

Diversity of Forest Undergrowth of North Eastern Region of Bangladesh

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Abstract: The diversity of undergrowth (shrubs, herbs and grasses) of forested north eastern region (part of Sylhet forest division) of Bangladesh was assessed and discussed. The study area identified major 14 species of 12 families of shrubs and 25 species of 16 families of herbs and grasses. The result revealed that Gramineae family was dominated with 5 species and Verbenaceae was dominated with 3 species followed by Leguminosae family with 3 species and the family Araceae, Umbelliferae, Piperaceae, Cimpositae contains 2 species each. Among the shrubs the highest density (53.57 plants/100 m²) and frequency (35.71%) were found in *Clerodendrum viscosum* and the lowest density was found at *Crotalaria medicagenia* (2.68 plants/100 m²) and frequency was found in *Crotalaria medicagenia*, *Samanea saman*, *Rivinia humilis*, *Firmiana colorata*, *Streblus asper*, *Solanum xanthocarpum* and *Lantana camara* (3.57%). The highest abundance was estimated in *Urena lobata* (412.5 plants/100 m²) and the lowest abundance was shown by *Lippia geminata* and *Crotalaria medicagenia* (75 plants/100 m²). Among the herbs and grasses *Eupatorium odoratum* shows the highest density (61.6 plants/100 m²) and the lowest density was shown by *Phaseolus adenanthus* and *Vanda roxburghii* (1.79 plants/100 m²). The highest frequency was found in *Eupatorium odoratum* and *Diplazium esculentum* (21.43%). Lowest frequency was found at *Mimosa pudica*, *Peperomia pellucida*, *Piper betel*, *Curcuma aromatica*, *Cleome rutidosperma*, *Polygonum lanatum*, *Phyllanthus nirruri*, *Vanda roxburghii*, *Doemia extensa* (3.57%). The highest abundance was estimated in *Vernonia cinerea* (425 plants/100 m²) followed by *Curcuma aromatica* (400 plants/100 m²) and the lowest abundance was estimated in *Phaseolus adenanthus* and *Vanda roxburghii* (50 plants/100 m²).

Key words: Undergrowth, Biodiversity, Plant diversity

INTRODUCTION

Biological diversity has become one of the most popular topic recently for discussion both in scientific and political forum at local, national, regional and global level [1]. Floral diversity is the total variability of plant communities and the ecological complexes they inhabit. The number of species in a community is important ecologically since the species diversity seems to increase as the community becomes stable [2]. Biodiversity is the variability of plant, animal and microorganism in an ecosystem [3]. Biodiversity entails all forms of biological entities inhabiting the earth-including prokaryotes-wild plants and animals, microorganisms, domesticated animals and cultivated plants and even genetic material like seeds and germplasm [4]. Bangladesh has a total land area of 14.39 million hectares, of which 9.12 million ha is cultivated, 2.14 million ha public forests, 0.27 million ha village groves and 1.64 million ha constantly under water. The remaining land area (1.22 million hectares) is occupied by tea gardens, uncultivable areas, rural and urban houses and ponds [5].

Bangladesh is rich in plant diversity includes 86 species of timber plants, 130 fiber-yielding plants, 500 medicinal plants and 29 orchids [6]. However, the loss of diversity is distinct due to population pressure, rapid urbanization and illicit felling of trees but a total listing of forest floor (undergrowth) of the forest is yet to be done. Therefore, there is a need may exist to quantify and listing of the shrubs, herbs and grasses and assess their diversity. This paper made an attempt to quantify the shrubs, herbs and grasses of north eastern region of (part of Sylhet forest division) of Bangladesh.

MATERIALS AND METHODS

The study was conducted in the forested north eastern region (part of Sylhet forest division) of Bangladesh which lies between 24°00¢-24°30¢ latitude and 91°30¢-92°00¢ longitude. The study area covers most part of two districts: Moulvibazar and Habigonj.

The soil varies from clayey loam on level ground to sandy loam on hilly ground [7]. Climate of the study area is warm and humid. The period from middle of

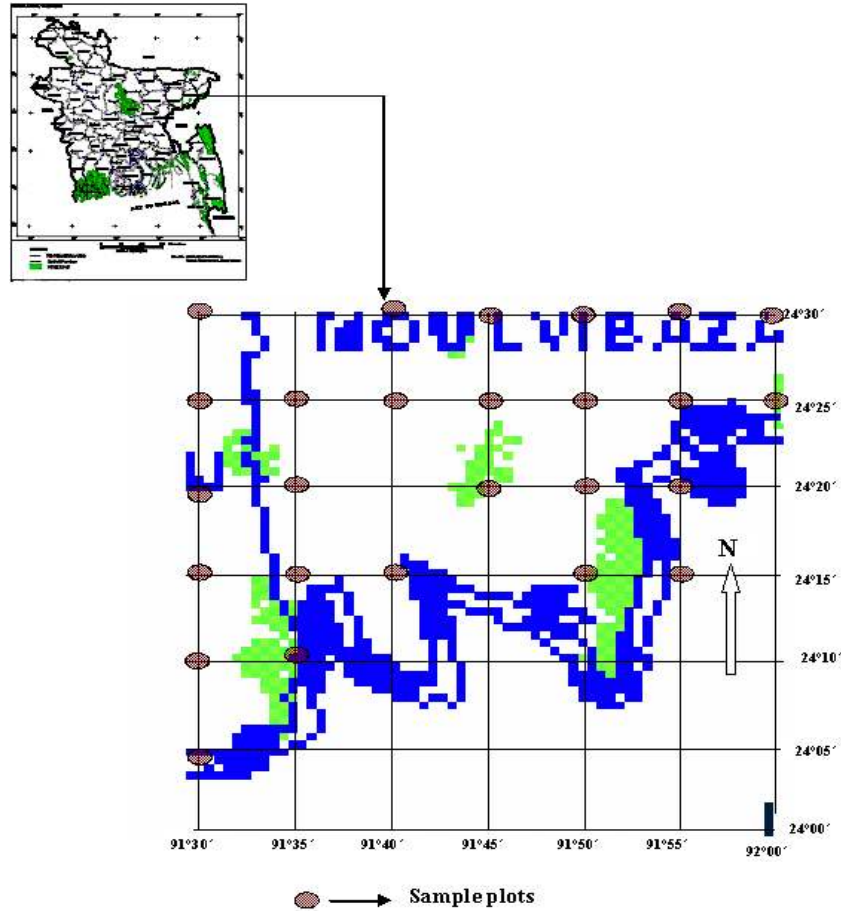


Fig. 1: Map showing the study area with sampling points at 5' intervals

November to end of February is fairly cool and in March the temperature begins to rise, but heavy rain in April and May prevents the development of extremes of climate^[8]. Occasionally cold spell occurs in February also. Mean annual temperature ranges from 20.87°C 29.69°C and mean annual rainfall is 2400 mm^[9].

The study was based on the data collection directly from the field through physical measurement. The study area was selected by using the help of forest map of Bangladesh and the number of plots determined by taking grid line intersection of the total area. Systematic sampling was carried out along with the grid lines (along the latitude and longitude) at the 5' interval. Sampling plot of 2m×2m size was taken in every grid intersection point. Standard procedure were followed to measure density, frequency abundance, Relative density (R.D.), Relative Frequency (R.F.), Relative Abundance (R.A.) and Important Value Index (IVI) of the species^[10,11]. Diversity index, the Shanon-Winner index for diversity and Species Richness index^[12] were also measured.

RESULTS AND DISCUSSIONS

Shrubs:

Following table (2) is illustrating highest density of shrubs: *Clerodendrum viscosum* (53 plants/100m²) and the lowest density *Crotalaria medicagenia* (nearly 3 plants/100 m²). Moreover, the highest relative density was found in *Clerodendrum viscosum* (22.22%) and the

Table 1: Composition of shrubs in the study area

Local name	Scientific name	Family
Bhat	<i>Clerodendrum viscosum</i>	Verbenaceae
Lantana	<i>Lantana camara</i>	Verbenaceae
Vui Ukra	<i>Lippia geminata</i>	Verbenaceae
Bantejpata	<i>Melastoma malabathricum</i>	Melastomaceae
Katabegun	<i>Solanum xanthocarpum</i>	Solanaceae
Sheora	<i>Streblus asper</i>	Moraceae
Bet	<i>Calamus sp</i>	Palmae
Ban Ukra	<i>Urena lobata</i>	Malvaceae
Uzaru	<i>Firmiana colorata</i>	Sterculiaceae
Marcha	<i>Rivinia humilis</i>	Phygonaceae
Sasti	<i>Samanea saman</i>	Leguminosae
Tea	<i>Camellia sinensis</i>	Theaceae
Dhulkolmi	<i>Ipomoea fistulosa</i>	Convolvulaceae
Jhunjhuni	<i>Crotalaria medicagenia</i>	Fabaceae

Table 2: Quantitative structure of shrubs of the study area.

Scientific name	Total individual	Density/100m ²	Freq. (%)	Abun. /100m ²	R.D. (%)	R.F. (%)	R.A. (%)	IVI
<i>Clerodendrum viscosum</i>	60	53.57	35.71	150	22.22	25	5.70	52.92
<i>Lantana camara</i>	4	3.57	3.57	100	1.48	2.50	3.80	7.78
<i>Lippia geminata</i>	9	8.04	10.71	75	3.33	7.5	2.85	13.68
<i>Melastoma malabathricum</i>	39	34.82	17.86	195	14.44	12.50	7.41	34.36
<i>Solanum xanthocarpum</i>	5	4.46	3.57	125	1.85	2.50	4.75	9.10
<i>Streblus asper</i>	14	12.5	3.57	350	5.19	2.50	13.31	20.99
<i>Calamus sp</i>	13	11.61	7.14	162.5	4.81	5	6.18	15.99
<i>Urena lobata</i>	33	29.46	7.14	412.5	12.1	5	15.46	32.5
<i>Firmiana colorata</i>	11	9.82	3.57	275	4.07	2.50	10.45	17.03
<i>Rivinia humilis</i>	12	10.71	3.57	300	4.44	2.50	11.40	18.35
<i>Samanea saman</i>	5	4.46	3.57	125	1.85	2.50	4.75	9.10
<i>Camellia sinensis</i>	42	37.5	28.57	131.25	15.56	20	4.99	40.54
<i>Ipomoea fistulosa</i>	23	20.54	10.71	191.75	8.52	7.5	7.29	23.31
<i>Crotalaria medicagenia</i>	3	2.68	3.57	75	1.11	2.50	2.85	6.46
Total	273	243.75	142.86	2667.92	100	100	100	300

lowest was shown by *Crotalaria medicagenia* (1.11%). On the other hand, the highest frequency was found in *Clerodendrum viscosum* (35.71%) and the lowest were found in *Crotalaria medicagenia*, *Samanea saman*, *Rivinia humilis*, *Firmiana colorata*, *Streblus asper*, *Solanum xanthocarpum* and *Lantana camara* (3.57%). Furthermore, the highest abundance was measured in *Urena lobata* (412.5 plants/100 m²) followed by *Streblus asper* (350 plants/100 m²) and the lowest abundance was shown by *Lippia geminata* and *Crotalaria medicagenia* (75 plants/100 m²). *Clerodendrum viscosum* has shown the highest relative frequency (25%) and the lowest relative frequency were found in *Crotalaria medicagenia*, *Samanea saman*, *Rivinia humilis*, *Firmiana colorata*, *Streblus asper*, *Solanum xanthocarpum* and *Lantana camara* (2.50%). The highest relative abundance was calculated in *Urena lobata* (15.46%) and the lowest relative abundance was shown by *Lippia geminata* and *Crotalaria medicagenia* (2.85%). The highest IVI was calculated in *Clerodendrum viscosum* (52.92) and the lowest IVI was shown by *Crotalaria medicagenia* (6.46) in Table 2.

Herbs and grasses: Table 3 is showing the results of the composition of herbs and grasses; 25 species of 16 families. Gramineae family was dominated with 5 species and followed by Leguminosae family with 3 species and the families Araceae, Umbelliferae,

Table 3: Composition of herbs and grasses in the study area.

Local name	Scientific name	Family
Kachu	<i>Colocasia esculenta</i>	Araceae
Maniplant	<i>Scindapsus aurieus</i>	Araceae
Lazzaboti	<i>Mimosa pudica</i>	Leguminosae
Kolkasundha	<i>Cassia sophera</i>	Leguminosae
Thankuni	<i>Centella asiatica</i>	Umbelliferae
Ban dhone	<i>Eryngium foetidum</i>	Umbelliferae
Lemongrass	<i>Cymbopogon citratus</i>	Gramineae
Durba ghas	<i>Cynodon dactylon</i>	Gramineae
Ulu gash	<i>Imperata cylindrica</i>	Gramineae
Fuljhar	<i>Thysalonema maxima</i>	Gramineae
Chanca	<i>Cyperas spp</i>	Gramineae
Shetodrone	<i>Leucas lini-fofia</i>	Labiatae
Paporomia	<i>Peperomia pellucida</i>	Piperaceae
Betel leaf	<i>Piper betel</i>	Piperaceae
Ban halud	<i>Curcuma aromatica</i>	Zingiberaceae
Shialnutri	<i>Vernonia cinerea</i>	Cimpositae
Assampata	<i>Eupatorium odoratum</i>	Cimpositae
Ban borboti	<i>Phaseolus adenanthus</i>	Leguminosae
Ban note	<i>Amarantus viridis</i>	Amarantaceae
Beguni hurhurey	<i>Cleome rutidosperma</i>	Cleomaceae
Bishkatali kukri	<i>Polygonum lanatum</i>	Polygonaceae
Bhui amla	<i>Phyllanthus nirruri</i>	Euphorbiaceae
Rashna	<i>Vanda roxburghii</i>	Orchidaceae
Dhekishak	<i>Diplazium esculentum</i>	Athyriaceae
Dudhilata	<i>Doemia extensa</i>	Asclepiadaceae

Piperaceae, Cimpositae contain 2 species each. The remaining families contain 1 species.

Table 4 is illustrating the highest density of herbs and grasses is *Eupatorium odoratum* (61 plants/100 m²) and the lowest density is with *Phaseolus adenanthus* and *Vanda roxburghii* (nearly 2 plants/100 m²).

Table 4: Quantitative structure of herbs and grasses.

Scientific name	Total individual	Density /100m ²	Freq. (%)	Abun. /100m ²	R. D. (%)	R.F. (%)	R.A. (%)	IVI
<i>Colocasia esculenta</i>	12	10.71	14.29	75	2.52	7.02	1.46	11
<i>Scindapsus aurieus</i>	12	10.71	7.14	150	2.52	3.51	2.91	8.93
<i>Mimosa pudica</i>	7	6.25	3.57	175	1.47	1.75	3.40	6.62
<i>Cassia sophera</i>	14	12.5	7.14	175	2.94	3.51	3.40	9.84
<i>Centella asiatica</i>	14	12.5	7.14	175	2.94	3.51	3.40	9.84
<i>Eryngium foetidum</i>	30	26.79	7.14	375	6.29	3.51	7.28	17.1
<i>Cymbopogon citratus</i>	19	16.96	10.71	158.33	3.98	5.26	3.07	12.3
<i>Cynodon dactylon</i>	32	28.57	10.71	266.67	6.71	5.26	5.17	17.1
<i>Imperata cylindrica</i>	45	40.18	14.29	281.25	9.43	7.02	5.46	21.9
<i>Thysalonema maxima</i>	36	32.14	10.71	283.33	7.55	5.26	5.50	18.3
<i>Cyperas spp</i>	16	14.29	7.14	200	3.35	3.51	3.88	10.7
<i>Leucas lini-foia</i>	35	31.25	14.29	218.75	7.34	7.02	4.24	18.6
<i>Peperomia pellucida</i>	12	10.71	3.57	300	2.52	1.75	5.82	10.1
<i>Piper betel</i>	6	5.36	3.57	150	1.26	1.75	2.91	5.92
<i>Curcuma aromatica</i>	16	14.29	3.57	400	3.35	1.75	7.76	12.9
<i>Vernonia cinerea</i>	34	30.36	7.14	425	7.13	3.51	8.25	18.9
<i>Eupatorium odoratum</i>	69	61.61	21.43	287.5	14.5	10.5	5.58	30.6
<i>Phaseolus adenanthus</i>	2	1.79	3.57	50	0.42	1.75	0.97	3.14
<i>Amarantus viridis</i>	8	7.14	7.14	100	1.68	3.51	1.94	7.13
<i>Cleome rutidosperma</i>	5	4.46	3.57	125	1.05	1.75	2.43	5.23
<i>Polygonum lanatum</i>	9	8.04	3.57	225	1.89	1.75	4.37	8.01
<i>Phyllanthus nirruri</i>	13	11.61	3.57	325	2.73	1.75	6.31	10.8
<i>Vanda roxburghii</i>	2	1.79	3.57	50	0.42	1.75	0.97	3.14
<i>Diplazium esculentum</i>	26	23.21	21.43	108.33	5.45	10.5	2.102	18.1
<i>Doemia extensa</i>	3	2.68	3.57	75	0.63	1.75	1.46	3.84
Total	477	425.89	203.57	5154.16	100	100	100	300

Table 5: Different diversity index for shrubs and herbs and grasses

Plants	Categories		
	S-W-I	ISR	DI
Shrubs	2.3	5.33	0.05
Herbs and Grasses	2.9	8.96	0.05

However, the highest relative density is with *Eupatorium odoratum* (14.5%) and the lowest relative density was shown by *Phaseolus adenanthus* and

Vanda roxburghii (0.42%).

Moreover, the highest frequency were found in *Eupatorium odoratum* and *Diplazium esculentum* (21.43%). On the contrary lowest frequency were found at *Mimosa pudica*, *Peperomia pellucida*, *Piper betel*, *Curcuma aromatica*, *Cleome rutidosperma*, *Polygonum lanatum*, *Phyllanthus nirruri*, *Vanda roxburghii*, *Doemia extensa* (3.57%). Rather, the highest relative frequency were found in *Diplazium esculentum* and

Eupatorium odoratum (10.5%). Although, the lowest were found at *Mimosa pudica*, *Peperomia pellucida*, *Piper betel*, *Curcuma aromatica*, *Cleome rutidosperma*, *Polygonum lanatum*, *Phyllanthus nirruri*, *Vanda roxburghii*, *Doemia extensa* (nearly 2%).

The highest abundance was estimated in *Vernonia cinerea* (425 plants/100 m²) followed by *Curcuma aromatica* (400 plants/100 m²) and the lowest abundance were estimated in *Phaseolus adenanthus* and *Vanda roxburghii* (50 plants/100 m²). Furthermore, the highest relative abundance was estimated in *Vernonia cinerea* (8.25%) followed by *Curcuma aromatica* (7.76%) and *Eryngium foetidum* (7.28%). The lowest relative abundance were found in *Phaseolus adenanthus* and *Vanda roxburghii* (0.97%) followed by *Colocasia esculenta* and *Doemia extensa* (1.46%). In addition the highest IVI was estimated in *Eupatorium odoratum* (30.6) followed by *Imperata cylindrical* (21.9), rather the lowest IVI was shown by *Vanda roxburghii* (3.14) followed by *Doemia extensa* (3.84) and *Cleome rutidosperma* (5.23).

Table 5 shows that for shrubs, Shanon-Winner Index is 2.3, index of species richness is 5.33 and diversity index is 0.05. For herbs and grasses Shanon-Winner Index is 2.9, index of species richness is 8.96, diversity index is 0.05.

Discussions: The study site includes hill plantations of *Acacia* of 5-6 years^[9], marginal lands, roadside, homesteads the open sunlight of which allows *Melastoma malabathricum* to grow abundantly. Under the dense shade of *Lophopetalum fimbriatum* (Raktan) of Lawachara Reserve forest *Diplazium esculentum* was the only herb that found in significant quantity. On the contrary, in Magurchara Reserve forest due to accidental fire in a near by gas field, undergrowth was not well developed. *Piper betel* was recorded as a commercial plant species of the tribal community of the study area. However, at Magurchara reserve forest the only the rare species which is *Vanda roxburghii* (the only orchid in the study site) has found. Light demanding, *Imperata cylindrical* was found in the marginal lands, homesteads as well as in denuded hills of the study area. *Mimosa pudica* was found under the shades of *Camellia sinensis* plantations. The prolific presence of *Clerodendrum viscosum* and *Camellia sinensis* in the shrubs and *Eupatorium odoratum*, *Imperata cylindrical* and *Thysalonema maxima* in herbs and grasses layer may be due to favorable climatic and edaphic factors such as Soil (clayey loam to sandy loam^[7], high rainfall (MAR 2400 mm), topography (slightly to moderately undulating) and suitable temperature range (20.87°C-29.69°C) as well as

humidity (66-86%)^[8]. Similar findings found in the southern part of the hilly region of the country and they concluded with the same assumptions (similar microclimatic condition)^[13]. Study conducted in the Chittagong (South) Forest Division found 14 species of shrubs of 12 families and 31 species of herbs and grasses of 19 families. Present study find the same figure for shrubs along with the dominating family, discrimination is in case of herbs and grasses where it finds 25 species of 16 families instead of 31 species of 19 families. Dominant family (Gramineae) is in consistent with that study. A little bit acidic condition of the soil (pH 5-6) may be the reason for the highest IVI of *Clerodendrum viscosum* as (teak indicator) followed by *Camellia sinensis*^[14]. Diversity index varied with different groups as well as different regions. In the study area the species richness index for shrubs is 5.33 and Shanon-Winner Index is 2.3. However, for herbs and grasses Shanon-Winner Index is 2.9, index of species richness is 8.96, diversity index is 0.05. The range of species richness index for shrubs is 0-10 and the range of Shanon-Winner Index is 0-5, which means the higher the value of species diversity index the lower the diversity. Therefore, species diversity of shrubs is less than herbs and grasses of the studied area. Researches conducted in a number of tropical countries have shown that tree planting on a degraded tropical land can dramatically increase the native forest species diversity. Existing forests (plantations) may act as a catalyst for successful natural forest succession of shrubs, herbs and grasses using the microclimatic conditions. Hence, may be creating a more favorable environment for the establishment of native forest flora and facilitate to attract fauna. Ultimately may be leading to conserving biological diversity^[15].

The study eventually concludes that a proper protection from human interferences and scientific management of undergrowth of the study area may lead a biodiversity rich site in the country.

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