UG CBCS Semester-IV (MJC-7: Ecology)

Ecosystem

Ecology is the study of the relationships between living organisms, including humans, and their physical environment; it seeks to understand the vital connections between plants and animals and the world around them. Ecology also provides information about the benefits of ecosystems and how we can use Earth's resources in ways that leave the environment healthy for future generations. The distribution and abundance of species and the biological structure of the community vary in response to environmental conditions. However, as we can see from the example of plant succession on the lava flows of Hawaii, it is equally true that the organisms themselves, in part, define the abiotic environment. It is this inseparable link between the biotic environment (the community) and the abiotic environment that led A. G. Tansley to coin the term *ecosystem* in an article in the journal *Ecology* in 1935. Tansley wrote:

The more fundamental conception is the whole system (in the sense of physics) including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment. We cannot separate them [the organisms] from their spatial environment with which they form one physical system. It is the systems so formed which [are] the basic units of nature on the face of the earth. These ecosystems, as we may call them, are of the most various kinds and sizes.

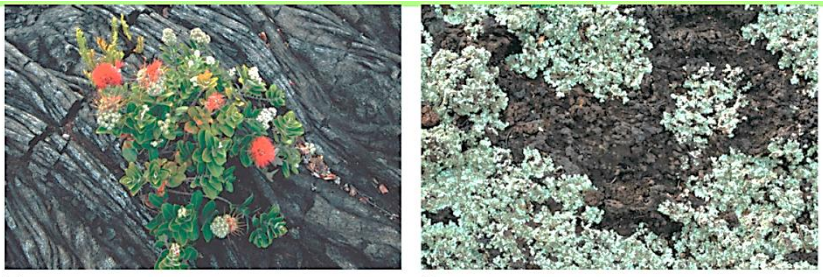
According to E.P. Odum, the ecosystem is the basic functional unit of organism and their environment interacting with each other. The function of ecosystem is related to the energy flow, decomposition, nutrient cycling and major biomes. In the concept of the ecosystem, the biological and physical components of the environment are a single interactive system. The ecosystem concept brought with it a new way of approaching the study of nature. Given the diversity of life within any given community, the taxonomic perspective had to give way to a more functional approach of viewing nature. In discussing the ecology of a forest with a population or community ecologist, one will hear a story of species—the dynamics of populations, their interactions, food webs, and patterns of diversity. Discuss the same forest with an ecosystem ecologist, however, and a more abstract picture emerges: a story of energy and matter, where the boundary between the biotic and abiotic components of the forest is often blurred. To the ecosystem ecologist, the forest is a system composed of autotrophs, heterotrophs, and the abiotic environment, each component processing and exchanging energy and matter. The autotrophs, or primary producers, are predominantly green plants and algae. These organisms use the energy of the Sun in photosynthesis to transform inorganic compounds into simple organic compounds. The heterotrophs, or consumers, use the organic compounds produced by the autotrophs as a source of food. Through decomposition, heterotrophs eventually transform these complex organic compounds into simple inorganic compounds that are once again used by the primary producers. The heterotrophic component of the ecosystem is often subdivided into two subsystems: consumers and decomposers. The consumers feed mostly on living tissue and the decomposers break down dead matter into inorganic substances. The abiotic component consists of the air, water, soil, sediments, particulate matter, dissolved organic matter in aquatic ecosystems, and dead organic matter. All of the dead organic matter is derived from plant and consumer remains and is acted upon by the decomposers. Such dead organic matter is crucial to the internal cycling of nutrients in the ecosystem.

The driving force of the ecosystem is the energy of the Sun. This energy, harnessed by the primary producers, flows from producers to consumers to decomposers and eventually dissipates as heat. Like the community, the ecosystem is a spatial concept; it has boundaries.

Like the community, these boundaries are often difficult to define. At first examination, a pond ecosystem is clearly separate and distinct from the surrounding terrestrial environment. A closer inspection, however, reveals a less distinct boundary between aquatic and adjacent terrestrial ecosystems.

Some plants along the shoreline, such as cattails, may be either partially submerged or rooted in the surrounding land and able to tap the shallow water table with their roots. Amphibians move between the shoreline and the water. Surrounding trees drop leaves into the pond, adding to the dead organic matter that feeds the decomposer community on the pond bottom. Regardless of these difficulties, ecosystems theoretically have spatial boundaries; having defined the boundaries, we can view our ecosystem in the context of its surrounding environment. Exchanges from the surrounding environment into the ecosystem are inputs. Exchanges from inside the ecosystem to the surrounding environment are outputs. An ecosystem with no inputs is called a **closed ecosystem;** one with inputs is an **open ecosystem.**

The study of ecosystems draws upon the concepts and understanding that we have developed thus far. In a way, it provides a framework to integrate our accumulated understanding of adaptation, populations, communities, and the abiotic environment.



(a) (b)

Plant species characteristic of the early stages of plant succession on the lava flows of Hawaii. (a) *Metrosideros polymorpha* (Hawaiian: *'ohi'a*) are well adapted to the environment of the lava flows and are a common plant in the early stages of colonization. (b) Litter breakdown is associated with the common lichen, *Stereocaulon volcani.*

Structure

Generally ecosystems consist of two basic components.

1. Abiotic components

It includes basic in-organic (soil, water, oxygen, calcium carbonates, phosphates etc.) and organic compounds. It also includes physical factors such as moisture, wind currents and solar radiation.

2. Biotic components

Include producers, consumers and decomposers.

Functions of Ecosystem

An ecosystem is a functional and life sustaining environmental system. The environmental system consists of biotic and abiotic components. Biotic components include living organisms and abiotic components includes in organic matter and energy.

In an ecosystem there are three functional components.

1. Inorganic constituents; **2.** Organism and **3.** Energy input

These three components interact with each other to form an environmental system. The primary producers convert inorganic constituents into organic components by photosynthesis using the energy from the solar radiations. The herbivores make use of the energy from the producers and they themselves serve as a food for the carnivores. Animals of different types accumulate organic matter in their body which is taken as food. They are known as secondary producers. The dead organic matters of plants and animals are decomposed by bacteria and fungi which break the complex molecules and liberate inorganic components. These are known as decomposers. During this process some amount of energy is released in the form of heat. The ecosystem of different habitats are interrelated with one another.