Unveiling the Ecological Tapestry: Alpha Diversity Patterns in the Banas River Corridor, Gujarat

Abstract:

Alpha diversity, also known as α-diversity, refers to the diversity of species within a specific area, community, or ecosystem. In this study, an analysis of alpha diversity in the Banas River corridor of Gujarat was conducted using the quadrate sampling method. The flora of the Banas River corridor in Gujarat demonstrates moderate levels of species diversity, evenness, and richness, indicating a vibrant and diverse ecosystem. Total 133 tree and Shrub species were observed from area. The Shannon diversity index, which measures the variety of plant species present, yielded a value of 2.26. This indicates a reasonable level of species diversity within the area. The Simpson diversity index, which assesses the distribution of individuals among species, resulted in a value of 0.88, suggesting a balanced distribution and promoting a healthy ecosystem. Additionally, the evenness value of 0.92 indicates an equitable representation of species, ensuring that no single species dominates the flora and allowing for the coexistence of multiple species. The Menhinick index, which measures species richness, provided a value of 2.16, indicating a moderate level of species richness in the Banas River corridor. This suggests that the area is home to a diverse range of plant species. Overall, the data from the alpha diversity analysis highlights a diverse and stable ecosystem in the Banas River corridor, characterized by a vibrant mix of plant species. This diversity promotes ecological resilience and the coexistence of different species, contributing to the overall health and functioning of the ecosystem.

Keywords: Alpha diversity, Diversity indices, Banas River Corridor, Gujarat

1. Introduction

Diversity indices offer a more comprehensive understanding of community composition compared to solely assessing species richness, which is the count of species present. These indices account for the relative abundances of different species, shedding light on the rarity and commonness of species within a community [1]. By incorporating both species richness and relative abundances, diversity indices serve as vital tools for biologists seeking to unravel the complexities of community structure.

One specific type of diversity index is alpha diversity, also known as α-diversity. It characterizes the biodiversity within a particular area, community, or ecosystem by quantifying the species richness present [2]. Typically, alpha diversity is assessed by counting the number of distinct taxa, such as families, genera, and species, within the ecosystem. However, it is important to consider that estimates of species richness can be heavily influenced by sample size. Therefore, various statistical techniques can be employed to correct for sample size variations and obtain comparable diversity values.

The tree and shrub communities play a crucial role in the stability and functioning of the riverine ecosystem. They help prevent soil erosion by stabilizing riverbanks with their extensive root systems [3]. The roots also aid in water absorption, regulating water flow and contributing to flood control [4]. The shade provided by the canopy of trees and shrubs helps in maintaining optimal water temperature for aquatic organisms and reduces the impact of direct sunlight on the water body [5].

The Banas River corridor in Gujarat, India, is known for its rich biodiversity and hosts a variety of ecosystems, including the tree and shrub communities. These communities contribute significantly to the ecological dynamics and conservation priorities of the region. They provide critical habitat and resources for a diverse array of organisms, including birds, mammals, and insects, making them essential components of the overall biodiversity [6].

The tree and shrub communities of the Banas River corridor exhibit remarkable ecological significance due to their structural complexity, canopy cover, and species composition. These communities contribute to the overall biodiversity by providing shelter, food, and nesting sites for various animal species, including birds, mammals, and insects. Additionally, the trees and shrubs act as vital contributors to the riverine ecosystem, stabilizing riverbanks, preventing soil erosion, and regulating water flow.

The aim of this study is to assesses the alpha diversity of the tree and shrub communities within the Banas River corridor of Gujarat. Through the implementation of a comprehensive survey and the utilization of appropriate statistical techniques, the species richness of these communities will be quantified.

2. Study site

The Banas River basin has a catchment area of 8,674 km^2, with 3,269 km^2 located in Rajasthan and the remaining 5,405 km^2 located in Gujarat [7]. For the study area, only the area located within Gujarat state is considered. The Banas River originates in the Aravalli Hills of Rajasthan and flows in a south-western direction, covering a total length of 266 km, of which 78 km is in Rajasthan and 188 km is in Gujarat [7]. The Banas River corridor location map is presented in Figure 1, which depicts that the majority of the basin area, around 62.3%, falls within the Banaskantha district of Gujarat [7].

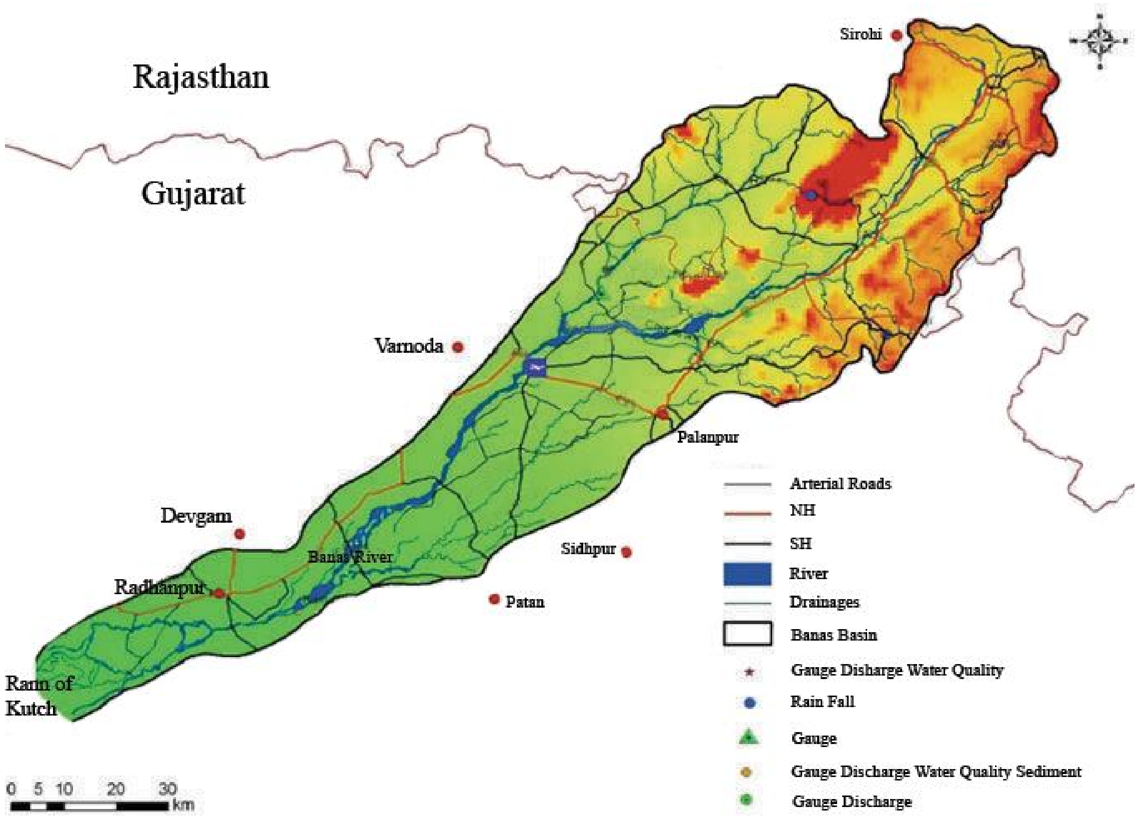

Figure 1: Location Map of Banas River Corridor (Sources: http://cgwb.gov.in/watershed/)

3. Methodology

The geomorphology of the entire *Banas* corridor varies significantly with very few trees visible and a salt marsh dominating the entire eastern border. To investigate the status of plant diversity and community structures, the study area was divided into four zones based on gradient (Table 1).

Table 1: Zonation of the Study site

Zones	Location
Zone - 1	Amirgadh - Dantiwada
Zone – 2	Dantiwada – Deesa – Kakrej
Zone – 3	Kankrej – Harij – Sami
Zone - 4	Sami – Radhanpur – Santalpur (The Little Rann of Kachchh)

The fieldwork spanned three years from January 2019 to December 2022 and community analysis was conducted during mid-monsoon and post-monsoon seasons when the plants were at their peak growth, as well as pre-monsoon season. Belt transect sampling was employed in this study to determine the distribution and density of plant species across the study area, with transects randomly placed to minimize bias and ensure representative sampling [8]. A total of 207 belt transects measuring 1km X 5m were randomly placed on opposite sides of the corridor in the study site. To study Tree species in each, transect a total of 5 quadrates of 5 X 5 m^2 were laid down. For collecting information in the field, separate data formats were developed for recording various parameters.

4. Alpha Diversity indices

(i) Shannon - Weaver Diversity Index (H): The Shannon diversity index (H) is another index that is commonly used to characterize species diversity in a community. Shannon's index accounts for both abundance and evenness of the species present. The proportion of species i relative to the total number of species (p_i) is calculated, and then multiplied by the natural logarithm of this proportion (lnp_i). The resulting product is summed across species, and multiplied by 1:

$$H^1 = -\sum p_i \ell n p_i \,;\, p_i = n_i / N$$

Where, p_i = the number of individuals in the i^{th} species, N = the total number of individuals, H^1 = Shannon Diversity Index.

(ii) Simpson diversity index: Simpson's diversity index is one of a number of diversity indices, used to measure diversity. In ecology, it is often used to quantify the biodiversity of a habitat. It takes into account the number of species present, as well as the relative abundance of each species. The Simpson index represents the probability that two randomly selected individuals in the habitat will not belong to the same species. The simplicity of Simpson's Diversity Index has led it to be used frequently.

For plant species the percentage cover in a square is usually used; the reason percentage cover used because it is usually very difficult to count all the individual plants. If p_i is the fraction of all organisms which belong to the i^{th} species, then Simpson's diversity index is most commonly defined as the statistic.

$$\text{Simpson Diversity Index } \Delta = \sum 1 - {P_i}^2$$

Where, $P_i = \frac{\eta_i}{N}$, η_i = No. of species individual in a community, N = Total no. of individuals, Δ = Diversity Index.

(iii) Menhinick Index (I): Menhinick's richness index demonstrate that the ratio of the number of taxa to the square root of sample size [9].

$$\text{Menhinick I } = S/\sqrt{N}$$

Where, S = Total no. of species in the community/sample/area, N = Total no. of individuals.

(iv) Pielou Index (e): The evenness index of the community (e)[10] was calculated by following:

$$e = H' / \ln S$$

Where, H' = Shannon Diversity Index.

5. Result and Discussion

5.1 Checklist of Tree and Shrub Species of Banas River Corridor, Gujarat

Total 133 Tree and Shrub species were observed in the study area (Table 2).

Table 2: Checklist of Tree and Shrub Species of Banas River corridor, Gujarat

Sr. No.	Species	Sr. No.	Species
1.	*Abelmoschus Manihot* (L.) Medik.	68.	*Ficus religiosa* L.
2.	*Abutilon indicum* (L.) Sweet	69.	*Gardenia turgida* Roxb.
3.	*Acacia chundra* (Roxb. ex Rottler) Willd.	70.	*Grewia hirsuta* Vahl
4.	*Acacia farnesiana* (L.) Willd.	71.	*Gmelina arborea* Roxb.
5.	*Acacia ferruginea* DC.	72.	*Grewia damine* Gaertn.
6.	*Acacia nilotica* (L.) Willd. ex Delile	73.	*Grewia flavescens* Juss.
7.	*Acacia Senegal* (L.) Willd.	74.	*Grewia tenax* (Forssk.) Fiori
8.	*Adhatoda vasica* Nees	75.	*Grewia tiliifolia* Vahl
9.	*Adina cordifolia* (Roxb.) Benth. & Hook.f. ex B.D.Jacks.	76.	*Helicteres isora* L.
10.	*Aegle marmelos* (L.) Corrêa	77.	*Holarrhena antidysenterica* Wall. ex A.DC.
11.	*Alangium salvifolium* (L.f.) Wangerin	78.	*Holoptelea integrifolia* (Roxb.) Planch.
12.	*Albizia lebbeck* (L.) Benth.	79.	*Hymenodictyon excelsum* Wall.
13.	*Albizia procera* (Roxb.) Benth.	80.	*Indigofera oblongifolia* Forssk.
14.	*Alianthus excelsa* Roxb.	81.	*Ipomoea fistulosa* Mart. ex Choisy
15.	*Anisomeles indica* (L.) Kuntze	82.	*Jatropha curcas* L.
16.	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr.	83.	*Kirganelia reticulata* (Poir.) Baill.
17.	*Anogeissus pendula Edgew.*	84.	*Lantana camara* L.
18.	*Anogeissus sericea* Brandis	85.	*Lepidagathis cuspidata* Nees
19.	*Balanites aegyptica* (L.) Delile	86.	*Leucaena leucocephala* (Lam.) de Wit
20.	*Bambusa arundinacea* Willd.	87.	*Limonia acidissima* Houtt.
21.	*Barleria prattensis* Santapau	88.	*Madhuka indica* J.F.Gmel.
22.	*Barleria prionitis* L.	89.	*Maytenus emarginata* (Willd.) Ding Hou
23.	*Bauhinia purpurea* L.	90.	*Melia azedarach* L.
24.	*Bauhinia racemose* Vahl	91.	*Mimosa hamata* Willd.
25.	*Bombax cieba* L.	92.	*Mitragyna parvifolia* Korth.
26.	*Boswellia serrata* Roxb.	93.	*Morinda tomentosa* B.Heyne
27.	*Breynia retusa* (Dennst.) Alston	94.	*Morus alba* L.
28.	*Bridelia retusa* (L.) A.Juss.	95.	*Opuntia elatior* Mill.
29.	*Butea monosperma* (Lam.) Kuntze	96.	*Parkinsonia aculeata* L.
30.	*Caesalpinia pulcherrima* (L.) Sw.	97.	*Pithecellobium dulce* (Roxb.) Benth.
31.	*Calotropis gigantea* (L.) Dryand.	98.	*Plumbago zeylanica* L.
32.	*Calotropis procera* (Aiton)	99.	*Prosopis cineraria* (L.) Druce

	Dryand.		
33.	*Capparis decidua* Edgew.	100.	*Prosopis juliflora (Sw.) DC.*
34.	*Capparis grandis* L.f.	101.	*Salvadora oleoides* Decne.
35.	*Capparis sepiaria* L.	102.	*Salvadora persica* L.
36.	*Carissa carandas* L.	103.	*Samanea saman* (Jacq.) Merr.
37.	*Cassia auriculata* L.	104.	*Sapindus emarginatus* Vahl
38.	*Cassia fistula* L.	105.	*Sesbania bispinosa* (Jacq.) W.Wight
39.	*Cassia occidentalis* L.	106.	*Sida acuta* Burm.f.
40.	*Cassia siamea* Lam.	107.	*Sida cordifolia* L.
41.	*Celastrus paniculatus* Willd.	108.	*Sida ovata* Forssk.
42.	*Clerodendron multiflorum* (Burm.f.) Kuntze	109.	*Sida retusa* L.
43.	*Cordia dichotoma* G.Forst.	110.	*Solanum indicum* L.
44.	*Cordia gharaf* Ehrenb. ex Asch.	111.	*Soymida febrifuga* (Roxb.) A.Juss.
45.	*Crateva religiosa* G.Forst.	112.	*Sterculia urens* Roxb.
46.	*Crotalaria juncea* L.	113.	*Syzygium cumini* (L.) Skeels
47.	*Crotalaria retusa* L.	114.	*Tamarindus indica* L.
48.	*Dalbergia latifolia* Roxb.	115.	*Tecomella undulata* Seem.
49.	*Dalbergia paniculata* Roxb.	116.	*Tephrosia purpurea* (L.) Pers.
50.	*Dalbergia sissoo* Roxb. ex DC.	117.	*Tephrosia senticosa* Pers.
51.	*Datura innoxia* Mill.	118.	*Tephrosia villosa (L.) Pers.*
52.	*Datura metel* L.	119.	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.
53.	*Dendrocalamus strictus* Nees	120.	*Terminalia bellirica* (Gaertn.) Roxb.
54.	*Dendrophthoe falcata* (L.f.) Ettingsh.	121.	*Terminalia crenulata* Roth
55.	*Derris indica* (Lam.) Benn.	122.	*Tectona grandis* L.f.
56.	*Dichrostachys cinerea* (L.) Wight & Arn.	123.	*Triumfetta rotundifolia* Lam.
57.	*Diospyros melanoxylon* Roxb.	124.	*Triumfetta rhomboidea* Jacq.
58.	*Ehretia laevis* Roxb.	125.	*Triumfetta pentandra* A.Rich.
59.	*Emblica officinalis* Gaertn.	126.	*Vitex negundo* L.
60.	*Eranthemum roseum* R.Br.	127.	*Waltheria indica* L.
61.	*Erythrina suberosa* Roxb.	128.	*Withania somnifera* (L.) Dunal
62.	*Euphorbia neriifolia* L.	129.	*Woodfordia fruticosa* Kurz
63.	*Euphorbia nivulia* Buch.-Ham.	130.	*Wrightia tinctoria* R.Br.
64.	*Euphorbia tirucalli* L.	131.	*Ziziphus mauritiana* Lam.
65.	*Ficus benghalensis* L.	132.	*Ziziphus nummularia* (Burm.f.) Wight & Arn.
66.	*Ficus hispida* L.f.	133.	*Ziziphus xylopyrus* (Retz.) Willd.
67.	*Ficus racemosa* L.		

5.2 Zone-1

Species diversity (Shannon diversity H') among trees & shrubs was highest in transect no.18 (2.793) while lowest in transect no.68 (2.128). Highest Simpson diversity was found in transect no.65 (0.933) while lowest in transects no.62 (0.86). Along with the species diversity, species richness and evenness were also measured. As mentioned, species richness was found highest in transect no.18(3.307) and lowest in transect no.42 (1.89) as well as evenness was found highest in transect no.61(0.98) while lowest in transect no. 62(0.84) (Table 3) Overall, the data suggests that the flora of this zone exhibits a moderate to high level of species diversity, with a relatively balanced and diverse distribution of species. The higher values of species diversity, richness, and evenness indicate a richer and more diverse flora, while the lower values suggest a comparatively lower species richness and potentially a dominance of certain species.

Table 3: Zone□1 – Alpha Diversity indices of Tree and Shrub Species

Transect No.	Shannon_H	Simpson_1-D	Evenness_e^H/S	Menhinick
T-1	2.26	0.89	0.96	2.00
T-2	2.48	0.91	0.92	2.55
T-3	2.67	0.92	0.90	2.92
T-4	2.46	0.91	0.90	2.60
T-5	2.51	0.91	0.88	2.80
T-6	2.58	0.92	0.94	2.60
T-7	2.68	0.92	0.91	3.08
T-8	2.53	0.91	0.90	2.69
T-9	2.71	0.93	0.94	2.83
T-10	2.48	0.91	0.92	2.65
T-11	2.63	0.92	0.93	2.65
T-12	2.70	0.93	0.93	2.79
T-13	2.60	0.92	0.90	2.89
T-14	2.76	0.93	0.88	3.13
T-15	2.69	0.93	0.92	2.87
T-16	2.67	0.92	0.90	2.92
T-17	2.73	0.93	0.90	3.10
T-18	2.79	0.93	0.86	3.31
T-19	2.41	0.90	0.85	2.46
T-20	2.65	0.93	0.94	2.69
T-21	2.54	0.91	0.91	2.56
T-22	2.58	0.92	0.94	2.60
T-23	2.36	0.90	0.96	2.25
T-24	2.51	0.92	0.95	2.60
T-25	2.58	0.92	0.94	2.40
T-26	2.56	0.92	0.92	2.40
T-27	2.55	0.92	0.91	2.56
T-28	2.47	0.91	0.91	2.46
T-29	2.51	0.92	0.95	2.41
T-30	2.55	0.92	0.92	2.44
T-31	2.50	0.91	0.94	2.50

T-32	2.27	0.89	0.88	2.12
T-33	2.55	0.92	0.92	2.69
T-34	2.55	0.92	0.91	2.48
T-35	2.52	0.92	0.95	2.46
T-36	2.45	0.91	0.89	2.50
T-37	2.70	0.92	0.87	2.87
T-38	2.36	0.90	0.96	2.20
T-39	2.30	0.89	0.91	2.12
T-40	2.43	0.91	0.95	2.27
T-41	2.48	0.91	0.92	2.41
T-42	2.23	0.89	0.93	1.89
T-43	2.46	0.91	0.98	2.23
T-44	2.52	0.92	0.96	2.65
T-45	2.48	0.91	0.92	2.65
T-46	2.61	0.92	0.91	2.54
T-47	2.59	0.92	0.88	2.65
T-48	2.73	0.93	0.90	2.92
T-49	2.36	0.90	0.96	2.08
T-50	2.53	0.92	0.96	2.55
T-51	2.50	0.91	0.94	2.34
T-52	2.49	0.91	0.93	2.34
T-53	2.27	0.89	0.88	2.12
T-54	2.71	0.93	0.93	2.53
T-55	2.43	0.91	0.94	2.09
T-56	2.70	0.93	0.93	2.79
T-57	2.59	0.92	0.95	2.51
T-58	2.40	0.90	0.92	2.27
T-59	2.47	0.91	0.98	2.19
T-60	2.42	0.91	0.94	2.19
T-61	2.69	0.93	0.98	2.40
T-62	2.14	0.87	0.85	1.96
T-63	2.61	0.92	0.97	2.69
T-64	2.44	0.91	0.95	2.16
T-65	2.78	0.93	0.90	2.92
T-66	2.34	0.89	0.87	2.45
T-67	2.35	0.90	0.95	2.04
T-68	2.13	0.88	0.93	1.96
T-69	2.62	0.92	0.91	2.57
T-70	2.38	0.90	0.90	2.40

5.3 Zone-2

Shannon diversity among trees & shrubs was highest in transect no.77 (2.783) while lowest in transect no.104 (2.038) this indicates a moderate to high level of species diversity in the flora of the zone. Simpson diversity was found highest in transect no. 77 (0.93) and lowest in transect no. 104 (0.85) these values suggest a relatively high level of species diversity and evenness in the flora. Species richness was found highest in transect no. 77 (3.043) and lowest in transect no.99(1.826) indicating a variation in the number of different species present in the flora. While evenness was found highest in transect no.100(0.96) and lowest in transect no. 104 (0.85) suggesting a variation in the relative abundance of different species. (Table 4).

Table 4: Zone□2 – Alpha Diversity indices of Tree and Shrub Species

Transect No.	Shannon_H	Simpson_1-D	Evenness_e^H/S	Menhinick
T-71	2.40	0.90	0.92	2.31
T-72	2.55	0.92	0.92	2.69
T-73	2.28	0.89	0.89	2.29
T-74	2.26	0.89	0.96	2.13
T-75	2.40	0.90	0.92	2.27
T-76	2.66	0.93	0.95	2.57
T-77	2.78	0.93	0.90	3.04
T-78	2.35	0.90	0.88	2.27
T-79	2.30	0.89	0.91	2.25
T-80	2.54	0.92	0.91	2.60
T-81	2.51	0.92	0.95	2.41
T-82	2.43	0.91	0.95	2.35
T-83	2.51	0.91	0.94	2.50
T-84	2.22	0.89	0.92	2.24
T-85	2.67	0.93	0.91	2.97
T-86	2.63	0.92	0.92	2.79
T-87	2.40	0.90	0.92	2.35
T-88	2.59	0.92	0.95	2.48
T-89	2.20	0.88	0.90	2.18
T-90	2.63	0.92	0.93	2.69
T-91	2.56	0.92	0.93	2.56
T-92	2.53	0.91	0.90	2.44
T-93	2.30	0.89	0.91	2.25
T-94	2.25	0.89	0.95	2.00
T-95	2.20	0.88	0.90	1.96
T-96	2.29	0.89	0.90	2.12
T-97	2.37	0.90	0.89	2.35
T-98	2.45	0.91	0.89	2.50

T-99	2.21	0.88	0.91	1.83
T-100	2.36	0.90	0.96	2.25
T-101	2.69	0.93	0.92	2.63
T-102	2.40	0.90	0.92	2.12
T-103	2.51	0.91	0.94	2.55
T-104	2.04	0.85	0.85	2.18
T-105	2.33	0.90	0.94	2.12

5.4 Zone-3

Species diversity (Shannon diversity H') among trees & shrubs was highest in transect no.155 (2.416) while lowest in transect no.162 (1.265). Highest Simpson diversity was found in transect no.112 (0.905) while lowest in transects no.162 (0.69). Species richness was found highest in transect no.121 (2.345) and lowest in transects no.160 & 162(1.15) as well as evenness was found highest in transect no.116 (0.99) while lowest in transect no.142 (0.818) (Table 5). Overall, it demonstrates a moderate to high level of species diversity, with relatively balanced distributions of species.

Table 5: Zone□3 – Alpha Diversity indices of Tree and Shrub Species

Transect No.	Shannon_H	Simpson_1-D	Evenness_e^H/S	Menhinick
T-106	2.01	0.86	0.94	1.89
T-107	2.32	0.90	0.93	2.20
T-108	2.03	0.87	0.95	1.79
T-109	2.10	0.87	0.91	2.01
T-110	2.14	0.88	0.94	2.12
T-111	2.14	0.88	0.95	1.77
T-112	2.38	0.91	0.98	2.20
T-113	2.26	0.89	0.96	2.00
T-114	2.21	0.88	0.91	2.04
T-115	2.11	0.87	0.92	1.92
T-116	1.94	0.86	0.99	1.57
T-117	1.64	0.77	0.85	1.50
T-118	2.20	0.88	0.91	2.00
T-119	1.93	0.83	0.86	1.75
T-120	2.24	0.89	0.94	2.13
T-121	2.37	0.91	0.98	2.35
T-122	1.86	0.84	0.92	1.75
T-123	1.99	0.85	0.91	1.89
T-124	2.05	0.87	0.97	1.71
T-125	2.23	0.89	0.93	2.00
T-126	2.17	0.87	0.87	2.00
T-127	1.73	0.81	0.94	1.34

T-128	1.80	0.81	0.87	1.75
T-129	2.26	0.89	0.96	2.09
T-130	2.22	0.88	0.92	2.09
T-131	2.13	0.88	0.93	2.01
T-132	2.01	0.86	0.94	1.89
T-133	2.07	0.86	0.88	1.92
T-134	2.00	0.85	0.92	1.57
T-135	1.86	0.83	0.91	1.61
T-136	1.86	0.84	0.92	1.57
T-137	2.20	0.88	0.90	2.09
T-138	2.26	0.89	0.96	2.09
T-139	2.12	0.87	0.92	1.80
T-140	1.68	0.79	0.89	1.55
T-141	1.31	0.72	0.93	1.33
T-142	1.88	0.81	0.82	1.89
T-143	2.11	0.87	0.92	1.92
T-144	1.83	0.83	0.89	1.87
T-145	1.93	0.85	0.98	1.65
T-146	2.13	0.88	0.93	1.96
T-147	1.88	0.84	0.94	1.65
T-148	2.05	0.87	0.97	1.71
T-149	1.70	0.80	0.91	1.41
T-150	1.67	0.79	0.89	1.66
T-151	1.70	0.80	0.91	1.41
T-152	1.82	0.82	0.88	1.53
T-153	2.01	0.86	0.93	1.94
T-154	1.52	0.76	0.91	1.25
T-155	2.42	0.91	0.93	2.31
T-156	1.85	0.83	0.91	1.57
T-157	1.85	0.83	0.91	1.57
T-158	2.01	0.86	0.94	1.84
T-159	2.03	0.86	0.95	1.89
T-160	1.36	0.74	0.97	1.16

5.5 Zone-4

Shannon diversity among trees & shrubs was highest in transect no.194 (2.42) while lowest in transect no.165 (1.71) as well as Simpson diversity was found highest in transect no. 194 (0.90) and lowest in transect no. 196 (0.78). Species richness was found highest in transect no.184 (2.44) and lowest in transect no.166 (1.376) while evenness was found highest in transect no.166 (0.99) and lowest in transect no. 196 (0.80) (Table 6). Overall, the data suggests that the flora of this zone also exhibits a moderate to high level of species diversity, with a relatively balanced and diverse distribution of species. The higher values of species diversity, richness, and evenness indicate a richer and more diverse flora, while the lower values suggest a comparatively lower species richness and potentially a dominance of certain species.

Table 6: Zone□3 – Alpha Diversity indices of Tree and Shrub Species

TRANSECT NO.	Shannon_H	Simpson_1-D	Evenness_e^H/S	Menhinick
T-164	2.22	0.89	0.92	2.04
T-165	1.72	0.80	0.93	1.50
T-166	1.79	0.83	0.99	1.38
T-167	2.07	0.87	0.99	1.71
T-168	2.40	0.90	0.92	2.27
T-169	2.38	0.90	0.90	2.31
T-170	1.89	0.84	0.95	1.46
T-171	2.25	0.89	0.95	1.96
T-172	2.12	0.87	0.93	1.84
T-173	2.12	0.87	0.93	1.92
T-174	2.24	0.89	0.94	2.09
T-175	2.02	0.84	0.83	2.01
T-176	2.02	0.86	0.94	1.79
T-177	2.25	0.89	0.95	2.24
T-178	2.18	0.89	0.98	1.84
T-179	1.85	0.83	0.91	1.65
T-180	2.11	0.87	0.91	2.07
T-181	1.96	0.84	0.88	1.94
T-182	1.94	0.84	0.87	1.84
T-183	2.07	0.87	0.99	1.71
T-184	2.24	0.89	0.94	2.18
T-185	2.25	0.89	0.95	1.96
T-186	1.99	0.85	0.91	1.79
T-187	2.11	0.87	0.91	2.07
T-188	2.26	0.89	0.96	2.29
T-189	2.39	0.90	0.91	2.31
T-190	2.23	0.89	0.93	1.96
T-191	1.87	0.84	0.93	1.75
T-192	2.15	0.88	0.96	1.96
T-193	2.00	0.86	0.93	1.89
T-194	2.42	0.91	0.94	2.45
T-195	2.06	0.86	0.87	1.96
T-196	1.74	0.79	0.81	1.61
T-197	1.77	0.80	0.84	1.65

T-198	2.01	0.85	0.83	2.01
T-199	2.38	0.90	0.90	2.19
T-200	2.14	0.88	0.94	1.92
T-201	2.17	0.87	0.87	1.93
T-202	2.28	0.90	0.98	1.96
T-203	2.00	0.85	0.92	1.67
T-204	1.99	0.85	0.91	1.79
T-205	1.85	0.83	0.91	1.65
T-206	2.08	0.86	0.89	1.96
T-207	2.16	0.88	0.96	1.88

5.6 Overall

Table 7: Alpha Diversity indices of Tree and Shrub Species of Banas River Corridor

Diversity Indices	Trees & Shrubs
Shannon_H	2.26
Simpson_1-D	0.88
Evenness_e^H/S	0.92
Menhinick	2.16

The Shannon diversity index value of 2.26 (Table 7) suggests a moderate level of species diversity in the flora of this area. This indicates that there is a reasonable variety of species present.

The Simpson diversity index value of 0.88 (Table 7) indicates a moderate level of species diversity and evenness in the flora. This suggests that the distribution of individuals among species is relatively balanced, with no single dominant species.

The evenness value of 0.92 (Table 7) suggests a relatively even distribution of individuals among species in the flora of this zone. This means that no particular species is significantly more abundant than others, resulting in a balanced representation of different species.

The Menhinick index value of 2.16 (Table 7) indicates a moderate species richness in the flora of this zone. This suggests a reasonable number of different species present, although it does not provide information about the abundance of each species.

6. Conclusion

The data suggests that the flora of the Banas River corridor in Gujarat exhibits a moderate level of species diversity and evenness. The presence of a diverse range of plant species indicates a rich and vibrant ecosystem within the corridor. This diversity contributes to the overall health and stability of the ecosystem, allowing for a balanced distribution of individuals among different species. Such equilibrium promotes coexistence and interactions among various plants, fostering a thriving and harmonious environment. The Banas River corridor showcases the beauty and resilience of nature, highlighting the intricate web of life supported by the diverse flora found within this region.

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