Original Research Article

Exploring Tree Communities in the Ecologically Significant Banas River Corridor of Gujarat: A Phytosociological Analysis

Abstract:

The findings of a phytosociological study conducted in the Banas River Corridor of Gujarat, India, are presented in this article.The primary objectives of the study were to identify, characterize, and classify the naturally occurring vegetation community in the area. Standard procedures were followed for vegetation sampling and data analysis, which resulted in the documentation of 70 tree species. The IVI value indicated that *Prosopisjuliflora* was the most successful and well-established species in the area. The recorded species were found to have contiguous distribution within the study area, and the overall vegetation community was observed to be heterogeneous. However, human activities such as fire incidence, livestock grazing, and other disturbances have led to the depletion of the forest's old and uneven age structure. The study provides crucial baseline information on the dry forests of the Banas River Corridor, highlighting the need for appropriate conservation and management practices to improve the botanical value of the area and its significance for other life forms.

Keywords: Tree Species, Community characters, IVI, Banas River Corridor, Gujarat.

Comment [HR1]: An Abstracts should contain all part of the article in short in a scientific paper
So that this paper lack
1.Background of the research paper
2.

Comment [HR2]: The reader need to know this standard data collection and analysis methods so it is better to mention few

Comment [HR3]: Please indicate the family and genera distribution in addition to total species and habit diversity is also mandatory

Comment [HR4]: Indicate the frequency distribution classes to see the distribution of plants were heterogeneous and homogeneous

1. Introduction

Comment [HR5]: The introduction lack describing about floristic composition versus Phytosociology, and why you give emphasis to phytosociology of the tree species alone.

The Banas River corridor is a significant ecological region in Gujarat, India, that is home to a diverse range of plant species. The vegetation of this area is influenced by the river's flow, soil type, and other environmental factors. The study of vegetation in this area has become increasingly important due to the ecological significance of the Banas River corridor and the potential impact of human activities on its biodiversity.

Phytosociology is the study of plant communities and their interactions with the environment. It is a vital tool for understanding the distribution, abundance, and diversity of plant species in a given area. Phytosociological analysis of the trees in the Banas River corridor can provide valuable insights into the structure and composition of this region's plant communities.

Several studies have been conducted on the vegetation of the Banas River corridor, including studies on the distribution and diversity of plant species [1,2]. However, there is a lack of research specifically focused on the phytosociology of the tree species in this area.

Therefore, the aim of this study is to conduct a phytosociological analysis of the trees in the Banas River corridor of Gujarat, India. The study will provide valuable information on the structure and composition of the tree communities in this region, including their species richness.

The findings of this study will contribute to our understanding of the ecological importance of the Banas River corridor and the conservation of its biodiversity. It will also provide a baseline for future studies on the vegetation of this area and serve as a reference for the development of management and conservation strategies.

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 [3]. 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 [3]. 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 [3].

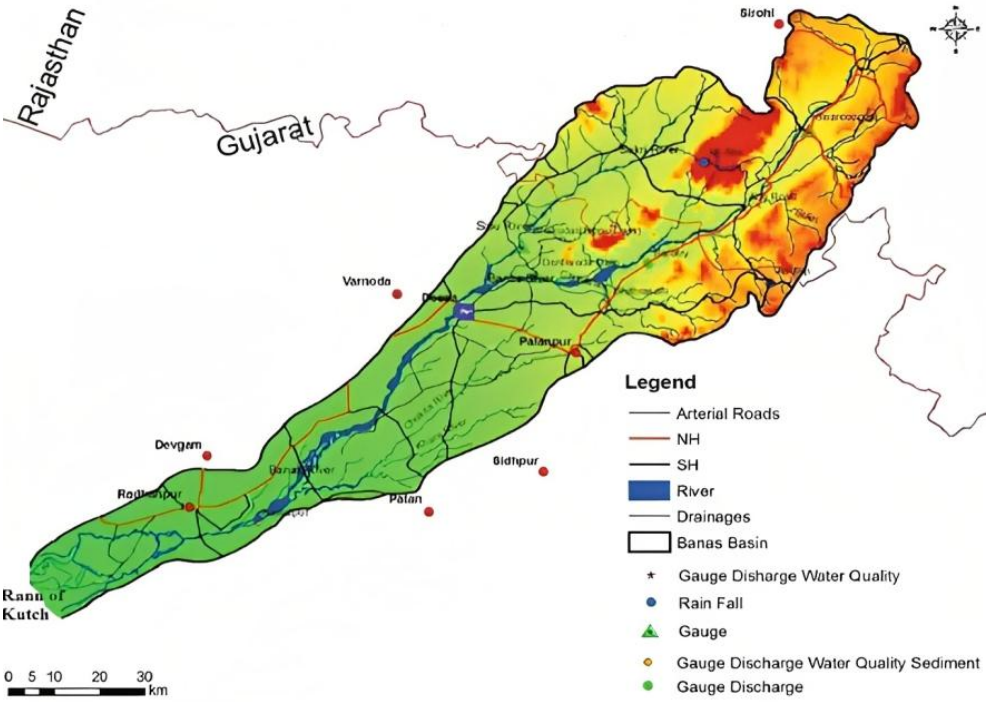

Figure 1: Location Map of Banas River Corridor (Sources: http://cgwb.gov.in/watershed/)

Comment [HR6]: Where is the absolute location of the area ???

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).

Comment [HR7]: If your base is gradient make it the classification scientific and hence add altitude otherwise it become traditional classification

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 LittleRann 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[4].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^2were laid down.For collecting information in the field, separate data formats were developed for recording various parameters.

Comment [HR8]: Why belt transect is selected?? Give brief reason based on the topography and altitude of the area

Comment [HR9]: The number of transect and quadrate number should be decided based on the size of your study area. For Phytosociological study a researcher should include 3-5% of sampled area of its total. This might represent the whole.

Comment [HR10]: This area is very small unless the tree is dense.

4. Phytosociological Measures

To determine the existing species richness and diversity in the study area, standard protocols outlined by Curtis & McIntosh [5] and Muller-Dombois&Ellenberg [10] were employed. The calculation of frequency, density, abundance, and Important Value Index (IVI) requires the use of the following formulas.

$$Density = \frac{Total\ No.of\ Individuals\ in\ all\ Sampling\ units}{Total\ No.of\ Sampling\ unit\ Studied}$$

$$\%Frequency = \frac{No.of\ Sampling\ unit\ in\ which\ Species\ Occured}{Total\ No.of\ Sampling\ units}\ X\ 100$$

$$Abundance = \frac{Total\ No.of\ Indiviuals\ in\ all\ Sampling\ units}{No.of\ Sampling\ units\ in\ which\ Species\ Occured}$$

$$\%Relative\ Density = \frac{Density\ value\ of\ Species}{Sum\ of\ Density\ value\ of\ all\ Species}\ X\ 100$$

$$\%Relative\ Frequency = \frac{Frequency\ value\ of\ Species}{Sum\ of\ Frequency\ value\ of\ all\ Species}\ X\ 100$$

$$\%Relative\ Abundance = \frac{Abundance\ value\ of\ Species}{Sum\ of\ Abundance\ value\ of\ all\ Species}\ X\ 100$$

$$\%Relative\ Dominance = \frac{Total\ Basal\ Area\ of\ the\ Species}{Total\ Basal\ Area\ of\ all\ Species}\ X\ 100$$

$$Basal\ Area = \frac{(DBH)^2}{4\pi}\ ,Where\ DBH = Diameter\ at\ Breast\ Heigh$$

$$IVI = Relative\ Frequency + Relative\ Density + Relative\ Dominance$$

Comment [HR11]: The formula of basal area is not correct please check it. It should be $Basal\ Area = \frac{\pi(DBH)^2}{4}$

5. Result and Discussion

5.1 Zone-1

5.1.1 Density and Frequency

In this particular zone, a total of 66 tree species were documented. Among them, the top five species with the highest density were *Buteamonosperma, Wrightiatinctoria, Derris indica, Diospyrosmelanoxylon*, and *Anogeissuslatifolia*. *Terminaliabellirica* and *Terminaliacrenulata* had the lowest density. *Buteamonosperma* was found to be the most frequently occurring species, with a frequency of 100%, followed by *Wrightiatinctoria*, which had a frequency of 50%. On the other hand, *Terminaliabellirica* and

Terminaliacrenulata were found to have the lowest frequency, with only 1.43% each (Appendix 1).

Table 2 shows the distribution of frequency in Raunkiaer's classes [7].The majority of species (90.90%) belong to class A while 6.06% of species belong to class B, and 1.51% of species belong to class C and class E each (Table 2).

The studied area is characterized by a mixed deciduous forest that exhibits a considerable variety of tree species. However, the distribution of these species is not evenly spread, as some have a greater density than others. The variation in tree density can be attributed to various factors such as micro-habitat conditions, topography, soil quality, and other environmental characteristics. Additionally, the level of canopy cover in this forest also varies across different parts of the area.

Table 2: Frequency class of Trees of Zone-1

Class	Range	No.ofSpecies	%
A	0-20	60	90.90
B	21-40	4	6.06
C	41-60	1	1.51
D	61-80	0	0
E	81-100	1	1.51
	TOTAL	**66**	**100**

Comment [HR12]: High frequency in Lower frequency class and low frequency in the higher frequency class distribution indicates the tree in the area is heterogeneous. This result need scientific explanation in relation to the continuity and different anthropogenic and natural factors exist in that specific area

5.1.2 Abundance

Two species of the *Acacia* Genus, *Acacianilotica*and *Acacia senegal*recorded with the highest abundance of 2.40 while a total of 18 species with the lowest abundance of 1.00 is recorded from this particular zone (Appendix 1).

Comment [HR13]: Recently the genius Acacia is changed in to Vachellia

In this specific zone, all the species, which account100%, are categorized as very rare, (Table 3).

Table 3: %Relative Abundance of Trees of Zone-1

Sr.No.	%Relative Abundance	No.ofSpecies	%
1	VeryRare–1–5%	66	100
2	Rare–6–10%	0	0
3	Not Common –11 –20%	0	0
4	Common –21 –40%	0	0
5	MoreCommon–41–60%	0	0
6	Abundant-61-80%	0	0
7	MostAbundant-81-100%	0	0
	Total	**66**	**100**

5.1.3 Basal Area

The maximum basal area was recorded in *Ficusbenghalensis* (6007.41 cm^2) followed by *Madhukaindica* (4054.38 cm^2). While the minimum was recorded in *Zizyphusmauritiana* (467.36 cm^2) followed by *Zizyphusnummularia* (591.93 cm^2) in the area (Appendix 1).

5.1.4 IVI

During the study, it was observed that *Buteamonosperma* exhibited the highest percentage of IVI (28.40%), implying that it is the most dominant species in the zone. *Wrightiatinctoria* was the second most dominant species, with a percentage of 19.65%, indicating that it is also well-adapted to the environmental conditions of the area. Conversely, *Parkinsonia aculeate* and *Morusalba* had the lowest percentage of IVI, with 1.17% and 1.40%, respectively, indicating that they are less adapted to the environmental conditions of the zone compared to the other species.

5.2 Zone-2

5.2.1 Density and Frequency

In this particular zone, a total of 58 tree species were documented. Among them, the top specie with the highest density is*Prosopisjuliflora*followed *by Acacia nilotica*. While 8 species had the lowest density of 0.03.*Acacia nilotica*was found to be the most frequently occurring species, with a frequency of 28.57%, followed by*Prosopisjuliflora*and*Ficusracemosa*, which had a frequency of 25.71%. On the other hand, 8 species were found to have the lowest frequency, with only 2.86% each (Appendix 1).

87.93% of species belong to class A while 12.06% of species belong to class B (Table 4). The high density and frequency of *Prosopisjuliflora* in the area indicate that this alien species has proliferated in the zone. The majority of species belong to low-frequency range class which indicates the scattered distribution of trees in this zone.

Table 4: Frequency class of Trees of Zone-2

Class	Range	No.ofSpecies	%
A	0-20	51	87.93
B	21-40	7	12.06
C	41-60	0	0
D	61-80	0	0
E	81-100	0	0
	TOTAL	**58**	**100**

5.2.2 Abundance

Prosopisjuliflorawas recorded with the highest abundance of 4.11 followed by *Acacia nilotica*(3.10) *and Prosopis cineraria* (2.75).~~while~~While a total of 21 species with the lowest abundance of 1.00 is recorded from this particular zone (Appendix 1).

In this specific zone, the majority of species, which accounts for 96.55%, are categorized as very rare, while 3.44% of species are classified as rare (Table 5).

Table 5: %Relative Abundance of Trees of Zone-2

Sr.No.	%Relative Abundance	No.ofSpecies	%
1	VeryRare–1–5%	56	96.55
2	Rare–6–10%	2	3.44
3	Not Common –11 –20%	0	0
4	Common –21 –40%	0	0
5	MoreCommon–41–60%	0	0
6	Abundant-61-80%	0	0
7	MostAbundant-81-100%	0	0
	Total	**58**	**100**

5.2.3 Basal Area

Maximum basal area was recorded in *Madhukaindica* (5975.86 cm^2) followed by *Sterculiaurens* (6500.59 cm^2) while the minimum area was recorded in *Zizyphusnummularia* (426.95 cm^2) followed by *Brideliaretusa* of 440.93 cm^2 (Appendix 1).

5.2.4 IVI

highest percent of IVIof *Acacia nilotica*(15.66%) and*Prosopisjuliflora* (15.34%) represents their ecological successfulness for this zone. While*Acacia farnesiana* occurred with the lowest percentage of IVI (1.22%) followed by *Vitexnegundo* (1.28%) in the Zone.

5.3 Zone-3

5.3.1 Density and Frequency

In this particular zone, a total of 41 tree species were documented. Among them, the top specie with the highest density is *Prosopisjuliflora* followed by *Acacia nilotica* and *Zizyphusmauritiana*. While 5 species had the lowest density of 0.02.*Prosopisjuliflora*was found to be the most frequently occurring species, with a frequency of 77.59% indication its invasion to this zone also, followed by *Zizyphusmauritiana*(34.48%) and *Acacia nilotica*(32.76%). On the other hand, 8 species were found to have the lowest frequency, with only 1.72% each (Appendix 1).

87.80% of species belong to class A while 9.75% of species belong to class B and 2.43% of species belong to class D (Table 6).

Table 6: Frequency class of Trees of Zone-3

Class	Range	No.ofSpecies	%
A	0-20	36	87.80
B	21-40	4	9.75
C	41-60	0	0
D	61-80	1	2.43
E	81-100	0	0
	TOTAL	**41**	**100**

5.3.2 Abundance

Prosopisjuliflora was recorded with the highest abundance of 4.42 followed by *Acacia nilotica*(2.74) *and Wrightiatinctoria*(2.50).while a total of 13 species with the lowest abundance of 1.00 is recorded from this particular zone (Appendix 1).

In this specific zone, the majority of species, which accounts for 97.56%, are categorized as very rare, while 2.43% of species are classified as rare (Table 7) contributing to the scattered tree vegetation of this area.

Table 7: %Relative Abundance of Trees of Zone-3

Sr.No.	%Relative Abundance	No.ofSpecies	%
1	VeryRare–1–5%	40	97.56
2	Rare–6–10%	1	2.43
3	Not Common –11 –20%	0	0
4	Common –21 –40%	0	0
5	MoreCommon–41–60%	0	0
6	Abundant-61-80%	0	0
7	MostAbundant-81-100%	0	0
	Total	**41**	**100**

5.3.3 Basal Area

Maximum basal area was recorded in *Sterculiaurens* (6500.59 cm^2) followed by *Madhukaindica* (5975.86 cm^2) while the minimum area was recorded in *Zizyphusnummularia* (426.95 cm^2) followed by *Brideliaretusa*of 440.93 cm^2 (Appendix 1).

5.3.4 IVI

In this Zone, *Prosopisjuliflora* occurred with the highest percent of IVI (58.40%) while *Acacia nilotica* occurred as the second highest dominant species in the zone with (19.86%). As compared to the highest IVI, *Kirganelia reticulate* occurred with the lowest percentage of IVI (1.52%) followed by *Acacia farnesiana* (1.97%) making them least adept in the zone.

5.4 Zone-4

5.4.1 Density and Frequency

In this particular zone, a total of 20 tree species were documented. Among them, the top specie with the highest density is *Prosopisjuliflora* followed by *Acacia nilotica* and *Ziziphusnummularia*. While the lowest density is of *Acacia ferruginea* followed by *Ailanthus excels* and *Pithecellobiumdulce*. *Prosopisjuliflora* was found to be the most frequently occurring species, with a frequency of 95.45%, followed by *Buteamonosperma*(31.82%) and *Acacia senegal* (22.73%). On the other hand, *Acacia ferruginea*was found to have the lowest frequency, with only 4.55% (Appendix 1). This zone zone is also heavily prolifeted by *Prosopisjuliflora.*

50% of species belong to class A while 45% of species belong to class B indicating scattered vegetation of this 95% species and 5% of species belong to class E (Table 8) indicating normal distribution of this 5% tree species.

Table 8: Frequency class of Trees of Zone-4

Class	Range	No.ofSpecies	%
A	0-20	10	50
B	21-40	9	45
C	41-60	0	0
D	61-80	0	0
E	81-100	1	5
	TOTAL	**20**	**100**

5.4.2 Abundance

Prosopisjuliflora was recorded with the highest abundance of 4.17 followed by *Acacia nilotica* (2.92). while a total of 3 species with the lowest abundance of 1.00 is recorded from this particular zone (Appendix 1).

In this specific zone, the majority of species, which accounts for 80%, are categorized as very rare, while 15% of species are classified as rare, and the remaining 5% are categorized as not common (Table 9).

Table 9: %Relative Abundance of Trees of Zone-4

Sr.No.	%Relative Abundance	No.ofSpecies	%
1	VeryRare–1–5%	10	80
2	Rare–6–10%	3	15
3	Not Common –11 –20%	1	5
4	Common –21 –40%	0	0
5	MoreCommon–41–60%	0	0
6	Abundant-61-80%	0	0
7	MostAbundant-81-100%	0	0
	Total	**20**	**100**

5.4.3 Basal Area

The maximum basal area was recorded in *Ficusbenghalensis* (7156.90 cm^2) followed by *Alianthusexcelsa* (5849.82 cm^2) while the minimum area was recorded in *Zizyphusnummularia* (589.13 cm^2) followed by *Samaneasaman*of 931.25 cm^2 (Appendix 1).

5.4.4 IVI

It was observed that *Prosopisjuliflora* occurred with the highest percent of IVI (69.00%) while *Ficusbenghalensis* occurred as the second highest dominant species in the zone with (19.73%) indicating the availability of a suitable niche for this species in the zone. As compared to the *Acacia ferruginia* occurred with the lowest percentage of IVI (4.29%) followed by *Pithecellobiumdulce* (5.33%) in the zone.

General comment

Your community classification is traditional.Even though it is traditional,you have to link the mentioned communities by using some sort of similarity indices like Sorenson's similarity indices and the like

This research need recommendation

All the results need scientific discussion. Your discussion is so weak

6. Conclusion

Comment [HR14]: In your conclusion citation is not mandatory rather you provide the major results, its impact and future prospect than supporting with references

At the research site, a total of 70 species of trees were identified. Moving from Amirgadh (Zone-1) to Santalpur (Zone-4), the diversity of tree species was observed to decrease. *Prosopisjuliflora*, due to its excessive growth and adaptability to different ecosystems, had a significantly high population density in three of the four studied zones. The seeds of this species have a high germination rate, as they are dispersed by both domesticated and wild herbivores. The frequency and abundance of different species can indicate their distribution pattern, with high frequency and low abundance suggesting regular distribution, and low frequency and high abundance suggesting contiguous distribution [8]. However, human activities such as commercial logging, conversion of pastures, shifting agriculture or mismanagement, industrialization, and urbanization are major contributors to changes in forest communities' composition and the depletion of forest cover, which poses a threat to biodiversity conservation. It is therefore essential to address these issues and take steps toward sustainable forest management practices.

References

[1] Chaturvedi, A., Singh, J. S., &Raghubanshi, A. S. (2014). Tree diversity and distribution in a tropical dry deciduous forest of northern Gujarat, India.*Journal of Forestry Research*, 25(3):607-616.

[2] Suthar P. R., Singh J. S., &Pandey H. N. (2013). Assessment of vegetation diversity in the Banas River corridor of the Aravalli mountain range, western India.*Journal of Mountain Science*, 10(5):825-835.

[3] Bhadula S. K., & Sharma C. M. (2018). Identification of priority areas for soil and water conservation measures in Banas river basin using geospatial techniques. *Journal of the Indian Society of Remote Sensing*, 46(1):79-92.

[4] Williams C. D., BarrettT. M., Breshears, D. D., Huxman T. E., &Whitham T. G. (2020). The use of belt transects in vegetation surveys: A review of best practices and applications. *Applied Vegetation Science*, 23(2):165-176.

[5] Curtis J.T, & McIntosh R. P.(1950).The interrelations of certain analytic and synthetic phytosociological characters.*Ecology*, 31:434-455.

[6] Muller-Dombois D.,&Ellenberg H. (1974).Aims and Methods of Vegetation Ecology, John Willey and Sons, New York, USA. 13:110-112.

[7] Raunkiaer C. C. (1934). The life forms of plants and statistical plant geography. Clarendon Press.

[8] Misra R. (1934). Ecological Work Book, Oxford and TBH Publication Co. Calcutta.

Appendix 1: PhytosociologicalAttributes of Banas River Corridor, Gujarat

Zone-1										
Sr.No.	**SpeciesName**	**%F**	**D**	**A**	**BA**	**% RF**	**% RD**	**% RA**	**% RDo**	**IVI**
1	*Acaciachundra*	4.29	0.06	1.33	1160.55	0.63	0.47	1.28	1.13	2.24
2	*Acaciafarnesiana*	4.29	0.09	2.00	1314.44	0.63	0.71	1.91	1.28	2.62
3	*Acaciaferruginia*	4.29	0.04	1.00	790.50	0.63	0.36	0.96	0.77	1.76
4	*Acacianilotica*	14.29	0.34	2.40	1234.74	2.11	2.84	2.30	1.21	6.15
5	*Acaciasenegal*	7.14	0.17	2.40	2863.81	1.05	1.42	2.30	2.80	5.27
6	*Adinacordifolia*	7.14	0.07	1.00	1308.02	1.05	0.59	0.96	1.28	2.92
7	*Aeglemarmelos*	10.00	0.11	1.14	1403.26	1.47	0.95	1.09	1.37	3.79
8	*Albizialebbeck*	5.71	0.07	1.25	3286.08	0.84	0.59	1.20	3.21	4.64
9	*Albiziaprocera*	8.57	0.09	1.00	2491.74	1.26	0.71	0.96	2.43	4.41
10	*Alianthusexcelsa*	7.14	0.09	1.20	2613.49	1.05	0.71	1.15	2.55	4.31
11	*Anogeissuslatifolia*	31.43	0.64	2.05	713.11	4.63	5.33	1.96	0.70	10.65
12	*Anogeissuspendula*	14.29	0.24	1.70	1004.96	2.11	2.01	1.63	0.98	5.10
13	*Anogeissussericea*	5.71	0.11	2.00	779.91	0.84	0.95	1.91	0.76	2.55
14	*Bauhiniapurpurea*	5.71	0.07	1.25	1435.31	0.84	0.59	1.20	1.40	2.84
15	*Bauhiniaracemosa*	4.29	0.07	1.67	1224.80	0.63	0.59	1.60	1.20	2.42
16	*Bombaxcieba*	2.86	0.06	2.00	1952.70	0.42	0.47	1.91	1.91	2.80
17	*Boswelliaserrata*	5.71	0.09	1.50	1203.80	0.84	0.71	1.44	1.18	2.73
18	*Brideliaretusa*	7.14	0.11	1.60	782.88	1.05	0.95	1.53	0.76	2.76
19	*Buteamonosperma*	100.00	1.50	1.50	1261.03	14.74	12.43	1.44	1.23	28.40
20	*Caesalpiniapulcherrima*	5.71	0.13	2.25	1090.99	0.84	1.07	2.15	1.07	2.97
21	*Cassiafistula*	10.00	0.26	2.57	2324.81	1.47	2.13	2.46	2.27	5.87

22	*Cassiasiamea*	8.57	0.09	1.00	3217.37	1.26	0.71	0.96	3.14	5.11
23	*Cordiadichotoma*	10.00	0.16	1.57	1161.15	1.47	1.30	1.50	1.13	3.91
24	*Cordiagharaf*	18.57	0.40	2.15	1351.97	2.74	3.31	2.06	1.32	7.37
25	*Crataevareligiosa*	7.14	0.09	1.20	859.01	1.05	0.71	1.15	0.84	2.60
26	*Dalbergialatifolia*	4.29	0.04	1.00	1400.17	0.63	0.36	0.96	1.37	2.35
27	*Dalbergiapeniculata*	4.29	0.07	1.67	1700.29	0.63	0.59	1.60	1.66	2.88
28	*Dalbergiasisoo*	10.00	0.16	1.57	838.37	1.47	1.30	1.50	0.82	3.59
29	*Derrisindica*	28.57	0.67	2.35	2613.49	4.21	5.56	2.25	2.55	12.32
30	*Diospyrosmelanoxylon*	30.00	0.67	2.24	669.32	4.42	5.56	2.14	0.65	10.64
31	*Emblicaofficinalis*	4.29	0.06	1.33	1799.61	0.63	0.47	1.28	1.76	2.86
32	*Erythrinasuberosa*	4.29	0.04	1.00	780.57	0.63	0.36	0.96	0.76	1.75
33	*Ficusbenghalensis*	8.57	0.09	1.00	6007.41	1.26	0.71	0.96	5.86	7.84
34	*Ficushispida*	4.29	0.09	2.00	3239.52	0.63	0.71	1.91	3.16	4.50
35	*Ficusrecemosa*	17.14	0.21	1.25	3076.23	2.53	1.78	1.20	3.00	7.30
36	*Ficusreligiosa*	7.14	0.11	1.60	3091.97	1.05	0.95	1.53	3.02	5.02
37	*Gmelinaarborea*	2.86	0.03	1.00	1034.39	0.42	0.24	0.96	1.01	1.67
38	*Helicteresisora*	8.57	0.16	1.83	779.91	1.26	1.30	1.75	0.76	3.33
39	*Holarrhenaantidysenterica*	7.14	0.14	2.00	825.08	1.05	1.18	1.91	0.81	3.04
40	*Holopteleaintrigrifolia*	14.29	0.31	2.20	664.75	2.11	2.60	2.11	0.65	5.36
41	*Kirganeliareticulata*	4.29	0.04	1.00	1289.72	0.63	0.36	0.96	1.26	2.25
42	*Leucaenaleucocephala*	2.86	0.04	1.50	1172.65	0.42	0.36	1.44	1.14	1.92
43	*Limoniaacidissima*	8.57	0.17	2.00	2440.70	1.26	1.42	1.91	2.38	5.07
44	*Madhukaindica*	4.29	0.04	1.00	4054.38	0.63	0.36	0.96	3.96	4.94
45	*Meliaazedirach*	7.14	0.09	1.20	836.32	1.05	0.71	1.15	0.82	2.58
46	*Mitragynaparvifolia*	5.71	0.09	1.50	1076.99	0.84	0.71	1.44	1.05	2.60

47	*Morindatomentosa*	8.57	0.16	1.83	891.52	1.26	1.30	1.75	0.87	3.44
48	*Morusalba*	2.86	0.03	1.00	761.70	0.42	0.24	0.96	0.74	1.40
49	*Parkinsoniaaculeata*	1.43	0.03	2.00	742.75	0.21	0.24	1.91	0.73	1.17
50	*Pithecellobiumdulce*	5.71	0.07	1.25	1362.41	0.84	0.59	1.20	1.33	2.76
51	*Prosopiscineraria*	4.29	0.10	2.33	1169.62	0.63	0.83	2.23	1.14	2.60
52	*Prosopisjuliflora*	5.71	0.13	2.25	1701.75	0.84	1.07	2.15	1.66	3.57
53	*Sapindusemargunatus*	5.71	0.06	1.00	2700.26	0.84	0.47	0.96	2.64	3.95
54	*Soymidafebrifuga*	4.29	0.04	1.00	1258.09	0.63	0.36	0.96	1.23	2.21
55	*Sterculiaurens*	7.14	0.07	1.00	1278.71	1.05	0.59	0.96	1.25	2.89
56	*Syzygiumcumini*	11.43	0.19	1.63	949.57	1.68	1.54	1.56	0.93	4.15
57	*Tamarindusindica*	11.43	0.24	2.13	2290.76	1.68	2.01	2.03	2.24	5.93
58	*Tecomellaundulata*	4.29	0.04	1.00	1485.42	0.63	0.36	0.96	1.45	2.44
59	*Terminaliaarjuna*	4.29	0.04	1.00	1336.81	0.63	0.36	0.96	1.31	2.29
60	*Terminaliabellirica*	1.43	0.01	1.00	1424.59	0.21	0.12	0.96	1.39	1.72
61	*Terminaliacrenulata*	1.43	0.01	1.00	1293.96	0.21	0.12	0.96	1.26	1.59
62	*Tectonagrandis*	5.71	0.07	1.25	773.98	0.84	0.59	1.20	0.76	2.19
63	*Wrightiatinctoria*	50.00	1.37	2.74	937.60	7.37	11.36	2.63	0.92	19.65
64	*Zizyphusmauritiana*	12.86	0.29	2.22	467.36	1.89	2.37	2.13	0.46	4.72
65	*Zizyphusnummularia*	25.71	0.54	2.11	591.93	3.79	4.50	2.02	0.58	8.86
66	*Zizyphusxylopyra*	5.71	0.10	1.75	792.83	0.84	0.83	1.68	0.77	2.44
	TOTAL	678.58	12.06	104.4	102434	100.00	100.00	100.00	100.00	300.00
Zone-2										
Sr. No.	***Species Name***	**%F**	**D**	**A**	**BA**	**%RF**	**% RD**	**% RA**	**%RDo**	**IVI**
1	*Acaciafarnesiana*	2.86	0.03	1.00	471.20	0.49	0.26	1.08	0.48	1.23
2	*Acaciaferruginia*	2.86	0.03	1.00	3347.31	0.49	0.26	1.08	3.40	4.15

3	*Acacianilotica*	28.57	0.89	3.10	2702.95	4.88	8.04	3.35	2.74	15.66
4	*Acaciasenegal*	11.43	0.23	2.00	803.12	1.95	2.07	2.16	0.82	4.84
5	*Adinacordifolia*	8.57	0.09	1.00	1580.22	1.46	0.78	1.08	1.60	3.85
6	*Aeglemarmelos*	8.57	0.11	1.33	1831.32	1.46	1.04	1.44	1.86	4.36
7	*Albizialebbeck*	14.29	0.20	1.40	2116.81	2.44	1.81	1.51	2.15	6.40
8	*Albiziaprocera*	11.43	0.14	1.25	1119.27	1.95	1.30	1.35	1.14	4.38
9	*Alianthusexcelsa*	11.43	0.11	1.00	2372.47	1.95	1.04	1.08	2.41	5.40
10	*Anogeissuslatifolia*	17.14	0.43	2.50	869.27	2.93	3.89	2.70	0.88	7.70
11	*Anogeissuspendula*	11.43	0.26	2.25	857.17	1.95	2.33	2.43	0.87	5.16
12	*Anogeissussericea*	5.71	0.11	2.00	769.06	0.98	1.04	2.16	0.78	2.79
13	*Bauhiniaracemosa*	2.86	0.03	1.00	2426.72	0.49	0.26	1.08	2.46	3.21
14	*Bombaxcieba*	2.86	0.06	2.00	4235.00	0.49	0.52	2.16	4.30	5.31
15	*Boswelliaserrata*	5.71	0.09	1.50	882.72	0.98	0.78	1.62	0.90	2.65
16	*Brideliaretusa*	8.57	0.09	1.00	440.93	0.98	0.52	1.08	0.45	1.94
17	*Buteamonosperma*	31.43	0.74	2.36	1087.64	5.37	6.74	2.56	1.10	13.21
18	*Caesalpiniapulcherrima*	8.57	0.09	1.00	1474.06	1.46	0.78	1.08	1.50	3.74
19	*Cassiafistula*	11.43	0.14	1.25	1424.59	1.95	1.30	1.35	1.45	4.69
20	*Cassiasiamea*	8.57	0.14	1.67	1551.00	1.46	1.30	1.80	1.57	4.33
21	*Cordiadichotoma*	11.43	0.23	2.00	1643.05	1.95	2.07	2.16	1.67	5.69
22	*Cordiagharaf*	8.57	0.14	1.67	2959.42	1.46	1.30	1.80	3.00	5.76
23	*Dalbergialatifolia*	8.57	0.11	1.33	441.86	1.46	1.04	1.44	0.45	2.95
24	*Dalbergiasisoo*	11.43	0.20	1.75	600.87	1.95	1.81	1.89	0.61	4.38
25	*Derrisindica*	8.57	0.14	1.67	1756.27	1.46	1.30	1.80	1.78	4.54
26	*Diospyrosmelanoxylon*	22.86	0.57	2.50	714.21	3.90	5.19	2.70	0.73	9.81
27	*Emblicaofficinalis*	5.71	0.09	1.50	2109.06	0.98	0.78	1.62	2.14	3.89

28	*Ficusbenghalensis*	14.29	0.20	1.40	3907.97	2.44	1.81	1.51	3.97	8.22
29	*Ficusrecemosa*	25.71	0.31	1.22	1268.59	4.39	2.85	1.32	1.29	8.53
30	*Ficusreligiosa*	14.29	0.23	1.60	4247.98	2.44	2.07	1.73	4.31	8.83
31	*Gmelinaarborea*	2.86	0.03	1.00	725.47	0.49	0.26	1.08	0.74	1.48
32	*Grewiatenax*	5.71	0.06	1.00	1133.54	0.98	0.52	1.08	1.15	2.65
33	*Grewiatiliaefolia*	11.43	0.14	1.25	1217.06	1.95	1.30	1.35	1.24	4.48
34	*Helicteresisora*	8.57	0.14	1.67	824.06	1.46	1.30	1.80	0.84	3.60
35	*Holarrhenaantidysenterica*	5.71	0.14	2.50	2147.20	0.98	1.30	2.70	2.18	4.45
36	*Kirganeliareticulata*	8.57	0.11	1.33	824.06	1.46	1.04	1.44	0.84	3.34
37	*Leucaenaleucocephala.*	5.71	0.09	1.50	812.24	0.98	0.78	1.62	0.82	2.58
38	*Limoniaacidissima.*	8.57	0.17	2.00	1446.97	1.46	1.56	2.16	1.47	4.49
39	*Madhukaindica*	5.71	0.06	1.00	5975.86	0.98	0.52	1.08	6.07	7.56
40	*Meliaazedirach*	5.71	0.06	1.00	839.39	0.98	0.52	1.08	0.85	2.35
41	*Morindatomentosa*	8.57	0.09	1.00	963.46	1.46	0.78	1.08	0.98	3.22
42	*Morusalba*	5.71	0.06	1.00	692.44	0.98	0.52	1.08	0.70	2.20
43	*Parkinsoniaaculeata*	2.86	0.03	1.00	2289.06	0.49	0.26	1.08	2.32	3.07
44	*Pithecellobiumdulce*	5.71	0.06	1.00	2732.59	0.98	0.52	1.08	2.77	4.27
45	*Prosopiscineraria*	11.43	0.31	2.75	4103.42	1.95	2.85	2.97	4.17	8.97
46	*Prosopisjuliflora*	25.71	1.06	4.11	1337.63	4.39	9.59	4.45	1.36	15.34
47	*Samaneasaman*	5.71	0.06	1.00	791.33	0.98	0.52	1.08	0.80	2.30
48	*Sapindusemargunatus*	2.86	0.03	1.00	1074.67	0.49	0.26	1.08	1.09	1.84
49	*Sterculiaurens*	2.86	0.03	1.00	6500.59	0.49	0.26	1.08	6.60	7.35
50	*Syzygiumcumini*	5.71	0.11	2.00	2363.84	0.98	1.04	2.16	2.40	4.41
51	*Tamarindusindica*	14.29	0.29	2.00	2466.16	2.44	2.59	2.16	2.50	7.54
52	*Tecomellaundulata*	5.71	0.06	1.00	626.48	0.98	0.52	1.08	0.64	2.13

53	*Tectonagrandis*	5.71	0.06	1.00	1368.30	0.98	0.52	1.08	1.39	2.88
54	*Vitexnegundo*	2.86	0.03	1.00	530.66	0.49	0.26	1.08	0.54	1.29
55	*Wrightiatinctoria*	22.86	0.54	2.38	996.12	3.90	4.93	2.57	1.01	9.84
56	*Zizyphusmauritiana*	14.29	0.37	2.60	662.08	2.44	3.37	2.81	0.67	6.48
57	*Zizyphusnummularia*	22.86	0.49	2.13	426.95	3.90	4.41	2.30	0.43	8.74
58	*Zizyphusxylopyra*	8.57	0.17	2.00	600.58	1.46	1.56	2.16	0.61	3.63
	TOTAL	558.55	11.08	92.47	98484	100.00	100.00	100.00	100.00	300.00
Zone-3										
Sr. No.	***Species Name***	**%F**	**D**	**A**	**BA**	**%RF**	**% RD**	**% RA**	**%RDo**	**IVI**
1	*Acaciafarnesiana*	1.72	0.03	2.00	916.38	0.43	0.36	2.93	1.17	1.97
2	*Acacianilotica*	32.76	0.90	2.74	1717.74	8.23	9.44	4.02	2.20	19.86
3	*Acaciasenegal*	15.52	0.31	2.00	2455.25	3.90	3.27	2.93	3.14	10.30
4	*Aeglemarmelos*	5.17	0.07	1.33	2007.61	1.30	0.73	1.95	2.57	4.59
5	*Albizialebbeck*	3.45	0.03	1.00	5941.67	0.87	0.36	1.46	7.59	8.82
6	*Albiziaprocera*	3.45	0.03	1.00	3471.47	0.87	0.36	1.46	4.44	5.67
7	*Alianthusexcelsa*	8.62	0.12	1.40	2092.14	2.16	1.27	2.05	2.67	6.11
8	*Anogeissuslatifolia*	6.90	0.14	2.00	507.12	1.73	1.45	2.93	0.65	3.83
9	*Anogeissuspendula*	1.72	0.03	2.00	1084.37	0.43	0.36	2.93	1.39	2.18
10	*Bauhiniapurpurea*	1.72	0.02	1.00	1163.57	0.43	0.18	1.46	1.49	2.10
11	*Bombaxcieba*	1.72	0.02	1.00	2163.66	0.43	0.18	1.46	2.77	3.38
12	*Brideliaretusa*	3.45	0.03	1.00	1133.54	0.87	0.36	1.46	1.45	2.68
13	*Buteamonosperma*	27.59	0.64	2.31	2152.57	6.93	6.72	3.39	2.75	16.39
14	*Cassiafistula*	6.90	0.12	1.75	2052.72	1.73	1.27	2.56	2.62	5.63
15	*Cordiadichotoma*	6.90	0.07	1.00	1634.09	1.73	0.73	1.46	2.09	4.55
16	*Cordiagharaf.*	5.17	0.10	2.00	2145.38	1.30	1.09	2.93	2.74	5.13

17	*Dalbergiasisoo*	12.07	0.19	1.57	1392.81	3.03	2.00	2.30	1.78	6.81
18	*Derrisindica*	20.69	0.40	1.92	2458.01	5.19	4.17	2.81	3.14	12.51
19	*Diospyrosmelanoxylon*	5.17	0.09	1.67	559.62	1.30	0.91	2.45	0.72	2.92
20	*Ficusbenghalensis*	5.17	0.05	1.00	5560.96	1.30	0.54	1.46	7.11	8.95
21	*Ficushispida*	1.72	0.03	2.00	1256.00	0.43	0.36	2.93	1.61	2.40
22	*Ficusrecemosa*	3.45	0.03	1.00	2163.66	0.87	0.36	1.46	2.77	3.99
23	*Ficusreligiosa*	6.90	0.07	1.00	5129.21	1.73	0.73	1.46	6.56	9.01
24	*Holarrhenaantidysenterica*	3.45	0.07	2.00	2746.50	0.87	0.73	2.93	3.51	5.10
25	*Holopteleaintrigrifolia*	5.17	0.07	1.33	1045.82	1.30	0.73	1.95	1.34	3.36
26	*Kirganeliareticulata*	1.72	0.02	1.00	706.50	0.43	0.18	1.46	0.90	1.52
27	*Leucaenaleucocephala*	5.17	0.12	2.33	1384.74	1.30	1.27	3.41	1.77	4.34
28	*Limoniaacidissima*	5.17	0.10	2.00	829.16	1.30	1.09	2.93	1.06	3.45
29	*Meliaazedirach*	3.45	0.03	1.00	829.16	0.87	0.36	1.46	1.06	2.29
30	*Morusalba*	3.45	0.03	1.00	637.62	0.87	0.36	1.46	0.81	2.04
31	*Parkinsoniaaculeata*	5.17	0.09	1.67	1187.87	1.30	0.91	2.45	1.52	3.72
32	*Pithecellobiumdulce*	5.17	0.07	1.33	1296.51	1.30	0.73	1.95	1.66	3.68
33	*Prosopisjuliflora*	77.59	3.43	4.42	2192.60	19.48	36.12	6.48	2.80	58.40
34	*Samaneasaman*	6.90	0.12	1.75	545.93	1.73	1.27	2.56	0.70	3.70
35	*Sterculiaurens*	1.72	0.02	1.00	3737.39	0.43	0.18	1.46	4.78	5.39
36	*Tamarindusindica*	25.86	0.57	2.20	2157.84	6.49	5.99	3.22	2.76	15.24
37	*Terminaliaarjuna*	1.72	0.02	1.00	2695.66	0.43	0.18	1.46	3.45	4.06
38	*Wrightiatinctoria*	3.45	0.09	2.50	1365.03	0.87	0.91	3.66	1.74	3.52
39	*Zizyphusmauritiana*	34.48	0.81	2.35	1184.48	8.66	8.53	3.44	1.51	18.70
40	*Zizyphusnummularia*	15.52	0.29	1.89	643.95	3.90	3.09	2.77	0.82	7.80
41	*Zizyphusxylopyra*	5.17	0.09	1.67	1900.20	1.30	0.91	2.45	2.43	4.63

	TOTAL	398.26	9.56	68.13	78247	100.00	100.00	100.00	100.00	300.00
Zone-4										
Sr. No.	***Species Name***	**%F**	**D**	**A**	**BA**	**%RF**	**%RD**	**%RA**	**%RDo**	**IVI**
1	*Acaciaferruginia*	4.55	0.05	1.00	1297.15	1.09	0.49	2.93	2.72	4.29
2	*Acacianilotica*	27.27	0.80	2.92	2227.64	6.52	8.50	8.55	4.67	19.69
3	*Acaciasenegal*	22.73	0.36	1.60	2024.40	5.43	3.89	4.69	4.25	13.57
4	*Albizialebbeck*	25.00	0.27	1.09	3693.20	5.98	2.91	3.20	7.75	16.64
5	*Alianthusexcelsa*	6.82	0.09	1.33	5849.82	1.63	0.97	3.91	12.27	14.87
6	*Buteamonosperma*	31.82	0.50	1.57	1602.01	7.61	5.34	4.61	3.36	16.31
7	*Cassiafistula*	27.27	0.39	1.42	1435.90	6.52	4.13	4.15	3.01	13.66
8	*Cordiadichotoma*	11.36	0.11	1.00	2537.95	2.72	1.21	2.93	5.32	9.25
9	*Dalbergiasisoo*	6.82	0.14	2.00	3381.57	1.63	1.46	5.87	7.09	10.18
10	*Derrisindica*	22.73	0.39	1.70	1901.57	5.43	4.13	4.99	3.99	13.55
11	*Ficusbenghalensis*	13.64	0.14	1.00	7156.90	3.26	1.46	2.93	15.01	19.73
12	*Ficusreligiosa*	22.73	0.25	1.10	3069.98	5.43	2.67	3.23	6.44	14.54
13	*Leucaenaleucocephala*	18.18	0.39	2.13	1088.26	4.35	4.13	6.23	2.28	10.76
14	*Parkinsoniaaculeata*	9.09	0.14	1.50	1863.69	2.17	1.46	4.40	3.91	7.54
15	*Pithecellobiumdulce*	6.82	0.09	1.33	1298.75	1.63	0.97	3.91	2.72	5.33
16	*Prosopiscineraria*	15.91	0.30	1.86	1932.42	3.80	3.16	5.45	4.05	11.01
17	*Prosopisjuliflora*	95.45	3.98	4.17	1757.76	22.83	42.49	12.22	3.68	69.00
18	*Samaneasaman*	9.09	0.16	1.75	931.25	2.17	1.70	5.13	1.95	5.83
19	*Tamarindusindica*	13.64	0.16	1.17	2047.51	3.26	1.70	3.42	4.29	9.25
20	*Zizyphusnummularia*	27.27	0.68	2.50	589.13	6.52	7.28	7.33	1.24	15.04
	TOTAL	418.19	9.39	34.14	47687	100.00	100.00	100.00	100.00	300.00

Note: F = Frequency, D = Density, A = Abundance, BA = Basal Area, RF = Relative Frequency, RD = Relative Density, RA = Relative Abundance, RDo = Relative Dominance, IVI = Importance Value Index