



UNIT 1

ECOSYSTEM

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Ecosystem

- **The term Ecosystem was first proposed by A.G. Tansley in 1935. He defined it as “The system resulting from the interaction of all the living and non living factors of the environment.”**
- **An ecosystem consists of the biological community that occurs in some locale, and the physical and chemical factors that make up its non-living or abiotic environment. There are many examples of ecosystems – a pond, a forest, an estuary, a grassland.**

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Structure of Ecosystem

- The structure of an ecosystem is basically a description of the organisms and physical features of environment including the amount and distribution of nutrients in a particular habitat.
- It also provides information regarding the range of climatic conditions prevailing in the area.

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Structure of Ecosystem Contd...

From the structure point of view, all ecosystems consist of the following basic components:

- 1. Abiotic components**
- 2. Biotic components**

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Abiotic Components

- Ecological relationships are manifested in physicochemical environment. Abiotic component of ecosystem includes basic inorganic elements and compounds, such as soil, water, oxygen, calcium carbonates, phosphates and a variety of organic compounds (by-products of organic activities or death).
- It also includes such physical factors and ingredients as moisture, wind currents and solar radiation. Radiant energy of sun is the only significant energy source for any ecosystem. The amount of non-living components, such as carbon, phosphorus, nitrogen, etc. that are present at any given time is known as standing state or standing quantity.

Biotic Components

- The biotic components include all living organisms present in the environmental system.

From nutrition point of view, the biotic components can be grouped into two basic components:

- (i) Autotrophic components, and
- (ii) Heterotrophic components

- The autotrophic components include all green plants which fix the radiant energy of sun and manufacture food from inorganic substances. The heterotrophic components include non-green plants and all animals which take food from autotrophs.

Biotic Components Contd...

So biotic components of an ecosystem can be described under the following three heads:

1. Producers (Autotrophic components),
2. Consumers, and
3. Decomposers or reducers and transformers

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Producers (Autotrophic elements)

The producers are the autotrophic elements— chiefly green plants. They use radiant energy of sun in photosynthetic process whereby carbon dioxide is assimilated and the light energy is converted into chemical energy. The chemical energy is actually locked up in the energy rich carbon compounds. Oxygen is evolved as by-product in the photosynthesis.

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Consumers

Those living members of ecosystem which consume the food synthesized by producers are called consumers. Under this category are included all kinds of animals that are found in an ecosystem.

There are different classes or categories of consumers, such as:

- (a) Consumers of the first order or primary consumers,
- (b) Consumers of the second order or secondary consumers,
- (c) Consumers of the third order or tertiary consumers, and
- (d) Parasites, scavengers and saprobes.

Consumers Contd...

(a) Primary consumers:

These are purely herbivorous animals that are dependent for their food on producers or green plants. Insects, rodents, rabbit, deer, cow, buffalo, goat are some of the common herbivores in the terrestrial ecosystem, and small crustaceans, molluscs, etc. in the aquatic habitat. Elton (1939) named herbivores of ecosystem as “key industry animals”. The herbivores serve as the chief food source for carnivores.

(b) Secondary consumers:

These are carnivores and omnivores. Carnivores are flesh eating animals and the omnivores are the animals that are adapted to consume herbivores as well as plants as their food. Examples of secondary consumers are sparrow, crow, fox, wolves, dogs, cats, snakes, etc.

Consumers Contd...

(c) Tertiary consumers:

These are the top carnivores which prey upon other carnivores, omnivores and herbivores. Lions, tigers, hawk, vulture, etc. are considered as tertiary or top consumers.

(d) Besides different classes of consumers, the parasites, scavengers and saprobes are also included in the consumers. The parasitic plants and animals utilize the living tissues of different plants and animals. The scavengers and saprobes utilize dead remains of animals and plants as their food.

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Decomposers and transformers

Decomposers and transformers are the living components of the ecosystem and they are fungi and bacteria. Decomposers attack the dead remains of producers and consumers and degrade the complex organic substances into simpler compounds. The simple organic matters are then attacked by another kind of bacteria, the transformers which change these organic compounds into the inorganic forms that are suitable for reuse by producers or green plants. The decomposers and transformers play very important role in maintaining the dynamic nature of ecosystems.

Functions of Ecosystem

- An ecosystem is a discrete structural, functional and life sustaining environmental system.
- The environmental system consists of biotic and abiotic components in a habitat.
- Biotic component of the ecosystem includes the living organisms; plants, animals and microbes whereas the abiotic component includes inorganic matter and energy.
- Abiotic components provide the matrix for the synthesis and perpetuation of organic components. The synthesis and perpetuation processes involve energy exchange and this energy comes from the sun in the form of light or solar energy.

Functional components

Thus, in any ecosystem we have the following functional components:

- (i) Inorganic constituents (air, water and mineral salts)
- (ii) Organisms (plants, animals and microbes), and
- (iii) Energy input which enters from outside (the sun).

Functional components Contd...

- These three interact and form an environmental system. Inorganic constituents are synthesized into organic structures by the green plants (primary producers) through photosynthesis and the solar energy is utilized in the process.
- Green plants become the source of energy for renewals (herbivores) which, in turn become source of energy for the flesh eating animals (carnivores).
- Animals of all types grow and add organic matter to their body weight and their source of energy is complex organic compound taken as food.
- They are known as secondary producers. All the living organisms whether plants or animals in an ecosystem have a definite life span after which they die.

Functional components Contd...

- The dead organic remains of plants and animals provide food for saprophytic microbes, such as bacteria, fungi and many other animals.
- The saprobes ultimately decompose the organic structure and break the complex molecules and liberate the inorganic components into their environment.
- These organisms are known as decomposers. During the process of decomposition of organic molecules, the energy which kept the inorganic components bound together in the form of organic molecules gets liberated and dissipated into the environment as heat energy.
- Thus in an ecosystem energy from the sun, the input is fixed by plants and transferred to animal components.

Functional components Contd...

- Nutrients are withdrawn from the substrate, deposited in the tissues of the plants and animals, cycled from one feeding group to another, released by decomposition to the soil, water and air and then recycled.
- The ecosystems operating in different habitats, such as deserts, forests, grasslands and seas are interdependent on one another.
- The energy and nutrients of one ecosystem may find their way into another so that ultimately all parts of the earth are interrelated, each comprising a part of the total system that keeps the biosphere functioning.

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Steps in the operation of ecosystem

Thus the principal steps in the operation of ecosystem are as follows:

- (1) Reception of radiant energy of sun,
- (2) Manufacture of organic materials from inorganic ones by producers,
- (3) Consumption of producers by consumers and further elaboration of consumed materials; and.
- (4) After the death of producers and consumers, complex organic compounds are degraded and finally converted by decomposers and converters into such forms as are suitable for reutilization by producers.

Steps in the operation of ecosystem Contd...

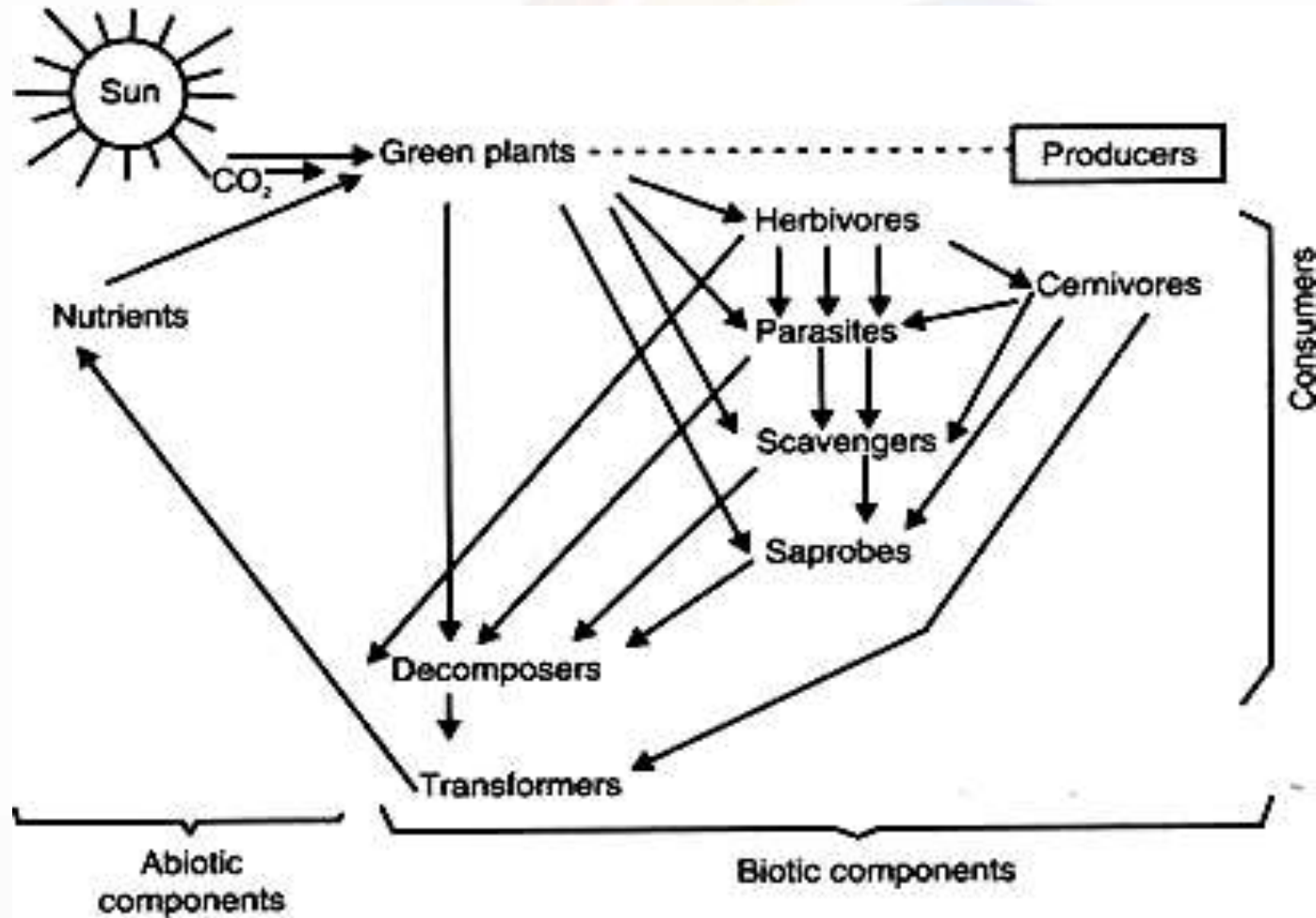
- The principal steps in the operation of ecosystem not only involve the production, growth and death of living components but also influence the abiotic aspects of habitat.
- It is now clear that there is transfer of both energy and nutrients from producers to consumers and finally to decomposers and transformers levels.
- In this transfer there is a progressive decrease of energy but nutrient component is not diminished and it shows cycling from abiotic to biotic and vice versa.

Steps in the operation of ecosystem Contd...

- The flow of energy is unidirectional. The two ecological processes—energy flow and mineral cycling which involve interaction between biotic and abiotic components lie at the heart of ecosystem dynamics.
- The principal steps and components of ecosystem are illustrated in the figure



Steps in the operation of ecosystem Contd...



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