COMMUNITY ECOLOGY

All the living entities of an ecosystem form a single biotic component, the **community** or **biotic community**. All the organisms of a community live together, share same habitat, influence each other's life directly or indirectly and have reached a survival level within a given radiant energy. Thus, a community is any assemblage of populations of living organisms in a prescribed area of habitat. A community is claimed to have one or more of the following attributes: (1) co-occurrence of species, (2) recurrence of groups of the same species, and (3) homeostasis or self-regulation (**Krebs**, 1985). Community is a larger unit than the population and it achieves many characteristics that are not found in its constituents, *i.e.,* the organisms and the populations. Communities may have a wide range of sizes, ranging from a small patch of land or water- body to extensive forests. **Minor communities** are greatly influenced by inputs from adjacent communities, while **major communities** are relatively independent and self-sufficient of their habitat. Communities differ from place to place and at the same place at different times. The approach of botanists and zoologists to community studies is quite different. While the zoologist is mainly con- cerned with the functional relationships within a community, involving both the plants and animals, the botanists are generally concerned with community structure and the changes that undergo in time and space.

CHARACTERISTICS OF A COMMUNITY

Like a population, a community has a series of characteristics such as follows :

1. **Species diversity.** Various species of plants and animals live in a community and exhibit species richness or species diversity. The study of species diversity is an essential component of community study. For animal communities, a study of age structure and growth pattern is important, while for plant communities, floristics, study of taxonomy, life forms such as herbs, shrubs, climbers, trees are important. Since seasonal changes occur in the appearance of plant structure and growth, periodicities and phenology (= seasonal succession in natural communities) are significant parameters.
2. **Growth form and structure.** The type of the community is described by major categories of growth forms (*e.g.,* trees, shrubs, herbs, mosses, etc.) These different growth forms determine the stratification, or vertical layering of the community.
3. **Dominance.** Among several species present in a community, a few exert a major controlling influence by virtue of their size, numbers, or activities. These are called as **ecological dominants** or **dominant species**.
4. **Relative abundance.** Different populations in a community exist in relative proportions and this idea is called as **relative abundance**.
5. **Trophic structure.** Who eats whom ? The feeding relations of the species in the community will determine the flow of energy and materials from plants to herbivorous animals to carnivorous animals.

CLASSIFICATION OF THE COMMUNITIES

Communities have been classified by different ecologists from different view points. In terms of the general growth, composition, shape, etc., of vegetation, and organisms

associated with them, communities may be classified as **forests**, **deserts**, **grasslands**, **tundra** and so on. Likewise, according to the amount of water in the habitat, communities may be divided as **hydrophytic** in predominantly aquatic habitats, **mesophytic** in moderately moist soils and **xerophytic** in arid or dry conditions. Communities growing in condition of abundant light are called **heliophytic** and those growing in shade are called **sciophytic**. **Clements** (1916) recognized the fact that plant communities are not always the same at any place and he classified the communities on two parallel lines : One in the process of change which are called **seral communities** and the others are called **stable** or **climax communities**.

Further, the **global community** is an enormous mass of life, comprising all the plants and animals in the world. The global community is further divided into : **continental communities** and **oceanic communities**. Since due to great variability in climatic factors, an exhaustive study in such vast areas is practically impossible, therefore, communities are often studied as **biotic province**. A biotic province can be defined as a considerable geographic area, over which the climate is relatively uniform though often modified by physiographic features (**Dice**, 1952). Since biotic province is an abstract community, so based on ecological criteria, the associations are studied as **concrete communities**. A concrete community can be defined as a specific area which can be observed directly and which is an assemblage of plants and animals that actually exists and from which some ecological data can be collected.

Lastly, a **stand** is the largest concrete community, for example, a particular forest, river, swamp, meadow or lake that can be seen, observed, measured and worked over by the ecologist. A **microstand** is a small localized area within stand. Thus, each individual plant or animal with its associated parasites, epiphytes and commensals are good examples of the microstands.

ECOLOGICAL AMPLITUDE

The range of environmental conditions which a taxon can tolerate is called **ecological amplitude**. The composition of a biotic community in any habitat is dependent upon the frequency of environmental conditions in that habitat and the ecological amplitude of species populations. Thus, the climate and other abiotic and biotic conditions of a habitat determine the type of community which survives and develops.

HABITAT AND NICHE

The term **niche** was for the first time used by **Joseph Grinnel** (1971) to explain microhabitats of California thrashers. According to him, "niche is the ultimate distributional unit, within which each species is held by its structural and instinctive limitations. no two species in the same general territory can occupy for long identically the same ecological niche." The **area** of a species or any other taxon refers to the total extent of its geographical range of dispersal; this can be plotted on a map. The **habitat** of a species described in a single word or phrase is the totality of abiotic factors to which the species is exposed in this area. Thus, one can talk of marine habitats, coastal habitats, marsh habitats, forest habitats, disturbed habitats or even dry habitats.

In many cases, however, the habitat of the species is highly specialized. Certain species of leaf miners, for example, live only in the upper photosynthetic layer of the leaves of certain species of plants, while other species live in the lower cell layer. These patterns of location are so consistent that it is clear that the habitats of the species are different. Subdivisions of the environment on this scale are commonly called **microhabitats**.

Thus, the leaf constitutes a microhabitat for leaf miners within the total forest, and the different cell layers of leaf constitute different microhabitats within the leaf for different species of leaf miner. Conditions within the leaves are quite different from the general conditions in the forest. The specific environmental variables in the microhabitat of a population is called **microenvironment** or the **microclimate** (**Clapham**, **Jr**., 1973).
Though habitats and microhabitats indicate the places where organisms of a community live, but, if one wishes to understand how a species fit into the fabric of the ecosystem, it is not enough to merely describe the creature's habitat or microhabitat, he must also understand its functional role within the community—"address" of the organism but its "profession" as well. This includes what it eats, what it does, where it lives—everything about it that influences the community. Thus, the ecological niche is the property of the community and it represents the place of the species in the formal community structure. In fact, the ecological niche is an inclusive term that involves not only the physical space occupied by an organism, but also its functional role in the community (*i.e.,* trophic position occupied) and its position in environmental gradients including other conditions of existence. These three aspects of ecological niche are generally designated as (i) the **spatial** or **habitat niche** (the physical space occupied); (ii) the **trophic niche** (functional role, *i.e.,* trophic position), and (iii) the multidimensional or **hypervolume niche** (position in the environmental gradients).

ECOTONE AND EDGE EFFECT

In the ecocline (*i.e.*, gradient of ecosystems), the line of demarcation (boundary-line) between two communities is often very difficult in view of the chances of overlapping of one community over another. Such demarcation will be conspicuous only when the dominants of the adjacent communities show clear and characteristic differences. The transition zone between two or more diverse communities is called the **ecotone**. The common examples of ecotone are following—the border between forest and grassland, the bank of a stream running through a meadow or between a soft bottom and hard bottom marine community. An ecotone, thus, presents conditions that are intermediate to the communities which are on either side of it. The ecotones may be narrow or very wide, extending to large areas. The community on either side of the ecotone may have a typical structure, but the ecotone is strikingly different. The ecotone has a higher diversity than either of the main communities, a diversity that is not directly controlled by the climate or further fundamental environmental factors, but because of the migrations of individuals of different species-populations from both communities. Further, a number of special populations can become adapted specifically to the ecotone, even when both of the major communities are too simple or are otherwise unsuited for successful colonization by the species. This potential for the ecotone to act as habitat for species found in neither major community is termed as the **edge effect**. 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 grassland. They depend on forest trees for nesting, and they do their hunting in the grassland, where they depend on field rodents for food. In man-made communities such as agricultural fields, the transition zone (ecotone) between the field and the forest may act as a refuge for animal species formerly found in the plowed area, as well as for other plants such as weeds. Ecotones of this type are also the prime habitat of many species of insect, game bird, and mammal.