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RESEARCH ARTICLE

A study on phenerogamic diversity in Haniya reserved forest, Karnataka

■ **K.S. VINAYAKA AND ARCHANA R. MESTA**

SUMMARY

Floristically the Western Ghats is one of the rich areas in the country harbouring more than 5000 species of flowering plant species and many plants found in the Western Ghats are extensively restricted distribution. In the present paper, we studied the floristic diversity of the Haniya forest region of Hosanagar taluk of Shimoga district, Karnataka. A total of 2290 individuals representing 226 species and 61 families were recorded from 20 quadrats. Haniya forest region located between 13°50'41" to 13°51'21" N and 75°03'12" to 75°04'18" E with an elevation of 460msl to 850 msl. Average rain fall is 900 cm. In this area the most important herb is *Sida acuta* with a SIV of 6.33 followed by *Cymbidium bicolor, Spilanthes calva* and *Stachytarpheta indica* with IVI of 5.68, 5.68 and 5.34, respectively. The shrubs are distributed in frequently. *Lantana camara* is the most important shrub with IVI of 13.81. *Rubia cardifolia, Naravelia zeylanica* were important climber with IVI of 11.41 and 10.48, respectively. The Haniya forest region trees distribution is moderate. Most of the trees are deciduous and semi evergreen in nature. The trees diversity represent by *Hopea parviflora* with basal area of 0.2h and IVI of 12. The forest region in the study area climatic climax forest consists of trees, shrubs lianas, climbers, herbs, ferns, mosses and epiphytes. We calculated alpha diversity for the plant species. The Shannon Weiner diversity index of herbaceous in Haniya forest is 4.3, shrubs 3.6, climbers 4 and for trees is 3.9, respectively. These forests showed rich in species diversity. Present information give the diversity and conservation value of plant species in the Haniya forest region.

Key Words : Haniya, Western Ghats, Diversity index, Conservation

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Plants are a vital part of the world's biological diversity and an essential resource for human well being. In addition to the small number of crop plants used for basic food and fibres many thousands of wild plants have great economic and cultural importance and potential providing food, medicine, fuel, clothing and shelter for vast number of people throughout the world. Plants play a key role in maintaining the planet's basic environmental balance and ecosystem stability and provide an important component of the habitats for the world's animal life. Biodiversity is a dynamic process among living organisms exhibiting different degrees of activities according to their placement in nature. Biodiversity is defined as the variety and variability among

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living organisms and the ecological complex in which they occur in measured at three levels. *viz.*, genes, species and ecosystem. Tropical forests are regarded as world's most diversity rich ecosystem (Collins *et al*., 1991). Monitoring forest biodiversity is a useful tool to understand the impacts of increased temperature and changing precipitation patterns associated with global climate change. Forests are significant for both economic and natural values and need to be monitored for the development of any adaptive management strategy (Butt, 2010).

The forest types in India ranges from thorny scrubby jungle to moist evergreen forest along with moist grasslands ad characteristic shoal vegetation. In each of these different types of forests, a very diverse plant species are found growing naturally. Identification of species and their diversity is a difficult task and it us virtually impossible to have a complete inventory of Indian biodiversity. However, there has been a limited investigation to characterize species at regional levels. Western ghats is threatened by the catastrophe and anthropogenic activities to larger extent are frequently responsible for endangering species through various ways such as degradation and fragmentation of habitats over exploitation and effect of pest and diseases. Karnataka's western ghats regions diversity was depleted in fast rate. For example, in the Uttar Kannada regions the forest area has condensed from 8000 sq. km to 600 sq. km in about 40 years (Pascal, 1988). Estimated that about 60 per cent of the tropical forests of the world have already been destroyed as for the biodiversity of western ghats is concern limited attempts has been made by certain group of research to document floristic diversity (Muthuramkumar and Parthasarthy, 2001). There are certain areas within the western ghats with remains to be explored for their biodiversity. These endemic species is threat due to damming and clearing diversity of KMTR western ghats region done (Ganesan, 2002). Forest degradation not only cause reduction in biodiversity but also leads to the change in the community composition (Kumar *et al.,* 2002 and 2006).

Climate is probably the most important determinant of vegetation patterns globally and has significant influence on the distribution, structure and ecology of forests (Ravindranath *et al.,* 2006). Species population shows two kinds of mature phase, where the topography is raised and gently sloping the vertical structure of the stand is discontinuous and where the stand is lower vertical structure of the stand is continuous (Pascal and Pellissier,1996). Increases human population in the last few decades demanding development in various areas has resulted directly or indirectly in sudden and often for reaching disturbances in natural ecosystem (Raizada and Vaid, 1957). Many areas of the forests are undergoing rapid, wide ranging changes in land cover. Among these changes, tropical forest clearing is dramatic. Most of these extinctions of forests in the tropics can be attributed to pressure of poverty and population growth and a lack of technical and scientific infrastructure to support conservation efforts (Myers *et al.,* 2000). Floristic inventory and diversity studies help us to understand the species composition and diversity status of forests (Phillips, 2003); hence, present study aims at a study of diversity and distribution of different plant groups in Haniya reserve forest of Shimoga district, Karnataka.

MATERIAL AND METHODS

Study area :

The present study was carried out in the Haniya state forest 13°50'41" to 13°51'21" N and 75°03'12" to 75°04'18" E longitude of Hosanagar taluk of Shimoga district, Karnataka. Study areas are located at an elevation range of 560 MSL to 800 MSL above the sea level. The rainfall varies from 850 to 900 mm per annum with a temperature range of 15 to 30^0C. Most of the rainfall occurs in the month of June to September carried by south west monsoon different weather parameters which are recorded in study areas during the last 10 years (2003-2013) are given (Fig.A).

Vegetation type :

The Haniya forest consists of almost semi-evergreen forest with evergreen and deciduous vegetation (Fig. B). Major tree species found in the study *are Litsea floribunda, Garcinia gummigutta, Cinnamomum verum, Myristica malabarica* etc. with shrubs like *Carissa carandas, Croton malabaricus, Memecylon malabaricum, Maesa indica, Leea indica* etc., and herbs like *Habenaria longicorniculata, Impatiens acaulis, Costus speciosus, Cassia tora, Mimosa pudica* etc., as major ground species.

Vegetation analysis :

The study site comprises of different types of vegetation. Plant enumerates were carried out from May

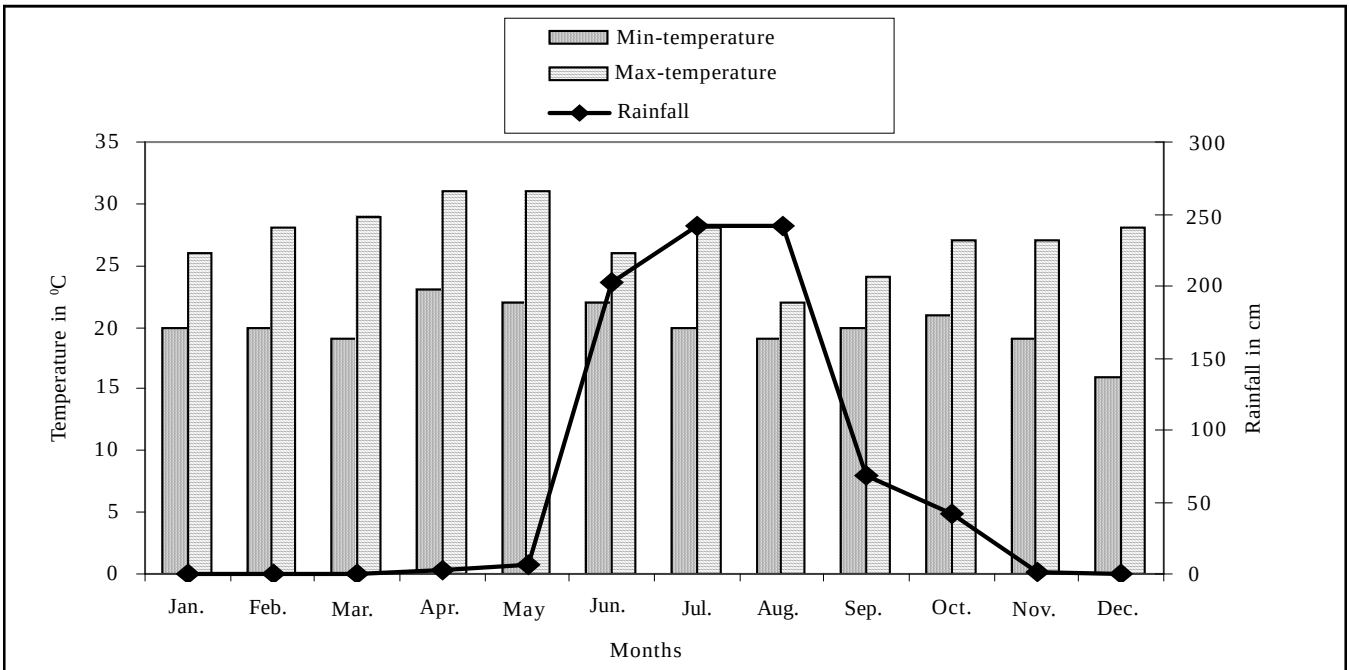


Fig. A : Average rainfall and temperature at Haniya forest region (2003-2013)

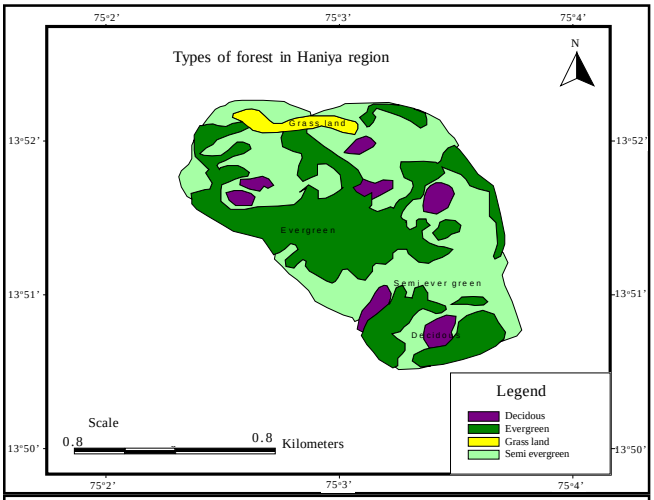


Fig. B : GIS map showing vegetation in Haniya forest region

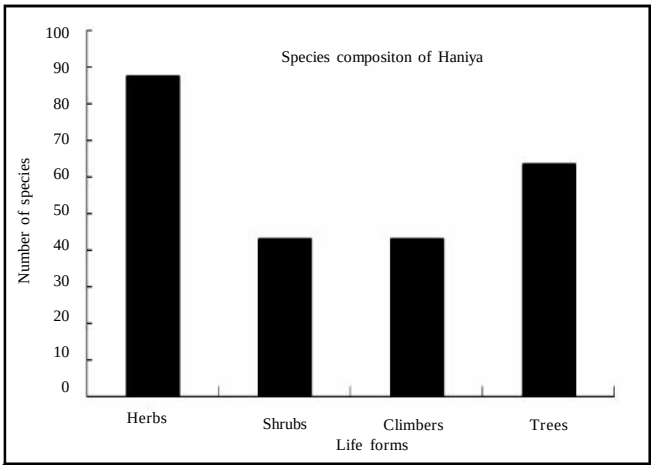


Fig. C : Graph showing diversity of different life forms in the study area discussion

2013 to June 2014. A total of 30 belt transects each measuring 25 x 5m were laid in Haniya forest in which plants were documented. All the plants above 10cm GBH (girth at breast height) were considered as trees whose girth has been measured for the basal area. Shrubs and herbs were recorded in 5m x 5m and 1m x 1m were confirmed using various region floras (Gamble, 1935; Saldanha,1996; Pascal and Ramesh, 1987; Yoganarasimhan and Razi, 1981; Ramaswamy *et al.*, 2001 and Neginhal, 2004). The vegetational data was qualitatively and quantitatively analysed for abundance, density, frequency, dominance and basal area following Cottam and Curtis (1956). The Important value index (IVI) for the species was determined as the sum of relative frequency, relative density and relative dominance Pielou (1975). Based on the data of the occurrence of species in the transects by Shannon's diversity index (H^1) and Simpson's diversity index were calculated as per Magurrom (1986).

Density and relative density was calculated by :

$$\text{Density} = \frac{\text{Total no. of individual species}}{\text{Total no. of transects studied}}$$

$$\text{Relative density} = \frac{\text{Total no. of individual of the species in all the transects}}{\text{Total no. of individuals of all the species in all the transects}} \text{x100}$$

Frequency and relative frequency was calculated by:

$$\text{Frequency} = \frac{\text{No. of transects in which species studied}}{\text{Total no. of transects studied}}$$

$$\text{Relative frequency} = \frac{\text{Frequency of a species}}{\text{Total frequency of all species}} \text{x100}$$

Abundance was calculated by :

$$\text{Abundance} = \frac{\text{Total no. of individuals of the species in all the transects}}{\text{Total no. of transects in which species has occurred}}$$

Relative dominance was calculated by :

Basal area is calculated by :

$$\text{Relative dominance} = \frac{\text{Total basal area of the species in all the transects}}{\text{Total no. of basal area of all the species in all the transects}}$$

$$\text{Basal area} = BA = \pi r^2$$

Important value index (IVI) was calculated by:

IVI= Relative frequency+ Relative density+ Relative BA

Based on the data of the occurrence of species in the transects by Shannon's diversity index was calculated which is represented below :

$H^1 = -\Sigma pi \ln pi$

where, **pi = (ni/N)**

Other diversity indices such as Simpson's values (D). Simpson's diversity index (E), was calculated as follows :

$$D = \Sigma \frac{ni\,(ni-1)}{N\,(N-1)}$$

Table 1: Herb species composition with their relative density, relative frequency and importance value index in Haniya forest

Sr. No.	Herb species	Family	No. of individuals	Relative density	Relative frequency	IVI
1.	*Sida acuta* N. Burman	Loranthaceae	32	3.48	2.84	6.33
2.	*Cymbidium bicolour* Lindl.	Urticaceae	18	1.96	3.72	5.68
3.	*Spillanthes calva* DC.	Fabaceae	22	2.39	3.28	5.68
4.	*Stachytarpheta indica* (L.) Vahl	Acenthaceae	29	3.16	2.19	5.34
5.	*Leucas marrubioides* Desf.	Zingiberaceae	20	2.18	2.63	4.80
6.	*Aerides maculosum* Lindl.	Rubiaceae	20	2.18	2.63	4.80
7.	*Aeginetia indica* L.	Rubiaceae	20	2.18	2.63	4.80
8.	*Justicia simplex* D. Don	Zingiberaceae	19	2.07	2.63	4.69
9.	*Osbeckia cupularis* D. Don	Tiliaceae	19	2.07	2.19	4.26
10.	*Cyperus rotandus* L.	Urticacae	19	2.07	1.97	4.04

Table 2 : Shrub species composition with their relative density, relative frequency and importance value index in Haniya forest

Sr. No.	Shrub species	Family	No. of individuals	Relative density	Relative frequency	IVI
1.	*Lantana camara* L.	Verbinaceae	40	7.34	6.47	13.81
2.	*Chromolaena odorata* (L.) King and Robinson	Asteraceae	20	3.67	6.47	10.14
3.	*Ziziphus oenoplia* (L.) Miller	Rhmanaceae	20	3.67	5.50	9.17
4.	*Syzygium caryophyllatum* (L.) Alton	Myratiaceae	19	3.49	4.85	8.34
5.	*Canthium dicoccum* (Gaertn.) Merr.	Rubiaceae	20	3.67	4.53	8.20
6.	*Memecylon malabaricm* Cogn.	Melastomaceae	20	3.67	3.88	7.55
7.	*Crotolaria pallida* Aiton	Euphorbiaceae	18	3.30	4.21	7.51
8.	*Caesalpinia mimosoidies* Lam.	Santalaceae	16	2.94	3.88	6.82
9.	*Grewia microcos* L.	Teliaceae	19	3.49	3.24	6.72
10.	*Clerodendrum senatum* (L.) Moon	Verbinaceae	22	4.04	2.27	6.30

where, ni = Number of individuals of the i^{th} species
N = Total number of individuals.

RESULTS AND DISCUSSION

A total of 2290 individuals representing 226 species and 61 families were recorded from 20 quadrats. In this area the most important herb is *Sida acuta* with a SIV of 6.33 and with relative density 3.48. Next place is occupied by *Cymbidium bicolor, Spilanthes calva* and *Stachytarpheta indica* with IVI of 5.68, 5.68 and 5.34, respectively. In the study area the IVI is represented in small number by *Scoparia dulcis, Zingiber neesanum, Dendropthoe falcata* with IVI of 0.55, respectively (Table 1).

The shrubs are distributed in frequently. *Lantana camara* is the most important shrub with IVI of 13.81 followed by *Chromolaena odorata, Ziziphus oenopila, Syzygium caryophyllatum, Canthium dicoccum* with IVI of 10.14, 9.17, 8.34, 8.20, respectively. The *Helicteres isora* and *Alangium salvifolium* shows low IVI of 2.01 and 1.75, respectively (Table 2).

The area is represented by less number of climbers.

Table 3: Climber species composition with their relative density, relative frequency and importance value index in Haniya forest

Sr. No.	Climber species	Family	No. of individuals	Relative density	Relative frequency	IVI
1.	*Tragia hispida* Willd.	Orchidaceae	17	4.90	7.44	12.34
2.	*Rubia cordifolia* L.	Acanthaceae	17	4.90	6.51	11.41
3.	*Naravelia zeylanica* (L.) DC.	Piparaceae	17	4.90	5.58	10.48
4.	*Hemidesmus indicus* (L.) R. Br.	Rubiaceae	20	5.76	4.65	10.41
5.	*Piper hookri* Miq.	Piperiaceae	19	5.48	4.65	10.13
6.	*Smilax zeylanica* L.	Dioscoraceae	19	5.48	4.65	10.13
7.	*Dioscorea bulbifera* L.	Dioscoraceae	15	4.32	4.19	8.51
8.	*Thunbergia mysorensis* (Wt.) T. Anderson	Asclepadeaceae	13	3.75	4.65	8.40
9.	*Mussaenda laxa* (J. Hooker) Hutch. Ex Gamble	Celastraceae	16	4.61	3.72	8.33
10.	*Cyclea peltata* (Lam.) J. Hooker and Thoms.	Araliaceae	11	3.17	5.12	8.29

Table 4 : Tree species composition with their relative density, relative frequency, abundance and importance value index in Haniya state forest, Hosanagara

Sr. No.	Tree species	Family	No. of individuals	Basal area	Relative density	Relative frequency	Re-BA	IVI
1.	*Garcinia Morella* Gaert.	Euphorbiaceae	20	0.1	3.8	5.0	0.5	9.3
2.	*Ziziphus rugosa* Lam.	Dipterocarpaceae	23	0.1	4.3	4.4	0.5	9.3
3.	*Holigarna arnottiana* Hook.	Meliaceae	15	0.9	2.8	2.3	4.0	9.2
4.	*Anacardium occidentale* L.	Clusiaceae	20	0.2	3.8	3.5	0.9	8.1
5.	*Hopea parviflora* Bedd.	Leeaceae	11	1.0	2.1	1.8	4.3	8.1
6.	*Vateria indica* L.	Anacardaceae	16	0.1	3.0	4.1	0.5	7.7
7.	*Emblica officinalis* Gaert.	Sapotaceae	12	0.5	2.3	2.9	2.1	7.3
8.	*Aporosa lindleyana* (Wt.) Baill.	Lauraceae	11	0.7	2.1	2.0	2.8	6.9
9.	*Acasia fistula*	Euphorbaceae	10	0.5	1.9	2.3	2.4	6.6
10.	*Olea dioica* Roxb.	Meliaceae	13	0.2	2.5	3.2	0.9	6.6

Table 5 : Species richness, shannon diversity index and simpson diversity index of different life forms

Life forms	Species richness	Shannon diversity index	Simpson diversity index
		H^I	D
Herbs	87	4.3	0.014
Shrubs	43	3.65	0.027
Climbers	33	3.4	0.034
Trees	63	3.9	0.024

Embelia ribes *N. burman*

Ipomoea pescaprae (L.) R.Br.

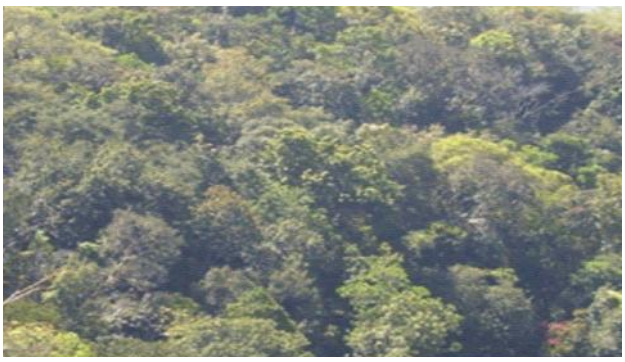
Gloriosa superba L.

Helicteres isora L.

Naravelia zeylanica L. DC.

Wendlandia thyrsoidea (Roemer and Sch.) steudel

A view of semi-evergreen forest



A view of evergreen forest

Plate 1 : The rare plants found in the Haniya forest

Some herbaceous creepers are also present. *Tragia hispida* is the most common creeper with IVI of 12.34. *Rubia cardifolia, Naravelia zeylanica* are also distributed with IVI of 11.41 and 10.48, respectively (Table 3).

In Haniya state forest trees distribution is moderate. Most of the trees are deciduous and semi evergreen in nature. The trees diversity represents by *Garcinia Morella* and *Ziziphus rugosa* with basal area of 0.1h. and IVI of 9.3 next to this *Holigarna arnottiana, Anacardium occidentale, Hopea parviflora* with IVI of 9.2, 8.1 and 8.1, respectively. *Acasia fistula* and *Olea dioica* show lowest IVI of 6.6 and with a basal area of 0.5 and 0.2, respectively. *Hopea parviflora* had more basal area in this forest region (Table 4).

This forest region shows less number of climbers. *Neravelia zeylanica* is an important species with IVI of 14.8 followed by *Thunbergia mysorensis, Piper hookeri* with IVI of 14.0 and 13.8, respectively. *Clematis gouriana* shows less IVI of 1.5 (Table 3).

The Haniya forest had 87 herbs species, 43 shrubs, climbers and 63 tree species. They are representation a total of 2290 individuals of 61 families. Haniya forest is rich in tree diversity.

The Shannon diversity index of herbaceous species of Haniya forest is 4.3. The diversity index of the climbers is 3.4 and tree species 3.9. The Simpson diversity index similarly shows following results. Herbaceous is 71 per cent and Shrubs diversity 37 per cent, climbers diversity 29 per cent, respectively. The tree diversity of Haniya is 41 per cent. The basal area of tree in the Haniya state forest is 23.068 m^2. The Haniya forest show more herbaceous diversity (Table 5).

Embelia ribes, Ipomoea pescaprae, Gloriosa superba, Helicteres isora, Naravelia zeylanica and *Wendiandia thyrsoidea* are the some of the rare plants found in the Haniya forest (Plate 1).

The present study revealed that the species richness in the Haniya state forests of central western ghats region. The study revealed that this region is very rich in species composition. A total of 2290 individuals (tree, GBH ≥10cm) are present. The number of individuals species in the area is formed to be very high when compared to Mudumalai deciduous forest which accounts for 71 species in 50 hectare permanent plot (Sukumar *et al.*, 1992). It was moderate against the transect study at 3.82 hectare done in Kalakad-Mundanthurai Tiger reserve which accounts for 173 woody plant species DBH ≥10cm belongs to 58 families. Similarly, transact study done in Uppangala natural forest recorded GBH ≥ 30cm 198 trees belonging to 91 species and 31 families in 3.12 hectares. This is found to be lesser as compared to all forest regions of Haniya.

Some important vegetation analysis work is carried out by different workers in the western ghats region and in south India. The structure and floristic composition of south west India by Pascal and Pellissier (1996) and another important study is carried by Sukumar *et al.* (1992) and the diversity of some vegetation in Sharavathi valley studied by Rao *et al.* (2005).

Conclusion :

The indiscriminate use and over exploitation of natural plant wealth for minor causes results in deterioration of ecosystem and a great loss to mankind. The developing countries concentrate on the development of industries and technique. This will lead to a great decrease in global biodiversities. The Haniya forest of western ghats, Hosanagar region shows high level of plant diversity compared with the other forests in the western ghats. The present study is highlighting the rich species composition of the forest and fragmentation of the forest for the different commercial plantation is threatening the forest balance. While, in case of Haniya reserve forest, Government prone developmental activities like mini dam construction across the river Sharavathi near Kodase and clearing of forest for the power lined are damaging in the plant diversity. Several forest management activities are needed for the conservation of diversity existing in this forest and also there is a need of educating the people regarding the loss of biodiversity from these forests. In the context, present study would serve as a baseline data for the effective forest management for the policy makers.

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