**, as predation occurs at every step. This food chain consists of producers, consumers and decomposers.

A typical food chain in an aquatic system is as follows:



ENERGY FLOW

- ➡ Sun is the ultimate source of energy in all ecosystems.
- ➡ Energy does not remain trapped permanently in any organisms. It is either passed on to the higher trophic level or becomes available to detritivores and decomposers after the organism dies.
- ➡ Flow of energy in an ecosystem is unidirectional.
- ➡ There is a decrease in the content and flow of energy with the rise in trophic level. Only 10% of the herbivore productivity is utilised for raising productivity of primary carnivores. Higher carnivores similarly are able to retain only 10% of energy present in primary carnivores. It is called **10% law** proposed by **Lindeman** in 1942.

FOOD WEB

- ➡ Food web is a network of food chains which become interconnected at various trophic levels so as to form a number of feeding connections amongst the different organisms of a biotic community. Food web is meant for increasing the stability of an ecosystem by providing alternate source of food and allowing the endangered population to grow in size.

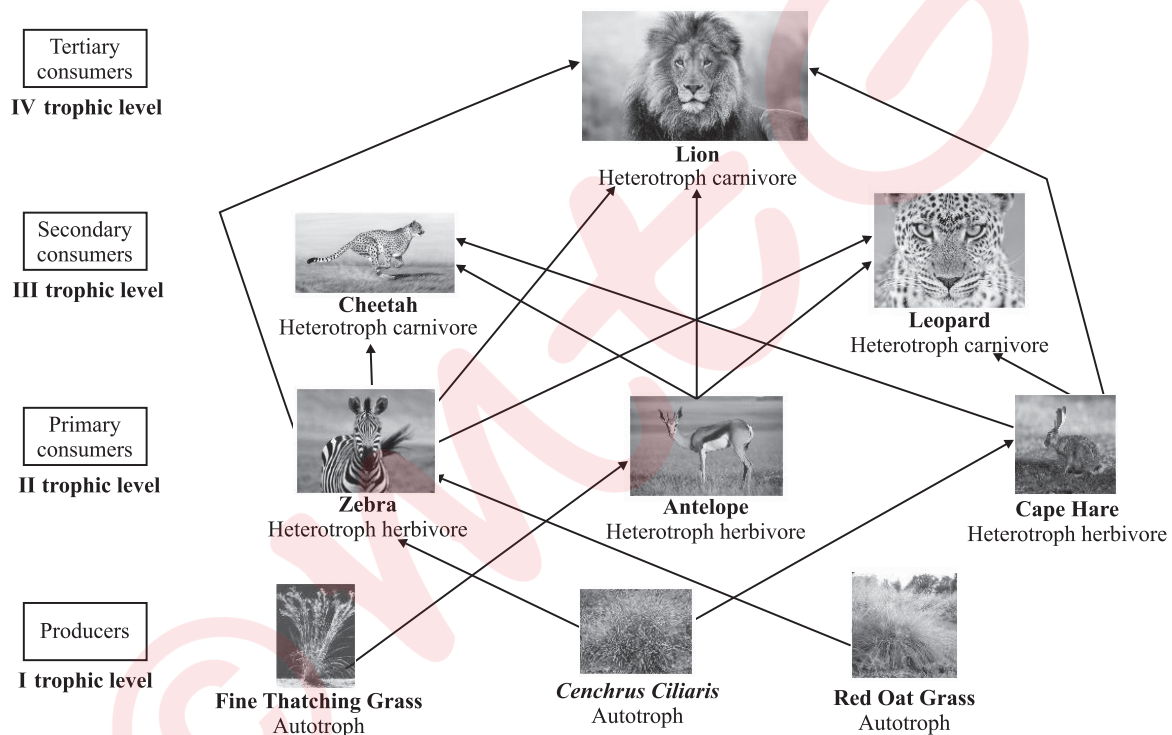


Fig.: A typical food web

ECOLOGICAL PYRAMIDS

- ➡ An ecological pyramid is a **graphical representation** of the relationship between individuals present in the various trophic levels of a food chain with producers forming the base and top carnivores the tip. Ecological pyramids were developed by **Charles Elton** (1927) and are therefore also known as **Eltonian pyramids**.
- ➡ An ecological pyramid can be **upright, inverted** or **spindle shaped**.
- ➡ Ecological pyramids are of three types :
 - (i) **Pyramid of numbers** : It represents the number of individual organisms per unit area of various trophic levels.
 - (ii) **Pyramid of biomass** : It is the graphical representation of biomass present sequence-wise per unit area of different trophic levels with producers at the base and top carnivores at the apex.

- (iii) **Pyramid of energy** : It is graphical representation of amount of energy trapped per unit time and area in different trophic levels of a food chain. It is always upright.

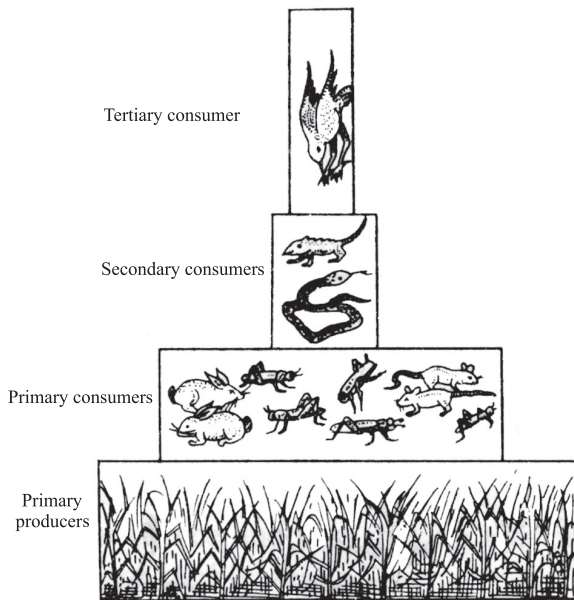


Fig.: Upright pyramid of number in grassland ecosystem

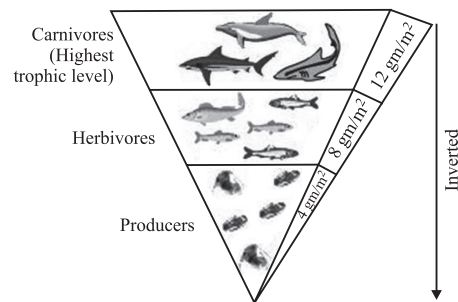


Fig.: Inverted pyramid of biomass in an aquatic ecosystem

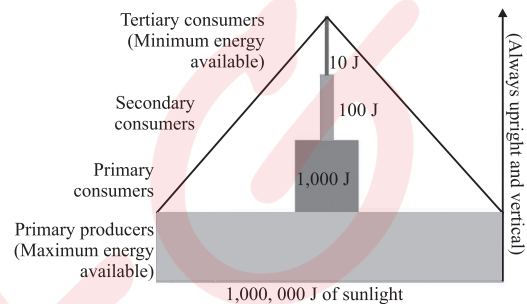


Fig.: An ideal pyramid of energy with primary producers storing only 1% of solar energy as NPP

LIMITATIONS OF ECOLOGICAL PYRAMIDS

- ➔ Ecological pyramids assume that food chains are simple, although simple food chains do not occur in nature. Instead, food webs are present.
- ➔ A single species may operate at two or more trophic levels. Ecological pyramids have no method of accommodating such cases.
- ➔ Ecological pyramids have no place for detritivores and decomposers, though they play a vital role in ecosystem.

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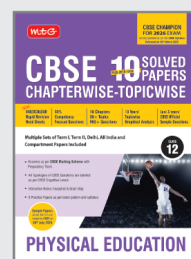
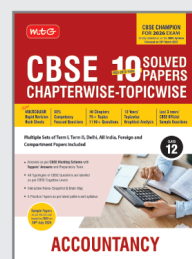
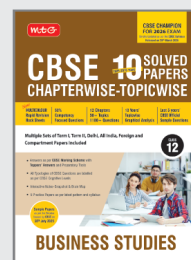
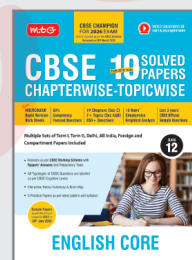
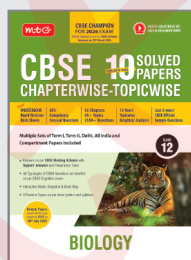
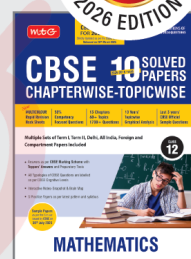
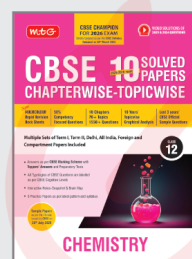
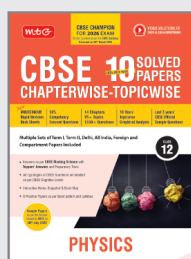
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