DIVERSITY AND STRUCTURAL COMPOSITION OF INDIGENOUS TREE SPECIES AT KAPTAI DEER BREEDING CENTRE OF RANGAMATI SOUTH FOREST DIVISION, BANGLADESH

Mohajan, B., M. K. Hossain, A. A. Mahmud and B. M. Khan

Institute of Forestry and Environmental Sciences, University of Chittagong, Chittagong-4331, Bangladesh

Abstract

The study was carried out to assess the composition, distribution and diversity of indigenous tree species at Kaptai Deer Breeding Centre of Chittagong Hill Tracts Rangamati South Forest Division, Bangladesh. The Breeding Centre covers an area of 161.94 ha with natural forests. Fifty sample plots of 10 m ×10 m size were randomly placed to assess the tree species diversity. A total of 69 tree species belonging to 55 genera and 29 families was recorded. Euphorbiaceae family was represented by highest number of species (seven species) followed by Anacardiaceae and Moraceae possessing five species each. The stem density of tree (1,480 stem/ha) and poor basal area (7.28 m^2/ha) indicate higher density of small trees. Highest basal area (0.62 m^2) was found for *Duabanga grandiflora* and the lowest (0.01 m^2) for *Aporosa wallichii, Clausena heptaphylla, Macaranga denticulate* with four other species. The percentage distribution of tree individuals in different height classes showed the highest tree individuals (35.95%) in 10 - <15 m height class. On the other hand, percentage distribution of individuals in different diameter classes showed the highest percentage (53.24%) of individuals occurred in the lowest (5 - <25 cm) diameter class and thus depicted a reverse J-shaped curve. The maximum Relative Density, Relative Abundance and Importance Value Index (IVI) were attained by *Lagerstroemia speciosa* indicating its dominance over other tree species. Some threatened tree species recorded from this centre need immediate conservation initiatives in order to protect them from extinction.

***Key words*:** Indigenous tree species, diversity, structural composition, height class, conservation initiatives, Kaptai Deer Breeding Centre.

INTRODUCTION

A comprehensive list of flora and fauna including all lower plants and animals along with their present status and recovery plan is needed for proper conservation and management of biodiversity. Habitat monitoring is, therefore, important in assessment of national biodiversity sustainability (Nath *et al*. 2000). Ecologists and taxonomists have been concerned mostly with diversity of plants, animals and their interactions within ecosystems and landscapes (Whittaker 1975, Magurran 1988). Forests represent the storehouse of diversity. The preservation of diversity is both a matter of insurance and investment in order to ensure sustainable improvement of agriculture, forestry and fisheries production. Preservation of biodiversity also sustains different services as a buffer against harmful environmental changes, as a raw material for scientific and industrial innovation and as a matter of moral principle (Anon 1980).

Bangladesh is a transitional zone of flora and fauna of both Indian and Malayan region, because of its geographical settings and climatic characteristics. Plants form key elements in maintaining the stability of biodiversity. They dominate our landscape; form the natural ecosystems that provide the habitat for most animal species. Through the process of photosynthesis, plants harness the energy of sun to make life on earth essential for human as well as all other trophic levels (Lal 1998, Trivedi 2000). The animals that are associated with a natural forest by means of both naturally or at captive condition impart significant impacts on plant diversity, composition and natural restoration potentiality of the forests. The present study site is a remnant natural forests patch, namely Deer Breeding Centre at Kaptai Mukh Beat under Karnafully Range of Rangamati South Forest Division. The patch is surrounded by the river Karnaphuli in south, natural patches and teak plantations on the other sides. It is one of the

remaining natural forest patches in the South-Eastern part of Rangamati district where a number of Asian Elephants still exist. The presence of elephants proves its vegetation richness as a wildlife habitat. According to the local's opinion and field observation this forest also hosts monkeys, gibbons, langurs, deer, leopard cat, birds etc. At present, such a stunning forest is really a heaven for scientists and nature lovers. The wildlife, particularly, the deer under captive breeding and their food habit is supposed to have substantial impacts on the forest specifically on regeneration, recruitment and ultimately on the population of certain plant species. There is no baseline study or continuous monitoring data available from previous years about the number of deer and plant composition and diversity in the deer breeding centre. That's why the present study was in an aim to identify and assess the indigenous native tree species with their quantitative structure at the Deer Breeding Centre of Kaptai upazila under Rangamati district, Bangladesh.

MATERIAL AND METHODS

The study area

Kaptai Deer Breeding Centre is surrounded by the river Karnaphuli from three sides with remnant natural forests which is administratively under Karnafully Range of Rangamati South Forest Division. The centre lies between $22^0$25´N and $22^0$30´N latitude and $92^0$10´E and $92^0$9´E longitude and is about 60 km away from Chittagong city (Anon 1970). The area of the deer breeding centre is about 161.94 ha composed of the hills extending from east to west. The boundary of the forest is partly artificial because of the barrage constructed for Kaptai Hydroelectric Project and partly natural. The river Karnaphuli runs along the south side of the forest (Fig. 1). The eastern side of this deer breeding centre consists of artificial teak plantations (*Tectona grandis*).

The configuration of the study area is less rugged and the hills are moderately low with easy slopes. The climate is typically sub-tropical, with a long dry season extending from October to May and punctuated by largely unpredictable rain storms. From June to September the South-west monsoons provide the majority of the annual rainfall which is about 2,540 mm in average. The temperature varies from 24^0C in December to 35^0C in May. The humidity on the whole area is very high throughout the year (Anon 1970).

Methods

A simple random quadrat method was followed to investigate the plant species composition and diversity of Kaptai Deer Breeding Centre. A total of 50 sample plots was selected from the whole study area. The optimum quadrat size (10 m × 10 m) was determined by applying a species area curve as carried out by Ambasht (1978), Sharma (1979) and Gareth (1991). Within each plot the total height and diameter at breast height (DBH) was recorded by the name and number of all tree species having ≥5cm DBH. Fertile samples of the unknown tree species were collected to prepare herbarium for their proper identification. The collected specimens were identified following Prain (1903), Brandis (1906) and with the help of taxonomists. The field data were compiled and analyzed for Density, Relative density (RD %), Frequency, Relative frequency (RF %), Abundance, Relative abundance (RA %) and Importance Value Index (IVI) according to Moore and Chapman (1986), Shukla and Chandel (1980) and Dallmeier *et al.* (1992). The basal area of individual tree was calculated according to Chaturvedi and Khanna (1982). The recorded trees were grouped into five height classes, i.e. 5-<10 m, 10-<15 m, 15-<20 m, 20-<25 m and ≥25 m based on total height as well as into five diameter classes, i.e. 5-<25 cm, 25-<45 cm, 45-<65 cm, 65-<85 cm and ≥85 cm.

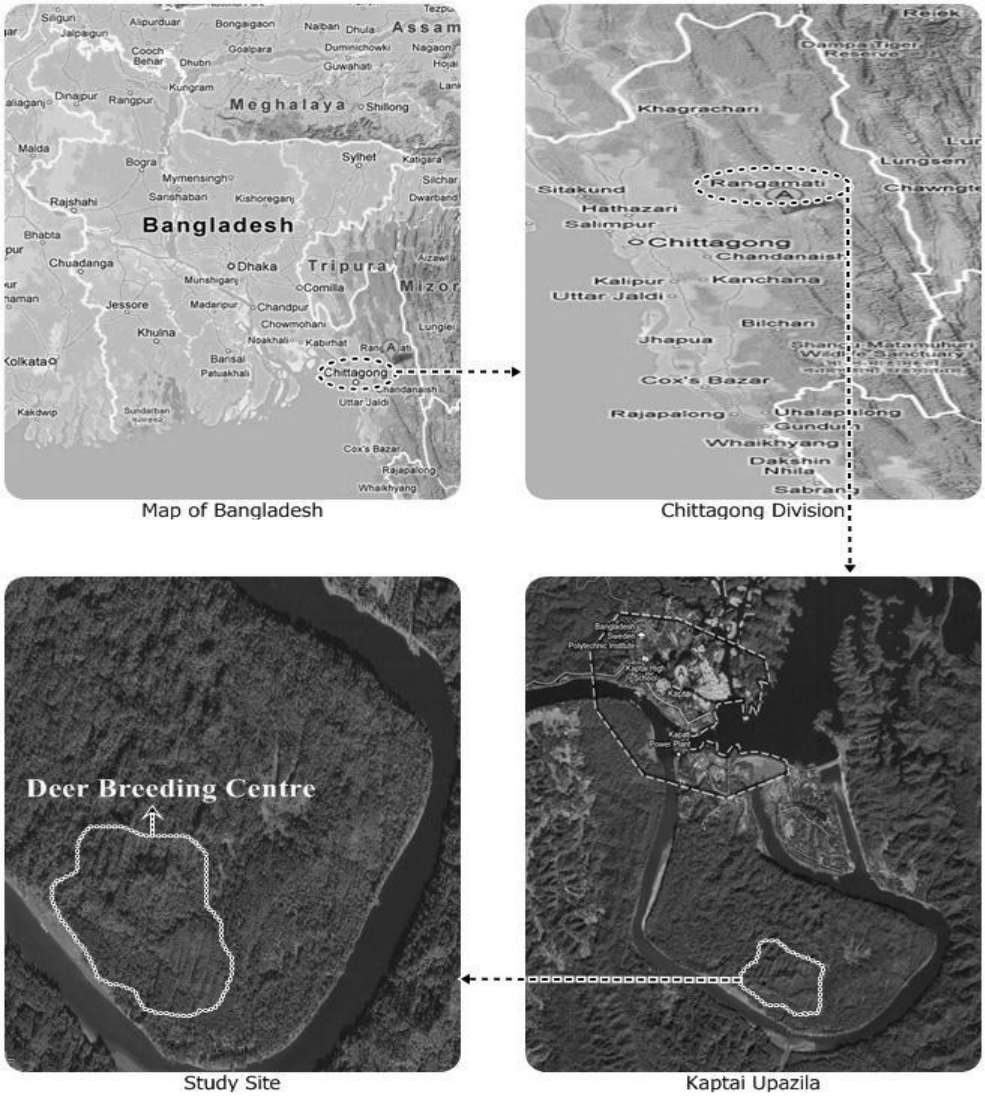

Fig. 1. Bangladesh and location of the Kaptai Deer Breeding Centre in detail.

RESULTS AND DISCUSSION

Floristic composition

A total of 69 tree species belonging to 55 genera and 29 families was recorded from the Deer Breeding Centre at Kaptai (Table 1). Among the families, Euphorbiaceae possessed the highest seven species followed by Anacardiaceae and Moraceae (five species each). Moreover, Lauraceae, Lythraceae and Meliaceae families were represented by four species each. On the other hand, Combretaceae, Fagaceae, Myrtaceae, Mimosaceae and Rubiaceae families contained three species each and the remaining families possess 1-2 species only (Table 1).

Height class distribution

Distribution of the tree individuals indicated that the number of tree species and individuals was maximum (55 species and 35.95% individuals) in 10-<15 m height range followed by 5-<10 m and 15-<20 m height ranges (Fig. 2). The trees belonging to the height class of ≥ 25 m were lowest by both species (13 species) and individuals (14 nos.) as the height range was represented by only 1.89 % tree

individuals (Fig. 2). By individuals of the recorded tree species, occurrence of *Lagerstroemia speciosa* was maximum (7.84%) followed by *Protium serratum* (7.16%), *Aphanamixis polystachya* (6.49%), *Holigarna caustica* (5.68%), *Baccaurea ramiflora* (5.54%) and *Syzygium cumini* (4.32%) in all the height ranges. Among the 69 tree species, *Swintonia floribunda*, *Vitex glabrata, Syzygium cumini, Lagerstroemia speciosa, Bischofia javanica* and *Mangifera sylvatica* were present in all height classes which mean that these species have sustained natural regeneration and successful recruitment in the study area.

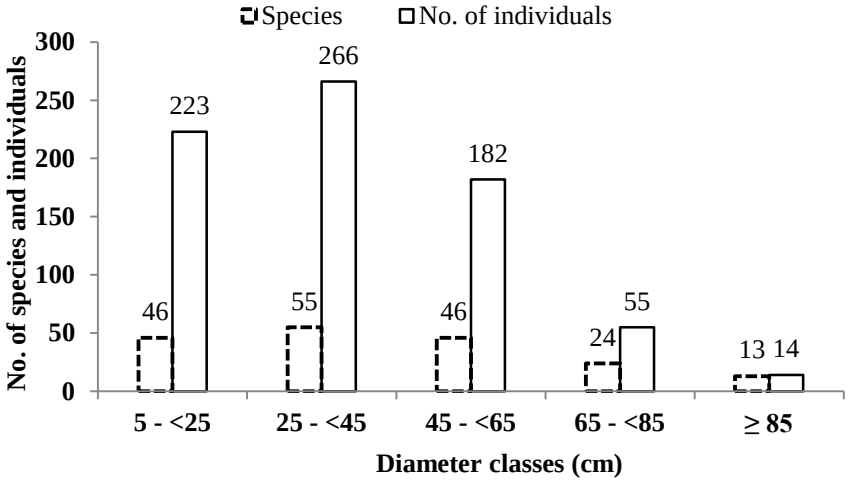

Fig. 2. Occurrence of tree species (no.) and individual tree stems (%) in different height (m) classes.

DBH class distribution

The distribution of tree species and individual stems in different diameter (cm) classes is shown in (Fig. 3). The figure depicted that a total of 58 tree species and most of the individuals (53.24%) occurred under diameter class of 5-<25 cm. On the other hand, the number of tree individuals was at its lowest (1.22%) in ≥85 cm diameter class. It was observed that the percentage of tree individuals decreases as the diameter of the tree species increased (Fig. 3).

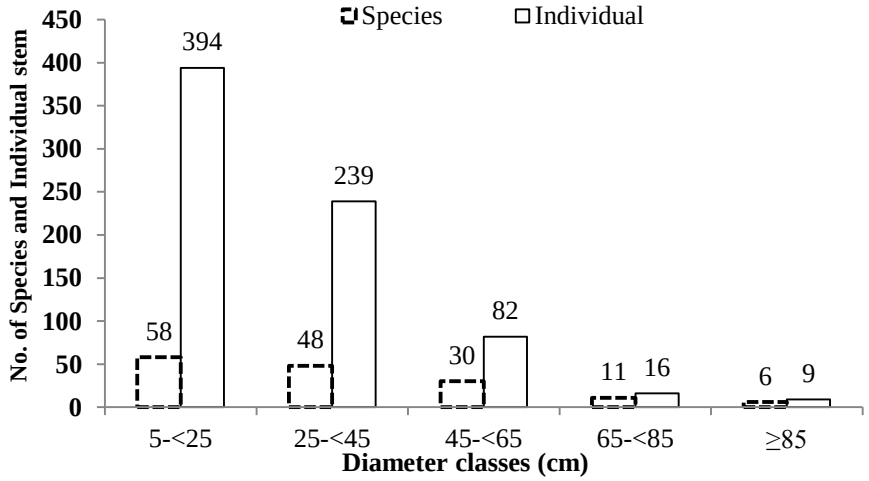

Fig. 3. Percentage distribution of the number of individual stems and species in different diameter (cm) classes.

Quantitative structure of tree species at Kaptai Deer Breeding Centre

Results of the study indicated that basal area of all the sampled trees was 7.28 m^2 per ha. Species wise maximum basal area was found for *Duabanga grandiflora* (0.62 m^2) followed by *Albizia lebbeck*

(0.38 m^2), *Tetrameles nudiflora* (0.36 m^2), *Artocarpus lacucha* (0.35 m^2), *Haldina cordifolia* (0.32 m^2) and *Chuckrasia tabularis* (0.30 m^2). Highest relative density was found for *Lagerstroemia speciosa* (8.11%) followed by *Protium serratum* (7.41%), *Aphanamixis polystachya* (6.71%), *Holigarna caustica* (5.87%), *Baccaurea ramiflora* (5.73%) and *Syzygium cumini* (4.48%). The relative frequency was assessed maximum for *Aphanamixis polystachya* (5.54%) followed by *Holigarna caustica* and *Protium serratum* (5.33% each), *Baccaurea ramiflora* (4.69%) and *Syzygium firmum* (4.49%). On the other hand, the species with the maximum relative abundance was *Clausena heptaphylla* (4.16%) which is followed by *Lagerstroemia parviflora* (3.82%), *Lagerstroemia speciosa* (3.82%), *Protium serratum* (2.21%), *Dehasia kurzii* (2.08%) and *Lagerstroemia tomentosa* (2.08%). Importance Value Index (IVI) indicates the dominance of a species in heterogeneous plant community (Shukla and Chandal, 1980).

Based on that assumption, *Lagerstroemia speciosa* was distinguished as the most dominant plant in the study area. Because, it is represented by the maximum IVI (16.19%) followed by *Protium serratum* (14.95%), *Aphanamixis polystachya* (14.17%), *Holigarna caustica* (12.95%), *Baccurea ramiflora* (12.36%), *Syzygium firmum* (10.72%) and *Syzygium cumini* (10.06%).

Table 1. Tree species with scientific name, local name and family recorded from the Deer Breeding Centre at Kaptai.

Family	Scientific Name	Local Name
Anacardiaceae	*Holigarna caustica* (Dennst.) Oken.	Barela
	Lannea coromandelica (Houtt.) Merr.	Bhadi, Jiga
	Mangifera sylvatica Roxb.	Uri Am
	Spondias pinnata (L. f.) Kurz	Deshi Amra
	Swintonia floribunda Griff.	Civit
Bignoniaceae	*Stereospermum colais* (Buch.–Ham. *ex* Dillw.)	Dharmara
	Haplophragma adenophyllum (Wall.) Dop	Barpatta, Parul
Bombacaceae	*Bombax ceiba* L.	Shimul
Burseraceae	*Garuga pinnata* Roxb.	Sill bhadi
	Protium serratumm (Wall. *ex* Coelbr.) Engl.	Gutgutia
Caesalpiniaceae	*Senna siamea* (Lamk.) Irwin & Barneby	Minjiri
Combretaceae	*Terminalia arjuna* (Roxb. *ex* DC.) Wt. et Arn.	Arjun
	T. bellirica (Gaertn.) Roxb.	Bohera
	T. chebula (Gaertn.) Retz.	Haritaki
Celastraceae	*Bhesa robusta* (Roxb.) Ding Hou	Ujja gach
Datiscaceae	*Tetrameles nudiflora* R. Br.	Chundul
Dilleniaceae	*Dillenia pentagyna* Roxb.	Hargoja
	D. indica L.	Chalta
Dipterocarpace	*Anisoptera scaphula* (Roxb.) Pierre	Boilam
	Dipterocarpus turbinatus Gaertn.	Teli garjan
Ebenaceae	*Diospyros peregrine* (Gaertn.) Gurke	Deshi Gab
	D. ramiflora Roxb.	Uri gab
Elaeocarpaceae	*Elaeocarpus varunua* Buch.–Ham. *ex* Masters	Bon jolpai
Euphorbiaceae	*Antidesma acidum* Retz.	Elena
	Aporosa wallichii Hook. f.	Castoma
	Baccaurea ramiflora Lour.	Lotkon
	Bischofia javanica Bl.	Kanjalbhadi
	Macaranga denticulata (Bl.) Muell.-Arg.	Bura
	Suregada multiflora (A. Juss.) Bail.	Maricha
	Trewia nudiflora L.	Pitali, Meragota
Fagaceae	*Lithocarpus acuminata* (Roxb.) Rehder	Dholi Batna
	L. polystachya (Wall. *ex* A. DC.) Rehder	Rai Batna
	Quercus gomeziana A. Camus	Khooissa batna

Lauraceae	*Cinnamomum iners* Reinw. *ex* Blume.	Tej Bohul
	Dehasia kurzii King	Modonmasta
	Litsea glutinosa (Lour.) C. B. Robinson.	Medha
	Actinodaphne angustifolia Ness.	Modonmasta
Lythraceae	*Lagerstroemia parviflora* Roxb.	Sidha Jarul
	L. speciosa (L.) Pers.	Jarul
	L. tomentosa Persl.	Painna Jarul
Meliaceae	*Aphanamixis polystachya* (Wall.) Parker	Pitraj
	Chukrasia tabularis A. Juss	Chikrassi
	Toona ciliata Roem	Toon
	Walsura robusta Roxb.	Bonlichu
Mimosaceae	*Albizia odoratissima* (L. f.) Benth.	Tetuiya Koroi
	A. procera (Roxb.) Benth.	Sil/sada koroi
	A. chinensis (Osb.) Merr.	Chakua Koroi
	A. lebbeck (L.) Benth.	Kala Koroi
Moraceae	*Artocarpus chama* Buch.-Ham.	Chapalish
	A. lacucha Buch.-Ham.	Borta, Dewa
	Ficus hispida L. f.	Dumur
	F. racemosa L.	Jaggya Dumur
	Streblus asper Lour.	Sheora, Herba
Myristicaceae	*Myristica linifolia* Roxb.	Am Berela
Myrtaceae	*Syzygium cumini* (L.) Skeel	Kalo jam
	S. fruticosum (Roxb.) DC.	Puti Jam
	S. firmum Thw.	Dhakijam
Rubiaceae	*Haldina cordifolia (*Roxb.) Ridsdale	Haldu
	Mitragyna parviflora (Roxb.) Korth.	Dakroom
	Morinda angustifolia Roxb.	Harinarphul
Rutaceae	*Clausena heptaphylla* (Roxb.) Wt. *et* Arn ex Steud.	Maricha
Sapotaceae	*Madhuca longifolia* (Koenig) Mac Bride	Mohua
Sonneratiaceae	*Duabanga grandiflora* (Roxb. *ex* DC.) Walp.	Banderhola
Sterculiaceae	*Firmiana colorata* (Roxb.) R. Br.	Faisa udal
	Pterospermum acerifolium (L.) Wild.	Moos
Theaceae	*Schima wallichii* (DC.) Korth	Konak
Tiliaceae	*Grewia nervosa* (Lour.) Panigr.	Achar gulla
Verbenaceae	*Gmelina arborea* Roxb.	Gamar
	Vitex glabrata R. Br.	Arsol, Goda

The forests though cover small area but seemed to be rich with diverse flora and dense populations. The study recorded 69 tree species belonging to 55 genera and 29 families in Kaptai Deer Breeding Centre of 161.94 ha area. The other studies conducted in adjacent similar forests having greater area reported comparable results. They found 107 tree species belonging to 72 genera and 37 families from Kamalachari Natural Forest of Chittagong South Forest Division. In these studies, 62 tree species have also been reported from Tankawati Natural Forest. The authors found 77 tree species from Dudhpukuria Natural forest and 240 tree species in Chunati wildlife sanctuary (Hossain *et al.* 2015, Hossain and Hossain 2014). Hossain *et al.* (1997) reported 85 tree species having dbh of 10 cm and above from the Bamu Reserve Forest of Cox's Bazar North Forest Division. Nath *et al*. (1998) studied a 2 ha area of Sitapahar Forest Reserve of Chittagong Hill Tracts, Bangladesh and found that there are 85 tree species (>10 cm dbh) of 68 genera under 36 families and the Euphorbiaceae was the dominant family, which is almost similar to the present study. Rahman (2002) studied in the natural and enrichment plantation area of Baraitali Forest of Chunati Range, Chittagong (South) Forest Division, Bangladesh and found 59 tree species (>10 cm DBH), which is comparatively lower than the recorded tree species of present study.

Results indicate comparatively rich composition and diversity of tree flora in the present study area though it is a small area. This area is comparatively less disturbed by anthropogenic activities because of its location nearby restricted Kaptai Hydroelectric Project and surrounded by river. Moreover, though the feeding habit and breeding of deer are supposed to have a negative impact on some specific plant community especially *Gmelina arborea*, no such impacts appeared to be prominent because the activity of Deer Breeding Centre is limited, breeding is not done exclusively in captive condition and the number of deer is within carrying capacity.

Table 2. Quantitative structure of tree species of the Deer Breeding Centre at Kaptai.

Name of the species	Stem ha^{-1}	BA (m^2)	RD (%)	RF (%)	RA (%)	IVI
Actinodephne angustifolia	12	0.07	0.84	0.85	1.56	3.25
Adina cordifolia	2	0.32	0.14	0.21	1.04	1.39
Albizia chinensis	4	0.25	0.28	0.43	1.04	1.77
Albizia lebbeck	2	0.38	0.14	0.21	1.04	1.39
Albizia odoratissima	2	0.11	0.14	0.21	1.04	1.39
Albizia procera	4	0.03	0.28	0.43	1.04	1.75
Anisoptera scapula	10	0.06	0.70	0.85	1.30	2.85
Antidesma spp.	2	0.04	0.14	0.21	1.04	1.39
Aphanamixis polystachya	96	0.04	6.71	5.54	1.92	14.18
Aporosa wallichii	8	0.01	0.56	0.43	2.08	3.07
Artocarpus chama	24	0.22	1.68	2.35	1.14	5.16
Artocarpus lacucha	2	0.35	0.14	0.21	1.04	1.40
Baccaurea ramiflora	82	0.01	5.73	4.69	1.94	12.37
Bischofia javanica	16	0.07	1.12	1.71	1.04	3.87
Bombax ceiba	2	0.22	0.14	0.21	1.04	1.39
Cassia siamea	2	0.18	0.14	0.21	1.04	1.39
Chickrassia velutina	6	0.30	0.42	0.64	1.04	2.10
Cinnamomum inners	6	0.03	0.42	0.64	1.04	2.10
Clausena heptaphylla	36	0.01	2.52	1.28	4.16	6.92
Dehasia kurzii	4	0.05	0.28	0.21	2.08	2.58
Dillenia indica	16	0.11	1.12	1.71	1.04	3.87
Dillenia pentagyna	8	0.01	0.56	0.85	1.04	2.45
Diospyros peregrina	12	0.03	0.70	0.85	1.30	2.85
Diospyros ramiflora	32	0.04	2.52	2.77	1.28	6.29
Dipterocarpus spp.	34	0.04	2.38	2.56	1.48	6.41
Duabanga grandiflora	12	0.62	0.84	1.28	1.04	3.16
Elaeocarpus varunua	8	0.03	0.56	0.85	1.54	2.45
Ficus hispida	12	0.17	0.84	1.50	1.25	3.16
Ficus racemosa	24	0.03	1.68	1.71	1.56	4.95
Firmiana colorata	4	0.06	0.28	0.43	1.04	1.75
Garuga pinnata	4	0.14	0.28	0.43	1.04	1.75
Gmelina arborea	4	0.13	0.28	0.43	1.54	2.75
Hijja (local name)	2	0.04	0.28	0.21	1.04	1.39
Holigarna caustica	86	0.05	5.87	5.33	1.75	12.95
Lagerstroemia parviflora	6	0.29	0.42	0.21	3.12	3.76
Lagerstroemia speciosa	116	0.09	8.11	4.26	3.02	15.40
Lagerstroemia tomentosa	4	0.10	0.28	0.21	2.08	2.58
Lannea coromandelica	8	0.06	0.56	0.85	1.08	2.45
Lithocarpus acuminata	6	0.06	0.42	0.64	1.04	3.30
Lithocarpus polystachya	24	0.04	1.40	1.92	1.30	4.41
Litsea glutinosa	12	0.02	0.84	0.85	1.56	3.25
Macaranga denticulata	50	0.01	3.50	2.77	2.00	8.27
Madhuca indica	2	0.01	0.14	0.21	1.04	1.39
Mangifera sylvatica	48	0.10	3.36	3.62	1.47	8.45

Microcos paniculata	48	0.05	3.36	3.84	1.39	8.58
Mitragyna parviflora	4	0.02	0.28	0.43	1.04	1.75
Morinda angustifolia	6	0.10	0.42	0.64	1.04	2.10
Myristica linifolia	14	0.03	0.98	1.28	1.22	3.47
Protium serratum	106	0.05	7.41	5.33	2.21	14.95
Pterospermum acerifolium	22	0.08	1.54	1.71	1.43	4.68
Quercus spicata	6	0.03	0.42	0.64	1.04	2.10
Schima wallichii	4	0.07	0.28	0.43	1.04	1.75
Spondis pinnata	8	0.07	0.70	0.85	1.04	2.45
Stereospermum colais	10	0.09	0.70	1.07	1.04	2.81
Stereospermum suaveolens	16	0.03	1.12	1.49	1.39	3.79
Streblus asper	12	0.03	0.70	0.85	1.30	2.85
Suregada multiflora	6	0.03	0.42	0.64	1.56	2.41
Swintonia floribunda	44	0.10	3.08	3.41	1.43	7.92
Syzygium cumini	64	0.09	4.48	3.62	1.96	10.06
Syzygium firmum	62	0.08	4.34	4.48	1.54	10.35
Syzygium fruticosum	18	0.08	1.12	1.49	1.19	3.80
Terminalia arjuna	2	0.07	0.14	0.42	1.04	1.39
Terminalia bellirica	10	0.17	0.84	1.07	1.04	2.81
Terminalia chebula	4	0.14	0.42	0.43	1.04	1.75
Tetrameles nudiflora	10	0.36	0.70	1.06	1.04	2.81
Toona ciliata	8	0.20	0.56	0.85	1.04	2.45
Trewia polycarpa	2	0.02	0.14	0.21	1.04	1.39
Vitex glabrata	50	0.12	3.50	2.99	1.86	8.34
Walsura robusta	38	0.04	2.66	2.77	1.52	6.95
Total	**1430**	**7.28**	**100**	**100**	**100**	**300**

The tree stem density in the forests of Kaptai Deer breeding centre (1,430 stems/ha) is greater than many other similar forests. In similar studies, Haque and Alam (1988) reported that the average density of tree species of dbh >20cm was 202-227 stems/ha in a natural forest of Cox's Bazar Forest Division, Ahmed and Haque (1993) reported the density of trees ≥10 cm DBH is 257 stems/ha in the natural forests of Ukhia Range in Cox's Bazar Forest Division, Nath *et al.* (1998) found density of trees having DBH ≥10 cm is 381 stems/ha in Sitapahar Reserve Forest of Chittagong Hill Tracts (South) Forest Division which is very near to the study site. Hossain and Hossain (2014) reported density of trees(≥5 cm) DBH varied 379-702 stem/ha at different beats of Chunati Wildlife Sanctuary.

The basal area of trees was poor (14.36 m^2/ha) in Kaptai Deer Breeding Centre. It seemed lower in comparison to 33.77 m^2/ha at Chunati Wildlife Sanctuary, 53.5 m^2/ha at Sitapahar Reserve Forest, 30.87 m^2/ha in a tropical rain forest of Western Ghats of India, 14.99 m^2/ha in dry deciduous woodland in Brazil, 25.4 m2/ha at Terra Frime Forest in Central Amazonia (Rahman *et al*. 2000, Nath *et al*. 1998, Neto *et al*. 1990, Ferreira and Rankin-de-Merona 1998).

The results indicated by the structural composition of tree species based on height class distribution are almost similar to that of Chunati Wildlife Sanctuary (Hossain and Hossain 2014). On the other hand, the distribution of tree species into different diameter classes indicated a reversed-J shaped curve which is quiet similar to that of a less disturbed natural forests is similar to that of Kamalachari Natural Forest of Chittagong South Forest Division (Hossain *et al.* 2015).The natural forests of Bangladesh are passing through various constraints and multifarious threats. The population pressure on the forest resources for fuel wood collection, habitation, agricultural expansion, timber extraction, shifting cultivation, commercial cropping practices, i.e. horticulture etc. is destroying natural forests with functional threats. Sometimes development projects for establishing industries, power plant even military base are getting priority than natural resources conservation. The Forest Department of Bangladesh and relevant stakeholders are trying to manage the existing forests sustainably and to conserve and enhance

biodiversity and forest ecosystem services. The present study provides an idea about tree composition and regeneration status in the forest of Deer Breeding Centre at Kaptai. Though the forest is a remnant natural patch, it has diversity with 69 naturally growing native tree species. But, field observation indicated that there is an increasing trend of local peoples' entrance for wild fruit and fuel wood collection which may be a vital threat for the Deer Breeding Centre in near future. Natural regeneration of tree species was also disturbed a little bit by wild animals, e.g. elephant, deer, monkey etc. In order to maintain the ecological complexity and species diversity of the study area, an ecologically sound management system with enhanced protection is necessary with minimum disturbance to the forest ecosystem. Side by side, the local administrative units (Beat and Range offices) of the Forest Department should be strengthened with necessary manpower, equipment, logistics and training, so that they become more capable to conduct the protection measures and conservation measures of the area. Awareness raising and consciousness of local people regarding the importance of forests, wildlife, environmental conservation, biodiversity and endangered ecosystems would also be helpful for protecting the rich floral biodiversity. Establishment of permanent sample plots of adequate size (0.5–1.0 ha) in representative vegetation types of the Deer Breeding Centre would be helpful along with the findings of the present study for long-term ecological monitoring and trends of changes as well as impacts of deer on plant composition and diversity.

REFERENCES

Ahmed, G. U. and S. M. S. Haque. 1993. Percentage distribution of species and diameter class in natural forest of Bangladesh. *Chittagong Univ. Stud. Sci*. Part II. **17**(1): 109-113.

Ambasht, R. S. 1978. *A textbook of plant ecology.* 5th ed. Students Friends and Co. Lanka, Varanasi, India. 276 pp.

Anonymous. 1970. Working Plan of Chittagong Hill Tracts (South) Forest Division for the period from 1969-1989. 147 pp.

Anonymous. 1980. *World Conservation Strategy*. International Union for Conservation of Nature (IUCN). 77 pp.

Brandis, D. 1906. *Indian Trees: An account of trees, shrubs, woody climbers, bamboos and palms indigenous or commonly cultivated in the British Indian Empire*. Archibald Constable and Co Ltd, London, UK. 767 pp.

Chaturvedi, A. N. and L. S. Khanna. 1982. *Forest Mensuration*. International Book Distributors, DheraDun, India. 406 pp.

Dallmeier, F., M. Kabel and R. Rice. 1992. Methods for long-term biodiversity inventory plots in protected tropical forests. In: Dallmeier (ed.). *Long-term monitoring of biological diversity in tropical forest areas methods for establishment and inventory of permanent plots.* MAB digest II, UNESCO, Paris, France., pp. 11-46.

Ferreira, L. V. and J. M. Randkin-de-Merona. 1998. Floristic composition and structure of a one hectare plot in Terra Firme Forest in Central Amazonia. In: F. Dallmeier and J. A. Comiskeyn (eds.). *Forest Biodiversity in North,Central and South America and the Caribbean: Research and Monitoring.* Vol. 21. Man and Biosphere Series. UNESCO, Paris, France., pp. 649-662.

Gareth, W. 1991. *Techniques and field work in ecology*. Collins educational publishers, Hammersmith, London, UK. 125 pp.

Haque, S. M. S. and M. S. Alam. 1988. Some aspects of practicing the clear-felling followed by artificial regeneration system in the Cox's Bazar Forest Division. *Chittagong Univ. Stud. Sci*. Part II. **12**(2): 87-95.

Hossain, M. A., M. K. Hossain, M. S. Alam and M. Main Uddin. 2015. Composition and diversity of tree species in Kamalachari natural forest of Chittagong south forest division, Bangladesh. *J. Forest Environ. Sci*. **31**(3): 192-201.

Hossain, M. K. and M. A. Hossain. 2014. *Biodiversity of Chunati Wildlife Sanctuary: Flora*. Arannayk Foundation and Bangladesh Forest Department, Dhaka, Bangladesh. 176 pp.

Hossain, M. K., M. Hossain and M. K. Alam. 1997. Diversity and structural composition of trees in Bamu reserved forest of Cox's Bazar forest division, Bangladesh. *Bangladesh J. Forest Sci.* **26**(1): 31-42.

Lal, J. B. 1998. *Forest Diversity Versus Biodiversity of Forest Species (A community forestry approach)*. DehraDun, India., pp. 1-12.

Magurran, A. E. 1988. *Ecological diversity and its measurement*. Princetom University Press, Princeton, New Jersey. Washington D.C. USA., pp. 449-479.

Moore, P. D. and S. B. Chapman. 1986. *Methods in plant ecology*. Blackwell Scientific Publications, Oxford, UK., pp. 285-344.

Nath, T. K., M. K. Hossain and M. K. Alam. 1998. Diversity and composition of trees in Sitapahar forest reserve of Chittagong Hill Tracts (South) Forest Division, Bangladesh. *Ann. For.* **6**(1): 1-9.

Nath, T. K., M. K. Hossain and M. K. Alam. 2000. Assessment of tree species diversity of Sitapahar forest reserve, Chittagong Hill Tracts (South) Forest Division, Bangladesh. *Indian Forester*. **126**: 16-21.

Neto, G. G., V. L. M. S. Guarim and G. T. Prance. 1990. Structure and floristic composition of the trees of an area of Cerrado near Cuiaba, MatoGrosso, Brazil. *Kew Bull.* **49**(3): 499-509.

Prain, D. 1903. *Bengal Plants*. Vol. 2. West, Newman and Co. Calcutta, India. 670 pp.

Rahman, M. L. 2002. Distribution pattern of medicinal tree species in Chunati Wildlife Sanctuary of Chittagong of Bangladesh. *J. Trop. Med. Plants.* **3**(1): 65-72.

Rahman, M. L., M. K. Hossain and Q. M. N. Karim. 2000. Diversity and composition of tree species in Chunati Wildlife Sanctuary of Chittagong Forest Division, Bangladesh. *Chittagong Univ. J. Sci.* **24**(1): 89-97.

Sharma, P. D. 1979. *Elements of ecology*. Pastogi publications, Meerat, India. 358 pp.

Shukla, R. S. and P. S. Chandel. 1980. *Plant Ecology*. S. Chand and Company Ltd. New Delhi, India. 197 pp.

Trivedi, P. R. 2000. *Global Biodiversity*. New Delhi, India. 314 pp.

Whittaker, R. H. 1975. *Communities and Ecosystems*. Macmillan Pub. Co. New York. 387 pp.