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Floristic Diversity and Population Structure of Native and Naturalised Tree Species in the Biodiversity Heritage - Site, GKVK Campus

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Abstract

This study assessed the floristic diversity of tree species at the biodiversity heritage site of Gandhi Krishi Vigyana Kendra, University of Agricultural Sciences, Bangalore. The aim was to better understand natural forest dynamics and provide data for future conservation efforts. Using the random quadrat sampling method, 137 quadrats (20m x 20m) were established for vegetation sampling. The survey identified 75 tree species, belonging to 57 genera and 29 families. *Eucalyptus tereticornis, Santalum album* and *Acacia auriculiformis* were the most frequently occurring species, with *E. tereticornis* and *A. auriculiformis* being the most abundant. The study area showed moderate diversity, with a Shannon species diversity index of 2.56 and Simpson's diversity index of 0.88. *E. tereticornis* and *A. auriculiformis* had the highest basal areas and were the most dominant tree species based on the importance value index (IVI). The site demonstrated good regeneration status with a high number of juveniles. These findings provide valuable insights into the composition and structure of forests and can inform future conservation strategies for this important biodiversity heritage site.

Keywords : Biodiversity, Heritage site, Regeneration, Conservation, Forest structure

Vegetation is the main component of the terrestrial biosphere and plays a crucial role in balancing global carbon, reducing the rise of CO_2 concentrations in the atmosphere and controlling climate change worldwide (Zhu *et al.,* 2017). The composition and structure of the vegetation not only serve as a reflection of basic phytosociological association but also provide a habitat for numerous organisms and vegetation holds significant ecological importance as it embodies an essential component of ecosystems, exemplifying the distinct impacts of environmental conditions as a whole (Liu *et al.,* 2019). Among all terrestrial ecosystems, forests are highly productive and intricate biological entities, with nearly 80 per cent of the above ground carbon, which plays a vital role in upholding the balance of carbon and serves as a crucial factor in mitigating climate change (Streck and Scholz, 2006 and Whitehead, 2011).

Vegetation documentation serves as a valuable means to encapsulate our understanding of vegetation patterns (MacKenzie *et al.,* 2019). They play an essential role in nature conservation, landscape mapping and land-use planning (Haq *et al.,* 2017). Floristic documentation also holds significance in discerning spatial distribution patterns of plant variations and composition. Together with ecological traits, these documentations offer valuable insights into the processes that uphold and sustain ecosystems (Taruk *et al.,* 2017). Such data are invaluable not only for comprehending the distinct ecological conditions associated with each community, including attributes

such as architecture, species richness and spatial association patterns, but also for gaining insights into the habitat requirements necessary for successful ecological restoration and biodiversity protection (Wasseige *et al.,* 2014). Documenting diverse species assemblages within a forest ecosystem, which are influenced by both natural and anthropogenic factors, is imperative for gaining insights into fundamental ecological functions and the resulting ecosystem services (Haq *et al.,* 2019).

The Gandhi Krishi Vijnana Kendra (GKVK) is contemplated as one of the greenest areas in Bengaluru city. The campus harbours abundant biodiversity and the biological diversity found within it serves as a repository for various forms of flora and fauna that require protection. However, the expansion of agriculture, research and other anthropogenic activities in the campus is reducing tree cover and destroying natural tree species. The sustainable maintenance of tree diversity relies on dependable inventories that enable determination of the characteristics and distribution of tree species within a managed forest ecosystem (Gopalakrishna *et al.,* 2015). Floristic inventories and vegetation analysis data from the GKVK campus are required to understand the tree diversity, ecological processes and vegetation structure are very limited. An in-depth study of various facets of tree species composition and diversity in the heritage site of GKVK is essential to better understand the structural dynamics, woody species diversity and extent of disturbance. The present study mainly addressed two questions: (i) dissimilarities in tree species diversity and distribution within the biodiversity heritage site of the GKVK campus and (ii) what is the population structure of tree species in the study site? Tree species inventories will provide baseline biodiversity data to the reference database on tree diversity analysis to guide the conservation community in the management, research, and conservation of tree diversity in the biodiversity heritage site of the GKVK campus.

Material and Methods

Description of the Study Area and Climate

Study Area : The study was conducted at the biodiversity heritage site of Gandhi Krishi Vigyana Kendra (GKVK), University of Agricultural Sciences, Bangalore. A total of 167 hectares of the campus have been carefully designated as biodiversity heritage site, comprising 14 distinct patches known as area A, B, C, D, E1, E2, E3, E4, E5, E6, E7, E8, E9 and E10 (Fig.1). The study area is characterized by a scrub

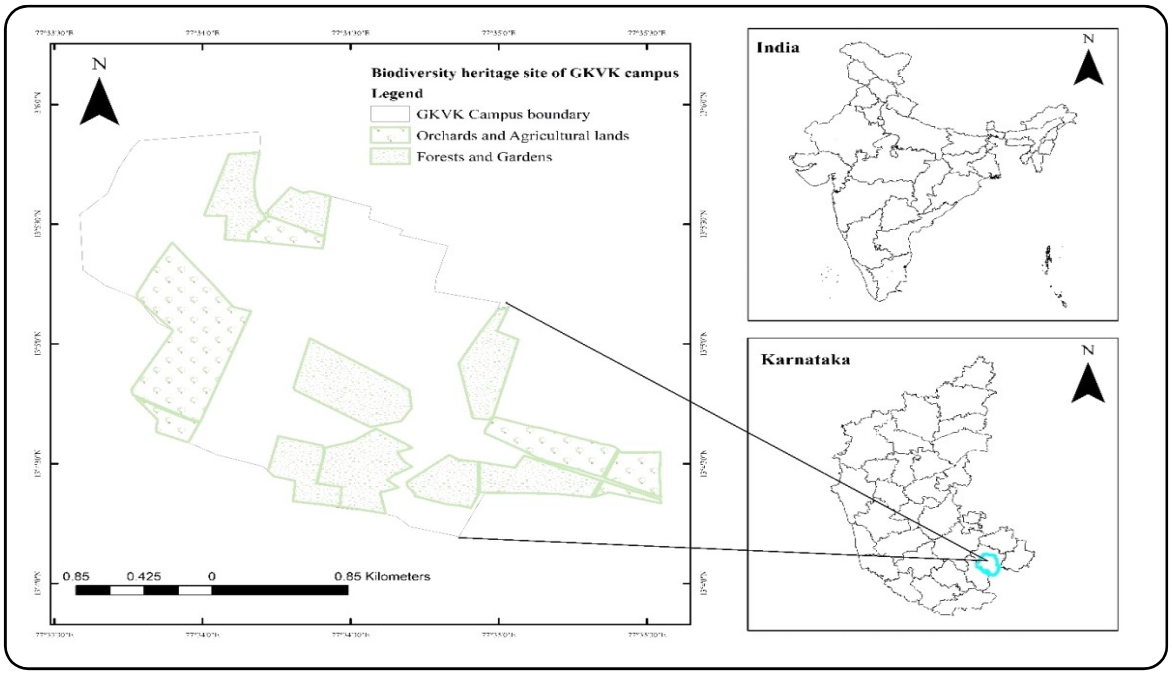

Fig. 1 : Map of the study area

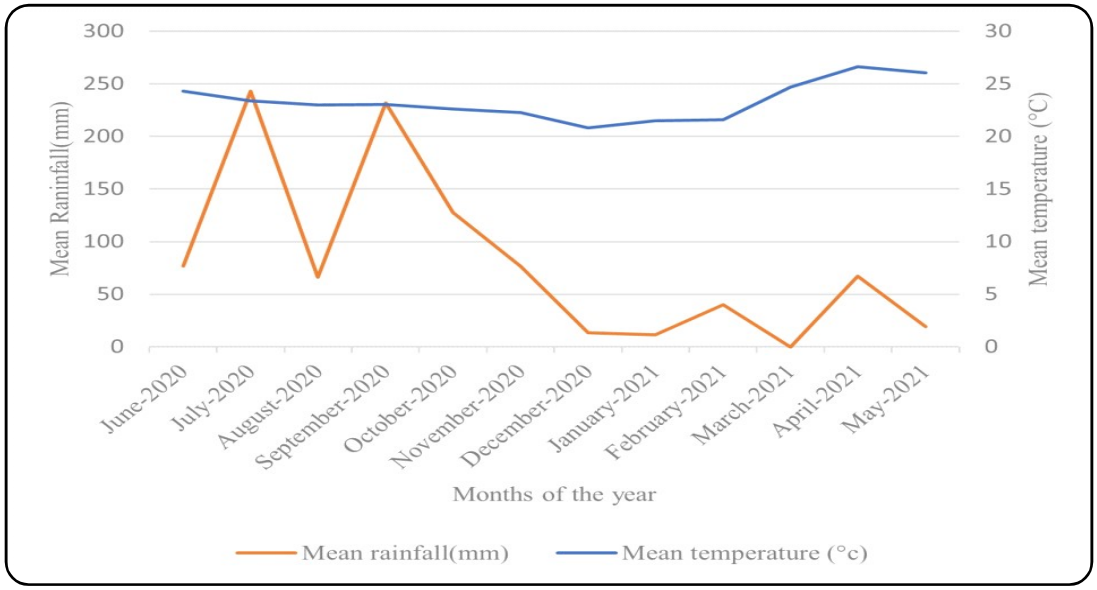

Fig. 2 : Climate graph showing rain fall distribution and temperature variation from June 2020 to May 2021

forest and supports a diverse range of agricultural crops that are cultivated throughout the year.

Climate : GKVK is located at an elevation of 924 m a.s.l. The area experiences annual rainfall that varies between 528 mm and 1374.4 mm with an average of 915.5 mm. Temperature and rainfall data were collected from the UAS, Bangalore Agrometeorology Climate Database. The study area is characterized by an average temperature and rainfall of 23.32°C and 973mm, respectively during the study period (Year 2021) (Fig. 2).

Sampling Design and Vegetation Data Collection : Random quadrat sampling was used to study tree species composition and species diversity. Quadrats (20 m^2) were placed in different locations in the study area. In each quadrat, all individuals with girth ≥ 30 cm were identified and their girth at breast height (GBH) and height were measured. Individuals with GBH less than 30 cm and height more than 1m were considered saplings and were enumerated in a 5 m^2 subplot in one corner of the main plot. A total of 137 quadrats were laid at the study site to record the tree diversity. Identification of the species was carried out with the help of local flora and by comparing the voucher specimen with the collection in the Mahatma Gandhi Botanical Garden herbarium, UAS, GKVK, Bengaluru.

Data Analysis

Floristic Composition : Vegetation data were compiled and summarized using Microsoft Excel 2019. Shannon diversity index (*H′*) and Simpson diversity index (1-D) were determined using $H' = -\sum_{i=1} P_i \ln P_i$ and "D"$=\sum n_i(n_i-1)/N(N-1)$ (where, n_i= Number of individuals of the i^{th} species, N= Total number of individuals, $P_i = n_i/N$), respectively. The indices used in this study assume that individuals are selected randomly from an infinitely large population and the sample includes all species present in the community (Yemata and Haregewoien, 2022).

Forest Structure : The structure of the forest was analysed considering key factors, such as density, frequency, basal area and importance value index. Data analysis was performed using Microsoft Excel 2019. Density refers to the number of all individual plants of a species per unit area and frequency is the probability of finding a species in any given quadrat. The obtained frequency values reflect the distribution pattern. Dominance was calculated using the Basal Area of the trees, and the basal area was calculated using the formula: Basal Area = πr^2 (Where, $\pi = 3.14$ and r is DBH; m).

Importance value index (IVI) : is an indicator of the ecological significance of a species. It often reflects

the extent of dominance, occurrence and abundance of a given species in relation to other associated species in an area (Kent and Coker, 1992). Relative Frequency, Relative dominance and Relative Density were calculated using the formula,

$$\text{Relative Frequency (RF)} = \frac{\text{Frequency of a species}}{\text{Total frequency of all species}} \times 100$$

$$\text{Relative dominance (RDo)} = \frac{\text{Total basal area of the species in all quadrats}}{\text{Total number of basal areas of all the species in all quadrats}} \times 100$$

$$\text{Relative Density (RD)} = \frac{\text{Number of quadrats in which species is studied}}{\text{Total number of quadrats studied}} \times 100$$

$$\text{IVI} = \text{RD} + \text{RF} + \text{RDo}$$

Population Structure

The stand and population structure of tree species were analysed based on diameter class distribution using DBH and eight height classes. The ten diameter classes analysed were 1: 1-30, 2: 30-60, 3: 60-90, 4: 90-120, 5: 120-150, 6: 150-180, 7: 180-210, 8: 210-240, 9: 240-270, 10: 270-300cm. On the other hand, eight height classes (m) were 1: <3, 2: 3-6, 3: 6-9, 4: 9-12, 5: 12-15, 6: 15-18, 7: 18-21 and 8:>21. The number of individual tree species within each diameter and height class was calculated and graphs were constructed to describe the population structure.

Results and Discussion

Floristic Composition and Tree Species Diversity

A total of 75 tree species encompassing 57 diverse genera spanning 29 different families (Table 1) were documented from a sample of 137 quadrats. Half of the total floristic composition was represented by members of five families. An equivalent number of species have also been identified in other deciduous forests (Thakur, 2015). The study forest exhibited greater tree diversity than dry deciduous forests in southern India, as reported by (Krishnamurthy *et al.,* 2010) and (Mehta *et al.,* 2008). On the contrary, the species richness was lower than that of the dry deciduous forests of the Eastern Ghats (Reddy *et al.,* 2008). This could potentially be attributed to the transition of the GKVK land for research and agricultural purposes. This could also be attributed to the shift in land use from natural forests to agro-ecosystems, resulting in a decrease in woody trees

Table 1

Tree species composition in the biodiversity heritage site of GKVK campus

Name of the Species	Family	Distribution
Acacia auriculiformis A.Cunn. ex Benth	Fabaceae	Exotic
Ailanthus excelsa Roxb.	Simaroubaceae	Native
Ailanthus malabarica DC.	Simaroubaceae	Exotic
Albizia amara (Roxb.) Boivin	Fabaceae	Native
Albizia lebbeck (L.) Benth.	Fabaceae	Native
Albizia odoratissima (L.f.) Benth.	Fabaceae	Native
Amoora lawii (Wight) Bedd	Meliaceae	Native
Anacardium occidentale L.	Anacardiaceae	Exotic
Andira inermis (W.Wright) DC.	Fabaceae	Native
Annona muricata L.	Annonaceae	Exotic
Arenga obtusifolia Mart.	Arecaceae	Native
Artocarpus heterophyllus Lam.	Moraceae	Exotic
Azadirachta indica A. Juss.	Meliaceae	Native

Continued...

TABLE 1 Continued...

Name of the Species	Family	Distribution
Bauhinia purpurea L	Fabaceae	Native
Bauhinia variegata L.	Fabaceae	Native
Broussonetia papyrifera (L.) L'Hér. ex Vent.	Moraceae	Exotic
Butea monosperma (Lam.) Kuntze	Fabaceae	Native
Cassia fistula L.	Fabaceae	Native
Cassia siamea Lam.	Fabaceae	Exotic
Delonix regia (Bojer ex Hook.) Raf	Fabaceae	Exotic
Dillenia indica L.	Dilleniaceae	Native
Diospyros melanoxylon Roxb.	Ebenaceae	Native
Diospyros montana B. Heyne ex A. DC	Ebenaceae	Native
Diospyros sp. L.	Ebenaceae	Native
Dracaena reflexa Lam.	Asparagaceae	Exotic
Enterolobium contortisiliquum (Vell.) Morong	Fabaceae	Native
Eucalyptus citriodora Hook.	Myrtaceae	Exotic
Eucalyptus tereticornis Sm.	Myrtaceae	Exotic
Ficus benghalensis L.	Moraceae	Native
Ficus benjamina L.	Moraceae	Exotic
Ficus krishnae C.DC.	Moraceae	Native
Ficus mollis Willd.	Moraceae	Native
Ficus tsjahela Burm.f	Moraceae	Native
Ficus virens Aiton	Moraceae	Native
Gliricidia sepium (Jacq.) Kunth	Fabaceae	Exotic
Gmelina arborea Roxb. ex Sm.	Lamiaceae	Exotic
Grevillea robusta A.Cunn. ex R.Br.	Proteaceae	Exotic
Jacaranda mimosifolia D.Don.	Bignoniaceae	Exotic
Lagerstroemia lanceolata Wight &Arn.	Lythraceae	Native
Leucaena leucocephala (Lam.) de Wit	Fabaceae	Exotic
Mangifera indica L.	Anacardiaceae	Native
Tapinanthus bangwensis (Engl. & K.Krause) Danser	Loranthaceae	Native
Manilkara zapota (L.) P.Royen	Sapotaceae	Exotic
Melia dubia Cav.	Meliaceae	Exotic
Michelia × longifolia Blume	-	Hybrid
Michelia champaca L.	Magnoliaceae	Native
Mimusops elengi Bojer	Sapotaceae	Native
Monoon fragrans (Dalzell) B.Xue & R.M.K.Saunders	Annonaceae	Native
Peltophorum pterocarpum (DC.) Backer ex K.Heyne	Fabaceae	Exotic
Persea americana Mill.	Lauraceae	Exotic
Phyllanthus emblica L.	Phyllanthaceae	Native
Phyllanthus polyphyllus Willd.	Phyllanthaceae	Native

Continued...

Table 1 Continued...

Name of the Species	Family	Origin
Polyalthia longifolia (Sonn.) Benth. &Hook.f. ex Thwaites	Annonaceae	Native
Pongamia pinnata (L.) Pierre.	Fabaceae	Native
Pritchardia pacifica Seem. & H.Wendl.	Arecaceae	Exotic
Psidium cattleyanum Sabine.	Myrtaceae	Exotic
Psidium guajava L.	Myrtaceae	Exotic
Pterocarpus marsupium Roxb.	Fabaceae	Native
Pterygota alata Thwaites	Malvaceae	Native
Santalum album L.	Santalaceae	Native
Sapindus laurifolius Balb. ex DC.	Sapindaceae	Native
Schleichera oleosa (Lour.) Oken	Sapindaceae	Native
Securinega leucopyrus (Willd.) Müll.Arg.	Phyllanthaceae	Exotic
Simarouba glauca DC.	Simaroubaceae	Exotic
Sterculia urens Roxb.	Malvaceae	Native
Swietenia mahagoni (L.) Jacq.	Meliaceae	Exotic
Syzygium cumini (L.) Skeels	Myrtaceae	Native
Syzygium jambos (L.) Alston	Myrtaceae	Exotic
Syzygium operculatum (Roxb.) Nied.	Myrtaceae	Native
Tamarindus indica L.	Fabaceae	Native
Tectona grandis L.f.	Lamiaceae	Native
Terminalia arjuna (Roxb. ex DC.) Wight &Arn.	Combretaceae	Native
Terminalia bellirica (Gaertn.) Roxb.	Combretaceae	Native
Terminalia tomentosa Wight &Arn.	Combretaceae	Native
Xanthophyllum ovatifolium Chodat	Polygalaceae	Native

and their subsequent replacement with shrubs and weedy herbs (Sumanth and Prasanna, 2022).

Most of the tree species found at the study site were either not evaluated (NE) or least concern (LC) categories in the IUCN red list. Two species (*Amooralawii* and *Santalum album)* are listed as vulnerable (VU) and one species (*Swietenia mahagoni*) is categorised under endangered (EN). Among the 75 species, 28 were exotic (37.33%), one was a hybrid and 46 (61.33%) were native to India. Exotic species like *Acacia auriculiformis* and *Eucalyptus tereticornis* are the dominant species (Table 5) in the study site, showing the introduction of exotic species and their dominance over native species, but the proportions show that native species successfully thrive in the campus.

The Among the families surveyed, Fabaceae exhibited a noteworthy representation of 17 species, accounting for 22.36 per cent of the species diversity (Fig. 2) and these species spanned across 17 different genera, reflecting the wide-ranging presence and significance of the family in the ecosystem. These findings align with observations made by Thakur (2015) in the dry deciduous forests of Madhya Pradesh. The success of this family may be the result of the presence of a greater number of species and higher adaptation capabilities to varying climates and anthropogenic activities. By contrast, Panda *et al.* (2013) reported Euphorbiaceous and Moraceae were the dominant families in eastern Ghats. This disparity can be attributed to anthropogenic activities, such as clearing the forest for agricultural purposes and planting and replanting of trees in the study area. Additionally,

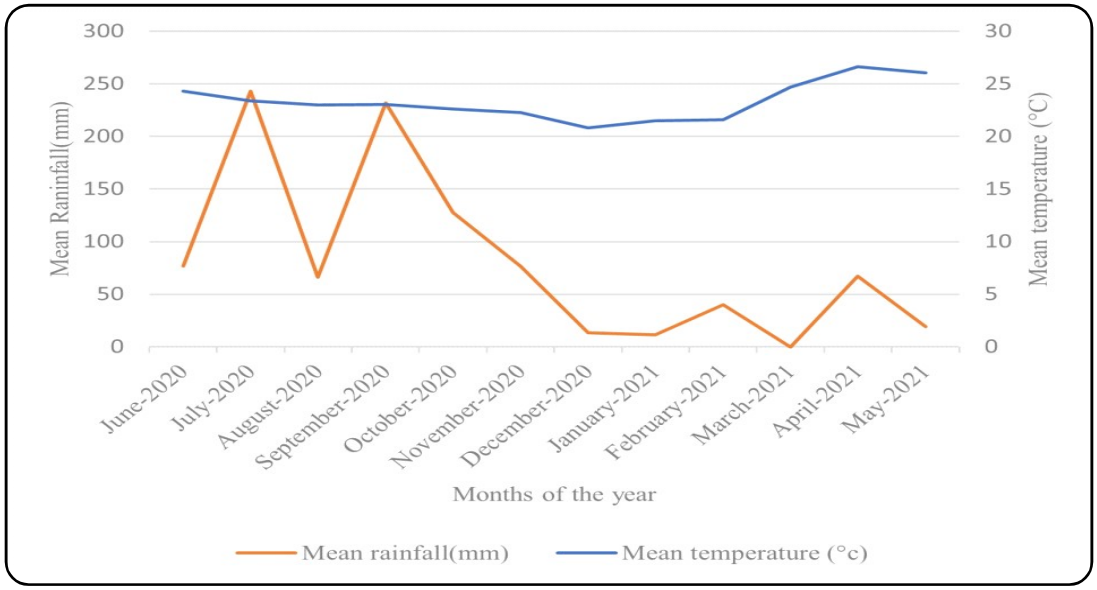

Fig. 2 : Climate graph showing rain fall distribution and temperature variation from June 2020 to May 2021

Moraceae featured eight species, each belonging to eight distinct genera, accounting for 10.52 per cent of the overall diversity. Myrtaceae demonstrated a considerable presence with six species, contributing 7.89 per cent to the overall diversity, distributed across six different genera. Meliaceae stood out with four species, representing 5.26 per cent of the total diversity, each classified within its unique genus and Annonaceae, with three species, accounted for 3.94 per cent of the overall diversity, each belonging to a separate genus. The diverse representation of these families highlights the richness and variety within the studied ecosystem. The number of families of tree species found in this study was lower than that reported by (Gopalakrishna *et al.,* 2015) in the dry forest of Bannerghatta, which was in close proximity to the study area. This may be due to the conversion of the land of the study site for human activities in contrast to the dry forest of Bannerghatta, which is protected by law, safeguarding it from similar disturbances.

An ecosystem characterized by high species diversity tends to exhibit a higher Shannon-Wiener index value, whereas an ecosystem with a low value will have low species diversity (Deka *et al.,* 2012). The study site had Shannon diversity index and Simpson diversity index values of 2.86 and 0.88, respectively, indicating biologically diverse species with balanced species distribution (Table 2). These results are within the

Table 2

Shannon diversity index (*H′*), Simpson diversity index (1-D) and Evenness index of the study area

Area Name	*H′*	1-D	J′
A	1.79	0.74	0.64
B	1.49	0.72	0.68
D	3.57	0.96	0.82
C	2.32	0.87	0.94
E1	*	*	*
E2	1.20	0.62	0.75
E3	1.61	0.78	0.90
E4	1.44	0.68	0.58
E5	1.68	0.78	0.76
E6	2.21	0.85	0.82
E7	2.62	0.92	0.88
E8	0.27	0.12	0.25
E9	*	*	*
E10	0.66	0.36	0.60
Overall	2.86	0.88	0.66

(*Indicates that single species dominates the site)

range (0.83-4.1) reported for forests in the Indian subcontinent (Pandey, 2000 amd Pitchairamu *et al.,* 2008). Simpson diversity index in the present study was lower than that reported by Tarakeswara *et al.,* 2018 in the tropical deciduous forests of the Eastern Ghats, India. Significant variations in the diversity indices were found across various sites within the study area. Shannon's diversity indices varied substantially between sites, ranging from 0 to 3.57. Simpson's diversity index values varied from 0 to 0.96. Shannon and Simpson index values of zero were obtained for the two patches of the study site because these patches were dominated by single tree species and there was no observed tree species diversity in those particular patches (Table 2). Evenness index value ranged between 0 and 0.94 from site to site within the study area showing the wide degree of distribution of individuals. Sites E1 and E9 were completely dominated by one species while in the site D, individuals of all species were evenly distributed (Table 2). This shows the degree of variations in the distribution of individual trees within the same ecosystem.

Frequency

The study results showed that *Eucalyptus tereticornis, Santalum album, Acacia auriculiformis, Mangifera indica, Jacaranda mimosifolia, Tamarindus indica* were the frequently occurring species which were recorded in 51, 50, 40, 31, 23 and 23quadrats, respectively. This may be because *E. tereticornis* and *A. auriculiformis* were planted throughout the campus long back and became naturalized. The high frequency of *S. album* can be attributed to the ideal conditions for natural regeneration, as reported by Lakshmi *et al.,* 2015. The six frequently observed species together contributed 28.60 per cent of the total relative frequency of the study site (Table 3). This shows that these tree species are the wide spread and dominant members of the ecosystem. In contrast, *Ficus benghalensis, Malpighia glabra, Broussonetia papyrifera* and *Michelia × longifolia,* rarely occurred and contributed little to the total relative frequencies.

Table 3

Basal area, frequency and abundance of some of the dominant tree species in the study site

Scientific Name	BA (m^2)	Frequency	Abundance
Acacia auriculiformis	9.31	0.30	6.23
Eucalyptus tereticornis	13.26	0.38	8.35
Jacaranda mimosifolia	1.51	0.17	5.39
Mangifera indica	2.79	0.23	2.58
Santalum album	0.33	0.37	2.90
Tamarindus indica	2.73	0.17	2.22

Abundance

The study revealed that *Eucalyptus tereticornis, Acacia auriculiformis, Jacaranda mimosifolia, Simarouba glauca, Santalum album* were the most abundant species with abundance values of 8.35, 6.23, 5.39, 3.40 and 2.90, respectively. These results highlight the significance of these species in terms of population size within the study site (Table 3).

Basal Area

The sampled area exhibited a total basal area of 43.48m^2 with a mean basal area of 7.93±3.19 $m^2 ha^{-1}$. The total basal area of the sampled trees was lower than the values recorded by Pitchairamu *et al.* (2008) in tropical dry deciduous forests in the Eastern Ghats, Tamil Nadu. The mean basal area of the sampled tree species was 7.93 ± 3.19 $m^2 ha^{-1}$, which is lower than the mean basal area (11.46 $m^2 ha^{-1}$) of dry forests of Eastern Ghats (Reddy *et al.,* 2008). This may be attributed to the greater anthropogenic disturbance to the growth and development of trees at the study site. Four tree species, *Eucalyptus tereticornis, Acacia auriculiformis, Mangifera indica* and *Tamarindus indica* occupied a significant proportion (28.09%) of the basal area of the study site (Table 3). This indicates the significant influence and contribution of these tree species to the overall basal area, denoting their importance in the ecosystem's structure. The highest basal area was observed in *Eucalyptus tereticornis* (13.26m^2) while the lowest was contributed by *Broussonetia papyrifera* (0.00028m^2).

Stem Density

The stem density in the biodiversity heritage site of GKVK is 211.31 stems/ha (Table 5). Area E5 and Area E4 exhibited the greater stem density. The stem density recorded in the study site is on par with the stem density reported by Udayakumar *et al.,* 2016 in the tropical semi evergreen forest of Pachaimalai hills (213 stems/ha) and it was lower than the eastern ghats of northern Andhra Pradesh (639-836 stems/ha, Reddy *et al.,* 2011). This high density may be due to careful planting and nurturing of plantations and gardens.

Importance Value Index

The IVI reflects the degree of dominance and abundance of a given species and thus its ecological importance relative to other co-occurring species in the community (Kent & Coker, 1992). In the current investigation, *Eucalyptus tereticornis* and *Acacia auriculiformis* were found to have higher IVI than other species (Table 4). Notably, the ten most dominant species collectively accounted for 60.50 per cent of the total IVI, underscoring their strong influence and contribution to the overall vegetation structure and composition in the study area. Similar results were also documented by Krishnamurthy *et al.* (2010) in the dry deciduous forests of Bhadra wildlife sanctuary where dominant species occupied 62 per cent of the Importance Value.

Diameter at Breast Height

The distribution of tree species in the different DBH classes is shown in Fig. 3. The second DBH class had the highest number of individuals, followed by the

Table 4

Density of tree stand in the study area

Site Name	Density (stems/ha)	Proportion (%)	
A	246.67	8.72	
B	241.25	8.52	
C	217.00	7.67	
D	200.91	7.10	
E1	134.29	4.75	
E2	150	5.30	
E3	165.00	5.83	
E4	315	11.13	
E5	321.67	11.37	
E6	224.44	7.93	
E7	247.86	8.76	
E8	105.83	3.74	
E9	126.67	4.48	
E10	133.33	4.71	
Overall		211.31	(stems/ha)

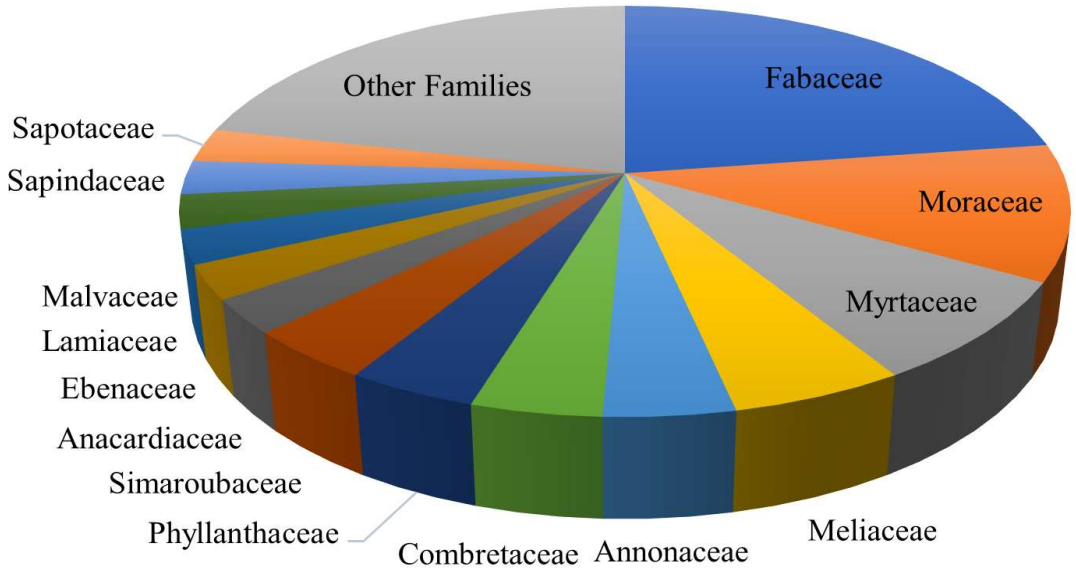

Fig. 3 : Familywise distribution of tree species in the study area

Table 5

Importance value index (IVI) of top ten dominant species in the study site (RD: Relative Density, RF: Relative Frequency, RDo: Relative Dominance)

Scientific Name	RD	RF	RDo	IVI
Eucalyptus tereticornis	26.43	4.05	30.46	60.94
Acacia auriculiformis	15.45	3.02	21.38	39.85
Jacaranda mimosifolia	7.69	2.61	3.48	13.78
Mangifera indica	4.96	1.25	6.41	12.63
Santalum album	9.00	1.41	0.76	11.16
Tectona grandis	3.23	5.04	2.59	10.86
Tamarindus indica	3.16	1.08	6.26	10.50
Pterocarpus marsupium	0.99	7.76	1.02	9.78
Ailanthus malabarica	0.62	4.85	0.60	6.07
Grevillea robusta	2.17	2.42	1.34	5.94

first class. Higher numbers of individuals were found in the lower diameter classes and a lower number of individuals were found in the higher DBH classes. Approximately 93.98 per cent of the individuals were found in the first three DBH classes. This shows that the study site contained more younger individuals. The higher contribution of juveniles with smaller diameter classes suggests that the tree species in the study area exhibit good regeneration. From the second DBH class on words, the study area showed an inverted J-shaped distribution. Our findings are consistent with those reported by Sudhakar *et al.* (2008) in the tropical forests of the Mudumalai Wildlife Sanctuary. Their research revealed a similar trend, indicating that a significant proportion (65.4%) of individuals of all tree species in the Mudumalai Wildlife Sanctuary forests were juveniles.

Height Class

The height class distribution analysis showed varying pattern of distribution. Maximum number of individuals *i.e.*, 31.45 per cent were observed in height class 5 (12-15m) indicating a significant concentration of trees within this range. These results are similar to the result reported by Tarakeswara *et al.* (2018) in the deciduous forests of Eastern Ghats where majority of the species had the height class 5-15m. Conversely, Height class 8 had the lowest number of individuals accounting only for 0.19 per cent (Fig. 4). Higher height classes were represented only by few tree species suggesting that only a few tree species managed to reach those taller heights. *Acacia auriculiformis* and *Eucalyptus tereticornis* were the most common in height class 5 and 6. Similarly *Eucalyptus tereticornis* was the most common tree species in height class 8. This suggests that *Eucalyptus tereticornis* is the dominant tree species in the study

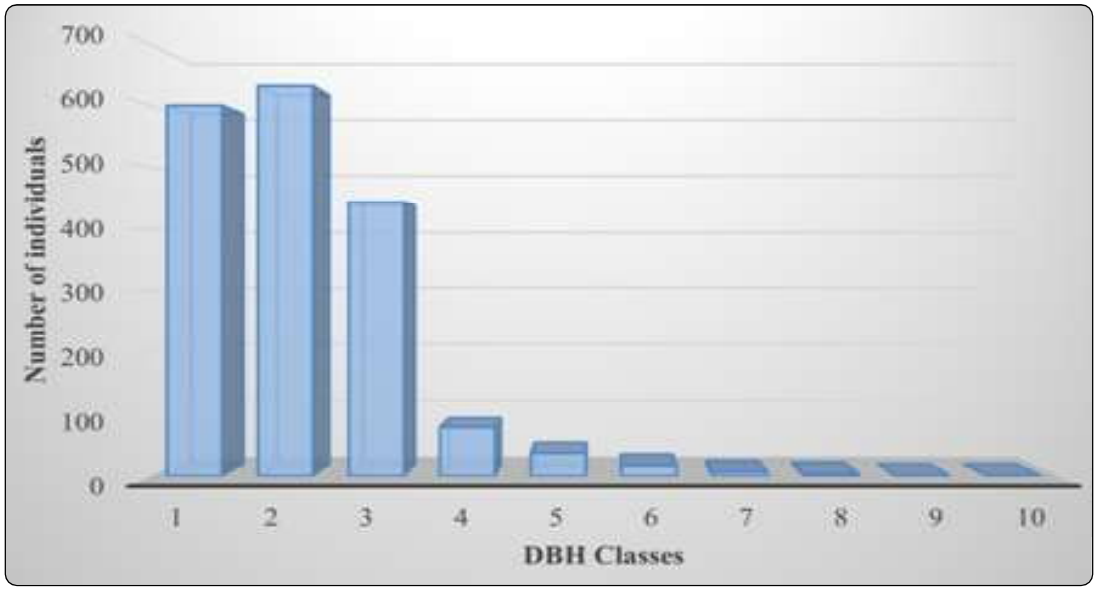

Fig. 3 : The DBH class distributions of all tree species in GKVK campus

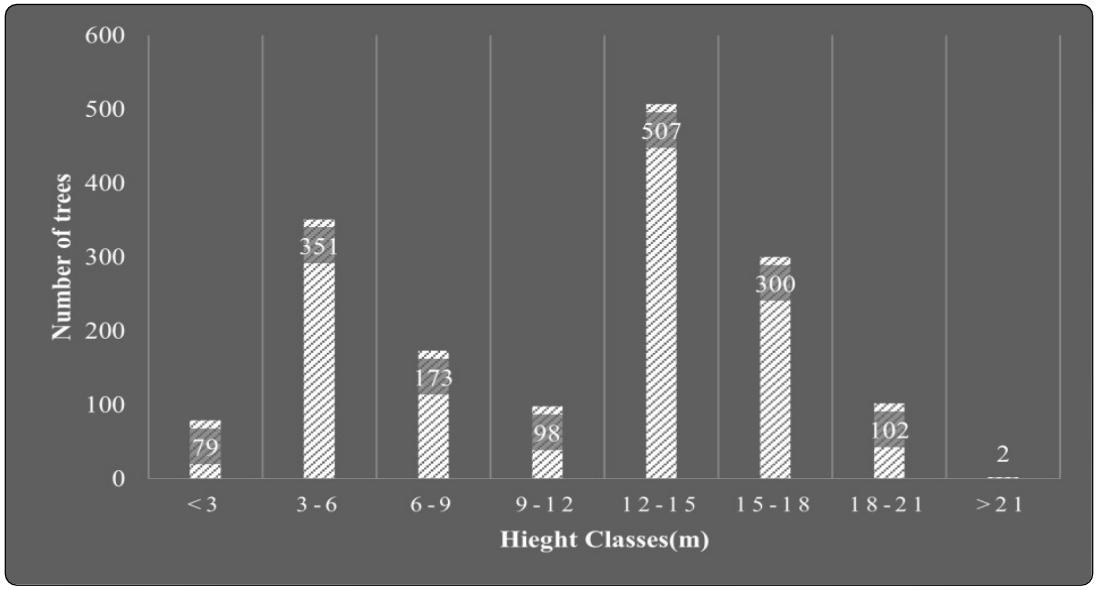

Fig. 4 : Height class cumulative distributions of tree stand in the study

site. The distribution of individuals across the height classes underscores the varying growth and development patterns of different tree species within the study site.

The results of the present study revealed a moderate diversity of tree species in the biodiversity heritage site of GKVK campus. This study hints at the influence of changes in land-use patterns around the natural ecosystem. Fabaceae was represented by the highest number of species. The study site is dominated by the individuals of *Eucalyptus tereticornis* and *Acacia auriculiformis*. Diameter class distribution analysis revealed that a higher number of individuals were found in lower diameter classes and there was a decrease in the number of individuals in the higher diameter classes. The overall regeneration status of the forest stands was good. The results of the present investigation will provide baseline data for future conservation and management practices in the heritage site of GKVK.

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