Impact Of Physico-Chemical Parameters And Diversity Of Plant Species

Tropical Dry Forests (TDFs) are the major centers of human habitation and encompass 42% of the tropical forests (Galicia et al., 2008). In Indian subcontinent, about 350 million rural people and 84 % of the tribal population live in forested areas (Mehta & Shah 2003), and still depend on the forest resources for their livelihood (Poffenberger & McGean 1996; Hegde & Enters 2000; Kutty & Kothari 2001; Harris & Mohammed 2003). In India TDFs occupy 38.2% of total forest cover (MoEF, 1999) facing high degree of anthropogenic disturbance leading to conversion from forest cover to grass land. Seasonally dry ecosystems have periods of plentiful water supply alternating with periods of drought (Eamus, 1999) with mean annual rainfall of 250-2000 mm and strong dry season of at least 3–4 months where annual ratio of potential evapotranspiration (PET) to precipitation (P) exceeds unity (Murphy and Lugo, 1986). DTFs are the less protected more threatened and rich centers of biodiversity in the world. Increase in anthropogenic pressure on the forest flora and fauna has increases rate of forest degradation and loss of biodiversity (Kothari et al. 1989; Gadgil & Guha 1992; Murali et al. 1996; Somanathan & Borges 2000; Rai & Chakrabarti 2001; Ramirez-Marcial et al. 2001; Puyravaud & Garrigues 2002; Anitha et al. 2003; Arjunan et al. 2005; Madhusudan 2005; Karanth et al. 2006; Shahabuddin & Kumar 2007). In the recent years, forest degradation has become a global concern, especiallt the tropical areas are facing very high degree of disturbance. Among plants in the TDFs, deciduousness is the single most important adaptation to the extended droughts and has also been reported to be a good predictor of drought survival (Poorter and Markesteijn 2008).

Most of the trees drop their leaves after the end of rainy season, and essentially halt photosynthesis, as they otherwise cannot sustain water loss during the dry season (Murphy and Lugo 1986). Before the leaves are shed, these species efficiently reabsorb nutrients which are utilized during the drought period and in the early growing season (Aerts 1996; Givnish 2002). It has been reported that the trees showing dry-season leaf flushing might overcome the soil water stress either by their deep tap root system or by the use of stored water in their vascular conductive tissues, as the transpiration is absent during the leafless period (Bullock and Solís Magallanes 1990; Murali and Sukumar 1993). Most estimates of species loss have focused on tropical forests, as they harbor the majority of the species (Jha et al., 2005). Despite their geographical and cultural importance, TDFs are among the least known and most endangered tropical ecosystems in the world (Janzen 1988; Vogt et al. 1986). Large areas of seasonally dry tropical forests (SDTFs) have been cleared for agricultural purposes as both climate and soils support which support SDTFs are also suitable for farming and ranching (Trejo and Dirzo, 2000).

Precipitation is likely the most important factor in setting an upper limit for SDTF (Brown and Lugo, 1982). Deciduousness is one of the very important character of SDTF (Singh and Kushwaha, 2005), and the duration of leafless period is correlated with the amount and time of precipitation. The large amount of precipitation increases photosynthetic rate and thus there is accumulation of large amount of biomass. The other potential factors controlling biomass in SDTF including life history traits are the availability of light and nutrients (Baker et al., 2003), water may have the strongest effect as it varies dramatically between conditions of scarcity in the dry season to overabundance in the wet season. In wetter forests nutrients and light may be more important for limiting growth and carbon storage (Graham et al., 2003; Cleveland et al., 2011) whereas dry forests are thought to have less nutrient leaching and their strong and lengthy droughts mean that water availability often constrains growth (Eamus, 1999). TDFs and savanna can potentially grow at high rates; however, their capacity to grow is strictly determined by climate and nutrients. Soils of about half of all tropical forests have been reported to be highly degraded, leached and impoverished; therefore the ecosystem needs to develop certain mechanisms for nutrient conservation (Sanchez 1976; Jordan 1985). In India, the species composition, distribution and diversity in TDF are influenced by small-scale differences in environmental parameters leading to patchiness in communities (Chaturvedi et al. 2011a; Chaturvedi and Raghubanshi 2014, 2015). The environmental heterogeneity and disturbance are the primary factors of patch formation. This patchy distribution of tree communities in TDFs results in uneven distribution of the above-ground tree biomass as well as carbon accumulation capacity (Chaturvedi et al. 2011b, c, 2012, 2017a). The deciduous forest in India has been reported to be a mosaic of plant communities exhibiting distinct species composition; the distribution of these communities in noncontiguous patches results into immense diversity (Jha and Singh 1990).

Physical and chemical characteristics of the soil are also major determinants of the forest diversity. It has also been reported that the texture determines most of the characteristics of the soil, including permeability, capacity to retain water, degree of aeration, capacity of storing plant-available nutrients in the clay-humus complex, ability to withstand mechanical damage of the top soil and lastly the capacity to support a permanent plant cover (Jha and Singh 1990). Studies in tropical forests suggest that the ecosystem productivity, stability, nutrient dynamics, and invasibility are influenced by plant species number and/or composition (Tilman, Wedin, & Knops, 1996; Tilman et al., 2001; Tilman, Reich, & Knops, 2006; Hector et al., 1999; Hooper et al., 2000, 2005; Levine, 2000; Naeem et al., 2000; Wolters et al., 2000; Spehn et al., 2005; van Ruijven & Berendse, 2005). Therefore, the main goal of conservation management is to maintain species diversity in order to prevent future species extinctions (Coleman, Mattice, & Brocksen, 1996). Also for efficient environmental planning, we need to have a clear picture of species richness spatial patterns (Kati et al., 2004a, 2004b Orme et al., 2005).

Modes of regeneration in TDF determine survival after a disturbance and also influence growth and survival when the disturbance is removed. Compared to wet forests, our understanding of regeneration processes in TDFs is very poor (Meli 2003; Vieira and Scariot 2006). The regeneration processes in these TDFs are likely to be influenced by a complex interplay of biotic and abiotic factors (Powers et al. 2009a). Biotic or management-related factors comprise the land-use pattern, factors affecting seed arrival (e.g. seed sources and dispersing agents) and factors that influence germination and establishment (e.g. competition from remaining pasture grasses, depth of litter layer, scarcity of mycorrhizal symbionts and seed predators) (Bazzaz and Pickett 1980; Ewel 1980; Wijdeven and Kuzee 2000; Khurana and Singh 2001a; Hooper et al. 2005). Abiotic factors influencing regeneration comprise regular fire disturbance, temperature, precipitation, light and nutrient availability, and drought conditions (Janzen 1988a; Gerhardt 1993; Campo and Vazquez-Yanes 2004; Ceccon et al. 2004; Vargas-Rodriguez et al. 2005).

The human population has been most attracted by TDFs (Murphy and Lugo 1986, 1995). The human activities have converted these forests into pastures and agricultural fields and have removed the above-ground woody biomass unsustainably to satisfy fuelwood demand (Murphy and Lugo 1986; Maass 1995) as tropical and subtropical dry forest life zones provide favourable climate for human habitation due to favourable climatic and edaphic conditions. The intensive human activities have degraded soils of TDF making it compact, nutrient poor and eroded (Maass 1995). Further, these human activities have fragmented the landscapes of dry life zones (Ramjohn et al. 2012).

Being suitable for the human settlements, tropical areas attracted human beings for their settlements and the tribal societies in any part of the world still rely on forest resources for food, fodder and medicines. Dependence on phytodiversity provides four categories of ecosystem goods and services to the human beings i.e. provisioning, regulating, supporting and cultural services (MEA, 2003). Social customs, rituals and religious beliefs have played vital roles in the conservation of biological diversity since time immemorial and people in the tribal areas are still practicing the traditional culture and knowledge which they have acquired from their ancestors. The social customs and cultural beliefs regarding the biological resources have played very crucial roles in the protection of important species. Globally, about 85% of the traditional medicines used for primary health care are derived from plants (Farnsworth 1988) and tribal societies in any part of the world still rely on forest resources both for their livelihood as well as for the therapeutic uses. These societies are the custodians of the traditional knowledge and culture and this knowledge of intimate relationship between man and his immediate surroundings has been passed on to us mainly through surviving traditions (Jain, 2004). According to Uprety et al. (2012) hundreds of millions of people, mostly in developing countries, derive a substantial part of their subsistence and income from wild plant products.