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Research Paper

Vegetation analysis of Tiger Corridor between Mudumalai Tiger Reserve and Mukurthi National Park in Nilgiri Biosphere Reserve

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Abstract

In the era of conservation forestry, protection of floral and faunal diversity is important prerequisite. Due to the effective implementation of conservation strategies in the protected areas, growth of faunal population will be in increasing phase which leads to the expansion of home range and territory. Conservation of wildlife corridor is an important management strategy to maintain ecological and genetic connectivity. With this background the present investigation was conducted to study the corridor status in between Mudumalai Tiger Reserve and Mukurthi National Park in Tamil Nadu during the period from August 2014 to July 2015. The study result revealed that, 78 plant species belonging to 56 families of trees, shrubs, herbs have been recorded in the study area through quadrates. In this 41 tree species, 20 shrubs species and 17 herbs species belonging to 29, 14 and 13 families respectively. Regarding individual plant species *Grevillea robusta*, *Camellia sinensis* and *Elymus repens* were observed maximum number of times in the quadrates with respect to trees, shrubs and herbs respectively. With respect to family Combretaceae, Verbenaceae and Zingiberoideae were found maximum for trees, shrubs and herbs respectively. The different diversity indices like Shannon - Weiner index and Simpson diversity index were calculated. Regarding Shannon - Weiner diversity index in trees, maximum was observed in *Grevillea robusta* (0.2131) for shrubs *Camellia sinensis* (0.3583) and for herbs *Elymus repens* (0.2887). Regarding Simpson diversity index diversity was maximum were observed in *Celtis philippensis* (0.9870) for tree, *Stachytarpheta jamaicensis* (1.00) for shrubs, *Lepharis maderaspatensis* (0.9998) for herbs. Regarding floral diversity indices in different grid, grid number 3 showed maximum diversity by Shannon-Wiener diversity index for tree, shrub and herbs. For Simpson diversity index, grid number 11 showed maximum diversity for tree and grid number 3 showed maximum diversity for shrubs and herbs.

Key Words: Habitat, Corridors, Vegetation analysis and Index

Introduction

The ability of animals to move across landscapes is critical at many scales. Animals should be able to move efficiently within their home ranges to access food, shelter, mates, and other basic needs (Stephens and Krebs, 1986). Animals also need to move beyond their home ranges to find unoccupied habitat and maintain genetic exchange between groups (Hanski and Gilpin, 1993). Landscape features can influence an animal's ability to move at both of these scales. Although effects will vary for different species, major highways, rugged topography, human development, and land cover types can affect an animal's ability to successfully move through an area (Gibeau and Heuer, 1996). Understanding patterns of landscape permeability is particularly important for the conservation of species with large home ranges and low-density populations, such as large carnivores (Noss et al., 2002). Habitat reduction and fragmentation at a variety of spatial scales has been widely acknowledged as a primary cause of the decline of many species worldwide. Habitat fragmentation generally leads to smaller and more isolated animal populations. Smaller populations are then more vulnerable to local extinction, due to stochastic events (Shaffer et al., 1985) and they are more susceptible to the negative effects of inbreeding depression. To reduce the isolation of habitat fragments, many conservation biologists have recommended maintaining landscape "connectivity", preserving habitat for movement of species between remaining fragments.

Corridors play a very important role in wildlife conservation and help in increasing biodiversity, through colonization (by making ways for the animals to move and colonize new areas conducive for their survival), migration (making it easy for animals to relocate safely seasonally in search of better habitat) and Interbreeding (animals can find new mates in the new habitat so that genetic diversity can increase). Corridors are made either on land or in water (streams and rivers) and are divided into 3 (three) categories, (Regional, Sub-regional and local) according to their width. The widths, length, design and quality is important in creating a perfect corridor. Effective implication of National Tiger Conservation Authority guidelines and management strategies in Mudumalai Tiger Reserve were leads to increase the population of tiger. Due to increasing population and its territories, the tiger starts to move towards one side that was Satyamangalam Reserve forest. Due to increase of tiger population in Satyamangalam Reserve forest in 2012 it was declared as Satyamangalam Tiger Reserve. Tiger starts moving on the other side of Mudumalai Tiger Reserve, i.e., Mukurthi National Park. This particular corridor between Mudumalai Tiger Reserve and Mukurthi National Park has to be explored to ascertain the condition of vegetation for prey base population. Against this backdrop the present study was designed to analysis the vegetation status of this corridor.

Materials and Methods

A field assessment was conducted to get the vegetation analysis in corridor between Mudumalai Tiger Reserve and Mukurthi National Park. The materials used and the methods followed in conducting the various investigations are enumerated here under

Study area

Assessment of corridor was carried out between Mudumalai Tiger Reserve and Mukurthi National Park located in the Nilgiri District of Tamil Nadu at 11.5454ºN and 11.36533ºN latitiude to 76.5056ºE and 76.48723ºE longitude. It extends over an area of 144 sq km and forms a part of the Nilgiri Biosphere Reserve. The study area is located in the Western Ghats, which is one of the 10 hottest biodiversity hotspots of the world (Mittermeier *et al*., 2000). Altitude in the study area varies from 908 m to 2428 m above Mean Sea Level (MSL). The study area was surrounded in north by Chamarajanagar District of Karnataka State, in North West by Wayanad District of Kerala State, in the South East by Coimbatore District and the North East by Erode District of Tamil Nadu

Climate

Although situated in the tropical zone this region enjoys a sub-tropical to temperate climate by virtue of its altitude. The region experiences an average maximum and minimum temperature of 23.1°C and 5.1°C respectively. The coldest month is December and the hottest month is April during which a dry wind blows from the North-East. Frosty nights are common during January and February. Thunderstorms are frequent throughout April and May and the monsoon brings in heavy rainfall. Wind velocity of this region ranges between 13.4 Km/hour and 4.4 Km/hour. Humidity also ranges from 70 per cent (December) to 94 per cent (July).

Rainfall

There has been a significant decrease in the number of rainy days over the years. The first three months of the year are almost without any rain. February shows no rainfall and the driest month recorded in this region. The mean amount of rainfall recorded during 2002-2003 was 1616.8 mm. The normal average rainfall in this region varies from place to place and is between 1500 mm-3000 mm. It is observed that storm rainfall values in excess of 12.5 mm occurring for more than five minutes duration can cause run off and soil detachment. Normally 70 per cent of such storms occur in the months of October, July, May and November in that order. Erosion intensity is high in May, October and July. The incidence of drought is also common in the Nilgiris, high incidence of drought during April and December, excess rainfall noticed during July and October.

Edaphic factor

Although soil derived from a given type of rock varies considerably with climatic conditions, the nature of parent rock exist a considerable influence on the properties of the soil. There were four major type of soil available viz, lateritic soil, red sandy soil, red loam, and alluvial.

Land use pattern of study area

The total geographical area of the study area is 144 sq km of which41.61 per cent (59.92 sq km) is under forest, the cultivable land was 4.90 per cent (7.06 sq km), the Grassland was 18.07 per cent (26.02 sq km), the Human settlements 9.17 per cent (13.2 sq km) and the tea estate was 26.25 per cent (37.8 sq km).

Forest type in study area

The study area has three major forest types *viz*., Evergreen forest, Semi Evergreen forest and Shola Forest (Champion and Seth, 1968) and manmade plantation *(Eucalyptus globulus, Eucalyptus grandis, Eucalyptus citridora, Pinus patula, Grevillea robusta* and *Tectona grandis*).

Southern Tropical Evergreen Forest ($1A/C_3$)

The tropical evergreen is characterised by its luxuriance of vegetation consisting of several tiers, the highest containing tall trees and the lower containing dense shrubby undergrowth. A heavy rainfall, high humidity, and a short dry season are characteristic of this forest type.

Southern Tropical Semi Evergreen Forest ($2A/C_2$)

These forests always occur in association with the evergreen forest. The mean annual temperature of region, where these forests occur is 26ºC. The mean annual maximum and mean annual minimum temperature are about 30ºC and 22.5ºC respectively the mean annual rainfall varies from 2000-2500 mm.

Southern Montane Wet Temperate Forest ($11A/C_1$)

The Tropical montane forest is also called Shola forest, found in valleys amid rolling grassland in the higher mountain region, The Shola Forest and Grassland complex has been described as climatic climax vegetation. It occurs between 1600 m-2000 m Mean Sea Level Shola is characteristics of highly branched trees, clothed with mosses and other epiphytes. Woody climbers are few. There is no stratification of trees.

Methodology

The study area was divided in to grids of 4 Sq km. By using Qgis Software, a total 36 grid was laid out throughout the

study area.

Floral diversity indices

Sampling of floral diversity by sample plot method. In case of plot method quadrates were used for floral diversity assessment (Daniels *et al*., 1996). In each grid 8 sampling plot was laid out for assessing tree, shrubs herbs and grass with the size of 10 m x 10 m, 5 m x 5 m and 1 m x 1 m respectively it covers 800 Sq m, 200 Sq m and 8 Sq m for trees, herbs and grass respectively in each grids. Sampling plot was laid out with the interval of 250 sq m. In the presence study, tree, shrubs and herbs were distinguished based on the following criteria. All plants over 15cm gbh and above were reckoned as trees, all plants less than 15cm gbh but above 1.37m were reckoned as a shrubs, all other plant less than 15 cm gbh and less than 1.37m in height were treated as herbs.

Tree, shrubs, herbs and grass were botanically identified to the species level by using field guide (Forest Plant of the Niligiris, Key stone foundation 2006.). The data was used to compute, Shannon's diversity indices, Simpson diversity indices for the species

Simpson index of diversity

The equation used to calculate Simpson's index was

$$D=\frac{\sum n_i(n_i-1)}{N(N-1)}$$

Where, D = Simpson index of dominance

ni = the total number of organisms of each individual species

N = the total number of organisms of all species As D increases, diversity decreases and Simpson's index was therefore usually expressed as 1 – D or 1/ D.

Shannon–Weiner index of diversity

The formula for calculating the Shannon diversity index was

$$H' = -\sum pi \, In \, pi$$

Where, H' = Shannon index of diversity

pi = the proportion of important value of the ith species (pi = ni / N, ni is the important value index of ith species and N is the important value index of all the species)

Ln = Natural logarithm on proportion of each species

Results and Discussion

Tree diversity

With regard to the tree diversity, the result revealed that 41 tree species belonging to the 29 family has been recorded in the study area through quadrates. The maximum number of tree species might be due to presence of three major type of forest in this region *viz*., southern tropical evergreen forest, southern tropical semi evergreen forest and southern montane wet temperate forest and also were receiving rainfall for about 7 months. This finding were similar with the result revealed by Sudhakar *et al.* (2011) who stated that a total of 124 tree species were recorded in tropical deciduous forest system in Mudumalai Wildlife Sanctuary and Pratap *et al.* (2014) inferred the same result a 16 tree species belonging to 12 family in semi evergreen forest. Regarding the occurrence of species *Grevillea robusta* was observed to be maximum occurring 83 times in the study area due to presence of tea estate which occupied an area of 37.8 sq km (26.25 % of study area), *Grevillea robusta* were used as a shade tree for tea and the tea estates were situated in forest fringe areas and then due to seed dispersal and then due to the species got widely spread inside the forest. This finding was similar with the findings revealed Sobuj *et al.* (2011) who reported that *Tectona grandis* had highest density in Khadimnagar National Park of Bangladesh. Regarding the occurrence of floral with reference to family, Combretaceae was the dominant family occurring followed by Anacardiaceae. Sobuj *et al.* (2011) also quoted a similar result from his studyies, which revealed that Combretaceae family dominated in the semi evergreen forest of Khadimnagar National Park of Bangladesh. Pratap *et al.* (2014) also inferred the same result revealed that Combretaceae was dominant family in the semi evergreen forest. Similar results were also recorded by Baranidharan 2000 in Chitteri Hills, Eastern Ghats (Table .1)

Shrub diversity

With respect to the shrub diversity, the result revealed that 20 species belonging to 14 families has been recorded in the study area through quadrates. The maximum diversity in the shrubs species might be due to the presence of different land use pattern and different type of forest. This finding was similar with the results revealed by Supriya Devi *et al.* (2006) who reported that 36 species belonging to 18 families were found to occur in the tropical evergreen forest of Manipur. Regarding the occurrence of species *Camellia sinensis* was observed to be maximum occurring 644 times in the study area which might be due to presence of tea estate covering an area of 37.8 sq km (26.25 % in the study area)**.** With respect to family, Verbenaceae was the dominant family occurring in the study area followed by Anacardiceae. This finding was similar to the result revealed by Supriya Devi *et al.* (2006) who reported that Fabaceae was the dominant family in the tropical evergreen forest of Manipur.

(Table.2)

Herb diversity

From the study of herb diversity the result revealed that 17 species belonging to 13 family has been recorded in the study area through quadrates. The maximum number of herbs occurring in the study area might be due to diverse land use pattern and occurrence of different forest types. It is also in line with the finding of Supriya Devi *et al.* (2006) who reported that 70 herb species belonging to 32 families were recorded in tropical evergreen forest of Manipur. Regarding the occurrence of species *Elymus repens* was observed to be maximum occurring 101 times in the study area, which might be due to the presence of shola forest the *Elymus repens* grass found more. *Arundinella setosa* exhibits the maximum occurrence followed by *Carex spinosa* and *Imperata cylindrica* reported by *Supriya Devi et al.* (2006). Regarding the occurrence of family Poaceae was found to be the dominant family followed by Anacardiaceae. Similar results were also reported by Supriya Devi *et al.* (2006) which revealed that Poaceae was the dominant family consisting of 19 species. (Table.3)

Floral diversity indices

Shannon - Weiner index of diversity

With respect to Shannon diversity indices of tree species, the results revealed that *Grevillea robusta* (0.2131) was highest among the tree species whereas shrubs *Camellia sinensis* (0.3583) was highest with reference to herbs *Elymus repens* (0.2887) was the highest. The reason may be due to the presence of Tea estate, different land use pattern and different forest type. These findings were similar with the result revealed by Raghubanshi *et al.* (2009) where Shannon - Weiner diversity index of *Lannea coromandelica* was (1.026) followed by *Terminalia belerica* (1.008) *Shorea robusta* (0.973).

Simpson diversity index

With respect to tree species *Celtis philippensis* recorded index (0.9870) highest regarding shrubs *Stachytarpheta jamaicensis* was recorded highest, regarding herbs *Trichodesma indicum* (0.9999) was recorded highest. These findings were similar with the result revealed by Jaffre (1993) that Simpson diversity index was 0.056 - 0.039 in a forest on alluvium and 0.049 - 0.045 in a forest on rocky slope

Conclusion:

The study revealed that, 78 plant species belonging to 56 families of trees, shrubs, herbs have been recorded in the study area through quadrats. In this 41 tree species, 20 shrub species and 17 herb species belonging to 29, 14 and 13 families respectively were observed. Regarding individual plant species *Grevillea robusta*, *Camellia sinensis* and *Elymus repens* were observed maximum number of time in quadrant with reference to trees, shrubs and herbs respectively. With respect to diversity among the families observed, family Combretaceae had maximum number of tree and family Verbenaceae had maximum number of shrubs whereas the family Zingiberoideae had maximum number of herb species. Regarding Shannon - Weiner diversity index in trees, maximum was observed with respect to *Grevillea robusta* (0.2131) for shrubs in *Camellia sinensis* (0.3583), and for herbs in *Elymus repens* (0.2887). Regarding Simpson diversity index was maximum were observed in *Celtis philippensis* (0.9870) for tree, *Stachytarpheta jamaicensis* (1.00) for shrubs, *Lepharis maderaspatensis* (0.9998) for herbs. Regarding floral diversity indices of different grid, number three grid indicated maximum diversity with respect to Shannon-Wiener diversity index for tree, shrub and herbs. For Simpson diversity index, grid number eleven showed maximum diversity for tree and grid number three showed maximum diversity for shrubs and herbs. Regarding the trees in the grids, grid number 3 showed highest diversity for trees, shrubs and herbs and it was due to the grids nearest to Mudumalai Tiger Reserve which occurred in the Southern tropical Evergreen Forest and also there were very less disturbance by the human. Regarding the Simpson index, the grid number 11 scored highest indices for tree. Whereas for shrubs and herbs the grid number 3 scored highest indices. The results conclude that corridor between Mudumalai Tiger Reserve and Mukurthi National Park has having more floral diversity, which supports the healthy prey population and provides good habitat for many herbivores.

Table 1. Diversity of trees and diversity indices of trees in the study area

S. No.	Common Name	Family	Scientific name	Individual	Pi	LnPi	Pi* LnPi	Squre pi	Shannon Index (H)	Simpson Index (D)
1	Wattel	Fabaceae	*Acacia mangium*	50	0.053	-2.943	-0.155	0.002776	0.1551	0.8449
2	p-nari	Simaroubaceae	*Ailanthus excelsa*	72	0.076	-2.579	-0.196	0.005756	0.1956	0.8044
3	Alangi	Cornaceae	*Alangium-salviifolium*	30	0.032	-3.454	-0.109	0.000999	0.1092	0.8908
4	Senthuram	Combretaceae	*Anogeissus latifolia*	3	0.003	-5.757	-0.018	0.000009	0.0182	0.9818
5	Mungil	Poaceae	*Bambusa arundinacea*	12	0.013	-4.371	-0.055	0.000159	0.0553	0.9447
6	Sappiraviral	Bixaceae	*Bixa orellana*	3	0.003	-5.757	-0.018	0.000009	0.0182	0.9818
7	Mullilavu	Bombacaceae	*Bombax ceiba*	8	0.008	-4.776	-0.040	0.000064	0.0403	0.9597
8	Kumancam	Burseraceae	*Boswellia serrata*	14	0.015	-4.216	-0.062	0.000218	0.0622	0.9378
9	Karuvali	Caesalpinioideae	*Cassine glauca*	26	0.027	-3.597	-0.099	0.000751	0.0986	0.9014
10	Beef wood	Casuarinaceae	*Casurina equisetofolia*	55	0.058	-2.848	-0.165	0.003359	0.1651	0.8349
11	Vellai Thovarai	Ulmaceae	*Celtis philippensis*	2	0.002	-6.162	-0.013	0.000336	0.0130	0.9870
12	Murungan	Ulmaceae	*Celtis tetrandra*	31	0.033	-3.421	-0.112	0.001067	0.1118	0.8882
13	Cinchona	Rubiaceae	*Cinchona officinalis*	24	0.025	-3.677	-0.093	0.000639	0.0930	0.9070

Contd…

14	Kal mungil	Bambuseae	*Dendrocalamus strictus*	14	0.015	-4.216	-0.062	0.000218	0.0622	0.9378
15	Vakkanatthi	Ebanaceae	*Diospyros montana*	28	0.030	-3.523	-0.104	0.000870	0.1040	0.8960
16	Viki	Eleocarpacaeae	*Elaeocarpus serratus*	44	0.046	-3.071	-0.142	0.002149	0.1424	0.8576
17	Sembulichan	Erythroxylaceae	*Erythroxylum monogynum*	15	0.016	-4.147	-0.066	0.000249	0.0656	0.9344
18	Citrodara	Myrtaceae	*Eucalyptus citrodara*	41	0.043	-3.142	-0.136	0.001866	0.1357	0.8643
19	Kumalaa	Verbanaceae	*Gmelina arborea*	4	0.004	-5.469	-0.023	0.000016	0.0231	0.9769
20	Irubogum	Dipterocarpaceae	*Hopea parviflora*	18	0.019	-3.965	-0.075	0.000359	0.0752	0.9248
21	Kattu illupai	Sapotaceae	*Madhuca indica*	18	0.019	-3.965	-0.075	0.000359	0.0752	0.9248
22	Maa	Anacardiceae	*Mangifera indica*	17	0.018	-4.022	-0.072	0.000321	0.0721	0.9279
23	Kannupala	Sapotaceae	*Manilkara hexandra*	24	0.025	-3.677	-0.093	0.000639	0.0930	0.9070
24	Senbegum	Magnoliaceae	*Michelia champaka*	5	0.005	-5.246	-0.028	0.000025	0.0276	0.9724
25	Kolamavu	Lauraceae	*Persea macrantha*	12	0.013	-4.371	-0.055	0.000159	0.0553	0.9447
26	Maankombu	Bignoniaceae	*Radermachera xylocarpa*	25	0.026	-3.637	-0.096	0.000693	0.0958	0.9042
27	Iravam	Clusiaceae/guttiferae	*Mesua ferrea*	20	0.021	-3.860	-0.081	0.000444	0.0813	0.9187
28	Neyyikiluvai,	Anacardiaceae	*Rhus\ mysorensis*	25	0.026	-3.637	-0.096	0.000694	0.0958	0.9042

Contd…

29	Puvan	Sapindaceae	*Schleichera oleosa*	20	0.021	-3.860	-0.081	0.000445	0.0813	0.9187
30	Mogalinga	Oleaceae	*Schrebera swietenioides*	20	0.021	-3.860	-0.081	0.000445	0.0813	0.9187
31	Kottai	Anacardiceae	*Semecarpus anacardicium*	18	0.019	-3.965	-0.075	0.000359	0.0752	0.9248
32	Kungiti	Dipterocarpaceae	*Shorea roxburghii*	12	0.013	-4.371	-0.055	0.000159	0.0553	0.9447
33	Silver oak	Proteaceae	*Grewelia robusta*	83	0.087	-2.437	-0.213	0.007649	0.2131	0.7869
34	Etti	Loganiaceae	*Strychnos maxvomica*	29	0.031	-3.488	-0.107	0.000934	0.1066	0.8934
35	Tattan kottei	Loganiaceae	*Strychnos potatorum*	23	0.024	-3.720	-0.090	0.000587	0.0902	0.9098
36	Naval	Myrtaceae	*Syzium cumini*	60	0.063	-2.761	-0.175	0.003997	0.1746	0.8254
37	Thanagaa	Verbanaceae	*Tectona grandis*	8	0.008	-4.776	-0.040	0.000064	0.0403	0.9597
38	Vella marudu	Combretaceae	*Terminalia arjuna*	3	0.003	-5.757	-0.018	0.000009	0.0182	0.9818
39	Semmaram	Combretaceae	*Terminalia bellerica*	3	0.003	-5.757	-0.018	0.000009	0.0182	0.9818
40	Kadukkai	Combretaceae	*Terminalia chebula*	8	0.008	-4.776	-0.040	0.000006	0.0403	0.9597
41	Tachaamaram	Ulmaceae	*Trema orientalis*	22	0.023	-3.764	-0.087	0.000537	0.0873	0.9127
Total									**3.4214**	**0.9166**

Table 2. Diversity of shrubs and diversity indices of shrubs in the study area

S. No.	Common Name	Family	Scientific Name	No. of individual	Pi	lNPi	Pi* lNPi	Square Pi	Shannon Index (H)	Simpson Index (D)
1	Vettai chedi	Convolvulaceae	*Argyreia cuneata*	49	0.035	-3.37	-0.12	0.0012	0.1164	0.9988
2	Kattu Kangaambaram	Acanthaceae	*Barleria prionitis*	19	0.013	-4.31	-0.06	0.0009	0.0578	0.9998
3	Pasalaikeerai	Basellaceae	*Basella alba*	34	0.024	-3.73	-0.09	0.0006	0.0895	0.9994
4	Arkkam	Asclepiadaceae	*Calotropis gigantea*	22	0.015	-4.17	-0.06	0.0002	0.0647	0.9998
5	Kurinjaa chedi	Boraginaceae	*Carmona retusa*	62	0.044	-3.13	-0.14	0.0019	0.1370	0.9981
6	Kariavaram	Caesalpinaceae	*Cassia didymobotrya*	15	0.011	-4.59	-0.05	0.0001	0.0482	0.9999
7	Tagrai	Caesalpinaceae	*Cassia tora*	29	0.021	-3.88	-0.08	0.0004	0.0796	0.9996
8	*Eupotorium*	Asteraceae	*Eupotorium Spp*	101	0.071	-2.64	-0.19	0.0050	0.1883	0.9949
9	Kannuvalik kodi	Liliaceae	*Gloriosa superba*	14	0.010	-4.62	-0.05	0.0009	0.0456	0.9999
10	Idamburi	Sterculiaceae	*Helicteres isora*	36	0.025	-3.68	-0.09	0.0006	0.0934	0.9994

Contd…

11	Kattumalli	Oliaceae	*Jasminum trichotomum*	31	0.021	-3.83	-0.08	0.0004	0.0837	0.9995
12	Unni chedi	Verbanaceae	*Lantana camara*	183	0.129	-2.05	-0.26	0.0167	0.2644	0.9833
13	Gumtae (iodex)	Solanaceae	*Nicandra physaloides*	68	0.048	-3.04	-0.14	0.0023	0.1458	0.9977
14	Ottumar chedi	Malvaceae	*Sida cordifolia*	33	0.023	-3.76	-0.09	0.0005	0.0876	0.9995
15	Karisalanganni	Malvaceae	*Sida rhombifolia*	21	0.015	-4.22	-0.06	0.0002	0.0625	0.9998
16	Seemainaayuruvi	Verbenaceae	*Stachytarpheta jamaicensis*	5	0.004	-5.65	-0.02	0.0001	0.0199	1.0000
17	Sirukilaa	Acanthaceae	*Trobilanthes cuspidate*	9	0.006	-5.06	-0.03	0.0004	0.0322	1.0000
18	Tea	Theaceae	*Camellia sinensis*	644	0.454	-0.79	-0.36	0.2068	0.3583	0.7932
19	Avuri	Fabaceae	*Tephrosia purpurea*	28	0.020	-3.92	-0.08	0.0004	0.0776	0.9996
20	Nalla nochi	Verbanaceae	*Vitex negundo*	13	0.009	-4.69	-0.04	0.0008	0.0431	0.9999
Total									2.0956	0.9882

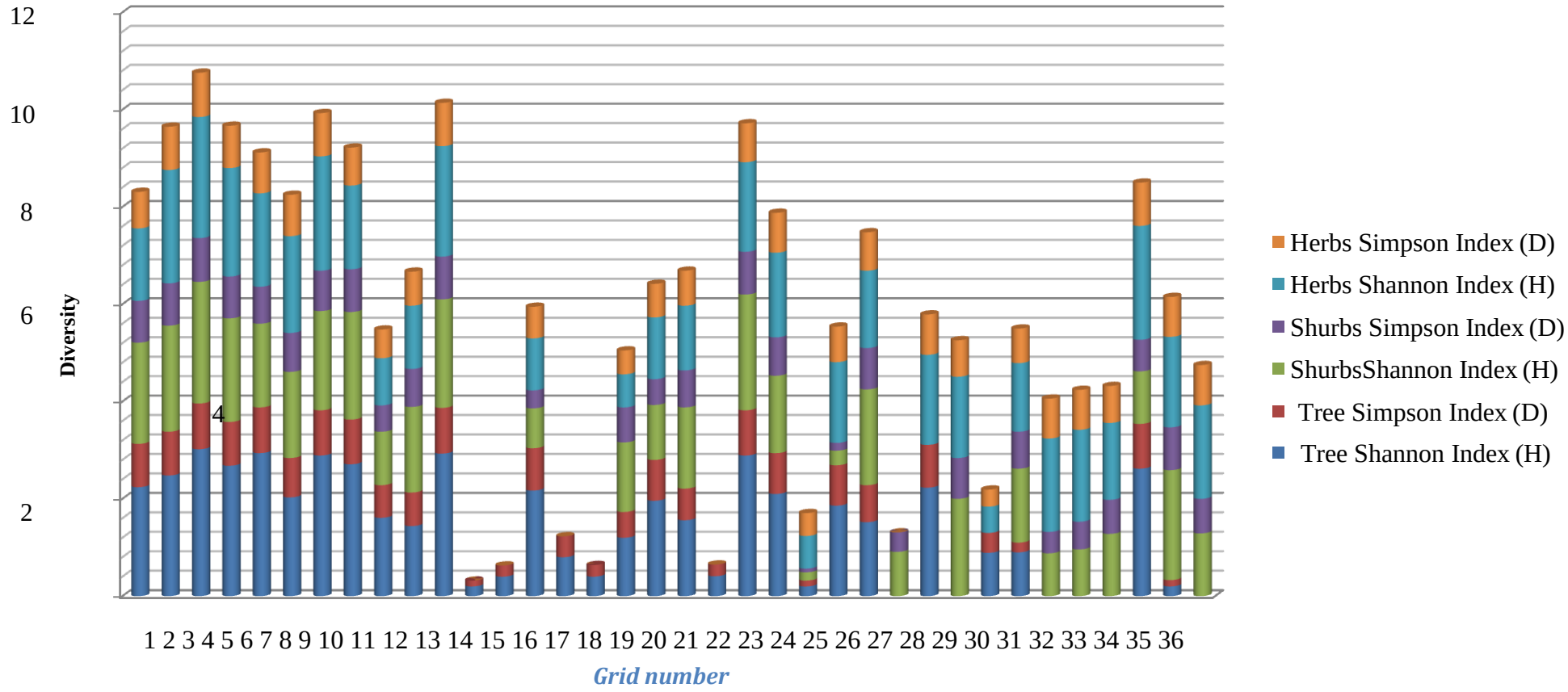
Table 3. Diversity of herbs and diversity indices of herbs in the study area

S. No.	Common Name	Family	Scientific Name	Number of individual	Pi	lnPi	Pi* lnPi	Square Pi	Shannon Index (H)	Simpson Index (D)
1	Kadamoolam	Liliaceae	*Asparagus racemosus (ferns)*	12	0.018	-3.99	-0.073	0.0003	0.0734	0.9997
2	Kooravaal chedi	Acanthaceae	*Lepharis maderaspatensis*	8	0.012	-4.40	-0.053	0.0001	0.0539	0.9998
3	Common carpet grass	Poaceae	*Axonopus fissifolius*	53	0.081	-2.51	-0.203	0.0066	0.2038	0.9934
4	Couch grass	Poaceae	*Elymus repents*	101	0.154	-1.86	-0.288	0.0239	0.2887	0.9761
5	Kattumanjal	Zingiberoideae	*Curcuma pseudomontana*	15	0.022	-3.77	-0.086	0.0005	0.0867	0.9995
6	Arugam pillu	Poaceae	*Cynodon dactylon*	12	0.018	-3.99	-0.073	0.0003	0.0734	0.9997
7	Vishnu kiranthi	Convolvullaceae	*Evolvulus alsinoides*	37	0.056	-2.87	-0.162	0.0032	0.1627	0.9968
8	Nannari kilangu	Apocynaceae	*hemidesmus indicus*	46	0.070	-2.65	-0.186	0.0049	0.1869	0.9950
9	Orilai Thamarai	Violaceae	*Hybanthus enneaspermus*	41	0.062	-2.76	-0.173	0.0039	0.1738	0.9961

Contd…

10	Kikuyu grass	Poaceae	*Pennisetum clandestinum*	48	0.073	-2.61	-0.191	0.0054	0.1919	0.9946
11	Thumbai	Laminaceae	*Leucas aspera*	33	0.050	-2.98	-0.150	0.0025	0.1509	0.9974
12	Thotta Surungi	Mimosoideae	*Mimosa pudica*	64	0.098	-2.32	-0.227	0.0096	0.2276	0.9904
13	Vallaarai	Apiaceae	*centella asiatica*	41	0.062	-2.76	-0.173	0.0039	0.1738	0.9961
14	Tickel grass	Poaceae	*Deschampsia cespitosa*	48	0.073	-2.61	-0.191	0.0054	0.1919	0.9946
15	Kindumullu	Rutaceae	*Toddalia asiatica*	60	0.092	-2.38	-0.219	0.0084	0.2193	0.9916
16	Nerinji	Zygophyllaceae	*Tribulus terrestris*	29	0.044	-3.11	-0.138	0.0019	0.1383	0.9980
17	Kali thumbae	Boraginaceae	*Trichodesma indicum*	5	0.007	-4.87	-0.037	0.0005	0.0373	0.9999
Total									**2.6344**	**0.9952**

Fig.1. Floral diversity indices of vegetation in different Grid of the study



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