ECOLOGY

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(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

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 rate of energy flow and/or productivity at successive trophic levels.

(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.

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 tropic 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.

(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 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

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 transferred 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:

(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 and 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 converged 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.

ENERGY-ITS FLOW IN ECOSYSTEM

Energy

Energy can be defined as the capacity to do work, whether that work be on a gross scale as raising mountains and moving air masses over continents, or on a small scale such as transmitting a nerve impulse from one cell to another

Kinds of Energy

There are two kinds of energy, potential and kinetic. They can be explained as under:-

1. Potential Energy

Potential energy is energy at rest. It is capable and available for work.

2. Kinetic Energy

Kinetic energy is due to motion, and results in work. Work that results from the expenditure of energy can be of two kinds:

(1) It can store energy (as potential energy).

(2) It can order matter without storing energy

3. Laws of Thermodynamics

The expenditure and storage of energy is described by two laws of thermodynamics:-

(i) Law of conservation of energy:

The law of conservation of energy states that energy is neither created nor destroyed. It may change forms, pass from one place to another, or act upon matter in various ways. In this process no gain or loss in total energy occurs. Energy is simply transferred from one form or place to another.

Two Reactions

There may be either of the two reactions:

1. Exothermic Reaction

When wood is burnt the potential energy present in the molecules of wood equals the kinetic energy released, and heat is evolved to the surroundings. This is an exothermic reaction.

2. Endothermic Reaction

In an endothermic reaction, energy from the surrounding may be paid into a reaction. For example, in photosynthesis, the molecules of the products store more energy than the reactants. The extra energy is acquired from the sunlight yet there is no gain or loss in total energy.

(ii) Law of Decrease in Energy:

The second law of thermodynamics states that on the transformation of from one kind to another, there is an increase in entropy and a decrease in the amount of useful energy. In this way, when coal in burned in a boiler to produce steam, some of the energy creates steam that performs work, but part of the energy is dispersed as heat to the surrounding air.

ECOLOGICAL SUCCESSION-MEANING AND TYPES

Meaning of Succession

Biotic communities are not static. Instead they change through time. This change can be understood on several levels. The simplest level is the growth, interaction and death of individual organisms as they pass through their life cycles, affected by the cycles of seasons and other natural phenomena. Some

other levels of community change act over longer time spans and that account for much larger changes in community composition and structure. These include ecological succession and community evolution.

It is evident from the above said that the term succession denotes a sequence of changes in the species composition of a community, which is generally associated with a sequence of changes in its structural and functional properties. The term is generally used for temporal sequence (in terms of years, decades or centuries) of vegetation on a site; although only short term changes can be observed directly and the long term ones are inferred from spatial sequences.

Ecological succession can be explained with the help of illustrations as under: -

1. Lake

When a lake fills with silt it changes gradually from a deep to a shallow lake of pond, then to a marsh, and beyond this, in some cases, to a dry-land forest.

2. Crop field

When a crop field is deserted or a forest is severely burned over, it is just like a plot of bare ground and a series of plant communities grow up there and replace on another - forest annual weeds, then perennial weeds and grasses, then shrubs, and trees-until a forest ends the development.

In this way, ecological succession is an orderly and progressive replacement of one community by another until a relatively stable community, called the climax community, occupies the area.

(1) In the first example the principal cause of the change in the community was physical process-the filling in of the lake with silt.

(2) In the second example, a principal cause was the growth of plants on an existing soil.

Types of Succession

The succession may be of the following two types:

1. Primary Succession

Primary Succession is the process of species colonization and replacement in which the environment is initially virtually free of life. In the other words the process starts with base rose or sand dune or river delta or glacial debris and it ends when climax is reached. The sere involved in primary succession is called presere.

2. Secondary Succession

Secondary succession is the process of change that occurs after an ecosystem is disrupted but not totally obliterated. In this situation, organic matter and some organisms from the original community will remain; thus the successional process does not start from scratch. As a result, secondary succession is

more rapid than primary. It is seen in areas burned by fire or cut by farmers for cultivation. The sere involved in secondary succession is called subsere