International Research Journal of Biological Sciences _____E-ISSN 2278-3202
Vol. **5(5),** 26-34, May **(2016)** *Int. Res. J. Biological Sci.*

Comparative anccount on Floristic diversity among the two different Tropical Reserved forests of Central Western Ghats, Karnataka, India

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Available online at: www.isca.in, www.isca.me
Received 1st March 2016, revised 3rd March 2016, accepted 2nd May 2016

Abstract

A comparative study is conducted to analyse the floristic diversity and distribution pattern in Haniya and Hulikal reserve forests of central Western Ghats. A total of 226 species belonging to 61 families were recorded from 20 quardrats in Haniya forest, whereas in Hulikal forest represents 231 species belonging to 60 families were recorded from 30 quadrats. Diversity of climbers and shrubs are almost all similar, but herbs diversity is more in Haniya, whereas tree diversity is more in Hulikal forests. The basal area in Hulikal (42.9 m^2) is higher when compare to Haniya (23.07m^2). The study revealed high level of species richness in the two reserve forests, which is found to be high as compared to certain other regions of Western Ghats. The Jaccard similarity index shows more similarity between the Hulikal and Haniya climbers (0.73) and some extinct between the shrubs (0.56). The present study highlights the rich species composition of the two reserve forests and the comparative account of two forest fragments. Thus, hopefully the present study may provide baseline information for the future investigations and conservation.

Keywords: Simpson's value, Jaccord index, Species Important Value, Tropical forests, β diversity.

Introduction

The diversity of plants is fundamental to total tropical forest biodiversity, because trees provide resources and habitats for almost all other forest species. The species diversity is significantly associated with forest structure and species composition of tropical forest communities[1]. Old-growth forests are heterogeneous in space and time and consist of patches at various stages of regeneration following gap formation[2].

The timing of periodic events in relation to climatic seasonality is of obvious importance in strongly seasonal areas, but even in the aseasonal tropics, synchronization at the population level may be essential for cross-pollination and escape from herbivores or seed predators[3]. Human disturbances have become an increasingly important factor influencing the distribution of individual species, the composition of ecological communities and the biogeochemistry of ecosystems[4].

As for the biodiversity of Western Ghats is concern limited attempts has been made by certain group of research to document floristic diversity[5]. The flora of Western Ghats comprises about 12,000 species ranging from unicellular cyanobacteria to angiosperms; of this spectrum the flowering plants contribute about 27% of Indian flora with 4000 species, of which 1500 species are endemic[6]. There are certain areas within the Western Ghats which are remaining unexplored for their biodiversity. One such area where there is no work focused on the quantitative aspects of the plant diversity and their population density is Haniya and Hilikal reserve forests of Hosanagar, Karnataka. Hence the present paper attempts to identify the proportional changes in the two above mentioned regions.

Materials and Methods

Study area: Two regions had been selected for the comparative vegetative analysis, comprising different types of forests, they are Hulikal reserve forest (13º46'15" N to 13º42'30" N and 75º1'30" E to 75º5'15" E) and Haniya reserve forest (13º45'15" N to 13º45'15" N and 75º03'12" E to 75º04'18" E) of Hosanagar taluk. Haniya and Hulikal reserve forests are situated in almost all same altitudinal range i.e., 560 to 800 m, from MSL; and there is no much difference in annual precipitation also (850 to 1200 cm). The recorded minimum temperature of these two regions is 13ºC, whereas the maximum temperature observed is 30ºC. We have analysed the soil parameters in two forest regions, we have found that rich in organic carbon and high moisture retaing capacity (Table-1 and 2).

Hulikal reserve forest comprise evergreen and semi-evergreen type of forests, where as Haniya reserve forest is dominated by semi-evergreen and evergreen forests; deciduous forests and grass land are present in small patches (Figure-1 and 2).

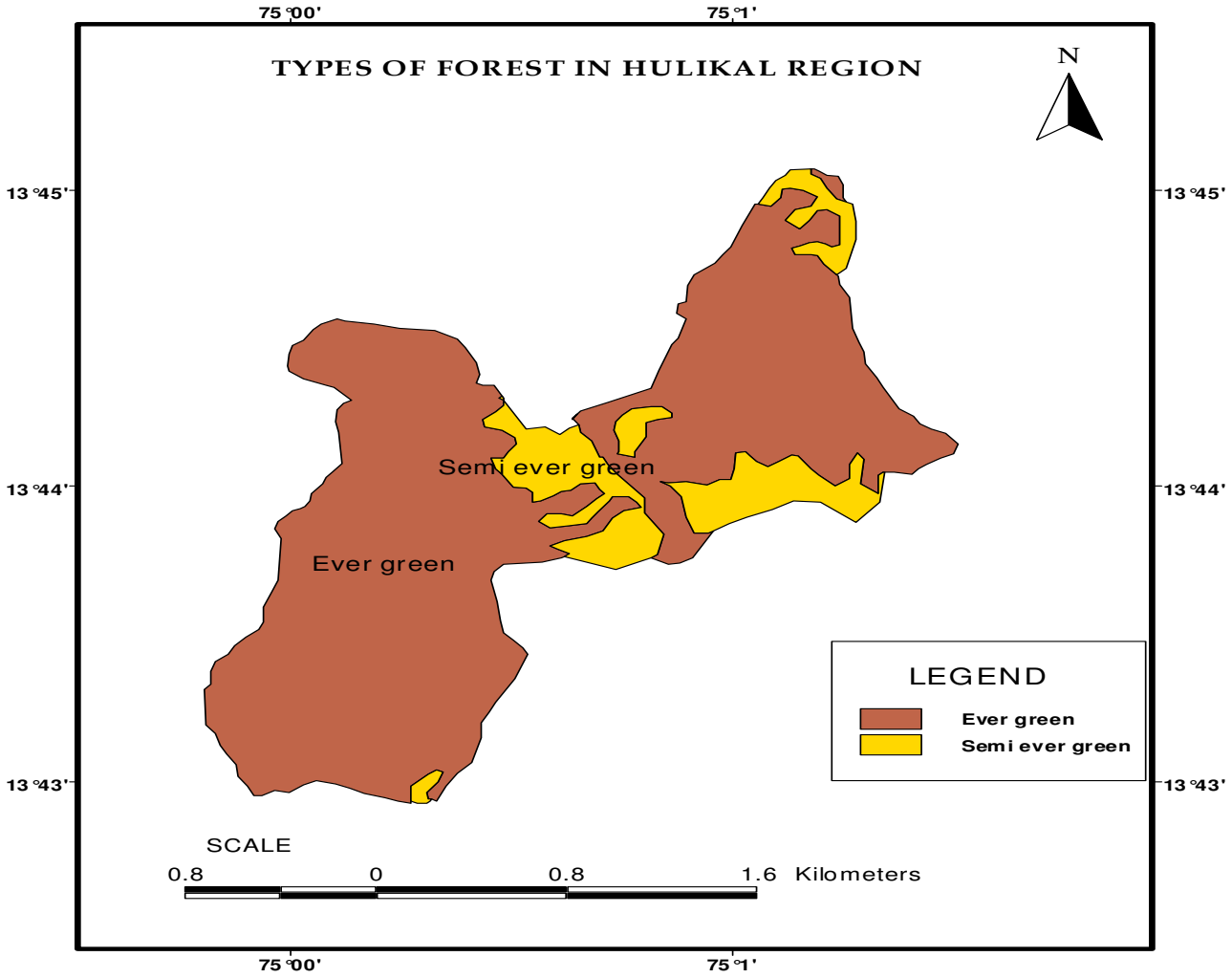


Figure-1
GIS Map of Hulikal forest

Table-1
Soil parameters of Haniya reserve forest

Temp. (^{0}C)	Moisture (%)	pH	Colour	Organic carbon (%)	Zn (ppm)	Cu (ppm)	Mn (ppm)	Fe (ppm)	P (Kg)	K (Kg)
23	76.57	5.5	Red	1.00	0.35	5.00	13.57	5.48	22	60
22.6	68.2	5.1	Red	0.95	0.38	4.74	14.1`8	9.08	32	180
19.2	72.09	5.1	Black	0.8	0.4	4.78	9.53	6.82	40	200
18.7	88.2	5.2	Red	0.35	0.46	4.57	13.46	3.58	29	170
21.1	85.3	5.2	Black	0.6	0.82	0.41	17.86	5.63	26	170
20.2	71.05	6.6	Red	0.8	0.34	4.67	9.15	3.36	12	90

Table-2
Soil parameters of Hulikal reserve forest

Temp. (^{0}C)	Moisture (%)	pH	Colour	Organic carbon (%)	Zn (ppm)	Cu (ppm)	Mn (ppm)	Fe (ppm)	P (Kg)	K (Kg)
23.1	68.55	5.4	Red	0.65	0.65	1.56	81.97	33.91	4	60
20.0	82.2	5.1	Red	0.85	1.06	1.65	28.29	44.61	6	90
21.5	91.6	5.3	Black	0.91	0.78	1.13	38.06	30.71	6	80
22.0	82.2	5.2	Black	1.00	0.92	1.31	38.04	38.51	6	80
21.3	79.4	5.0	Red	1.00	0.64	1.87	74.17	39.46	4	30
19.4	76.6	5.6	Black	0.45	0.11	1.21	5.48	8.24	10	70

Plants were enumerated in the study areas using standard quadrant methodology. A total of 50 quadrants each measuring 10 X 20 m were laid in Hulikal (30 quadrate) and Haniya (20 quadrate) reserve forests. Plants ≥ 10 Cm GBH were considered as trees for enumeration. Shrubs and herbs were recorded in 5mX5m and 1mX1m quadrates respectively. The identification of the plants was confirmed using regional floras[7-8]. The specimens was collected at flowering stage and was processed to be preserving as herbaria sample, which was deposited in the Department of P.G. Studies and Research in Applied Botany, Kuvempu University, Shimoga, Karnataka, India.

Data on various plant characteristics in different quadrants were collected and analyzed statistically using standard formulae. For species diversity and dominance (α diversity) Shannon-Wiener (H') = - Σpi ln pi and Simpsons (cd) indices = Σpi^2 were calculated as per[9]. Similarly β diversity analysis is done by using Jaccard similarity index (Cj) = j/(a+b-j), and Sorenson similarity index (Cs) = 2j/(a+b); where j = Number of species common to both the sites, a = Number of species in site A, b = Number of species in site B.

Results and Discussion

A total of 2290 individuals representing 226 species and 61 families were recorded from 20 quardrats in Haniya forest, whereas in Hulikal forest, a total of 2172 individuals representing 231 species and 60 families were recorded from 30 quadrats. Hulikal reserve forest comprises relatively low herbaceous diversity (53 species) than that of Haniya reserve forest (87 species). *Sida acuta* has heighest density in Haniya reserve forest while *Cymbidium bicolor* is more frequent. *Cymbopogen nardus* is less abundant in Haniya but *Mimosa pudica* is more abundant in the region. In Hulikal reserve forest *Girardinia diversifolia and Viscum orientale* are more dence, *Viscum orientale* is also more frequently available and *Blepharis asperrima, Rawvolfia serpentina are* more abundent.

Shrub compositions of the two reserve forests are also show differences. 51 species of shrubs are present in Hulikal and only 43 species are present in Haniya. *Latana camara* is the most dence and frequent, *Chromolaena odorata* is also has same frequency. Shrubs in Haniya forest were *Pavetta tomantosa* and *Maesa indica* are more abundant. But in Hulikal reserve forest *Chromolaena odorata, Memecylon malabaricum* and *Lantana camara* comprises equal density, *Lantana camara* is most frequent but not frequent as that of in Haniya, along with the other two species; *Clerodendron serratum* and *Maesa indica*. While *Cromolina odorata* is found in adundence in the Hulikal.

Both Haniya and Hulikal reserve forests harbour less number of climbers (33 and 31 secies respectively includinding some herbaceous creapers). In Hulikal *Dioscorea bulbifolia* is most abundant species, where as in Haniya *Pothas scandens* is the abundant. *Gnetum ula* has maximum density in Haniya but in Hulikal, *Naravelia zeylanica* and *Piper hookeri* comprise heighest density and also frequency, along with *Thunbergia mysorensis*. *Tragia hispida* is the most frequent species in Haniya.

About 96 tree species are found in Hulikal reserve forest, at the same time only 63 species are found in Haniya. *Fahrenheitia zeylanica, Hopea ponga* are the two species in Hulikal forest, with the maximum density, *Fahrenheitia zeylanica* is the most frequently documented tree species in Hulikal, where as *Notophodytes nimmonniana* and *Hopea canarensis* are found in abundance. *Acacia aruclifolia* has heighest density and frequency in Haniya, where as the most abundent species is *Garcinia gummigutta.*

The basal area in Hulikal (42.9 m^2) is higher when compare to Haniya (23.0684 m^2). Five species (i.e., *Symplocos racemosa, Mangifera indica, Lagerstroemia microcarpa, Trichilia connaroides* and *Holigarna arnottiana*) contributes to high basal area in Hulikal reserve forest and *Hopea parviflora* in Haniya reserve forest.

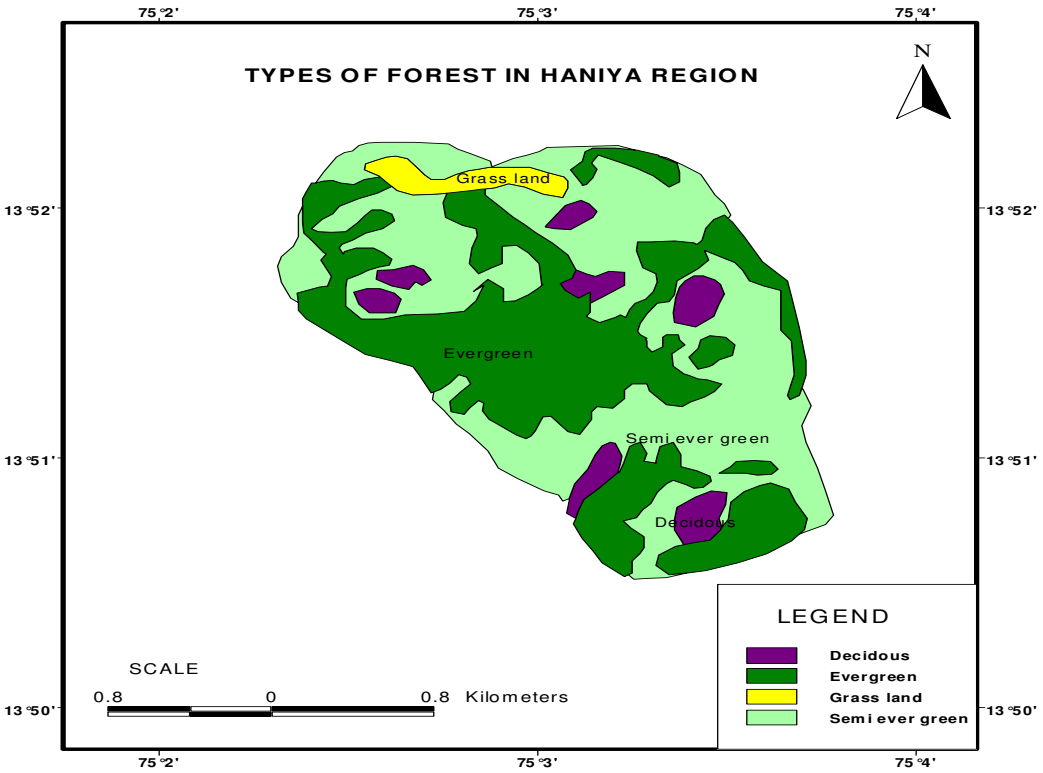


Figure-2
GIS Map of Haiya forest

Important Value Index of top ten species of herbs, shrubs, climbers and trees in two reserve forests are ploted in the graphs (Figure-3 to 10). Jaccard and Sorenson similarity measures among Haniya and Hulikal reserve forests for herbs, shrubs, climbers and trees are given (Figure-11). Species composition of the two regions differs for different type of vegetations (Figure-12). Diversity of climbers and shrubs are almost all similar, but shrubs diversity is more in Hulikal whereas tree diversity is more in Haniya.

In the present area the canopy is accupied by the tall trees measuring about 60 to 80 feet, which make almost imposible to enter the forest. The forest is also significant by the presence of diverse herbs, shrubs, climbers and lower plants like ferns, mosses and epiphytes along with several fungi, algae and lichens. As like any other tropical rain forests the Hulikal and Haniya reserve forests are also rich in humus in soil. According to the Remote Sensing Data of IRS, Hulikal region show rich evergreen type of vegetation (Figure-1), and Haniya region showed maximum cover of deciduous and evergren type of vegetation (Figure-2).

The present study revealed high level of species richness in the two reserve forests of Hulikal and Haniya, which is found to be high as compared to certain other regions of Western Ghats[10-11]. As per the present study, a total of 226 species of trees (GBH ≥10 Cm) from Haniya and 231 species from Hulikal reserve forests were recorded. The number of individual species in the area is formed to be very high when compared to Madumalai deciduous forest which accounts for only 71 species in 50 hectare permanent plot[10]. Similarly, transect study done in Uppangala natural forest recorded trees (GBH ≥30 Cm) belonging to 91 species in 3.12 hactare and tree diversity in Western Ghats[12-13], which is found to be lesser as compared to the two reserve forests of present study.

Basal area of Haniya reserve forest (23.068 m^2/ha) is lower than that of Kalakad Mudanthurai Tiger Reserve (42.03 m^2/ha)[14] and is more or less same as that of Hulikal reserve forest (42.9 m^2/ha). The Shannon – Weiner diversity index of herbs, shrubs, climbers and trees in Haniya is 4.3, 3.65, 3.4 and 3.9 respectively, while in Hulikal the diversity index for herbs, shrubs, climbers and trees is 3.9, 3.8, 3.3 and 4.3 respectively. These indices were significant enough to indicate the high species diversity as compare to the evergreen forests of Kalakad Mundanthurai Tiger Reserve which had the index value[14] and the present study areas are very rich in species index than that of Savanadurga reserve forest which showed species index[2] and dry deciduous forest of Bidar district[11]. The Jaccard similarity index shows more similarity between the Hulikal and Haniya climbers (0.73) and some extinct between the shrubs (0.56). But all these similarity indices were found to be very high when comparing to Savanadurga reserve forest[2].

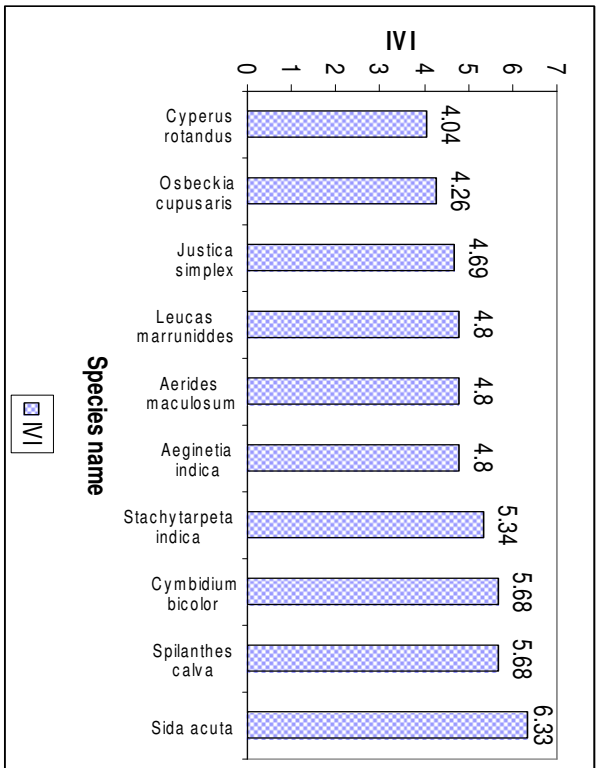


Figure-3
IVI value of top ten Herb species in Haniya reserve forest

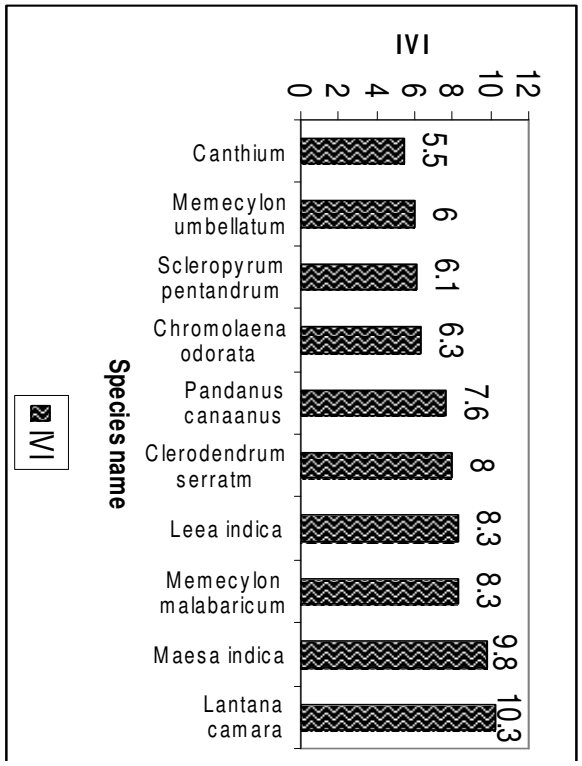


Figure-5
IVI value of top ten Shrub species in Haniya reserve forest

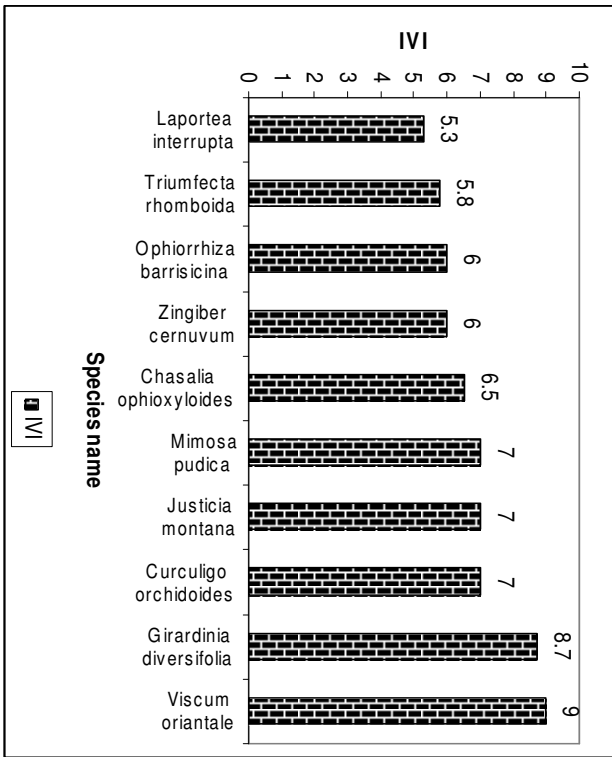


Figure-4
IVI value of top ten Herb species in Hulikal reserve forest

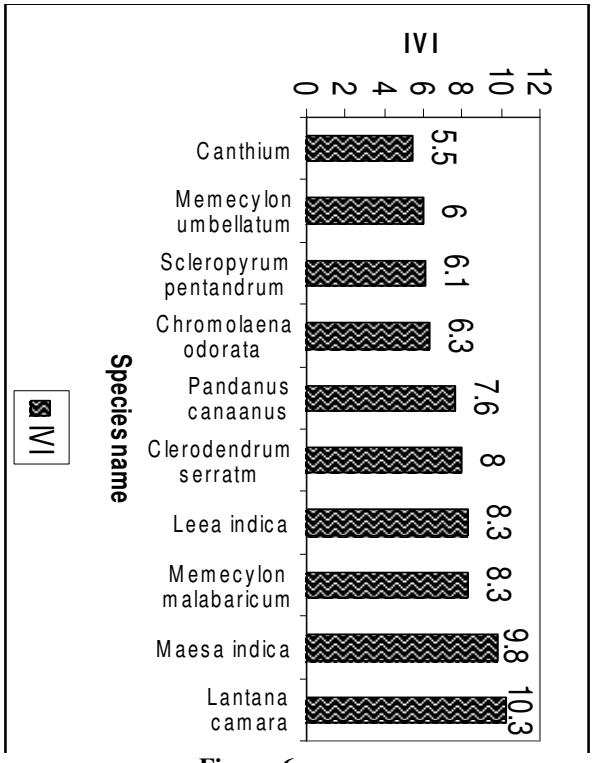


Figure-6
IVI value of top ten Shrub species in Hulikal reserve forest

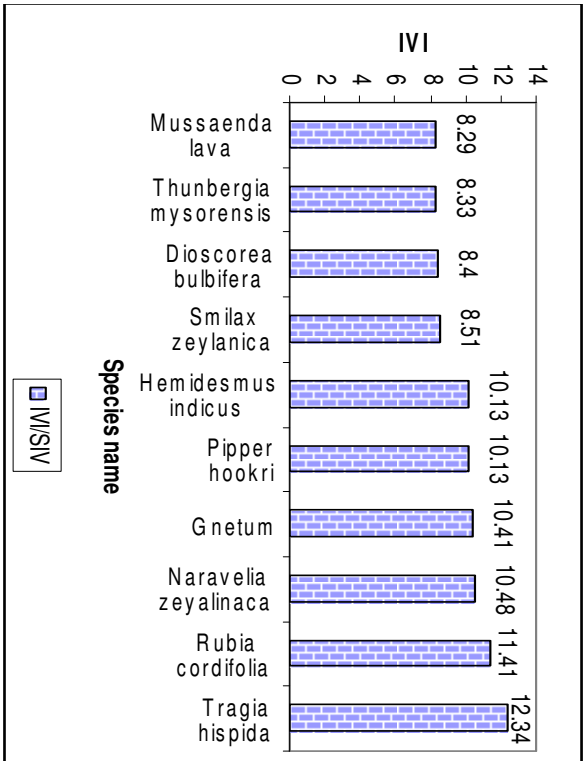


Figure-7
IVI value of top ten Climber species in Haniya reserve forest

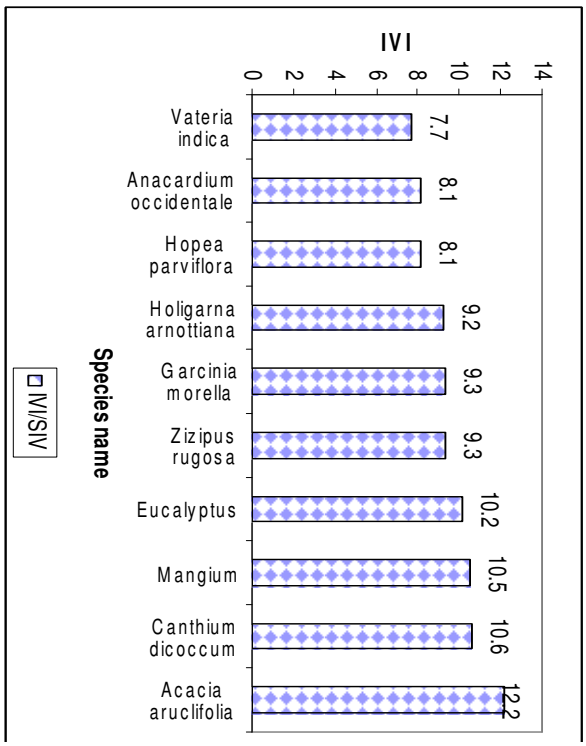


Figure-9
IVI value of top ten Tree species in Haniya reserve forest

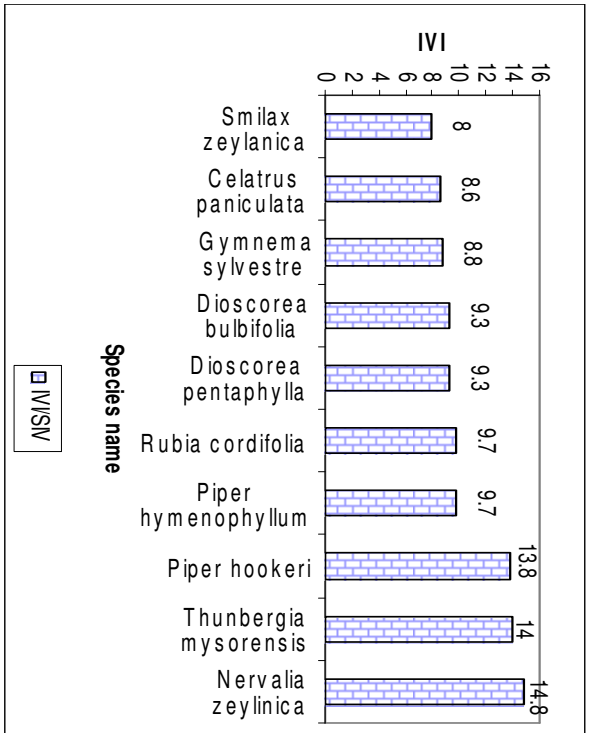


Figure-8
IVI value of top ten Climber species in Hulikal reserve forest

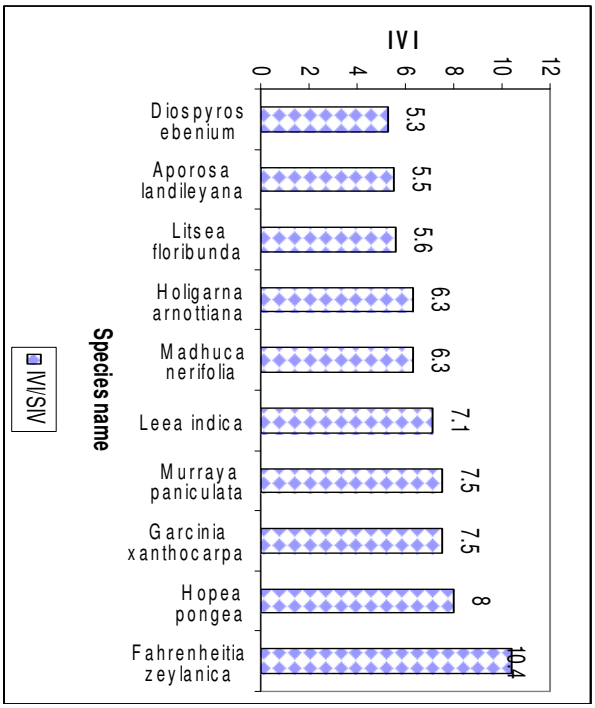


Figure-10
IVI value of top ten Tree species in Hulikal reserve forest

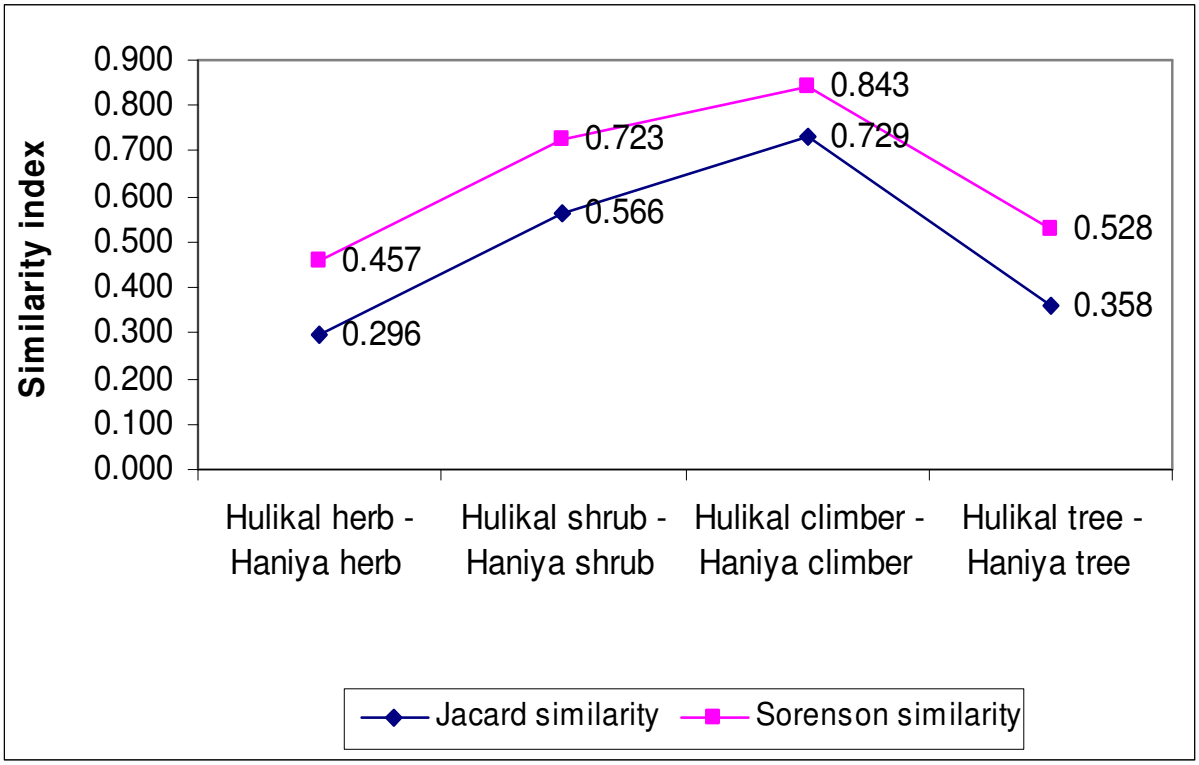


Figure-11
Comparison of Jaccard and Sorenson similarity measures among Haniya and Hulikal reserve forests, Hosanagara

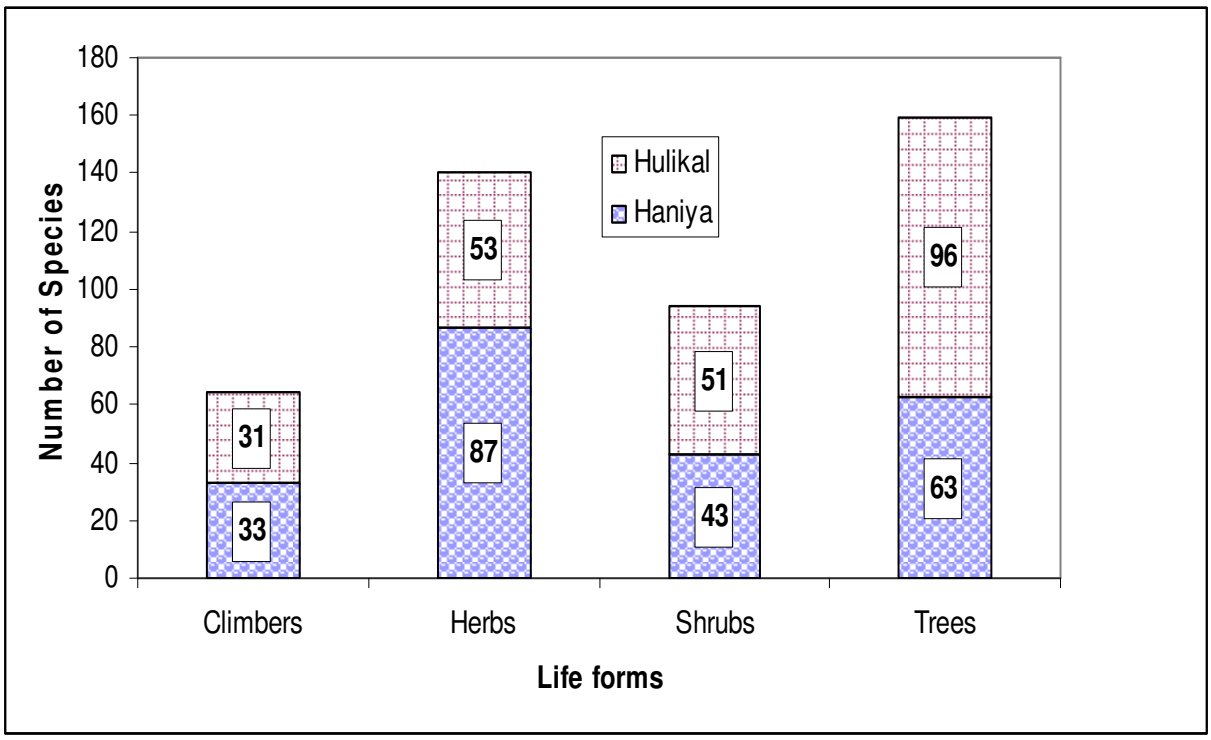


Figure-12
Comparission of species composition of Haniya and Hulikal reserve forests, Hosanagara

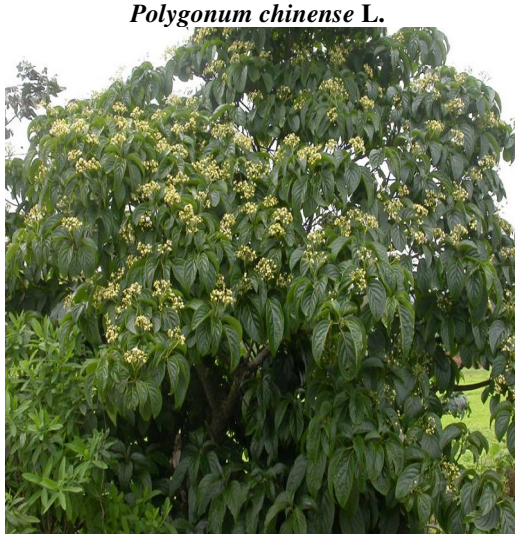
***Calamus nagbettai* L.**

***Pinanga dicksonii* (Roxb.) Scheffer**

***Cymbidium bicolor* Lindl**

***Polygonum chinense* L.**

***Litsea floribunda* (Blume) Gamble**



***Nothophodytes nimmoniana* (Wt.) Sleumer**

Figure-13
Some important plant species of study area

Conclusion

Mature natural forests led to less variation in species richness and abundance, and then likely more stable plant community[1]. The general characteristics and traits of a forest community cannot be detected by small-scale studies because heterogeneity in internal or external conditions, such as competition, topography, soil and light, are ignored. Short-term studies also give wrong estimates of forest canopy and community dynamics because the effects of rare or episodic events, such as large-scale or strong disturbances, are not considered[15]. Large-scale and long-term studies of dynamics are therefore needed. Many tropical forest plants, and especially many of the lacally endemic taxa, are herbs, shrubs, or epiphytes, the optimal conservation plan for plants might well focus on preserving many small areas rather than the fewer large areas that have been advocated by many biologists and that might also be best for trees[16]. The ecosystem diversity and its conservation is the foundation for the conservation of biodiversity[17].

The present study highlights the rich species composition of the two reserve forests and the comparative account of two forest fragments. Various disturbances like fuel wood collection illegal grazing, litter collection and NTFP collection have been rendering the existing diversity in the Haniya reserve forest. While, in case of Hulikal reserve forest, Government proned developmental activities like dam construction across the river Varahi near Hulikal and clearing of forest for the power lines are damaging the plant diversity. Management and conservation activities thus gains importence in these two forests. Thus, hopefully the present study may provide scientific basis for forest management and also help policy makers to understand the existing situation.

Acknowledgements

We are thankful to Management, Swamy Vivekananda Vidya Samsthe, Shikaripura and Chairman, Dept of Botany, Kuvempu University, Shimoga for providing platform for conducting the current research work.

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