TOPIC: Ecosystems- components, types, energy flow; Food chain, food web.

The living organisms and non-living environment are inseparably inter-related and also interact with each other. Keeping this view in mind, the term ecosystem was proposed by the British ecologists **A. G. Tansley** (1935), who defined the ecosystem as "The system resulting from the integration of all the living (Biotic) and non-living (Abiotic) factors of the environment." Same idea was proposed by **V. Sukachaev** (1944) in the term of **Biogeocoenosis.**

Components of ecosystem

The biotic and abiotic parts are the basic components of ecosystem—

(1) Abiotic components: Basic abiotic components are:

(i) **Inorganic substances** like C, N, P, H, O, S, etc. which are involved in the mineral cycle.

(ii) Organic compounds: It includes carbohydrates, fats, proteins, which link the biotic and abiotic components eratuke.

(iii) Climatic regime: Solar radiation, temperature, and other physical factors making the climate to the given region.

(2) Biotic components: These are represent trophic (nutrition) structure of any ecosystem where living organisms are distinguish on the basis of their nutritional relationships—

(a) Autotrops or Producers: Green plants including photosynthetic bacteria, which they build organic food through the process of photosynthesis.

It also includes some chemosynthetic bacteria which also contribute to build of organic matter.

(b) Heterotrops or Consumers: These are fungi, most of the bacteria and animals. These lack chlorophyll and obtain their food energy directly or indirectly from the autotrops. It further categorised into—

(i) Macro-Consumers —These denotes orderly placed animals-such as, herbivores (Primary consumers), Carnivores (Secondary Consumer) based on the pattern of food chain.

(ii) Micro-Consumers (Decomposers) —It includes mainly bacteria, Achnomycetes and fungi. They break down of complex compound or living protoplasm into simpler substances and release them. So that these substances can be reutilised by the primary producers.

Trophic Structure

The producers-Consumers arrangement is one kind of structure called as trophic structure.

(i) Food Chain: Simple and linear relationship between the producer and consumer of different trophic level is called food chain. In this case the food energy moves from green plant to the top carnivores in one linear direction e.g., grass gives food to grasshopper which are eaten by frog and frogs are eaten by snake.

Grass → Grasshopper → Frog → Snake

It is of 3 types —

(A) Predator Chain —Start from producers through herbivores and end to the carnivores e.g. –

Green plants → Rabbit → Jackal → Tiger

(B) Parasitic Chain —Starting from larger animals and goes to smaller animals, e.g.

Human beings → Helminthes → Bacteria → Crop plant → Parasite → Hyper parasite.

(C) Saprophytic Chain —Start from organic materials and goes to micro-organisms, e.g.,

Fallen twig or leaves → Primary colonizer → Secondary colonizer.

(ii) Food Web—In any ecosystem no organism is fully dependent on only one source.

The linear arrangement of food chains interconnected with each other through different types of organisms at the different trophic levels. In this case feeding relationship are not in chain but net like. This net like relationship between producers and consumers of different level is called Food Web.

(iii) Trophic level—The food chain in any ecosystem can not be more than five stage (Elton 1947). All the organism with similar feeding habitats in food chain have been grouped together as trophic level. The graphic representation of trophic level is given below—

Producer → Herbivores → Carnivores → Top Carnivores → Decomposers

T_1 T_2 T_3 T_4 T_5

The no. of organism at T_1 is always higher than that of T_2, T_3, T_4, level at least.

Characteristics of Grazing Food Chain

(a) These are directly dependent upon solar radiations as the primary source of energy and the producers (green plants) synthesize their plant biomass by the process of photosynthesis. Producers form the first trophic level.

(b) Herbivores or primary consumers eat upon the producers and form the second trophic level.

(c) Herbivores are in-turn eaten by different categories of carnivores forming the higher trophic levels.

(d) Grazing food chains are longer food chains and they always end at decomposer level.

Type of Ecosystem	Producers	Herbivores	Primary Carnivores	Secondary Carnivores	Tertiary Carnivores
A. Grassland Ecosystem	1. Grasses 2. Grasses 3. Grasses	Insects Rats and Mice Rabbit	Frogs Snakes Fox	Snakes Predatory Birds Wolf	Predatory Birds Lion
B. Pond Ecosystem	Phytoplankton	Zooplanktons	Small Fishes	Large Fishes	Predatory Birds
C. Forest Ecosystem	Trees	Phytophagous Insects, Herbivore Mammals	Lizards Birds Foxes	Lions Tigers Etc.	

Characteristics of Detritus Food Chain

a) Primary source of energy is dead organic matter called 'detritus' which are fallen leaves, plant parts or dead animal bodies.

b) Primary consumers are 'detritivores' including protozoans, bacteria, fungi, etc which feed upon the detritus saprophytically.

c) Detritivores are in turn eaten by secondary consumers such as insect larvae, nematodes, etc.

d) Detritus food chains are generally shorter than grazing food chains

e) In nature, detritus food chains are indispensable as the dead organic matter of grazing food chain is acted upon by the detritivores to recycle the inorganic elements into the ecosystem.

Detritus food chain

Detritus	Detritivores	Detritivores Consumers	Small Carnivores	Large Carnivores
Mangrove Follen Leaves and Dead Bodies	Fungi,Bacteria and Protozoans	Insect Larvae,Certain Crustaceans,Molluscs and Fishes	Minnows Small game fish etc.	Large Fish,Fish eating Birds

Differences between Grazing and Detritus food Chains

Characters	Grazing food chain	Detritus food chain
Primary source of energy	Solar radiations	Detritus
First trophic level	All herbivores	Detritivores (a mixed group in terms of trophic levels and may be herbivores, omnivores and primary carnivores)
Size	Long-sized chains	Small-sized chains

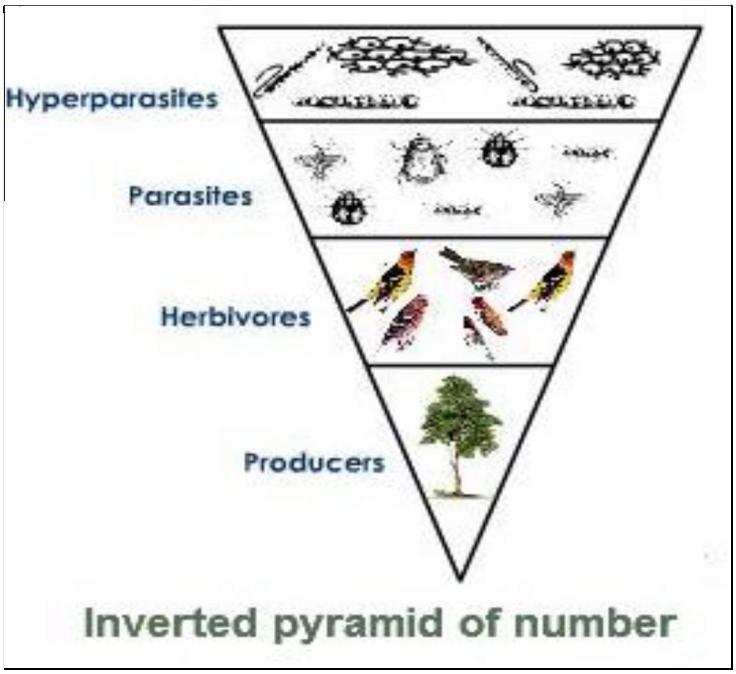
1. **Ecological Pyramid**— **Ecological pyramids** are diagrams that illustrate how ecologically important factors, such as energy, biomass, and population size, vary between trophic levels in an ecosystem.

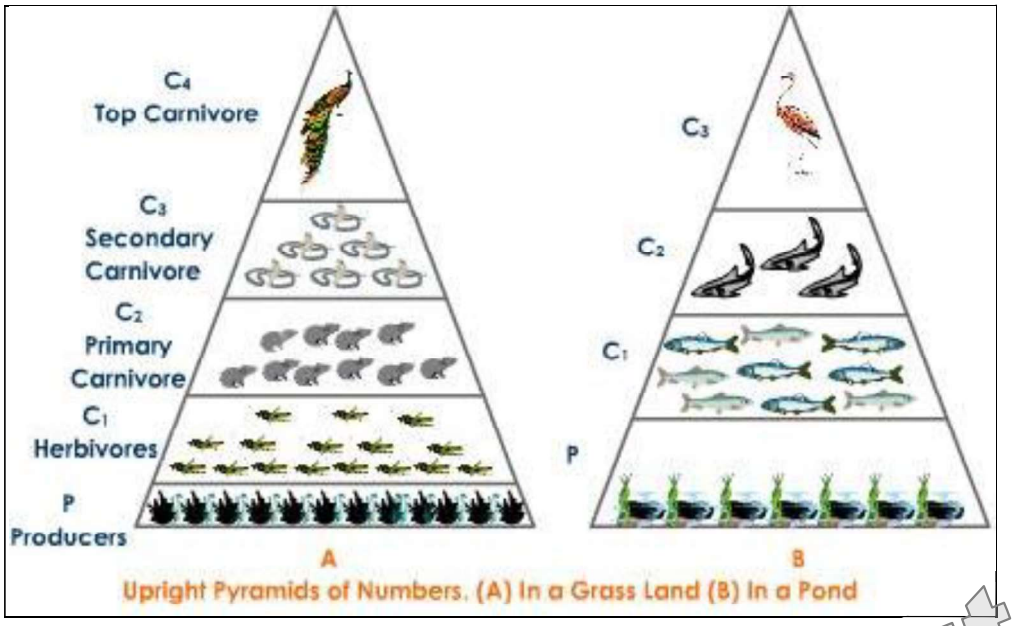
The trophic structure and function at successive trophic level form the ecological pyramids i.e. → producers → herbivores → carnivores, may be shown by means of ecological pyramids.

(a) Pyramid of number— It deals relationship between the number of primary producers and consumers at different trophic levels.

(i) In crop land ecosystem primary producers are large in numbers forming upright pyramid.

(ii) In forest ecosystem when the primary producers are less number forming pyramid which is inverted.



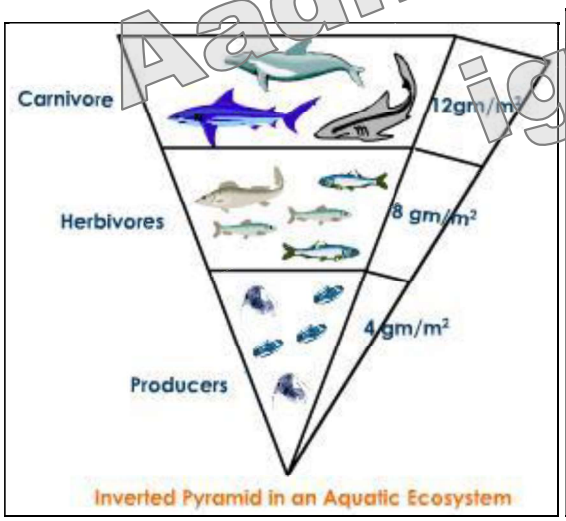


Upright Pyramids of Numbers. (A) In a Grass Land (B) In a Pond

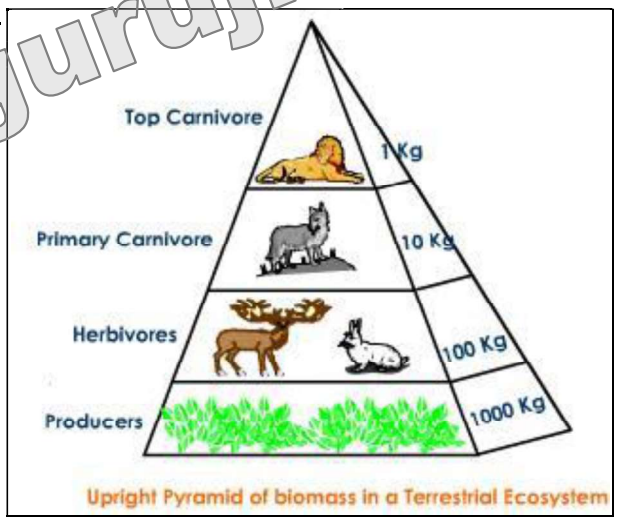
(b) Pyramid of biomass:

(i) In terrestrial ecosystem, the biomass of all the primary producers is always maximum and top carnivores have low biomass. So it is upright pyramid.

(ii) In aquatic ecosystem the biomass of consumers is always higher than primary producers & invert pyramid.



Inverted Pyramid in an Aquatic Ecosystem



Upright Pyramid of biomass in a Terrestrial Ecosystem

(c) Pyramid of energy: It represent the productivity of the system at each trophic level values of energy accumulation at each level per square metre per yr. are obtained for any ecosystems.

Such pyramid for all ecosystems is always upright. T_1 possess maximum value, starting from herbivores the energy value per square metre year increase by l/10th.