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Original article

Tree diversity, stand structure, and community composition of tropical forests in Eastern Ghats of Andhra Pradesh, India



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ABSTRACT

Species diversity and density of trees were assessed in four 1-ha plots (at 457–925 m in elevation) in the Eastern Ghats of the Andhra Pradesh region comprising mostly of tropical deciduous forests based on a census of all trees with girth at breast height ≥ 15 cm. We compared tree community characteristics like stem density, basal area, diversity, and species composition of four plots using a tree dataset of eight belt transects (5 m \times 1000 m) in the study area. A total of 2,227 individuals of 44 families, 98 genera, and 129 species were recorded. Combretaceae, Euphorbiaceae, and Anacardiaceae, showed the greatest importance value index. It was noticed that the most species were contributed by Euphorbiaceae and the tree density varied from 435 ha⁻¹ to 767 ha⁻¹ with an average basal area of 25.82 m²/ha. Shannon–Weiner index (H') ranged from 3.76 to 3.96, the Simpson index ranged from 0.96 to 0.97, evenness index ranged from 0.60 to 0.78, and species richness index ranged from 10.04 to 11.24. At present the biodiversity of these forests are under threat due to the anthropogenic and upcoming mining activities. The present study will help us to understand the patterns of tree species composition and diversity in the Eastern Ghats of India.

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Introduction

Tropical forests are the richest biological communities on earth and these forests have been recognized to harbor a significant proportion of global biodiversity (Myers et al 2000; Baraloto et al 2013). These forests provide many ecosystem services such as species conservation, prevention of soil erosion, and preservation of habitat for plants and animals (Armenteras et al 2009). Biotic factors such as seed quality, seedling survivorship, and recruitment are important in maintaining the tree composition of tropical forests (Connell 1971). Overexploitation has resulted in the rapid loss of forests and is recognized to be one of the biggest environmental and economic problems around the world (Mani and Parthasarathy 2006). Tropical forests are disappearing at alarming rates worldwide, reducing annually by 1–4% of their current area (Laurance

1999). Relatively increased anthropogenic pressures have led to agricultural expansion and overgrazing of livestock (Anitha et al 2010).

Trees, an important component of vegetation, must therefore be constantly monitored and managed in order to direct successional processes towards maintaining species and habitat diversity (Turner 1987; Attua and Pabi 2013). Tree species diversity is an important aspect of forest ecosystem diversity (Rennolls and Laumonier 2000; Tchouto et al 2006) and is also fundamental to tropical forest biodiversity (Evariste et al 2010). Tree census plots have been established in forest types through tropical regions to monitor forest dynamics over time and to assess the effects of disturbance and climate change on plant demography (Condit et al 1996; Laurance et al 2004; Mohandass and Davidar 2009). Tree species diversity that influences the forests are climate, stand structure, species composition, and geomorphology. Forest stand structure is a key element in understanding forest ecosystems and also an important element of stand biodiversity (Ozcelik 2009). The rapid inventory of tree species that provides information on diversity will represent an important tool to enhance our ability to maximize biodiversity conservation that results from deforestation and degradation

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(Baraloto et al 2013). Information from this quantitative inventory will provide a valuable reference forest assessment and improve our knowledge by the identification of ecologically, useful species as well as species of special concern, thus identifying conservation efforts for sustainability of forest biodiversity.

The Eastern Ghats (EG) is a discontinuous range of mountains situated along the eastern coast of India. EG contributes significantly to both species richness and endemism of the Indian region (Reddy et al 2011). Due to overexploitation of medicinal plants, fuel wood collection, habitat destruction, and grazing, the plant diversity of EG hill ranges is declining at an alarming rate (Padal et al 2009; Premavani et al 2014). This may lead to the extinction of many valuable species. Irrespective of rich floral diversity, the hills are under severe threat of deforestation and degradation due to several anthropogenic activities (Naidu et al 2014a,b). Due to population pressures the forest cover has drastically shrunk and is now limited to a few relic patches in hill tracts. The present study is significant in generating useful baseline data in order to conserve and manage the native flora and fauna of this tropical forest ecosystem in the region and elsewhere in the tropical forests in India. Information from this quantitative inventory will provide valuable documentation of forest assessment and improve our knowledge in identification of ecologically useful species. The objective of this paper is to study the community composition, species diversity, and tree population structure in four stands of tropical forests of EG of Andhra Pradesh, India.

Materials and methods

Study area

The study sites are located in the Visakhapatnam district of Andhra Pradesh, India, which are part of the EG of northern Andhra Pradesh. The district lies between 17°15' and 18°32' Northern latitude and 83°54' and 83°30' in Eastern longitude with an altitude varying between 355 m and 1200 m mean sea level. The data were collected from four sites, namely Madimanulu (MM), Tyada (TD), Kokkiripalli (KP), and Sndhiputtu (SP), in the years 2012–2014 (Figure 1). The temperature of the Visakhapatnam district is characterized by permanent high temperatures ranging from 15°C to 38°C. Rainfall (1000–2000 mm) is considerably more in the high areas. Geologically, rocks are the oldest, belonging to the Archean system, with gneiss being the most common rock in the hills. The soils are ferruginous loams mixed with quartzite in the hill slopes (Subrahmanyam 1982). The natural vegetation of the district has a broad sense of tropical deciduous types (Champion and Seth 1968) with most of the species characteristic to the deciduous forest of the EG. The district is undergoing rapid changes in vegetation and is facing large scale anthropogenic forcing in the form of mining, thermal power generation, hydro-power project, etc. Besides sporadic tree felling, widespread lopping and extraction of nontimber resources has been noticed. The forest cover is continuously decreasing and the remnant forest cover exists in the form of fragments of varying sizes.

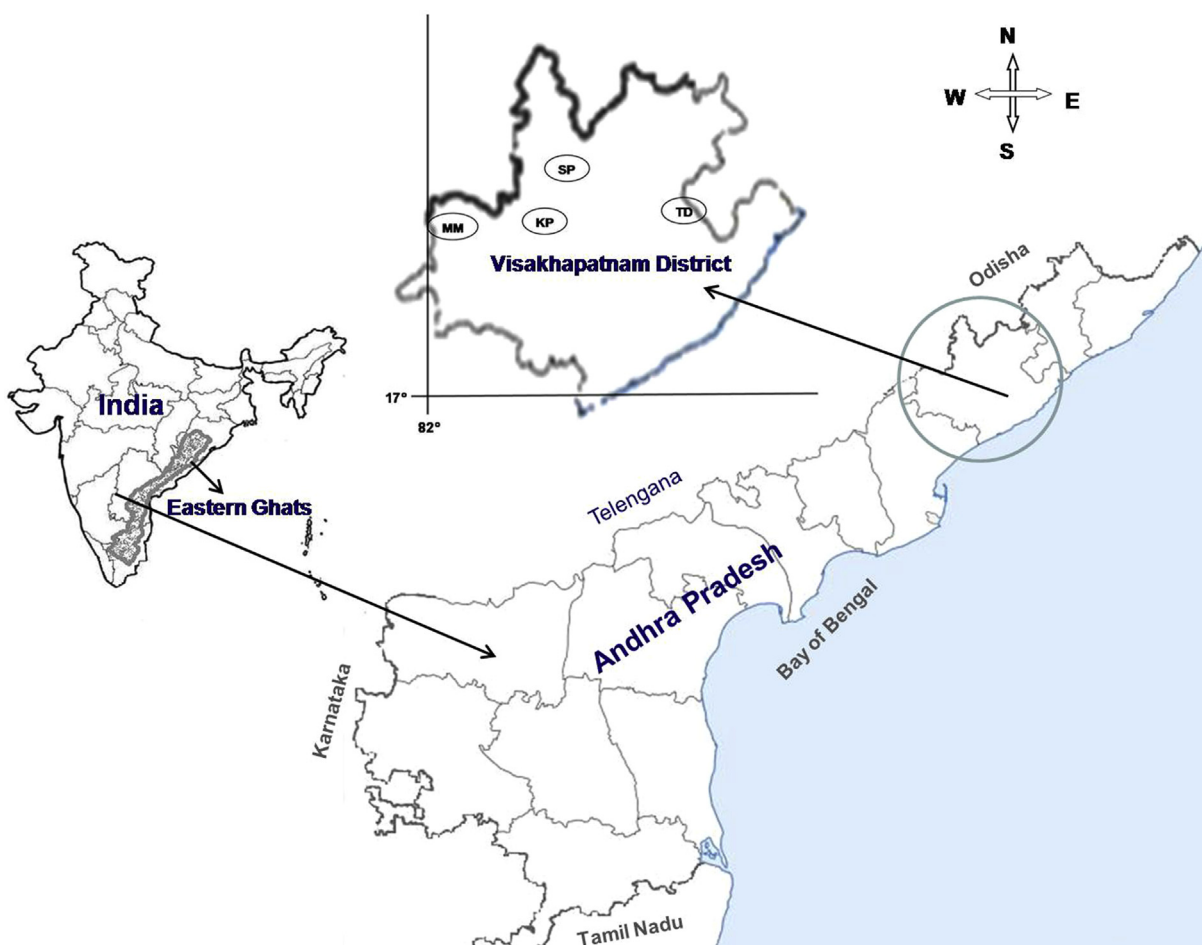


Figure 1. Map showing the sampled localities in the Visakhapatnam district: KP = Kokkiripalli; MM = Madimanulu; SP = Sndhiputtu; TD = Tyada.

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