Unit 8: Ecosystem: (Structure and trophic organization)

It is a basic functional unit to study ecology, as it includes both organisms and their abiotic environment.

Ecosystem: An ecosystem is an interacting unit of biotic (living) and abiotic (non-living) components at a given place, so that a flow of energy leads to clearly defined trophic structure, biotic diversity and material cycle.

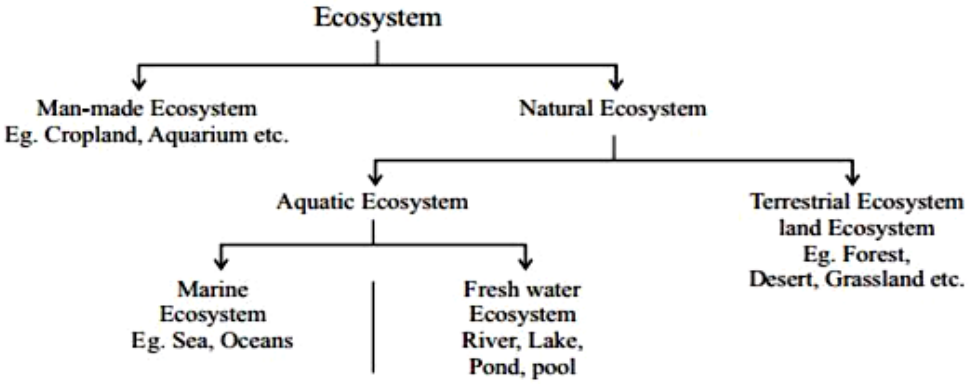
A.G. Tansley (British Ecologist) proposed this term for the first time in 1935. He defined the ecosystem as 'the system resulting from the interaction of all living and non-living factors of the environment'.

Some other terms for ecosystem are Biocoenosis by Karl Mobius (1877) and Microcosm by S.A. Forbes (1887).

Types of Ecosystems

(i) Natural ecosystems- These operate by themselves under natural conditions without any major interference by man.

(ii) Artificial (man-made) ecosystems- These are maintained artificially by man, by addition of energy and planned manipulations.



Structure of an Ecosystem

Component of Ecosystem:

(A) Abiotic Components (nonliving):

1) Climatic factors, edaphic and topographical factors.
2) Inorganic substances- micronutrients (e.g. zinc, boron and magnesium) and macronutrients (such as carbon, hydrogen, nitrogen, phosphorus calcium and potassium).
3) Organic compounds such as carbohydrates, proteins, lipids and humic substances.

(B) Biotic Components (living):

1. **Producers or Autotrophs:** The green plants produce food for the entire ecosystem by the process of photosynthesis. They take inorganic nutrients from the soil and manufacture complex organic compounds by capturing solar energy. All green plants including microscopic algae and some bacteria are producers, since they may exhibit chemosynthesis or photosynthesis.

2. **Macro-consumers or Heterotrophs:** These are animals which utilize the organic material directly or indirectly synthesized by the plants.

(i) Primary consumers/ herbivores: They directly consume the organic compounds of plants (autotrophs) e.g. cow, deer and rabbit.

(ii) Secondary or Tertiary consumers/ carnivores are the animals which feed upon other animals/herbivores for food e.g. frog, hawk or Lion.

***Omnivore*:** The animals feeding on both plants and animals are known *as omnivores* like human, pig and bear.

3. **Micro-consumers** or **Decomposers:** The decomposers are special type of consumers and depend on the dead remains of animals and plants. They are also called ***detrivores* or *detritus*** feeders. These are saprotrophs (microdecomposers) mostly bacteria, actinomycetes and fungi that break down the complex dead organic matter into the simple molecules. Thus they play a very important role in recycling of the nutrients. Some are *macrodecomposers* like worms, beetles, snails, millipedes and earthworms.

Ecosystem Processes

Flow of Energy (Trophic organization, Food chains, Food webs, Ecological pyramids)

Trophic organization: Trophic (related to food) organization of an ecosystem represents the feeding relationships of its organisms.

Food Chain: Transfer of food from the plants (producers) through a series of organisms with repeated eating and being eaten is called **food chain.**

e.g.**Grasses** eaten by ➡**Grasshoppers** ➡**Frogs** ➡ **Snakes** further eaten by ➡ **Hawk / Eagle .**

Each step in the food chain is called **trophic level**. The functional level of an organism in any food chain is trophic level. The number of steps in a food chain is limited to 4 -5.

Standing crop*:* *Standing crop is the amount of living matter at any given time in an ecosystem.* It can be expressed in terms of *biomass, number* or *total amount of energy* fixed at each step of the food chain. It gives a definite trophic structure to the ecosystem.

Standing state or standing quality: The amount of these inorganic substances present at any given time in any ecosystem is designated as the standing state/standing quality.

Types of food chains in ecosystem:* *Grazing food chain and ***Detritus food chain***

In both the food chains, carnivores feed upon the herbivores.

a) **Grazing food chain** begins with the living plant biomass (net primary production). Grazing food chains dominate in grasslands (grass--fox----rabbit), freshwater bodies (pond ecosystem, phytoplankton—zooplankton----small fish-------carnivorous fish).

b) **Detritus food chain** begins with the dead organic matter (detritus) as the source of energy. For example, some bacteria using litter as the source of energy and these bacteria are eaten by some nematodes. Detritus food chain dominates in a climax forest (Dead organic matter—fungi-----bacteria) and deep oceans.

Food web: Food chains in the ecosystem are not linear rather they are interconnected with one another. A network of food chains which are interconnected at various trophic levels so as to form a network of feeding connections in a community called a ***food web.***