Ecological Pyramids

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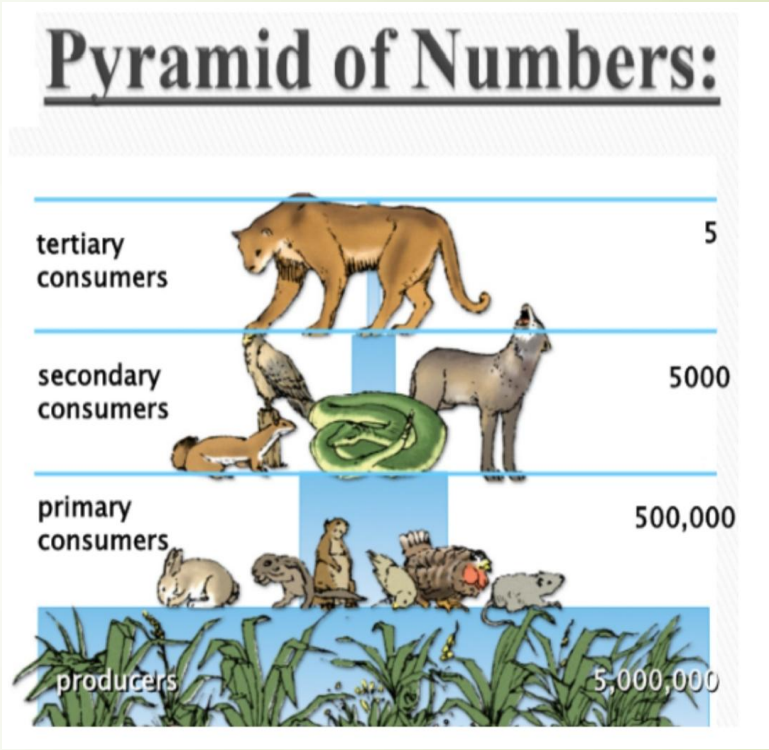
Trophic structure:

- The arrangement of biotic components of the food chain (Producers-herbivores-carnivores) according to their size and metabolic relationship is known as ‘Trophic structure’.
- This relationship between the various trophic levels of a food chain can be shown diagrammatically by Ecological pyramids.
- **An ecological pyramid**: is defined as the graphical representation showing the relationship between the various trophic levels of a community. Ecological pyramid was first proposed by British Ecologist, Charles Elton (1927), and can also be called as ‘Eltonian pyramids’.

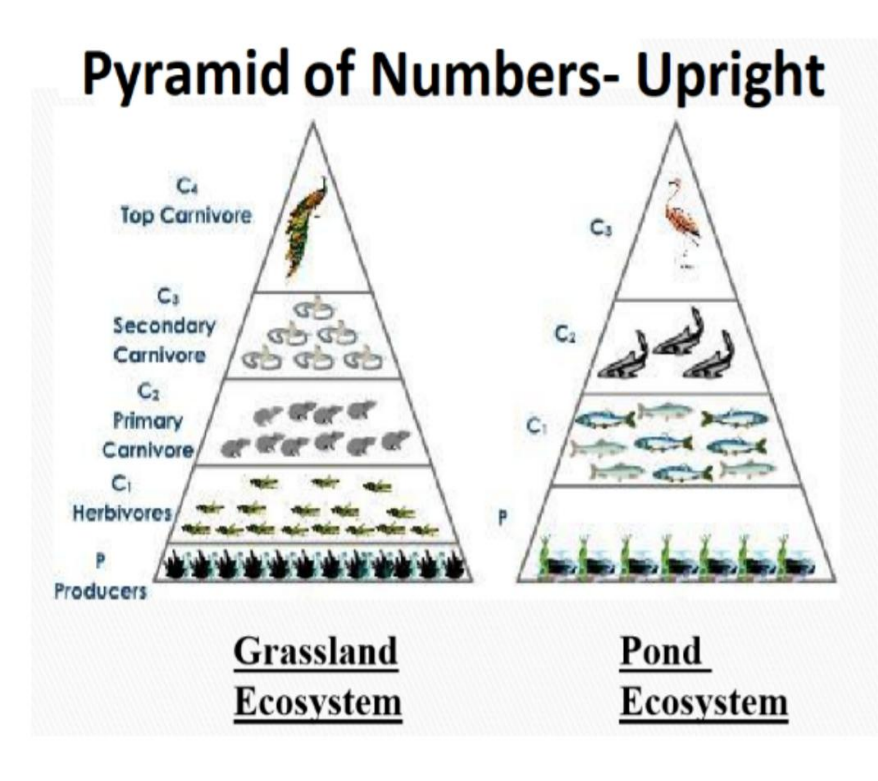
1. PYRAMID OF NUMBER

- show the graphic relationship between producers, herbivores and carnivores at successive trophic levels in terms of their number.
- Pyramid of numbers represents the total number of individuals of different species (population) at each trophic level.
- Depending upon the size, the pyramid of numbers may not always be upright, and may even be completely inverted.



PYRAMID OF NUMBER:

1. UPRIGHT:



In this pyramid, the number of individuals is decreased from lower level to higher trophic level.

(i) In a Grassland ecosystem:

- In a grassland the producers, which are mainly grasses, are always maximum in number.
- The next higher trophic level is primary consumer – herbivores like a grasshopper whose number is always less than that of grass.
- The next energy level is a primary carnivore like rats which less than grasshopper. The next higher trophic level is secondary carnivore like snakes. They feed on rats.
- The next higher trophic level is the top carnivore like Hawk or birds, are least in number.

(ii) In a Pond ecosystem:

- The producers, which are mainly the phyto-planktons as algae, bacteria etc. are maximum in number;
- The herbivores, which are smaller fish; rotifers etc are less in number than the producers;
- The secondary consumers (carnivores), such as small fish which eat up each other, water beetles etc. are less in number than the herbivore. Finally, the top (tertiary) consumers, the bigger fish are least in number.

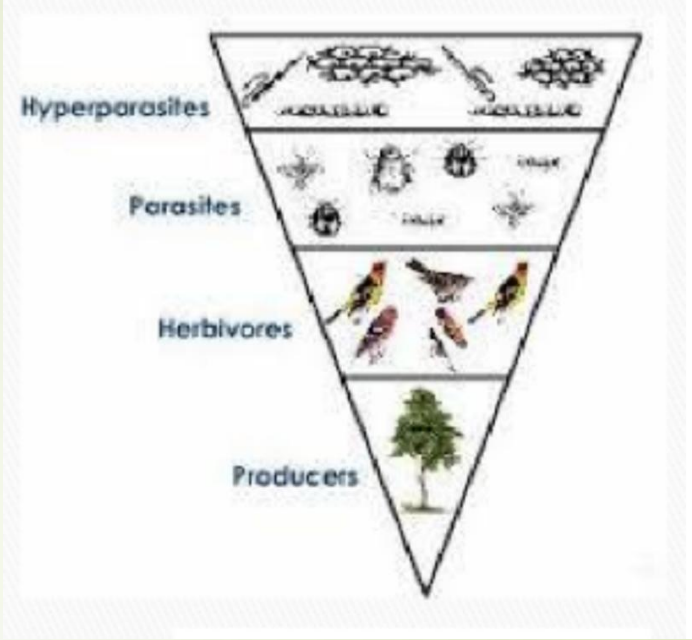
PYRAMID OF NUMBER:

2. INVERTED or SPINDLE:

In this pyramid, the number of individuals increase from lower level to higher trophic level.

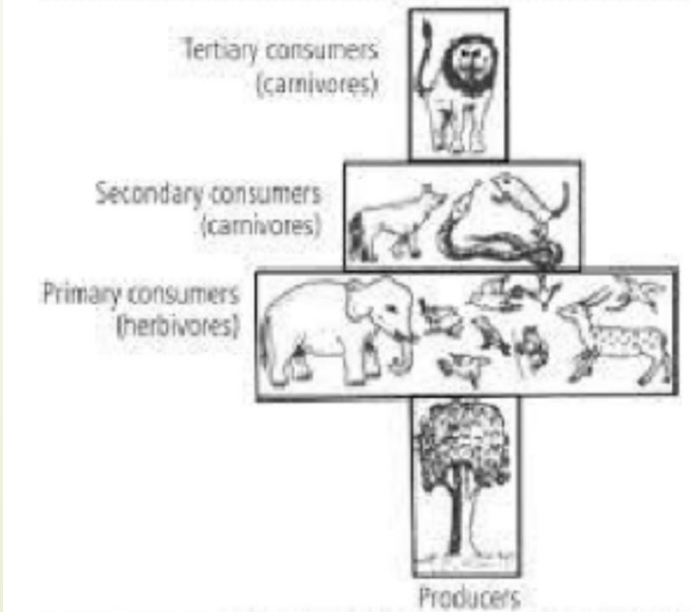
(i) In a Parasitic food chain:

- In a parasites food chain the pyramids are **inverted.** This is for the reason that a single plant or tree may support the growth of many herbivores, the fruit- eating birds, elephants . In turn, each herbivore may provide nutrition to several parasites, which support many hyperparasites. Consequently from the producer towards consumers, there is a reverse position. In other words the number of organisms gradually shows an increase, making the pyramid inverted in shape.



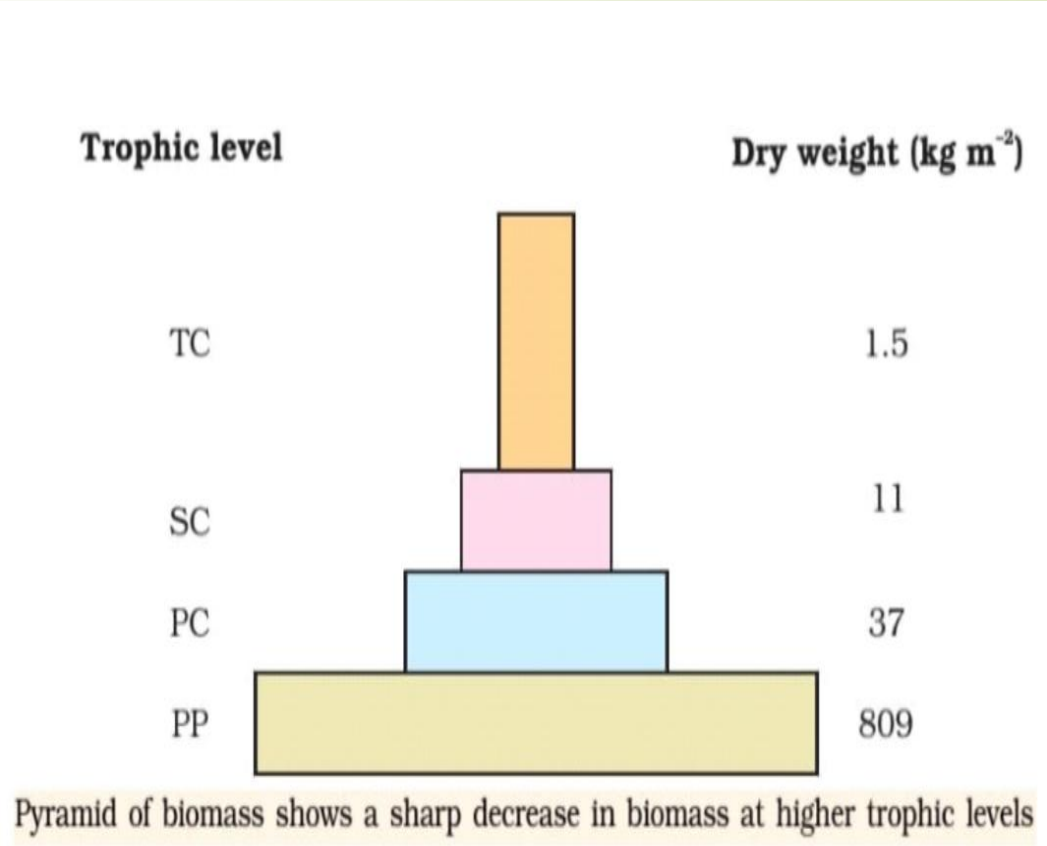
(ii) In a forest eco-system:

- The pyramid of numbers is **spindle in forest ecosystem**.
- Here producer are mainly large-sized trees, they are less in number, and form the base of the pyramid. The herbivores, which are the fruit-eating birds, elephants, deer etc. are more in number than the producers. Thereafter there is a gradual decrease in the number of successive carnivores. Giving it a spindle shape.



2. Pyramids of Biomass:

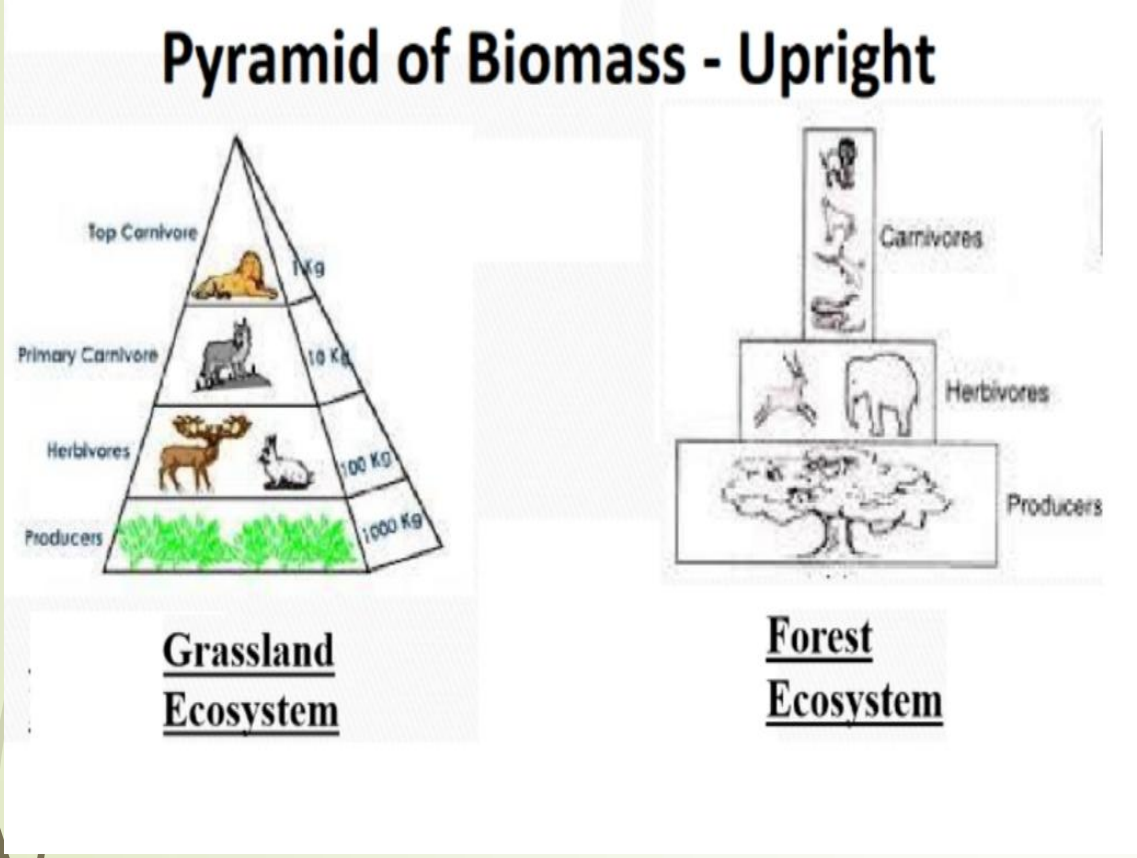
- The amount of living material in an organism is called biomass.
- Biomass is an expression of the mass per unit area. Hence, its unit of measurements are grams per square meter or tons per square kilometre.
- The biomass pyramid shows the total dry mass of all the living organisms at each trophic level. It shows the quantitative relationship existing at various trophic levels.
- Pyramid of biomass is usually determined by collecting all organisms occupying each trophic level separately and measuring their dry weight. This overcomes the size difference problem because all kinds of organisms at a trophic level are weighed.



Pyramid of biomass shows a sharp decrease in biomass at higher trophic levels

Pyramids of Biomass:

1. UPRIGHT



Terrestrial ecosystems

(Grassland and Forests):

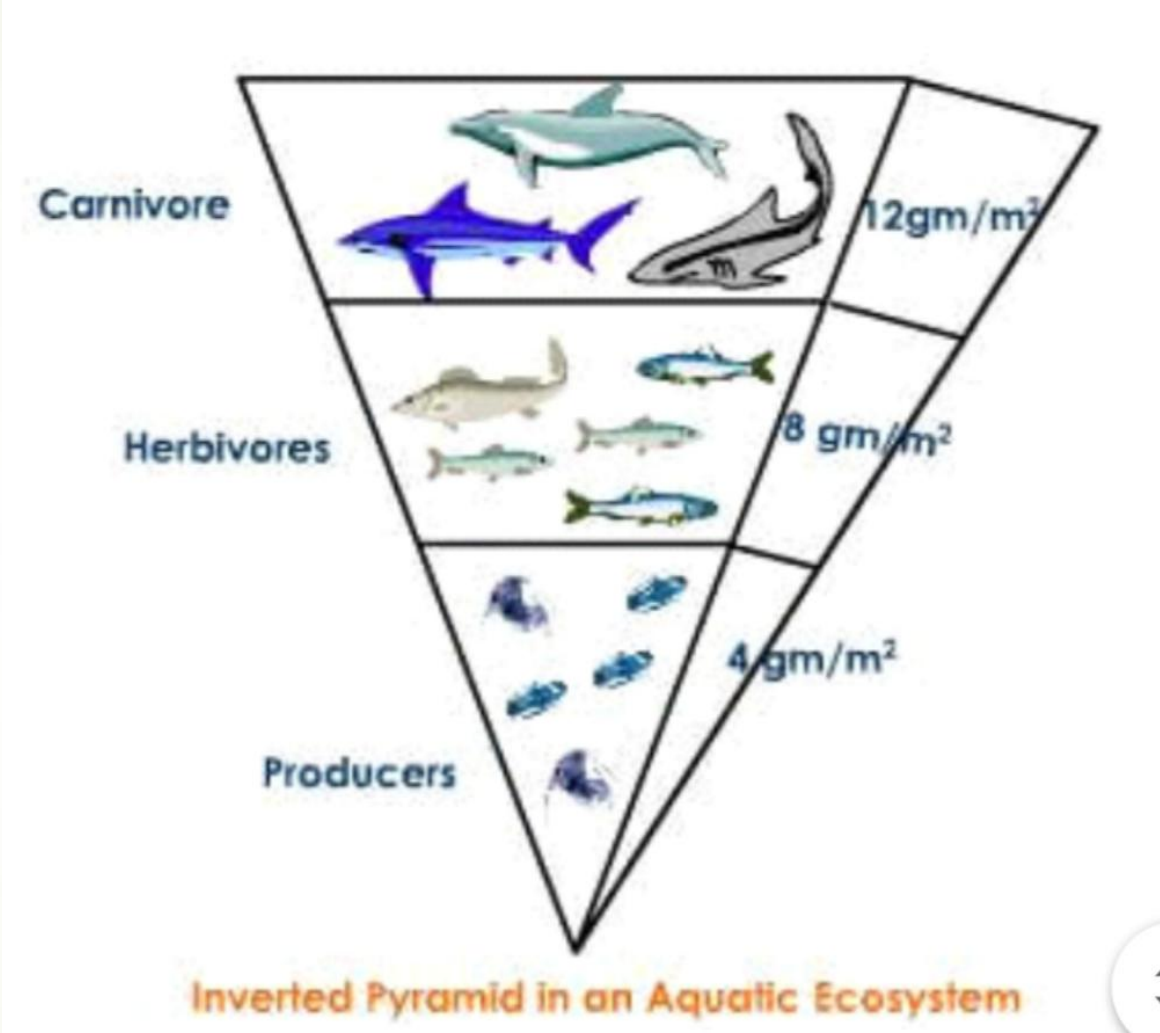
- In grassland and forests, there is generally a gradual decrease in, biomass of organisms at successive levels from the producers to the top carnivores.
- The biomass of producers (autotrophs) is maximum.
- The biomass of next trophic level i.e. primary consumers is less than the producers.
- The biomass of next higher trophic level i.e. secondary consumers is less than the primary consumers.
- The top, high trophic level has very less amount of biomass. Thus pyramids are upright

Pyramids of Biomass:

2. INVERTED:

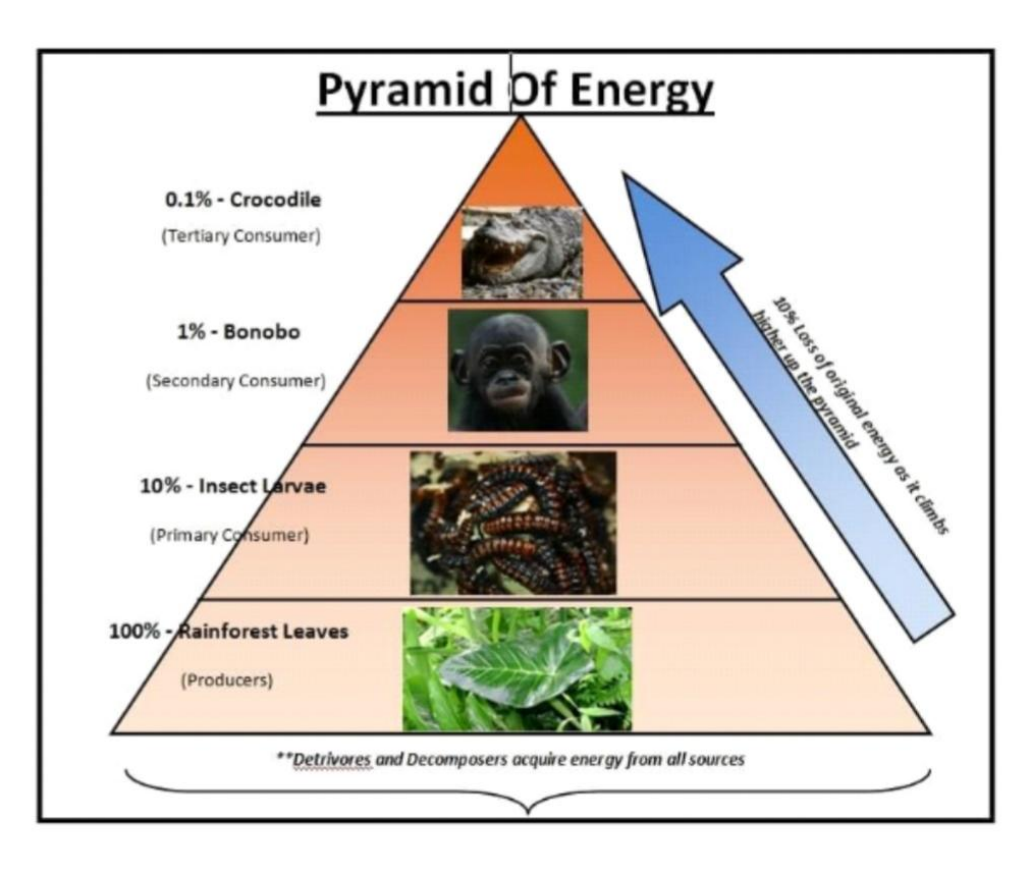
Aquatic ecosystems (Ponds):

- In an aquatic ecosystem the producers are small organisms, their biomass is least, and this value gradually shows an increase towards the apex of the pyramid. T
- This is because the producers are tiny phytoplankton that grows and reproduces rapidly.
- The pyramid of biomass has a small base, with the consumer biomass at any instant exceeding the producer biomass and the pyramid assumes an inverted shape.



Inverted Pyramid in an Aquatic Ecosystem

3. Pyramid of energy:



- It is a graphic representation of amount of energy trapped per unit time and area in different trophic levels of food chain with producers forming the base and top carnivores the tip.
- The energy content is expressed as Kcal/m2/yr.
- An energy pyramid represents the amount of energy at each trophic level and loss of energy at each transfer to another trophic level. Hence the pyramid is always upward, with a large energy base at the bottom.
- The pattern of the energy flow in this type of pyramid is based on the principles of thermodynamics. This law specifically says that energy is neither be created nor destroyed; only transformed into another form.
- This pyramid shows that energy is transferred from lower trophic levels with more amount of energy (producers) to higher ones (consumers) and converted in the biomass.