REGENERATION STATUS IN A PROPOSED BIODIVERSITY CONSERVATION AREA OF BANGLADESH

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Abstract

The paper describes the composition and status of regeneration in a proposed biodiversity conservation area (Bamerchara and Danerchara) Chittagong, Bangladesh. A stratified random quadrat method was used to study the regeneration status. Total 143 seedlings and saplings of 39 species under 18 families were recorded in the sampled area. Moraceae is the dominant family having 5 species followed by Anacardiaceae, Euphorbieaceae, Myrtaceae, Mimosaceae, Combretaceae and Verbenaceae (3 species each). *Tectona grandis* has the highest importance value index (31.05) followed by *Gmelina arborea* (16.05), *Mangifera indica* (13.59), *Erythrina variegata* (12.53) Unidentified-2 (11.06), *Bombax ceiba* (11.05) *Eucalyptus camaldulensis* (9.92) and *Oroxylum indicum* (9.65). The distribution of all the regenerated species is contagious except *Tectona grandis*, which show random distribution The study of density, frequency, abundance, relative density, relative frequency, relative abundance of various species showed that it is possible to bring the depleted area under complete forest cover through the protection of natural regeneration.

Introduction

The natural forest of Bangladesh has been facing such a serious onslaught that a large portion of it has already been lost, leaving the country with only a small percentage of forest cover. Though only 27 plant species are listed as threatened or endangered, there could be many more (Anon., 1992). 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 plants (Manilal, 1997). Thus Bangladesh is losing its biodiversity day by day. The rational use and management of biodiversity, the habitats, species and genes prevalent in the area are the imperative need of the day. Sustainable use of biodiversity is therefore a matter of paramount importance. To develop biodiversity sustainably one must know the species present in an ecosystem (Verma, *et al.*, 1999). To conserve biodiversity it is fundamental to arrest the fatigue of natural resources by adopting proper conservation strategies and protection of natural regeneration.

The Bamerchara (Left lake) and Danerchara (Right lake) is a degraded deforested wet evergreen forest of Jaldi beat under Jaldi Range of Chittagong South Forest Division (Mabud, 2001). The area is located at Sheelkup union of

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Banskhali upazilla about 80 km away from Chittagong city and lies between 21°51′ to 22°11′ N latitude and 91°51′ to 92°03′ E longitude (GOB, 1996). The area was under natural forest but from 1871 plantation in Bangladesh began with teak from Myanmar (Anon., 1993). Since then a large portion of natural forest areas were clear felled and planted with teak and some other exotic or indigenous species. As a part of this programme, the natural forest of the study area were also converted in the plantation of *Tectona grandis* and *Eucalyptus camaldulensis.* Later on, the plantation forest of the study area was destroyed. As a strategy to increase the protected areas through out country, the government of Bangladesh has taken a scheme to develop this place as a protected area by planned plantation, developing natural environment for wildlife and winter migratory birds *etc.* with a view of biodiversity conservation area. Ecotourism will be encouraged by building resorts, ropeway and other attractions for the tourists (Alamgir, 2003). Now huge amount of tree species are growing naturally and from the coppice of destroyed planted species, which are still in the seedling and sapling stages due to provided protection. Therefore, Information on the regeneration status is important to determine the potentiality of an area for biodiversity conservation. At present no information is available on the regeneration status of this proposed biodiversity conservation area. The aim of this study was to determine the current natural regeneration status of the area with special attention to the potentiality of biodiversity conservation.

Material and Methods

The total area of Bamerchara is about 50 acres while the Danerchara is about 100 acres. The Bamerchara is about 2 Km. in length and on an average 50m wide while the Danerchara is about 4 km. in length and average 60m wide. The average depth of the lake is 5m (GOB, 1996). Both the lakes are surrounded with small hills and connected with a narrow channel (Alamgir, 2003). The hills are extended from southwest to northeast and consists of small and large hills. The hill composed of medium hard to soft shale and sandstones and the height is below 150m. 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 2540mm., average temperature vary from 39.4°c 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 particularly during May and October (GOB, 1996). Stratified random quadrat method was used during February to August 2003 to find out the regeneration status of the Danerchara and Bamerchara. Initially sampling points were located on the map proportionally and finally identified in the field.

There were 30 plots at Danerchara and 10 at Bamerchara of 2m ×2m in size. All the seedlings/saplings recorded; density, frequency, abundance, relative density, relative abundance and relative frequency were calculated following Ambast (1978), Shukla and Chandal (1980), Moore and Chapman (1986), and Dallmeier *et al.* (1992). Importance value index (IVI) was estimated using formula of Shukla and Chandal (1980). Different tree species in the area have been gathered and representative samples have been collected for herbarium preparations. The collected specimens were identified following Prain (1903), Brandis (1906) and Heinig (1925). The ratio of abundance to frequency for different species was determined for distribution patterns. This ratio indicates regular (< 0.025), random (0.025 to 0.05) and contagious (>0.05) distributions (Curtis and Cottam, 1956).

Results and Discussion

Table 1 shows the presence of 143 seedlings & saplings of 39 species of which 36 were identified and those belongs to18 families in the sample of the study area. Moraceae is the dominant family having 5 species, followed by Anacardiaceae, Euphorbieaceae, Myrtaceae, Mimosaceae, Combretaceae and Verbenaceae (3 species each). The remaining family contains 1 to 2 species. The family Dipterocrpaceae, Ligominosae, and Sterculiaceae and the species *Cassia fistula, Terminalia chibula*, *Ficus* sp. *Syzygium cumini*, *Trewia nodiflora*, and *Sterculia vilosa* were not present as trees (Alamgir, 2003) so the number of regenerating species is increasing day by day. (Hossain,1994). 52 species of 32 families were found in the Sitapahar natural forest of Chittagong Hilltracts (South) Forest Division and Ahmed and Bhuyian (1994) found 42 known and few unknown regenerating species in the natural forest of Cox's Bazar Forest Division, Bangladesh. In comparison to these studies, though the study area is a degraded deforested forest, the number of regenerating species of the area is appreciable to turn the area in natural forest again. Table 1 also shows that the coppice of previously planted species is coming up with seedling/ sapling of naturally regenerating species.

Ahmed *et al.* (1992) estimated that the denuded hills of Chittagong, Bangladesh, can be brought under complete forest cover by natural regeneration at about 61% the cost of planting. Ahmed and Bhuyian (1994) estimated that the natural forest of Cox's Bazar forest Division, Bangladesh, could be brought under complete forest cover by natural forest establishment. The present study showed that though the study area is a degraded deforested area (natural forest later on planted with *Tectona grandis* and *Eucalyptus camaldulensis*), the area can be brought under complete forest cover by natural regeneration.

Table 2 shows the quantitative structure of regeneration in the study area. The total seedling/sapling/ha are 8928 in the study area. The highest density recorded for *Tectona grandis* (1250) followed by *Ficus hispida*, *Gmelina arborea* (625 each) and *Mangifera indica* (500). The density of remaining species is 62 to 449. Table 2 also reveals the highest frequency (42.5%) of *Tectona grandis*, followed by *Gmelina arborea*, *Ficus hispida* (17.5% each), *Bombax ceiba*, *Eucalyptus camaldulensis* and *Lannea coromandelica* (12.5% each). The highest values of abundance (seedling/sapling/100m^2) of some major species are 50 for Unidentified-2, *Psidium guajava*, and *Glochidion velutinum* followed by *Oroxylum indicum* (41.67) and *Gmelina arborea*, *Ficus hispida* (35.71 each).

The relative density of *Tectona grandis* is the highest (13.99%) followed by *Gmelina arborea*, *Ficus hispida* (6.99% each), *Erythrina variegata* (4.90%) and *Bombax ceiba* (4.20%). *Tectona grandis* shows the highest relative frequency (14.53%) followed by *Gmelina arborea*, *Ficus hispida* (5.98% each), *Erythrina variegata* (5.13%) and *Lannea coromandelica*, *Bombax ceiba* (4.27% each). However the highest relative abundance for unidentified-2, *Glochidion velutinum*, and *Psidium guajava* (4.30% each) followed by *Oroxylum indicum* (3.59%), *Albizia chinensis*, *Cassia fistula* (3.23% each) and *Ficus hispida*, *Gmelina arborea* (3.07% each).

Tectona grandis has the highest Importance value index (31.05) followed by *Gmelina arborea* (16.05), *Mangifera indica* (13.59), *Erythrina variegata* (12.53) Unidentified-2 (11.06), *Bombax ceiba* (11.05), *Eucalyptus camaldulensis* (9.92) and *Oroxylum indicum* (9.65). Importance value index indicates the dominance of species in a heterogeneous plant community (Shukla and Chandel, 1980). Thereore, the study area is dominated by the seedling/sapling of *Tectona grandis*, *Gmelina arborea, Mangifera indica* and *Erythrina variegata*. However, among the recorded species, the dominant species are not only important for biodiversity conservation but also important commercially. The plantations in these areas were raised at 1.82m × 1.82m (6 feet × 6 feet) spacing which means that 3018 seedlings were required per ha. In the present study the density (8928 seedlings/ saplings/ ha) recorded is almost double than plantation.The potentiality of the study area for regeneration is very high. It is a degraded form of a natural forest where many depleted species such as *Anacardium occidentale* ((IVI=5.26), *Anogeissus acuminata* (IVI=3.72), *Callicarpa tomentosa* (IVI=8.26), *Glochidion velutinum* (IVI=6.56), *Holarrhena pubescence* (IVI=5.26), *Macaranga denticulate* (IVI=5.26), *Mitragyna parvifolia* (IVI=3.71), *Protium serratum* (IVI=3.71) and *Stereospermum personatum* (IVI=3.71) are very much important for biodiversity conservation.

Ratio of abundance to frequency (A/F) indicates that the distribution of all the regenerated species is contagious except *Tectona grandis*, which show random distribution (Table 2). According to Odum (1971), contagious distribution is the commonest pattern in nature and random distribution is found in very uniform environments. The contagious distribution in natural vegetation has been reported by several workers (Greig-Smith1975, Kershaw 1973, Singh and Yadava 1974 and Verma *et al.*, 1999). From these research findings it is evident that the Bamerchara and Danerchara is turning to the natural forest again.

Considering the number of stems/ha, RD, RF and RA as a measure of success in reforestation it is possible to reestablish a complete forest cover for the degraded deforested area by natural regeneration. Bangladesh supports approximately 5000 species of angiosperms, out of which about 300 species are being cultivated (Anon, 2001) but the base line information on occurance and composition of forest trees is inadequate except the emphasis on a few economically important timber species. This resulted in the loss of wild biodiversity (Nath *et al.* 1998). Research conducted in number of tropical countries have shown that tree planting on a degraded tropical lands can dramatically increase the native forest species diversity (Verma, *et. al.*, 1999). This finding also supports the present research. The density of seedling and sapling is a measure of regeneration potential (Rajwar, *et al.*, 1999). The high density of seedling and sapling in Bamerchara and Danerchara indicate high potentiality of regeneration. Though the study area is a degraded deforested area, but government of Bangladesh proposed it as a biodiversity conservation area to be conserved for species composition. The recorded density of the study area is considered to be quite adequate to get a complete forest cover which is very important for biodiversity conservation. The growing of fruit tree species is a good indication for conserving animal diversity of the area. The findings of present study provide a complete view of regeneration status in the study area. The investigation indicate that the proposed biodiversity conservation area is rich in regenerating species and needs only protection to conserve seedling or sapling of the regenerated species.

Table 1 Present status of regeneration with their scientific names, families and available mode.

Sl. no.	Family name	Species name	Mode of available regeneration
1	Anacardiaceae	*Anacardium occidentale* L	Seedling and Sapling
		Lannea coromandelica (Houtt.) Merr	Seedling and Sapling
		Mangifera indica L	Seedling and Sapling
2	Apocynaceae	*Holarrhena pubescence* (Buch Ham.) Wall	Seedling and Sapling
3	Bignoniaceae	*Oroxylum indicum* (L.) Vent	Seedling and Sapling
		Stereospermum personatum (Hassk.)	Seedling and Sapling
4	Bombacaceae	*Bombax ceiba* L	Seedling and Sapling
5	Burseraceae	*Protium serratum* (Wall. exColebr.)	Seedling and Sapling
6	Combretaceae	*Anogeissus acuminata*(Roxb.) Wall.exBedd	Seedling and Sapling
		Terminalia bellerica (Gaertn.) Rox	Seedling and Sapling
		Terminallia chebula Retz.	Seedling and Sapling
7	Dipterocarpacae	*Hopea odorata* Roxb.	Seedling and Sapling
8	Euporbeaceae	*Macaranga denticulata* (Bl.) Muell. Arg.	Seedling and Sapling
		Glochidion velutinum Weight	Seedling and Sapling
		Trewia nudiflora L.	Seedling and Sapling
9	Fabaceae	*Erythrina variegata* L. var.	Seedling and Sapling
10	Ligominoceae	*Cassia fistula* L.	Seedling and Sapling
11	Lythraceae	*Lagerstroemia speciosa* (L.) Pers.	Seedling and Sapling
12	Meliceae	*Lannea coromandelica*(Houtt.) Merr.	Seedling and Sapling
		Toona cilita M.J. Roem	Seedling and Sapling
13	Mimosaceae	*Albizia chinensis* (Osbeck) Mers	Seedling and Sapling
		Albizia lebbeck (L.) Benth	Seedling and Sapling
		Leucaena leucocephala (Lam.) de wit	Seedling and Sapling
14	Moraceae	*Artocarpus lacucha* Buch-Hum	Seedling and Sapling
		Artocarpus chaplasha	Seedling and Sapling
		Ficus hispida L.f.	Seedling and Sapling
		Ficus sp	Seedling and Sapling
		Streblus asper Lour.	Seedling and Sapling
15	Myrtaceae	**Eucalyptus camaldulensis* Dehnn.	Coppice
		Psidium guajava (L.) Bat.	Seedling and Sapling
		Syzyzium cumini Skeel	Seedling and Sapling
16	Rubiaceae	*Mitragyna parvifolia* (Roxb.)Korth	Seedling and Sapling
17	Verbenaceae	*Callicarpa tomentosa* (L.) Murr	Seedling and Sapling
		Gmelina arborea Roxb.	Seedling and Sapling
		**Tectona grandis* L.	Coppice
18	Sterculiaceae	*Sterculia villosa* Roxb.	Seedling and Sapling
		Unidentified-1	Seedling and Sapling
		Unidentified-2	Seedling and Sapling
		Unidentified-3	Seedling and Sapling
	Families-18	Species-39	

- Species regenerated from planted deforested stems

Table 2 Density (D), Frequency (F), Abundance (A), Relative density (RD) Relative Frequency (RF), Relative Abundance (RA) Importance value index (IVI) and Abundance to Frequency (A/F) of regenerating species in study area.

Sl No	Name of the species	D /ha	F %	A /100m^2	RD (%)	RF (%)	RA (%)	IVI	A/F
01.	*Albizia chinensis*	187	5	37.5	2.10	1.71	3.23	7.04	0.30
02.	*Albizia lebbeck*	125	5	25	1.40	1.71	2.15	5.26	0.20
03.	*Anacardium occidentale*	125	5	25	1.40	1.71	2.15	5.26	0.20
04.	*Anogeissus acuminata*	62	2.5	25	0.70	0.85	2.15	3.71	0.40
05.	*Artocarpus chaplasha*	125	5	25	1.40	1.71	2.15	5.26	0.20
06.	*Artocarpus lacucha*	62	2.5	25	0.70	0.85	2.15	3.71	0.40
07.	*Bombax ceiba*	375	12.5	30	4.20	4.27	2.58	11.05	0.10
08.	*Callicarpa tomentosa*	250	7.5	33.33	2.80	2.56	2.87	8.23	0.18
09.	*Cassia fistula*	187	5	37.5	2.10	1.71	3.23	7.04	0.30
10.	*Erythrina variegate*	437	15	29.17	4.90	5.13	2.51	12.53	0.08
11.	*Eucalyptus camaldulensis*	312	12.5	25	3.50	4.27	2.15	9.92	0.08
12.	*Ficus hispida*	625	17.5	35.71	6.99	5.98	3.07	16.05	0.08
13.	*Ficus sp.*	187	7.5	25	2.10	2.56	2.15	6.81	0.13
14.	*Glochidion velutinum*	125	2.5	50	1.40	0.85	4.30	6.56	0.80
15.	*Gmelina arborea*	625	17.5	35.71	6.99	5.98	3.07	16.05	0 08
16.	*Holarrhena pubescence*	125	5	25	1.40	1.71	2.15	5.26	0.20
17.	*Hopea odorata*	125	5	25	1.40	1.71	2.15	5.26	0.20
18.	*Lagerstroemia speciosa*	62	2.5	25	0.70	0.85	2.15	3.71	0.40
19.	*Lannea coromandelica*	437	12.5	35	4.90	4.27	3.01	12.18	0.11
20.	*Leucaena leucocephala*	62	2.5	25	0.70	0.85	2.15	3.71	0.40
21.	*Macaranga denticulata*	125	5	25	1.40	1.71	2.15	5.26	0.20
22.	*Mangifera indica*	500	15	33.33	5.59	5.13	2.87	13.59	0.09
23.	*Melia sempervirens*	187	7.5	25	2.10	2.56	2.15	6.81	0.13
24.	*Mitragyna parvifolia*	62	2.5	25	0.70	0.85	2.15	3.71	0.40
25.	*Oroxylum indicum*	312	7.5	41.67	3.50	2.56	3.59	9.65	0.22
26.	*Protium serratum*	62	2.5	25	0.70	0.85	2.15	3.71	0.40
27.	*Psidium guajava*	125	2.5	50	1.40	0.85	4.30	6.56	0.80
28.	*Sterculia villosa*	187	7.5	25	2.10	2.56	2.15	6.81	0.13
29.	*Stereospermum personatum*	62	2.5	25	0.70	0.85	2.15	3.71	0.40
30.	*Streblus asper*	187	7.5	25	2.10	2.56	2.15	6.81	0.13
31.	*Syzygium cumini*	62	2.5	25	0.70	0.85	2.15	3.71	0.40
32.	*Tectona grandis*	1250	42.5	29.41	13.99	14.53	2.53	31.05	0.03
33.	*Terminalia bellerica*	125	5	25	1.40	1.71	2.15	5.26	0.20
34.	*Terminalia chebula*	125	5	25	1.40	1.71	2.15	5.26	0.20
35.	*Toona cilita*	125	5	25	1.40	1.71	2.15	5.26	0.20
36.	*Trewia nudiflora*	62	2.5	25	0.70	0.85	2.15	3.71	0.40
37.	Unidentified –3	250	7.5	33.33	2.80	2.56	2.87	8.23	0.18
38.	Unidentified-1	125	5	25	1.40	1.71	2.15	5.26	0.20
39.	Unidentified-2	375	7.5	50	4.20	2.56	4.30	11.06	0.27
	Total	8928	292.5	1161.67	100	100	100	300	9.82

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