Ecosystem

CHAPTER 14

NCERT FOCUS

ANSWERS

1. The components of an ecosystem are as follows :

(i) Abiotic components or non-living components : These include inorganic substances or minerals (standing state or standing quality), organic substances and different climatic conditions like temperature, pH, light, etc.

(ii) Biotic components or living components :

(a) Autotrophs or producers which have capacity to manufacture their own food or which can fix radiant energy of sun into chemical energy, *e.g.*, green plants and photosynthetic bacteria.

(b) Heterotrophs or consumers which are unable to manufacture their own food and depend upon other organisms for their food. These are of following types:

- Primary consumers or herbivores which depend upon producers or green plants for their food.
- Secondary consumers or carnivores which live upon herbivores.
- Top consumers or top carnivores which live upon secondary consumers.

(c) Decomposers or microconsumers decompose dead organic substances of producers and consumers into simple substances and thus continue mineral cycles, *e.g.*, bacteria, fungi, actinomycetes etc.

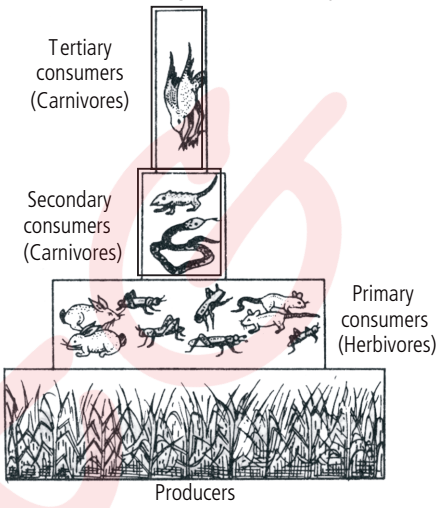
2. An ecological pyramid is a graphic representation of an ecological parameter, like number of individuals present in various trophic levels of a food chain with producers forming the base and top carnivores the tip. Ecological pyramids were developed by Charles Elton (1927) and are, therefore, also called Eltonian pyramids.

There are three types of ecological pyramids, namely,

- Pyramid of numbers
- Pyramid of biomass
- Pyramid of energy

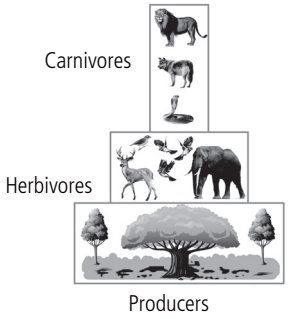
Pyramid of numbers : It is a graphic representation of the number of individuals per unit area of various trophic levels stepwise with producers at the base and top carnivores at the tip. In a grassland the producers, which are mainly grasses, are always maximum in number. This number then shows a decrease towards apex, as the primary consumers (herbivores) like rabbits, mice etc. are lesser in number than the grasses; the secondary consumers, snakes and lizards are lesser in number than the rabbits and mice. Finally, the top (tertiary) consumers hawks or other birds, are least in number. Thus, the pyramid becomes upright.

Pyramid of number in grassland ecosystem is as follows :



Pyramid of biomass : The amount of living organic matter (fresh and dry weight) is called biomass. Here, different trophic level of the ecosystem are arranged according to the biomass of the organisms. In grassland and forest, there is generally a gradual decrease in biomass of organisms at successive levels from the producers to the top carnivores. Thus these pyramids are upright. But in pond ecosystem, it is inverted because the biomass gradually increases from the producers to carnivores.

Pyramid of biomass in forest system is as follows :



3. Primary productivity is the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis. It is expressed in terms of weight ($g/m^2/yr$) or energy ($Kcal/m^2/yr$). It is of two types : gross primary productivity and net primary productivity. Gross primary productivity of an ecosystem is the rate of production

for organic matter during photosynthesis. Gross primary productivity minus respiration losses (R), is the net primary productivity (NPP).

Factors affecting primary productivity are as follows:

(i) Solar radiation : Maximum light is available in tropics. Poles receive minimum light. Due to this, photosynthesis is maximum and net primary productivity (NPP) is highest (> 20 t ha^{-1} $year^{-1}$) in tropics against (8 t ha^{-1} $year^{-1}$) in temperate forests.

(ii) Temperature : Temperate forests have lesser productivity (about 8 t ha^{-1} $year^{-1}$) than tropical rain forests (20 t ha^{-1} $year^{-1}$) due to cold climate.

(iii) Moisture : Rain and humidity increase productivity of the ecosystem.

(iv) Nutrients : Nutrients are essential for producers growth. Desert soils are deficient in nutrients and therefore, are less productive.

(v) Photosynthetic efficiency of producers: C_4 plants are more productive than C_3 plants.

4. The process by which decomposers break down complex organic remains (dead plants, animal remains and excretions) into inorganic substances like carbon dioxide, water and nutrients is called decomposition. The important steps in the process of decomposition are fragmentation, leaching, catabolism, humification and mineralisation.

(i) Detritivores (*e.g.*, earthworm) break down detritus into smaller particles. This process is called fragmentation.

(ii) By the process of leaching, water-soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts.

(iii) Bacterial and fungal enzymes degrade detritus into simpler inorganic substances. The process is called as catabolism.

All the above steps in decomposition operate simultaneously on the detritus. Humification and mineralisation occur during decomposition in the soil.

(iv) Humification leads to accumulation of a dark coloured amorphous substance called humus that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate. Being colloidal in nature it serves as a reservoir of nutrients.

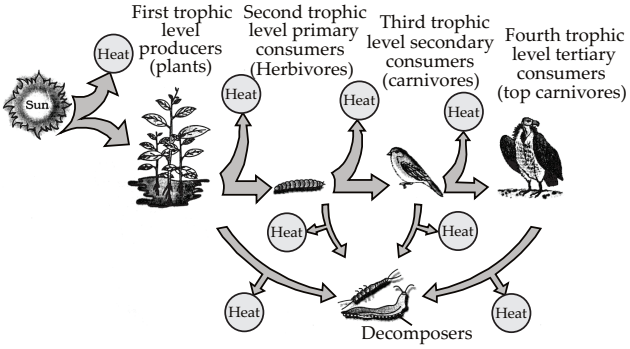
(v) The humus is further degraded by some microbes and release of inorganic nutrients occur by the process known as mineralisation.

5. Ecosystem require a constant input of energy as every component of an ecosystem is regularly dissipating energy. Two laws of thermodynamics govern this flow of energy. According to first law of thermodynamics, energy can be transferred as well as transformed but is neither created nor destroyed. According to second law of thermodynamics, every activity involving energy transformation is accompanied by dissipation of energy. Except for deep hydrothermal ecosystems, the source of energy in all ecosystems is solar energy. 50% of the solar energy incident over earth is present in PAR (photosynthetically active radiation).

Energy flow in an ecosystem is always unidirectional or one way, *i.e.*, solar radiations → producers → herbivores → carnivores. It cannot pass in the reverse direction. There is decrease in the content and flow of energy with the rise in trophic level. Only 10% of energy is transferred from one trophic level to the next.

Producer biomass (1000 K cal) → Herbivore biomass (100 K cal) → Carnivore I biomass (10 K cal) → Carnivore II biomass (1 K cal)

Energy flow through different trophic levels is as follows :



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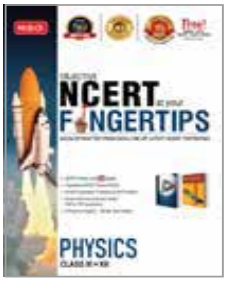

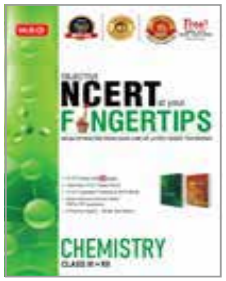

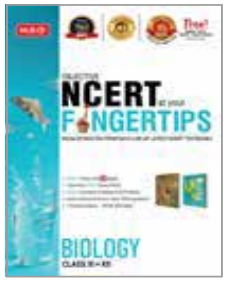

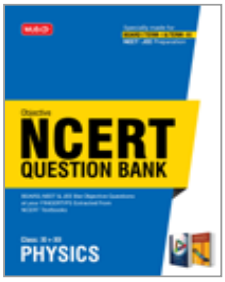

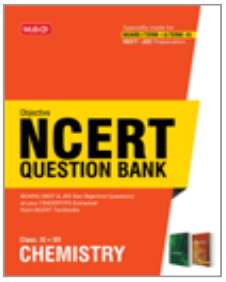

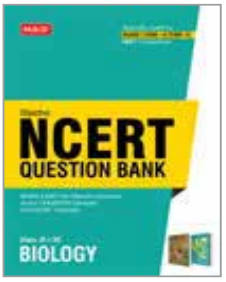

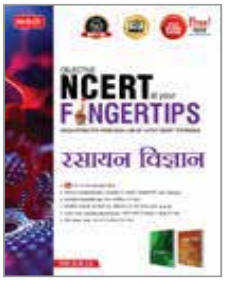

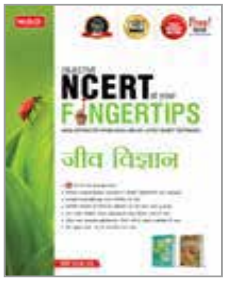

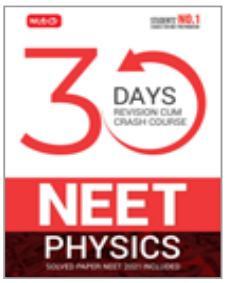

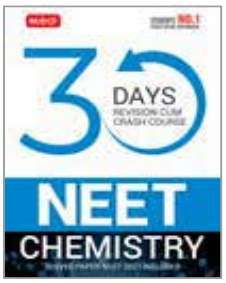

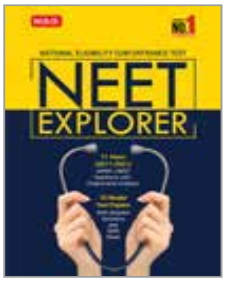

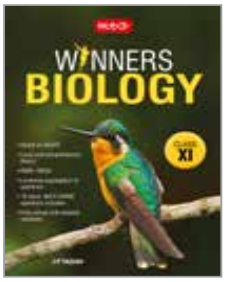

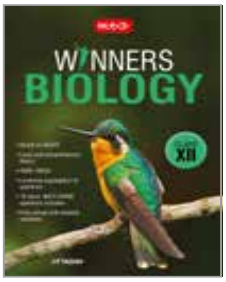

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