

# EXPLORING THE CURRENT FLORISTIC DIVERSITY AT KOLANKI HILLS ASHAPUR RAICHUR KARNATAKA INDIA

Theophilus Deenadayal<sup>1\*</sup>, Dr Tarun Jain<sup>2</sup>

<sup>1\*</sup>Research Scholar, Department of Botany, Sunrise University, Alwar, Rajasthan, India

<sup>2</sup>Associate Professor, Department of Botany, Sunrise University, Alwar, Rajasthan, India

DOI: [https://doi.org/10.63001/tbs.2024.v19.i02.S.I\(1\).pp846-859](https://doi.org/10.63001/tbs.2024.v19.i02.S.I(1).pp846-859)

## KEYWORDS

Kolanki Hills,  
floristic diversity,  
Raichur District,  
quadrat method,  
biodiversity indices,  
Shannon-Weiner Index,  
Simpson's Diversity Index,  
plant species richness

Received on:

19-09-2024

Accepted on:

29-12-2024

## ABSTRACT

The Kolanki hills in Ashapur of Raichur District of Karnataka represent a potential hotspot for an array of highly biodiverse plants. The present research systematically records 405 plant species from 76 families indicating the area's significance for this ecosystem. In this study, species density, abundance and frequency were determined using the quadrat method for inferring community structure. Key diversity indices, including the Shannon-Weiner Index (4.23), Simpson's Diversity Index (1.00) and Species Richness Index (0.70), underscore the hills' biodiversity richness and evenness. Dominant genera, such as *Indigofera* (10 species) and *Cyperus* (9 species), highlight the area's floristic composition. The findings emphasize the need for conservation strategies to protect the ecological integrity of this semi-arid ecosystem. Insights from this study provide a foundation for sustainable management and contribute to understanding regional biodiversity.

## INTRODUCTION

Floristic diversity is an important measure of ecosystem health and ecological resilience as it measures the species, species frequency, and distribution within a specific habitat. It has a very important function of supporting ecosystem services including; fertility of the soil, regulation of climate as well as support of biological diversity. Research on floristic diversity is especially important in geographical provinces, such as Kolanki Hills, Ashapur, Raichur District of Karnataka, where diverse habitats support numerous plant species. Quadrat techniques of assessment of bio-diversity also facilitate quantitative measurements of density, abundance and frequency essential in establishing the community structure and ecological interactions. Such data help in comparing the ecological conditions of a particular area at different points in time and in suggesting appropriate measures for its management and conservation (Gadgil and Vartak, 1975; Hedge and Chandran, 1998; Bhandary and Chandrashekar, 2003). This was established by the fact that groves, forests and hills in India are viewed as bio reserves due to the cultural and religious prohibitions on the destruction of the reserves. These areas usually host endemic, medicinal and economic plants. Such sacred locations which are axiologically significant are usually a lot less researched than their popular counterparts in similar dominantly rural contexts in India (Magurran, 2004). Recording such a scenario is very important in

the understanding of the stability of such an area and perhaps its priority in terms of conservation. However, growing anthropogenic pressures, dissection of the habitats and over-exploitation of resources are major threats to such areas for instance, (Daniels, 2003; Pielou, 1966). A study collected and recorded 158 plant species from Raichur Fort's rocks, fort walls, and ponds, including 39 Angiosperm families, 4 Pteridophytes, 3 Bryophytes, and 4 Algae (HC Shrishil, et al, 2020). Kolanki hills of Raichur flora diversity, 39 species and 38 genera from 26 families were found (Prashant Kumar, 2020). floristic diversity of Maraladinni village forest shows 252 Angiosperm species from 186 taxa and 56 families (Savita R and Kotresh K, 2022).

In Kolanki Hills, documenting 405 plant species across 76 families highlights the region's biodiversity richness. This study focuses on the floristic composition of the Kolanki Hills, encompassing 405 plant species across 76 families. The application of quantitative ecological indices such as the Shannon-Weiner Diversity Index (4.23), Simpson's Diversity Index (1.00) and Species Richness Index (0.70) provides insights into the distribution patterns and dominance of species. *Indigofera*, *Crotalaria*, and *Cyperus* genera characterize the site's flora and demonstrate spatial variability and successful adjustment to vegetation conditions (Kent and Coker, 1992; Kilmes, 2003; Taylor *et al.*, 1993).

Floristic diversification study does not only assist in the assessment of ecological relationships but also helps in determination of the state of conservation and the managements

of bio-diversity status. This supports the blend of academic research with developmental understanding and protection of biodiverse areas such as the Kolanki Hills.

## 1. METHODOLOGY:

### 2.1 Study Area:

The present floristic survey was carried out in Kolanki hills, situated in Ashapur, Raichur District of Karnataka State, India, shown in Figure 1. The increased and decreased duration of rainfall: The climate of the region is semi-arid with annual rainfall varying from 700-900 mm. The hilly areas include mostly rocky grounds, montane meadows and shrubland with rich vegetation cover.

### 2.2 Sampling Design:

The quadrat sampling technique was used to determine the distribution, population and occurrence of plant species in the study area. Sampling was done using fifty 10m × 10m quadrats placed systematically across a wide variety of habitats to obtain an accurate spatial distribution of the hills. Plant species identification was conducted using the following references: *Flora of Gulbarga District* by Seetharam *et al.*, (2000), *Flora of the Presidency of Madras* (Volumes I to III) by Gamble (1957), *Flora of North Eastern Karnataka* by N.P. Singh (1988), and the detailed studies *Flora of Karnataka* (Volume I, 1984 and Volume II, 1996) by Saldanha & Larsen, 1996 Photographs and voucher specimens of the identified species were deposited in the Herbarium of the

Department of Botany at Sunrise University, Alwar, Rajasthan (HSUR).

1. **Quadrat Size:** Calculated based on a species-area curve, where special care is paid to species sample representativeness.
2. **Selection Criteria:** Quadrats are randomly located in areas that are easily reachable. Random sampling for all the grids in the study sites, or Stratified sampling for different vegetation types such as those situated at rocky places, water sources and so on. Vegetation types (e.g., rocky outcrops, water bodies).

### 2.3 Data Collection

1. **Floristic Identification:** vegetation samples were collected from each quadrat and determined locally by comparing with the standard floras and herbarium records of Flora of the Presidency of Madras (Gamble, 1920, 1928; Gamble and Fischer, 1967) and Flora of Karnataka (Rao & Razi, 1981).
2. **Parameters Measured:**
  - **Density:** Density means the total number of people of a certain species in an area of space.
  - **Abundance:** Mean density of population per occupied square of unit area
  - **Frequency:** The proportion of the species in the numbered quadrats.

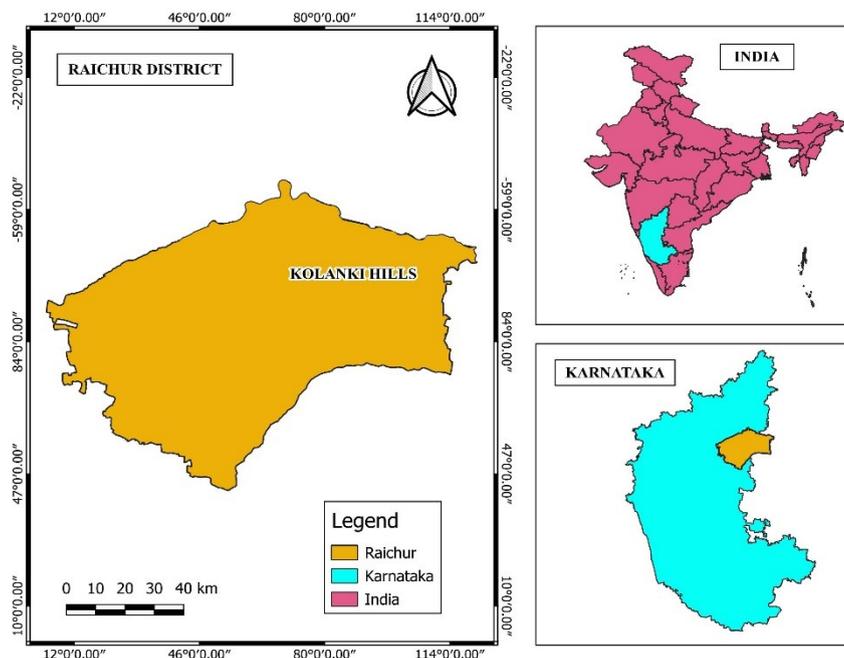


Figure 1: Site Map of Kolanki Hills, located in Ashapur, Raichur District, Karnataka, India

### 2.4 Diversity Indices

Diversity metrics were calculated using the following indices:

1. **Shannon-Weiner Diversity Index (H')**: For measuring richness and species diversity  $H' = -\sum (p_i \cdot \ln p_i)$  where  $p_i$  is the proportion of individuals of the  $i^{\text{th}}$  species.
2. **Simpson's Diversity Index (D)**: For measuring the dominance of species.  $D = 1 - \sum (p_i^2)$
3. **Species Richness Index (S)**: This index is used to quantify the total number of species.

### 2.5 Data Analysis

1. **Species-Area Relationship:** It was designed to assess the sufficiency of the sampling endeavour.
2. **Community Analysis:** Conducted to assess dominant, co-dominant and insignificant species. Performed to determine dominant, co-dominant, and rare species.

3. **GIS Mapping:** Floristic diversity distribution maps were generated and analysed with the use of geospatial tools.

### 2.6 Ethical and Ecological Considerations

The study based its sampling on only non-destructive methods of sample collection. The work in the fields was done with respect to ecological legislation of the corresponding territories, and no species received transplantation.

### 3. RESULT AND DISCUSSION:

Quadrat methods are the best known of all the ecological sampling techniques used for evaluating parameters like species density, abundance and frequency of vegetation. Understanding this method's utility at Kolanki Hills, Ashapur highlights the potential for reconstructing plant affiliations' structure, distribution and ecological conditions in this area. Density can be defined as the population of a certain species per unit area. Perhaps data coming from Kolanki Hills give signals of the plant species that are preferred in that area of specific soil and climatic conditions. High-density species can easily be referred to as keystone species

as they greatly influence ecosystem processes. The observed differences in density between the species imply the heterogeneity of the habitat and the physical characteristics of light, soil type and moisture (Taylor *et al.*, 1992; Krebs, 1999). Abundance is the count of the mean number of organisms in the given species in each of such a quadrat where it is found. Great abundance values of particular organisms denote favourable conditions with high niche space, while low values may be due to competition or some unfavourable conditions for the species (Mueller- Dombois, 1974; Mueller- Dombois and Ellenberg, 2002). At Kolanki Hills, richness could help indicate whether species preferred certain plant parts and whether certain plant types were dominant or rare. Frequency refers to the number of surveys out of a total of 100 that a species was recorded. It offers a glimpse of the species distribution regime. The bird species with high-frequency values

are assumed to have broad geographical ranges, whereas the ones with low frequency either occupy only a narrow range of habitats or species may be virtually extinct locally (Gairola *et al.*, 2011; 2012; Sharma *et al.*, 2011). The frequency distribution may present at Kolanki Hills the species' response to ecological settings, pressure, or historical perturbation. Functions of density, abundance, and frequency help in prioritizing the focus of conservation Kolanki Hills Species, which are either dense or frequent should be closely watched to see how they are faring considering the pressure they are bound to receive from the environment and man. The promotion of local conservation programs should target species with small density and frequency values in order to avoid their local elimination. Knowledge of the distribution of species helps in designing various land use practices that would meet the needs of people and at the same time protect the environment.

Plate-1: Some of the Selected Plants List at Kolanki Hills Ashapur Raichur





Vegetation of Kolanki Hills at Ashapur in Raichur District of Karnataka State in India revealed a notable richness with 405 plant species from 76 families shown in Plate 1. In this composition the area of interest's vegetation in terms of biodiverse and dependent on; altitude, climate and soil conditions. The findings of the quadrat method give the basis for the Kolanki Hills' ecological processes. This leads to the identification of keystone species or species that are important in terms of stability of ecosystems from the marginal species or species that are very scarce and may,

therefore, need protection (Champion and Seth, 1968). Equitability in species abundance and distribution are usually considered an index of environmental health, whereas dissymmetrical distribution might suggest abnormal conditions. These results can also indicate particular habitats, for example, xerophytes, that prefer rocky slopes or mesophytes, that prefer wetter sites. The plants list with density, abundance and frequency is depicted in Table 1.

**Table 1: Density, Abundance and Frequency by Quadrante Method of Kolanki Hills - Ashapur**

S. No	Plant Species	Family	Density = A/B	Abundance = A/C	Frequency (%) = C/B* 100
1	<i>Barleria prionitis</i> (L.)L.	Acanthaceae	2.80	7.00	40
2	<i>Barleria tomentosa</i> Willd	Acanthaceae	1.05	3.00	35
3	<i>Blepharis maderaspatensis</i> (L)B. Heyne ex Roth	Acanthaceae	2.30	4.60	50
4	<i>Diplotera paniculata</i> (Jacq.) Juss.	Acanthaceae	1.10	4.40	25
5	<i>Hygrophila auriculata</i> Heine	Acanthaceae	1.50	3.75	40
6	<i>Indoneesiella echioides</i> (L.) Sreem.	Acanthaceae	1.60	3.56	45
7	<i>Justicia betonica</i> L.	Acanthaceae	1.95	3.90	50
8	<i>Justicia diffusa</i> Willd	Acanthaceae	1.95	3.90	50
9	<i>Justicia glauca</i> (Burm.f.) Vahl	Acanthaceae	2.30	5.75	40
10	<i>Lepidogathis cristata</i> (L.)Nees	Acanthaceae	1.40	2.80	50
11	<i>Rostellularia procumbens</i> (L.) Nees	Acanthaceae	2.10	4.20	50
12	<i>Rungia elegans</i> (Vahl) Nees	Acanthaceae	1.80	4.00	45
13	<i>Trianthema portulacastrum</i> L.	Aizoaceae	1.85	3.70	50
14	<i>Zaleya govindia</i> (L.) Oken	Aizoaceae	0.90	4.50	20
15	<i>Achyranthes aspera</i> L.	<i>Achyranthes aspera</i>	2.50	5.00	50
16	<i>Allmania nodiflora</i> (L.) R.Br.	<i>Allmania nodiflora</i>	4.70	5.88	80
17	<i>Alternanthera pungens</i> (Kunth) Kuntze	<i>Alternanthera pungens</i>	2.65	3.53	75
18	<i>Alternanthera sessilis</i> (L.) R.Br.	<i>Alternanthera sessilis</i>	3.05	4.36	70
19	<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	<i>Alternanthera philoxeroides</i>	1.95	2.79	70
20	<i>Aerva lanata</i> (L.) Juss.ex Schult.	<i>Aerva lanata</i>	2.60	3.71	70
21	<i>Amaranthus graecizans</i> L.	<i>Amaranthus graecizans</i>	1.30	3.25	40
22	<i>Gomphrena celosioides</i> Mart.	<i>Gomphrena celosioides</i>	3.55	7.10	50
23	<i>Pupalia lappacea</i> (L.) Juss.ex Poir	<i>Pupalia lappacea</i>	1.40	3.50	40
24	<i>Trichuriella monsoniae</i> (L.) Benth.	<i>Trichuriella monsoniae</i>	1.50	3.33	45
25	<i>Mangifera indica</i> L.	Anacardiaceae	2.30	5.75	40
26	<i>Annona squamosa</i> L.	Annonaceae	3.30	4.71	70
27	<i>Calotropis gigantean</i> (L.) Dryand	Apocynaceae	0.60	1.33	45
28	<i>Calotropis procera</i> L.	Apocynaceae	0.85	1.42	60
29	<i>Carissa spinarum</i> L.	Apocynaceae	0.60	1.50	40
30	<i>Fimbria fimbriat</i> L. (Linnaeus)	Apocynaceae	1.05	2.63	40
31	<i>Cryptostegia grandiflora</i> (R.Br.) R.Br.ex Roem. & Schult.	Apocynaceae	0.85	2.13	40
32	<i>Hemidesmous indicus</i> (L.) R.Br.	Apocynaceae	0.85	1.89	45
33	<i>Oxystelma esculentum</i> (L.) K.Schum.	Apocynaceae	0.80	2.00	40
34	<i>Pergularia daemia</i> (L.) N.E.Br.	Apocynaceae	0.85	2.43	35
35	<i>Stephanotis volubilis</i> J.L. (Roxb.) L.	Apocynaceae	0.70	2.33	30
36	<i>Phoenix sylvestris</i> (L.) Roxb.	Aracaceae	1.50	3.75	40
37	<i>Lemna minor</i> L.	Araceae	35.00	41.18	85
38	<i>Wolffia globosa</i> (L.) Horkel ex Wimm.	Araceae	42.95	53.69	80
39	<i>Aristolochia indica</i> L.	Aristolochiaceae	1.45	3.22	45

40	<i>Aristolochia bracteolata</i> Lam.	Aristolochiaceae	1.25	2.50	50
41	<i>Agave Americana</i> L.	Asperagaceae	1.65	4.13	40
42	<i>Asparagus racemosus</i> Willd.	Asperagaceae	1.00	2.86	35
43	<i>Drimia indica</i> (Roxb.) Jessop	Asperagaceae	1.60	4.00	40
44	<i>Ledebouria revolute</i> (Thunb.) Jessop	Asperagaceae	0.70	2.00	35
45	<i>Acanthospermum hispidum</i> (DC.) Kuntze	Asteraceae	2.10	4.67	45
46	<i>Ageratum conyzoides</i> L.	Asteraceae	1.75	3.50	50
47	<i>Bidens bipinnata</i> L.	Asteraceae	1.20	3.43	35
48	<i>Bidens biterneta</i> L.	Asteraceae	0.95	3.17	30
49	<i>Blumea axillaris</i> (D.Don) DC.	Asteraceae	1.15	3.29	35
50	<i>Blumea eriantha</i> DC.	Asteraceae	1.20	3.43	35
51	<i>Blumea lacera</i> (L.)Merr.	Asteraceae	0.70	1.75	40
52	<i>Blumea malcolmii</i> (C. B. Clarke) Prain	Asteraceae	0.85	2.83	30
53	<i>Blumea obliqua</i> (L.) Druce	Asteraceae	1.10	3.14	35
54	<i>Blainvillae acmella</i> (L.)Kuntze	Asteraceae	1.25	4.17	30
55	<i>Caesulia axillaris</i> Roxb.	Asteraceae	1.00	2.86	35
56	<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	Asteraceae	0.70	2.80	25
57	<i>Eclipta prostrata</i> L.	Asteraceae	1.60	3.56	45
58	<i>Echinops echinatus</i> Roxb.	Asteraceae	0.95	2.38	40
59	<i>Epaltes divaricata</i> (L.) R.Br.	Asteraceae	0.85	2.43	35
60	<i>Flaveria trinerva</i> (L.) Juss.	Asteraceae	0.90	2.57	35
61	<i>Glossocardia bosvallia</i> (L.) Kuntze	Asteraceae	1.75	4.38	40
62	<i>Goniocaulon indicum</i> (L.) P.K.Hsiao	Asteraceae	0.80	2.29	35
63	<i>Grangea maderaspatana</i> (L.) Poir	Asteraceae	0.80	2.67	30
64	<i>Pseudognaphalium luteoalbum</i> (L.)Hillaiard & B.L.Turner	Asteraceae	0.90	2.25	40
65	<i>Lagascea mollis</i> (Burm.f.) Benth.	Asteraceae	0.95	3.17	30
66	<i>Parthenium hysterophorus</i> L.	Asteraceae	2.55	4.25	60
67	<i>Phagnalon rupestre</i> (L.) Maire	Asteraceae	1.10	3.14	35
68	<i>Pluchea tomentosa</i> L.	Asteraceae	0.95	2.38	40
69	<i>Pulicaria wightiana</i> (DC.) Kuntze	Asteraceae	1.95	5.57	35
70	<i>Senecio tenuifolius</i> Willd.	Asteraceae	1.05	2.63	40
71	<i>Soncus aspera</i> (L.) Hill	Asteraceae	0.95	3.17	30
72	<i>Sphaeranthus indicus</i> L.	Asteraceae	1.70	4.25	40
73	<i>Synedrella nodiflora</i> (L.) Gaertn.	Asteraceae	2.75	6.11	45
74	<i>Tricholepis amplexicaule</i> (L.) Kuntze	Asteraceae	1.10	3.14	35
75	<i>Tricholepis radicans</i> (L.) DC.	Asteraceae	0.90	3.00	30
76	<i>Tridax procumbens</i> L.	Asteraceae	2.05	4.56	45
77	<i>Vernonia cinerea</i> (L.) Less.	Asteraceae	1.20	4.00	30
78	<i>Vicoa indica</i> (L.) Kuntze	Asteraceae	1.40	3.50	40
79	<i>Xanthium indicum</i> L.	Asteraceae	1.75	5.00	35
80	<i>Coldenia procumbens</i> (L.) I.M.Johnst.	Boraginaceae	1.25	3.57	35
81	<i>Heliotropium marifolium</i> L.	Boraginaceae	1.30	3.71	35
82	<i>Heliotropium supinum</i> L.	Boraginaceae	0.65	2.60	25
83	<i>Rotula aquatica</i> (L.) G.Don	Boraginaceae	0.75	3.00	25
84	<i>Trichodesma indicum</i> (L.) R.Br.	Boraginaceae	1.70	3.78	45
85	<i>Trichodesma zeylanicum</i> (L.) R.Br.	Boraginaceae	1.50	3.00	50
86	<i>Schouwia purpurea</i> (L.) DC.	Brassicaceae	0.80	2.29	35
87	<i>Opuntia elatior</i> (Mill.) Haw.	Cactaceae	1.50	5.00	30
88	<i>Lobelia alsinoides</i> L.	Campanulaceae	1.20	3.43	35
89	<i>Capparis divaricata</i> Forssk.	Capparaceae	1.30	4.33	30
90	<i>Cadaba fruticosa</i> Forssk.	Capparaceae	1.90	4.75	40
91	<i>Polycarpea aurea</i> (L.) Druce	Caryophyllaceae	1.00	3.33	30
92	<i>Polycarpea corymbosa</i> (L.) L.	Caryophyllaceae	1.60	4.00	40
93	<i>Gymnosporia emarginata</i> (Vahl) Loes	Celastraceae	0.95	2.71	35
94	<i>Cleome aspera</i> L.	Cleomaceae	1.05	3.00	35
95	<i>Cleome chelidoni</i> L.	Cleomaceae	0.80	3.20	25
96	<i>Cleome feline</i> Vahl	Cleomaceae	0.90	3.00	30
97	<i>Cleome gynandra</i> L.	Cleomaceae	2.35	4.70	50
98	<i>Cleome monophylla</i> L.	Cleomaceae	1.05	3.00	35
99	<i>Cleome viscosa</i> L.	Cleomaceae	3.35	5.15	65
100	<i>Iphigenia indica</i> (L.) C.B. Clarke	Colichiaceae	1.10	4.40	25
101	<i>Commelina benghalensis</i> L.	Commelinaceae	3.15	7.00	45
102	<i>Commelina clavata</i> (Burm.f.) Merr.	Commelinaceae	3.70	6.73	55
103	<i>Commelina ensifolia</i> Burm.f.	Commelinaceae	1.15	3.29	35
104	<i>Commelina longifolia</i> L.	Commelinaceae	2.60	6.50	40
105	<i>Commelina subulata</i> (L.) J.Koenig	Commelinaceae	1.40	4.00	35
106	<i>Cyanotis arachnoidea</i> Willd.	Commelinaceae	2.90	4.46	65
107	<i>Cyanotis axillaris</i> (L.) U.de Vries	Commelinaceae	2.00	4.44	45

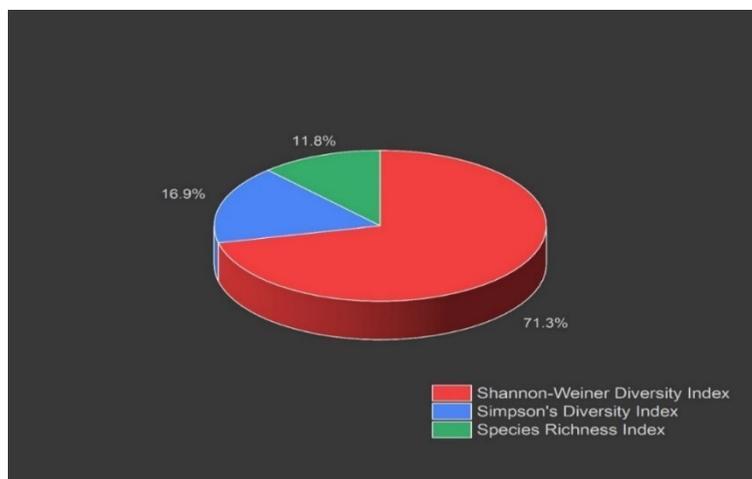
108	<i>Cyanotis fasciculata</i> (Burm.f.) L.	Commelinaceae	1.90	4.75	40
109	<i>Cyanotis pilosa</i> (Roxb.) C.B.Clarke	Commelinaceae	0.85	2.83	30
110	<i>Cyanotis tuberosa</i> (L.) Moench	Commelinaceae	1.30	3.71	35
111	<i>Murdannia nudiflora</i> (L.) Brer	Commelinaceae	1.30	3.71	35
112	<i>Murdannia semiteres</i> (Hassk.) C.B.Clarke	Commelinaceae	0.85	2.83	30
113	<i>Murdannia spirata</i> (Roxb.) C.B.Clarke	Commelinaceae	1.00	4.00	25
114	<i>Murdannia vaginata</i> (Hassk.) C.B.Clarke	Commelinaceae	0.95	3.17	30
115	<i>Cuscuta chinensis</i> Lam.	Convolvulaceae	1.50	3.75	40
116	<i>Cuscuta reflexa</i> Roxb.	Convolvulaceae	1.55	3.10	50
117	<i>Evolvulus alsinoides</i> (L.) L.	Convolvulaceae	1.65	4.13	40
118	<i>Ipomea obscura</i> (L.) Ker Gawl.	Convolvulaceae	1.45	3.63	40
119	<i>Ipomea quinata</i> (L.) L.	Convolvulaceae	0.85	3.40	25
120	<i>Ipomoea nil</i> (L.) Roth	Convolvulaceae	1.25	3.57	35
121	<i>Ipomoea pes-tigris</i> (L.) Choisy	Convolvulaceae	0.90	3.60	25
122	<i>Ipomoea quamoclit</i> L.	Convolvulaceae	1.00	3.33	30
123	<i>Merremia emarginata</i> (L.) Hallier f.	Convolvulaceae	0.70	2.80	25
124	<i>Xenostegia tridentata</i> (L.) Dandy	Convolvulaceae	1.00	4.00	25
125	<i>Terminalia chebula</i> (Gaertn.) Retz.	Combretaceae	1.05	3.50	30.00
126	<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	1.50	3.75	40
127	<i>Cucumis melo</i> L.	Cucurbitaceae	0.65	2.60	25
128	<i>Cucumis prophantum</i> L.	Cucurbitaceae	1.05	3.00	35
129	<i>Diplocyclos palmatus</i> (L.) Merr.	Cucurbitaceae	0.85	3.40	25
130	<i>Momordica cymbalaria</i> (L.) Sw.	Cucurbitaceae	1.55	3.44	45
131	<i>Mukia madarapatana</i> (L.) Mabb.	Cucurbitaceae	0.85	2.83	30
132	<i>Bulbostylis barbata</i> (L.) J.Presl	Cyperaceae	2.00	4.00	50
133	<i>Cyperus compressus</i> L.	Cyperaceae	2.20	3.67	60
134	<i>Cyperus difformis</i> L.	Cyperaceae	2.65	4.08	65
135	<i>Cyperus haspan</i> L.	Cyperaceae	4.25	5.31	80
136	<i>Cyperus iria</i> L.	Cyperaceae	2.40	4.00	60
137	<i>Cyperus laevigatus</i> L.	Cyperaceae	1.45	3.22	45
138	<i>Cyperus neochinensis</i> C.B.Clarke	Cyperaceae	1.45	3.63	40
139	<i>Cyperus niveus</i> Retz.	Cyperaceae	1.80	4.00	45
140	<i>Cyperus pulchellus</i> (L.) Willd	Cyperaceae	2.20	4.89	45
141	<i>Cyperus pygmaeus</i> (L.)Rottb.	Cyperaceae	2.45	4.90	50
142	<i>Eleocharis atropurpurea</i> (Roxb.) Schult.	Cyperaceae	2.50	4.55	55
143	<i>Fimbristylis complanata</i> (L.) Ward	Cyperaceae	2.85	4.75	60
144	<i>Fimbristylis dichotoma</i> (L.) Vahl	Cyperaceae	1.50	3.33	45
145	<i>Fimbristylis ferruginea</i> (L.) Vahl	Cyperaceae	0.80	3.20	25
146	<i>Fimbristylis miliacea</i> (L.) Vahl	Cyperaceae	1.25	4.17	30
147	<i>Fimbristylis ovate</i> (L.) Vahl	Cyperaceae	1.90	4.22	45
148	<i>Fimbristylis quinquangularis</i> (L.) Vahl	Cyperaceae	1.15	5.75	20
149	<i>Fuirena capitata</i> (L.) Hook.	Cyperaceae	1.75	5.00	35
150	<i>Fuirena umbellata</i> (L.) Rottb.	Cyperaceae	1.10	3.67	30
151	<i>Kyllinga brevifolia</i> (Rottb.) Pers.	Cyperaceae	2.65	5.30	50
152	<i>Schoenoplectiella mucronata</i> (L.) Lye	Cyperaceae	1.10	3.67	30
153	<i>Schoenoplectiella supina</i> (L.) Lye	Cyperaceae	1.15	3.29	35
154	<i>Drosera burmanii</i> Vahl	Droseraceae	3.55	5.07	70
155	<i>Drosera indica</i> L.	Droseraceae	3.50	5.38	65
156	<i>Bergia ammanianoides</i> (Horchst.) Fenzl	Elatinaceae	2.30	4.60	50
157	<i>Eriocaulon quinquangulare</i> L.	Eriocaulaceae	4.05	5.40	75
158	<i>Eriocaulon heterolepis</i> (Baker) K.Schum.	Eriocaulaceae	5.15	6.06	85
159	<i>Acalypha capitata</i> Forssk.	Euphorbiaceae	1.70	3.78	45
160	<i>Acalypha indica</i> L.	Euphorbiaceae	2.90	5.27	55
161	<i>Acalypha lanceolata</i> (L.) L.	Euphorbiaceae	1.90	4.75	40
162	<i>Chrozophora plicata</i> (L.) A.Juss	Euphorbiaceae	1.70	3.78	45
163	<i>Chrozophora rottlerin</i> (Rottler) M.A.Laws	Euphorbiaceae	1.30	3.71	35
164	<i>Croton bonplandianus</i> Baill.	Euphorbiaceae	2.60	5.20	50
165	<i>Euphorbia antiquorum</i> L.	Euphorbiaceae	1.20	4.80	25
166	<i>Euphorbia caducifolia</i> (Burm.f.) Hook. f.	Euphorbiaceae	1.20	4.00	30
167	<i>Euphorbia heyneana</i> Wall.	Euphorbiaceae	1.85	4.63	40
168	<i>Euphorbia hirta</i> L.	Euphorbiaceae	3.60	7.20	50
169	<i>Euphorbia parviflora</i> (L.) A. Juss	Euphorbiaceae	1.45	4.83	30
170	<i>Euphorbia tirucalli</i> L.	Euphorbiaceae	2.05	5.13	40

171	<i>Givotia rottleriformis</i> (Rottler) F.Muell.	Euphorbiaceae	1.65	4.71	35
172	<i>Jatropha gossipifolia</i> (L.) J.Konig & H.Schwantes	Euphorbiaceae	1.60	3.56	45
173	<i>Microstachy chamaelea</i> (L.) R.Br.	Euphorbiaceae	3.05	5.08	60
174	<i>Abrus precatorius</i> L.	Fabaceae	2.35	4.27	55
175	<i>Albizia amara</i> (Roxb.) Boiv.	Fabaceae	1.35	4.50	30
176	<i>Albizia procera</i> (Roxb.) Benth.	Fabaceae	1.35	5.40	25
177	<i>Alysicarpus buplerifolius</i> (L.) Wight & Arn.	Fabaceae	2.80	5.09	55
178	<i>Alysicarpus vasavadae</i> (K.& S.) K.& S.	Fabaceae	4.15	5.53	75
179	<i>Alysicarpus moniliform</i>	Fabaceae	2.75	3.24	85
180	<i>Alysicarpus hamosus</i> (L.) Wight & Arn	Fabaceae	2.45	4.90	50
181	<i>Alysicarpus rugosus</i> (L.) DC.	Fabaceae	2.80	4.31	65
182	<i>Chamaecrista pumila</i> (L.) Greene	Fabaceae	4.10	5.47	75
183	<i>Cassia fistula</i> L.	Fabaceae	0.80	3.20	25
184	<i>Clitoria ternetea</i> L.	Fabaceae	2.75	4.23	65
185	<i>Crotalaria albida</i> Aiton	Fabaceae	2.75	5.50	50
186	<i>Crotalaria medicaginea</i> L.	Fabaceae	3.55	4.73	75
187	<i>Crotalaria nana</i> Benth.	Fabaceae	3.05	4.07	75
188	<i>Crotalaria orixensis</i> (Dalzell) Benth.	Fabaceae	2.70	5.40	50
189	<i>Crotalaria pusilla</i> (Roxb.) Wight & Arn.	Fabaceae	2.95	3.93	75
190	<i>Crotalaria verrucosa</i> L.	Fabaceae	1.15	4.60	25
191	<i>Crotalaria hebecarpa</i> (Dalzell) Benth.	Fabaceae	4.55	6.50	70
192	<i>Cullen corylifolium</i> (L.) Medik.	Fabaceae	2.45	4.90	50
193	<i>Grona heterophylla</i> (Roxb.) Kuntze	Fabaceae	1.75	4.38	40
194	<i>Grona triflorum</i> (Burm.f.) Kuntze	Fabaceae	2.60	5.20	50
195	<i>Indigofera caerulea</i> Roxb.	Fabaceae	3.00	7.50	40
196	<i>Indigofera cordifolia</i> (L.) L.	Fabaceae	3.70	4.93	75
197	<i>Indigofera coultea</i> (Roxb.) Kuntze	Fabaceae	3.90	6.00	65
198	<i>Indigofera glandulosa</i> (L.) Sweet	Fabaceae	4.60	6.13	75
199	<i>Indigofera linifolia</i> L.	Fabaceae	3.95	5.27	75
200	<i>Cambelli</i> (Benth.) Baker	Fabaceae	4.10	5.86	70
201	<i>Indigofera linnaei</i> (L.) Kuntze	Fabaceae	4.40	5.87	75
202	<i>Indigofera nummularifolia</i> (Vahl) Willd.	Fabaceae	4.55	6.50	70
203	<i>Indigofera trifoliata</i> L.	Fabaceae	3.95	5.27	75
204	<i>Indigofera trita</i> (L.) Spreng.	Fabaceae	3.85	7.00	55
205	<i>Macroptilium lathyroides</i> (L.) Verdc.	Fabaceae	2.00	3.33	60
206	<i>Mimosa hamate</i> (L.) Willd.	Fabaceae	2.30	4.60	50
207	<i>Mimosa pudica</i> L.	Fabaceae	4.15	8.30	50
208	<i>Neptunia oleracea</i> (L.) Lour.	Fabaceae	3.60	5.14	70
209	<i>Neptunia triquetra</i> (L.) Wight	Fabaceae	3.55	4.73	75
210	<i>Prosopis cineraria</i> (L.) Druce	Fabaceae	1.55	2.58	60
211	<i>Prosopis juliflora</i> (Sw.) DC.	Fabaceae	2.20	4.00	55
212	<i>Rhynchosia capitata</i> (L.) R.Br.	Fabaceae	2.55	3.92	65
213	<i>Rhynchosia minima</i> (L.) DC.	Fabaceae	2.40	3.69	65
214	<i>Rhynchosia rufescens</i> (Desv.) DC.	Fabaceae	3.20	4.57	70
215	<i>Rhynchosia viscosa</i> (L.) DC.	Fabaceae	3.70	4.93	75
216	<i>Rothia indica</i> (L.) Benth.	Fabaceae	2.20	3.67	60
217	<i>Senna auriculata</i> (L.) Roxb.	Fabaceae	3.45	4.60	75
218	<i>Senna occidentalis</i> (L.) Link.	Fabaceae	3.70	4.63	80
219	<i>Senna uniflora</i> (L.) Link.	Fabaceae	3.40	4.53	75
220	<i>Senegalia chundra</i> (Roxb.) Maslin	Fabaceae	1.95	2.44	80
221	<i>Sesbania bispinosa</i> (Jacq.) W. Wight	Fabaceae	2.70	3.86	70
222	<i>Stylosanthes fruticose</i> (L.) J.H.Kirkbr.	Fabaceae	2.30	3.83	60
223	<i>Stylosanthes hamate</i> (L.) Taub.	Fabaceae	2.80	3.73	75
224	<i>Tamarindus indica</i> L.	Fabaceae	1.55	2.38	65
225	<i>Taverniera cuneifolia</i> (Roxb.) Wight	Fabaceae	3.90	4.88	80
226	<i>Tephrosia pumila</i> (L.) Pers.	Fabaceae	2.80	4.31	65
227	<i>Tephrosia purpurea</i> (L.) Pers.	Fabaceae	3.25	4.06	80
228	<i>Tephrosia strigose</i> (L.) DC.	Fabaceae	3.05	4.36	70
229	<i>Tephrosia villosa</i> (L.) Pers	Fabaceae	2.90	4.14	70
230	<i>Vachellia eburnean</i> (Roxb.) Seigler & Ebinger	Fabaceae	1.45	3.22	45
231	<i>Vachellia farnesiana</i> (L.) Seigler & Ebinger	Fabaceae	1.60	3.56	45
232	<i>Vachellia horrida</i> (L.) Seigler & Ebinger	Fabaceae	1.80	3.60	50

233	<i>Vachellia leucophloea</i> (Roxb.) Seigler & Ebinger	Fabaceae	1.90	3.45	55
234	<i>Vachellia nilotica</i> (L) P.J.H. Hurter	Fabaceae	1.60	3.20	50
235	<i>Vigna aconitifolia</i> (Jacq.) Marechal	Fabaceae	3.15	4.50	70
236	<i>Vigna trilobata</i> (L.) Verdc.	Fabaceae	2.75	4.58	60
237	<i>Vigna vexillata</i> (L.) A.Rich.	Fabaceae	2.60	3.71	70
238	<i>Zornia gibbose</i> (L.) H.S.Irwin & Barneby	Fabaceae	3.20	5.33	60
239	<i>Gliricidia sepium</i> (Jacq.) Kunth	Fabaceae	2.40	5.33	45
240	<i>Canscora diffusa</i> (Roxb.) Alston	Gentianaceae	2.10	5.25	40
241	<i>Centaurium centaurioides</i> (Roxb.) Kuntze	Gentianaceae	2.35	4.70	50
242	<i>Enicostemma axillare</i> (Lam.) Alston	Gentianaceae	2.25	4.09	55
243	<i>Hoppea dichotoma</i> (L.) Engl.	Gentianaceae	1.75	3.18	55
244	<i>Gisekia pharnaceoides</i> (L.) Kuntze	Gieskiaceae	1.50	3.00	50
245	<i>Gyrocarpus americanus</i> (L.) H.B.K	Hernandiaceae	1.85	2.64	70
246	<i>Ottelia alismoides</i> (L.) Pers.	Hydrocharitaceae	3.10	5.17	60
247	<i>Anisomeles malabarica</i> (L.) R.Br.	Lamiaceae	1.40	2.55	55
248	<i>Coleus strobilifer</i> (Benth.)R.Br.	Lamiaceae	2.40	3.43	70
249	<i>Mesosphaerum suaveolens</i> (L.) Kuntze	Lamiaceae	2.45	3.77	65
250	<i>Lavandula bipinnata</i> (L.) L.	Lamiaceae	1.25	2.50	50
251	<i>Leonotis nepetifolia</i> (L.)R.Br.	Lamiaceae	1.50	2.73	55
252	<i>Leucas aspera</i> (Willd.) Link	Lamiaceae	2.80	4.00	70
253	<i>Leucas martinicensis</i> (L.) R.Br.	Lamiaceae	1.75	3.89	45
254	<i>Ocimum basilicum</i> L.	Lamiaceae	2.55	3.64	70
255	<i>Ocimum filamentosum</i> (Benth.) Hook.f.	Lamiaceae	1.70	3.40	50
256	<i>Ocimum sanctum</i> L.	Lamiaceae	2.50	5.00	50
257	<i>Orthosiphon thymiflorus</i> (Burm.f.) Miq.	Lamiaceae	3.15	4.50	70
258	<i>Platostoma menthoides</i> (Burm.f.) Miq.	Lamiaceae	1.60	3.20	50
259	<i>Cassytha filiformis</i> L.	Lauraceae	2.30	4.18	55
260	<i>Utricularia bifida</i> L.	Lentibulariaceae	1.95	3.25	60
261	<i>Utricularia caerulea</i> L.	Lentibulariaceae	1.90	3.45	55
262	<i>Lindernia parviflora</i> (L.) Pennell	Linderniaceae	1.60	3.20	50
263	<i>Ammania baccifera</i> L.	Lythraceae	2.15	4.30	50
264	<i>Ammania multiflora</i> L.	Lythraceae	1.55	3.88	40
265	<i>Rotala densiflora</i> (Vahl) J.W. Robbins	Lythraceae	1.45	3.22	45
266	<i>Abutilon hirtum</i> (L.) Sweet	Malvaceae	2.35	4.27	55
267	<i>Abutilon indicum</i> (L.) Sweet	Malvaceae	2.20	3.67	60
268	<i>Corchorus aestuans</i> L.	Malvaceae	1.80	3.60	50
269	<i>Corchorus olitorius</i> L.	Malvaceae	2.05	4.10	50
270	<i>Corchorus trilocularis</i> L.	Malvaceae	1.85	3.70	50
271	<i>Grewia damine</i> (Forsk.) Fiori	Malvaceae	1.85	3.70	50
272	<i>Grewia tenax</i> (Forsk.) Fiori	Malvaceae	1.95	3.90	50
273	<i>Hibiscus lobatus</i> (L.) L.	Malvaceae	1.30	1.37	95
274	<i>Hibiscus ovalifolius</i> (Forsk.) Delile	Malvaceae	1.50	3.33	45
275	<i>Hibiscus panduriformis</i> (L.) Lam.	Malvaceae	1.15	3.83	30
276	<i>Hibiscus vitifolius</i> L.	Malvaceae	1.75	3.50	50
277	<i>Melochia corchorofolia</i> (L.) L.	Malvaceae	0.90	3.60	25
278	<i>Melhania incana</i> (L.) A.Rich.	Malvaceae	1.10	2.75	40
279	<i>Pavonia odorata</i> (Cav.) R.Br.	Malvaceae	2.00	4.44	45
280	<i>Pavonia procumbens</i> (L.) L.	Malvaceae	2.15	4.30	50
281	<i>Pavonia zeylanica</i> (L.) Merr.	Malvaceae	2.35	4.70	50
282	<i>Sida acuta</i> Burm.f	Malvaceae	4.00	5.71	70
283	<i>Sida cordata</i> (Burm.f.) Benth.	Malvaceae	2.95	4.54	65
284	<i>Sida rhombifolia</i> L.	Malvaceae	2.35	4.70	50
285	<i>Sida spinosa</i> L.	Malvaceae	1.15	3.83	30
286	<i>Trimufetta rhomboidea</i> (L.) A. Rich.	Malvaceae	2.70	4.15	65
287	<i>Triumfetta malabarica</i> (L.) T.Anderson	Malvaceae	3.35	4.47	75
288	<i>Waltheria indica</i> L.	Malvaceae	1.95	4.33	45
289	<i>Martynia annual</i> L.	Martyniaceae	1.70	3.78	45
290	<i>Corymbia citriodora</i> (Hook.) K.D.Hill & L.A.S.Johnson	Myrtaceae	1.60	3.56	45
291	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	1.80	4.00	45
292	<i>Azadirachta indica</i> A.Juss.	Meliaceae	1.60	3.56	45
293	<i>Tinospora cordifolia</i> (Willd.) Miers	Menispermaceae	2.55	5.67	45
294	<i>Cocculus hirsutus</i> (L.) Diels	Menispermaceae	1.50	3.00	50
295	<i>Glinus lotoides</i> L.	Molluginaceae	1.10	2.44	45
296	<i>Glinus oppositifolius</i> (L.) Aug.DC	Molluginaceae	1.55	3.44	45

297	<i>Paramollugo nudicaulis</i> (L.) S.R.& A.	Molluginaceae	0.95	2.38	40
298	<i>Ficus religiosa</i> L.	Moraceae	1.85	3.70	50
299	<i>Boerhavia diffusa</i> (L.) A.DC.	Nyctaginaceae	2.40	4.36	55
300	<i>Boerhavia erecta</i> L.	Nyctaginaceae	2.20	3.67	60
301	<i>Nymphaea pubescens</i> Willd.	Nymphaeaceae	2.10	3.82	55
302	<i>Ludwigia perennis</i> L.	Onagraceae	3.10	4.77	65
303	<i>Sopubia delphinifolia</i> (L.) L.	Orobanchaceae	2.70	4.15	65
304	<i>Striga angustifolia</i> Benth.	Orobanchaceae	3.10	4.43	70
305	<i>Striga densiflora</i> (Benth.) Sprague	Orobanchaceae	1.30	2.89	45
306	<i>Striga gesnerioides</i> L.	Orobanchaceae	2.15	4.30	50
307	<i>Argemone Mexicana</i> L.	Papavaraceae	2.00	4.44	45
308	<i>Passiflora foetida</i> L.	Passifloraceae	1.85	3.70	50
309	<i>Pedaliium murex</i> L.	Pedaliaceae	2.45	4.08	60
310	<i>Sesamum indicum</i> L.	Pedaliaceae	1.15	3.29	35
311	<i>Phyllanthus amarus</i> Schumach.	Phyllanthaceae	3.35	4.79	70
312	<i>Phyllanthus maderapatensis</i> (L.)	Phyllanthaceae	1.60	2.67	60
313	<i>Phyllanthus reticulate</i> (L.)	Phyllanthaceae	1.75	3.50	50
314	<i>Acrachne racemosa</i> (L.) Willd.	Poaceae	4.05	5.40	75
315	<i>Alloteropsis cimicina</i> (L.) R.Br.	Poaceae	3.40	4.53	75
316	<i>Apluda mutica</i> L.	Poaceae	4.60	5.75	80
317	<i>Aristida adscensionsis</i> (L.) P.Beauv	Poaceae	5.55	6.17	90
318	<i>Aristida hystrix</i> Willd.	Poaceae	2.95	4.92	60
319	<i>Aristida setacea</i> (L.) P.Beauv.	Poaceae	3.30	4.71	70
320	<i>Cenchrus pedicellatus</i> (L.) P.Beauv.	Poaceae	2.70	4.15	65
321	<i>Chloris quinquesetica</i> (L.) Sw.	Poaceae	2.75	4.23	65
322	<i>Chloris virgata</i> Sw.	Poaceae	3.65	5.21	70
323	<i>Chrysopogon fulvus</i> (Roxb.) Bentham & Hook. f.	Poaceae	3.00	4.29	70
324	<i>Cymbopogon coloratus</i> (Nees) Benth.	Poaceae	4.40	5.87	75
325	<i>Cynodon dactylon</i> (L.) Pers	Poaceae	4.75	5.94	80
326	<i>Digitaria ciliaris</i> (Retz.) Koel.	Poaceae	4.70	5.88	80
327	<i>Dactyloctenium aegypticum</i> (L.) Beauv.	Poaceae	3.80	5.07	75
328	<i>Dichanthium annulatum</i> (Forssk.) Stapf	Poaceae	3.40	4.53	75
329	<i>Dichanthium pertusum</i> (L.) Munro ex Benth.	Poaceae	4.60	6.13	75
330	<i>Dinebra chinensis</i> (L.) P.Beauv.	Poaceae	3.55	4.73	75
331	<i>Dinebra retroflexa</i> (L.) Willd.	Poaceae	4.00	5.33	75
332	<i>Echinochola colona</i> (L.) Link	Poaceae	3.90	5.20	75
333	<i>Elytrophorus spicatus</i> (L.) Roem. &Schult.	Poaceae	2.65	4.42	60
334	<i>Eragrostiella bifaria</i> (L.) A.Haines	Poaceae	4.50	5.29	85
335	<i>Eragrostis atrovirens</i> (Desf.) P. Beauv.	Poaceae	4.20	4.67	90
336	<i>Eragrostis minor</i> (Hook.f.) Steud.	Poaceae	3.45	4.31	80
337	<i>Eragrostis pilosa</i> (L.) P.Beauv.	Poaceae	4.75	5.28	90
338	<i>Eragrostis viscosa</i> Nees	Poaceae	4.85	6.47	75
339	<i>Eriochola procera</i> (Roxb.) P.Beauv.	Poaceae	3.30	4.40	75
340	<i>Hackelochloa granularis</i> (L.) Kuntze	Poaceae	4.55	5.35	85
341	<i>Heteropogon contortus</i> (L.) P.Beauv.	Poaceae	6.85	7.61	90
342	<i>Iseilema laxum</i> (L.) Steud.	Poaceae	2.60	3.71	70
343	<i>Lophopogon tridentatus</i> (L.) P.Beauv.	Poaceae	2.25	3.75	60
344	<i>Melanocenchris jacquemontii</i> (Benth.) Hook.f.	Poaceae	6.45	6.79	95
345	<i>Melinis repens</i> (Willd.) Zizka	Poaceae	1.90	3.17	60
346	<i>Michrochloa indica</i> (L.) Kunth	Poaceae	2.40	3.69	65
347	<i>Moorochloa eruciformis</i> (L.) Munro	Poaceae	2.05	3.42	60
348	<i>Oplismenus burmanii</i> (Retz.) P.Beauv.	Poaceae	2.15	3.31	65
349	<i>Oropetium thomaenum</i> (L.) Henrard	Poaceae	2.10	3.50	60
350	<i>Paspalum vaginatum</i> Sw.	Poaceae	1.95	3.25	60
351	<i>Panicum curviflorum</i> (L.) P.Beauv.	Poaceae	1.75	2.92	60
352	<i>Paspalidium punctatum</i> (L.) Stapf	Poaceae	2.25	3.75	60
353	<i>Paspalidium flavidum</i> (L.) Stapf	Poaceae	2.15	3.31	65
354	<i>Perotis indica</i> (L.) L.	Poaceae	3.50	5.83	60
355	<i>Pseudoraphis spinescens</i> (L.) P.Beauv.	Poaceae	2.25	3.75	60
356	<i>Rottboellia cochinchinensis</i> (Lour.) W.T.Aiton	Poaceae	2.65	4.42	60
357	<i>Sacciolepis myosuroides</i> (L.) N.Schum.	Poaceae	3.15	3.94	80
358	<i>Setaria intermedia</i> (L.) P.Beauv.	Poaceae	4.55	5.35	85

359	<i>Setaria pumila</i> (Poir.) Roem, & Schult.	Poaceae	5.35	5.94	90
360	<i>Themeda tremula</i> (Forssk.) Bernth.	Poaceae	3.90	5.20	75
361	<i>Themeda triandra</i> Forssk.	Poaceae	4.00	4.44	90
362	<i>Tragus roxburghii</i> (Hook.f.) C.E.Hubb.	Poaceae	1.95	2.17	90
363	<i>Trachys muricata</i> (L.) Thunb.	Poaceae	5.00	5.26	95
364	<i>Tetrapogona tenellus</i> (L.)Steud.	Poaceae	3.80	4.47	85
365	<i>Tripogon bromoides</i> (L.) R.Br.	Poaceae	2.30	2.71	85
366	<i>Urochloa panicoides</i> (L.) Munro	Poaceae	3.50	5.83	85
367	<i>Polygala arvensis</i> L.	Polygalaceae	0.90	1.29	70
368	<i>Portulaca oleracea</i> L.	Portulacaceae	3.95	4.65	85
369	<i>Portulaca pilosa</i> L.	Portulacaceae	2.70	3.86	70
370	<i>Ziziphus mauritiana</i> Lam	Rhamnaceae	1.90	2.53	75
371	<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn	Rhamnaceae	1.45	2.23	65
372	<i>Ziziphus xylopyrus</i> (Retz.) Willd.	Rhamnaceae	1.40	2.33	60
373	<i>Zizipus oenophile</i> (L.) P.Beauv.	Rhamnaceae	1.85	2.64	70
374	<i>Canthium coromandelicum</i> (L.) Kuntze	Rubiaceae	1.75	2.19	80
375	<i>Catunaregam spinosa</i> (Thunb.) Tiveng.	Rubiaceae	1.70	2.43	70
376	<i>Oldenlandia corymbosa</i> L.	Rubiaceae	3.60	5.54	65
377	<i>Spermacoce articularis</i> L.	Rubiaceae	2.70	4.15	65
378	<i>Spermacoce pusilla</i> (Poir.) Kuntze	Rubiaceae	3.00	4.29	70
379	<i>Aegle marmelos</i> (L.) Correa	Rutaceae	2.35	3.62	65
380	<i>Cardiospermum halicacabum</i> L.	Sapindaceae	3.35	4.79	70
381	<i>Sapindus emarginatus</i> L.	Sapindaceae	1.70	2.62	65
382	<i>Datura stramonium</i> L.	Solanaceae	1.35	3.38	40
383	<i>Physalis minima</i> L.	Solanaceae	1.70	3.78	45
384	<i>Physalis peruviana</i> L.	Solanaceae	1.75	3.89	45
385	<i>Solanum lasiocarpum</i> (Dunal) Dunal	Solanaceae	1.50	2.73	55
386	<i>Solanum nigrum</i> L.	Solanaceae	2.25	3.75	60
387	<i>Solanum trilobatum</i> L.	Solanaceae	2.20	3.67	60
388	<i>Datura Innoxia</i> Mill.	Solanaceae	2.30	3.83	60
389	<i>Typha angustifolia</i> L.	Typhaceae	3.00	4.62	65
390	<i>Holoptelia integrifolia</i> (L.) Griseb.	Ulmaceae	1.55	2.58	60
391	<i>Lantana camara</i> L.	Verbinaceae	1.60	2.91	55
392	<i>Premna serratifolia</i> L.	Verbinaceae	1.50	3.33	45
393	<i>Priva cordifolia</i> (L.) R.Br.	Verbinaceae	1.60	3.20	50
394	<i>Hybanthus enneaspermus</i> (L.) F.Muell.	Violaceae	2.50	4.55	55
395	<i>Cissus repanda</i> (L.) Lam.	Vitaceae	2.05	3.42	60
396	<i>Xyris pauciflora</i> (L.) Nutt.	Xyridaceae	4.35	4.83	90
397	<i>Tribulus terrestris</i> L.	Zygophyllaceae	3.00	4.29	70
398	<i>Nelumbo nucifera</i> Gaertn.	Nelumbonaceae	1.30	4.33	30
399	<i>Marselia minuta</i> L.	Marsilleaceae	3.35	4.47	75
400	<i>Marselia quadrifolia</i> L.	Marsilleaceae	2.85	5.70	50
401	<i>Riccia dichotoma</i> (L.) Corda	Ricciaceae	2.80	3.73	75
402	<i>Selaginella bryopteris</i> (L.) Bory	Selaginellaceae	4.90	5.44	90
403	<i>Polytrichum sps</i> (L.)	Polytrichaceae	2.55	3.64	70
404	<i>Funaria sps</i> (L.)	Funariaceae	2.25	3.46	65
405	<i>Ophioglossum reticulatum</i> L.	Ophioglossaceae	0.75	2.14	35



**Figure 2: Shannon-Weiner Diversity Index, Simpson's Diversity Index and Species Richness Index of Kolanki Hills Ashapur Raichur District -Floristic Diversity**

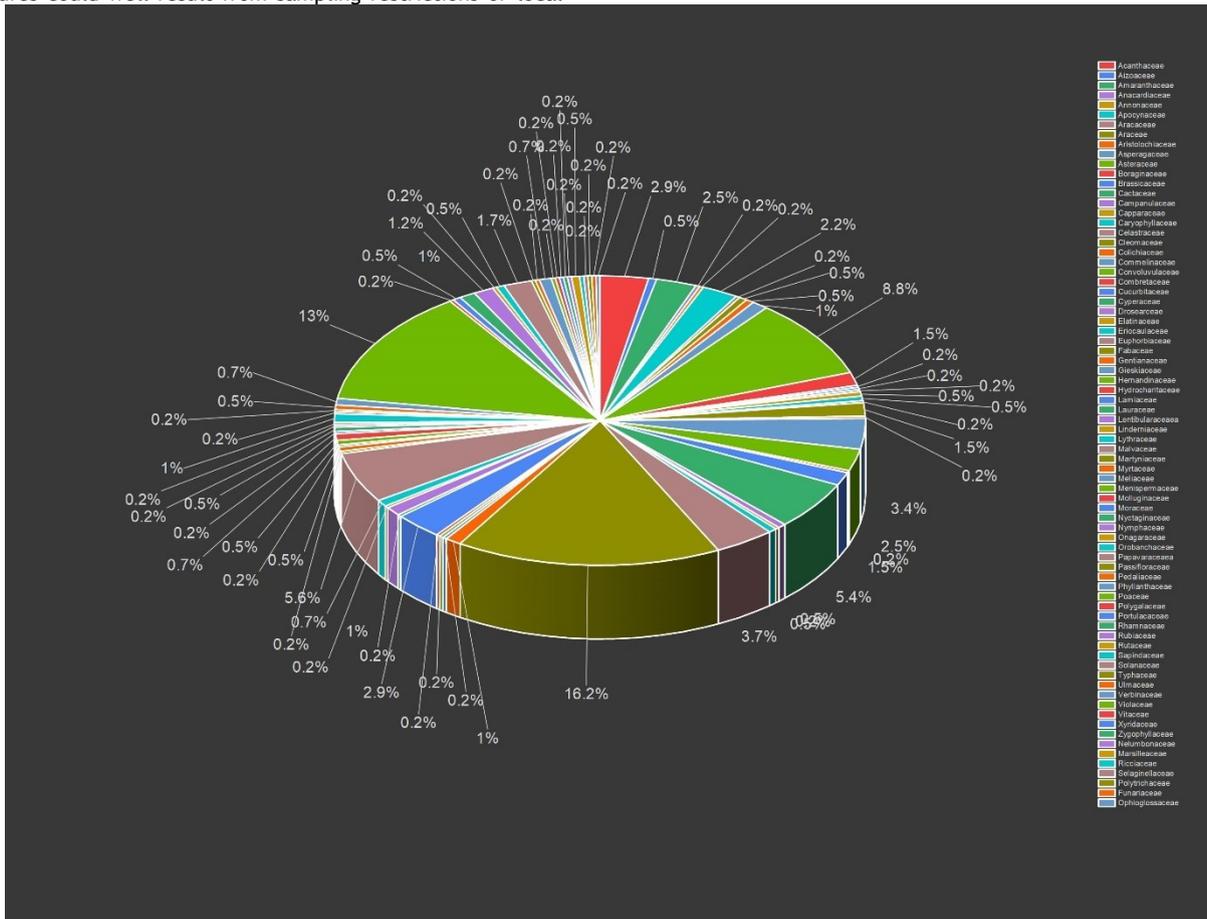
The three important biodiversity indices Shannon-Weiner Diversity Index, Simpson's Diversity Index and Species Richness Index collectively describe the floristic diversity of the Kolanki Hills, Ashapur, Raichur District, Karnataka, India, illustrated in Figure 2. The Shannon-Weiner Diversity Index (4.23), this index reflects the species diversity of a community, taking into account both richness (number of species) and evenness (distribution of individuals among species). A score of 4.23 led to the findings that Kolanki Hills is a complex and stable environment as far as species diversity is concerned. Values above 3 can be attributed to highly heterogeneous structures. High diversity could be given by factors such as the quality of soil, climate conditions or specialization of the habitats.

Simpson's Index of a sample entails the chance that two individuals of a given sample are from two different species at random. It varies from 0 to 1, where the results closer to 1 mean higher diversity. A value of 1.00 suggests that the area hosts a diverse distribution of many species in largely stabilized proportional densities thus reflecting almost the highest level of species heterogeneity. This result therefore confirms that the Kolanki Hills area plays a significant role in the sustainability of the floristic richness of our ecosystems. The Species Richness Index assesses the total number of species in an area of study in proportionate to the number of species sampled. A value of 0.70 can be considered high indicating the community to be moderate in richness in terms of species density where the index is calculated on the basis of the number of species without any regarding consideration towards endowment or vastness of area possessed by the species. Despite the intrinsic interest of such high values, the figures could well result from sampling restrictions or local

environmental conditions that constrain the availability of some species.

Thus, the Kolanki Hills has been proven to have a highly diverse floristic composition through the values from Shannon-Weiner and Simpson's diversity index. This suggests that the area is one of the hotspots in terms of diversity (Krebs, 1999). There could be scope for some misrepresentation of the data based on the assumption that only standardized surveys need to be conducted, to include all relevant plants because the score is moderate, indicating possible miscounting of some rare, or some seasonal, plants. The above high diversity indices prove that this region should be protected because any changes to the environment, including destruction of habitat, are likely to have a severe impact on this diverse biodiversity. The variations indicated imply that Kolanki Hills could offer other valuable ecosystem services such as carbon storage, soil protection and pollinators. Some of the threats that may adversely affect this ecosystem include; deforestation, mining or expansion of agricultural land. These analyses point out the need to consider the above options in formulating conservation tactics to enhance sustainability (Pielou, 1975; Kohn, 1977).

The identified plant species recorded 405 show that species richness is high and reflects the condition and stability of the Kolanki Hills ecosystem. It covers trees, shrubs, herbs, climbers, and epiphytes in an implication of the diversified ecological roles assumed by the plant resources. The 76 recorded families indicate that there is a rich taxonomic representation predominant families include Fabaceae, Poaceae, Euphorbiaceae; Asteraceae & Rubiaceae as shown in Figure 3 & 4. Such families are invariably more dominant in tropical and sub-tropical regions. Legumes or Fabaceae are sometimes dominant because they fix nitrogen from the atmosphere making them friendly to growth in nutrient-scarce environments.



**Figure 3: Floristic Diversity of Raichur District- Total Family and Number of Plants in Family**  
The floristic composition will therefore most probably consist of xerophytic, mesophytic and hydrophytic elements in response to

the climatic conditions and edaphic gradients on the hills. It is also likely that the Kolanki Hills contain areas of religious significance the sacred groves, mixed grasslands, cliffs and the banks of the temporary water meadows each providing access to a wide variety

of plant species. Possibly some of these plants' species may be endemic to this region and therefore, the Kolanki Hills could be pointed out as a centre of plant diversity. Endemic species make up the ecological pyramid and often have great potential for

medicinal and economic benefits. Some of the species are rare, threatened or endangered and need conservation intervention against factors such as deforestation, overgrazing as well as habitat conversion.

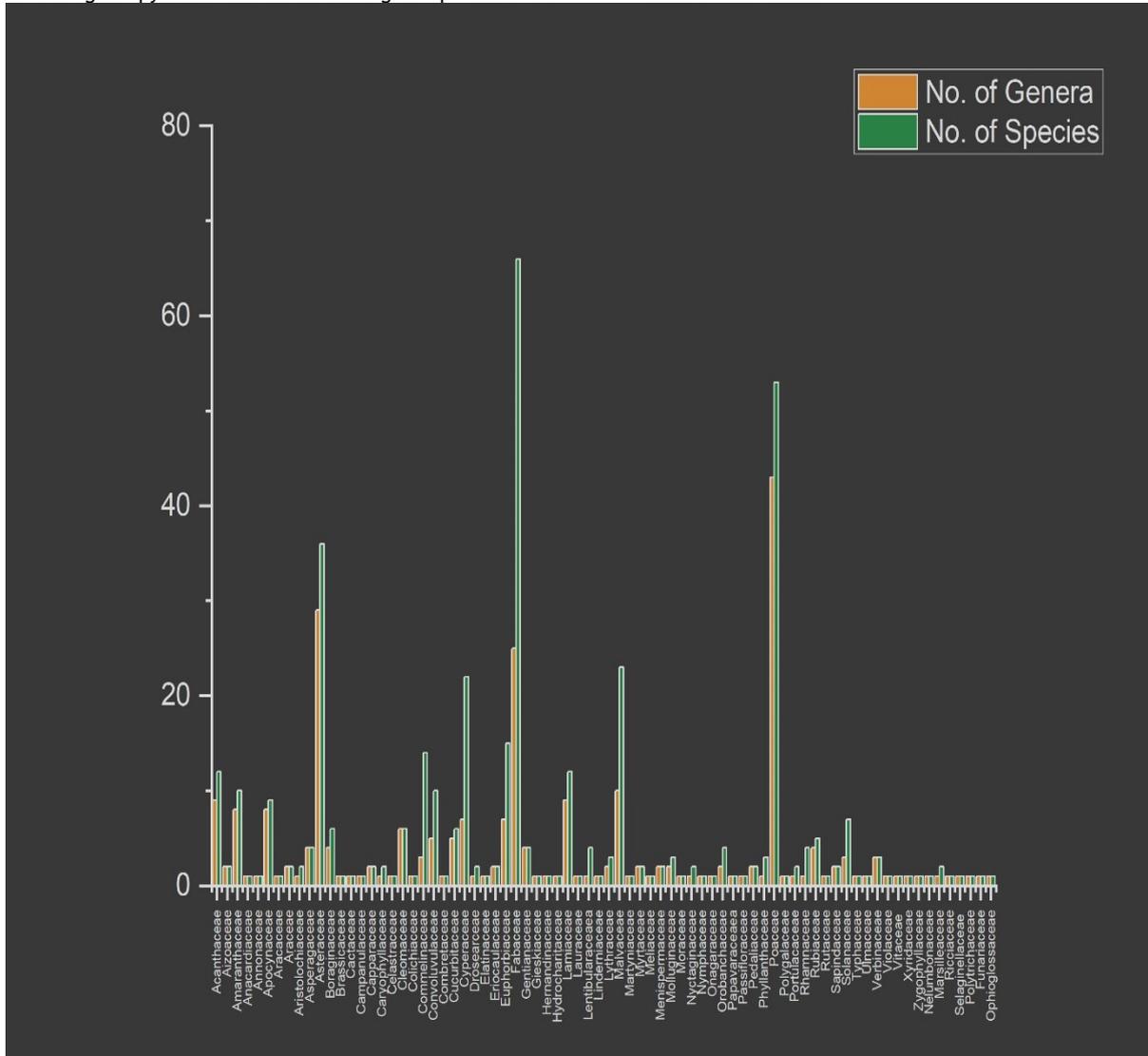
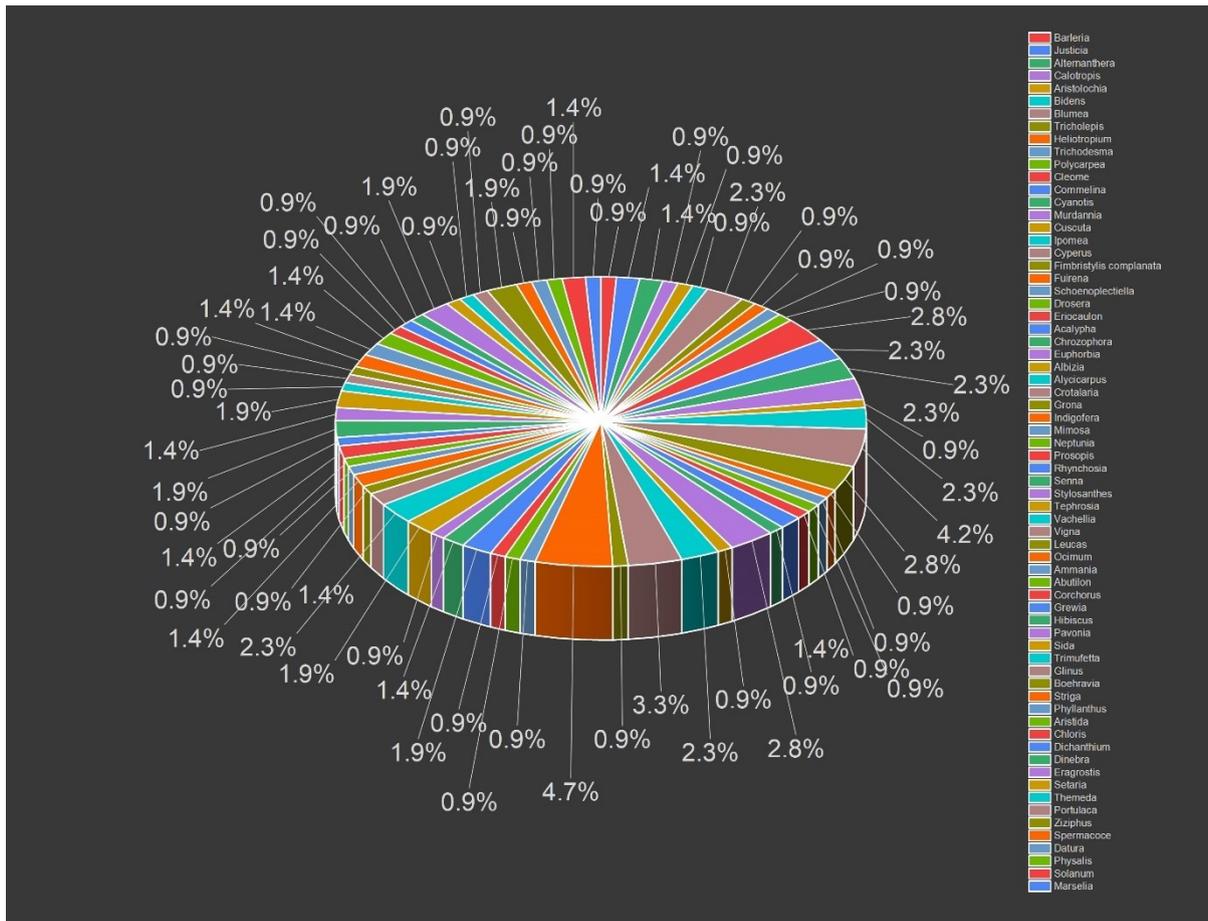


Figure 4: Family Wise Distribution-Floristic Diversity of Raichur

Enumerates 405 plant species belonging to 76 families from Kolanki Hills, Ashapur, Raichur District Karnataka India the species list given is supplemented by the distribution of species belonging to individual genus. Among the cited genus, Indigofera is listed as the most diverse with 10 identified species that inhabit the area to prove the area's versatility and productivity. Several genera have a large number of representatives: Cyperus (9 species) and Crotalaria (7 species) indicate the species specificity of this habitat. Among them, Fabaceae containing such genera as Indigofera, Crotalaria and Rhynchosia is numerous and shows that

nitrogen-fixing legumes dominate in the applicable area. Cyperaceae, represented by Cyperus and *Fimbristylis complanata*, reflects the region's microhabitat variability, particularly in moist and semi-aquatic zones. Numerous genera, including Barleria, Bidens and Calotropis, are represented by only two species each. This suggests either specialized ecological roles or limited adaptive ranges in the region. Genera like Cleome, Blumea and Vachellia (5-6 species each) suggest moderate abundance, playing a critical role in the ecological balance is shown in Figure 5



**Figure 5: Generic Level Distribution-Floristic Diversity of Raichur**

From the knowledge of the plant formations and species of Kolanki Hills during the study, the guilds evident particularly in diverse families like; Fabaceae and Cyperaceae infers that the vegetative diversity represents a multi-faceted dry deciduous area and wetland adjacent areas conducive to sustaining species and phylogenetic diversity (Gadagkar *et al.*, 1990). Euphorbia and Indigofera genera being typical of water stress in the region are key to climate change studies in semi-arid regions (Reddy *et al.*, 2002; Harha *et al.*, 2002).

A number of genera e.g. Drosera (insectivorous plants) and Aristolochia (butterflies' host plants) exemplify the urgency to preserve this world of biological richness. Globally, low-represented genera could be pushed to the brink due to habitat sensor/interference, stresses support for protective braces. Comparison with Other Studies: Other similar studies conducted in Karnataka have established similar genera including Senna and Sida in the Western Ghats and Deccan plateau regions and similar though distinct floricity but specific micro-adaptation in Kolanki Hills (Myers *et al.*, 2000).

## CONCLUSION

The study on the floristic diversity of Kolanki Hills revealed a rich biodiversity comprising 405 plant species across 76 families, showcasing the ecological importance of this region. The dominance of key genera such as Indigofera, Cyperus and Crotalaria, alongside the presence of less-represented taxa, highlights the ecological heterogeneity and adaptability of flora in semi-arid ecosystems. The diversity indices Shannon-Weiner Index (4.23), Simpson's Index (1.00) and Species Richness (0.70) indicate a highly diverse and balanced ecosystem. This richness supports various ecological functions, such as nutrient cycling and habitat provision for fauna. The prevalence of drought-resistant genera like Euphorbia and Indigofera demonstrates the adaptive mechanisms of the flora to withstand arid and semi-arid climatic conditions. The findings of Drosera and Aristolochia related to ecology and medicines point out the importance of conservation to protect the species and their

habitats from human impacts. Floristic patterns acting as a resource for future ecological and pharmacological studies are also considered. The highly diverse and less represented generations should also be protected in order to retain the ecosystems. Measures in the management of land and development of the natural environment for the preservation of Kolanki Hills should be used. This study serves as a reference for tracking the data concerning the changes in the diversity of species and underlines the biological and historical value of the territory. More studies and protection programs will be needed to preserve the biologically diverse area that this site represents.

## ACKNOWLEDGEMENT:

The authors would like to extend their deepest gratitude to Raviraju Balappa D, and Rakesh K for their invaluable time and insights, which were pivotal to this study's success. They also profoundly appreciate Sunrise University, Alwar, Rajasthan, for its institutional support. The authors are especially indebted to Helen Lalitha Kumari J James for their expert guidance and unwavering support, which were instrumental throughout the research process.

## REFERENCES

- A.K. Thakur, R. Kumar, R.K. Verma, Analysing India's current national forest inventory for biodiversity information, *Biodivers. Conserv.* 27 (12) (2018) 3049-3069.
- Ahmedullah, M. (2000). Endemism in the Indian flora. *Flora of India, Introductory*, 1(Part 2), 246-265.
- Arora, R. K. (1964). Phytogeographical notes on the humid tropics flora of India-world distribution and analysis of the woody dicotyledonous flora of Western Ghats and Assam.
- Bhandary, M. J., & Chandrashekar, K. R. (2003). Sacred groves of Dakshina Kannada and Udupi districts of Karnataka. *Current Science*, 85(12), 1655-1656.

- Champion, H. G., & Seth, S. K. (1968). A revised survey of the forest types of India. Manager of publications.
- Daniels, R. R. (2003). Biodiversity of the western ghats: An overview. *Wildlife and Protected Areas, Conservation of Rainforests in India*, 4, 25-40.
- Daniels, R. R. (2003). Impact of tea cultivation on anurans in the Western Ghats. *Current Science*, 85(10), 1415-1422.
- Dr. Prashant Kumar. Plant species diversity in Kolanki hills of Raichur, Karnataka, India. *Int J Home Sci* 2020;6(3):506-510.
- Gadagkar, R., Chandrashekara, K., & Nair, P. (1990). Insect species diversity in tropics: Sampling methods and a case study. *Journal of the Bombay Natural History Society*, 87(3), 337-353.
- Gadgil, M., & Vartak, V. D. (1975). Sacred groves of India - a plea for continued conservation. *Journal of the Bombay Natural History Society*, 72(2), 314-320.
- Gairola, S., Sharma, C. M., Ghildiyal, S. K., & Suyal, S. (2011). Live tree biomass and carbon variation along an altitudinal gradient in moist temperate valley slopes of the Garhwal Himalaya (India). *Current science*, 1862-1870.
- Gamble, J. S., & Fischer, G. E. G. (1967). *Presidency of Madras. Vol. II. Reprint*, 461.
- Harsha, V. H., Hebbar, S. S., Hegde, G. R., & Shripathi, V. (2002). Ethnomedical knowledge of plants used by the Kunabi Tribe of Karnataka in India. *Fitoterapia*, 73(4), 281-287.
- HC Shrishail, Siddappa Kakkalameeli, Madhura S, Yogashree G D, "Floristic Diversity of Raichur Fort Karnataka India", *International Journal of Science and Research (IJSR)*, Volume 9 Issue 9, September 2020, pp. 188-191, URL: <https://www.ijsr.net/getabstract.php?paperid=SR20827152225>.
- Hedge, V., Chandran, M. D. S., & Gadgil, M. (1998). Variation in bark thickness in a tropical forest community of Western Ghats in India. *Functional Ecology*, 313-318.
- Kent, M., & Coker, P. (1992). *Vegetation description and analysis, a practical approach*-John Wiley & Sons. New York, 319.
- Klimeš, L. (2003). Scale-dependent variation in visual estimates of grassland plant cover. *Journal of Vegetation Science*, 14(6), 815-821.
- Kohn, A. J. (1977). *Pielou, EC 1975. Ecological diversity. John Wiley & Sons, New York, viii+ 165 p. \$14.95.*
- Krebs, C. J. (1989). *Ecological methodology. (No Title).*
- L. Sharma Måren, *Managing biodiversity: impacts of legal protection in mountain forests of the Himalayas, Forests* 9 (8) (2018) 476, <https://doi.org/10.3390/f9080476>.
- Magurran, A. E. (2003). *Measuring biological diversity. John Wiley & Sons.*
- Mani, M. S. (1974). Biogeographical evolution in India. In *Ecology and biogeography in India* (pp. 698-724). Dordrecht: Springer Netherlands.
- Mueller-Dombois, D. (1974). *Aims and methods of vegetation ecology. John Wiley & Sons.*
- Mueller-Dombois, D., & Ellenberg, H. (2002). *Aims and methods of vegetation ecology. Caldwell.*
- Myers, N., Mittermeier, R. A., Mittermeier, C. G., Da Fonseca, G. A., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, 403(6772), 853-858.
- Pielou, E. C. (1966). The measurement of diversity in different types of biological collections. *Journal of Theoretical Biology*, 13, 131-144.
- Pielou, E. C. (1975). *Ecological diversity. John Wiley & Sons, 168.*
- Rao, R. R., & Razi, B. A. (1981). *A systematic flora of Mysore District. New Delhi: Today and Tomorrow Printers, 401-2.*
- Reddy, K. N., Rimando, A. M., Duke, S. O., & Nandula, V. K. (2008). Aminomethylphosphonic acid accumulation in plant species treated with glyphosate. *Journal of Agricultural and Food Chemistry*, 56(6), 2125-2130.
- Saldanha, C. J., & Larsen, K. (1996). *Flora of Karnataka. Vol. 2. Nordic Journal of Botany*, 16(6), 636-636.
- Savita R, Kotresha K. A Floristic Diversity of Maraladinni Village Forest Raichuru District, Karnataka. *J Plant Sci Res.* 2022;9(1): 217
- Seetharam, Y.N., Kotresha, K. & Uplankar, S.B. (2000). *Flora of Gulbarga District, Karnataka. Gulbarga University Gulbarga.*
- Sharma, C. M., Butola, D. S., Gairola, S., Ghildiyal, S. K., & Suyal, S. (2011). Forest utilization pattern in relation to the socio-economic status of people in the dudhatoli area of garhwal himalaya. *Forests, Trees and Livelihoods*, 20(4), 249-263.
- Taylor, D., Kent, M., & Coker, P. (1993). *Vegetation description and analysis: a practical approach. The Geographical Journal*, 159(2), 237.