Community

"A biotic community is a naturally occurring assemblage of plants and animals that live in the same environment, are mutually sustaining and interdependent, and are constantly fixing and dissipating energy."

However, the different species in a biotic community share a common environment and their relationships are based on direct or indirect functional interactions. The nature of relationship is determined by the requirements of the members of the community.

Biotic community organisation results from interdependence and interaction among populations of different species in a habitat. Large number of biotic communities found in nature due to two specific reasons.

They are as follows:

(i) Existence of diverse habitats with characteristic environmental conditions and

(ii) Co-occurrence of different species whose tolerance ranges overlap with the environmental condition obtained in that habitat. When similar habitat conditions are repeated at another location, the same biotic community gets established there.

Characteristics of Biotic Community:

Each biotic community consists of very diverse organisms belonging to different kingdoms of living things. The number of species and abundance of population in communities also vary greatly. The organisms in a community depend upon each other as well as upon the non-living environment for food, shelter and reproduction.

Species Composition:

The kinds of plants and other organisms present in a community indicate its species composition, which differs from one community to another. Sometimes, in the same community, there may be seasonal variation in plant species.

Each species of community has got definite range of tolerance towards the physical and biological environmental conditions of the habitat. The range of environment a species can tolerate is called its ecological amplitude. The nature of community of a particular habitat is determined by the species, and physical and biotic influences prevailing in the locale of community.

Dominance:

A biotic community may have major categories of growth forms, such as trees, shrubs, herbs and mosses. Out of hundreds of species present in the community, relatively only a few exert a major controlling influence due to their large size, numbers of activities.

The phenomenon is called dominance. **"Dominant species are those which are highly successful ecologically and which determine to a considerable extent the conditions under which the associated species must grow."**

The dominance in the community may be the result of co-action between two or more species. Different communities are generally recognized and named on the basis of dominant species occurring in them. For example, a forest community in which pine trees are dominant is called pine forest.

Grassland represents a community which has grass species dominating over the other herbs. Sometimes, communities are named after environmental factors, such as desert community, marine community, mangrove vegetation, etc.

Stratification:

Every biotic community has a vertical layering or stratification of organisms or environmental conditions. A number of examples can be cited to support the concept of community stratification from different habitats.

In grassland community three strata, namely:

(a) Subterranean,
(b) Floor and
(c) Herbaceous may be recognized.

The subterranean stratum contains the roots of the principal vegetation and provides permanent shelter to bacteria, fungi, protozoans, nematodes, earthworms, ringworms and several other invertebrates. The floor stratum consists of basal parts of the vegetation, including the rhizomes of grass plants.

In this stratum, generally the insects, spiders, reptiles and rodents are present. The herbaceous stratum of grassland community is represented by upper parts of grasses and herbs. Several types of insects, birds and grazing mammals are included in this stratum.

In a forest community, five vertical strata are present. They are:

(a) Overstorey stratum,

(b) Understorey stratum,
(c) Transgressive stratum,
(d) Seedling stratum, and
(e) Subterranean stratum.
A typical forest may have an overstorey stratum comprised of trees that are more than forty feet in height. These trees make a canopy. Just beneath this canopy there is an understory stratum that extends from twenty feet in height to a short distance below the overstorey. A transgressive stratum extends from four feet to twenty feet or more and comprises of shorter shade loving species.

The seedling stratum begins at the soil level and extends to the lower limit of the transgressive strautm. The subterranean stratum in the forest community is moist and contains a large amount of humus. It is very prominent up-to a depth of two to three meters. Each strautm has its own group of animals.

However, most animals can move from one stratum to another in search of food or in response to many biotic factors, such as insects, snails, birds and squirrels.

The animals found above the soil include turtles, snakes, some birds, insects and a variety of mammals, such as rabbits, deer, wolves and foxes. The animals living in humus soil are beetles, fly larvae, spiders, annelids, antipodes, mites, protozoans, nematodes and some springtails.

In pond community, vertical stratification is very little. However, in deep ponds and lakes three strata:
(a) Littoral zone,
(b) Limnetic zone and
(c) Profundal zone can be recognized.
The littoral zone comprises shallow water region and is occupied by rooted plants. The limnetic zone occupies the depth up-to which the light penetrates and inhabited by planktons, nektons and neustons. In profundal zone, there is no penetration of light, and therefore, it has no photosynthetic organisms.

Species Diversity:
The biotic community is a natural assemblage of a large number of plant and animal species in an area. However, in any particular habitat there is no considerable variation in environmental

condition, the plants growing together in a community show unique uniformity in their behaviour.

Vegetation, therefore, is reflection of a climate and, in general, widely separated areas having similar climate have similar aspects of landscape.

Some communities, for example, tropical rain forest and coral reef community, show high species diversity with many different kinds of species living at each trophic level.

Some community areas have limits but more often the community boundaries are hard to define. A clearly distinguished area or a type of area with uniform habitat conditions and supporting characteristic type of vegetation is termed biotype.

Ecotone and Edge Effect:

The zone where two or more different communities meet and integrate, is called transition zone or ecotone. This zone of integration may be narrow or wide, local (e.g., a zone between field and a forest) or regional (e.g., the transition between forest and grass land). Ecotone contains few species from both communities. The total number of species is often greater in the ecotone than in the adjoining communities.

The ecotone or transition zone exhibits a shift in dominance of the conspicuous species of both sides. It may also include a number of highly adaptable species that tend to colonize such transitional areas. Because of this, the variety (i.e., species diversity) and density of life is often greatest in such areas.

This potential for the ecotone to act as a habitat for species found in neither major community is called edge effect. Thus the tendency of increased variety and density of some organisms at the community border is known as edge effect.

The organisms that occur primarily, or most abundantly, or spend the greatest amount of their time in junctions between communities are called edge species. A common example of the edge effect in action can be seen in those species of owl that live in or near ecotones between forests and grasslands. They depend on forest trees for nesting and do their hunting in the grassland, where they depend on field rodents for food.

In man-made communities such as agricultural fields, the ecotone between the field and the forest act as refuge for species formerly found in the ploughed area, as well as for other plants

such as weeds. Ecotones of this type are also the prime habitat of may species of insects, game birds, and mammals.

Keystone Species:

The species, which have much greater influence on community characteristics, relative to their low abundance or biomass, are known as keystone species. Such species play a vital role in controlling the relative abundance of other species.

When keystone species is removed, it causes serious disruption in the functioning of the community. For example, in the tropical rain forests, the different species of figs are the keystone species as they produce large quantity of fruits. During the time of food scarcity, these fruits are consumed by monkeys, bats, birds, etc. Thus, by protecting the fig trees, the animals dependent on them are also conserved.

Climax community

Climax community is the stable end product of successional sequence or sere. It is a community that has reached a steady state of species composition, structure and energy flow, under a particular set of environmental conditions. Steady state indicates the dynamic nature of the climax.

Also the end of successional change does not mean that community development has come to an end. As has been stated above, climax community is always in a state of flux and its structure undergoes changes due to birth, death and growth processes. However, these changes are less dramatic than the community transformations observed during succession.

The characteristics of a climax community are:

1. The climax community is able to tolerate its own reaction.

2. It tends to be mesic (medium moisture content) rather than xeric (dry) or hydric (wet).

3. The climax community is more highly organised.

4. The climax community with its more complex organisation has large number of species and more niches.

5. The organisms of earlier successional stages tend to be smaller, shorter-lived with a higher biotic potential (r-selected). In contrast, the species of climax community tend to be relatively large, long lived and with a low biotic potential (K-selected).

6. In climax community, energy is at a steady state (net primary production is zero), whereas, in immature stage of succession, gross primary production tends to be greater than community respiration, signifying accumulation of energy.

7. Immature ecosystems are temporary while in climax community the stability is high.

8. Climax communities show less broader changes and are more resistant to invasions than immature ecosystems.

There are following theories of the climax:

1. Mono-climax Theory:According to the mono-climax theory of succession (Clements, 1936), every region has one climax community toward which all communities are developing. He believed that climate was the determining factor for vegetation and the climax of any area was solely a function of its climate. Various terms such as sub-climax, dis-climax, post-climax, and pre-climax are used to describe the deviations from the climatically stabilized climax. These communities, controlled by topographic, edaphic (soil), or biotic factors are regarded as exceptions by the supporters of the mono-climax view.

2. Poly climax Theory: This theory was proposed by Tansley (1939) and later supported by Daubenmire (1966). The poly-climax theory of succession holds that many different types of vegetation as climax communities may be recognized in a given area. These will be climaxes, controlled by soil moisture, soil nutrients, activity of animals and other factors. According to this theory, climate is only one of the several factors, any of which may have a controlling influence on the structure and stability of the climax. This allows many climaxes in a climate region and is, therefore, called the poly-climax theory.

The difference between this theory and the mono-climax theory is largely a matter of emphasis on which factor is responsible for the stability of a climax. According to Krebs (1994), the real difference between two theories lies in the time factor of measuring relative stability. The climate varies on an ecological time scale as well as on a geological time scale. Succession in a sense, then, is continuous because we have variable vegetation approaching a variable climate.

3. Climax-pattern Theory: Whittaker (1953) emphasized that a natural community is adapted to the whole pattern of environmental factors in which it exists; the major factors are: genetic structure of each species, climate, site, soil, biotic factors (activity of animals), fire, and wind, availability of plant and animal species, and chances of dispersal. According to this theory, climax communities are patterns of populations varying according to the total environment. There is thus no discrete number of climax communities and no one factor determines the structure and stability of a climax community.

Whereas the mono-climax theory allows for only one climatic climax in a region and the poly-climax theory allows several climaxes, the climax-pattern hypothesis allows a continuity of climax types varying gradually along environmental gradients and not clearly separable into discrete climax types.

4. Climax as Vegetation: According to Egler (1954) one can say that "climaxes" in a broad sense are nothing more than totality of vegetation, itself He, thus, favors the study, of vegetation; as it is, with careful observations to explain and interpret past, present, and future conditions of particular communities.

We may conclude from these theories that the end point of succession is climax which is in itself not completely stable. The climate of an area has overall control on the vegetation; but within each of the broad climatic zones there are many modifications caused by soil, topography, and animals which lead to many climax situations. Climax communities do not necessarily represent a halt to successional change.

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