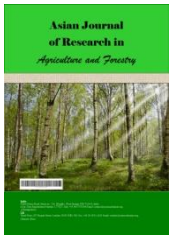

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Forest Dependency and Conservation Attitude of Indigenous Communities: Lessons from Komolchari Village Common Forest of Chittagong Hill Tracts, Bangladesh

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Authors' contributions

This work was carried out in collaboration among all authors. Authors DC and SMSH designed the study, performed the statistical analysis and wrote the first draft of the manuscript. Authors MAH and TKN managed the analysis, literature review and discussion of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The study explored the role of Komolchari Village Common Forest (VCF) of Chittagong Hill Tracts, Bangladesh in the development of the socio-economic condition of the local communities and their perceptions about VCF conservation and management.
Study Design: The research is conducted through rigorous literature review and semi-structured household interview of the associated communities of the study area.
Place and Duration of Study: The study was done in three villages around Komolchari VCF from February 2014 to January 2015. It is located in sadar upazila of Khagrachhari hilly district.
Methodology: We selected the households through simple random sampling. The households were categorized into three groups based on their socio-economic status. Results were presented

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together as there were no significant differences between datasets obtained from the three villages.

Results: Agriculture is the major occupation of the poor, whereas medium and rich peoples were doing business and service. Forest products i.e. fuel-wood, pole, bamboo, wild fruits, vegetables, and medicinal plants are regularly collected by the poor in a higher amount than that of medium and rich socio-economic groups. The study indicated 74% of the poor households extracted their necessary fuel wood from the VCF. Forest dependency showed that 31% households receive more than 40% of total annual income from the VCF. Traditionally, the VCF has been managed by the communities, but presently they formed a organization for management. Interventions of government and non-government organizations rose mass awareness about forest, biodiversity, and environment, which made them feel responsible for VCF management and conservation. Thus, 85% people expressed their interest to participate in the conservation initiatives.

Conclusion: Poor dwellers are more dependent on the Komolchari VCF as they extract more forest resources than the higher income groups. Thus, poor might be the major target group for further development to reduce their forest dependency.

Keywords: Natural resources; village common forests management; Komolchari; forest dependency; conservation.

1. INTRODUCTION

Forests provide diverse benefits to associated communities such as timber, non-timber products, recreation, clean air and safe water, biodiversity, carbon sequestration, as well as spiritual services. The Chittagong Hill Tracts (CHTs), the only mountainous area of Bangladesh situated in the south-eastern part, is considered a centre of bio-cultural diversity [1] because of its richness in natural resources and cultural diversity [2]. The hilly terrain of CHTs contains 73% forest, 15% horticultural, and 3% terraced agricultural land. The remaining 9% land is occupied by human settlements [3].

The CHTs is populated by 12 indigenous communities. The highly diverse plant and animal communities of the hill forests traditionally supported the livelihoods of the hill people, which include items for dwelling, food, clothing, medication and religious festivals. Thus the culture and lifestyle of the indigenous communities living there are closely related to the forest ecosystems [2] for their basic subsistence [3] and cash income [4].

Historically, indigenous people practice shifting cultivation, but exclude a patch of forest adjacent to their village, known as a Village Common Forest (VCF). These forests in CHTs are one of the key elements that are traditionally associated with the livelihood, lifestyle and culture of the indigenous people. The VCFs are mostly small, averaging 20 to 120 hectares in size, consisting of naturally grown or regenerated vegetation [5] that are collectively used and managed by village communities, and is regarded as common property, irrespective of its legal classification [6]. According to customary practice, these forests are reserved solely for use and extraction relating to domestic purposes, such as for timber food and medicine [7].

The VCF, administered by indigenous communities, have a standard model for the protection of biodiversity, environment and natural resources in CHTs. Thus these forests are good examples of effective community-based natural resource management (CBNRM) [8]. However, notwithstanding the above, these VCFs are under severe threat because in most instances, common property regimes seem to have been legislated out of existence [9]. This has resulted in VCFs being degraded both in quantity (number and size) and quality [10].

Understanding the cultural perspectives of resource use, and influence of culture on indigenous peoples' conservation attitude, provides insight for strategic and sustainable management of forest resources [11]. Resource use patterns of indigenous people, as well as the forest and water quality degradation in CHTs, draw attention to the sustainability of resources [12]. A clear understanding of local dependency on protected areas provides insights for formulating policies to conserve biodiversity and find alternative economic opportunities to improve the livelihoods of these people. The dependency of the local communities on forest resources and their attitude regarding the conservation of natural resources need rigorous

assessment to develop a sustainable VCF management framework.

The Komolchari VCF has hitherto been managed through the traditional management and conservation systems of nearby Chakma and Tripura ethnic communities. Notwithstanding this management, the Komolchari VCF, has degraded due to over-utilization, anthropogenic disturbances and shifting cultivation. This has necessitated government and non-government organizations to intervene via forest and biodiversity restoration, conservation, and mass awareness raising activities. The associated communities have close cultural ties with Komolchari VCF because of the necessity of plants used in the socio-cultural festivals. The study aimed at investigating the forest dependency and conservation attitude of indigenous communities towards the Komolchari VCF of Chittagong Hill Tracts, Bangladesh. The extent and nature of forest dependency of the associated community is rarely considered during planning the VCF management and conservation interventions. The more specific information regarding the forest dependency and conservation attitudes of the associated community might help in sustainable management of the VCF resources and guide planning socio-economic development of the associated communities. This research provides an account of the socio-economic condition, forest resource extraction and community perceptions towards the conservation and management of the VCF. A model on sustainable management of VCF presented in this paper might also help planning management interventions for more than 300 VCFs of CHTs.

2. METHODOLOGY

2.1 Study Area

The Komolchari VCF, covering a hilly area of 128 hectares, is situated at Komolchari village under Bhuiyochari *mouza* (a mouza is a type of administrative unit, corresponding to a specific land area within which there may be one or more settlements) of Khagrachari District (
Fig. **1**). This village is inhabited by 315 *Chakma* ethnic families (source: personal communication with Komolchari VCF committee). The VCF is about 5 km away from the Komolchari village and surrounded by two Tripura villages, namely; *Thanachandra* para and *Jaduram para*. About 150 Tripura families live in each village (source: personal communication with Komolchari VCF committee). Tripura villages equate to very small subsistence agricultural settlements.

2.2 Data Collection and Analysis

Participatory rural appraisal tools, including semi-structured household interviews and focus group discussions, were used for gathering information on forest dependency, socio-economic conditions, VCF management systems, resource extraction, benefits and income received from the extracted forest resources and associated conservation issues as well as perceptions of the respondents on forest and biodiversity conservation.

The family heads of the 120 randomly selected households (26% of the population) were interviewed among which 60 were taken from Komolchari and the remaining 60 were from *Thanachandra* and *Jadurampara*. Preliminary discussion with villagers revealed that there was income disparity among them that had an influence on forest dependency. Thus the three villages were divided into three socio-economic groups (SEG) on the basis of monthly household income: poor (P) (less than BDT 70000 (Bangladesh Taka) mean annual income) (1 USD = BDT 85), medium (M) (mean monthly income BDT 70000 – BDT 180000) and rich (R) (mean monthly income >BDT 180000). After the survey, it was observed that among the interviewed households, 62 households were in PSEG, 37 in MSEG and 21 in RSEG. Based on the level of education the households were categorized into Illiterate, Primary (0-5 classes), Secondary (6-10 classes) and College (7-12 classes and above). Moreover, considering the number of family members the households were grouped into small (1 – 3 member), medium (4 – 6 member) and large (7 or more members) families. The family income of the households from different sources were recorded separately as Komolchari VCF, homestead forest, agricultural products, fruit garden, livestock, wage labor, service and business.

Considering the percentage of total annual income received from extracted forest resources the respondents were then categorized as not dependent (no income received from forest resources), less dependent (up to 40% of total income received), dependent (more than 40% of total income received). Both consumption and sale value of the products collected from the VCF is used for indicating income received from VCF.

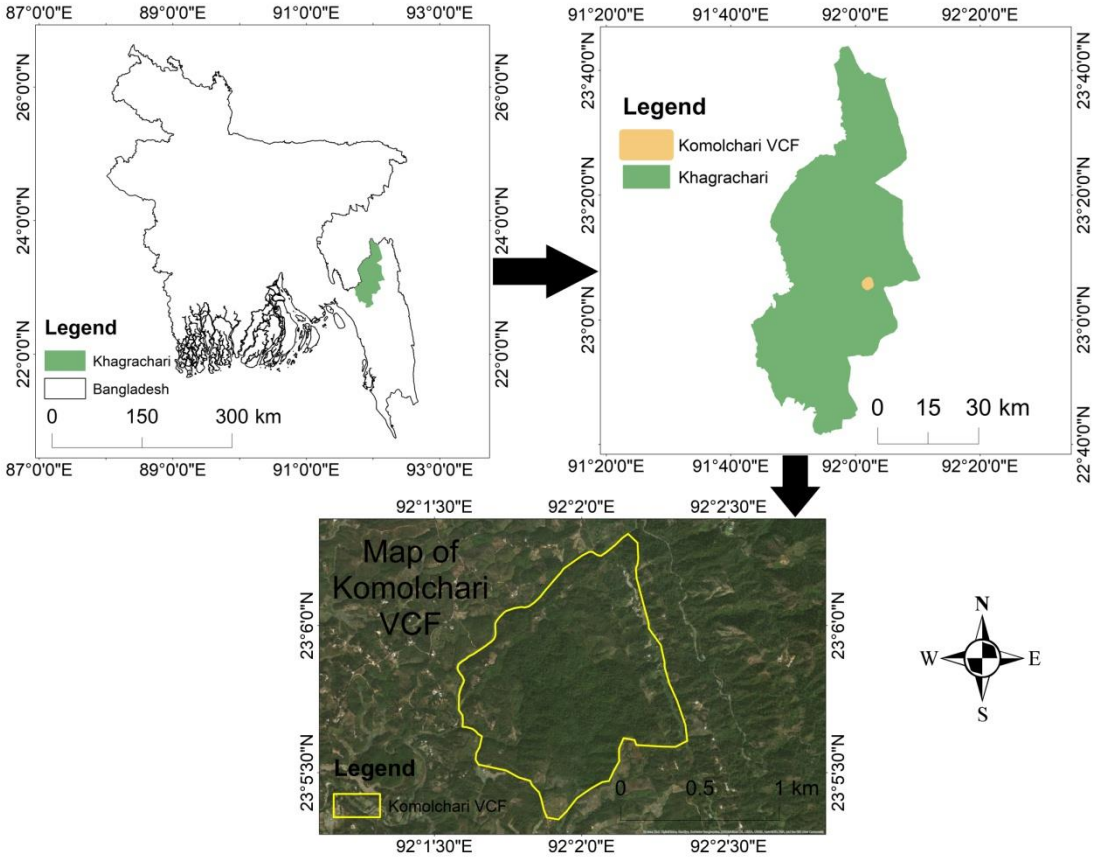

Fig. 1. Location of Komolchari village common forest in Bangladesh

The quantitative data were then compiled and percentages were derived using MS Excel. As there was no significant difference between the datasets obtained from the three different villages, that's why they were grouped and the results were presented together.

3. RESULTS AND DISCUSSION

3.1 Socio-economic Profile of Respondents

Table 1 showed that males slightly dominated in the sampling with 54.2%. Most of the households (38.3%) were educated up to secondary education level followed by primary (30.8%) and college (7.5%) whereas 23.3% were illiterate. The education rate is higher than that of Khagrachari according to [13] where they mentioned 21.2% of people are educated upto primary level, 19.7% upto secondary level and 48.8% people were illiterate. The literacy rate (77%) in the three villages of the study area was also above the national average (59.42%) [14]. The fact is that the survey area is situated at Sadar upazilla of Khagrachari district where people have easy access to educational institutions.

A total of 72.5% of the families were medium-sized having 4 - 6 members. The mean family size was 5.7 ± 1.88, which is a little greater than the national average of 4.85 [14]. Family size, level of education, gender and income level has substantial impact on the degree of dependency on forest. Jannat et al. [15] showed that education level significantly influence local peoples' forest dependency. The higher the education level the higher the consciousness about nature conservation may be a reason of less dependency. Moreover, educated people might have better source of income. So, the findings of this study indicate that the VCF could be better managed in future if the education level of the people could be enhanced. Women are primary user of much of the forest resources [16] hence they are more concerned with conservation than male counterparts. Among the studied two ethnic communities, *Tripura* families are matriarch-dominated [17] whereas in *Chakma* families women are much empowered

and make 41% decisions of their family affairs [18]. Thus, women of these communities has substantial stake on the forest resource extraction and family income which significantly affect the use and conservation of natural resources of VCF. The outcomes of the study showed that the family income, forest resource extraction and perception about the nature conservation, discussed in the later sections of this article, greatly influenced by the family size and gender proportion.

3.2 Occupational Status of the Associated Communities

A range of on-farm and off-farm activities that provides food and other family requirements made up livelihoods of the local communities. Most of the households collect resources from the Komolchari VCF, besides this, each household had both primary and secondary means for generating livelihood. The study explored that people of the three villages earned livelihoods through service, agricultural crop cultivation, business, and wage labor. The primary occupational status presented in Fig. 2 showed that poor socio-economic groups (PSEG) were largely engaged in agriculture (71%) followed by day labor (26%). The rich socio-economic groups (RSEG) was mainly engaged in business (48%) and service (38%) whereas the middle socio-economic group (MSEG) was in agriculture (49%) followed by service (30%) and business (21%). Across three socioeconomic groups (SEGs) livestock rearing (56%) and fruit gardening (39%) were important on-farm activities of the ethnic farmers whereas wage earning (51%) was the major means of livelihood among the off-farm activities.

Table 1. Distribution of respondents according to demographic characteristics like gender, literacy and family size of the sample households

Variable name	Number	Percentage	Cumulative percentage
1. Gender			
Male	65	54.2	54.2
Female	55	45.8	100
Total	120	100.0	
2. Education status			
Illiterate	28	23.3	23.3
Primary (0-5 classes)	37	30.8	54.2
Secondary (6-10 classes)	46	38.3	92.5
College (7-12 classes and above)	9	7.5	100
3. Family size (No. of family members)			
Small (1 – 3 member)	6	5	5
Medium (4 – 6 member)	87	72.5	77.5
Large (7 or more members)	27	22.5	100

Mean family size = 5.7 ± 1.88

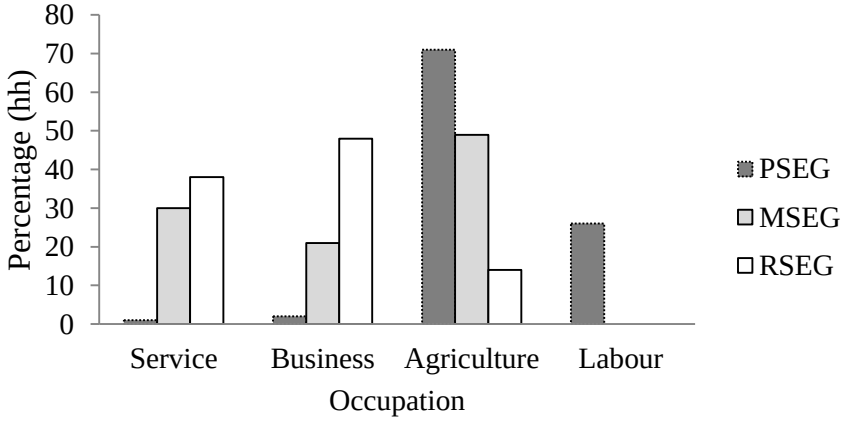

Fig. 2. Occupational status of the communities

[Here, PSEG = Poor socioeconomic group; MSEG = Medium socio-economic group; RSEG = Rich socioeconomic group, hh=household]

3.3 Income and Income Sources

The income level indicates to some extent the standard of livelihood and status of food security existing among the households. The income generated in the last year by the surveyed households was used to assume the average annual income of the households. The study revealed that the average annual income of the households was Tk. 108,345 which ranged from Tk. 7,000 to Tk. 800000 (1 USD = BDT 85). Miah et al. [19] found that an average income of Tk. 93,606 per year per household in the three villages of Rangamati Sadar (central) Upazilla (sub-district) of the CHTs. The main sources of income of PSEG are the Komolchari VCF from which they receive 29% of total annual income which is followed by agriculture (25%), wage labor (16%) and homestead forest (13%) (Table 2). All the households under PSEG collect resources from the VCF whereas 63% of PSEG obtained income from homestead forest and agriculture. The income sources under others category include shifting cultivation, tailoring, and occasional job, etc. About 57% of households from MSEG collect resources from the VCF for meeting their daily needs of fuel, timber, vegetables, bamboo, etc. The other major income sources of MSEG were agriculture (16%) and fruit garden (9%). Though number of households involved in the business (27%) and service (30%) is less but the average percentage share of total income (30% for both) is quite significant. The main income sources of RSEG were business as they receive 40% of their total annual income. Business is followed by service (31% of total income) and fruit garden (22% of total income). From all sources, the mean annual income of the households was found as Tk. 35,906 for PSEG, Tk. 131,118 for MSEG and Tk. 350,759 for RSEG in associated communities of the Komolchari VCF. Higher the socio-economic status of people the lower their dependency on forest resources [15] is an established fact that proved again in this study.

Although Fig. 2 showed the overall occupational status of the different SEGs but other than these, they were also found dependent on VCF. It was observed that the extraction of forest products from VCF varies with family size. The larger the family the greater is forest product consumption. The family size having 4-6 and 7-9 members extracted more forest products in comparison to the family with 1-3 members. Family size having 1-3 members extracted forest products equivalent to Tk. 4,731 while the value of forest resources extracted by families with 4-6 and 7-9 members was Tk. 5,373 and Tk. 5,473 respectively.

The amount of forest product extraction also varied with the occupation of the villagers. From the study, it was revealed that the extraction of forest resources by labors was maximum (Tk. 8,464 per annum) followed by farmers (Tk. 5,348 per annum). Businessmen were the least extractor of the products. Each businessman extracts forest products equivalent to Tk. 1,216 per annum.

Table 2. Annual income of different socio-economic groups

Income sources	Mean annual income of the three socio-economic groups					
	PSEG		MSEG		RSEG	
	Income (% of total)	HH (%)	Income (% of total)	HH (%)	Income (% of total)	HH (%)
Village Common Forest	10358 (28.8)	100	8153 (6.2)	57	7783 (2.2)	29.0
Homestead forest	4717 (13.1)	63	4454 (3.4)	19	576 (0.2)	4.8
Agricultural products	8884 (24.7)	63	11086 (8.5)	43	13940 (4)	24.6
Fruit garden	1082 (3.0)	11	21013 (16)	40	77900 (22.2)	38.0
Livestock	1685 (4.7)	37	2363 (1.8)	27	715 (0.2)	14.3
Wage Labor	5835 (16.3)	40	-	-	-	-
Service	800 (2.2)	2	38945 (29.7)	30	109630 (31.3)	38.0
Business	1280 (3.6)	3	39636 (30.2)	27	140215 (40)	62.0
Other	1265 (3.5)	40	5468 (4.2)	27		-
Mean annual income	35906 (100)	-	131118 (100)	-	350759 (100)	-
Mean annual expenditure	33053 (92)	-	114118 (87)	-	314141 (90)	-
Net income	2854 (8.6)	-	17001 (15)	-	36618 (11.7	-

[Here, PSEG = Poor socio-economic group, MSEG = Medium socio-economic group, RSEG = Rich socio-economic group]

3.4 Forest Products Extraction from VCF

3.4.1 Food products (Flora and fauna)

The ethnic communities of CHTs use adjacent forests and VCFs for the extraction of varied food in the form of leaf, stem, roots, tubers, fruits, wildlife and fishes. A total of 13 species of flora and 9 fauna were recorded from the study area which was extracted from the Komolchari VCF as food items to fulfill their nourishment demand (Table 3). People also extracted mushrooms from the forest. These foods help to meet the gap between food demand and production from traditional farms and thus reduce the food insecurity.

3.4.2 House building materials

Housing pattern is one of the important indicators of living standard of human beings. Housing pattern of the study area indicated that 84% houses of the poor socio-economic groups (PSEG), 70% of the MSEG and 48% of the RSEG were made of bamboo mate wall (Fig. 4). People of the study area used bamboo, mud, and brick for a wall of the houses as well as sun-grass, corrugated tin and concrete were used for the roof.

Bamboo (*Bambusa* spp.) and sungrass (*Imperata cylindrica*) were the most important forest resource for the indigenous people [20] and were greatly used for house construction by the indigenous communities in the CHTs [21]. The situation has changed due to availability and low price of tin as roofing materials as well as less durability and unavailability of sun-grasses in the forest. The major roofing materials were tin for all of the socio-economic groups. Only 29% of the PSEG and 5% of the MSEG used sun-grass as a roofing material. Chowdhury and Miah [22] reported that the *Mro* ethnic of CHTs traditionally use bamboo, pole, and sun-grass for building their houses.

3.4.3 Medicinal plants

Many VCFs of CHTs contain the herbaria of medicinal plants, which the local *Viadya* or *Ojha* (herbal doctor) used to prepare their traditional medicine. The study revealed that a wide variety of medicinal plants were collected from the Komolchari VCF and which were used for treating different fatal diseases. A total of 8 major medicinal plants were recorded to be collected and processed by the *Viadya* or *Ojha* for treating various diseases (Table 4).

VCFs are repositories of biodiversity, food, and medicinal plants to the indigenous communities. The traditional management techniques of the VCFs by the indigenous communities have set a standard model of VCF management for the protection of biodiversity, environment, nutrient cycles and natural resources in the CHT [8]. VCF shows rich biodiversity [11] compared to government managed reserve forests in CHT although biodiversity is decreasing day by day [23].

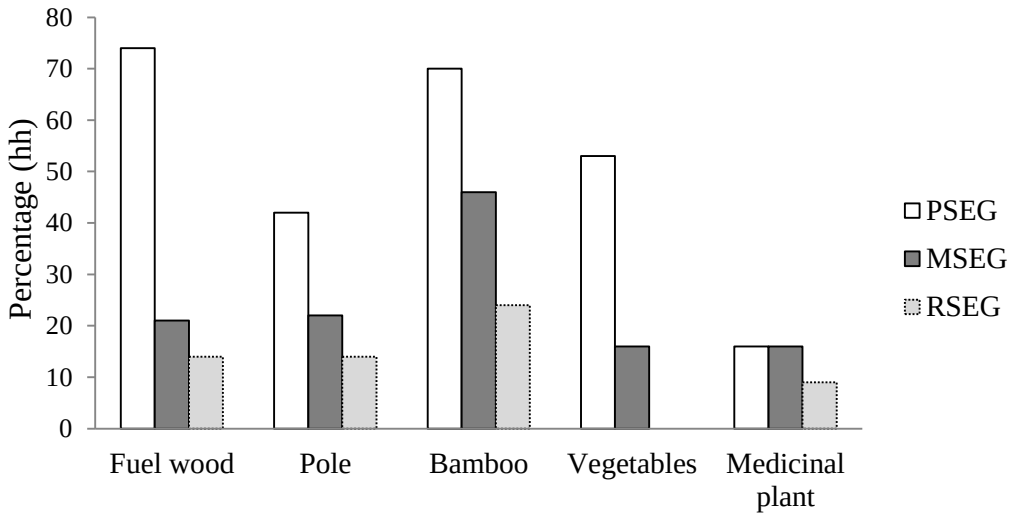

Fig. 3. Major products collected by the different socio-economic group

[*Here, PSEG = poor socioeconomic group; MSEG = medium socioeconomic group; RSEG = rich socioeconomic group*]

Table 3. List of food products (Flora and fauna) extracted from VCF by the local people

Extracted food products from Komolchari VCF (Flora)		
Local name	**English name**	**Scientific name**
Pan alu	Yam	*Dioscorea bulbifera*
Dheki shak	Table fern	*Angiopteris evecta*
Kolar thore	Plantain Stem	*Musa ornata*
Baruna Shak	Indian Ivy-rue	*Xanthoxylum rhetsa*
Misti begun	Pea eggplant	*Solanum spinosa*
Ojan shak	Pellitary	*Spilanthes calva*
Lalom pata	Headache Tree	*Premna obtusifolia*
Kusumgulu	Bead tree	*Elaeocarpus angustifolius*
Thankuni	Centella, Gotu kola	*Centella asiatica*
Dumurshumi shak	Pigeon pea	*Cajanus cajan*
Sanjna	Drumstick tree	*Moringa oleifera*
Roshko	N/A	*Syzygium balsameum*
Tak begun	Solanum	*Solanum virginianum*
Extracted food products from Komolchari VCF (Fauna)		
Local name	**English name**	**Scientific name**
Kakra	Crab	*Liocarcinus vernalis*
Taki mach	Taki fish	*Channa puncpatus*
Bele mach	Bailla	*Awaous guamensis*
Shamuk (choto)	Snails (Small)	*Helix pomatia*
Shamuk (Boro)	Snails (Large)	*Helix pomati*
Chingri mach	Shrimp	*Macrobrachium rosenberghii*
Beng	Frog	*Litoria caerulea*
Choto puti	Fry (very small)	*Puntius ticho*
Kuchia	Gangetic mudeel	*Monopterus cuchia*

Table 4. List of major medicinal plants used for treating diseases in Komolchari VCF

Local name	Scientific name, (family name)	Disease/Ailment
Lengragach	*Achyranthes aspera* L. (Amaranthaceae	Dog and fox bite
Khetranga	*Alpinia conchigera* Griff. (Zingiberaceae)	Gastric pain
Bandortala	*Adiantum lunulatum* Burm. (Adiantaceae)	Boils
Sidirabaisa	*Emilia* sp. DC. (Asteraceae)	Dysentery, diarrhea, paralysis
Kuchbihari	*Solanum* sp. (Solanaceae)	Cancer, sore, wounds
Koishang lota	*Vitis* sp. (Vitaceae)	Broken bones
Nagaghoissa	*Perilla ocymoides* L. (Lamiaceae)	Cut, sore, bruises
Kalahalood	*Kaempferia parviflora* Wall. *ex* Baker (Zingiberaceae)	Diarrhea along with vomiting

The socio-economic stratification has a strong association with the extent of different forest resources extraction from VCF. It was found that people from PSEG, MSEG, and RSEG collected fuel wood, pole, bamboo, vegetables, medicinal plants, etc. from the Komolchari VCF but their relative dependency varied widely. The study revealed that 74% of households of PSEG collect fuel wood followed by 21% of households of MSEG and 14% of households of RSEG (Fig. 3). In the case of bamboo, another major forest product, households of PSEG gathered maximum (70% households) followed by MSEG (46% households) and RSEG (24% households). Medicinal plant extraction is least for all the socio-economic groups. The results indicated that PSEG is the most dependent on the forest resources than those of MSEG and RSEG which was also supported by Sapkota and Oden [24] and Adhikari et al. [25] in their studies in Nepal.

3.5 Extent of Livelihood Dependency on VCF

The Komolchari VCF is one of the most important livelihoods means of the surrounding ethnic communities as they were found dependent on the VCF at varying degrees. The present study indicated that 31% of households of three villages were dependent on the VCF for

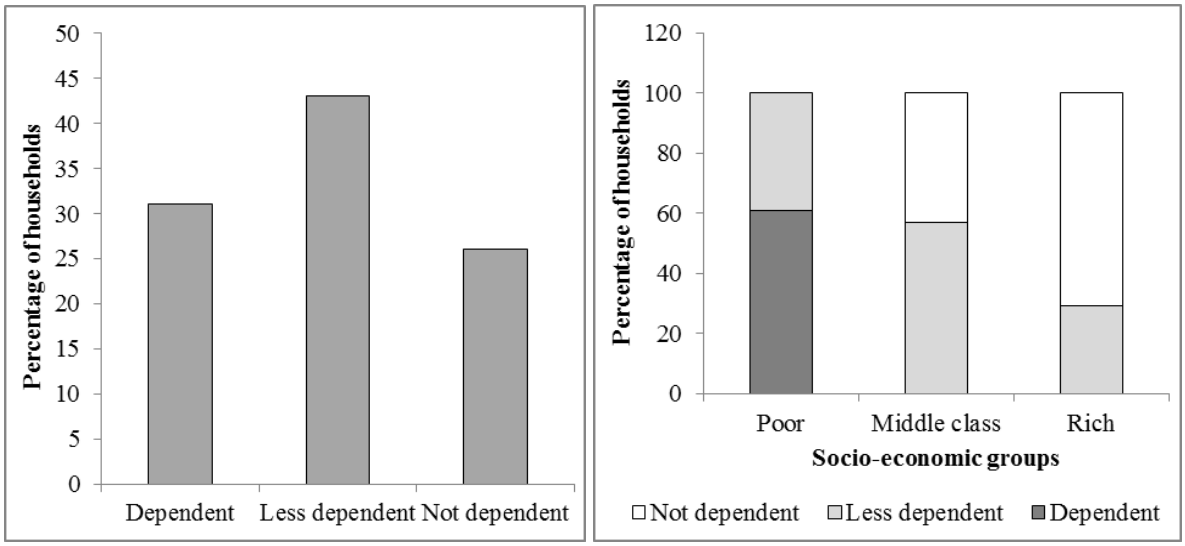

Fig. 4. Dependency of local ethnic communities on Komolchari village common forest

their daily livelihood and 43% of them were less dependent and 26% were not dependent on the VCF (Fig. 4) Miah et al. [19] reported that forest products contribute 32% of the total income of the rural Chakma community in Rangamati. Bahuguna [26] found that the dependence of the rural communities on forests in the Madhya Pradesh, Orissa, and Gujarat states of India ranged from 37 to 76%. Kamanga et al. [27] stated that the poorest segment depends more on the forest for income than the rich group in Chiradzulu of Malawi. Livelihoods in CHTs are still greatly dependent on *Jhum* cultivation [13] and extraction of different natural forest resources from the forest [28].

It was also found that the degree of dependency varied greatly with the socio-economic conditions of the ethnic people. The VCF plays a vital role in the livelihood of the poor as 61% of them depend on VCF resources for their household income. The study revealed comparatively less dependency of the middle and rich people for income on Komolchari VCF as they were seemed less dependent (57% medium and 26% rich) or not dependent (43% medium and 71% rich). Rich and middle-class households had choices of alternative income generation so that they can readily afford for better livelihood. On the other hand, poor households had limited options, and hence, they collected larger amounts of products from the VCF. If the poor were provided with appropriate alternative income generation opportunities then forest resource extraction would be reduced.

3.6 Management System of Komolchari VCF

The Komolchari VCF is being managed through traditional knowledge and indigenous belief by the ethnic communities since 1950. Presently an organization named *Palli Kalyan Samiti* (PKS) manages the VCF. The club was established in 1973 and registered with the local government council in 2001. The PKS has an executive committee consisting of 19 elected executive members for 5 years. All members pay a monthly subscription of Tk. 5.00 to conduct the managerial activities. The VCF members need prior permission of PKS to collect any goods from VCF and require to pay a small fee for the forest products determined by PKS. The committee has a written constitution and rules on forest use and management. The PKS assembly is the apex body of user groups and makes all decisions about forest management, utilization, rights and obligation of its members. The income generated from forest activities goes directly to the community fund which is later incurred for operating PKS activities and community development activities.

3.7 Peoples' Attitude towards Conservation of the VCF

The ethnic communities have been traditionally managing and conserving their VCF for their inherited belief and cultural value. Traditionally they believe that protection of natural reserves would provide them food, water and fuel along with other daily necessities. Interventions of government and non-government organizations

make them more conscious about biodiversity and ecosystem conservation. In this study, 55% of respondents expressed their apprehensions as the VCF was degrading due to managerial inefficiency, illegal felling, excessive extraction and recent gregarious flowering of bamboo. But, 27% of households thought that the forest of Komolchari VCF was improving in some locations due to recent conservation initiatives.

PROSHIKA, a national NGO, accomplished some enrichment plantations under a Arannayk Foundation funded project for the restoration of forest and associated biodiversity. In order to develop the institutional capacity of ethnic people, PROSHIKA provided several pieces of training on organizational development, capacity building for VCF management, awareness creation among villagers for the conservation of the VCF and development of alternative income generation activities so that dependency on VCF resources reduce significantly. Peoples' perception about the conservation of VCF resources were studied which showed 80% of the respondents understand the necessity of VCF conservation.

When asked for their willingness to participate in VCF conservation 70% of the respondents reported that it was their own responsibility to conserve the VCF and 18% opined that it was the responsibility of PKS. On the other hand, 85% of respondents were willing to participate in the conservation initiatives undertaken in collaboration with others i.e. PKS, NGOs, etc. It is obvious that villagers bear a positive attitude for VCF conservation. An evaluation report of Arannayk Foundation mentioned augmented awareness of the local people about VCF, biodiversity, and environment which motivated them to feel the responsibility of management and participate in the conservation activities [29]. Findings of the present study indicating higher level mass consciousness regarding the ownership and conservative attitude towards the VCF is in line with the statement of Arannayk Foundation.

3.8 Challenges of VCF Conservation

The findings indicated that conservation of the VCF largely depends on the efficiency of PKS and VCF members' socio-economic conditions, awareness and willingness to help PKS in management interventions. PKS lacks the capacity of VCF managemeent especially in the organization of activities, community mobilization, implementation of managerial decisions and fiduciary management. The community needs more support for alternative livelihood generating activities and training in order to uplift their socio-economic condition and reduce dependency on VCF resources. These limitations make the conservation and management interventions challenging for the associated community organizations (i.e. PKS and VCF). Because, the weaknesses will limit the community to efficiently patrol and protect their VCF resources, develop and manage community funds for managment interventions, plan effective conservation measures with the probable changing situations. The comminities feel that they need further support for 3 years more to became capable of managing their VCF sustainably.

3.9 A Proposed Framework for Sustainable Management of VCF

Important conservation strategies are being developed in many countries to link community development [11] and natural resources management and conservation [30]. The community-based management approaches are specific to geographical, ecological [31], cultural and socio-economic situations which sometimes cause hitches in generalizing outcomes [32]. A management strategy depicting and specifying the interactions between forests, communities, government and non-government organizations is crucial for sustainable management of community resources i.e. VCFs. The forest managers and conservationists are yet to develop any widely acceptable common property management strategies based on field experiences and success stories. However, the findings, field observations, and experiences from the present study were used to formulate a generalized conceptual framework for sustainable management of village common forests (Fig. 5).

A management framework is proposed considering the present situation of Chittagong Hill Tracts of Bangladesh for sustainable management of the Village Common Forests which encompass the needs of forest and biodiversity conservation through raising community awareness and establishing community-based organizations, optimized extraction of forest resources and substituting the demands of forest resources. Temporary support

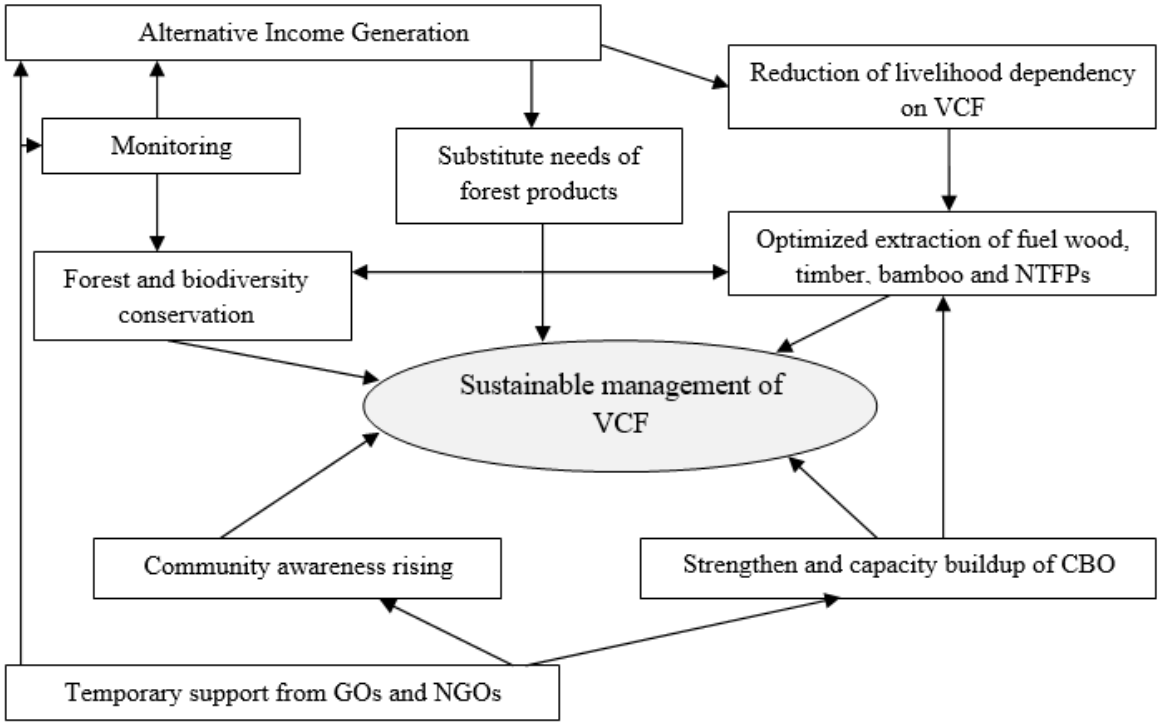

Fig. 5. A conceptual framework for sustainable community-based management of village common forests

from the government, non-government and donor agencies in the form of alternative income-generating activities, strengthening community organizations, raising community awareness and substituting forest goods are crucial to achieving the goal of sustainable Village Common Forest (VCF) management. Moreover, appropriate cost-benefit sharing arrangements, empowerment of the resource users, and equitable and sustainable management efforts are some essential elements mentioned by Adhikari et al. [25] which could be ensured through supporting and strengthening the capacity of community organization mentioned in the proposed conceptual framework.

4. CONCLUSION

The results provide significant implications for forest and biodiversity conservation of the Komolchari VCF through socio-economic development of the local community, raising awareness about forest conservation and strengthening individual and institutional capacity. Local stakeholders of Komolchari VCF collect different types of forest products like fuelwood, housing materials, medicinal plants, and vegetables, etc. all of which add subsistence to their livelihood. The study shows that forest dependency exists in all socio-economic groups but the poor people are highly dependent and thus are vulnerable as availability and supply of forest resources may be impaired. Poor have less access to alternative income-generating activities and most of them are daily labor and poor farmer. Forest dependency of the poor increases when there is little work for daily laborers and unavailability of cultivation farms in the hilly terrain around the VCF. The study indicated the poor as a major target group to work with for their socio-economic development by diversifying livelihood through providing alternative income-generating activities. The traditional management system of Komolchari VCF may be incorporated with modern ideas of forest and biodiversity conservation which likely to help to reach sustainable management of the VCF. Retaining and nourishing the present positive attitude of the local communities will also help to achieve sustained management of Komolchari VCF with rich biodiversity and natural resources. The findings of this study will provide a basis for forest management planners, decision-makers and conservationists to formulate effective management and conservation strategies for the VCFs of Chittagong Hill Tract.

CONSENT

All authors declare that informed consent was obtained from the interviewees for publication of this case report.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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