Structural composition and diversity of tree species in two village jungles of Mymensingh

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Abstract: The study describes the community structure and diversity of plant species in two village jungles of Mymensingh based on a random stratified quadrat sampling method. *Aphanamixis polystachya* showed the highest density (288 trees/ha), Importance Value Index (67.38) and Species Diversity (0.358) in Jungle-1 (Laxmipur jungle); while the maximum Total Basal Cover (296.5 m^2/ha) was found in *Artocarpus heterophyllus*. In the Jungle-2 (Dublachara jungle), highest density (521 tress/ha), Importance Value Index (82.2), Total Basal Cover (275.67 m^2/ha) and Species Diversity (0.36) were observed in *Caryota urens*. Considering sapling stage, *Aphanamixis polystachya* ranked first in terms of density (833 and 1302 tress/ha), Importance Value Index (96.22 and 125.83), Total Basal Cover (9.07 and 11.92 m^2/ha) and Species Diversity (0.139 and 0.223) in both the jungles.

Keywords: community structure, Diversity, Importance Value Index, Total Basal Cover.

Introduction

Forests are the most biodiverse terrestrial ecosystems. Village forests hold the vast majority of the world's terrestrial species. Village forests of Bangladesh cover an area of 0.27 million hectare while state forests cover 2.25 million hectares. Village forests, mostly privately owned are more productive than the government forest and supply about 85% of timber requirements of the country. Both indigenous and exotic trees are the major components of the village forests in Bangladesh (Alam, *et. al*. 1996). Forest biodiversity provides a wide array of goods and services which includes timber, pulpwood, firewood, fodder, fruits, fuel, vegetables and medicinal plants. Forests provide ecological services that are extremely important to the environment. Forest biodiversity also has important economic, social and cultural roles in the lives of many indigenous and local communities. Forest biodiversity especially village jungle diversity is being lost because of rapid human population growth, fragmentation and degradation of all forest types. Destruction or conversion of habitat is the most significant cause of biodiversity loss. The main causes are conversion of forest to agricultural land, overgrazing, shifting cultivation and infrastructure development (roads, buildings, housing etc.). Biological diversity in forests depends on their composition and vertical structure (Puumalainen, 2001) and efforts have been made all over the world to include them in the criteria and indicators of forest biodiversity (Stork, *et. al.* 1997). A considerable work on community structure of forests has been conducted in many countries throughout the world but a very few research has been undertaken in Bangladesh especially on village forests structure. Correct inventory of plant species and assessment of village forest biodiversity in different habitats is necessary for framing a long term strategy for rehabilitation of endangered species. The present research work has been undertaken to describe the structure, composition and distribution of plant species in two selected jungles in Mymensingh district.

Materials and methods

The selected study site, Mymensingh district is situated between $24^0 15'$ and $25^0 12'$ north latitudes and $90^0 13'$ and $90^0 49'$ east longitudes. The study was carried out in two village jungles of Bhangnamari union of Gouripur Upazila under Mymensingh district from July, 2005 to September, 2005. Both the jungles are situated on the bank of Old Brahmaputra river. The area of the Jungle-1 (Laxmipur jungle) was 11250 m^2 and that of the Jungle-2 (Dublachara jungle) was 13500 m^2. The phytosociological analysis of the vegetation was done on each jungle by using 6 randomly placed quadrats. The size (8m X 8m) and number of quadrats were determined by the species area curve (Misra, 1968). The vegetation was quantitatively analyzed for frequency, density and abundance following Curtis and Mclntosh (1950). The relative values of frequency, density and dominance were determined as per Phillips (1959). These values were summed to represent IVI (Importance Value Index) of individual species (Curtis, 1959). The ratio of abundance to frequency (A/F) for different species was determined for eliciting the distribution patterns. The trees more than 31.5 cm cbh (circumference at breast height i. e. 1.37 m above the ground) were individually measured for cbh. Individuals between 10.5 to 31.5 cm cbh were recorded either as saplings or shrubs and the individuals less than 10.5 cm cbh were considered as seedlings (Knight, 1963). For Total Basal Cover (TBC), the cbh of all individuals of all the species was measured and then the basal area (BA) of each species was calculated by using the formula, $\pi\ (cbh/2)^2$. The species diversity (H) was determined by using Shannon-Wiener (1963) information index as $H= - \sum (Ni/N) \log n (Ni/N)$, where Ni is the total density value for species i and N is the total density value of all the species in a stand. The concentration of dominance (Cd) was determined by Simpson′s (1949) index, as $Cd = \sum (Ni/N)^2$, where Ni and N are same as for Shannon-Wiener information index.

Results and discussion

A total of 13 tree species under 10 genera and 9 families were recorded in Jungel-1. In the Jungle-2, a total of 20 tree species under 19 genera and 16 families have been recorded. Two species in the Jungle-1 and one species in the Jungle-2 were unidentified. Moraceae was the largest family in both the jungles followed by Meliaceae (Table 1). The highest density belongs to the species *Aphanamixis polystachya* (288 tress/ha) followed by *Artocarpus heterophyllus* (130 trees/ha) in the Jungle-1 (Table 2). In the Jungle-2, the density range of the tree species was observed from 25 trees/ha to 521 trees/ha. *Caryota urens* was the dominant tree species (521 trees/ha) followed by *Artocarpus heterophyllus* (338 trees/ha) (Table 3). Akhter *et al.* (1997) found *Magnifera indica* as highest in number in the sampled villages of Chittagong, Bangladesh. The tree frequency ranged from 16 to 83% in Jungle-1 and 16 to 100% in the Jungle-2. The highest frequency was observed in *Aphanamixis polystachya* in both the jungles followed by *Caryota urens* (50% in Jungle-1 and 66% in Jungle-2) (Table 2, 3). In the Jungle-1, the TBC ranged from 3.62 m^2/ha to 296.5 m^2/ha and in Jungle-2 it varied from 2.0 m^2/ha to 275.67 m^2/ha (Table 2, 3). Table 2 and 3 showed that the maximum TBC value belonged to the species *Artocarpus heterophyllus* (296.5 m^2/ha) in Jungle-1 while the species *Caryota urens* (275.67 m^2/ha) represented maximum occurrence in terms of TBC value in Jungle-2. Al-Amin et *al*. (2005) found the highest TBC in *Tectona grandis* in degraded forest of Chittagong, Bangladesh. The species *caryota urens, Artocarpus heterophyllus, Annona reticulata, Lagerstroemia speciosa* (0.062) represented the highest A/F ratio values in Jungle-1 and the greater A/F ratio was found in *Magnolia pumila* (0.125) in Jungle-2 (Table 2, 3). The IVI value varied between 6.35 and 67.38 in Jungle-1 and between 5.12 and 82.2 in Jungle-2 (Table 2, 3). The species *Aphanamixis polystachya* (67.438) in Jungle-1 and the species *Caryota urens* (82.2) in Jungle-2 had a high IVI score due to the many species present in the jungles (Table 2, 3). Hossain *et al.* (1997) observed the highest IVI in *Bursera serata* in Ramu Reserved Forest of Cox'sBazar, Bangladesh.

The tree species diversity has been observed from 0.092 to 0.358 in Jungle-1 and in Jungle-2 it varied from 0.064 to 0.367 (Table 2, 3). *Aphanamixis polystachya* (0.358) ranked first with respect to species diversity in Jungle-1 and *Caryota urens* (0.367) showed the greater diversity values in Jungle-2. The highest Cd was found in *Aphanamixis polystachya* and *Caryota urens* in the Jungle-1 and Jungle-2, respectively (Table 2, 3).

A total of 12 tree sapling species under 11 genera and 9 families were recorded in Jungle-1. In Jungle-2 a total of 9 tree sapling species under 8 genera and 7 families have been recorded. One species in both the jungles was unidentified. Moraceae was the largest family in both the jungles (Table-1). The sapling of *Aphanamixis polystachya* species was the largest species in the both jungles (833 trees/ha in Jungle-1 and 1301 trees/ha in Jungle-2) (Table 4 & 5)

Table 1: Total number of tree and tree sapling species, genera and families as recorded in both the jungles

		Tree	Tree sapling
Jungle-1	Species	13	12
	Genera	10	11
	Family	09	09
Jungle-2	Species	20	09
	Genera	19	08
	Family	16	07

Table 2: Phytosociological attributes with Species diversity (H) and Concentration of dominance (Cd) of tree species in Jungle-1

Sl no	Botanical name	Density (Trees/ha)	Freq (%)	TBC (m^2/ha)	A/F ratio	IVI	H	Cd
1	*Aphanamixis polystachya*	288	83	69.96	0.026	67.38	0.358	0.08179
2	*Artocarpus heterophyllus*	103	33	296.5	0.062	43.47	0.23321	0.01046
3	*Annona reticulata*	25	16	3.62	0.062	6.35	0.09175	0.00061
4	*Zanthooxylum rhetsa*	25	33	12.56	0.030	12.34	0.09175	0.00061
5	*Alstonia scholaris*	103	50	67.94	0.026	31.11	0.23321	0.01046
6	*Oroxylum indicum*	78	50	16.34	0.026	23.86	0.19814	0.0061
7	*Caryota urens*	103	50	27.19	0.026	28.96	0.23321	0.01046
8	*Ficus racemosa*	103	33	27.90	0.062	25.38	0.23321	0.01046
9	*Lagerstroemia speciosa*	25	16	5.30	0.062	6.66	0.09175	0.00061
10	*Michelia champaca*	25	16	19.62	0.062	8.29	0.09175	0.00061
11	*Ficus hispida*	25	16	16.25	0.062	7.99	0.09175	0.00061
12	Unidentified 1	52	33	30.19	0.030	18.12	0.15303	0.00266
13	Unidentified 2	52	33	10.61	0.030	15.73	0.15303	0.00266

Table 3: Phytosociological attributes with Species diversity (H) and Concentration of dominance (Cd) of tree species in Jungle-2

Sl no	Botanical name	Density (Trees/ha)	Freq (%)	TBC (m^2/ha)	A/F ratio	IVI	H	Cd
1	*Aphanamixis polystachya*	338	100	55.75	0.021	52.08	0.32446	0.0417
2	*Artocarpus heterophyllus*	130	33	46.35	0.05	21.65	0.19976	0.0061
3	*Bombax ceiba*	52	33	9.01	0.03	11.13	0.10821	0.0009
4	*Toona ciliata*	52	33	14.45	0.03	11.72	0.10821	0.0009
5	*Cassia fistula*	25	16	6.83	0.063	5.77	0.06342	0.0002
6	*Annona reticulata*	52	16	6.05	0.125	7.76	0.10821	0.0009
7	*Aegle mermelos*	52	33	8.26	0.03	11.50	0.10821	0.0009
8	*Caryota urens*	521	66	275.67	0.075	82.2	0.36388	0.0991
9	*Samanea saman*	79	50	37.08	0.02	18.94	0.14431	0.0022
10	Unidentified 2	78	33	41.19	0.045	14.35	0.14431	0.0022
11	*Moringa oleifera*	25	16	16.97	0.0625	6.59	0.06342	0.0002
12	*Tamarindus indica*	25	16	2.00	0.0625	5.12	0.06342	0.0002
13	*Ficus racemosa*	25	16	8.29	0.0625	5.91	0.06342	0.0002
14	*Lagerstromia speciosa*	25	16	6.60	0.0625	5.74	0.06342	0.0002
15	*Hynenodietyon excelsum*	25	16	14.51	0.0625	6.41	0.06342	0.0002
16	*Oroxylum indicum*	25	16	6.37	0.0625	5.72	0.06342	0.0002
17	*Elaeocarpus floribundus*	25	16	11.33	0.0625	5.72	0.06342	0.0002
18	*Magnolia pumia*	52	16	5.29	0.125	7.64	0.10821	0.0009
19	*Swietinia mahogani*	25	16	2.40	0.0625	5.19	0.06342	0.0002
20	*Trema orientalis*	25	16	78.5	0.0625	9.15	0.06342	0.0002

Table 4: Phytosociological attributes with Species diversity (H) and Concentration of dominance (Cd) of tree sapling species in Jungle-1

Sl no	Botanical name	Density (Trees/ha)	Freq (%)	TBC (m^2/ha)	A/F ratio	IVI	H	Cd
1	*Aphanamixis polystachya*	833	100	9.07	0.05	96.22	0.36784	0.1391
2	*Annona reticulata*	78	33	3.14	0.045	17.32	0.11717	0.0012
3	*Zanthooxylum rhetsa*	52	16	0.76	0.062	9.81	0.08756	0.0005
4	*Alstonia scholaris*	25	16	0.785	0.062	6.52	0.05029	0.0001
5	*Oroxylum indicum*	52	16	1.98	0.125	10.11	0.08756	0.0005
6	*Caryota urens*	156	33	0.44	0.09	18.91	0.18592	0.0048
7	*Sterblus asper*	521	83	2.45	0.048	56.53	0.33956	0.0544
8	*Toona ciliata*	156	50	3.47	0.04	27.74	0.18592	0.0048
9	*Cassia fistula*	103	50	0.129	0.026	16.87	0.1419	0.0021
10	*Ficus hispida*	52	33	1.12	0.03	12.43	0.08756	0.0005
11	Unidentified 2	153	33	0.123	0.09	19.71	0.18367	0.0046
12	*Gmelina arborea*	52	16	1.80	0.125	9.81	0.08756	0.0005

Table 5: Phytosociological attributes with Species diversity (H) and Concentration of dominance (Cd) of tree sapling species in Jungle-2

Sl no	Botanical name	Density (Trees/ha)	Freq (%)	TBC (m^2/ha)	A/F ratio	IVI	H	Cd
1	*Aphanamixis polystachya*	1302	100	11.92	0.083	125.83	0.3542	0.2231
2	*Annona reticulata*	25	16	0.95	0.062	7.58	0.0426	$8x10^{-05}$
3	*Caryota urens*	104	33	6.86	0.062	18.66	0.1229	0.0014
4	*Cassia fistula*	286	50	3.39	0.073	36.16	0.2351	0.0107
5	*Unknwn 2*	781	66	2.43	0.11	64.79	0.3573	0.0804
6	*Oroxylum indicum*	52	16	1.48	0.125	10	0.0744	0.0003
7	*Artocarpus lakoocha*	52	16	0.64	0.125	8.8	0.0744	0.0003
8	*Toona ciliata*	130	33	2.62	0.075	21.63	0.1438	0.0022
9	*Baccaurea ramiflora*	25	16	0.20	0.062	6.49	0.0426	$8x10^{-05}$

Aphanamixis polystachya (100%) represented the highest frequency rate in both the jungles.

The lowest and highest TBC values of the tree sapling species have been recorded as 0.12 m^2/ha and 9.07 m^2/ha in Jungle-1, respectively (Table 4). *Dipterocarpus turbinatus* showed the maximum TBC in 318.09 ha forest reserves in Bangladesh observed by Nath *et al.* (1998). The maximum A/F ratio (0.125) was observed in the species *Gmelina arborea* and *Oroxylum indicum* in Jungle-1 and the species *Oroxylum indicum* and *Artocarpus heterophyllus* in the Jungle-2, respectively (Table 4 & 5). The species *Aphanamixis polystachya* (96.22 in Jungle-1 and 125.82 in Jungle-2) had the greater IVI value in both the jungles. The species diversity ranged from 0.088 to 0.368 in Jungle-1 and from 0.043 to 0.355 in the Jungle-2. The highest diversity was observed in *Aphanamixis polystachya* in both the jungles (0.368 in Jungle-1 and 0.355 in Jungle-2).

The Cd was recorded from 0.0001 to 0.1391 in the Jungle-1 and in the Jungle-2 it varied from $8x10^{-5}$ to 0.2231 (Table 4 & 5). The highest Cd was found in Aphanamixis polystachya in both the jungles.

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