

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Composition and Diversity of Tree Species in Dudhpukuria-Dhopachori Wildlife Sanctuary of Chittagong (South) Forest Division, Bangladesh

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ABSTRACT

The study investigated the composition and diversity of tree species of Dudhpukuria-Dhopachori Wildlife Sanctuary during April, 2010 to November, 2011. A total of 125 quadrats of 20 m × 20 m in size were established randomly in three beats of the sanctuary namely Dudhpukuria (31), Kamalachori (31) and Dhopachori (63). A total of 2,338 individual tree stems of ≥ 10 cm dbh (468 stem ha^{-1}) of 183 tree species belonging to 125 genera and 48 families were enumerated. Family Euphorbiaceae was represented by maximum number of species (17) and genera (11) followed by Rubiaceae (13 species and 11 genera) and Moraceae (13 species and 3 genera). Monocotyledonous and dicotyledonous trees were 6 and 177 respectively, whereas 6 species were recorded from plantations and 177 tree species were naturally grown. Tree species richness varied from 107 to 158 species, stem density from 418 stem ha^{-1} to 540 stem ha^{-1} and basal area from 21.10 m^2 to 33.92 m^2 in the three beats. Shannon-Wiener's, Margalef's and Simpson's diversity index were 4.449, 23.46 and 0.01923, respectively. *Dipterocarpus turbinatus* showed highest Importance Value Index (13.74) followed by *Lithocarpus acuminata* (10.81). Trends of diversity indices showed highly diverse and stable plant community of this wildlife sanctuary.

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INTRODUCTION

Bangladesh is situated in transition of two floristically rich Indo-Myanmar regions and possesses more than 5700 angiosperm plant species due to its unique geo-physical location [3-5, 16]. Most of the tropical ever-green to semi-evergreen forests of Bangladesh are situated in the South-Eastern region of the country. But, the vegetation resources are being destroyed at an alarming rate because of various socio-economic threats, biotic pressures and competing land uses [14]. This depletion and degradation took place in the form of agriculture expansion, livestock grazing and overexploitation of forest resources for fuel wood, construction material and timber. The depletion of native species was also accelerating at an alarming rate through the rapid loss and degradation of forests in Bangladesh [17, 6]. Consequently deforestation and land degradation results in ecological and socio-economic crisis.

The knowledge of vegetation composition, diversity, habitats, and comparison with similar other habitats may become a tool to estimate the level of adaptation to the environment and their ecological significance. Information on plant species diversity and the forest community structure is also required for conservation management in order to chalk out necessary actions [20]. But, in Bangladesh the issues of conservation and protection of biological diversity have so far had a low priority [6]. The database regarding biodiversity in Bangladesh is very poor and often based on scarce information [5].

Dudhpukuria-Dhopachori is one of the remnant natural forest patches, recently declared as Wildlife Sanctuary, and thus require due attention. There is a need to generate required information in order to ensure conservation, management and sustainable utilization of the forest resources in particular and the biodiversity as a whole. Thus, the current investigation was carried out to determine the species richness, population density and diversity of tree species in the forests of Dudhpukuria-Dhopachori Wildlife Sanctuary.

MATERIALS AND METHODS

Study Area

The study was carried out in the Dudhpukuria-Dhopachori Wildlife Sanctuary (lies between 22°09' to 22°22' north latitude and 92°05' to 92°10' east longitudes) along the borderline of Chittagong, Rangamati and Bandarban districts. The Wildlife Sanctuary (WS) comprises the Reserved Forests of three beat namely Dudhpukuria, Dhopachori, and Kamalachari of Khurusia and Dohazari Forest Ranges of Chittagong (South) Forest Division. The sanctuary comprises a total area of 4,716.57 ha. The whole wildlife sanctuary area, criss-crossed by numerous creeks, is comprised of hill and hillocks (about 80% of total area) and plain lands (about 20% of total area) covered with forests and grasses. The climate of this area is typically subtropical, with a long dry season extending from October to April. From June to September, the south-west monsoon provides the majority of the average rainfall of about 2200-3400 mm. In the past, the forest possessed rich and dense vegetation, but the forest depleted continuously as a result of illegal and over exploitation of forest resources. Till now it

inhibits a better patch of forest vegetation and wildlife in comparison to other protected areas of Bangladesh.

Methods of the Study

Reconnaissance survey was made to the study area in order to get general information about physiognomy of the vegetation, surrounding people, and accessibility to the forests and select sampling methods.

Collection of general information

Information about the study area was collected from Chittagong Forest Division (South) and concerned beat offices.

Vegetation sampling

Stratified Random Sample method was used for the inventory of the tree species. The whole WS was divided into three beat areas namely Dudhpukuria, Dhopachori and Kamalachori. A total of 125 sample plots of 20m × 20m in size were taken from the three blocks (Dudhpukuria 31 plots, Kamalachori 31 plots and Dhopachori 63 plots) randomly to cover a total sample area of 5 ha in order to assess the tree species diversity. In each plot, all the tree species were identified by their local and/or scientific names and enumerate their numbers, measure total height and diameter of the trees having diameter at breast height of ≥10 cm. Herbarium specimen were prepared and preserved following standard scientific methods. The voucher specimens were then deposited to the Herbarium of the Institute of Forestry and Environmental Sciences, Chittagong University.

Data Analysis

Tree species composition and diversity of the tree species was determined using the Shannon-Wiener's diversity index, Simpson's diversity index, Margalef's diversity index, species evenness following Krebs [10] and Barnes [2]. The density, relative frequency, relative abundance, relative dominance and Importance Value Index (IVI) were calculated following Lamprecht [12] and Kent and Coker [9] for each tree species using the following formula.

Species diversity index, $S_{D_i} = S/N$

Margalef's index, $R = (S-1)/\ln(N)$

Shannon-Wiener's diversity index, $H = -\sum_{i=1}^n P_i \ln P_i$

Simpson's diversity index, $D = \sum_{i=1}^n P_i^2$

Species evenness index, $E = \frac{H}{\ln(S)}$

Here, S = Total number of species,

N = Total number of individuals of all the species,

H = Shannon-Wiener's diversity index

P_i = Number of individuals of one species/Total number of individuals in the samples

$$\text{Relative density} = \frac{\text{Total No. of individuals of the species}}{\text{Total No. of individuals of all the species}} \times 100$$

$$\text{Relative frequency} = \frac{\text{Frequency of one species}}{\text{Total frequency}} \times 100$$

$$\text{Relative abundance} = \frac{\text{Abundance of one species}}{\text{Total abundance}} \times 100$$

$$\text{Relative dominance} = \frac{\text{Basal area of one species}}{\text{Total basal area}} \times 100$$

IVI = relative density + Relative frequency + Relative dominance

IVI is calculated following the methods of Lamprecht and Kent and Coker [9, 12].

RESULTS AND DISCUSSION

A total of 2,338 individual stems of 183 tree species belonging to 125 genera and 48 family were enumerated from 5 ha random sample area of the WS. Stem density (540 stems ha⁻¹) and basal area (33.92 m² ha⁻¹) both were highest in Dudhpukuria beat in comparison to Kamalachori and Dhopachori, but the species richness (158 species) is higher in Dhopachori beat (Table 1).

Table 1: Density and basal area of the tree species in the three beats of the WS

	Dudhpukuria beat	Kamalachori beat	Dhopachori beat
Number of tree species	117	107	158
Density (stem ha ⁻¹)	540	418	457
Basal area (m ² ha ⁻¹)	33.92	21.10	27.51

Diversity indices

A total of 2,338 stems were recorded from the 5 ha surveyed area. The stem density was 467.6 trees ha⁻¹ and basal area was 27.51 m²ha⁻¹. The value of species diversity index in the whole survey area was 0.078. The Shannon-Wiener's index in the area was 4.449 with Shannon's maximum diversity index of 5.209. The species evenness index was 0.853. Margalef's diversity index was 23.46. The Simpson's diversity index was 0.0193 (Table 2). The values of Shannon-Wiener's and Margalef's diversity index indicate proficient presence of plant species in the area. Lower value of Simpson's index also stands for diverse tree species.

Table 2: Density, basal area and tree diversity indices of the Dudhpukuria - Dhopachori WS

Parameters	Total for whole DDWS
Density (Stems ha ⁻¹)	468
Basal Area (m ² ha ⁻¹)	27.51
Species diversity index	0.078
Shanon's diversity index	4.449
Shannon's maximum diversity index	5.209
Shannon's equitability index or species evenness index	0.853
Margalef's diversity index	23.46
Simpson's diversity index	0.01923

Importance Value Index (IVI) of the tree species found in the Dudhpukuria-Dhopachori Wildlife Sanctuary

Basal area, density, relative density, relative frequency, relative abundance, relative dominance and Importance Value Index (IVI) of the recorded tree species are shown in Table 3. Among the 183 tree species, 15 dominant tree species represents the 44.87% of the stand density (1,041 individuals of 2,338 individuals). Similarly, 35.23% of the basal area, 44.87% of the relative density, 32.36% of the relative frequency, 16.02% of the relative abundance, 35.23% of the relative dominance and 37.49% of the IVI were occupied by the 15 dominant tree species (Table 3). *Dipterocarpus turbinatus* possessed the maximum stem ha⁻¹ (26 stem ha⁻¹) followed by *Lithocarpus acuminata* (21.8), *Aporosa wallichii* (21.2), *Grewia nervosa* (19.2) and *Artocarpus chama* (17.6). *Grevillea robusta*, *Diospyros toposia*, *Vatica lanceaefolia*, *Artocarpus heterophyllus*, *Leea robusta* etc. species possessed single stems only in 5 ha sample area. *Dipterocarpus turbinatus* showed the maximum IVI (13.74) followed by *Lithocarpus acuminata* (10.81), *Artocarpus chama* (10.69), *Grewia nervosa* (9.83), *Aporosa wallichii* (9.43), *Terminalia bellirica* (8.37), *Schima wallichii* (7.36) and 7.06 for *Stereospermum colais* (Table 3).

Table 3: Basal area, stems/5 ha sampled area, relative density, relative frequency, relative abundance, relative dominance and Importance Value Index (IVI) of trees of DDWS

Sl. No.	Scientific Name	BA (m ²)	Stem/5 ha	RD (%)	RF (%)	RA (%)	RDo (%)	IVI
1	<i>Acacia auriculiformis</i>	0.057	2	0.09	0.13	0.4	0.04	0.26
2	<i>Acacia mangium</i>	0.059	2	0.09	0.07	0.81	0.04	0.2
3	<i>Acronychia pedunculata</i>	1.697	53	2.27	1.86	0.76	1.23	5.36
4	<i>Actinodaphne angustifolia</i>	0.405	17	0.73	0.93	0.49	0.29	1.95
5	<i>Aegle marmelos</i>	0.038	2	0.09	0.13	0.4	0.03	0.25
6	<i>Aglaia chittagonga</i>	0.239	9	0.38	0.53	0.45	0.17	1.09
7	<i>Aglaia perviridis</i>	0.303	7	0.3	0.27	0.71	0.22	0.79
8	<i>Aglaia spectabilis</i>	0.75	3	0.13	0.2	0.4	0.54	0.87
9	<i>Aidia oppositifolia</i>	0.198	5	0.21	0.27	0.5	0.14	0.62
10	<i>Alangium chinense</i>	0.927	18	0.77	0.93	0.52	0.67	2.38
11	<i>Albizia chinensis</i>	0.398	24	1.03	0.73	0.88	0.29	2.05
12	<i>Albizia odoratissima</i>	0.829	22	0.94	0.8	0.74	0.6	2.34
13	<i>Albizia procera</i>	0.627	10	0.43	0.6	0.45	0.46	1.48
14	<i>Alstonia scholaris</i>	0.082	7	0.3	0.4	0.47	0.06	0.76

15	<i>Anisoptera scaphula</i>	0.602	4	0.17	0.27	0.4	0.44	0.87
16	<i>Anogeissus acuminata</i>	0.576	23	0.98	1.26	0.49	0.42	2.67
17	<i>Antidesma banius</i>	0.011	1	0.04	0.07	0.4	0.01	0.12
18	<i>Antidesm avelutinum</i>	0.025	2	0.09	0.07	0.81	0.02	0.17
19	<i>Aphanamixis polystachya</i>	0.759	19	0.81	1.2	0.43	0.55	2.56
20	<i>Aporusa wallichii</i>	2.615	106	4.53	3	0.95	1.9	9.43
21	<i>Aquilaria agallocha</i>	0.057	2	0.09	0.13	0.4	0.04	0.26
22	<i>Artocarpus heterophyllus</i>	0.108	1	0.04	0.07	0.4	0.08	0.19
23	<i>Artocarpus chama</i>	5.309	88	3.76	3.06	0.77	3.86	10.69
24	<i>Artocarpus lacucha</i>	0.881	22	0.94	1.26	0.47	0.64	2.85
25	<i>Baccaurea ramiflora</i>	0.012	1	0.04	0.07	0.4	0.01	0.12
26	<i>Berrya cordifolia</i>	1.063	8	0.34	0.07	3.23	0.77	1.18
27	<i>Bombax insigne</i>	1.454	13	0.56	0.67	0.52	1.06	2.28
28	<i>Brassaiopsis glomerulata</i>	0.011	1	0.04	0.07	0.4	0.01	0.12
29	<i>Bridelia retusa</i>	0.035	3	0.13	0.2	0.4	0.03	0.35
30	<i>Brownlowia elata</i>	0.142	4	0.17	0.27	0.4	0.1	0.54
31	<i>Butea monosperma</i>	0.01	1	0.04	0.07	0.4	0.01	0.12
32	<i>Caesalpinia pulcherrima</i>	0.095	1	0.04	0.07	0.4	0.07	0.18
33	<i>Callicarpa arborea</i>	0.798	34	1.45	1.4	0.65	0.58	3.43
34	<i>Calophyllum polyanthum</i>	0.275	3	0.13	0.2	0.4	0.2	0.53
35	<i>Canthium horridum</i>	0.039	2	0.09	0.13	0.4	0.03	0.25
36	<i>Carallia brachiata</i>	0.747	7	0.3	0.47	0.4	0.54	1.31
37	<i>Caryota mitis</i>	0.177	13	0.56	0.73	0.48	0.13	1.42
38	<i>Caryota urens</i>	0.063	6	0.26	0.33	0.48	0.05	0.64
39	<i>Cassia fistula</i>	0.195	5	0.21	0.27	0.5	0.14	0.62
40	<i>Cassia nodosa</i>	0.033	1	0.04	0.07	0.4	0.02	0.13
41	<i>Ceriscoides campanulata</i>	0.018	2	0.09	0.13	0.4	0.01	0.23
42	<i>Chickrassia tabularis</i>	2.538	25	1.07	0.53	1.26	1.85	3.45
43	<i>Chisocheton cumingianus</i>	2.207	20	0.86	0.93	0.58	1.6	3.39
44	<i>Cinnamomum iners</i>	0.044	3	0.13	0.2	0.4	0.03	0.36
45	<i>Cocos nucifera</i>	0.13	3	0.13	0.2	0.4	0.09	0.42
46	<i>Crypteronia paniculata</i>	0.124	2	0.09	0.13	0.4	0.09	0.31
47	<i>Cryptocarya amygdalina</i>	1.349	17	0.73	0.67	0.69	0.98	2.37
48	<i>Derris robusta</i>	0.066	1	0.04	0.07	0.4	0.05	0.16
49	<i>Didymosper magracilis</i>	0.023	2	0.09	0.13	0.4	0.02	0.24
50	<i>Dillenia indica</i>	0.031	1	0.04	0.07	0.4	0.02	0.13
51	<i>Dillenia scabrella</i>	3.414	29	1.24	1.4	0.56	2.48	5.12
52	<i>Diospyros malabarica</i>	0.818	7	0.3	0.47	0.4	0.59	1.36
53	<i>Diospyros toposia</i>	0.166	1	0.04	0.07	0.4	0.12	0.23
54	<i>Dipterocarpus alatus</i>	2.628	6	0.26	0.4	0.4	1.91	2.57
55	<i>Dipterocarpus costatus</i>	5.732	22	0.94	0.73	0.81	4.17	5.84
56	<i>Dipterocarpus turbinatus</i>	8.691	130	5.56	1.86	1.87	6.32	13.74
57	<i>Discospermum abnorme</i>	0.011	1	0.04	0.07	0.4	0.01	0.12
58	<i>Drimycarpus acemosus</i>	0.103	3	0.13	0.2	0.4	0.07	0.4
59	<i>Duabanga grandiflora</i>	0.262	5	0.21	0.27	0.5	0.19	0.67
60	<i>Dysoxylum binectariferum</i>	0.097	2	0.09	0.13	0.4	0.07	0.29
61	<i>Dysoxylum excelsum</i>	0.057	2	0.09	0.13	0.4	0.04	0.26
62	<i>Ehretia serrata</i>	0.096	1	0.04	0.07	0.4	0.07	0.18
63	<i>Elaeocarpus floribundus</i>	0.976	9	0.38	0.53	0.45	0.71	1.63
64	<i>Elaeocarpus tectorius</i>	0.959	11	0.47	0.67	0.44	0.7	1.83

65	<i>Elaeocarpus varunua</i>	0.112	2	0.09	0.13	0.4	0.08	0.3
66	<i>Engelhardi faspicata</i>	0.091	1	0.04	0.07	0.4	0.07	0.18
67	<i>Erythrina fusca</i>	0.594	7	0.3	0.47	0.4	0.43	1.2
68	<i>Ficus auriculata</i>	0.149	4	0.17	0.27	0.4	0.11	0.55
69	<i>Ficus benghalensis</i>	7.037	6	0.26	0.4	0.4	5.12	5.77
70	<i>Ficus fistulosa</i>	0.041	1	0.04	0.07	0.4	0.03	0.14
71	<i>Ficus hispida</i>	0.465	23	0.98	1.26	0.49	0.34	2.59
72	<i>Ficus lamponga</i>	2.565	9	0.38	0.47	0.52	1.86	2.72
73	<i>Ficus nervosa</i>	2.136	10	0.43	0.6	0.45	1.55	2.58
74	<i>Ficus racemosa</i>	0.589	12	0.51	0.73	0.44	0.43	1.67
75	<i>Ficus semicordata</i>	0.101	4	0.17	0.13	0.81	0.07	0.38
76	<i>Ficus variegata</i>	1.577	26	1.11	1.46	0.48	1.15	3.72
77	<i>Flacourtia jangomas</i>	0.008	1	0.04	0.07	0.4	0.01	0.12
78	<i>Garcinia cowa</i>	0.746	26	1.11	1.13	0.62	0.54	2.79
79	<i>Garcinia morella</i>	0.104	3	0.13	0.2	0.4	0.08	0.4
80	<i>Garcinia xanthochymus</i>	0.591	5	0.21	0.2	0.67	0.43	0.84
81	<i>Gardenia coronaria</i>	0.01	1	0.04	0.07	0.4	0.01	0.12
82	<i>Garuga pinnata</i>	2.928	35	1.5	1.86	0.5	2.13	5.49
83	<i>Glochidion lanceolarium</i>	0.018	1	0.04	0.07	0.4	0.01	0.12
84	<i>Glochidion multiloculare</i>	0.383	20	0.86	1.07	0.5	0.28	2.2
85	<i>Glochidionvelutinum</i>	0.022	2	0.09	0.13	0.4	0.02	0.23
86	<i>Glutaelegans</i>	1.35	17	0.73	0.73	0.62	0.98	2.44
87	<i>Glycosmispentaphylla</i>	0.024	1	0.04	0.07	0.4	0.02	0.13
88	<i>Gmelinaarborea</i>	0.223	9	0.38	0.6	0.4	0.16	1.15
89	<i>Grevillearobusta</i>	0.588	1	0.04	0.07	0.4	0.43	0.54
90	<i>Grewia nervosa</i>	3.296	96	4.11	3.33	0.77	2.4	9.83
91	<i>Grewia tiliifolia</i>	0.027	3	0.13	0.2	0.4	0.02	0.35
92	<i>Haldina cordifolia</i>	0.035	3	0.13	0.2	0.4	0.03	0.35
93	<i>Harpullia cupanoides</i>	0.063	1	0.04	0.07	0.4	0.05	0.16
94	<i>Holarrhena antidysenterica</i>	0.291	20	0.86	0.87	0.62	0.21	1.93
95	<i>Hopea odorata</i>	0.044	3	0.13	0.2	0.4	0.03	0.36
96	<i>Hydnocarpus laurifolius</i>	0.784	26	1.11	1.26	0.55	0.57	2.95
97	<i>Illex godajam</i>	0.036	2	0.09	0.13	0.4	0.03	0.25
98	<i>Lagerstroemia macrocarpa</i>	0.217	13	0.56	0.8	0.44	0.16	1.51
99	<i>Lagerstromia speciosa</i>	0.367	9	0.38	0.53	0.45	0.27	1.18
100	<i>Lannea coromandelica</i>	0.036	1	0.04	0.07	0.4	0.03	0.14
101	<i>Leea robusta</i>	0.105	1	0.04	0.07	0.4	0.08	0.19
102	<i>Lepisanthes rubiginosa</i>	0.025	1	0.04	0.07	0.4	0.02	0.13
103	<i>Licuala peltata</i>	2.28	23	0.98	1.33	0.46	1.66	3.97
104	<i>Lithocarpus acuminata</i>	3.786	109	4.66	3.4	0.86	2.75	10.81
105	<i>Lithocarpus elegans</i>	0.56	11	0.47	0.53	0.55	0.41	1.41
106	<i>Lithocarpus pachyphylla</i>	1.73	22	0.94	1.07	0.55	1.26	3.26
107	<i>Lithocarpus polystachya</i>	0.542	20	0.86	0.87	0.62	0.39	2.12
108	<i>Litsea glutinosa</i>	0.152	11	0.47	0.73	0.4	0.11	1.31
109	<i>Macaranga adenticulata</i>	0.734	28	1.2	1.4	0.54	0.53	3.13
110	<i>Macaranga indica</i>	0.061	3	0.13	0.13	0.6	0.04	0.31
111	<i>Macaranga peltata</i>	0.02	2	0.09	0.13	0.4	0.01	0.23
112	<i>Maesa chisia</i>	0.008	1	0.04	0.07	0.4	0.01	0.12
113	<i>Maesa indica</i>	0.185	11	0.47	0.67	0.44	0.13	1.27

114	<i>Magifera sylvatica</i>	0.724	6	0.26	0.4	0.4	0.53	1.18
115	<i>Mallotus tetracoccus</i>	0.009	1	0.04	0.07	0.4	0.01	0.12
116	<i>Mangifera indica</i>	0.163	2	0.09	0.13	0.4	0.12	0.34
117	<i>Michelia bailloni</i>	0.101	1	0.04	0.07	0.4	0.07	0.18
118	<i>Micromelum minutum</i>	0.048	4	0.17	0.13	0.81	0.03	0.34
119	<i>Mitragyna diversifolia</i>	0.404	20	0.86	1.13	0.47	0.29	2.28
120	<i>Mitragyna parvifolia</i>	0.424	26	1.11	1.4	0.5	0.31	2.82
121	<i>Mitragyna rotundifolia</i>	0.147	6	0.26	0.33	0.48	0.11	0.7
122	<i>Myristica linifolia</i>	0.107	6	0.26	0.33	0.48	0.08	0.67
123	<i>Neolamarckia cadamba</i>	0.293	16	0.68	0.53	0.81	0.21	1.43
124	<i>Neonauclea sessilifolia</i>	0.03	3	0.13	0.2	0.4	0.02	0.35
125	<i>Ormosia robusta</i>	0.031	1	0.04	0.07	0.4	0.02	0.13
126	<i>Oroxylum indicum</i>	0.134	9	0.38	0.53	0.45	0.1	1.02
127	<i>Pajanelia longifolia</i>	0.074	2	0.09	0.13	0.4	0.05	0.27
128	<i>Palaquium polyanthum</i>	0.214	3	0.13	0.2	0.4	0.16	0.48
129	<i>Persea bombycina</i>	0.008	1	0.04	0.07	0.4	0.01	0.12
130	<i>Phoebe lanceolata</i>	0.02	1	0.04	0.07	0.4	0.01	0.12
131	<i>Phoenix sylvestris</i>	0.039	2	0.09	0.07	0.81	0.03	0.18
132	<i>Phyllanthus emblica</i>	0.216	10	0.43	0.53	0.5	0.16	1.12
133	<i>Phyllanthus reticulatus</i>	0.023	1	0.04	0.07	0.4	0.02	0.13
134	<i>Picrasma javanica</i>	0.02	2	0.09	0.07	0.81	0.01	0.17
135	<i>Pithecellobium angulatum</i>	0.751	12	0.51	0.73	0.44	0.55	1.79
136	<i>Protium serratum</i>	1.822	61	2.61	2.06	0.79	1.32	6
137	<i>Psidium guajaba</i>	0.031	1	0.04	0.07	0.4	0.02	0.13
138	<i>Pterospermum acerifolium</i>	0.829	18	0.77	1.13	0.43	0.6	2.5
139	<i>Pterospermum semisagittatum</i>	0.897	23	0.98	0.93	0.66	0.65	2.57
140	<i>Sapium baccatum</i>	1.969	15	0.64	0.67	0.6	1.43	2.74
141	<i>Sapros maternatum</i>	0.028	1	0.04	0.07	0.4	0.02	0.13
142	<i>Sarcochlamys pulcherrima</i>	0.036	2	0.09	0.13	0.4	0.03	0.25
143	<i>Schima wallichii</i>	4.084	56	2.4	2	0.75	2.97	7.36
144	<i>Senna siamea</i>	0.528	9	0.38	0.47	0.52	0.38	1.23
145	<i>Shorea robusta</i>	0.064	1	0.04	0.07	0.4	0.05	0.16
146	<i>Siphono doncelastrineus</i>	0.201	8	0.34	0.53	0.4	0.15	1.02
147	<i>Spondias pinnata</i>	0.555	17	0.73	1	0.46	0.4	2.13
148	<i>Sterculia foetida</i>	0.716	18	0.77	1	0.48	0.52	2.29
149	<i>Sterculia hamiltonii</i>	0.015	1	0.04	0.07	0.4	0.01	0.12
150	<i>Sterculia villosa</i>	0.765	15	0.64	0.8	0.5	0.56	2
151	<i>Stereospermum colais</i>	3.926	50	2.14	2.06	0.65	2.85	7.06
152	<i>Steteospermum suaveolens</i>	0.613	11	0.47	0.73	0.4	0.45	1.65
153	<i>Streblus asper</i>	0.501	10	0.43	0.27	1.01	0.36	1.06
154	<i>Suregada multiflora</i>	0.013	1	0.04	0.07	0.4	0.01	0.12
155	<i>Swietenia mehogoni</i>	0.102	1	0.04	0.07	0.4	0.07	0.18
156	<i>Swintonia floribunda</i>	5.651	12	0.51	0.47	0.69	4.11	5.09
157	<i>Syzygium balsameum</i>	0.657	5	0.21	0.33	0.4	0.48	1.02
158	<i>Syzygium claviflorum</i>	0.664	2	0.09	0.07	0.81	0.48	0.63
159	<i>Syzygium cumini</i>	0.12	4	0.17	0.27	0.4	0.09	0.52
160	<i>Syzygium cymosum</i>	0.038	1	0.04	0.07	0.4	0.03	0.14
161	<i>Syzygium firmum</i>	0.141	9	0.38	0.4	0.6	0.1	0.89
162	<i>Syzygium fruticosum</i>	0.174	5	0.21	0.33	0.4	0.13	0.67

163	<i>Syzygium ramosissimum</i>	0.162	2	0.09	0.13	0.4	0.12	0.34
164	<i>Syzygium syzygioides</i>	0.265	7	0.3	0.4	0.47	0.19	0.89
165	<i>Syzygium tetragonum</i>	2.807	15	0.64	0.8	0.5	2.04	3.48
166	<i>Tamarindus indica</i>	0.06	3	0.13	0.13	0.6	0.04	0.31
167	<i>Tarena campaniflora</i>	0.701	43	1.84	1.73	0.67	0.51	4.08
168	<i>Tectona grandis</i>	2.817	80	3.42	0.47	4.61	2.05	5.94
169	<i>Terminalia alata</i>	0.201	3	0.13	0.2	0.4	0.15	0.47
170	<i>Terminalia arjuna</i>	1.179	12	0.51	0.67	0.48	0.86	2.04
171	<i>Terminalia bellirica</i>	5.011	53	2.27	2.46	0.58	3.64	8.37
172	<i>Terminalia chebula</i>	0.414	3	0.13	0.2	0.4	0.3	0.63
173	<i>Tetrameles nudiflora</i>	0.431	9	0.38	0.6	0.4	0.31	1.3
174	<i>Toona ciliata</i>	0.38	12	0.51	0.67	0.48	0.28	1.46
175	<i>Trema orientalis</i>	0.009	1	0.04	0.07	0.4	0.01	0.12
176	<i>Trewia nudiflora</i>	0.503	11	0.47	0.67	0.44	0.37	1.5
177	<i>Vatica lanceaefolia</i>	0.113	1	0.04	0.07	0.4	0.08	0.19
178	<i>Vitex glabrata</i>	0.297	7	0.3	0.47	0.4	0.22	0.98
179	<i>Vitex peduncularis</i>	0.986	55	2.35	1.8	0.82	0.72	4.87
180	<i>Vitex pinnata</i>	0.546	13	0.56	0.67	0.52	0.4	1.62
181	<i>Walsura robusta</i>	0.172	3	0.13	0.2	0.4	0.13	0.45
182	<i>Wrightia arborea</i>	0.096	3	0.13	0.13	0.6	0.07	0.33
183	<i>Zanthoxylum rhetsa</i>	0.213	6	0.26	0.33	0.48	0.15	0.74
Total		137.56	2338	100	100	100	100	300

[BA= Basal Area, RD= Relative Density, RF= Relative Frequency, RA= Relative Abundance, RDO= Relative Dominance and IVI= Importance Value Index]

Tree species richness of a study site gives a reliable instrument to indicate diversity level of a forest site [21]. The tree species composition of Dudhpukuria-Dhopachori WS (183 species, 123 genera and 50 families) is higher in comparison to many natural evergreen and semi-evergreen forests of Bangladesh, i.e. 38 tree species in Ukhiya Range of Cox's Bazar [1], 85 tree species in Sitapahar Reserve forest of Chittagong Hill Tracts (South) Forest Division [15], 85 tree species in Bamu reserve forest of Cox's Bazar [8], 92 tree species in Chunati wildlife sanctuary [18], 62 tree species in Tankawati natural forest [13]. Dudhpukuria-Dhopachori Wildlife Sanctuary possesses higher tree species in comparison to the similar natural forests of Bangladesh, or even higher in comparison to the 153 tree species in tropical forests of Eastern Ghats, India [20], 162 tree species in primary forests of Garo Hills, India [11]. Considering the results of these similar studies, it can be inferred that the Dudhpukuria - Dhopachori Wildlife Sanctuary possesses a comparatively well rich natural forest with diverse number of tree species in comparison to the similar forests of the country.

The stem density (464 stem/ha) ranks highest in comparison to 381 stems ha⁻¹ in Sitapahar reserve forest of Chittagong Hill Tracts (South) Forest Division [15], 459 stem ha⁻¹ in Chunati WS [18], 257 stem ha⁻¹ in Ukhiya natural forests of Cox's-Bazar Forest Division [1], 369 stem ha⁻¹ in Bamu reserve forests of Cox's Bazar [5]. Similarly, the basal area (27.07 m²ha⁻¹) of DDWS is much higher than that of 16.88 m²ha⁻¹ in Chunuti Wildlife Sanctuary [18], but lower than that of 53.5 m²ha⁻¹ in Sitapahar reserve forests of Chittagong Hill Tracts [15], 47.02 - 62.16 m²ha⁻¹ in Tankawati natural forest of Chittagong South Forest Division [13]. Higher species

diversity and stem density but lower basal area indicates that the forest is suffering from deforestation and removal of mature trees.

The Importance Value Index (IVI) indicates a complete picture of phytosociological character of a species in the community [5]. *Dipterocarpus turbinatus* possesses the highest IVI values (13.93) followed by *Lithocarpus acuminata* (10.90), *Artocarpus chama* (10.63) and *Grewia nervosa* (9.90). Traditionally the forests of Dudhpukuria-Dhopachori are known as Garjon forest because of availability and dominance of *Dipterocarpus* species. Till now mature (more than 100 years) individuals of *Dipterocarps* species in association with some native species are found dominating the forests though indiscriminate deforestation was occurred earlier.

The Shannon-Wiener diversity index (4.45) of the forest is higher than that of 2.98 in Shitapahar reserve forest [15] and 3.25 in Tankawati natural forest of Chittagong (South) Forest Division [13]. The diversity index is almost comparable to 4.27 of Garo Hills of India [11]. The value of Shannon-Wiener diversity index (4.45) and Margalef's index (23.46) and lower value of Simpson's index indicates higher species diversity in Dudhpukuria - Dhopachori Wildlife Sanctuary.

Conversion of species rich such tropical semi-evergreen rain forests to various land uses and increased human settlement around forests may change the tree species composition and density. Rehabilitation of tribal community in the reserve forest also caused rapid deforestation and conversion of forests land to agricultural land. Some domestic tree species e. g. *Cocos nucifera*, *Artocarpus heterophyllus*, *Mangifera indica* etc. were found to grow in the vicinity of the forests. *Tectona grandis*, *Aquilaria agallocha*, *Shorea robusta* were also recorded from the plantation activities of the Forest Department.

CONCLUSION

Primary natural forests of Bangladesh are disappearing at an alarming rate. The situation demands an urgent attention to enrich the plant diversity at genera and species levels to avoid the risk of extinction of single species or general with single species. It is also important to conserve biodiversity for the sake of our living, aesthetic appreciation and curiosity. The IVI of the study reveals the most ecologically important species in forests of Dudhpukuria - Dhopachori and those to be prioritized for conservation programs.

ACKNOWLEDGEMENTS

The authors are cordially appreciating the financial supports of Arannayk Foundation (Tropical Forest Conservation Program of the Government of USA and Bangladesh) for the field studies and the Forest Department personnel for cooperation and help in the field works.



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