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Assessment of Floristic Diversity and its Structural Composition in Tapi District, South Gujarat, India

Pinky J Mali[1,2] and Kalpesh Patel[1*]
[1]Biology Department, B.K.M. Science College, Valsad, Gujarat, India
[2]Biosciences Department, Veer Narmad South Gujarat University, Surat, Gujarat, India
kalpu125@gmail.com

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Abstract

This study examines the floristic diversity and structural composition in the Tapi district of South Gujarat, employing a stratified random sampling method for vegetation assessment. The survey recorded 77 plant species, which included 47 tree species, 20 shrub species, 3 herb species, 2 climber species, 2 grass species, and 1 weed species across 18 families. The vegetation analysis indicated that the plant communities were predominantly from the Lamiaceae, Rhamnaceae, and Asteraceae families, highlighting significant variations in site conditions. The forest's good condition is reflected in the high diversity levels and substantial basal area of woody plant species. Nonetheless, there are observed impacts of human activities and stressors, suggesting the need for proper management to maintain or improve current species diversity. The most dominant species documented, which also had the highest biomass and carbon content, were Butea monosperma, Tectona grandis, Terminalia arjuna, and Terminalia crenulata. Nearly all species exhibited a contagious distribution pattern. The Shannon index values indicate extremely high diversity for all plant habits except for shrub species.

Keywords: Floristic diversity, Structural composition, Species diversity, Biomass, Carbon sequestration.

Introduction

Biodiversity is essential for human survival, economic prosperity, and the stability and functioning of ecosystems[1]. Tree diversity supplies resources and habitats for nearly all forest life forms, varying significantly with biogeography and habitat disturbance[2]. Diversity across all structural levels, from genetic to ecosystem diversity within a landscape, ultimately supports global biodiversity. Species diversity, in particular, is crucial as the number and types of species in any location influence ecosystem processes[3]. Floristic diversity refers to the variety of plant species in a specific area, shaped by climate conditions, vegetation appearance, and biotic influences[4].

Documenting the plant species in a geographic region is vital for understanding land use characteristics. Floristic diversity reflects environmental conditions, physiognomy, and biotic influences[2]. It underpins most terrestrial ecosystems, with humans and fauna relying on plants' ability to convert sunlight into energy. However, anthropogenic activities, urbanization, climate change, and resource over-exploitation are distancing people from nature. Vegetation or phytosociological analysis is crucial for assessing an area's plant biodiversity, describing vegetation health, available resources, and user composition. Structural analysis studies vegetation's internal relationships and provides information on plant community composition and succession.

Forests regulate local and regional rainfall and mitigate global warming by sequestering carbon[5]. They influence and are influenced by global atmospheric carbon levels and climate change[6]. The Mandvi forest can help mitigate climate change through carbon sequestration and proper forest management, positively impacting conservation. Understanding the economic value of sequestered carbon is vital in addressing global climate change challenges. Forests need protection from human pressures like illegal logging, cultivation, overgrazing, encroachment, poaching, and human-wildlife conflicts. Local governments and forest departments currently protect forests for their resources and economic benefits, with community involvement also playing a role. Effective management is crucial for the survival of those dependent on forest resources. Research on biodiversity using a participatory approach is essential for forest ecosystem conservation and management. This study will highlight the current status of vegetation and its structure in the forest.

Materials and Methods

Field Survey and Vegetation Sampling: Floristic diversity and assessment surveys were conducted in Mandvi's forest region using stratified random sampling across 50 plots. The survey was carried out from December 2018 to January 2019. Unidentified plants were dried, pressed, and made into herbarium sheets for further identification using resources from the digital flora of Gujarat website and the GEER Foundation, Gandhinagar.

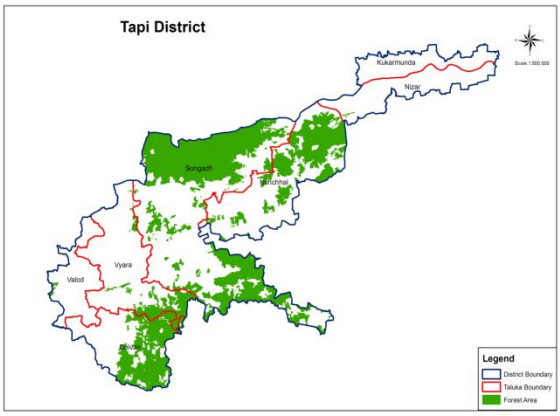

Figure-1: Map of Study area.

Measurement of Diameter at Breast Height (DBH): The structural composition analysis included all vegetation types, such as trees, shrubs, herbs, and grasses. Sample plot sizes were 314 square meters (10×10 meters) for trees with a girth above 10 cm at breast height (DBH). A subplot of 28 square meters (3×3 meters) within the sample plot was used to gather data on shrubs and saplings/regeneration (DBH < 10 cm)[7].

Structural Composition: Various physiognomic measures were examined, such as basal area, density, abundance, frequency, dominance, diversity indices, and importance value index (IVI). IVI, which is the sum of relative frequency, relative dominance, and relative density, helps understand the ecological attributes of the community[8]. Higher IVI values indicate greater dominance and resource utilization by particular species. Species diversity was assessed using the Shannon index (H') and Simpson's index of diversity (1-D)[9,10].

Regeneration Status: The forest's regeneration status was evaluated by comparing seedlings and saplings to mature woody tree species following the criteria by Dhaulkhandi et al.[11] and Tiwari et al.[12]. Categories included suitable (seedlings > saplings > mature), fair (seedlings > or ≤ saplings ≤ mature), poor (saplings ≤ or ≥ mature), and not regenerating (only mature plants present).

Shannon and Simpson Index: The Shannon index (H') was calculated using the equation $H' = -\sum (pi \cdot \ln(pi))$H′=−∑(pi·ln(pi))H' = -\sum (pi \cdot \ln(pi))H′=−∑(pi·ln(pi)), where pipipi is the proportion of individuals of species iii. The Simpson index (D) was calculated using $D = 1 - \sum (pi^2)$D=1−∑(pi2)D = 1 - \sum (pi^2)D=1−∑(pi2)[9].

Biomass: Sample plots with 10-meter diameters were used to estimate above-ground tree biomass. DBH and height of all tree species within the plot were measured and extrapolated to the entire study area. Biomass was calculated using the equation by Brown[13], where:

$$\text{Volume (m3)} = \frac{43.14 \times \text{DBH2} \times \text{height}}{4}$$

The conversion factor used was 1m³ of green wood weight, equivalent to 2118kg, and dry weight was considered as 46% of the green weight.

Estimation of Forest Carbon: The carbon sequestration value was calculated, assuming carbon content to be 45-47% of dry biomass[14,15]. The CO_2 stock was calculated using:

$$\text{CO}_2 \text{ Stock} = \frac{\text{Biomass (ton/ha)} \times 45}{100}$$

Results and Discussion

Local Dependence on Forest Resources: The local population relies on the forest for grazing and collecting forest products such as firewood, fodder, Timaru leaves for making bidis, Mahuda fruits for alcohol, and gum from Kadaya trees. Communities typically gather fuel wood twice a year, before the rainy season and after harvest. There are no restrictions on entering or grazing in the forest, but the community conserves and protects forest resources to support their livelihoods.

Plant Species: A total of 77 plant species were identified in the study area, including 49 tree species, 20 shrub species, 3 herbs, 2 climbers, 2 grasses, and 1 weed species from 18 families (Table-1). The structural composition comprised 61% trees, 26% shrubs, 4% herbs, 5% climbers, and 4% grasses (Figure-2). Mature woody trees were the most prevalent, followed by shrubs and herbs, while climbers and grasses were less common, likely due to overgrazing and the autumn season. There is an urgent need to focus on newly planted species.

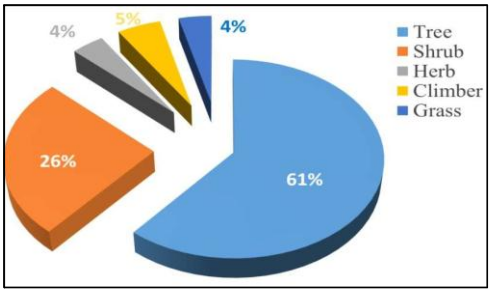

Figure-2: Percent wise distribution of plant species.

Structural Characteristics: Trees: Forty-nine mature tree species were recorded. The Importance Value Index (IVI) indicated that Butea monosperma (17.85%) was the most dominant species, utilizing the most resources across all sites (Table-2), followed by *Tectona grandis*, *Terminalia arjuna*, *Terminalia crenulata*, *Miliusa tomentosa*, and *Azadirachta indica*. *Butea monosperma*, *Tectona grandis*, *Terminalia arjuna*, and *Terminalia crenulata* had high relative density, frequency, and dominance, indicating their widespread distribution. *Terminalia crenulata* and *Miliusa tomentosa*, with high relative frequency but lower relative dominance and density, were frequent but smaller. Species with low values across all attributes, including IVI, were less common.

The species distribution pattern, determined by the abundance-to-frequency ratio, indicated regular distribution below 0.025, random distribution between 0.025-0.050, and contagious distribution above 0.050 [16].

Regeneration Status: Twenty-five sapling species were identified (Table-3). The IVI showed Butea monosperma (31% of total) was the most dominant, followed by *Tectona grandis*, *Canavalia ensiformis*, *Dyospyros melanoxylon*, and *Terminalia arjuna. Holorrhena antidysenterica*, a good indicator species of a healthy teak forest[10], was prevalent and used locally for fodder and fuel wood. Other species had lower IVI values, indicating fewer individuals present. Co-dominant species included *Wrightia tinctoria*, *Ceasalpinia bonduc*, *a*nd *Lantana camara*, with fewer invasive species like *Prosopis juliflora* and *Lantana camara*, indicating a healthy forest.

Climbers, Grasses, and Herbs: Eleven species of climbers, herbs, grasses, and weeds were identified (Table-5). *Bambusa vulgaris* had the highest IVI (108.3%), distributed in patches, followed by *Canavalia ensiformis*, *Cynodon dactylon*, *Parthenium hysterophorus*, and *Mollugo verticillata.* Species with low IVI values were less prevalent.

Dominant Species: The total density of tree species was higher than that of saplings, suggesting a potential future decline. *Butea monosperma* had the highest density (108 plants/ha), followed by *Tectona grandis* and *Terminalia arjuna*. The lower regeneration status of *Terminalia arjuna*, an endangered species in Gujarat, highlights the need for conservation (Figure-3). Teak, economically valuable for its timber[13,17], was sold by panchayat members for economic benefits.

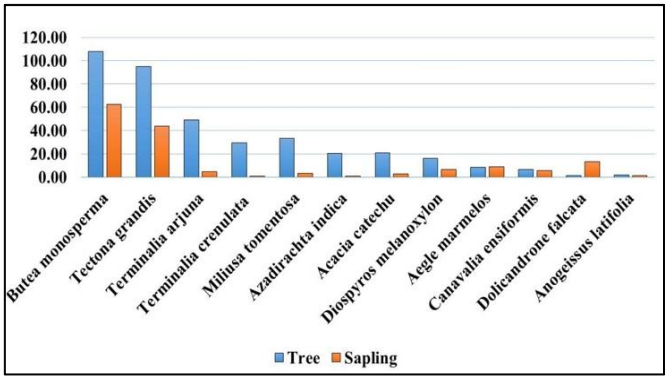

Figure-3: Density per hectare of dominant species.

Family-Wise Species Count: The Lamiaceae family, essential for its medicinal, flavour, and fragrance properties, had the highest species count (13), followed by *Asteraceae*, *Moraceae*, *Coranaceae*, *Phyllanthaceae*, and *Rhamnaceae* (12 species each) (Figure-4).

Diversity Indices: The diversity indices (Shannon index (H') and Simpson index) indicated high species diversity in the area. Collected species included 49 trees, 25 saplings, 20 shrubs, and 11 herb/climber/grass species, with Shannon indices of 2.83, 2.39, 0.81, and 2.16, respectively, and lower Simpson indices indicating high diversity (Table-6).

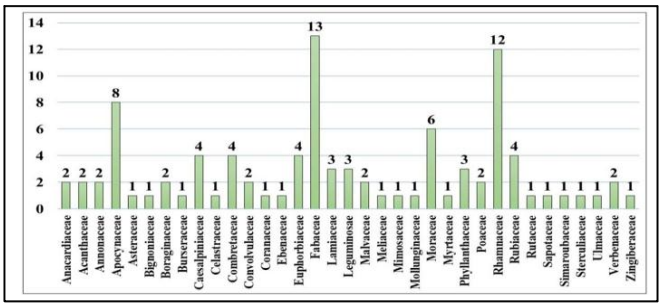

Figure-4: Family wise number of species at the study site.

DBH Class of Plant Species: The DBH class indicated a higher number of species in the 0 to 10 cm DBH range, suggesting newly planted or regenerated forests with potential for higher carbon absorption and stock (Figure-5). Mature woody trees, with DBH above 36 cm, were protected by the community.

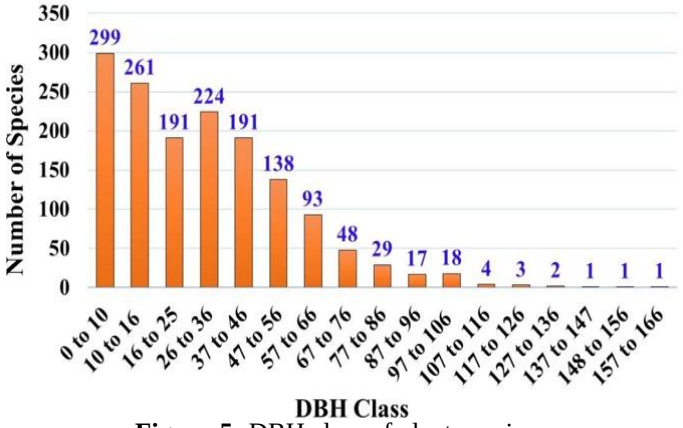

Figure-5: DBH class of plant species.

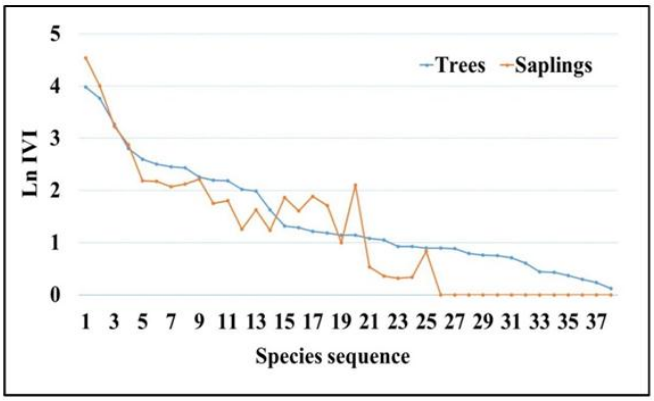

Figure-6: Dominance-diversity curve.

Dominance-Diversity Curve: The dominance-diversity curve, showing species ranked from most to least abundant, indicated a

high diversity condition, with most species having lower abundance and population, while *Butea monosperma* and *Tectona grandis* were the most abundant. The curve resembled a geometric series distribution, indicating good environmental conditions for species survival (Figure-6).

Community Participation in Forest Conservation: Interviews and field observations highlighted community involvement in forest conservation. The community reserved forests and participated in afforestation efforts led by Tapi Van Vibha Samiti. Traditional beliefs, customs, and religious rules supported conservation efforts (Figure-7). The local community maintained nurseries and plantations established by the Tapi Forest Division, playing a significant role in forest conservation.

Biomass and Carbon Sequestration: Tectona grandis had the highest biomass per hectare due to its larger basal area and volume (Table-7). The carbon stock was highest in *Butea monosperma* (160 ton/ha) and *Tectona grandis* (116 ton/ha). Mature woody plants stored more carbon and were essential for biodiversity, while newly planted species had greater carbon capture potential. Annual plantation efforts are recommended due to the lower number of saplings compared to mature plants.

Figure-7: Conservation through traditional belief.

Table-1: Plant species recorded from the study site.

English name	Botanical name	Family	Habit
Dwarf Heliotrope	*Heliotropium supinum*	Boraginaceae	Herb
Malkangani	*Celastruspaniculatus*	Celastraceae	Climber
Famado	*Canavaliaensiformis*	Fabaceae	Climber
Bhoybala	*Sidacordata*	Malvaceae	Herb
Mollugo	*Mollugoverticillata*	Mollunginaceae	Weed
Bamboo	*Bambusavulgaris*	Poaceae	Long grass
Asi, Asvel	*Ventilagodenticulata*	Rhamnaceae	Climber
Devahehaldo	*Curcumaarometica*	*Zingiberaceae*	Herb
Gado	*Tinosporacordifolia*	Menispermacea	Climber
Congressgrass	*Partheniumhysterophorus*	Asteraceae	Grass
Ghans	*Cynodondactylon*	Poaceae	Grass
Karavu	*Erenthemumpulchellum*	Acanthaceae	Shrub

Ankdo	*Calotropisgigantean*	Apocynaceae	Shrub
Karamda	*Carissa Carandas*	*Apocynaceae*	Shrub
Dudhilu	*Wrightiatinctoria R.Br*	*Apocynaceae*	Shrub
Kudi	*Holorrhenaantidysenterica*	*Apocynaceae*	Shrub
Kachku	*Ceasalpiniabonduc*	*Caesalpiniaceae*	Shrub
Nashedi	*Ipomeafistula*	*Convolvulaceae*	Shrub
Kamboi	*Phyllanthusreticulatus*	Euphorbiaceae	Shrub
Jungaliarenda	*Ricinuscommunis*	*Euphorbiaceae*	Shrub
Chanothi	*Abruspricatorious Linn.*	Fabaceae	Shrub
Kuvach	*Mucunapruriens*	*Fabaceae*	Shrub
Babool	*Vachellianilotica*	Fabaceae	Shrub
Nirgundi	*Vitexnirgunda*	Lamiaceae	Shrub
Pembadiyu	*Cassiatora*	*Leguminosae*	Shrub
Bor	*Zizyphusmauritiana*	Rhamnaceae	Shrub
Chanibor	*Zizyphusnummulatria*	Rhamnaceae	Shrub
Ghatbor	*Ziziphusxyiopyra*	*Rhamnaceae*	Shrub
Motabor	*Ziziphusjujuba*	*Rhamnaceae*	Shrub
Chamatoda	*Ziziphusoenoplia*	*Rhamnaceae*	Shrub
Gongadu	*Lantanacamara*	*Verbenaceae*	Shrub
Kaju	*Anacardiumoccidentale, L*	Anacardiaceae	Tree
Mahudo	*Madhucalongifolia*	Sapotaceae	Tree
Madhlo	*Lanneacoromandelica*	Anacardiaceae	Tree
Sitafal	*Annonasquamosal*	Annonaceae	Tree
Umbha	*Miliusatomentosa*	Annonaceae	Tree
Medsingu	*Dolicandronefalcate*	Bignoniaceae	Tree
Gundo	*Cordiadichotoma*	Boraginaceae	Tree
Kakdo	*Garuga pinnata Roxb*	Burseraceae	Tree
Kojalo	*Bauhiniapurpurea*	Caesalpiniaceae	Tree
Ashitro	*Bauhiniaracemosa Lam*	Ceasalpiniaceae	Tree

Dhamdo	*Anogeissuslatifolia*	Combretaceae	Tree
Baheda	*Terminaliabellirica*	Combretaceae	Tree
ArjunSadad	*Terminaliaarjuna*	Combretaceae	Tree
SafedSadad	*Terminaliacrenulata*	Combretaceae	Tree
Ankol/Akinu	*Alangiumsalviifolium*	Coranaceae	Tree
Timaru	*Diospyrosmelanoxylon*	Ebenaceae	Tree
Khakhro	*Buteamonosperma*	Fabaceae	Tree
Garmado	*Cassiafistula*	Fabaceae	Tree
Sheesham	*Dalbergiasissoo*	Fabaceae	Tree
Karanj	*Pongamiapinnata*	Fabaceae	Tree
Gorbaval	*Prosopisjuliflora*	Fabaceae	Tree
Amli	*Tamarindusindica*	Fabaceae	Tree
Saag	*Tectonagrandis*	Lamiaceae	Tree
Kher	*Acaciacatechu*	Leguminosae	Tree
Samar	*Bombaxceabae*	Malvaceae	Tree
Neem	*Azadirachtaindica*	Meliaceae	Tree
Kalohero	*Albizialabbeck*	Mimosaceae	Tree
Vad	*Ficusbenghalensis*	Moraceae	Tree
Karveto	*Ficushispida*	Moraceae	Tree
Umar	*Ficusracemosa L.*	Moraceae	Tree
Peepal	*Ficusreligiosa*	Moraceae	Tree
Atayu	*Ficusamplissima*	Moraceae	Tree
Peepali	*Ficusvirens*	Moraceae	Tree
Nilgiri	*Eucalyptushybrid*	Myrtaceae	Tree
Hakano	*Brideliaretusa*	Phyllanthaceae	Tree
Amla	*Phyllanthusemblica*	Phyllanthaceae	Tree
Thumro	*Securinegaleucopyrus*	Phyllanthaceae	Tree
Bor	*Zizyphusmauritiana*	Rhamnaceae	Tree
Kanabo/Kalam	*Mitragynaparvifolia*	Rubiaceae	Tree

Anudo	*Morindapubescens*	Rubiaceae	Tree
Kadamb	*Neolamarckiacadamba*	Rubiaceae	Tree
Bili	*Aeglemarmelos*	Rutaceae	Tree
Rayan	*Manilkara Hexandra*	Sapotaceae	Tree
Arduso	*Ailanthusexcels*	Simaroubaceae	Tree
Kadayu	*Sterculiaurens*	Sterculiaceae	Tree
Kanajo/Kukranj	*Holopteleaintegrifolia*	Ulmaceae	Tree

Table-2: Vegetation parameters of tree species.

Name of species	Relative density	Relative frequency	Relative dominance	Important value Index	Abundance Frequency ratio
Buteamonosperma	21.31	14.18	18.05	53.55	0.10
Tectonagrandis	18.79	10.76	13.55	43.10	0.15
Terminaliaarjuna	9.71	7.82	8.69	26.22	0.15
Terminaliacrenulata	5.80	5.87	4.77	16.44	0.16
Miliusatomentosa	6.56	3.42	3.41	13.39	0.53
Azadirachtaindica	4.04	4.89	3.32	12.25	0.16
Acaciacatechu	4.16	5.38	2.05	11.59	0.14
Madhucalongifolia	0.76	2.93	7.71	11.40	0.08
Tamarindusindica	0.88	2.20	6.49	9.58	0.16
Eucalyptushybrid	1.77	2.93	4.25	8.95	0.19
Ficusreligiosa	0.25	0.98	7.64	8.87	0.25
Ficusbenghalensis	2.27	0.98	4.29	7.53	2.25
Diospyrosmelanoxylon	3.15	2.93	1.23	7.32	0.35
Holopteleaintegrifolia	1.77	2.44	0.88	5.09	0.28
Aeglemarmelos	1.64	1.47	0.62	3.73	0.72
Bauhiniaracemosa	1.39	1.47	0.75	3.60	0.61
Sterculiaurens	0.63	1.47	1.27	3.37	0.28
Canavaliaensiformis	1.26	1.47	0.55	3.27	0.56
Dalbergiasissoo	1.01	0.98	1.16	3.14	1.00
Vachellianilotica	1.01	1.47	0.65	3.13	0.44

Morindapubescens	0.76	1.96	0.23	2.94	0.19
Ricinuscommunis	1.13	1.47	0.24	2.84	0.50
Andrographispaniculata	0.76	0.98	0.80	2.53	0.75
Dolicandronefalcate	0.25	0.49	1.77	2.51	1.00
Zizyphusxyiopyra	1.13	0.98	0.34	2.45	1.13
Brideliaretusa	0.63	1.47	0.33	2.43	0.28
Garuga pinnata Roxb	0.63	0.98	0.81	2.42	0.63
Mitragynaparvifolia	0.38	0.98	0.84	2.19	0.38
Lanneacoromandelica	0.63	0.98	0.52	2.13	0.63
Ficusracemose	0.88	0.98	0.25	2.11	0.88
Terminaliabellirica	0.38	1.47	0.18	2.02	0.17
Prosopisjuliflora	0.38	0.98	0.48	1.84	0.38
Anogeissuslatifolia	0.38	0.98	0.19	1.55	0.38
Anacardiumoccidentale,	0.76	0.49	0.30	1.54	3.00
Annonasquamosal	0.25	0.98	0.21	1.44	0.25
Pongamiapinnata	0.25	0.98	0.12	1.35	0.25
Carissa Carandas	0.25	0.98	0.03	1.26	0.25
Ficusvirens	0.38	0.49	0.26	1.13	1.50
Mitragynaparviflora	0.25	0.49	0.11	0.85	1.00
Cassiafistula	0.25	0.49	0.11	0.85	1.00
Albizialabbeck	0.13	0.49	0.18	0.80	0.50
Cordiadichotoma	0.13	0.49	0.11	0.73	0.50
Alangiumsalviifolium	0.13	0.49	0.09	0.71	0.50
Phyllanthusemblica	0.13	0.49	0.08	0.70	0.50
Bombaxceabae	0.13	0.49	0.04	0.65	0.50
Manilkara Hexandra	0.13	0.49	0.03	0.65	0.50
Securinegaleucopyrus	0.13	0.49	0.03	0.64	0.50
Ailanthusexcelsa Roxb	0.13	0.49	0.00	0.62	0.50
Acacialeaucophlea	0.13	0.49	0.00	0.62	0.50

Table-3: Vegetation parameters of saplings.

Name of species	Relative density	Relative frequency	Relative dominance	Important value index	Abundance/ Frequency ratio
Buteamonosperma	30.06	22.92	40.04	93.02	0.1
Tectonagrandis	21.17	17.71	15.8	54.68	0.12
Canavaliaensiformis	8.59	7.29	9.34	25.22	0.29
Diospyrosmelanoxylon	6.44	7.29	3.94	17.67	0.21
Terminaliaarjuna	2.76	3.13	3.27	9.15	0.5
Acaciacatechu	4.29	3.13	1.43	8.85	0.78
Aeglemarmelos	3.99	3.13	1.68	8.8	0.72
Morindapubescens	2.76	5.21	0.37	8.34	0.18
Ficusracemose	0.92	1.04	6.2	8.16	1.5
Terminaliacrenulata	3.07	3.13	1.75	7.94	0.56
Prosopisjuliflora	1.23	2.08	3.28	6.59	0.5
Azadirachtaindica	1.23	2.08	3.13	6.44	0.5
Dolicandronefalcate	2.15	1.04	2.84	6.03	3.5
Miliusatomentosa	2.15	3.13	0.46	5.73	0.39
Cassiafistula	0.92	2.08	2.51	5.51	0.38
Holopteleaintegrifolia	1.53	3.13	0.4	5.06	0.28
Cordiadichotoma	1.23	3.13	0.62	4.98	0.22
Carissacarandas	1.53	1.04	0.92	3.5	2.5
Anogeissuspendula	1.23	2.08	0.12	3.43	0.5
Mitragynaparvifolia	0.92	1.04	0.75	2.72	1.5
Manilkara Hexandra	0.31	1.04	0.94	2.29	0.5
Zizyphusmauritiana	0.61	1.04	0.04	1.7	1
Acacialeucophlea	0.31	1.04	0.07	1.42	0.5
Eucalyptushybrid	0.31	1.04	0.05	1.39	0.5
Anogeissuslatifolia	0.31	1.04	0.03	1.37	0.5

Table-4: Vegetation parameters for shrub species.

Name of species	Relative density	Relative frequency	Relative dominance	Important value index	Abundance Frequency ratio
Holorrhenaantidysenterica	76.63	53.23	80.86	210.72	0.09
Wrightiatinctoria R.Br	8.43	11.29	12.16	31.88	0.22
Ceasalpiniabonduc	4.98	11.29	3.53	19.80	0.13
Lantanacamara	3.07	6.45	1.32	10.84	0.25
Calotropisgigantean	2.68	6.45	1.41	10.55	0.22
Carissa Carandas	1.15	4.84	0.00	5.99	0.17
Ipomeafistula	1.92	3.23	0.71	5.85	0.63
Vitexnirgunda	0.77	1.61	0.00	2.38	1.00
Ricinuscommunis	0.38	1.61	0.00	2.00	0.50

Table-5: Vegetation parameters of Climbers/Grasses/Herbs.

Botanical name	R.D	R.F	R.A	IVI	A/F
Bambusavulgaris (Longgrass)	17.93	4.9505	28.44	51.32	0.66
Canavaliaensiformis (Climbers)	15.76	21.78	5.68	43.22	0.03
Cynodondactylon (Grass)	14.67	20.79	5.54	41	0.03
Partheniumhysterophoru s (Grass)	13.59	18.81	5.67	38.06	0.03
Mollugoverticillata (Herb)	13.04	6.93	14.77	34.74	0.24
Heliotropiumsupinum (Weed)	10.33	7.92	10.23	28.48	0.15
Sidacordata (Grass)	4.891	4.95	7.75	17.59	0.18
Ventilagodenticulata Willd. (Climber*)*	3.804	3.96	7.54	15.30	0.22
Celastruspaniculatus (Climber)	2.174	2.97	5.74	10.89	0.22
Tinosporacordifoilia (Gado) (Climber)	2.174	3.96	4.31	10.44	0.13
Curcumaarometica (Herb)	1.63	2.97	4.31	8.90	0.17

Table-6: Species diversity indices

Diversity indices	Shannon index	Simpson index**	No. of species	Diversity
Trees	2.83	0.10	49	Extremely high
Sapling	2.39	0.15	25	Extremely high
Shrub	0.81	0.65	20	Moderate
Herbs/Grass/Climber	2.16	0.12	11	Extremely high
**Lower the value higher the diversity				

Table-7: Biomass and carbon sequestration of dominant species.

Biomass & carbon stock of tree/saplings	Tree	Sapling		
Name of species	Biomass (Tha^{-1})	-1 CO_2 (Tha).	-1. Biomass (Tha)	CO_2 (Tha)
Buteamonosperma	356	160	14	10
Tectonagrandis	257	116	8	5
Terminaliaarjuna	164	74	1	0
Terminaliacrenulata	90	41	1	1
Miliusatomentosa	57	26	1	1
Azadirachtaindica	66	30	1	1
Acaciacatechu	67	30	1	1
Madhucalongifolia	347	156	-	-
Tamarindusindica	251	113	-	-
Eucalyptushybrid	110	49	0	0
Ficusreligiosa	404	182	-	-
Ficusbenghalensis	142	64	-	-
Diospyrosmelanoxylon	19	9	2	1
Aeglemarmelos	10	5	1	1
Bauhiniaracemosa	13	6	-	-
Total	2352	1058	29	21

Conclusion

Floristic diversity and structural composition are vital for ecosystem stability. Dominant species included *Butea monosperma, Tectona grandis*, and *Terminalia arjuna*, with few exotic species present. The area had a high percentage of mature woody trees, fewer saplings, and shrubs and herbs. The forest's future density is at risk without focusing on regeneration. Endangered species like *Terminalia arjuna, Celastrus paniculatus,* and *Tinospora cordifolia*, with significant medicinal and traditional uses, need conservation. This study provides a baseline for further research and the development of conservation and management strategies for essential plant species.

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