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Structural Composition Based on Diameter and Height Class Distribution of a Deforested Area of Chittagong, Bangladesh

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Abstract: The study describes the structural composition of a degraded forest of Chittagong, Bangladesh. Stratified random quadrat was used in this study. *Tectona grandis* was found as dominant with 28.87% of the total individuals, Diameter at Breast Height (DBH) range less than 5 cm represent highest percentage (66.14%) of all the individuals however the largest DBH range ≥ 17 cm represent only 0.84% of all the individuals. The number of trees and the number of species was the highest (158 and 32, respectively) in the < 5 cm DBH range and least number of trees and species (1 and 1) was represent in 15-16.9 cm DBH ranges. Height class < 3 m consist of the highest individuals (55.67% of total population). *Tectona grandis* showed the highest percentage (28.8%) followed by *Ficus hispida* (12.97%), *Eucalyptus camaldulensis* (7.53%), *Albizia lebbeck* (5.86%) and *Gmelina arborea* (5.44%). Number of trees and species are decreased with increasing height and DBH classes. This may be due to recent adopting management measures like protection of the area for biodiversity conservation.

Key words: Biodiversity conservation, degraded forest, diameter class, height class

INTRODUCTION

Biodiversity is the most significant national asset and constitutes enduring resources for supporting the continued existence of human societies. Biodiversity comprises every form of life from the tiniest microbes to the highest beasts and gigantic tree^[1]. It is estimated that the disappearance of one plant species results in the loss of 10 to 13 dependent species of insects, higher animals and even other plant^[2]. In Bangladesh from 1871 plantation forestry began with *Tectona grandis* from Myanmar^[3]. The natural forests of the study area were converted into plantation of *Tectona grandis* and *Eucalyptus camaldulensis*. Later on, the plantation was destroyed by illicit feller^[4]. Now a large number of tree species and coppice of planted species are growing naturally. This facilitates the Government of Bangladesh to take a scheme to develop this place as a protected area by planned plantation, developing environment for wildlife and winter migratory birds etc. with a view to develop a biodiversity conservation area.

The silvicultural system practiced in the hill forests of Bangladesh is the clear felling followed by artificial regeneration with valuable species^[5,6]. As a result natural forests loose their diversity^[7]. Loss of biodiversity resources, habitat degradation and erosion of gene pool

and narrowing of genetic diversity are of serious concern for future preservation of flora and fauna. For any feasible conservation activity the bioinventory of the area is inevitable. Correct inventorisation and assessment of biodiversity in different habitats is also necessary for evolving a long term strategy for rehabilitation of endangered species in similar, alternate habitats when original habitat gets destroyed^[8] but little information on the structural distribution of the study area is available. So the present study was conducted to get the structural information of the study area which is necessary for biodiversity conservation.

MATERIALS AND METHODS

The study area is the Bamerchara and Danerchara is a reserve forest of Jaldi beat under Jaldi Range of Chittagong (South) Forest Division^[9]. It lies between $21^{\circ}51'$ to $22^{\circ}11'$ N latitude and $91^{\circ}51'$ to $92^{\circ}03'$ E longitude at Sheelkup union of Banskhalia upazilla about 80 km away from Chittagong city^[10]. The total area of Danerchara is about 100 acres while the Bamerchara is about 50 acres. Both the lakes are connected with a narrow channel and surrounded with small hills. The hills are extended from southwest to northeast and consist of small and large hills. The slope of the hills is categorized from medium to

steep. The climate is typically sub tropical with a long dry season extending from October to May. From June to September the south west monsoons provide the majority of the average rainfall of about 2540 mm, average temperature vary from 39.4 to 8.3°C throughout the year, the humidity is very high throughout the year, the prevailing winds are from north-west from march to may, from south-east from June to September, and from north-west from October to February, Cyclones are frequently occurred and periodically causes serious damage, they occur mainly during May and October^[10].

During February 2003 to August 2003 Stratified random quadrat method was used to collect the information. Thirty plots at Danerchara and 10 at Bamerchara of 10 x 10 m in size were located on the map proportionally and finally identified in the field. The optimum quadrat size (10 x 10 m) was determined by applying species area curve through^[11]. All the trees, which crossed 1.5 m in height, are measured for Diameter at Breast Height (DBH). Different tree species in the area have been gathered and representative samples have been collected for herbarium preparations. The collected specimens were identified following^[12-14]. Trees of each species were tallied into DBH classes of 0.2 cm intervals and height classes of 2 m interval. Trees which crossed 1.5 m was measured because it is a degraded forests and most of the trees are coming up in recent years due to some protection has been provided to conserve biodiversity.

RESULTS

A total of 239 individual stems of 32 tree species were recorded from the sampled area. The percentage distribution of individual species in different DBH classes showed (Table 1) that most of the trees (66.14%) belong to the diameter class of less than 5 cm and the lowest percentage (0.41%) was represented by 15-16.9 cm DBH range. The largest DBH range (>17 cm) comprised 0.84% individuals only. The individual of trees were decreases with the increase of diameter class except in the diameter class of 13-14.9 (1.68%).

Different DBH classes were found to be dominated by different tree species (Table 1) *Tectona grandis* (19.2 and 8.4%, respectively) was dominated in <5 cm and 5-6.99 cm DBH ranges followed by *Ficus hispida* (11.3%), *Albizia lebbeck* (3.3%) and *Eucalyptus camaldulensis* (2.6%), respectively. *Eucalyptus camaldulensis* was dominated (1.67%) in 7-8.99 cm DBH range followed by *Gmelina arborea* (1.25%) and *Tectona grandis* (0.85%). *Eucalyptus camaldulensis* and *Lagerstroemia speciosa* (0.84% each)

were dominated in 9-10.99 cm DBH ranges. Only two species *Albizia chinensis* and *Gmelina arborea* (0.42% each) were present in 11-12.99 cm DBH ranges. *Psidium guajava* (0.84%) was dominated in 13-14.99 cm DBH range. only *Lannea coromendalica* (0.41%) was present in 15-16.99 cm DBH ranges. *Anacardium occidentale* and *Gmelina arborea* (0.42% each) were present in >17 cm DBH ranges. For individual species, *Tectona grandis* had the highest representation (28.87%) followed by *Ficus hispida* (12.97%) *Eucalyptus camaldulensis* (7.53%) *Albizia lebbeck* (5.86%). *Gmelina arborea* represents 5.44% of all the species.

Figure 1 illustrating the distribution of species and individuals with diameter classes. It is found that the percentage of individual trees decreased with increasing diameter except 13-14.9 cm DBH range. The number of trees and species was the highest (148 and 32, respectively) in <5 cm DBH range followed by 5-6.99 cm diameter class (16 species with 48 individuals) (Fig.1). The least number of species (1 species each) and individuals (1 and 2, respectively) were present in the two highest DBH ranges (15-16.9 and >17 cm).

It is predicted that different height class were dominated by different species. Height class <3 m was dominated by *Tectona grandis* (21.75%) followed by *Ficus hispida* (8.78%) *Albizia chinensis*, *Albizia lebbeck* and *Holarrhena pubescence* (2.09% each) and class 3-4.99 m were dominated by *Eucalyptus camaldulensis* (7.11%) followed by *Tectona grandis* (5.86%), *Ficus hispida* (4.19%), *Gmelina arborea* (3.76%) and *Albizia lebbeck* (2.51%). Height class >3 m represents highest percentage of individuals (55.67%) followed by height class 3-4.99 m (38.52%), class 5-6.99 m (3.77%) and class 7-8.99 m (1.26%). Among the species *Tectona grandis* (28.87%) shows the height percentage of

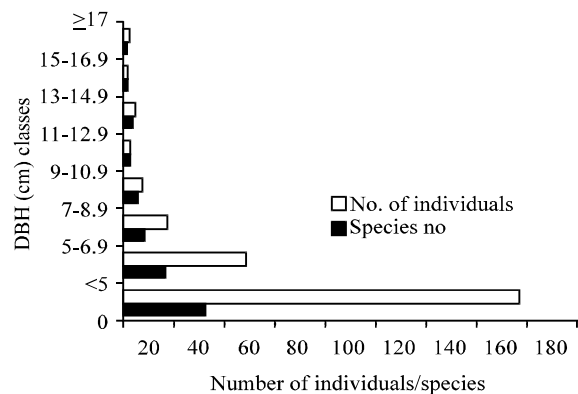


Fig.1: Distribution of individuals and species in different diameter (cm) classes

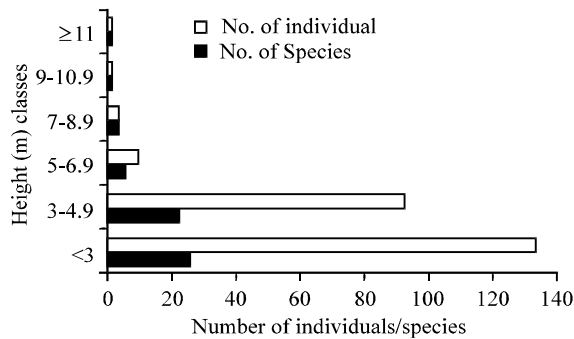


Fig. 2: Distribution of individuals and species in different height (m) classes

individuals followed by *Ficus hispida* (12.97%), *Eucalyptus camaldulensis* (7.53%), *Albizia lebbeck* (5.86%), *Gmelina arborea* (5.44%), *Bombax ceiba* and *Psidium guajava* (2.51%each) (Table 2).

Figure 2 represents the relationship of number of species and individuals with height classes. The majority of individuals (133) and species (25) were belonging to the height class <3 m that is followed by the class 3-4.99 m

(92 individuals and 22 species), class 5-6.99 m (9 individuals and 5 species), class 7-8.9 m (3 individuals and species each). Higher height class 9-10.9 m and >11 m consists of only 1 individual and species each.

DISCUSSION

The diameter class distribution of the species and individuals revealed that percentage of individual decreases with the increase of diameter classes (Table 1). The lowest diameter classes include all the species and the highest diameter class includes only two species (Fig. 1). This depicted that the species recruitment is started recently with an encouraging manner and may be recent protection measure helped the process of enrolment. The results also showed that *Tectona grandis* and *Ficus hispida* are suitable for the site. The selective management system based on DBH distribution practised in Peninsular Malaysia, favours the sustained production of commercially valuable *Dipterocarpus* species while ensuring an overall species diversity^[15]. This management system may be applied in the study area to maintain its

Table 1: Percentage distribution of individual species in different DBH (cm) classes

Species name	Diameter classes (cm)								Total
	<5	5-6.99	7-8.99	9-10.99	11-12.99	13-14.99	15-16.99	≥17	
<i>Albizia chinensis</i>	1.7	0.42		0.42	0.42				2.93
<i>Albizia lebbeck</i>	3.3	0.84	0.84	0.42				0.42	5.86
<i>Anacardium occidentale</i>	0.84								0.84
<i>Anogeissus acuminata</i>	1.3								1.26
<i>Artocarpus chaplasha</i>	0.84								0.84
<i>Artocarpus lacucha</i>	0.84	0.42							1.26
<i>Bombax ceiba</i>	2.1	0.42							2.51
<i>Callicarpa tomentosa</i>	0.84								0.84
<i>Erythrina variegata</i>	1.25	0.42							1.67
<i>Eucalyptus camaldulensis</i>	2.6	2.6	1.67	0.84					7.53
<i>Ficus hispida</i>	11.3	1.7							12.97
<i>Glochidion velutinum</i>	0.84								0.84
<i>Gmelina arborea</i>	1.3	1.7	1.25		0.42	0.42		0.42	5.44
<i>Holarrhena pubescence</i>	2.1	0.42	0.42						2.93
<i>Lagerstroemia speciosa</i>	0.42			0.84		0.42			1.67
<i>Lansea coromendalica</i>	0.42	0.42	0.84				0.41		2.09
<i>Leucaena leucoccephala</i>	1.3								1.26
<i>Macaranga denticulata</i>	1.3								1.26
<i>Mangifera indica</i>	1.7	0.42							2.09
<i>Melia sempervirens</i>	0.42	0.84							1.26
<i>Mitragyna parvifolia</i>	0.84								0.84
<i>Oroxylum indicum</i>	0.84								0.84
<i>Protium serratum</i>	1.7								1.26
<i>Psidium guajava</i>	0.42	0.42	0.84			0.84			2.51
<i>Stereospermum personatum</i>	1.3								1.26
<i>Strobilus asper</i>	1.3	0.42							1.67
<i>Tectona grandis</i>	19.2	8.4	0.85	0.42					28.87
<i>Terminalia bellerica</i>	0.84								0.84
<i>Toona ciliata</i>	0.42	0.42							0.84
Unidentified-1	0.84								0.84
Unidentified-2	1.7		0.42						2.09
Unidentified-3	0.84								0.84
Total	66.14	20.21	7.13	2.4	0.84	1.68	0.41	0.84	100.00

Table 2: Percentage distribution of each individual species in different height (m) classes.

Species name	Height classes (m)						Total
	<3	3-4.99	5-6.99	7-8.99	9-10.99	≥11	
<i>Albizia chinensis</i>	2.09	0.84					2.93
<i>Albizia lebbeck</i>	2.09	2.51	0.84			0.42	5.86
<i>Anacardium occidentale</i>	.84						0.84
<i>Anogeissus acuminata</i>	1.26						1.26
<i>Artocarpus chaplasha</i>		0.84					0.84
<i>Artocarpus lacucha</i>	0.42	0.84					1.26
<i>Bombax ceiba</i>	0.84	1.67					2.51
<i>Callicarpa tomentosa</i>	0.84						0.84
<i>Erythrina variegata</i>	0.84	0.83					1.67
<i>Eucalyptus camaldulensis</i>	0.42	7.11					7.53
<i>Ficus hispida</i>	8.78	4.19					12.97
<i>Glochidion velutinum</i>		0.84					0.84
<i>Gmelina arborea</i>	1.26	3.76		0.42			5.44
<i>Holarrhena pubescence</i>	2.09	0.84					2.93
<i>Lagerstroemia speciosa</i>		0.42	0.83	0.42			1.67
<i>Lanena coromendalica</i>	0.84	0.84			0.41		2.09
<i>Leucaena leucocephala</i>	1.26						1.26
<i>Macaranga denticulata</i>	1.26						1.26
<i>Mangifera indica</i> L.	1.25	0.84					2.09
<i>Melia sempervirens</i>		1.26					1.26
<i>Mitragyna parvifolia</i>	0.84						0.84
<i>Oroxylum indicum</i>	0.42	0.42					0.84
<i>Protium serratum</i>	1.26						1.26
<i>Psidium guajava</i>		1.67	0.42	0.42			2.51
<i>Stereospermum personatum</i>	1.26						1.26
<i>Strobilus asper</i>	0.83	0.84					1.67
<i>Tectona grandis</i>	21.75	5.86	1.26				28.87
<i>Terminalia bellerica</i>		0.84					0.84
<i>Toona ciliata</i>		0.84					0.84
Unidentified-1	0.84						0.84
Unidentified-2	1.25	0.42					2.09
Unidentified-3	0.84						0.84
Total	55.67	38.52	3.77	1.26	0.41	0.42	100.00

diversity and sustainable productivity of valuable *Tectona grandis* in future. A regular diameter distribution may be maintained in the stand to maximize the multiple functions of forest^[16] so adequate protection may be provided to the area to maintain each diameter class. The percentage of trees is decreased with increasing height classes (Table 2). The number of individuals and species were decrease by increasing of height class (Fig. 2) which illustrates the addition of new species and individuals. The coppices of *Tectona grandis* (28.87%) and *Eucalyptus camaldulensis* (7.53%) consist of only 36.4% of the forest area. The remaining species, which are coming up through natural regeneration, constituted 63.6% of the forest vegetation. Consequently, the study area is suitable for natural regeneration and the diversity of the tree species is increasing subsequently. Number of individuals and species were decreased with the increase of diameter and height classes, which indicates once upon a time it was completely deforested. And now it is in a process of recruitment with a diverse composition. Therefore, the area may turn into a potential biodiversity conservation area for Bangladesh.

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