## 3.5**ECOLOGICAL PYRAMIDS**

- In 1927, Charles Elton observed that the number of animals present at the top of the trophic level is much less compared to the number of animals present at the base of the food chain.
- He also plotted his findings on a graph to get a pyramid like structure.
- He called this pyramid the Eltonian Pyramid after his name.
- It is also known as ecological pyramid.
- Thus an ecological pyramid is the graphical representation of the trophic structure and function at successive trophic levels.
- The base of the pyramid consists of the food producer level.
- The successive levels make the tiers, with the top carnivores forming the apex.

The ecological pyramids are of three types:

(i) Pyramid of energy Pyramid and Pyramid of numbers.

### 1. The Pyramid of Energy

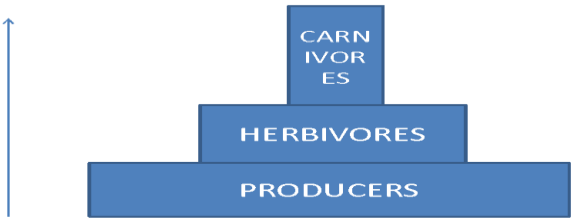
- The energy pyramids give the best picture of the overall nature of the ecosystem.
- There is decrease in energy flow from autotrophs on\ at successive trophic levels.
- In the course of energy flow from one organism to the other, is considerable loss of energy in the form of heat.
- More energy is available in the autotrophs t in the primary consumers.
- The least amount of available energy will be in the tertiary consumer.
- Therefore, shorter the food chain, greater is the amount of energy available at the top.
- The energy pyramid always upright and erect.
- It shows the rate of energy flows at different trophic levels.
- It shows that energy is maximum at producer level and minimum at the carnivores' level.
- At every successive trophic level there is a loss of energy in the form of heat, respiration etc.
- The **Ten percent law** for the transfer of energy from one trophic level to the next was introduced by Lindeman (1942).

- According to this law, during the transfer of energy from organic food from one trophic level to the next, only about ten percent of the energy from organic matter is stored as flesh.
- The remaining is lost during transfer, broken down in respiration, or lost to incomplete digestion by higher trophic levels.


PYRAMID OF ENERGY

## 2. The Pyramid of Biomass

- They are comparatively more fundamental, as they, instead of the geometric factor, shows the quantitative relationships of the standing crops.
- Here there will be gradual decrease in the biomass from the autotrophs to the higher trophic levels.
- This may be illustrated by studying the trophic levels in a pond.
- The biomass in autotrophs like algae, green flagellates, green plants etc. is the maximum.
- The biomass is considerably less in the next trophic level occupied by secondary consumers like small fishes.
- The least amount of biomass is present in the last trophic level.
- This pyramid shows the total biomass at each trophic level in a food chain.
- Pyramid in erect.
- It indicates a decrease in the biomass at each trophic level from the base to apex of pyramid.
- Example: Total biomass than herbivores, which is again more than carnivorous.



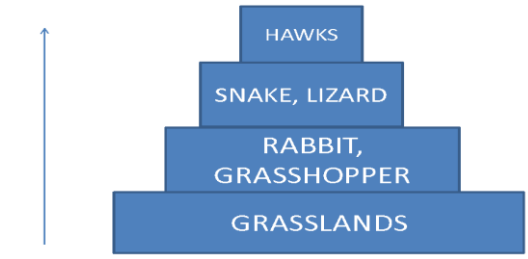

PYRAMID OF BIOMASS FOR FORESTS/GRASSLANDS


PYRAMID OF BIOMASS FOR AQUATIC ECOSYSTEM

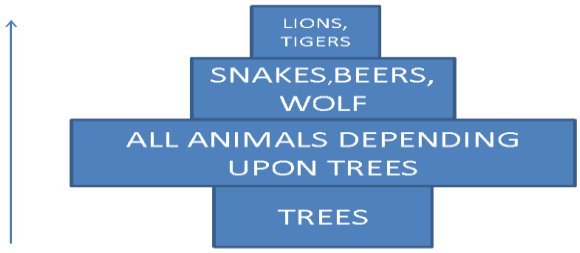
3. **The Pyramid of Numbers**

- They show the relationship between producers, herbivores and carnivores at successive trophic levels in terms of their number.
- Here there will be a gradual decrease in the number of individuals from the lower to the higher trophic levels.
- This may be studied by taking the example of trophic levels in grassland.
- The grasses occupy the lowest trophic level and they are abundantly present in the grassland ecosystem.
- The deers occupy the second level; their number is less than compared to the grasses.
- The wolves, which feed upon the deers, are far less in number when compared to the number of deers.
- The lions, which occupy the next trophic level, feed upon wolves, and the number of individuals in the last trophic level is greatly reduced.
- In the parasitic food chain, the pyramid of numbers is found to be inverted. Here, a single plant or tree might support varieties of herbivore.
- These herbivores like birds in turn, support varieties of parasites like lice, bugs that outnumber the herbivores.
- Subsequently each parasite might support a number of hyperparasites like bacteria and fungi, which will outnumber the parasites.
- Thus from the producer level onwards, towards the consumers, in the parasitic food chain there is a gradual increase in the number of organisms, instead of the usual decrease.

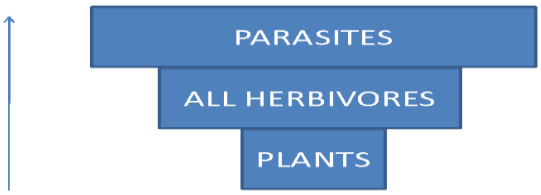
- As a result of this, the pyramid becomes inverted in the parasitic food chain.
- There is a gradual increase in the numbers of individuals from autotrophs to the higher trophic levels.
- It shows the number of organism at different levels.
- The pyramid is erect.
- The smaller animals are preyed upon larger animals and smaller animals increase faster in number of organism at each stage of food chain, makes a triangular figure that is known as pyramid of number.




PYRAMID OF NUMBERS FOR GRASSLANDS




PYRAMID OF NUMBERS FOR FOREST ECOSYSTEM




PYRAMID OF NUMBERS FOR PARASITIC FOODCHAIN