UNIT-II

ECOSYSTEM

The bio-sphere is made up of the living system consisting of plant and animal kingdom, and the non-living components including minerals, water etc. The entire system is sustained by the source of energy, the Sun. Organisms belonging to different species either of plant kingdom or animal kingdom interact among themselves as well with the physical environments they occupy. This system is called ecological system or ecosystem.

Components of Ecosystem

As discussed above, an ecosystem has three distinctive components that can be identified as:

- non living or abiotic component including climate regime
- living or biotic component
- source of energy – light and heat

Abiotic Substances

These comprise of inorganic and organic compounds present in the environment. The inorganic components of an ecosystem are oxygen, carbon dioxide, water, minerals etc., whereas carbohydrates, proteins, lipids, amino acids etc., are examples for organic material. The climate, light and heat can be either studied under abiotic component, or as separate entities. The predominant source of energy in the earth's biosphere is sun. The abiotic substances are circulated in the ecosystem through material cycles and energy cycles.

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Biotic Substances

Living organisms in the ecosystem – various species of plants and animals including microbes are termed as biotic components. They can be classified as producers (autotrophs) and consumers (heterotrophs).

Ecology Defined

1. Ernst Haeckel (1866) defined ecology "as the body of knowledge concerning the economy of nature-the investigation of the total relations of animal to its inorganic and organic environment.
2. Frederick Clements (1916) considered ecology to be "the science of community.
3. British ecologist Charles Elton (1927) defined ecology as "the scientific natural history concerned with the sociology and economics of animals."
   (4) Taylor (1936) defines ecology as "the science of the relations of all organisms to all their environments."

Ecosystem

At present ecological studies are made at Eco-system level. At this level the units of study are quite large. This approach has the view that living organisms and their non-living environment are inseparably interrelated and interact with each other. A.G. Tansley (in 1935) defined the Eco-system as 'the system resulting from the integrations of all the loving and non-living actors of the environment'. Thus he regarded the Eco-systems as including not only the organism complex but also the whole complex of physical factors forming the environment.

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Historical Background

The idea of Eco-system is quite an old one. We find in literature some such parallel terms as (i) biocoenosis (Karl Mobius, 1977), (ii) microcosm (S.A. Forbes, 1887),(iii) Geobiocoenosis (V.V. Doduchaev, 1846-1903; G.F. Morozov; see Sukachev, 1944), (iv) hlocoen (Friendenichs, 1930), (v) biosystem (Thienemann, 1939), (vi) bioenert body (Vernadsky, 1994), and ecosom etc. use for such ecological systems.

The terms ecosystems is most preferred, where 'eco' implies the environment, and 'system' implies an interacting, inter-dependent complex.

In this way, it can be said that any unit that includes all the organisms i.e. the communities in a given area, interact with the physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity and material cycle (i.e. exchange of materials between living and non-living components) within the system, is known as an ecological system or eco-system.

Eco-system may be visualized as 3-dimensional cutouts from the ecosphere. All primary and secondary producers composing the ecosystem are its essential elements. The unique feature of eco-systems is the maintenance of their chemical state and of their environment.

Aspect of Ecosystem

The eco-system can be defined as any spatial or organizational unit including living organisms and non-living substances interacting to produce an exchange of materials between the living and non-living parts. The eco-system can be

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studied from either structural or functional aspects.

1. Structural Aspect

The structural aspects of ecosystem include a description of the arrangement, types and numbers of species and their life histories, along with a description of the physical features of the environment.

2. Functional

The functional aspects of the ecosystem include the flow of energy and the cycling of nutrients.

Habitat

The non-living part of the eco-system includes different kinds of habitats such as air, water and land, and a variety of abiotic factors. Habitat can be defined as the natural abode or locality of an animal, plant or person. It includes all features of the environment in a given locality. For example, water is used as habitat by aquatic organisms and it comprises three major categories-marine, brackish and freshwater habitats. Each of these categories may be subdivided into smaller unit, such a freshwater habitat may exist as a large lake, a pond, a puddle, a river or a stream.

Abiotic Factors

Among the main abiotic factors of the ecosystem are included the following:

1. The climatic factors as solar radiation, temperature, wind, water currents, rainfall.
2. The physical factors as light, fire, pressure, geomagnetism,

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3. Chemical factors as acidity, salinity and the availability of inorganic nutrients needed by plants.

Biotic or Biological Factors

The biological (biotic) factors of ecosystem include all the living organisms-plants, animals, bacteria and viruses. Each kind of living organism found in an ecosystem is given the name a species. A species includes individuals which have the following features:

i. They are genetically alike.
ii. They are capable of freely inter-breeding and producing fertile offsprings.

Relationships

In an ecosystem, there exist various relationships between species. The relationship may be as under:

(1) Effects

Two species may have any of the following kind of effects:

1. They may have a negative effect upon one another (competition).
2. They may have a neutral effect (neutralism).
3. They may have beneficial effect (protoco-operation and mutualism).

(2) Other kinds of Relationship

The species may aggregate, or separate, or show a random relationship to one another.

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Population

A population is a group of inter-acting individuals, usually of the same species, in a definable space. In this way we can speak of population of deer on an island, and the population of fishes in a pond. A balance between two aspects determines the size of a population of any given species:

(i) Its reproductive potential,

(ii) Its environmental resistance.

In this way population size is determined by the relative number of organisms added to or removed from the group as under:

(i) Addition

Recruitment into the population is a function of birth rate and immigration rate.

(ii) Removal

Loss from the population is a function of death rate and emigration.

Factors Regulating Population

Following factors does population regulation:

1. Physical attributes of the environment (e.g. climate),
2. Food (quantity and quality),
3. Disease (host-parasite relationships).
4. Predation,
5. Competition (inter-specific and intra-specific).

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An ecosystem contains numerous populations of different species of plants, animals and microbes; all of them interact with one another as a community and with the physical environment as well. A community or biotic community, thus, consists of the population of plants and animals living together in a particular place.

Division of Ecosystem

The ecosystem can be divided, from the energetic view point into three types of organisms: producers, consumers, and reducers. These can be explained as under:

(1) Producer

Photosynthetic algae, plants and bacteria are the producers of the ecosystem; all other organisms depend upon them directly or indirectly for food.

(2) Consumers

Consumers are herbivorous, carnivorous, and omnivorous animals; they eat the organic matter produced by other organisms.

(3) Reducers

Reducers are heterotrophic organisms like animals; they are fungi and bacteria that decompose dead organic matter.

Food Chains or Food Web

Species are related by their feeding behaviour in food chains or food webs. There are two basic types of food chains as under-

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I. The consumer food chain includes the sequence of energy flow from producer+herbivore+carnivore+reducer;

II. The detritus food chain pypasses the consumers, going from producer+reducer.

Basic Theme of Ecosystems

(1) Relationship

The first and foremost theme of an ecosystem in that everything is somehow or other related to everything else, the relationships include interlocking functioning of organisms among themselves besides with their environment. Biocoenosis and bioecocoenois are roughly equivalent to community and ecosystem respectively. Biotopes are the physical environment in which such communities exist. According to Lamotte (1969), it is this network of multiple interactions that permits us to define the ecosystem completely. Many ecologists regard Interdependence as the first basic theme of ecology. Ecosystem includes interacting and interdependent components that are open and linked to each other.

(2) Limitation

The second basis theme is Limitation which means that limits are ubiquitous and that no individual or species goes on growing indefinitely. Various species control and limit their own growth in response to overcrowding or other environmental signals and the total numbers keep pace with the resources available.

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(3) Complexity

Complexity is a third characteristic of any eco-system. The three-dimensional interactions of the various constituent elements of an ecosystem are highly complex and often beyond the comprehension on the human brain.

Characteristics of Eco-system

According to Smith following are the general characteristics of eco-system.

1. The ecosystem is a major structural and functional unit of ecology.
2. The structure of an eco-system is related to its species diversity; as such the more complex ecosystem has high species diversity.
3. The relative amount of energy required to maintain an ecosystem depends on its structure. The more complex the structure, the lesser the energy it requires to maintain itself.
4. The function of the ecosystem is related to energy flow in material cycling through and within the system.
5. Ecosystems mature by passing from less complex to more complex states. Early stages of such succession have an excess of potential energy. Later (mature) stages have less energy accumulation.
6. Both the environment and the energy fixation in any given ecosystem are limited. They cannot be exceeded in any way without causing serious undesirable effect.
7. Alterations in the environments represent selective pressures upon the population to which it must adjust. Organisms, which fail to adjust to the changed environment, must vanish.

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To conclude the eco-system is an integrated unit or zone of variable size, it comprises vegetation, fauna, microbes and the environment. Most ecosystems process a well-defined soil, climate, flora and fauna and their own potential for adaptation, change and tolerance. The functioning of any ecosystem involves a series of cycles. These cycles are driven by energy flow, the energy being the solar energy.

Structure of an Eco-system

Meaning of Structure

By structure of an eco-system we mean as under.

I. The composition of biological community including species, numbers, biomass, life history and distribution in space etc.
II. The quantity and distribution of the non-living materials, such as nutrients, water etc.
III. Structure of an ecosystem the range, or gradient of conditions of existence, such as temperature.

Natural and Function of Structure of Eco-system

The structure of an ecosystem is in fact, a description of the species of organisms that are present, including information on their life histories, population and distribution in space. It guides us to know who's who in the ecosystem. It also includes descriptive information on the non-living features of ecosystem give us information about the range of climatic conditions that prevail in the area. From structural point of view all ecosystems consist of following two basic components:

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1. Abiotic Substances (Non-Living Components)

The Abiotic substances include basic inorganic and organic compounds of the environment or habitat of the organism.

(a) Inorganic Components: The inorganic components of an ecosystem are carbon dioxide, water, nitrogen, calcium, and phosphate. All of these are involved in matter cycles (biogeochemical cycles).

(b) Organic Components: The organic components of an ecosystem are proteins, carbohydrates; lipids and amino acids. All of these are synthesized by the biota (flora and fauna) of an ecosystem and are reached to ecosystem as their wastes, dead remains, etc.

(c) The climate, temperature, light, soil etc., are other abiotic components of the eco-system.

(3) Biotic Substances (Living Components): This is indeed the trophic structure of any ecosystem, where living organisms are distinguished on the basis of their nutritional relationships. From this trophic (nutritional) standpoint, an ecosystem has two components:

(a) Autotrophic Component of Producers

These are the components in which fixation of light energy use of simple inorganic substances and build up of complex substance predominate.

I. The component is constituted mainly by green plants, including photosynthetic bacteria.
II. To some lesser extent, chemosynthetic microbes also contribute to the build up of organic matter.

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III. Members of the autotrophic component are known as eco-system producers because they capture energy from non-organic sources, especially light, and store some of the energy in the form of chemical bonds, for the later use.

IV. Algae of various types are the most important producers of aquatic eco-systems, although in estuaries and marshes, grasses may be important as producers.

V. Terrestrial ecosystems have trees, herbs, grasses, and mosses that contribute with varying importance to the production of the eco-systems.

(b) Heterotrophic Component or Consumers

These are the components in which utilization; rearrangement and decomposition of complex materials predominate. The organisms involved are known as consumers, as they consume autotrophic organisms like bacterial and algae for their nutrition, the amount of energy that the producers capture, sets the limit on the availability of energy for the ecosystem. Thus, when a green plant captures a certain amount of energy from sunlight, it is said to produce the energy for the ecosystem. The consumers are further categorized as:

(i) Macroconsumers

Marcoconsumers are the consumers, which in a order as they occur in a food chain are, herbivores, carnivores (or omnivores).

(a) Herbivores are also known as primary consumers.

(b) Secondary and tertiary consumers, if preset, are carnivores of omnivores. They all phagotrophs that include mainly animals that ingest other organic and particulate organic matter.

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(ii) Microconsumers

These are popularly known as decomposers. They are saprotrophs (=osmotrophs) they include mainly bacteria, actinomycetes and fungi. They breakdown complex compounds of dead or living protoplasm, they absorb some of the decomposition or breakdown products. Besides, they release inorganic nutrients in environment, making them available again to autotrophs.

The biotic component of any ecosystem may be thought of as the functional kingdom of nature. The reason is, they are based on the type of nutrition and the energy source used. The trophic structure of an ecosystem is one kind of producer consumer arrangement, where each "food" level is known as trophic level.

Standing Corp

The amount of living material in different trophic levels or in a component population is known as the standing corp. This term applies to both, plants as well as animals. The standing crop may be expressed in terms

I. Number of organisms per unit area,
II. Biomass i.e.organism mass in unit area, we can measure it as living weight, dry weight, ash-free dry weight of carbon weight, or calories or any other convenient unit suitable.

Decomposers

In the absence of decomposers, no ecosystem could function long. In their absence, dead organisms would pile up without rotting, as would waste products, It would not be long before and an essential element, phosphorus, for

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example, would be first in short supply and then gone altogether, the reason is the dead corpses littering the landscape would be hoarding the entire supply. The decomposers tear apart organisms and in their metabolic processes release to the environment atoms and molecules that can be reused again by autotrophic point of view. Instead they are important from the material (nutrient) point of view. Energy cannot be recycled, but matter can be. Hence it is necessary to feed Energy into ecosystem to keep up with the dissipation of heat or the increase in entrophy. Matter must be recycled again and again by an ecological process called biogeochemical cycle.

The Structure of ecosystem can be illustrated as under with the help of ponds example.

1. Abiotic Part: The abiotic or non-living parts of a freshwater pond include the follwing:

I. Water,
II. Dissolved oxygen,
III. Carbon Dioxide,
IV. Inorganic salts such as phosphates, nitrates and chlorides of sodium, potassium, and calcium
V. A multitude of organic compounds such as amino acids, humic acids, etc. according to the functions of the organisms, i.e., their contribution towards keeping the ecosystem operating as a stable, interacting whole.

(a) Produces

In a freshwater pond there are two types of producers,

I. First are the larger plants growing along the shore or floating in shallow, water,

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II. Second are the microscopic floating plants, most of which are algae,

These tiny plants are collectively referred to as phytoplankton. They are usually not visible. They are visible only when they are present in great abundance and given the water a greenish tinge. Phytoplanktons are more significant as food producers for the freshwater pond ecosystem than are the more readily visible plants.

(b) Consumers

Among the macro consumers or phagotrophas of pond ecosystems include insects and insect larvae, Crustaces, fish and perhaps some freshwater clams.

(i) Primary Consumers: Primary consumers such as zooplankton (animal plankton) are found near the surface of water. Likewise benthos (bottom forms) are the plant eaters (herbivores).

(ii) Secondary consumers: The secondary consumers are the carnivores that eat the primary consumers. There might be some tertiary consumers that eat the carnivores (secondary consumers).

Saprotrophs

The ecosystem is completed by saprotrophs or decomposer organisms such as bacteria, flagellage protozoans and fungi, They break down the organic compounds of cells from dead producer and consumer organisms in any of these ways-

I. Into small organic molecules, which they utilize themselves, or
II. Inorganic substances that can be used as raw materials by green plants.

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Ecological pyramids

The main characteristic of each type of Ecosystem in Trophic structure, i.e. the interaction of food chain and the size metabolism relationship between the linearly arranged various biotic components of an ecosystem.

We can show the trophic structure and function at successive trophic levels, as under:-

Producers ⟶ Herbivores ⟶ Carnivores

It may be known by means of ecological pyramids. In this pyramid the first or producer level constitutes the base of the pyramid. The successive levels, the three make the apex.

Ecological pyramids are of three general types as under:

(i) Pyramid of numbers: It shows the number of individual organisms at each level,

(ii) Pyramid of biomass: It shows the total dry weight and another suitable measure of the total amount of living matter, and

(iii) Pyramid of energy: It shows the rate of energy flow and/or productivity at successive trophic levels.

The first two pyramids

That is the pyramid of numbers and biomass may be upright or inverted. It depends upon the nature of the food chain in the particular ecosystem, However, the pyramids of energy are always upright.

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A brief description of these pyramids is as under:

1. Pyramids of numbers: The pyramids of numbers show the relationship between producers, herbivores and carnivores at successive trophic levels in terms or their numbers.

I. In a grassland the producers, which are mainly grasses, are always maximum in number.
II. This number shows a decrease towards apex, the reason is obvious, number than the grasses.
III. The secondary consumers, snakes and lizards are less in number than the rabbits and mice.
IV. In the top (tertiary) consumers hawks or other birds, are least in number. In this way the pyramid becomes upright.

In a pond ecosystem, also the pyramid is upright as under:

I. The producers, which are mainly the phyto-planktons as algae, bacteria etc. are maximum in number;
II. The herbivores, which are smaller fish; rotifers etc are less in number than the producers;
III. The secondary consumers (carnivores), such as small fish which eat up each other, water beetles etc. are less in number than the herbivores;
IV. Finally, the top (tertiary) consumers, the bigger fish are least in number. However, the case is not so in a forest eco-system.

There the pyramid of numbers is somewhat different in shape:—

I. Producer, here the producers, are mainly large-sized trees, they are less in number, and form the base of the pyramid.

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II. The herbivores, which are the fruit-eating birds, elephants, deer etc. are more in number than the producers.

III. Thereafter there is a gradual decrease in the number of successive carnivores. In this way the pyramid is made again upright. However, in a parasites food chain the pyramids are inverted. This is for the reason that a single plant may support the growth of many herbivores. In its turn, each herbivore may provide nutrition to several parasites, which support many hyperparasites. Consequently from the producer towards consumers, there is a reverse position. In other words the number of organisms gradually shows an increase, making the pyramid inverted in shape.

2. Pyramids of biomass

The pyramids of biomass are comparatively more fundamentalism; as the reason is they instead of geometric factor; show the quantitative relationships of the standing crops. The pyramids of biomass in different types of ecosystem may be compared as under:

In grassland and forest there is generally a gradual decrease in biomass of organisms at successive levels from the producers to the top carnivores. In this way, the pyramids are upright. However, in a pond the producers are small organisms, their biomass is least, and this value gradually shows an increase towards the apex of the pyramid and the pyramids are made inverted in shape.

3. Pyramid of energy

The energy pyramid gives the best picture of overall nature of the ecosystem. Here, number and weight of organisms at any level depends on the rate at which

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food is being produced. If we compare the pyramid of energy with the pyramids of numbers and biomass, which are pictures of the standing situations (organisms present at any moment), the pyramid of energy is a picture of the rates of passage of food mass through the food chain. It is always upright in shape.

Functions of Eco-system

For a fuller understanding of ecosystems a fuller understanding of their functions besides their structures is essential. The function of ecosystems includes, the process how an eco-system works or operates in normal condition.

From the operational viewpoint, the living and non-living components of ecosystem are interwoven into the fabric of nature. Hence their separation from each other becomes practically very much difficult. The producers, green plants, fix radiant energy and with the help of minerals (C, O, N, P, L, Ca, Mg, Zn, Fe etc.) taken from their soil and aerial environment (nutrient pool) they build up complex prefer to call the green plants as converters or transducers because in their opinion the terms ‘producer’ form an energy viewpoint which is somewhat misleading. They contend that green plants produce carbohydrates and not energy and since they convert or transducer radiant energy into chemical form, they must be better called the converters or transducers. However, the term’ producer’ is so widely used that it is preferred to retain it as such.

While considering the function of an ecosystem, the flow of energy and the cycling of nutrients are descibed. In other words, how much sunlight plants trap in a year, how much plant material is eaten by herbivores, and how many herbivores carnivores eat.

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The functions of Ecosystem are as under:

1. Transformation of Solar Energy into Food Energy

The solar radiation is major source of energy in the ecosystem. It is the basic input of energy entering the ecosystem. The green plants receive it and is converted into heat energy. It is lost from the ecosystem to the atmosphere through plant communities. It is only a small proportion of radiant solar energy that is used by plant to make food through the process of photosynthesis. Green plants transform a part of solar energy into food energy or chemical energy. The green plants to develop their tissues use this energy. It is stored in the primary producers at the bottom of trophic levels. The chemical energy, which is stored at rapid level one, becomes the source of energy to the herbivorous animals at trophic level two of the food chain. Some portion energy is lost from trophic level one through respiration and some portion is transfereed to plant-eating animals at trophic level two.

2. The Circulation of elements through Energy Flow

It is seen that in the various biotic components of the ecosystem the energy flow is the main driving force of nutrient circulation. The organic and inorganic substances are moved reversibly through various closed system of cycles in the biosphere, atmosphere, hydrosphere and lithosphere. This activity is done in such a way that total mass of these substances remains almost the same and is always available to biotic communities.

3. The Conversion of Elements into Inorganic Flow

The organic elements of plants and animals are released in the under mentioned ways:

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I. Decomposition of leaf falls from the plants dead plants and animals by decomposers and their conversion into soluble inorganic form.

II. Burning of vegetation by lighting, accidental forest fire or deliberate action of man. When burnt, the portions of organic matter are released to the atmosphere at these again fall down, under the impact of precipitation, on the ground. Then they become soluble inorganic form of element to join soil storage, some portions in the form of ashes are decomposed by bacterial activities.

III. The waste materials released by animals are decomposed by bacteria. They find their way in soluble inorganic form to soil storage.

4. The Growth and Development of Plants

In the biogeochemical cycles are included the uptake of nutrients of inorganic elements by the plants through their roots. The nutrients are derived from the soil where these inorganic elements are stored. The decomposition of leaves, plants and animals and their conversion into soluble inorganic form are stored into soil contributing to the growth and development of plants. Decompositions are converted into some elements. These elements are easily used in development of plant tissues and plant growth by biochemical processes, mainly photosynthesis.

5. Productivity of ecosystem

The productivity of an ecosystem refers to the rate of production i.e. the amount of organic matter, which is accumulated in any unit time. Productivity is of the following types:

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(1) Primary productivity: It is associated with the producers which are autotrophic, Most of these are photosynthetic, thus, they are, to a much lesser extent the chemosynthetic micro organisms. These are the green plants, higher saprophytes as well as lower forms, the phytoplankton's and some photosynthetic bacteria. We can define Primary productivity as "the rate at which radiant energy is stored by photosynthetic and chemosynthetic activity of producers." Primary productivity is further distinguished as:

Gross primary productivity: Gross Primary Productivity is the rate of storage of organic matter in plant tissues in excess of the respiratory utilization by plants during the measurement period. This is, thus, the rate of increases of biomass. In this way, net primary productivity refers to balance between gross photosynthesis and respiration and other plant losses as death etc.

(2) Secondary productivity: These are the rates of energy storage at consumer level. Since consumers only utilize food materials (already produced) in their respiration, simply covering the food matters to different tissues by an overall process. The secondary productivity is not divided into 'gross' and 'net' amount.

(3) Net Productivity: Net productivity refers to the rate of storage of organic matter not used by the heterotrophs (consumer) i.e. equivalent to net primary production minus consumption by the heterotrophs during the unit period. It is thus the rate of increase of biomass of the primary producers, which has been left over by the consumers.

(4) Stability of Ecosystem: The stability of ecosystems refers to the balance between production and consumption of each element in the ecosystem. In other

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words, balance between input and output of energy and normal functioning of different biogeochemical cycles and stable conditions of equilibrium as under:-

(i) The Equilibrium Model: The equilibrium model states that an ecosystem always tends towards stability. As soon as the community of an ecosystem is disturbed due to external environmental change, it quickly returns to original state.

(ii) The non-equilibrium model: The non-equilibrium model states that ecosystem stability is rarely attained because disturbances caused by frequent external environmental change do not allow to develop ordered state of species assemblages in an ecosystem.

Ecosystem

Species is the basic unit of Ecology. Set of several species makes population, different populations make a community, and several communities interacting with each other make an Ecosystem. Each biotic community lies in an abiotic environment called Biotope. The biotopes provide materials and energy to the communities inhabiting it. This means there is an interaction between biotic community and its environment.

The term ecosystem was introduced by AG Tansley in 1935 as Living world and its habitat, but the concept appeared in Ecology much later. An ecosystem is the structural and functional unit of biosphere comprising of the living organisms and their non-living environment that interact to form a self sufficient stable system. The relationship between a biotic community and the non-living environment is always a mutual one that means not only the

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environment affects the community but the community also modifies the environment.

Ecosystem has been assigned various names by different workers, such as:

1. Biocoenosis by Karl Mobius (1877)
2. Microcosm by S.A. Forbes (1887)
3. Holocoen by Friederich (1930)
4. Biosystem by Thinneman (1939)
5. Biogeocoenosis by Sukhachev (1944)
6. Ecocosm by R. Mishra (1960)

The importance of Ecosystem lies in the flow of energy and cycling of matter between living and non-living components of the system.

The study of Ecosystem offers holistic approach i.e. it gives a complete picture of the unit which is more important than its individual components.

Ecosystem approach involves the following important aspects:

1. Flow of the energy from living to non living.
2. Cycling of matter between biotic and abiotic components.
3. Functional relationship between the organisms themselves and the environment.

Types of ecosystem:

The natural ecosystem is of two types

(A) Terrestrial

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(B) Aquatic

The terrestrial ecosystem includes forests, grasslands and deserts. In this film, grasslands and desert ecosystems have been dealt with.

GRASSLAND ECOSYSTEM:

Grassland Ecosystem is an area where the vegetation is dominated by grasses and other herbaceous (non-woody) plants. It is also called transitional landscape because grassland ecosystems are dominated by the grass with few or no trees in the area where there is not enough for a forest and too much of a forest.

Components of Grassland Ecosystem

The components of the Grassland Ecosystem are discussed below:

1. Abiotic Components: These are non-living thing components consist of carbon, hydrogen, sulphur, nitrogen and phosphorous etc.

2. Biotic Components: These are living components and its sub-components are discussed below-

(I) Producers: The primary producers of food are the grasses such as Aristida, Cynodon, Digitaria, Desmodium, Setaria etc. If herbs and shrubs are present, they also contribute to the primary production of food.

(II) Consumers: The consumers in a grassland ecosystem are of three levels.

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(a) Primary consumers: These feed directly from the grasses (grazing) and include herbivores such as Cows, Buffaloes, Goats, Rabbits, Mouse etc. and also insects, termites, centipede, millipedes etc.

(b) Secondary consumers: These consumers are the carnivorous animals such as snakes, lizard, jackal, foxes, frogs etc. which feed on the primary consumers.

(c) Tertiary consumers: Hawk, Eagles and vultures constitute the tertiary consumer in the grassland ecosystem which preys upon the secondary and primary consumer.

(III) Decomposers: The organic matter of the grassland is decomposed by the microbes like actinomycetes, fungi (Mucor, Aspergillus, Rhizopus, Penincillium, and Cladosporium), aerobic and anaerobic soil bacteria etc. They release the minerals back into the soil thus making the soil fertile.

Functions of the Grassland Ecosystem

The primary function of an ecosystem is productivity. The producers fix the solar energy and produce the complex organic matter with the help of minerals. It provides forage for livestock, protection and conservation of soil and water resources, furnishing a habitat for wildlife, both flora and fauna and (contribution to the attractiveness of the landscape. The functional aspects of the Grassland can be studied by two means:

1. Food Chain in an ecosystem: There is an important feature of the ecosystem that one level of an organism serves as food for another level of the organism. A series is formed which is known as Food Chain. In an ecosystem, the food chain does not follow the linear pattern, but an organism may feed upon more than

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one organism in the same food chain or upon organisms of different food chains. Thus interconnected food chain system is formed known as a food web.

2. Nutrient cycle in an ecosystem: For any ecosystem to be successful, it is important that the constituent materials move in a cyclic manner. The producers (green plant) takes up the mineral elements from the soil and air, convert them into organic form and after passing through the different trophic levels, are again returned to the soil and air.

Economic importance of Grassland Ecosystem

Grass lands biomes are important to maintain the crop of many domesticated and wild herbivores such as horse, mule, ass, cow, pig, sheep, goat, buffalo, camel, deer, zebra etc. which provides food, milk, wool and transportation to man.

Hence, we can say that the Grassland Ecosystem is a mixture of grass, clover and other leguminous species, dicotyledonous, herbs and shrubs which contribute to a high degree of the preservation.

FOREST ECOSYSTEM

A forest ecosystem is a natural woodland unit consisting of all plants, animals and microorganisms (Biotic components) in that area functioning together with all of the non-living physical (abiotic) factors of the environment.

Types:

(a)Temperate Forest Ecosystem

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The temperate forest ecosystem is very important on Earth. Temperate forests are in regions where the climate changes a lot from summer to winter. Tropical rain forests are in regions where the climate stays constant all year long. Temperate forests are almost always made of two types of trees, deciduous and evergreen. Deciduous trees are trees that lose their leaves in the winter.

Evergreens are trees that keep them all year long, like pine trees. Forests can either be one or the other, or a combination of both. A fourth kind of forest is a temperate rain forest. These are found in California, Oregon and Washington in the United States.

These forests are made of redwoods and sequoias, the tallest trees in the world. The amount of rainfall in an area determines if a forest is present. If there is enough rain to support trees, then a forest will usually develop. Otherwise, the region will become grasslands

(b) The Tropical Rain Forest Ecosystem

Tropical rain forests are one of the most important areas on Earth. These special ecosystems are homes to thousands of species animals and plants. Contrary to popular belief, rain forests are not only densely packed plants, but are also full of tall trees that form a ceiling from the Sun above. This ceiling keeps smaller plants from growing. Areas where sunlight can reach the surface are full of interesting plants. The famous Amazon jungle is located in Brazil, in South America. This particular forest is called the Neotropics. Other large blocks are located in Central and West Africa.

(c) Boreal or Taiga Forests

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The boreal forest ecosystem is the contiguous green belt of conifer and deciduous trees that encircles a large portion of the Northern Hemisphere. In North America, the boreal forest stretches across most of northern Canada and into Alaska. It has long been identified as one of the world's great forest ecosystems.

Characteristics of the forest

- high animal and vegetal biodiversity.
- evergreen trees.
- dark and sparse undergrowth interspersed with clearings.
- scanty litter (organic matter settling on the ground)
- presence of "strangler" creepers

Structure of Forest Ecosystems

Different organisms exist within the forest layers. These organisms interact with each other and their surroundings. Each organism has a role or niche in sustaining the ecosystem. Some provide food for other organisms; others provide shelter or control populations through predation.

Producers

All living organisms intake energy in order to survive. In a forest ecosystem, trees and other plants get their energy from sunlight. Plants produce their own food, in the form of carbohydrates. Plants are, therefore, called the primary producers, since they produce the basic foodstuffs for other organisms within food chains and food webs. Photosynthesis is the chemical reaction that allows plants to produce their own food.

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Consumers

Animals cannot produce their own food. They must consume food sources for die energy they need to survive. All animals, including mammals, insects, and birds, are called consumers. Consumers rely on plants and other animals as a food source. Details of these animals in a forest ecosystem have been given earlier.

Primary consumers only eat plants and are referred to as herbivores. Secondary consumers are referred to as carnivores and feed on herbivores. Tertiary consumers are carnivores that feed on other carnivores. Omnivores eat both plant and animal matter.

Decomposers

Leaves, needles, and old branches fall to the forest floor as trees grow. Eventually all plants and animals die. These materials are decomposed by worms, microbes, fungi, ants, and other bugs. Decomposers break these items down into their smallest primary elements to be used again. Decomposers are important in that they sustain the nutrient cycle of ecosystems.

Functions of the ecosystem

The functions of the ecosystem are as follows:

- It regulates the essential ecological processes, supports life systems and renders the stability.
- It is also responsible for the cycling of nutrients between biotic and abiotic components.
- It maintains a balance among the various trophic levels in the ecosystem.
- forest has a stabilising effect on the natural environment.

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Humans are part of Forest Ecosystem

Humans are consumers. We get food and materials from forests. Because of this, we are a part of the forest ecosystem. Human consumption alters forest ecosystems. Human intervention may be necessary to sustain forest communities under the increased pressure of human use

DESERT ECOSYSTEM

A desert ecosystem is defined by interactions between organism, the climate in which they live, and any other non-living influences on the habitat. Deserts are arid regions which are generally associated with warm temperatures, however cold deserts also exist.

Deserts have an oppressive environment which host animals and plants living in extreme conditions. Plants and animals are involved in ecological cycle of tropical deserts. The strength of some desert-areas animals come from eating plants of the same area of them.

Desert is one of the most dried land areas on this planet that receives very little precipitation annually. It is a land with very less rainfall throughout the year measured less than 50 cm a year. Desert ecosystem is the driest ecosystem of the earth and this is the reason it has less vegetation and less diversity of life. It is one of the parts of the terrestrial ecosystem. The plants and animals of the desert ecosystem have mastered the art of survival in harsh conditions. A desert ecosystem is basically devoid of any rainfall or precipitation.

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Characteristic of Deserts Ecosystem

- **Aridity**

It is the common characteristic of all the deserts on the earth. Aridity simply implies the deficiency of moisture's or dryness. Desert experience very less rainfall and thus result in aridity.

- **Less rainfall/ precipitation**

Less precipitation is one of the major features of deserts and also the reason behind the dryness. The rainfall in deserts is seasonal and occurs only for a limited duration. The annual rainfall that a desert receives every year is just 25-30 centimeters.

- **Extreme temperature**

Desert ecosystems experience extreme temperatures during day and night. The days are very hot and the nights can be extremely cold. It is the sole characteristic of all the desert ecosystems either hot or cold all lacks moisture.

- **Velocity of wind**

It tends to be very high in a desert ecosystem. This is the reason deserts experience sandstorms/ dust storms of high intensity resulting in the formation of huge sand dunes.

- **Scarcity of water**

Due to less rainfall, there is a shortage of water in a desert ecosystem. Due to the scarcity of water deserts have to face the situation of drought half of the year.

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- **Humidity-**

The humidity level in a desert ecosystem is very low in the daytime and relatively high at night.

- **The quality of the soil**

In deserts is very low to grow vegetation. It is dry, rocky, thin, sandy, mainly grey in colour and has no organic contents like nitrogen, phosphorus etc which are essential for the growth of plants.

- **Biodiversity in a desert ecosystem –**

However, the survival in a desert ecosystem is very hard but despite the fact, deserts are home to various plants and animals. The plants and animals have adapted to survive in the harsh and extreme conditions of the desert.

- **The population density**

Density Is very low in deserts and nearby areas as there is there a scarcity of water, food and climatic conditioner are too harsh.

Structure of Desert Ecosystem

The desert ecosystem have following parts:

I. Biotic components the biotic components of desert ecosystem have three levels:

1) Producer Organisms

- In a desert, producers are mainly shrubs/bushes; some grasses & a few trees.
- Dominant plant species include: Succulents (water - retaining plants adapted to arid climate or soil conditions) & hardy grasses.
- Besides some lower plants such as lichens & xerophytic mosses are also present.

2) Consumer Organisms

These include animals such as insects, reptiles which are capable of living in xeric conditions

- Besides some nocturnal rodents, birds & some mammalians like camel etc are also found.

3) Decomposers

Due to poor vegetation with very low amount of dead organic matter, decomposers are poor in desert ecosystem.

- The common decomposers are some bacteria & fungi, most of which are thermophillic.

II. Abiotic components

Due to high temperature & very low rainfall, the organic substances are poorly present in the soil.

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Types of desert ecosystem

Desert ecosystems do not exist only in hot and dry areas of the earth. You can a find a desert ecosystem in a tropical, arid, and even in extremely cold locations.

Here we have shared information about all the types of Desert Ecosystem that exist on this earth.

1. Hot and Dry Desert Ecosystem-

These kinds of the desert ecosystem have hot and dry climatic conditions through the air and have very low annual rainfall. The hot desert ecosystem is basically found in Central America, South Asia, North America, Africa, Australia etc. There are extreme variations in temperature and soil is rough and harsh.

2. Semi-arid Desert Ecosystem-

This desert ecosystem is quite similar to the Hot and Dry desert ecosystem. This kind of ecosystem has hard rocks, stable ground, less sand dunes. Temperature is not as extreme as a hot and dry desert ecosystem. Great Basin is an example of Semi-arid desert ecosystem. It receives a lot of rain as compared to the normal desert's ecosystem.

3. Coastal desert ecosystem-

The Atacama Desert in Chile and Namib in Africa are a good example of Coastal desert ecosystem. Such desert ecosystems are found near the coastal lines of big water bodies like oceans and seas and are generally affected by the ocean currents. Winter fogs are common here. They are more hospitable than

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other desert ecosystem and therefore they have a more flora and fauna than others.

4. Cold desert ecosystem-

This desert ecosystem comprises of abundant rainfall throughout the winters and less in summers and generally has chilling winters with snowfall. The summers are short, moderately hot and moist here. These are usually covered with snow dunes. Such desert ecosystem can be found in Greenland, Antarctica, and Nearctic realm.

Importance of desert ecosystem

It is usually considered as the waste and useless land. However, the literal meaning of desert is waste but the truth is a desert ecosystem is a significant part of the earth like other ecosystems. No matter they are dry, receives less rainfall, have less biodiversity but they are a part of earth and help in maintaining a balance. Desert ecosystem is important for the earth because-

- Desert ecosystem is habitat to various species of plants and animals. These plants have adapted to survive in an extreme environment.
- It is also important as they act as carbon sink which means the bacteria in the sand helps to store the carbon dioxide and prevent it from entering into the atmosphere.
- This ecosystem is a big source of minerals and natural gas and oil. Also, check ways to save natural resources to protect the ecosystem.
- Desert ecosystem is usually for the production of salt.

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- This kind of ecosystem is ideal for the preservation of historical remains artefacts. Thus, deserts have great significance in archaeological discoveries.
- Deserts have unusual landscape and oasis and people around the world get attracted to the scenic beauty of such natural formation. Therefore, deserts are important tourist locations.
- Desert sands also act as a carbon sink. Scientists found that bacteria which are living in Kalahari desert of Africa helps in storing carbon dioxide from the air.

In totality, it is a crucial part of this earth and is beneficial for plants, animals, human beings and the environment of the earth. We should not forget that a desert ecosystem is arid and dry but it is full of life and beauty.

AQUATIC ECOSYSTEM

An ecosystem termed is a natural unit of living and nonliving parts that interact to produce a stable system. Furthermore, habitat is an important part of such an ecosystem. Primarily ecosystem has two domains such as terrestrial ecosystem and aquatic ecosystem.

Water certainly supports many lives. Moreover, the organisms which survive in water are aquatic organisms. Furthermore, they thus depend on water for their food, shelter, reproduction and many other life activities.

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Definition of Aquatic Ecosystem

First of all, an ecosystem is a community of living organisms and their physical and chemical environment, linked with the help of flows of energy and nutrients. Furthermore, ecosystems function as an ecological unit and therefore can be defined at a variety of scales.

Most noteworthy, the aquatic ecosystem includes freshwater habitats such as lakes, ponds, rivers, oceans and streams, wetlands, swamp, etc. Whereas marine habitats include oceans, intertidal zone, reefs, seabed and so on. Furthermore, the aquatic ecosystem is the habitat for water-dependent species like animals, plants, and microbes.

Living organisms in a particular environment are certainly affected by characteristics such as nutrient concentrations, temperature, water flow, and shelter. Furthermore, only those organisms can survive which are able to live in the conditions of a particular habitat and use the available resources.

Interactions between living organisms also affect the type of organisms which can be found in an aquatic ecosystem. Therefore, the understanding of the basic components of aquatic ecosystems and the related interactions can lead to better management of human impacts on these systems.

Types of Aquatic Ecosystem

Different types of aquatic ecosystems are as follows:

1. Freshwater Ecosystem:

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These cover only a small portion of the earth which is nearly 0.8 percent. Freshwater means lakes, ponds, rivers and streams, wetlands, swamp, bog, and temporary pools.

2. Lotic Ecosystems:

These mainly refer to the rapidly flowing waters that move in a unidirectional way including the rivers and streams. Furthermore, these environments have numerous species such as beetles, mayflies, stoneflies and several species of fishes including trout, eel, minnow, etc.

3. Lentic Ecosystems:

They include all standing water habitats. Moreover, lakes and ponds are the primary examples of the Lentic Ecosystem. Also, these ecosystems contain algae, crabs, shrimps, and amphibians such as frogs and salamanders.

4. Wetlands:

Wetlands are marshy areas and are sometimes covered in water which has a wide variety of plants and animals. Swamps, marshes, bogs, black spruce, and water lilies are the main examples in the plant species. The animal life of this ecosystem consists of dragonflies, damselflies, and various birds and fishes.

5. Marine Aquatic Ecosystem:

The marine ecosystem covers the largest surface on the earth. Two-thirds of the earth is covered by water which constitutes oceans, seas, intertidal zone, reefs, seabed, etc. Form of each life is unique and native to its habitat.

6. Ocean Ecosystems:

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Our earth is having five major oceans. Moreover, these oceans are like a home to more than five lakhs aquatic species. Some species of this ecosystem include shellfish, Shark, Tube Worms, Crab Small, and large ocean fishes.

7. Coastal Systems:

These are the open systems of land and water, joined together to form the coastal ecosystems. A wide variety of species of aquatic plants and algae live at the bottom of it. The diverse fauna consists of crabs, fish, insects, lobsters snails, shrimp, etc.

Structure of aquatic ecosystem

The food cycle is an aquatic ecosystem involves the concentration of organic ingredients and the constant breaking up of the same into smaller and basic parts.the aquatic ecosystem has the following parts:

1. Abiotic component

The aquatic ecosystem encompasses biotic communities that are structured by abiotic environmental factors and biological intrections.the major environmental factors of the aquatic ecosystem are substrate type,depth of water, nutrient present in water, dissolved oxygen,acidity level etc.

2. Biotic components

The biotic component of aquatic ecosystemconsists of allthe living organisms living in the water

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Function of aquatic ecosystem

Main functions of an ecosystems are

- recycle of nutrients
- energy flow
- purification of water
- attenuate floods
- recharge of ground water and provide verities of microhabitats.

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