Proc. Pakistan Acad. Sci. 46(1):13-22. 2009

IMPACT OF FOREST AND NON-FOREST VILLAGERS ON UKHIA AND INANI FOREST RANGE UNDER COX'S BAZAR (SOUTH) FOREST DIVISION, BANGLADESH

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Received September 2008, accepted February 2009

Abstract: This article compared livelihood dependency of forest and non-forest villagers and their impacts on Ukhia and Inani forest ranges of Cox's bazar forest division, Bangladesh. Information was collected through household's interviews using a semi-structured questionnaire during December to June 2008. Total 121 respondents were randomly selected from both forest areas, where 41 respondents were in Inani and 80 were in Ukhia forest. We found diversified livelihood activities in both forest areas. Agrofarming and fuelwood collection turned out to be consistently major activities of both types of villagers at the two sites. Of the various activities, timber and fuelwood collection appeared to have high negative impact, while others were deemed to have comparatively less impact. The results also indicated that both types of villagers depend on forest resources. The non-forest villagers appeared freer to engage in such income earning activities as business and service besides labor work. Fuelwood and timber collection had high negative impact on forest resources and biodiversity. It is suggested that steps are necessary for alternative income generation activities and/or participatory management approaches for sustainability of the forests and their biodiversity at the two study sites

Keywords*:* Forest resources, resource degradation, resource management and sustainability impact, Bangladesh

Introduction

People in most of the developing world depend on forests for their livelihood [1]. Where people depend most immediately upon local ecosystems for their livelihoods, they also unwittingly become responsible for the degradation of the resources, not realizing the consequences of this dependence [2,3]. If we do not restrict such activities or find alternative solutions, low-level resource gathering activities can quickly turn into wide-scale and, often, irrevocable forest degradation. Livelihood is a complex concept and it is constantly discussed and reformulated, but the definition, mostly used by policy makers is "livelihood comprises the capabilities, assets (including both materials and social resources) and activities required for a means of living" [1]. The socio-economic and cultural life of the forest dwellers is closely associated with forest to a great extent [4-5]. Everyday millions of the poor and the forest dwellers are earning their livelihood from the forest [6] and their dependency on forest varies from area to area [7].

The livelihood of millions of people, living in rural areas, depends on accessing forest products and services. They use forests for subsistence, livestock rearing, fuelwood collection and as a source of goods to sell in the market. These actions can have positive or negative impact on forest conservation and the impact consequently varies according to their resource use patterns. Therefore, it is important to understand forest dwellers' livelihoods, their perceived needs, and their development strategies. We explored various livelihood activities of forest villagers (inhabitants of the study area who are living within the forest area allocated by the Forest Department

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having condition of protecting the forests) and non-forest villagers (inhabitants of the study area who are living in their own land and having no obligation towards the Forest Department to protect the forests) and compared their overall impacts on Ukhia and Inani forest Range under Cox's Bazar (South) Forest Division, Bangladesh. This study also sought to improve understanding of the situation and to provide insights which would be useful to relevant organizations for supporting forest dependent people and reduce pressures on both forest areas.

Materials and Methods

Study site

Cox's Bazar Division was divided into Cox's Bazar North and South Forest Divisions as per reorganization by the Directorate on 1st July 2001. The study was conducted at Ukhia and Inani forest range under the jurisdiction of Cox's Bazaar South Forest Division (Fig. 1). The total forest area lying within the jurisdiction of Cox's Bazar South Forest Division is 43,410 ha of which 36,574 ha is a Reserved Forest while the remaining 6,836 ha is Protected Forest. These forests are situated within Teknaf, Ukhia and partially in Ramu and Sadar Upazila [8]. Total area of Ukhia Forest Range is 21280 acres and Inani forest range is 20157 acres. The total vacant areas in Ukhia and Inani Forest Ranges are 14121 acres and 3800 acres, respectively [9]. The topography of Ukhia and Inani Forest range is diverse with almost flat land to medium hillocks. This area has low hills of less than 100-meter elevation from the mean sea level. Approximately 10% landscape of the area is occupied with well drained flood plains. Soils of the site are sandy to sandy loam in highlands and clayey to silty clay in the depressions. The climate is mainly monsoon type. Total annual average rainfall is 3595 mm; while average maximum temperature is 34.2 °C and minimum temperature is 15.6°C. Average relative humidity is over 90% during July to August, whereas in December it decreases to about 74% [10]. The literacy rate is only 17%. Approximately 9% people have completed primary level; 3% secondary education, while less than 2% have higher secondary education [11]. Most of the people living in the Teknaf peninsula are poor and per capita income has ranged from USD 50-150 [11].

According to Cox's Bazaar (South) Forest Division office the total number of forest villagers of both the ranges is 354. Thus a total of 68 households were randomly selected from the two forest ranges, with 19.20 % sampling intensity. The total number of non-forest villagers of both the ranges is approximately 500. Thus, a total of 53 households were randomly selected from the two forest ranges, with 10.60 % sampling intensity. The respondents were questioned about their income from different livelihood activities, and then calculated the monthly income of each household. The households were categorized into three income groups such as poor (monthly income range ≤ 5000=USD 71), middle (Tk. 5000-10000=USD 71-143) and rich (Tk. 10000+= USD 143+). The survey was carried out using a semi-structured questionnaire. Regarding livelihood activities, the study was focused on collecting the following data from each household: demographic information, housing pattern, livelihood activities, their role and seasonal variation, forest resource collected from the study area and their purpose. Regarding deforestation, data were required on status of existing forest cover in the study area, list of plants and animals that have disappeared from the forest in the recent past, and which plants and animals in the forest have been declining very rapidly. Field observations together with household interviews were important to study the livelihood activities of forest and non-forest villagers and their overall impacts. To study peoples' perceptions regarding different forest resources collected by them and their impacts

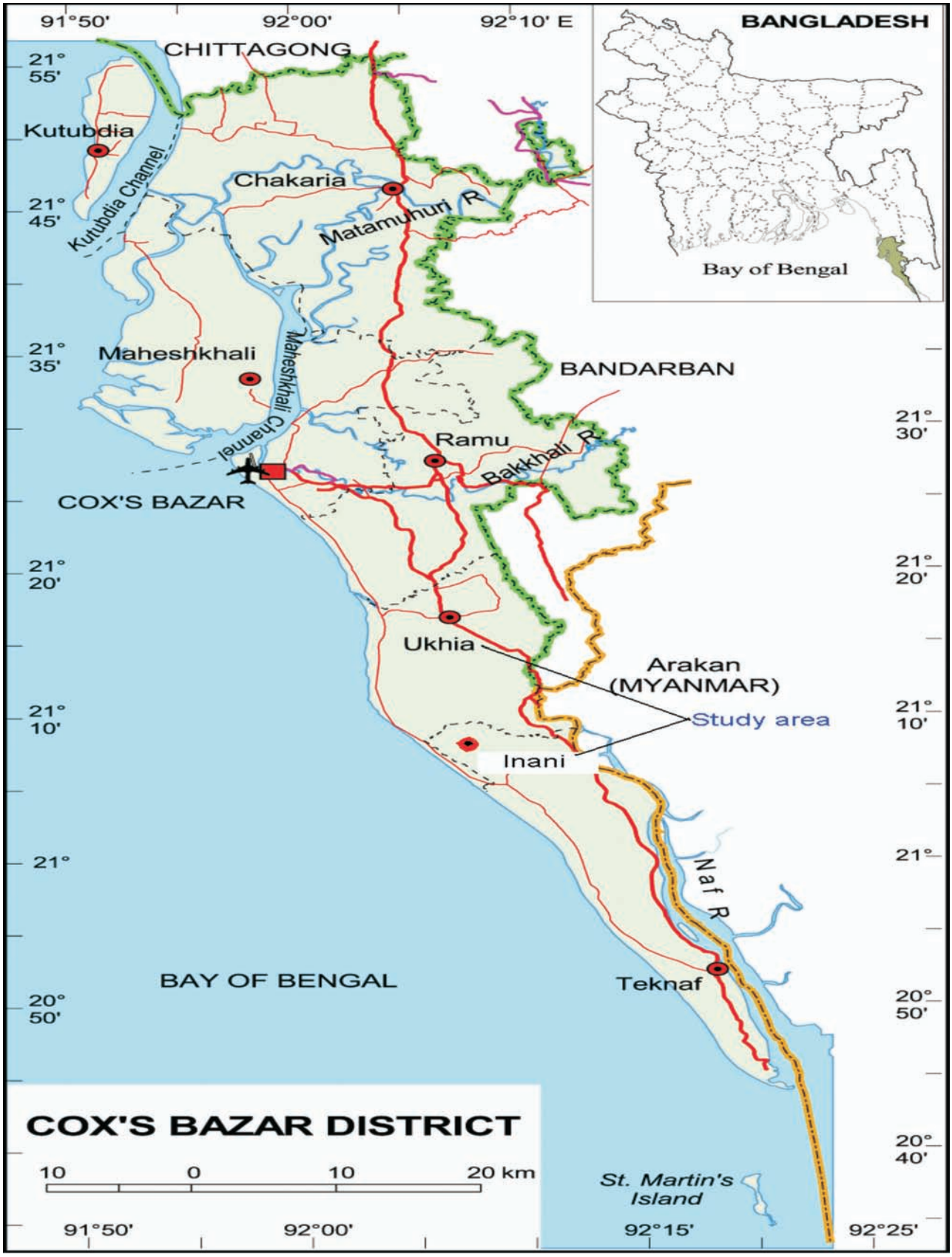

Figure 1. Map indicating the study site

on the forest ecosystem, we classified impacts on the forest ecosystem into three categories: high impact, moderate impact and low impact. To calculate this we considered the direct cash derived from sale of the forest products, and the cash value of the products they consumed. Peoples' perceptions of impact on forest diversity were also taken into account through interviews.

Results

Socioeconomic condition

A total of 121 households we interviewed with an average family size of forest villagers of Ukhia and Inani range being 7 members each. This average was 6 and 7 for non-forest villagers of the two ranges, respectively (Table 1).

Table 1. Household status of study sites

Study area	Community	Household (no.)	Average household size
Ukhia range	Forest villagers	45	7
	Non forest villagers	35	6
Inani range	Forest villagers	23	7
	Non forest villagers	18	7

The illiteracy rate of the forest villagers of the Ukhia and Inani ranges was higher than that of the non forest villagers at the two sites (Table 2). This shows that the literacy of the non forest villagers was better than at the Ukhia range. The average schooling (primary, S.S.C., H.S.C.) of the forest villagers of the Ukhia and Inani ranges was less than that of the non forest villagers (Table 2). Low educational status of the forest villagers is due to poverty and lack of educational institutes in the near by areas.

In case of self-owned land, the forest villagers at Ukhia range had higher land holding (homestead and agricultural) in comparison to the non forest villagers (Table 3). In contrast, the non forest villagers at the Inani site were better off in total land holding than the forest villagers there.

People at the two study sites made their houses from tin, mud, bamboo and sungrass. Most (94%) houses of the forest villagers in Ukhia range were made of sungrass/ bamboo while only 31% houses of non forest villagers were made of sungrass/ bamboo (Table 4). In case of the forest villagers in Inani range, most (94%) of the houses were made of sungrass/ bamboo while 55% house of non-forest villagers were made of sungrass/ bamboo, (Table 4). In both forest areas, forest villagers were mostly dependent on sungrass/ bamboo for their house construction.

Most of the two types of villaers at the two study sites fell in the poor to middle income category (Table 5); the poor category being by far the most obvious. The pattern for the rich category, though highly insignificant, appeared better for the non forest villagers, especially at the Inani range (Table 5).

Livelihood activities

Both the forest villagers and non-forest villagers in the two forest areas engaged in diversified livelihood activities (Table 6). While, there were differences in their livelihood patterns, all types of villagers largely showed dependence on local forest resources rather than on business and service roles. Agrofarming, fuelwood, sungrass, bamboo and dry leaf collection were more or less but consistently the major livelihood activities of both types of villagers at the two sites (Table 6). In contrast, the two types of villagers there engaged in business and service to a relatively insignificant extent. The involvement of the villagers at the Inani site was nearly two fold greater than at Ukhia range. Day labor was a highly notable activity of the forest villagers mostly at Ukhia. In general, the villagers at the two sites depended largely on

Table 2. Educational status.

Study area	Community	Illiteracy	Primary	S.S.C.	H.S.C
Ukhia range	Forest villagers	74%	24%	2%	-
	Non forest villagers	54%	33%	8%	5%
Inani range	Forest villagers	75%	22%	3%	-
	Non forest villagers	39%	47%	8%	3%

Note: '-' indicate absence of respondents

Table 3. Land holding pattern.

Study area	Community	Self-owned (decimal)		Lease (decimal)	
		Homestead	Agriculture	Homestead	Agriculture
Ukhia range	Forest villagers	43	173	1	38
	Non forest villagers	34	126	1	34
Inani range	Forest villagers	26	92	1	32
	Non forest villagers	41	153	1	35

Note: (1 decimal = 0.1 square feet) Decimal indicates a number in the decimal system or a proper fraction whose denominator is a power of 10

Table 4. Housing pattern.

Category	**Ukhia range**		**Inani range**	
	Forest villager (%)	**Non-forest villager (%)**	**Forest villager (%)**	**Non-forest villager (%)**
Semi-building (Building+Tin)	17	-	-	17
Tin Shed	11	40	4	28
Sungrass/Bamboo	94	31	94	55
Mud	91	66	70	89

Note: Respondents have more than one category of housing pattern.

Table 5. Extent of income.

Income class (Tk)	Ukhia range		Inani range	
	Forest villager (%)	Non Forest villager (%)	Forest villager (%)	Non Forest villager (%)
TK≤5000=USD71 (poor)	92	77	83	67
TK5000-10000 =USD143 (middle)	6	17	17	22
TK10000+=USD143 (rich)	2	6	-	11

Note: '-' indicate absence of respondents

Table 6. Livelihood activities

Livelihood activities	Ukhia range		Inani range	
	Forest villager (%)	Non forest villager (%)	Forest v illager (%)	Non forest villager (%)
Agrofarming	91	89	87	88
Fuelwood collection	97	75	96	72
Fishing	11	23	52	50
Sungrass collection	84	42	80	61
Day labor	95	14	22	39
Business	4	6	9	11
Bamboo collection	49	31	46	50
Timber collection	33	23	72	65
Dry leaf collection	62	29	83	70
Service (Government and private job)	-	-	4	6

Note: In the study area the respondents involved more than one livelihood activities.

Table 7. People's perceptions of negative impact of collection of various forest resources on the forests.

Livelihood activities	Impact on the forest	Level of impact
Fuelwood collection	Loss of floral and faunal diversity.	High
Timber collection	Failure of plantation program, Destruction of wild life habitat, deficiency of soil nutrients	High
Bamboo collection	Decreasing non-timber forest products	Moderate
Dry leaf collection	No apparent impact	Low
Sungrass collection	Decreasing non-timber forest products	Low

forest resources (Table 6).

Forest resource consumption patterns, impact on forest and livelihood

People's perceptions (based on interviews) regarding use of different forest resources and impact on the forest ecosystem as well as villagers' livelihood are summarized in Table 7.

Fuelwood collection

Fuelwood collection was a major and frequently visible activity (Table 6) in the two forest areas. Fuelwood collection provided primary and secondary occupation for many households. Fuelwood was collected for household consumption and also for commercial purposes. Estimates revealed that non-forest villagers of Ukhia range collected ~7 kg/day and 5 kg per day fuelwood in dry and rainy seasons, respectively. This estimate for the Inani site non-forest villagers was 8 and 5 Kg per day for the dry and rainy seasons, respectively. For the forest villagers of Ukhia range, the estimates were ~9 and ~6 kg/day, respectively, in the two seasons, whereas at Inani, these villagers collected 6 and ~5 Kg/day of the wood in the two seasons, respectively. Overall, the amounts collected at the two sites and by all types of villagers were not too noticeably different. During the 2 to 10 trips per week to collect fuelwood, each household could collect approximately 23 kg per trip. Fuelwood was collected all year round, but major extraction occured during the dry season. No rules or regulations governed the collectors and fuelwood collection remained unrestricted. This activity was perceived to have high negative impact on forest resources (Table 7).

Timber collection

Non-forest villagers of Ukhia range collected 10 bundles month (per household; 2-3 logs made a bundle) in the dry season and 6 bundles/month in rainy season. Forest villagers of Ukhia range collected 15 bundles/month in dry season and 11 bundles/month in rainy season. Non-forest villagers of Inani range collected 8 bundles/months in dry season and 5 bundles/month in rainy season. Forest villagers at Inani range collected 6 bundles/month in dry season and 4 bundles/month in rainy season. They collected one headload or approximately 25-30 kg per trip (average price of timber per bundle being 300-500 Taka (70 Tk = 1 USD). This activity was perceived to have high negative impact (Table 7).

Bamboo collection

Non-forest villagers of Ukhia range collected 50 bundles/months in the dry season and 35 bundles/month in the rainy season. Forest villagers here collected 70 bundles/month in the dry season and 50 bundles/month in the rainy season. Non-forest villagers of Inani range collect 64 bundles/month in the dry season and 36 bundles/month in the rainy season. Forest villagers of Inani range collected 70 bundles/month in the dry season and 50 bundles/month in the rainy season. Households collected bamboo

to supplement their income. Bamboos are used as raw materials for house construction. The natural regeneration of bamboo has become limited and its futures appeared threatened due to over exploitation. In the household interviews, people mentioned that they sold a bundle of bamboo weighing approximately 20-25 kg (the average price of bamboo being 150-200 Taka per bundle (70 Tk = 1 USD). Bamboo collection was deemed to have moderate negative impact (Table 7).

Dry leaf collection

Non-forest villagers of Ukhia range collected 17 sacs/months in the dry season and 8 sacs/ months in the rainy season. Forest villagers of Ukhia range collected 22 sacs/ months in the dry season and 10 sacs/months in the rainy season. Non-forest villagers of Inani range collected 15 sacs/months in the dry season and 6 sacs/months in the rainy season. Forest villagers of Inani range collected 25 sacs/months in the dry season and 10 sacs/months in the rainy season. They collected dry leaves mainly for consumption as biomass fuel. This activity was considered to be of low negative impact (Table 7)

Sungrass collection

Both the forest and non-forest villagers collected sungrass as building material for commercial purposes and for household consumption. Poor people, especially young men and women, were the main collectors of sungrass. Sungrass removal also was seen as a low impact activity (Table 7).

Evidence of forest biodiversity destruction

In this study, we found that species diversity at the two forest ranges was very poor and *Acacia (Acacia auriculiformis)* and *(Acacia mangium)* were the major plant species. Most of the forest land was vacant. Many of the households we surveyed collected non-timber forest products (NTFPs) from the two forest ranges. Bamboo, sungrass and various building materials from these forest ranges appeared to decrease at an alarming rate due to the unsustainable collection activity. This study revealed that a few years ago, all kinds of NTFPs were available within a short distance but now people have to collect these products a long distance inside the reserve. The total vacant area of Ukhia and Inani Forest Ranges was 14121 acres and 3800 acres, respectively [9].

According to the respondents, the threatened flora consisted of baitta garjan *(Dipterocarpus scaber)*, bandarhola *(Duabhanga sonneratiodes),* bailum *(Anisoptera glabra*), batna *(Quercus sp.),* bahera *(Terminalia beleric),* chandul *(Tetrameles nudiflora*), chakua koroi *(A. odoratissima)*, chapalish *(Artocarpus chaplasha)*, champa *(Michelia champaca*), dhuila garjan *(D. alatus),g*amar *(Gmelina arborea*), goda *(V. pinnata),* harina *(Vitex glabrata),* jam *(Syzygium* spp.), jarul *(Lagerstoemia speciosa),* koroi *(Albizia lebbeck)*, kadam *(Anthocephalus chinensis),* pitraj *(Ammora wallici)*, shimul *(Salmalia malabarica),* shil koroi *(Albizia procera)*, telia garjan *(Dipterocarpus turbinatus)*, telsure *(Hopea odorata)*, toon *(Cedrela toona).*

Once Ukiah and Inani ranges were famous for Asian elephant *(Elephas maximus*) but now these are few in number. In this study, we found that the forest and non-forest villagers were not aware of the importance of wildlife. They reported that a large number of wildlife that could be seen in the recent past is no longer seen now. According to them, the animal species that are not seen now are black drongo *(Dicrurus adsimilis),* rhesus monkey *(Macaca mulatta),* rabbit *(Caprimulgus hispidus),* squirrel *(Calloscirus erythracus)*, sambeer deer *(Muntiacus muntjak* common langur *(Presbytis entellus)*,

jungle cat *(Felis chaus)*, common mongoose *(Herpestis edwardsi)*, Porcupine *(Hystrix hodgsonil)*, wild pig *(Sus scrofa)*, dove *(Streptopelia chinensis),* hornbill *(Anthracoceros albirostris),* jungle fowl *(Gallus gallus),* kingfisher *(Alcedo atthis),* lapwing *(Vanellus vanellus),* little egret *(Egretta alba),* magpie robin *(Copsychus saularis), m*ayna *(Acridotheres tristis),* woodpecker *(Blythopicus pyrrhotis),* mud turtle *(Trionyz nigricans)*, cobra (*Naja naja)*, monitor lizard *(Varanus bengalensis),* python *(Python molurus)*.

Discussion

The results presented here reveal some useful information regarding the livelihood activities of the forest and non-forest villagers and the overall impact on the forest resource. The villagers in the forest areas of Bangladesh in general depend on extraction of forest products, especially timber [12]. Furthermore, non-timber forest products make vital contribution to the livelihood of a large proportion of the poor living in or close to the forests in most tropical countries [13]. In the Ukhia and Inani forest ranges, the forest and non-forest villagers also depend on forest resources for their livelihoods, involving fuelwood, bamboo, sungrass, dry leaf and timber collection (Table 6). Bamboo is possibly the most important forest resource for the forest dependent people, and is greatly used for house construction and making agricultural implements in the Chittagong Hill Tracts [14]. Next to bamboo, sungrass (*Imperata cylindrica*) is the most important material for house construction, which is used for thatching the roof of houses [14,15]. Similar results also found in Ukhia and Inani forest. For house construction, they mainly use bamboo and sungrass (Table 4), but major threats to the forest areas of Bangladesh are fuelwood collection, overexploitation of timber and other non-timber forest resources, including rural poverty in the surrounding of forest areas [16-20]. In Ukhia and Inani forest most of the forest and non-forest villagers were poor (Tables 5 and 6). The direct cause of forest biodiversity loss is forest decline, in particular the human-caused destruction and/or degradation of natural and semi-natural forests (forest which consist of artificial and natural forest combined) forest ecosystems [21-24]. The extraction of these resources raises concerns in relation to the ecological impact of such activity in the context of desertification and deforestation paradigms [25-26]. Over extraction of forest resources by the forest-dependent people that exceeds sustainability levels threatens to degrade the Ukhia and Inani forests in terms of such adverse consequences as decreasing NTFPs, deficiency of soil nutrients, loss of floral diversity and destruction of wildlife habitat. Perceptions about deforestation have been termed by various experts as "mainstream views" [27]; "narratives" [28]; "received wisdom" [29]; and "orthodoxies" [30]. The present study supports the view that use of fuelwood and over extraction of non-timber forest produces by forest-dependent people are some of the most important factors leading to deforestation. This generalization has been presented by a number of workers as well [31,32]. As in other regions around the globe, the biodiversity of Bangladesh is also passing through a critical period. Already, 12 wildlife species have apparently become extinct [33]. In addition, IUCN [34] has listed a total of 40 inland mammalian species, 41 bird species, 58 reptiles and 8 amphibians under various degrees of risk in the country [34], and the Bangladesh National Herbarium has reported 106 vascular plant species under risk of various degrees of extinction in the country [35]. This study also found a lot of threatened floral species and a number of faunal species that according to forest and non-forest villagers are no longer seen in the two ranges studied here.

Conclusion

The present work shows that both forest

and non-forest villagers are highly dependent on the local forest resources. The non forest villagers appeared freer to engage in such work as business and service compared to the forest villagers. Nevertheless, the livelihood activities of both types of villagers threaten biodiversity and local forest resources. Fuelwood and timber collection at the two sites have high negative impact on the forest biodiversity, as determined from the peoples' perception. Therefore, policy interventions are needed to decrease dependence of the villagers on local forest resources or by promoting roles that ensure sustainability of the forest biodiversity or by creating alternative income-generating activities for their households. It is possible that participatory forest management would be one option for restoring the forest areas under crown cover and for protecting whatever forest resource at the two sites exist at present.

Acknowledgements

The authors wish to acknowledge the contribution of Harunur Rashid Khan, ACF of Cox's Bazar South Forest Division, in preparing the manuscript as well as for the critical suggestions of the anonymous referees for help in improving the paper.

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