Vegetation of Kalyana Karnataka Region, India

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Abstract Understanding the diversity of vegetation is a useful tool in plant ecology and forestry to compare the composition of different species. Kalyana Karnataka region is one of the largest arid regions in India. The natural vegetation can be seen mostly in the valleys and hill locks only. The forest vegetation generally falls under Southern tropical dry deciduous forest and Southern tropical thorn forests. Dry deciduous forests are found in small blocks almost throughout the area but the mere composition is at Chincholi in Kaluburagi district, Khanapur and Changler in Bidar District and Sandur and Sogi in Bellary. Trees of this region are generally drought resistant with wide distribution and have great adaptability (*Anogeissus latifolia*, *Soymida febrifuga* etc.). The occurrence of teak (*Tectona grandis*) in low to fair amount characterizes this type. Yadgir, Raichur and Koppal district comprising predominant thorny and hardwood species, main components are *Acacia chundra*, *A. leucophloea*, *Albizia amara*, *Ixora arborea*, *Cassia fistula* etc.; this can be classified as thorn forests. Associated and encountered shrubs and herbs in the region were also recorded. Interestingly, few insectivorous plants viz., *Drosera indica*, *D. Burmanii*, *Utricularia* species are found. Pteridophytes like *Isoetes coramandaliana*, *Selaginella bryopteris*, *Pteris jeranifolia*, *Adiantum incisum* etc. are creating botanical interest about the forest vegetation of Yadgiri and Raichur district.

Keywords Kalyana Karnataka, Forests, Vegetation

1. Introduction

Vegetation is an assemblage of plants growing under similar climatic conditions. The composition of vegetation depends on the assemblage of species population of a particular type and in turn the spatial distribution pattern of species population depends on the dispersal capacity of the species, the microclimatic condition in which it grows and other biotic factors. Vegetation also plays an important role in soil formation.

North-Eastern Karnataka is comprised of 6 districts of Karnataka state viz. Bidar, Kalaburagi, Yadgir, Raichur, Koppal, Bellary (**Fig-1**) as listed from north to South. Physiographically North-Eastern Karnataka falls in the 'Maidan' or the plain country and is mainly an inland plateau. The main features of plateau landscape are either flat or rolling, extensive plains between 300-900 m altitude. The peninsular plateau constitutes the largest physiographic division of India and consists of South Deccan plateau as one of its five sub-divisions, of which the Karnataka plateau is one of the constituents. There are some terrains in the southern part of the region (Singh, 1988).

Figure 1. Map showing Districts of Kalyana Karnataka, India

Figure 2. Quadrant laid at different places during the study

Geologically, this area varied from region to region, Bidar and Kalaburagi districts covered by dark coloured, large sheets of basic lava about 60 million years. A few of the economically important schist belts in the area are small bands of Kushtagi, Maski and Raichur. Small running bands of Sandur and copper mountain range and the Pennar-Hagari band in Ballari district. According to Raychaudhuri and Satyaprasad (1963) North-Eastern Karnataka has four types of soils. i) Laterite soils found in Southern Bidar and parts of Kalaburagi districts. ii) Red soil is found in almost all areas of the region except parts of Bidar and Kalaburagi districts. iii) Mixed red, yellow and grey soils are sedentary soils formed from the underlying, mostly granitic, parent rocks seen in parts of Raichur district and iv) Black soils are mainly found in the

northern half besides on eastern and western boundaries of Ballari district.

The climate of North-Eastern Karnataka is generally dry, that can be classified as semi-arid. This area belongs to low rainfall area, receives rainfall from both South-West and North-East monsoon, South-West monsoon is responsible for maximum precipitation, and, the annual average rainfall is 668 mm. The mean daily maximum temperature ranging from 25.3 to 29.7°C and daily minimum temperature ranging from 15.6 to 17.7°C.

Ahmed, (2012) analysed the forest vegetation in Ranikhet, Kumaon Himalayas, Uttarakhand. Bhuyan *et al.*, (2003) studied the tree diversity and population structure in undisturbed and human-impacted stands of tropical wet evergreen forest in Arunachal Pradesh, Eastern Himalayas, India. Tree species richness varied along the disturbance gradient in different stands. Kumar *et al.*, (2006) studied the tree species diversity and distribution patterns in tropical forests of Garo Hills, Western Meghalaya, Northeast India. They found that the main vegetation of the region included primary secondary forest and Sal (*Shorea robusta*) plantations.

The structure of forest vegetation in India has been studied by several workers (Meher-Homji, 1973; Saxena and Singh, 1982; Singh and Singh, 1986). Singh and Singh (1987) have extensively reviewed studies on vegetation of the Himalaya including information on phytogeography, structure and functional aspects. Garga, (1988) have revealed the status of forests in India. Gaussen (1965) have worked mapping of vegetation and environmental conditions of the world and in particular reference to India.

Kharkwal and Rawat, (2010) studied the structure and composition of vegetation in sub-tropical forest of Kumaun, Himalaya. They found that *Quercus leucotrichophora* A. Campus, *Quercus floribunda* Lindl. ex Rehder, *Quercus semecarpifolia* J.E. Smith and *Pinus roxburghii* Sarg. were the dominant tree species in Banj-oak, Tilonj-oak, Kharsu-oak and Chir-pine forests respectively.

Some of the botanical exploration works have been attempted in the region by Singh (1988), Saldanha (1984), Gamble (1915-36) and Khan (1953). These workers have highlighted the areas in their works.

Considering the heterogeneity of forest landscapes, soils diversity vegetation structure and their ecological, economical and academic importance, no significant efforts have made by earlier researchers due to various reasons.

Detailed survey of vegetation will provide valuable information for 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 riparian forest biodiversity. Hence, an attempt is made to provide comprehensive and unified account on vegetation of this region which in turns helpful for researchers, foresters, and students which are involved in the botanical studies.

2. Methodology

Description of the Study Area

The study was carried out in Kalyana-Karnataka region earlier it was known as Hyderabad Karnataka. The largest city of the the region is Kalaburagi falls in Latitude: 17°20'08" N Longitude 76°50'15" and altitude ranges from 300 to 750 msl. Total area of the region is 44,138 km² of which 1247.88 km² area is of forest cover. The highest forest cover is in Bellary district (739.22 km²) and lowest in Koppal district (88.42 km²).

Figure 3. Panoramic view of different location of Forests of Kalyana Karnataka regions

The most important factors determining the conditions of plant life in this region are attributed to low or scanty rainfall with long continuous drought period of six months besides high temperatures, especially during the summer seasons.

The region is endowed with diverse climate, topography and soils which has resulted in varied biodiversity. The diverse ecological niches support characteristic flora and fauna. The semi evergreen forests of the Sandur-Kumarswamy Hills cover about 60% of forest area of the region followed by Konchavaram forest of Chincholi taluk of Kalaburagi district (Chincholi Wildlife Sanctuary) (Fig-3).

Most of the areas of the region are subjected to different kinds of disturbances i.e., human induce or anthropogenic activities.

Survey and Data Collection

Field Work and Sampling

The survey had been planned in such a way to cover all the possible forest area of the region viz., Kalaburagi, Yadgir, Raichur, Bidar, Bellary and Koppal during all the seasons. A comprehensive and exhaustive data of the vegetation of the entire forest area was collected from 2014 to 2019.

Fidelibus and Mac Allister (1993) have agreed that in a study site quadrates can be established regularly, subjectively or randomly.

The floristic and physiognomic characteristics were studied and recorded during the said period. The structural physiognomy of each plant species encountered were grouped into broader classes based on their height and growth form viz., tree (woody plants taller than 1.5 m), shrubs (woody plants from 0 to 1.5 m), herbaceous and grasses.

A stratified random sampling approach was established. A squared field plot of size 20m x 20m (Standardised Quadrat Structure) were inventoried. Each laid plot constitutes the tree species and their properties, i.e., canopy cover, density, and species composition etc. and sample plots were laid according to the recommendations of Gibbs Russell *et al.* (1985) (Plate-1). During the survey, most of the species were identified and recorded on site, if immediate identification was not possible, specimens were collected for later identification with keys.

Identification of Plants

The plants from the study sites were identified with the aid of regional floras (Hooker, 1897; Saldanha, 1984 & 1996; Singh, 1988; Gamble and Fishcer 1935; Seetharam *et al.*, 2000). In the taxonomical survey the rare plants are identified with the help of red data book and other literature surveys.

3. Results and Discussions

According to Champion and Set (1968) the vegetation of Northeastern Karnataka which includes Hyderabad Karnataka (Now it is renamed as Kalyana Karnataka) province. The region comprises Bidar, Yadgir, Raichur, Koppal, Bellary and Kalaburagi that are in the present state of Karnataka and is the second largest arid region in India. Vegetation generally falls in to two regions viz., southern tropical dry deciduous forest and southern tropical thorn forest.

Southern Tropical Dry Deciduous Forest

The dry deciduous forests are found in small blocks almost throughout the area but to a much limited extent and the best ones are at Chincholi in Gulbarga district and Sandur and Sogi in Bellary districts. Trees here are generally drought resistant are of wide distribution and have great adaptability. Depending on the presence or absence of teak these forests can be classified as,

1. **Very dry teak forests:** The occurrence of teak in low to fair amount characterizes this type. These are open forests found at Chincholi of Kalaburagi, Sandur and Sogi of Bellary district and Changlera, Biranalli, Karakanalli of Bidar District. *Tectona grandis* is basic species of these forests.

Common Trees: The other characteristic tree species are *Anogeissus latifolia*, *Boswellia serrata*, *Terminalia alata*, *Sterculia urens*, *S.guttata*, *Givotia rottleriformis* etc. Common trees are *Chloroxylon swietenia*, *Dalbergia paniculata*, *D.latifolia*, *Pterocarpus marsupium*, *Wrightia tinctoria*, *Soymida febrifuga*, *Acacia leucophloea*, *Albizia lebbek*, *Bauhinia racemosa*, *Cassia fistula*, *Embllica officinalis*, *Polyalthia cerasoides*, *Butea monosperma*, *Steriospermum chelonoides*, *Syzygium cumini*, *Diospyros montana*, *Alangium salvifolium*, *Dolichnondrone falcata* etc.

Common Shrubs: *Flacourtia indica*, *Lantana camera*, *Cassia auriculata*, *Gymnsoria montana*, *Ziziphus nummularia*, *Carissa spinarum*, etc. (occurring all types of habitat, especially in more open dry tracts). *Canthium parviflorum*, *Diospyros melanoxylon*, *D. chloroxylon*, *Gardenia gummifera*, *G. resinifera*, *Dodonea viscosa*, *Holarrhena antidysenterica*, *Triumfetta rhomboidea*, *Olex scandens*, *Helictres isora*, *Ximenia Americana*, etc.

Common herbs: *Lavandulla bipinnata*, *Pupalia lappacea*, *Vicoa indica* and *Tricholepis radicans* are commonly distributed and frequently occurring herbs are *Pavonia zeylanica*, *Euphorbia cristata*, while *Barleria cristata* and *Chlorophytum laxum*, *Andrographis paniculata* occur occasionally. Among the grasses *Apluda mutica*, *Heteropogon contortus*, *Chrysopogon aspera* and *Perotis indica* are common one whereas *Cymbopogon martini*, *Chrysopogon fulvus*, *Eragrostis tenella* etc., occurs frequently. *Cymbopogon coloratus* is one of the

dominant grass in the dry deciduous forests. *Ephiphytic* and ground orchids are rare found. *Habenaria* spp. found only in Chincholi Konchavaram and Sandur forest areas.

Climbers: Vines and climbers are the characteristics of dry deciduous forests, it constitutes up to 15% of the total species (Money *et al.*, 1995). In Sandur, Karpakapalli and Konchavarum forests some of the common species like *Ampelocissus tomentosa*, *Ipomoea muricata*, *I. obscura*, *I. pes-tigridis*, *I. eriocarpa*, *I. hederacea*, *Cryptolepis buchmani*, *Dioscorea oppositifolia*, *Tetrastigma sulcatum*, etc. but some species like *Jasminum auriculatum*, *Combretum ovalifolium*, *Ventilago denticulate*, *Ipomoea staphylinia* are restricted in distribution and most common are *Mucuna pruriens*, *Dioscorea tomentosa*, *D. pentaphylla* while *Celastrus paniculata* is rare one.

2. **Dry mixed deciduous forests:** The vegetation distinguished by absence of teak predominance with **xeromorphic** species, Bamboos represented by *Dendrocalamus strictus* is found frequently in Yadgir district and Sandur, climbers are few while epiphytes are absent and ferns are inconspicuous. *Selaginella bryopteris* occurs moderately and *Actiniopteris radiata* usually found under stone crevices.

Common Trees: *Anogeissus latifolia* is most common and found associated with *Albizia amara*, *Terminalia alata*, *Chloroxylon swietenia*, *Hardwickia binata*, *Soyimida febrifuga* mixed with *Accaia chundra*, and *Shorea roxburghii*. Also found *Pterolobium hexapetalum*. General composition is similar to teak type, including shrubs, climbers, herbs and grasses.

Southern Tropical Thorn Forests

Widely scattered thorn forests in the present area are very open having thorny and hardwood species as its predominant and are generally short mixed with composed of thorn/prickly plants and are less in numbers. Such type of forests can be seen in Yadgir and Raichur district flora.

Common trees: Main components are *Acacia chundra*, *A. leucophloea*, *A. latronum*, *Albizia amara*, *Ziziphus mauritiana*, *Cassia fistula* found associated with *Acacia nilotica*. *Ficus amplissima*, *F. mollis* and *Ziziphus xylorpyrus*, *Prosopis cineraria*, *Dolichondrone falcata*, *Hardwickia binata*, *Strychnos potatorum* are occur occasionally.

Common Shrubs: Commonly occurring are *Cadaba fruticosa*, *Canthium parviflorum*, *Dichrostachys cinerea*, *Maytenus emarginatus*, *Ixora arborea*, *Ziziphus oenoplia*, *Securinega leucospyrus*, *Balanites aegyptiaca*, *Carissa spinarum*, *Tarenna asiatica*, *Toddalia asiatica* and *Pterolobium hexapetalum*. *Woodfordia fruticosa* occur occasionally in Yadagir areas. Frequent ones are *Capparis zeylanica*, *Calatropis gigantia*, *Cissus woodrowii*, *Ehretia laevis*, *Plumbago zeylanica*, *Kirganelia reticulata*,

Capparis sepeira, *Capparis divericata*, *Opuntia dillenii*, *Ximenia americana*. *Barleria prionitis*, *Euphorbia antiqorum*, *Pavetta tomentosa*, *Capparis decidua* occur occasionally.

Common herbs: The herbacious vegetation of the area are *Dipterocanthus patulus*, *Echinops echinatus*, *Lavandulla bipinnata*, *Phyllanthus maderaspatensis*, *Waltheria americana*, *W. Indica*, *Aerva lanata* (very common). Most common are *Celosia argentea*, *Citrulus colocynthis*, *Merremia tridentata*, *Mollugo pentaphylla*, *Phyllanthus virgatus*, *Sophubia delpinifolia*, *Zornia gibbosa*, *Sesamum laciniatum*, *Chlorophytum acculare*, *Leucaas eiostoma*, *Pulicaria wightiana*, *Sesbania aegyptica*. Those occasionally met with all over area *Allmania nodiflora*, *Anisochilus carnosus*, *Bleparis maderaspatensis*, *B. repens*, *Bidens bipinnata*, *Blumea obliqua*, *Glossocordia bosvallea*, *Lepidagathis cristata*, *Acalypha indica*, *Caralluma adscendens*, *Crotalaria retusa*, *C. medicaginea*, *C. pusila*, *Rungia repens* etc. *Aristida adscensionis*, *Chrysopogon fulvus* and *Dichanthium annulatum* are the most common grasses.

Common Climbers: Climbers found in the area are quite distinct and characteristic some of the common ones are *Cardiospermum helicabum*, *Coccinia grandis*, *Cocculus hirsutus*, *Gymnema sylvestre*, *Typhora indica*. Those frequently met with are *Abrus precatorius*, *Corallocarpus epigaeus*, *Hemidesmus indicus*, *Derris scandens*, *Mukia maderaspatana*, *Leptadenia reticulata*, *Gloriosa superba*, *Passiflora foetida*. Occasionally occurring are *Argyreia cymosa*, *Asparagus racemosus* and *Dioscorea oppositifolia*, *Paracalyx scariosa*, *Dioscoria pentaphylla*, *Diplocyclos palmatus*.

Common grasses: *Apluda mutica*, *Heteropogon contortus* *Aristida setacea*, *Lophopogon tridentatus*, *Chrysopogon fulvus*. Few species of *Sehima* occur rarely.

Interesting Vegetation of the Yadgir Forest

Few insectivorous plants have been observed keenly and took beautiful photographs of *Drosera indica*, *Utricularia* species. Soil seems to be indication of less fertile and nitrogen deficient. *Isoetes coramandaliana*, *Selaginella bryopteris* (**Sanjeevini**) Pteridophytes are creating botanical interest about the forest.

4. Conclusions

Many studies confirmed that forests have an important role in maintaining the productivity of the environment; Plants serve as a standing cover to protect the land forms wind and water erosion, stabilizing the water cycle, facilitate the process of evaporation, and keep the soil porous.

Kalyan Karantaka (earlier name: Hyderabad Karnataka) enjoying with arid climate and most of the forests falls under the category of thorn scrubby jungles except few

patches like Konchavaram, Chincholi, Changler, Sandur and Sogi are dry deciduous forests. *Tectona grandis*, *Anageissus latifolia* and *Boswellia serrata* are the basic component of the dry deciduous forests and followed by *Chloroxylon swietenia*, *Dalbergia paniculata*, *Terminalia alata*, *Acacia chundra*, *Albizia amara*, etc. Typical thorn scrubby jungles found in this area and represented by

Acacia chundra, *Albizia amara*, *Wrightia tinctoria*, *Soyimida febrifuga*, *Pterolobium hexapetalum*, *Ziziphus nummularia*, *Ziziphus oenoplia*, *Grewia flaescense*, *Acacia hohenackeri*, *Limonia acidissima*, *Mimosa hamata* etc. *Gyrocarpus americanus* rarely seen in the rocky boulders of Yadgir district (Fig: 4 & 5).

Figure 4. Selected Photographs of Tree species of Kalyana Karnataka Region, a. *Terminalia arjuna* (Roxb.) Wight & Arn.; b. *T. arjuna* (Roxb.) Wight & Arn. fruit and inflorescence; c. *Aegle marmelos* (L.) Correa.; d. *Dolichandrone falcata* Seem.; e. *Butea monosperma* (Lam.) Taub.; f. *Phoenix dactylifera* L.

Figure 5. Selected Photographs of Tree species of Kalyana Karnataka Region, a. *Syzygium cumini* (L.) Skeels.; b. *Gyrocarpus americanus* Jacq.; c. *Limonia acidissima* L.; d. *Phyllanthus emblica* L.; e. *Cordia dichotoma* G. Forst

One of the most important factors determining the conditions of plant life in this region is low or scanty rainfall with long continuous drought period of more than six months besides high temperatures, especially during the summer seasons. These are supplemented by the prevalence of poor soils. The natural vegetation in the areas at present can be seen mostly on the hill locks only. The forest being open, allow a lot of scope for the invasion of fresh entrants.

These floristically rich forests shrinking like any other forests due to climatic and anthropogenic factors, the dry deciduous forests degraded to thorn scrubby jungles and to barren grass lands. Various factors threat to degrade the forests like fire is the regular occurrence, mining

operations, illegal cuttings, collection of fire wood, encroachments, grazing etc. are main threats. Hence it needs immediate action to conserve the forest areas.

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