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Impacts of Rohingya on Natural Forests Resources of South Eastern Part in Bangladesh

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Abstract

The study was conducted to estimate the loss of natural resources by the Rohingya refugees in the Ukhiya and Teknaf forests area. The main objectives of the study were to find out the loss of biodiversity and environmental impacts on natural resources. Field measurement, data collection and allometric equations model were followed. The findings of the results revealed that the total of 44% protected forests land was encroached by Rohingya refugees. The average family members were 7.07±2.50 and 63.54 bamboos were used for the construction of their each communal house. The results also presented that 6,825 tonnes fuel wood was collected by the Rohingya refugee from nearby natural forests per day and 555.64 tha^{-1} biomass was lost and 277.82 tha^{-1} carbon was emitted into the atmosphere. The results can be directed to researchers and the administrators to realize the environmental impacts and sustainable management and protection of this important terrestrial forest ecosystem.

Keywords: Rohingya, influx, biodiversity, effect, conservation

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1. INTRODUCTION

Last 25th August 2017, about 6,50,000 Rohingya crossed the border into Cox's Bazar district under Bangladesh from the Rakhaine State of Myanmar for the internal violence. The people who have arrived in Bangladesh, now reliant on humanitarian assistance for food, shelter and other life-saving needs. The Rohingya have been arriving in two Upzilas, Ukhiya and Teknaf in Cox's Bazar district of Bangladesh (Sources: Rohingya Refugee Crisis Cox's Bazar). The Bangladesh Government has allocated the Rohingya in the protected forest land under Ukhiya and Teknaf Upazila which are covered by tropical evergreen and semi-evergreen forests tree species (IUCN 2000).

The Teknaf Wildlife Sanctuary (TWS) is one of the most important forest ecosystems in Bangladesh (Arannayk Foundation 2013). Maximum parts of the hills are denuded by anthropogenic activities and converted into shrubby bushes (Nishorgo Support Project 2006).
Over the last 50 years, the vegetation in the area has been degraded by both human and natural factors. The Rohingya influx in 1991 and several other influxes reduced the forests of Ukhiya and Teknaf substantially.
The three major cyclones, in 1991, 1994 and 1997 severely affected the forests areas (Arannayk Foundation 2013). Inside the TWS boundary, the settlements and homestead forests were decreased by 52.60% (IPAC 2011). Himchhari National Park, declared in 1980, is one of the most important protected areas in Bangladesh. It lies within the Cox's Bazar South Forest Division covering an area of 1729 ha. The park is home to 100 species of trees, shrubs, grasses, canes, palms, fern and herbs. The diversity of the park is threatened by many anthropogenic factors which have been exacerbated by the Rohingya influx as merchants illegally collect bamboo and fuel woods from this forest and sell them to the Rohingya community (Tani and Rahman 2018).

The Inani National Park is also under Cox's Bazar, South Forest Division covering an evergreen and semi-evergreen tropical forest zone. It includes both the Inani and the Ukhiya Forest Range. Although the Inani forest one was historically rich in biodiversity, the current vegetation consists of herbs, sungrass, shrubs and bushes. The high forest has shrunk from 70% to 30% in the last three decades (Arannayk Foundation 2016). The local people extracted bamboo and fuel wood from the Inani park areas and sold them to the Rohingya community. The natural resources are decreasing at an alarming rate after the Rohingya influx in Bangladesh (Tani and Rahman 2018). Therefore, degradation of natural resources have been occurring in two Upzilas and their

surrounding areas by Rohingya settlements. But, there is no baseline information on the degradation of natural resources in the southeastern region of Bangladesh. Considering this fact, an attempt was made to estimate the loss of the natural resources in the Rohingya allocated areas.

2. Materials and Methods

The study areas are located at Ukhiya and Teknaf Upzila, which are 40 and 80 km away from Cox's Bazar district and lies between 20°.50′ to 21°.20′N latitudes and 92°.00′ to 92°.20′ Elongitudes (Fig. 1 A,B,C,D). The study areas are consisted of evergreen and semi- evergreen tropical forests and covered by Hills and the Naf River. Administratively these areas are under the Cox's Bazar South Forests Divisions in Bangladesh.

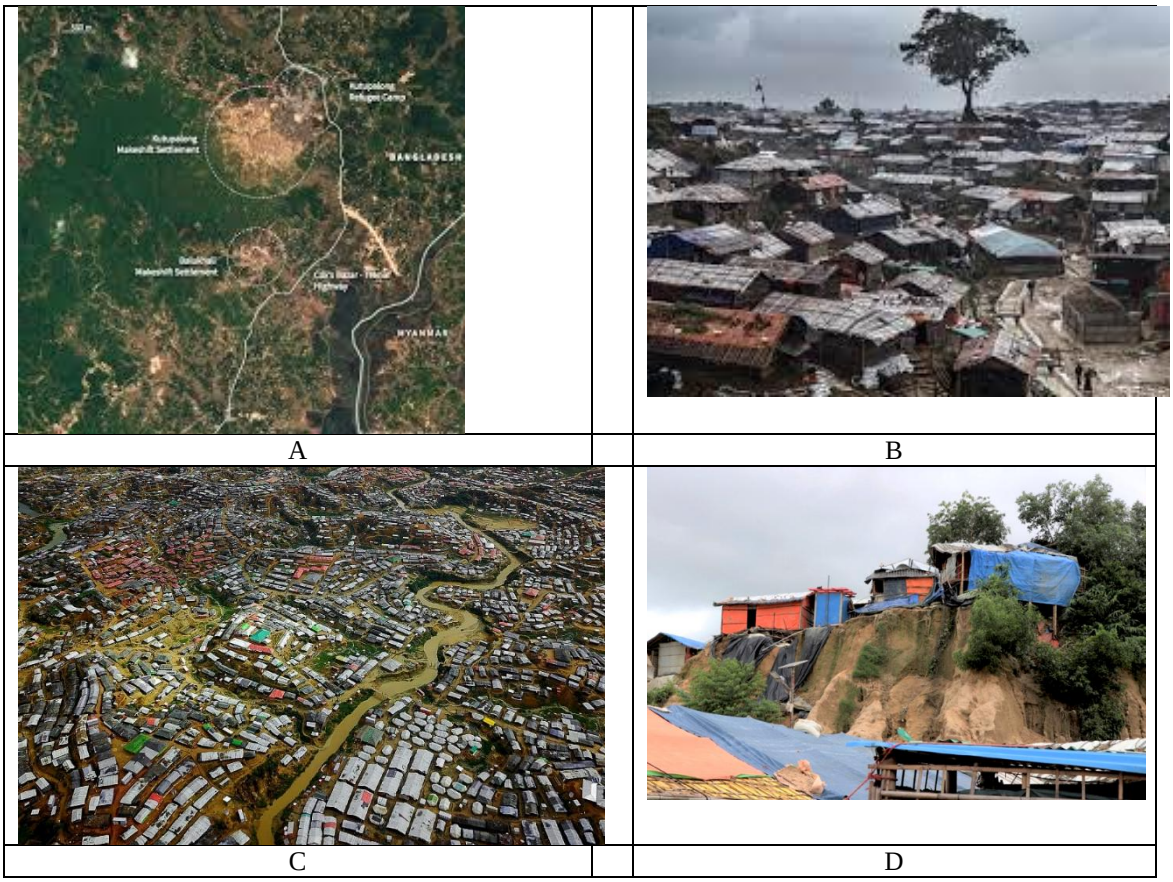

Fig. 1.Map of the study areas

About 30% of the land is used for crop production and the remaining areas are included of hills (DOE-GIS 1999). The climate of this region is tropical in nature and characterized by monsoon related seasons: pre-monsoon (March to May); monsoon (June to September); post- monsoon (October to November) and the dry season (December to February). The influx area is highly susceptible to tropical cyclones and tidal surges. Cyclonic storms develop in the Bay of Bengal, generally during the periods from April to May and October to November and make landfall and causing severe damage to human settlements and vegetation (Source: Cox's Bazar Weather Office 2001). The major soil types are red, alluvial, muddy, sandy and less acidic soil (Arannayk Foundation 2013).The influx area is situated on a combination of small hills and plain extending into the Chittagong Hill Tracts bordering Myanmar (IUCN 2000).The study was based on the field data collection through physical measurements, field investigator and laboratory analysis. Data were collected from Ukhiya and Teknaf Rohingya camps area in the period of January 2019 to December 2019. For convenience of the study, the plots were selected with the help of GPS. A total number of 384 plots were selected and apart from 100 m each other (Fig. 2).

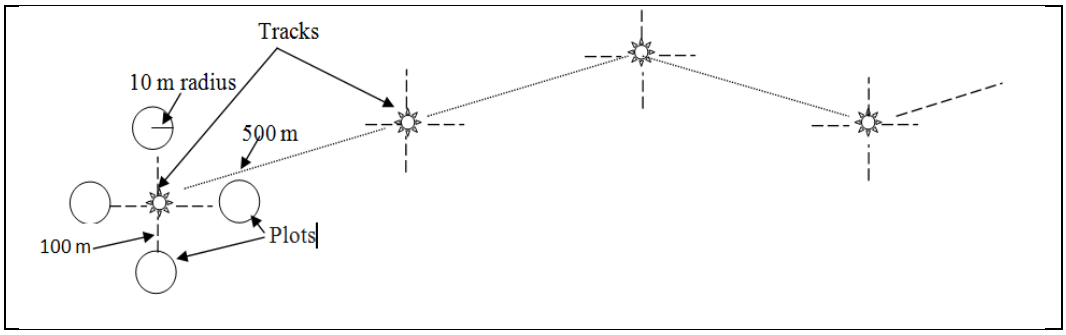

Fig. 2. Schematic representation of the arrangement of sampling tracks and plots

The total number of tracks and plots were 96 and 384 respectively. In the each sampling plot, total trees and total species were counted. The total height and diameter at breast height (1.3m from ground level) of trees were measurements under each track and plot. The aboveground biomass (AGB) and belowground biomass (BGB) of the trees was estimated using the allometric model described by Brown *et al*. (1989).

AGB=exp. {-2.4090+0.9522 ln (D^2HS)}

Where, AGB=is the above ground biomass (kg), H is the height of the trees (m), D is the diameter at breast height of the tree (cm) and S is the specific wood density (m^3).

The wood density values of different tree species grown under local conditions were obtained from Sattar *et al.* (1999). Belowground biomass (BGB) was calculated considering 15% of the aboveground biomass (Mac Dicken, 1997).

BGB=AGB (15/100)

Total carbon (TC) of the tree was determined by using the following formula.

TC= (AGB+BGB) ×0.50

Where, 0.50 is the conversion factor (Schroeder, 1997).

ANOVA and DMRT were done for carbon stock per tree was performed by using SPSS 20 version.

3. Results and Discussion

The total protected land is 60, 0000 ha in the Ukhiya and Teknaf Forest Range under Cox's Bazar, South Forest Division and 26600 ha land (44%) was directly used for the Rohingya makeshifts camps. The remaining lands were also degraded after the Rohingya influx in Bangladesh. The protected forest was covered by different types of evergreen and semi-evergreen forest tree species. *Albizia procera*, *Crateva magna*, *Artocarpus lacucha*, *Tectona grandis*, *Lagerstroemia speciosa*, *Acacia auriculiformis*, *Gmelina arborea*, *Swietenia macrophylla*, *Dipterocarpus turbinatus*,*Protium serratum*, *Hopea odorata*, *Brownlowia elata*, *Anisoptera scaphula*,*Mangifera sylvestica*, *Stereospermum colais*,*Syzygium grande*, *Mesua ferrea*,*Michelia chapaca*, *Sterculia villosa*, *Toona ciliata*, *Terminalia chebula*, *Avicennia officinalis*, *Casuarina equisetifolia*, *Melastoma melabathricum*, *Lantana camara*, *Eupatorium odoratum*, *Microcos paniculata*, *Clerodendrum viscosum* and *Ipomoea pes-caprae*etc. were found in the protected areas. Setting up large makeshift camps in the kutupalong, Balukhali and other have made a substantial direct impact on the forest resources in the Ukhiya Range. This causes additional stress on the Ukhiya forest land that has already been cut by 30-40% the ongoing deforestation process. In the Teknaf Range the influx has also impacted some of the plantations in the buffer zone and has started impacting the core zone of the TWS as well. (Table 1).

Table 1. Rohingya camps in different locations of Ukhiya and Teknaf protected forest areas

Upzila	Location of the Rohingya camp		Legal status
Ukhiya	Forest Range	Rohingya camp	Reserved forests
	Ukhiya	Balukhalidhala	Reserved forests
		Tanjimakhola	Reserved & protected forests
		Mokkarbill, Hakimpara, Jamtoli and Bagghona	Reserved forests
		Balukhali	Reserved forests
		Kutupalong	Reserved forests
		Shafiullah kata	Protected forests
Teknaf	Whykong	Putibunia	Reserved forests
		Chakmarkul	Reserved forests
		Nayapara, Shamlapur	Protected forests
		Leda	Reserved forests

The Bangladesh Government has allocated about 26,000 ha in the protected forest land for Rohingya makeshift settlements in Ukhiya and Teknaf regions. The total land was covered by different types of evergreen and semi-evergreen forest tree species which was known as a core forest. The extraction of forest resources was rapidly increased after the Rohingya influx and forested lands were also converted into herbs and shrubs land at an alarming rate. It was observed during the field reconnaissance that the Rohingya collected fuel wood from the natural and community forests for a long time. It is clear that continued demand for the fuel wood will inevitably push Rohingya to further encroach in the natural forest and plantations expand deforestation on a substantial scale (Table 2).

Table 2. Fuel wood and bamboo used in the Rohingya camps at Ukhiya and Teknaf

Rohingya camps	Fresh weight of bamboo	Fuel wood / month (kg)	Average size/family	Average number of bamboo
Ukhiya	310.78±7.31	156.92 ±7.07	6.54 ±0.94	60.69 ±1.75
Teknaf	400.67±7.41	146.55 ±5.92	7.54 ±0.96	66.00 ±1.56
Mean	358.93±8.52	151.07 ±7.47	7.07 ±0.54	63.54 ±1.99

The survey was conducted in the Ukhiya and Teknaf areas and found that the average number of family members were 7.07 ±2.5 and fuel wood consumption by single Rohingya family was 151.07 ±7.25 kg per month. Fuel wood was mostly bought from the local market, which was collected from the nearby forests. It was also found that 63.54 (Table 2) culms of bamboo used per family for the construction of their communal housing plots ($45m^2$) and fresh weight was 358.93±8.52 kg per family (Table 2). The finding of the results showed that the average demand of fuel wood per day per person was 0.70 kg and Rohingya collected approximately 50% of their fuel demand from the forests. The total Rohingya influx was about 6, 50,000 and the total consumption of fuel wood ($0.70\times0.50\times650000/1000=6825$) was 6825 ton per day. The area of the land cover falls within the footprint of the camps and within the 5 km m and 10 km buffer around all camps. The collection of fuel wood from the natural forest within the 5 km buffer around the camps will sustain fuel supply for approximately four months, but the forested area of 14,000 ha will be degraded and converted in shrub dominated areas with low biomass and productivity. The collection of fuel wood from the natural forest within the 10 km buffer around the camps will sustain fuel supply for approximately one year and the entire remaining forest land of 26,000 ha will be degraded and converted into shrubby dominated areas with low biomass and productivity (IOM & FAO 2017).

Table 3. Biomass and carbon loss in the forest areas due to makeshift settlements in Ukhiya and Teknaf regions.

Forest Range	AGB	BGB	TB (t ha^{-1})	TC(t ha^{-1})
Ukhiya	602.85±69.10	90.43±11.20	693.28±75.22	346.64±29.30
Teknaf	363.48±43.55	54.52±7.89	418.00±73.59	209.00±15.62
Mean	483.16	72.48	555.64	277.82

The average 555.64 b t ha^{-1} biomass was collected from nearby the natural forests and 227.82 t ha^{-1} carbon was emitted in the atmosphere (Table 3).The results of the study showed that 7% of the total area occupied by plantations and orchards and 3% of shrub dominated forest have been already cleared to set up makeshift camps for the Rohingya. It was also found that, more than 61% of the plantations and remnants of natural forests will be degraded and converted to shrubby land due to the influx of Rohingya refugees.

Since 2017, the Rohingya has been the major impact on the environment of Cox's Bazar that require the implementation of a mitigation programme and offsets to prevent the environment from significant degradation. There are many adverse impacts on various environmental components caused both by the direct footprint of the Rohingya camps and by increased anthropogenic pressure, far beyond the boundaries of the area of the camps. The environmental impacts are continuing unmitigated, the heavily degraded protected ecosystems will soon suffer significant conversion and degradation, substantially reducing the habitat's ability to maintain viability. The population of its native species and losing its ability to sustain its ecosystem. Otherwise disturbed landscape will have reduced water retention capacity, which may impact ground water and surface water in the protected forest areas.

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