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Assessment of Biodiversity Using IVI and Ecological Parameters in the Wan Forest along the Wan Sankul Riverside, Vidarbha, Maharashtra

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Abstract

This study assessed the biodiversity of the Wan Forest along the Wan River in Vidarbha, Maharashtra, using the Importance Value Index (IVI) and various ecological parameters. A total of **22** plant species were recorded within the quadrats, with ***Tectona grandis* L.f. and *Vitex negundo* L.** being the most prominent. The total number of individuals counted for *Tectona grandis* was **105**, while *Vitex negundo* was prevalent, with **103** individuals recorded. Additionally, rare species like ***Buchanania lanzan* (Chaar) and *Syzygium cumini* (Jamun)** were noted within the quadrats, highlighting the ecological richness of the area. The assessment revealed significant biodiversity parameters: the relative frequency (RLFQ %) for *Tectona grandis* was 7.27%, and for *Vitex negundo*, it was also 7.27%. The relative density (RLDN %) for *Tectona grandis* was 29.41%, while *Vitex negundo* had a relative density of 28.84%. The abundance (AB) for *Tectona grandis* was 35, and for *Vitex negundo*, it was 34.33. The calculated Importance Value Index (IVI) for *Tectona grandis* was **76.45**, and for *Vitex negundo*, it was **75.12**. This study emphasizes the need for ongoing monitoring and conservation efforts to protect the unique biodiversity of the Wan Forest, particularly the rare species identified within the quadrats, which contribute to the ecosystem's complexity.

Keywords: Biodiversity, Importance Value Index, *Tectona grandis*, *Vitex negundo*, Ecological parameters, Conservation, Wan Forest, Maharashtra.

1. Introduction

The Wan Wildlife Sanctuary, located in the Vidarbha region of Maharashtra, India, is a vital ecological reserve within the Akot Wildlife Division of the Akola district. Spanning approximately 211 square kilometers, this sanctuary is a crucial component of the Melghat Tiger Reserve, known for its rich biodiversity and unique mix of rehabilitated villages, which are now managed as "Meadows" (**Ingle & Pawar, 2023**). Situated in the rugged Satpura Range, the sanctuary is characterized by tropical dry deciduous forests and the Wan River, which, together with the Wan Sankul riverside, provides a variety of habitats supporting an array of flora and fauna. The biodiversity of the Wan Forest is notable for its combination of species that thrive in both forested and riverside environments. The riverside regions of the Wan River, in particular, are home to a wide array of medicinal plants that play a significant role in traditional medicine systems such as Ayurveda, Unani, and Siddha. These medicinal plants are rich in secondary metabolites such as alkaloids, glycosides, and essential oils, which are valued for their therapeutic properties (**Sandhiya et al., 2010**). The importance of these plants extends beyond traditional medicine, as they continue to contribute to contemporary natural health practices. Additionally, the preservation of this medicinal flora is critical for maintaining the ecological balance and biodiversity of the region (**Rothe, 2003**). This study aims to assess the biodiversity of the Wan Forest, particularly along the Wan River, using the Importance Value Index (IVI) and various ecological parameters. By evaluating species abundance, density, and ecological roles, this research provides insights that are crucial for future conservation efforts. The findings are expected to help guide strategies for preserving the sanctuary's unique biodiversity, ensuring that both its ecological and medicinal importance is maintained.

2. Materials and Methods

2.1 Study Area

- **Location**: Wan Sankul Riverside, Vidarbha, Maharashtra.
- **Ecosystem**: The forest features tropical dry deciduous vegetation and mountainous terrain, supporting a rich variety of plant species.

2.2 Objectives

- To assess biodiversity using the Importance Value Index (IVI).
- To analyze ecological parameters to understand the structure of the plant community.

2.3 Materials

- **Data Collection Tools**:
  - Line transects for sampling plant species.
  - Field notebooks for recording data.
- **Reference Materials**:
  - Floras and plant identification guides specific to the region.

2.4 Methodology

1. **Transect Establishment**:
   - Three line transects were set up in different sections of the forest to sample plant species.
2. **Data Collection**:
   - The total number of plants for each species was counted along the transects.
   - Both vernacular (Hindi/Marathi) and scientific names were recorded.
3. **Ecological Parameter Calculation**:
   - **Total Plants (TP)**: The overall count of individuals for each species.
   - **Frequency (%)**: The percentage of transects where each species was observed.
   - **Density (DN)**: The number of individuals per unit area.
   - **Abundance (AB)**: The average number of individuals of a species in sampled plots.
   - **Relative Frequency (RLFQ)**: Frequency of a species relative to the total frequency of all species.
   - **Relative Density (RLDN)**: Density of a species relative to the total density of all species.
   - **Relative Abundance (RLAB)**: Abundance of a species relative to the total abundance of all species.
   - **Importance Value Index (IVI)**: A composite index calculated as the sum of relative frequency, relative density, and relative abundance for each species.

3. Results

3.1 Species Composition

A total of **22 s**pecies were identified in the Wan Forest. Below is **Table 1**, summarizing the scientific names, vernacular names, line transecting data, and total plants for each species.

Table 1: Species Composition in Wan Forest

S.N.	Scientific Names	Vernacular Names (Hindi/Marathi)	Line Transect			Total Plants
			1	2	3	
1.	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr.	Hindi: Dhaora, Marathi: Dhawda	01	00	03	**04**
2.	*Bambusa vulgaris* Schrad. ex Wendl.	Hindi: Baans, Marathi: Vedha	05	12	07	**24**
3.	*Bauhinia racemosa* Lam.	Hindi: Apta, Marathi: Aapta	00	03	10	**13**
4.	*Bauhinia variegata* L.	Hindi: Kachnar, Marathi:	02	05	00	**07**

3.2

		Kanchan				
5.	*Boswellia serrata* Roxb. ex Colebr.	Hindi: Salai, Marathi: Salai	00	02	02	**04**
6.	*Buchanania lanzan* Spreng.	Hindi: Charoli, Marathi: Piyal	00	01	00	**01**
7.	*Butea monosperma* (Lam.) Taub.	Hindi: Palash, Marathi: Palas	03	07	04	**14**
8.	*Cassia fistula* L.	Hindi: Amaltas, Marathi: Bahava	02	05	00	**07**
9.	*Crotalaria juncea* L.	Hindi: San, Marathi: Randhul	03	00	02	**05**
10.	*Gymnosporia montana* (Roth) Benth.	Hindi: Bhugrund, Marathi: Vikran	02	04	01	**07**
11.	*Lannea coromandelica* (Houtt.) Merr.	Hindi: Moi, Marathi: Modad	00	02	01	**03**
12.	*Lantana camara* L.	Hindi: Raimuniya, Marathi: Ghaneri	05	09	03	**17**
13.	*Mallotus philippensis* (Lam.) Müll. Arg.	Hindi: Kamla, Marathi: Shendri	01	00	02	**03**
14.	*Schleichera oleosa* (Lour.) Oken	Hindi: Kusum, Marathi: Kusumb	01	00	02	**03**
15.	*Senegalia catechu* (L.f.) P.J.H.Hurter & Mabb.	Hindi: Khair, Marathi: Khair	00	02	01	**03**
16.	*Sterculia urens* Roxb.	Hindi: Kadaya, Marathi: Kullu	00	02	03	**05**
17.	*Syzygium cumini* (L.) Skeels	Hindi: Jamun, Marathi: Jambhul	01	00	01	**02**
18.	*Tectona grandis* L.f.	Hindi: Sagwan, Marathi: Sagwan	23	44	38	**105**
19.	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Hindi: Arjun, Marathi: Arjun	15	05	02	**22**
20.	*Vitex negundo* L.	Hindi: Nirgundi, Marathi: Nirgundi	46	26	31	**103**
21.	*Woodfordia fruticosa* (L.) Kurz	Hindi: Dhataki, Marathi: Dhayati	01	00	02	**03**
22.	*Wrightia tinctoria* (Roxb.) R.Br.	Hindi: Indrajau, Marathi: Kala Kuda	01	03	00	**04**

Dominance and Rarity

- **Dominant Species**:
  - *Tectona grandis* and *Vitex negundo* were the most dominant, with high total counts and IVI scores.
- **Rare Species**:
  - Species such as *Buchanania lanzan* (1 individual) and *Syzygium cumini* (2 individuals) were noted as rare within the study area.

3.3 Ecological Parameters

The following **Table 2** summarizes the ecological parameters for each species, including frequency, density, abundance, relative frequency, relative density, relative abundance, and IVI.

Table 2: Ecological Parameters of Identified Species

S. N.	Scientific Names	Total Plants	Frequency (%)	Density	Abundance	Relative Frequency (%)	Relative Density (%)	Relative Abundance (%)	Importance Value Index
		T.P	FQ %	DN	AB	RLFQ %	RLDN%	RLAB%	IVI
1.	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr.	4	66.67	1.33	2	4.85	1.12	2.27	**8.24**
2.	*Bambusa vulgaris* Schrad. ex Wendl.	24	100	8	8	7.27	6.72	9.09	**23.08**
3.	*Bauhinia racemosa* Lam.	13	66.67	4.33	6.5	4.85	3.64	7.39	**15.88**
4.	*Bauhinia variegata* L.	7	66.67	2.33	3.5	4.85	1.96	3.98	**10.79**
5.	*Boswellia serrata* Roxb. ex Colebr.	4	66.67	1.33	2	4.85	1.12	2.27	**8.24**
6.	*Buchanania lanzan* Spreng.	1	33.33	0.33	1	2.42	0.28	1.14	**3.83**
7.	*Butea monosperma* (Lam.) Taub.	14	100	4.67	4.67	7.27	3.92	5.31	**16.51**
8.	*Cassia fistula* L.	7	66.67	2.33	3.5	4.85	1.96	3.98	**10.79**
9.	*Crotalaria juncea* L.	5	66.67	1.67	2.5	4.85	1.4	2.84	**9.09**
10.	*Gymnosporia montana* (Roth) Benth.	7	66.67	2.33	3.5	4.85	1.96	3.98	**10.79**
11.	*Lannea coromandelica* (Houtt.) Merr.	3	66.67	1	1.5	4.85	0.84	1.7	**7.39**
12.	*Lantana camara* L.	17	100	5.67	5.67	7.27	4.75	6.45	**18.47**
13.	*Mallotus philippensis* (Lam.) Müll. Arg.	3	66.67	1	1.5	4.85	0.84	1.7	**7.39**
14.	*Schleichera oleosa* (Lour.) Oken	3	66.67	1	1.5	4.85	0.84	1.7	**7.39**
15.	*Senegalia catechu* (L.f.) P.J.H.Hurter & Mabb.	3	66.67	1	1.5	4.85	0.84	1.7	**7.39**
16.	*Sterculia urens* Roxb.	5	66.67	1.67	2.5	4.85	1.4	2.84	**9.09**
17.	*Syzygium cumini* (L.) Skeels	2	66.67	0.67	1	4.85	0.56	1.14	**6.55**
18.	*Tectona grandis* L.f.	105	100	35	35	7.27	29.41	39.77	**76.45**
19.	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	22	100	7.33	7.33	7.27	6.16	8.33	**21.76**
20.	*Vitex negundo* L.	103	100	34.33	34.33	7.27	28.84	39.01	**75.12**
21.	*Woodfordia fruticosa* (L.) Kurz	3	66.67	1	1.5	4.85	0.84	1.7	**7.39**
22.	*Wrightia tinctoria* (Roxb.) R.Br.	4	66.67	1.33	2	4.85	1.12	2.27	**8.24**

4. Discussion

This study highlights the rich biodiversity of the Wan Forest along the Wan Sankul Riverside, revealing a diverse plant community with important ecological functions. The presence of the river plays a significant role in enhancing the forest's biodiversity by providing vital water resources that support various plant species.

4.1 Dominance of *Tectona grandis*

The dominance of *Tectona grandis* (Teak), as shown by its highest IVI, reflects its adaptability to both the forest environment and the riverine conditions along the Wan Sankul Riverside. Teak thrives in this moisture-rich habitat, where the river enhances soil quality and water availability, allowing the species to maintain high frequency, density, and abundance.

4.2 Habitat Complexity along the Riverside

The river promotes a mosaic of habitats that support a variety of species. The presence of *Vitex negundo*, *Terminalia arjuna*, and *Bauhinia racemosa*, along with riverbank species like *Lantana camara* and *Syzygium cumini*, adds structural complexity to the riverside ecosystem. These species create distinct layers of vegetation that foster wildlife, contributing to the forest's resilience.

4.3 Ecological Roles of Understory and Less Dominant Species

While dominant species like Teak shape the canopy, the ecological roles of understory species, such as *Lantana camara* and *Buchanania lanzan*, are critical in maintaining habitat diversity along the river. These species provide food, shelter, and microhabitats for a range of organisms, enriching the riverside ecosystem.

4.4 Impact of the Wan River on Biodiversity

The Wan River is crucial in maintaining biodiversity within the forest, particularly in dry seasons, by acting as a water source. This supports species that depend on moist habitats, such as *Syzygium cumini* and *Terminalia arjuna*, which thrive near water bodies.

4.5 Conservation and Management

The unique combination of riparian and forest ecosystems in the Wan Sankul area highlights the need for integrated conservation efforts. Protecting the riverside from invasive species like *Lantana camara* is essential to preserving the natural diversity and ecological balance along the Wan Sankul Riverside.

5. Conclusion

This biodiversity assessment of the Wan Forest, particularly along the Wan Sankul Riverside, using Importance Value Index (IVI) and various ecological parameters, reveals a highly diverse and ecologically significant plant community. The river's influence enhances the richness of species and contributes to the forest's structural complexity, supporting both dominant and rare species. The combination of forest and riparian ecosystems plays a crucial role in sustaining local biodiversity, offering vital ecological services such as water regulation, habitat provision, and nutrient cycling.

The study emphasizes the importance of continued monitoring to track changes in species composition, particularly in light of environmental pressures and human activities. Targeted conservation strategies, focusing on protecting both the forest and riverside habitats, are essential for maintaining the ecological balance and preserving this unique biodiversity hotspot. By integrating sustainable management practices with community involvement, the Wan Forest can be safeguarded for future generations, ensuring the continued vitality of its diverse ecosystems.

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