CHAPTER-II

REVIEW OF LITERATURE
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Vegetation ecology is the study of both the structure and distribution of vegetation. This includes the investigations of species composition, sociological interaction of species in communities, community development, change and stability with time. It is concerned with all geographic levels of plant communities, from vast physiognomic formations to the very fine floristic pattern occurring on an area less than a square meter in size. Vegetation ecology is very much concerned with correlation between environment and vegetation ultimately resulting into formation of community (Mueller – Dombois and Ellenberg, 1974). According to Shrinerwell (1971), vegetation is of different type of plant communities within the region. Plant community is a random aggregation of plants with a typical floristic composition and morphological structure, which have resulted from the interaction of species populations through time. Every organism exists in nature through some relationship with other organisms and the prevailing environmental conditions. The aim of this relationship is to maintain steady production of organic matter, energy flow and nutrient cycling. Energy flow is the main criterion for existence of any ecosystem. It is seldom a limiting factor in the productivity of ecosystem. However, availability of nutrients and water is the important influencing factor for functioning of most of terrestrial ecosystems Duvigneaud and DeSmet, (1973). Species in natural community are not isolated, but exhibit either positive or negative relationship among them because of interactions between the species or of similar responses of species to the environment. According to Dansereau (1960), each species in a community has
its own ecological amplitude and has particular relationship to the environment and to the associated species as well. Thus the nature of plant community at a place is determined by the species that grow and develop in such environment (Bliss, 1962). Warming (1909), Braun-Blanquet (1965) and Nicholas (1977) considered the community as basic unit of vegetation classification. Higher taxa may also be used provided that a relationship can be established between the distribution patterns of the higher taxa and those of the species that they contain (Williams and Gaston, 1994). Higher taxa are also cheaper and quicker to survey and identify. The search in the past has been for so called ‘indicator taxa’, small groups of species or other taxa that would act as general biodiversity predictors. It is clear that there is no such things or a single indicator taxa that can accurately predict overall species richness for all groups. However, there is little evidence that any subset of taxa can fully or completely represents biodiversity as a whole (Prendergast et al., 1993).

The species diversity and vegetational structure in tropical dry deciduous forest ecosystem in general have been studied by several workers, i.e. Shah et al., (1978), Shah and Bhatt (1980), Verma and Das (1981), Banajeer and Lal (1985) and Sharma et al., (1986). The composition of any community is reflected more in the life–forms than any other characteristics of vegetation, which present a clear picture of ecological nature of community. It is essential to study various plant communities for knowing the vegetation dynamics which influence the life of plants in social units Braun-Blanquet (1932). Vegetation ecology is very much
concerned with the causes of community formations (Muller-Dombois and Ellenberg, 1974).

Lugo et al., (1993) have reported that the use of mathematical expressions relating to the number of species supports the amount of habitat area, while employing species-area models of proven generality, it fails to reduce the estimation of biodiversity losses. There is no doubt that deforestation in tropical regions is threatening of eliminating numerous tropical forest ecosystems, species and genetically unique populations (WCMC, 1992), including valuable tropical forest genetic resources. (FAO, 1990).

Kunhikannan et al., (1993) have studied the plant species characteristics and successional stages have been grouped into hydrophytic, amphibious, sedges, grasses and pioneer tree community. Similar type of communities in swampy area were also observed by Deva and Srivastava (1978) in Golatappav Swamp in Dehradun.

Verma and Das (1981) have studied the vegetation of Kolaras Range, M.P. and reported that how human interferences together with the topography of the land can produce a large variety of environmental complexes. The various plant communities have been compared by evaluating the similarity indices. Sampson (1939) has discussed the significance of plant communities as indicator to provide a rough estimate of the controlling factors present in the habitat. However, it was pointed out by him that all the species in community provide a better basis for approximating the causative factors for the presence of a species.
As pointed out by Polunin (1960) that the climate is a master factor determining vegetation of an area but the fact that the development of vegetation within same climate would also depend largely on the availability of plant species (Beadle, 1951) and their adaptations cannot be ignored. The classical view of diversity remains important for intensive studies of particular ecological communities and forest stands (Hunter, 1990). The traditional approach in the biodiversity studies has been qualitative based on some important perceptions. However, there is a trend towards a more objective quantitative estimation of species diversity, frequency and distribution patterns (Swindel et al. 1991). The Shannon Wiener diversity index is often used to estimate alpha diversity. Beta diversity studies of the elements that make up this diversity would be extremely useful under different land uses (Swindel et al., 1984). There have been several methodologies proposed for statistical analysis of the plant cover (Greig-Smith, 1983). Laying quadrats and transects, enumeration of trees of specific DBH, measuring of distance of a tree from its nearest neighbour, determining distance to the nearest taxa are some methods in quantitative ecology (Gove et al., 1994).

Progressive impoverishment of biota at regional and global scales has shown a growing sense of urgency for conservation of biological diversity in light of which locally intensive biodiversity analysis becomes somewhat akin to making a detailed study (Swindel et. al., 1987). In historical times, not a single species of plant or animal was known to have become extinct except by the direct or indirect hand of man (Frankel and Soule, 1981) and prospects for species extinction were greatest in the tropics (Whitmore, 1980). Till a few years
ago studies on endemism and rarity or conservation of plants had received very little attention in India (Jain and Rao, 1983). If a species is not known to exist, then its extinction will also be unknown. Hence, the necessity of inventorisaton is of prime importance. When a species is not recorded or seen during the last fifty years with repeated searches, then it can be safely presumed to be extinct (Nayar, 1987).

Studies in Angiosperm diversity should first of all tell us what flora grows in a particular locality. After 4 years of exploration in the proposed Namdapha Biosphere Reserve area, Joseph (1986) observed that the area remains Terra incognita (botanically 60% of the total potential area is left to be explored). Saxena (1970) has listed 635 plant species from the Amarkantak forests. Similarly, Manilal (1985) could document 966 angiosperm plant species belonging to 559 genera and 134 families after 4 years of study in the Silent Valley area of Kerala. N.C. Nair estimated the holdings from the Silent Valley, in Coimbatore herbarium, at over 1, 600 species (Saldanha, 1982), knowing what grows should lead to knowing how plants grow. Each of the Biosphere Reserves represents a different ecosystem with several vegetation patterns. The frequency and distribution of species, niche preferences of particular associations, community structure – be it of forest, grassland or mangrove – all these should be part of diversity studies (Saldanha, 1987). The botanical survey of India has made extensive collections and published a checklist of 2, 769 plants from Tamil Nadu portion of the Nilgiri Biosphere Reserve (Sharma et al., 1977). Diversity of Angiospermic flora of Darjeeling Hills has been studied by Das (1955) who has
revealed a very diverse flora consisting of 1052 species and Varieties, 550 genera and 127 families.

Thornthwaite (1933) explained grasslands climatically as sub humid areas falling within the mesothermal temperatures. In the tropical countries this ecosystem has grasses as the main component along with rare occurrence of trees. Moore (1964) defines grassland as community in which the dominant species are perennial grasses: there are a few or no shrubs and trees are absent.

Millner and Huges (1968) have recognized grasslands floristically, as plant community in which members of poaceae are dominant and trees are rare or absent. They have further explained the grassland. Physiognomically or structurally as plant communities with low growing plant cover of non woody species. Lloyd et al. (1971) have introduced grasslands as herbaceous vegetation in which grasses predominate.

Grasslands have been differentiated into prairies, steppes and savannahs. This sub-division is chiefly based on the physiognomic appearance and general climate of the region. The basic difference between prairies and steppes is that the prairies are less humid than forest and more humid than steppes (Van Dyne et. al., 1973).

Grasslands of India are distributed in extensive patches all over the country representing disclimax of the area (Bor, 1942; Mishra, 1946) controlled by biotic factors. Theses grasslands are man made. Champion (1936) stated that Indian grasslands are not climatic climax and are controlled by biotic factors.
Whyte (1968) pointed out that the grasslands of India represent secondary areas or sometimes preserve. Wherever they are more stable, they may constitute a biotic climax or a dis-climax maintained by grazing, cutting and burning. Billore (1978) also confirmed the seral status of Indian grasslands and concluded that grazing is an important functional process in maintaining the seral status of grasslands.

A survey of literature reveals that initially the study of grasslands was done to understand their structure and composition and the phenomenon of plant succession. Later on, nature of climax and factors operating upon the community were investigated (Clements, 916). Hanson (1950) has reviewed the work done on descriptive aspects of ecology.


The term 'phenological events' means the seasonal changes occurring in the life cycle of plants. It considers leafing, flowering, fruiting and fruit fall as periodic phenomenon. These studies are useful in determining the character of
forest floor composed of different species and in the preparation of the suitable sampling plans for the later years of forest Bhatnagar (1968).

Daubenmire (1947) related the phenological events with latitude and longitude. Some workers emphasized that the climatic conditions affect the Phenological events to a certain extant.

A number of workers have studied the phenological behaviour of different forest plants from time to time. Several workers viz. Scheffler (1901), Wright (1905) and Holtum (1931) have studied the phenology of tropical rain forests of different countries. Such studies in tropical semi deciduous forests were made by Daubenmire (1972) in North Western Popler et. al., (1980) in lowland of Costa Rica.

Phenological studies in temperate forests were under taken by Holtum (1931). Ahlgren (1957) studied the phenology of species of junipers and some alpine species respectively.

Many workers have carried out phonological investigations of forest tree in India. Krishnaswamy and Mathuda (1954) observed Phenological response of tree species of new forest, Dehradun. Gupta (1960) has made certain Phenological studies on the flora of Nainital and Mussoorie hills. Bhatnagar (1968) for the first time studied, the phenology of forest trees in dry deciduous forest of Sagar. Rathore (1970) gave the phenological events of Diospyros melanoxyylon and he also developed a pictorial diagram called as phenobiogram for the species. Joseph (1977) also studied the phenological events of 40 forest tree species of the same locality.

The flowering phenology and floral success of the monocarpic understory shrub species _Barleria involucrate_ var. elata (Acanthaceae) in a medium elevation evergreen forest in southern Western Ghats was examined by Krishnan (2000). Chang et. al. (2000) studied the phonological survey of _Machilus kusanoi, Machilus zuihonsis, Elaeocarpus sylvestris, and Castanopsis carlesii_ for over 3 years (1994-1996).


Soils are that portion of the earth's crust in which land plants can grow, if water and temperature are adequate at least the minimum nutrients are available and toxic substances are in low concentration. All soils develop from weathered
rock, volcanic deposits or accumulated plant residues. Most soils are formed from weathered rocks and minerals. These minerals include, Quartz, Feldspars, Micas, Hornblende, Calcite and Gypsum.

The determination of the amounts of primary soil particles (sand, silt and clay) can be carried out by the pipette method (Kilmer and Alexander, 1949) and by the Hydrometer method (Bouyoucos, 1934) following removal of the soil organic matter and the complete dispersion of the sample. The dimension of the box used in the laboratory differs slightly from those described by Coutts (1930).

John, et. al., (1998) described physical, chemical and mineralogical properties of two forest soil (an Andosol and Ultisol) from the trible region. Differences in weathering processes and soil/fertility are highlighted, with particular reference to factors, which might limit plant growth.


Raina, et. al., (2000) a predominance of loam texture indicate that soils of these nurseries have comparatively better water holding and cation exchange capacities.

carbon decreased after burning and this depletion continue up to cropping and harvesting period.

According to Singh et. al., (2001) total nitrogen decreased after burning and this depletion continue up to cropping and harvesting period. Horkar and Totey (2002), classified soils as loamy, mixed hyperthermic and loamy, skeletal, mixed and dark brown. Wang et. al. (1996), studied soil and chemical properties forest litter, water holding capacity, soil permeability, of Pinus tabrilaefonis plantation in Taihang mountains, Shanxi, China.

The physical and chemical properties of a freshwater body are characteristic of the climatic, geochemical, geomorphological and pollution conditions (largely) prevailing in the drainage basin and the underlying aquifer. The biota in the surface water is governed entirely by various environmental conditions that determine the selection of species as the physiological performance of the individual organisms. The primary production of organic matter, in the form of phytoplankton and macrophytes is more intense in lakes and reservoirs than in rivers. In contrast to the chemical quality of water bodies, which can be measured by suitable analytical methods, biological quality is a combination of both qualitative and quantitative characterization.

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Natural lakes and impoundments of small streams are attractive environmental resources that create a demand for shared uses ranging from
water supply to community development of shore lines for housing & recreational activities (Geldreich 1989, 1990).

The high concentration of chloride in fresh water is assigned to human sewage (Moyle, 1949) and undesirable taste to water & sewerages Byars (1960) regard that temperature is the prime factor in determining the seasonal changes of flora & fauna.

The atmospheric temperature was always higher than that of surface water, surface water temperature closely reflected to ambient air temperature. This is particularly true for shallow lakes and ponds (Efford, 1967).

Mishra (1991) studied physico-chemical parameters of a pond ecosystem of Purnea for its water quality and checked temperature. pH is the logarithm of the reciprocal concentration of hydrogen ions (Davis, 1954).

Sansalone (2000) studied physico-chemical assessment for treatment of storm water, under conditions of low residence time, low runoff pH in storm water can be mainly dissolved.

Pearsall (1930) and Lund (1965) observed that the pH of the water appears to be dependent upon the relative quantities of calcium carbonate and bicarbonates. Patel (1991) presents a study of pH and its variation with time of rainwater of Rourkela industrial complex.

Chloride a dominant constituent of salinity is normally found in very low quantities in fresh waters; when present in higher concentration it indicates the extent of pollution due to sewage (Moyle, 1949; Singh, 1960; Sreenivasan, 1965; Wetzel, 1966, 1979; Aboo and Manuel, 1967).


Fire is the dominant fact of the history. The great majority of forests of world, excepting wet rain forest have burned more or less at frequent intervals for many thousand years (Spurr, 1964; Moody et. al. 2000). Coal beds with fossil charcoal indicate the fire was a part of ancient ecosystem (Komarck, 1972 and Hayley 2000).

Fire is an important ecological force and part of the environment along with moisture, temperature, wind and soil Smith (1980). Almost every aspect of environment is altered when vegetation is burnt. Kozlowski and Ahlgren (1974) have reviewed the literature on fire and ecosystem. Davis (1959) has reviewed the work on control and use of forest fire. Some studies have been done in India on the effects of fire in forests (khare, 1981) and grasslands (Mehta, 1977).
There are few Indian studies on the effects of fire on wild life (Kotwal, 1993 and Pine et. al., 1999).

Srivastava (2002) studied the land use, forest fire and other human interference a threat to the Nilgiri Biosphere. Tansley (1935) & others have called each stable community as climax & described them as edaphic climax, biotic climax, fire climax & topographic etc. Certain plant communities prefer periodic fire to maintain their position in the ecosystem and thus driving force of fire has been recognized in their management such as Chir pine, ponderosa pine, giant Sequoia (Mutch 1970), Teak (Maha, phol, 1954) & Eucalyptus (Hodgson 1968). It can be concluded that fire has been almost as closely related to many communities as other factors of their environment.


Like topography and edaphic conditions, biotic interference in forest also plays much more important role in changing the landscape of forests. Forests are renewable resources therefore the role of man in manipulation and changing forested area, have gained tremendous importance. In the present day context of population explosion and its increased demands man has been destroying forests through shifting cultivation, felling of trees for house hold purposes, grazing, fire and many other ways (Shukla, 1990).
Stebbing (1921-26) studied forests of India and described the human interference in vegetation of India, Mobbs (1941) also analysed the history of man's interference in Indian vegetation. Mohan and Puri (1955) studied the succession of forest communities in oak-conifer forest of Bashahr Himalayas and found that the number of communities owe their existence directly of the interference by man. Bormann et. al., (1968) studied the nutrient loss accelerated by clear felling of a forest community and observed that nitrogen loss during the first year was equivalent to the amount annually turned over in an undisturbed system and losses of cation were 3 to 20 times greater than from comparable undisturbed system; the possible cause described was clear felling of trees which reduces transpiration and increases the amount of water passing through the system. Bhatt (1979) stated that Mussoorie, once the queen of the hills is today being inexorably destroyed by heavy deforestation and unchecked landslide. The consequences of blasting and deforestation were manifested in the disastrous Doon flood of 1987.

A forest is sound when it is able to maintain its structure at a landscape scale in the face of all regular and incidental natural disturbance factors (Karr and Budley, 1981). The main criterion for integrity is the occurrence of all species of organisms and age class in a particular proportion of social organization, as would occur in a natural situation, i.e., without human interference Halle et al., (1978) and Oldman and Vander Meer (1988) have reported that the loss of particular species is the symptom of poor forest condition (Oldman and Vander Meer, 1988). With increased human induced forest dynamics, biodiversity in
terms of numbers of species may decline, remain the same or even increase (Swaine and Hall, 1983). Hommel (1990) suggested that it is almost impossible to make an inventory of species diversity and their relative population composition, in order to evaluate ecological integrity for planning and management.

A study of extent of biotic impacts on natural forests in Madhya Pradesh was conducted by Prasad and Pandey (1992) who calculated species diversity index, concentration of dominance and dominance diversity curve. The species and vegetation structure of the dry deciduous forests are directly related to the local demand of fuel and fodder and have been discussed by George and Verghese (1993) in their study of a tropical dry deciduous forest of Coimbatore. An extensive ecological study of Kanha National Park, was conducted by Pandey et al., (1986). Impact of human activities on wildlife in Chambal Sanctuary has been studied by Rao (1992).