

# INTRODUCTION

- ♦ **A.G. Tansley** – The term "ecosystem" first of all coined by A.G. Tansley.  
**According to Tansley** – Ecosystem is symbol of structure and function of nature.
- ♦ **E.P. Odum** – Father of ecosystem ecology.  
**According to E.P. Odum** – Ecosystem is the smallest structural and functional unit of nature or environment.
- ♦ **Karl Mobius** – Used term biocoenosis for ecosystem  
**Definition** – Total living factor (biotic) and total non living factor (abiotic) of the environment present in a particular area is called ecosystem.

## Note :

- ♦ The boundaries of ecosystem are indistinct and have a overlapping character over each other.
- ♦ Ecosystem is the smallest structural and functional unit of nature or environment. It is a self regulatory and self sustaining unit.

- ♦ Ecosystem may be large or small. Single drop of water may be an ecosystem.
- ♦ Ecosystem may be temporary or permanent.

## 1. TYPE OF ECOSYSTEM

### A. Natural Ecosystem –

#### a. Terrestrial Ecosystem –

e.g. forest, grassland, tree, desert ecosystem

#### b. Aquatic ecosystem – Aquatic ecosystem is again of two type :

- (i) Lentic ecosystem → stagnant fresh water, lake, pond, swamp.
- (ii) Lotic – Running fresh water ecosystem  
e.g. - river.

## B. Artificial Ecosystem

Man made e.g. cropland, Gardens etc.

**On the basis of size types of ecosystem**

- (i) Mega ecosystem – Ocean/Sea
- (ii) Macroecosystem – Forest
- (iii) Microecosystem – Pond
- (iv) Nanoecosystem – Drop of water

## 2. COMPONENTS OF ECOSYSTEM

Every ecosystem is composed of two components -

### BIOTIC COMPONENT

It involve all livings (plant, animal and microbes) of ecosystem. Biotic component are mainly of two type.

#### 1. Producers –

All the autotrophs of ecosystem are called producers. They prepare their own food. The green plants are the main producers. In the process of photosynthesis, producers absorb solar energy and convert it into chemical energy so producers are also called **transducers or converters**.

Energy enters into the ecosystem through the producers. The **solar energy** is the only ultimate source of energy in ecosystem. This energy is available for the remaining living organisms.

- ♦ **In aquatic ecosystem :** Floating plants called **phytoplankton** are the major autotrophs.

#### 2. Consumer –

All the heterotrophs of the ecosystem are known as consumers. They directly (herbivores) or indirectly (Carnivores) depend on the producers for food.



**Types of consumer**(i) **Macroconsumers** (ii) **Microconsumers**

- (i) **Macro consumers (Phagotrophs or holozoic)** – They digest their food inside the body of organism i.e. first ingestion then digestion.

**Macro consumers are of following type**

- (a) **Primary consumer** – Such living organisms which obtain food directly from producers or plants are known as primary consumers.

e.g. herbivores of ecosystem, cow, grazing cattle, Rabbit.

- ◆ These are also known as secondary producers

- (b) **Secondary consumers or primary carnivores** – Animals which feed upon primary consumers and obtain food. Those carnivores which kill and eat the herbivores.

e.g. Dog, cat, snake

- (c) **Top Consumers** – Those animals which kill other animals and eat them, but they are not killed & eaten by other animal in the nature.

e.g. Lion, man, hawk, peacock

- (ii) **Micro Consumers/Decomposers or Saprotrophs /osmotrophs** –

Those living organisms which decompose the dead body of producers and consumers are known as decomposers or reducers or transformers or osmotrophs.

**Note :**

- ◆ The main decomposers in ecosystem are bacteria and fungi.
- ◆ Decomposers play a significant role in **mineral cycle**. Decomposers are responsible for converting complex organic material of dead animals or plants into simpler organic matter through the process of decomposition and release mineral substances into the soil where these are reused by the producers, So that soil is considered as the best resource of minerals.
- ◆ In Bacteria and fungi, process of decomposition completely takes place outside the body. They release enzymes from their body on dead remains and decompose it into simpler organic substances and then absorb it so these are called as **osmotrophs (absorptive)**.

**SPECIAL POINT OF BIOTIC FACTOR**

- ◆ **Nutrient Immobilisation**- In the process of decomposition, some nutrients get tied up with the biomass of microbes and become temporarily unavailable to other organisms. Such incorporation of nutrient in living microbes (bacteria & fungi) is called **nutrient immobilisation**.
- ◆ In aquatic system **whale** is secondary consumer. It is an example of **filter feeder** because it feeds on plankton.
- ◆ **Plant parasites** are known as primary consumers while animals parasites (E.coli bacteria, Entamoeba histolitica, liver fluke, tapeworm) are known as secondary consumers.
- ◆ **All the insectivorous** plants play the double role i.e. producer as well as secondary consumer because they synthesise their own food through photosynthesis and they eat insects simultaneously.
- ◆ **Man and peacock** are omnivores.
- ◆ Organisms which use **milk** or **curd** are known as secondary consumer.

**Note :**

**Inorganic materials** ( $\text{CO}_2$ ,  $\text{H}_2\text{O}$ , Light), autotrophs (**Producers**) and **decomposers** are essential in ecosystem but, **macro consumers** are non essential.

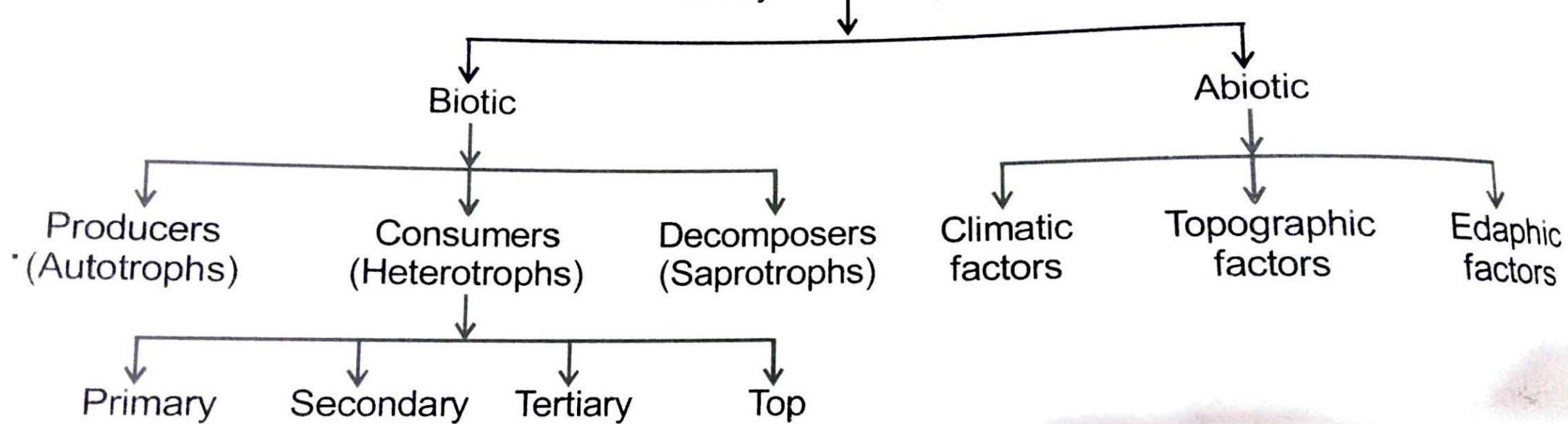
**Functional aspects of ecosystem :**

- (i) **Energy flow** (ii) **Nutrient cycling**  
(iii) **Productivity** (iv) **Decomposition**

**Energy flow** – The storage, expenditure, transformation of energy is based on two basic law of thermodynamics –

- ◆ First law of thermodynamics :- Energy is neither created nor destroyed but only transformed from one state to another state.
- ◆ Second law of thermodynamics (the law of entropy) - The transfer of food energy from one to another organism leads to loss of energy as heat due to metabolic activity. Further. ecosystems

# Ecosystem Components





**Productivity of biosphere** : Annual NPP of whole biosphere is approximately 170 billion tons (dry weight) of organic matter. Of this, despite occupying about 70% of the surface, the productivity of oceans are only 55 billion tons and for terrestrial system is 115 billion tons.

**Reasons for the low productivity of oceans** : In deep marine habitats two main limiting factors are there.

- (i) **Light** : It decreases with depth.
- (ii) **Nutrients** : Most limiting nutrient of marine ecosystem is **nitrogen**.

**(ii) Secondary productivity :**

It is the rate of formation of new organic matter by consumers.

- (iii) Community productivity** : It is the rate of net synthesis and built up of organic matter by a community per unit time and area.
- (iv) Ecological efficiency/Trophic level efficiency** : The percentage of energy converted into biomass by a higher trophic level over the energy of food resources available at the lower trophic level is called ecological efficiency.

$$\text{Ecological efficiency} = \frac{\text{Energy converted into biomass at a trophic level}}{\text{Energy present in biomass at lower trophic level}} \times 100$$

**(v) Photosynthetic efficiency** =  $\frac{\text{Gross primary productivity}}{\text{Incident total solar radiation}} \times 100$

**(vi) Net production efficiency** =  $\frac{\text{Net primary productivity}}{\text{Gross primary productivity}} \times 100$

Incident solar radiation  
(100%)



Photosynthetically  
active radiation (PAR)  
(Less than 50%)

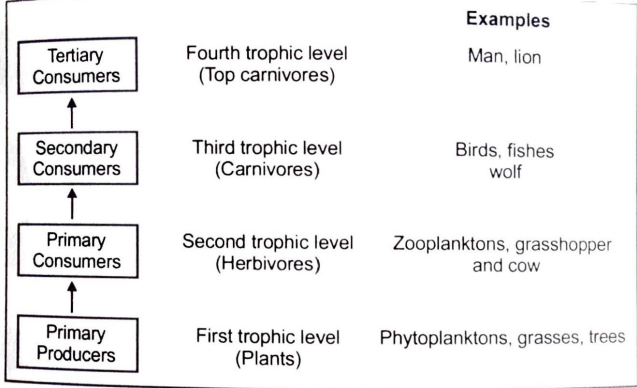
↓ Energy loss (45–49%)

Captured in  
photosynthesis (GPP)  
(1–5%)

↓ Respiratory loss (0.2–1%)

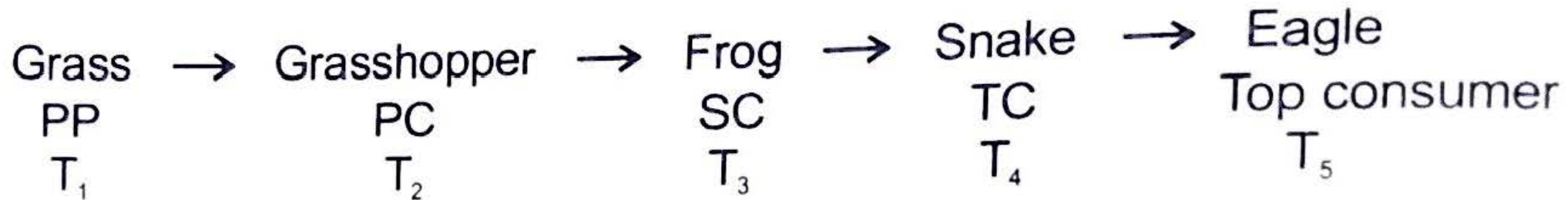
NPP  
(0.8–4%)

Absorbed by  
gases/water vapours;  
reflected by clouds;  
scattered by  
dust particles  
(More than 50%)



**Fig.:** Diagrammatic representation of trophic levels in an ecosystem

## Terrestrial food chain:

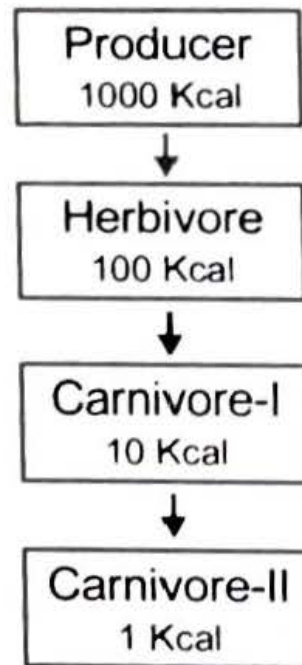


## Aquatic food chain :



## Ten Percent Law of Energy Transfer:

The law was proposed by **Lindeman** in 1942. The transfer of energy from one trophic level to another trophic level is accompanied by loss of energy at each level or step. When the plants are eaten by herbivore, about 10% of energy in the food is fixed into animal flesh while 90% is consumed in ingestion, respiration, maintenance of body heat and other activities. Similarly, when a carnivore consumes that herbivore, again about 10% of energy is fixed. Therefore, at each transfer only 10% of the total energy is actually available to the next trophic level. It is called 10% law.





## Types of Successional Communities

- (i) **Pioneer community** : The first biotic community that develops in a bare area is termed as pioneer community. *e.g.*, Lichens on rock, phytoplanktons and zooplanktons in pond.
- (ii) **Transitional or seral community** : The pioneer community is followed by a specific orderly sequence of series of plant communities know as seral communities. *e.g.*, Bryophytes, herbs, shrubs in xerosere; submerged, floating etc. in pond.
- (iii) **Climax community** : The last community in biotic succession which is relatively stable and is in near equilibrium with the environment of that area is called climax community. *e.g.*, Forests.

The entire series of communities occurring in biotic succession is called **sere**. The individual transitional communities are termed seral stages or seral communities.

## Types of Succession

- (i) Depending upon nature of habitat it starts, it is of two types *i.e.*,

Xerosere or Xerarch succession	Hydrosere or Hydrarch succession
Takes place in dry areas like rock (lithosere), sand (psammosere) and saline conditions (halosere).	Starts in aquatic habitat.

Depending upon the type of nudity of the area, it is of two types:

Primary succession	Secondary succession
<ul style="list-style-type: none"><li>(a) It starts at barren area, never having vegetation of any type or where no living organism ever existed.</li><li>(b) Cooled volcanic lava, sand dunes, igneous rocks, newly exposed sea or newly submerged terrestrial habitats in water, etc., are the areas where primary succession starts.</li><li>(c) It is very difficult for the pioneer community to get established in these areas.</li><li>(d) It takes natural processes several hundred to several thousands years to produce fertile soil on bare rock thus it takes a very long time to reach climax.</li></ul>	<ul style="list-style-type: none"><li>(a) It starts in areas that somehow lost all the living organisms that existed there.</li><li>(b) It occurs in areas such as in abandoned farm lands, burned or cut forests, lands that have been flooded.</li><li>(c) Pioneer community establishes with comparatively more ease.</li><li>(d) Since some soil or sediment is present, succession is faster. Here, climax is also reached more quickly.</li></ul>

# **Types of Biogeochemical Cycles**

## **(i) Gaseous cycle**

- (a)** Exchange of nutrients occurs in gaseous or vapour form.
- (b)** Biogeochemical is non-mineral.
- (c)** Reservoir pool is atmosphere or hydrosphere.  
*e.g.*, Nitrogen, Carbon, Oxygen, Hydrogen cycle.



**(ii) Sedimentary cycle**

(a) Biogeochemical is mineral.

(b) Reservoir pool is earth's crust or lithosphere.

*e.g.*, Sulphur, Phosphorous cycle.