



Community Dependency and Conservation Practices in Khagrachari, Bangladesh: A Study on Management of Village Common Forests (VCFs)

**Masum Alam¹, Md. Rayhanur Rahman², Md. Arif Chowdhury^{3*}
and Mohammed Shafiu Alam¹**

¹*Institute of Forestry and Environmental Sciences, University of Chittagong, Chittagong-4331, Bangladesh.*

²*Faculty of Science and Forestry, University of Eastern Finland, 80101 Joensuu, Finland.*

³*Institute of Water and Flood Management, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh.*

Authors' contributions

This work was carried out in collaboration among all authors. Author MA designed the study, performed data collection and wrote the first draft of the manuscript. Authors MRR and MAC managed the data compilation, literature searches, analyses and manuscript writing of the study. Author MSA has done the commenting, editing and overall supervision of the study. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJRAF/2019/v4i230060

Editor(s):

(1) Dr. Pierre A. Raoufou Radji, Associate Professor, Ornamental Horticulture and Urban Ecology Node Manager GBIF Togo Herbarium Scientific Curator Laboratory of Forestry Research (LRF), University of Lome, Togo.

Reviewers:

(1) Manoel Fernando Demétrio, Brazil.

(2) Victoria Wilson, Rivers State University, Nigeria.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/51421>

Original Research Article

Received 17 July 2019
Accepted 19 September 2019
Published 25 September 2019

ABSTRACT

Forest is one of the main sources of different resources where indigenous communities are mostly dependent on the forest for their sustainable management of life. Following the dependency of indigenous communities on natural resources and their conservation practices and development of Village Common Forest (VCF) in Chittagong hill tracts. Present study was conducted at Haduk Para and Hridoy Member Para VCF's in Khagrachari, Bangladesh to understand the dependency and practices of villagers on the VCF for their livelihood and other resources. Among different types of products extracted from Haduk Para and Hridoy Member Para, the monetary value was highest

*Corresponding author: E-mail: arifchowdhury065@gmail.com;

(14700 BDT and 22400 BDT, respectively) for timber but fuelwood is the most extracted product (1930 Kg HH⁻¹Yr⁻¹ and 2470 Kg HH⁻¹Yr⁻¹, respectively) they have collected from VCF. Besides, to fulfill daily personal needs different plant edible products, fauna, and medicinal plants have been collected by the community people from both VCFs. In case of conservation purpose, Hridoy Member Para giving more priority for protecting the source of water resources where the majority from Haduk Para community replied that their priority was to avert natural calamities. However, both the VCFs community have taken some initiatives to reduce the pressure from the forest floor like enrichment planting, non-wood forest products cultivation, regional training for handicraft manufacturing and alternative income generation activities for the villagers. Therefore, safeguarding forest and biodiversity resources and at the same time improving the livelihood security for the indigenous communities, nowadays is mandatory to protect and manage these VCFs from being degraded.

Keywords: Community people; income generation; ethnomedicinal practices; extraction value; Khagrachari.

1. INTRODUCTION

Forest lands are the vital sources of wood and non-wood products for the community people [1]. Global landscape areas with demographic variables such as sex, age, education, occupation, and ethnicity are generally found to be significant predictors of conservation attitudes [2,3]. Forest has always played a significant role for the well-being of the tribes in Bangladesh where mainly religious, cultural and economic activities depend vastly on it [4,5].

The Chittagong hill tracts (CHTs) of Bangladesh covers about 13,294 km² combining three hilly districts covering more than 75% is considered suitable for forest resources [6,7]. In CHTs, Village Common Forest (VCF) is a natural forest other than the government forest around the households of the ethnic communities and managed for water source conservation, livelihoods and other biomass needs in the hilly areas of Bangladesh [1,6]. However, the long term sustainability of the VCFs will depend upon how well the local community peoples feel VCF's usefulness in their everyday lives. The management and conservation practices of VCF become crucial for livelihood, environmental stability, ethnomedicinal, cultural and religious needs of indigenous communities [8,9]. In CHTs, VCFs meet the vast resource needs and fulfills the demand for bamboo, timber, medicinal plants, fuelwood and other minor forest products for the ethnic community [10].

However, in recent years, VCF's have come under threat primarily due to various factors like tenure insecurity resulting from population pressure, unrestricted settlements, scarcity of

land area and expansion of agriculture, horticulture and tree plantations. Others factors include frequent migration, lack of institutional support and other socio-political reasons [11,12] as insecure property rights are one of the main causes of deforestation, in contrast, to applying proper management techniques to improve the condition of forests [13,14]. In addition, a silvicultural system like clear-felling followed by artificial regeneration caused serious harm to natural regeneration, seedling and sapling establishment, soil fertility and hence the natural ecosystem [15]. Both natural and anthropogenic factors affect forest management in hill tracts of Bangladesh. As a result, changes in forest ecosystem services are affecting the livelihoods of forests dependent community people [16].

Furthermore, VCFs are good examples of effective community-based forest management under certain customary rules and regulations [8]. Community-based practices including indigenous knowledge, behavior, and perception of conservation of resources are highly related to livelihood of local people and several studies confirm this for coastal areas [17,18,19,20] and for hilly tracts in Bangladesh [9,21]. However, while several studies have been conducted on community-based adaptation from the perspective of CHTs and in other parts of Bangladesh [5,6,8,10,13,22] and on species diversity of VCFs and other forests in Bangladesh [23,24,25] few studies on community dependency on VCF are available. Therefore, this study was conducted to evaluate the dependency of the community and participation in and attitudes about conservation practices of Haduk Para and Hridoy Member Para VCF of Khagrachari.

2. MATERIALS AND METHODS

2.1 Study Area

Two VCFs known as Haduk Para from Khagrachari Sadar Upazila and Hridoy Member Para from Matiranga Upazila were selected purposively to conduct this research (Fig. 1). There are 130 and 105 households in Haduk Para and Hridoy Member Para, respectively. In addition, the total area of Haduk Para and Hridoy Member Para is 110 and 45 acres, respectively [26,27]. In this research, household survey and forest survey were conducted from December 2017 to May 2018.

2.2 Household Data Collection

Among the entire number of households, individual household surveys were conducted by random sampling method with 35 (27% sampling intensity) households from Haduk Para and 35 households (33% sampling intensity) from the Hridoy Member Para using a present questionnaire. In addition, three focus group discussions (FGDs) were conducted to

understand current threats, availability of forest resources and rules and regulations of institutional arrangement for further VCF management. Moreover, five Key Informant Interviews (KIIs) were done with local shopkeepers, farmers and headman, personnel from local Non-Government Organization and Government organization and local people purposively considering the fact that they were engaged with VCF management activities.

2.3 Forest Data Collection and Specimen Identification

Forest data were collected by transect survey method following the method described by Hossain et al. [28] where the common species (flora and fauna) collected by community people were identified directly in the field, while the fresh samples of the unknown tree species were collected for the preparation of herbarium specimens. Further identification was done with help of taxonomist from the Institute of Forestry and Environmental Sciences, University of Chittagong (IFESCU) [29,30].

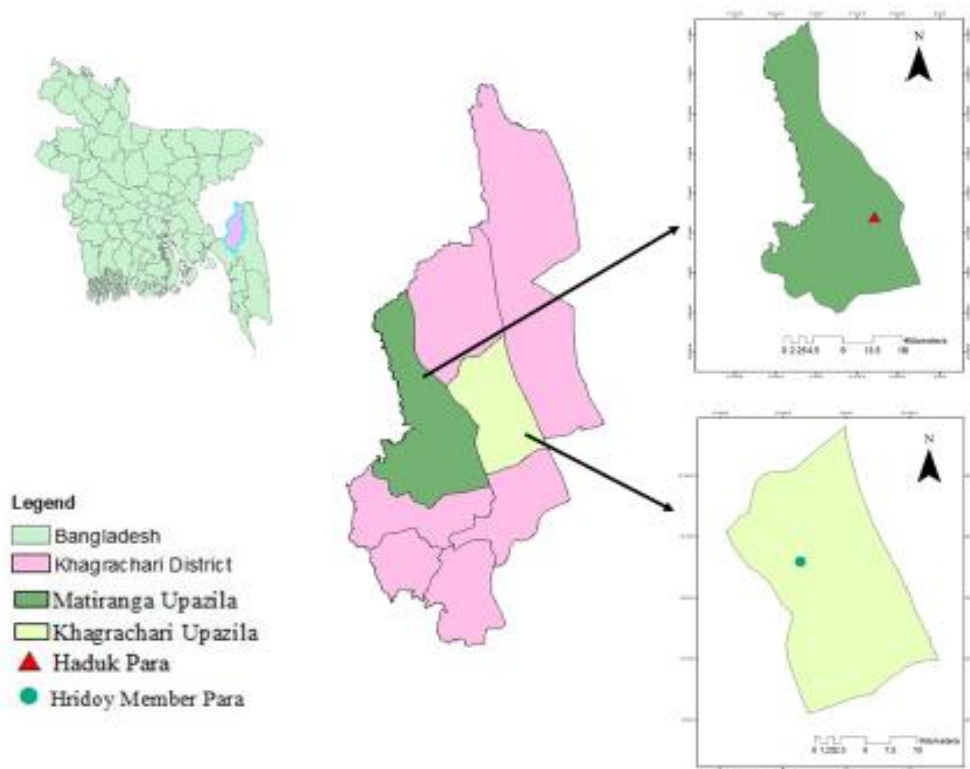


Fig. 1. Location map of the study area (Haduk Para and Hridoy Member Para in Khagrachari)

Table 1. Distribution of respondent households by respondent’s sex and educational status

Village name	Sex			Educational status					
	M	F	Total	I	P	S	S.S.C	H.S.C	Total
Haduk Para	28 (80) ^a	7 (20)	35 (100)	9 (25.71)	13 (37.14)	7 (20)	4 (11.42)	2 (5.71)	35 (100)
Hridoy Member Para	30 (85.71)	5 (14.28)	35 (100)	18 (51.42)	10 (28.57)	5 (14.28)	2 (5.71)	00	35 (100)
Total (Average)	58 (82.85)	12 (17.14)	70 (100)	27 (38.56)	23 (32.85)	12 (17.14)	6 (8.56)	2 (2.85)	70 (100)

[Note: M= male; F= Female; I= Illiterate; P= primary; S= Secondary, S.S.C. = Secondary School Certificate, H.S.C. = Higher School Certificate (Figures in the parenthesis denote percentages)]

2.4 Data Analysis

Collected data were sorted carefully, analyzed by excel, and present scientifically where the value of extracted materials is calculated by the following formula:

$$\text{Value of extraction (E}_x\text{)} = A_e \times P_c$$

Here,

E_x = Value of extraction (Tk), A_e= Amount of extracted materials (Kg HH⁻¹Yr⁻¹), P_c = Price per unit of product (Tk).

3. RESULTS AND DISCUSSION

3.1 Background Characteristics of Respondents

The result of the household survey showed that most of the respondents (82.85%) were male and the rest (17.14%) were female (Table 1). Educational status of the respondents showed that most respondents (38.56%) were illiterates followed by primary level education (32.85%) whereas in the case of Hridoy Member Para there was not a single person found who had gained higher secondary certificate (Table 1).

The study revealed average family size was higher (5.78) in Hridoy Member Para in comparison to Haduk Para (5.25) whereas average earning was more (2.3) in Hridoy Member Para compared to Haduk Para (2.1) (Table 2). Besides, average annual income among the respondents was higher in Haduk Para (1, 25, 400 Tk.) than Hridoy Member Para (1, 02, 340 Tk.) (Table 2).

Most (44%) of the income comes from agricultural products followed by fruits (36%) for Haduk Para VCF. Similar kind of trend was observed for Hridoy Member Para where most of

the income (56%) also comes from agricultural products followed by fruit cultivation (25%) (Fig. 2). However, the most common agricultural products grown by the community people of VCFs were rice, different kinds of vegetables, spices like turmeric, ginger, etc. (Source: FGD).

3.2 Types, Amount, Value and Purpose of Forest Products Extraction

Respondents from Hridoy Member Para VCF collect more forest products than Haduk Para VCF. In Haduk Para average fuelwood extraction is 1930 kg HH⁻¹Yr⁻¹ where 76% of respondents collect fuelwood. However, in the case of Hridoy Member Para, the study revealed 100% of respondents collect fuelwood where the average fuelwood extraction was 2470 kg HH⁻¹ Yr⁻¹ (Table 3).

3.3 Available Edible Forest Products in VCFs

Respondents whose residences are very close to the forest area, collect edible forest products of which 34 species of edible flora were identified from the VCFs (Table 4). These products play an important role to satisfy their nutritional as well as livelihood facilities and community people gave priority for their optimum production (Source: FGDs and KILs).

3.4 Available Edible Fauna in VCFs

Fishing activities, including catching, cooking, sharing, and consumption are very common phenomenon for community groups in the VCFs of Haduk Para and Hridoy Member Para and which occupy a good source of protein for them. The stream which flows through the VCF contains 15 species of fauna like fish, prawn, shrimp, frog, snails, etc. (Table 5). During the dry season, the people fish from the placid stream

water by hand fishing method. Besides, Borshi (Hooks), Kunch, Shat-phala, polo, Chunga, Doair, nets, etc. are also used to catch fishes from the stream (Source: Field survey and FGD).

3.5 Available Medicinal Plants in VCFs

The study found species which contain medicinal value growing naturally in the VCFs such as Anoigota, kalahalood, Khetranga, Koishanglota, Kuchbihari, etc. whereas others like Amloki, Bohera, Arjun, Neem, etc are widely cultivated nowadays to create folk medicines. Therefore, the 35 overall medicinal plants found in the VCFs areas are listed below (Table 6).

3.6 VCF Conservation

3.6.1 Purposes of VCFs conservation

As water is a scarce resource here, people of this area bring in water from a long distance. For water collection, they dig a hole close to the stream, in which very often capillary water stores naturally (Source: FGD). Therefore, the

respondents of both VCFs were asked to determine the purpose of the conservation of VCF. The study revealed that conservation of water source (34%) was the main purpose for VCF conservation followed by safety from natural calamities (25%) and the least (12.5%) was for vegetable and spices production (Table 7).

3.6.2 Issues arising from management of VCF

Due to increased population pressure, houses were constructed within the VCF area rapidly and just because of this overall VCF area is shrinking gradually (Source: FGD). As tree harvesting and bamboo cuts were forbidden, non-native people somehow convince the villagers to fell illegally from VCF area, resulting in discord among the community people. Another matter of concern was drying up the stream in VCF area which is the main source of water for those hilly people. In this regard, the community people thought that excessive collection of fuelwood, bamboo, fodder, and pole are the main causes of this situation.

Table 2. Distribution of respondent's average family size, earning member and income

Name of the village	Average family size (No.)	Average earnings member (No.)	Mean annual income per family (Tk.)
Haduk Para	5.25	2.1	1,25,400
Hridoy Member Para	5.78	2.3	1,02,340

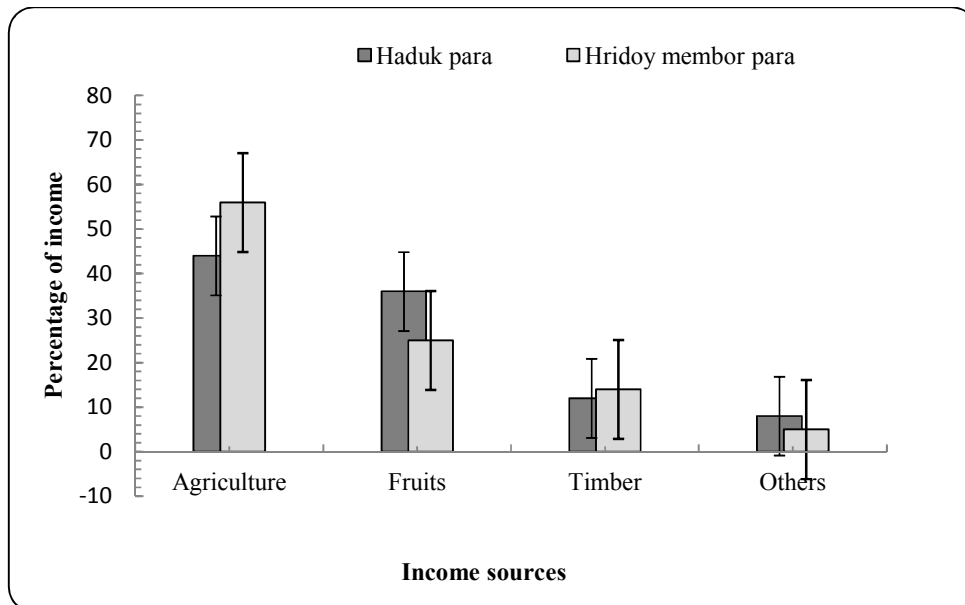


Fig. 2. Percentage distribution of the respondent's family income

Table 3. Forest dependency of the respondents of Haduk Para and Hridoy Member Para

Types of product extracted	Collector (%)		Amount of extraction Kg HH ⁻¹ Yr ⁻¹		Price per unit product (Tk)		Value of extraction (Tk)		HH use (%)		Sold (%)	
	H _d	R _d	H _d	R _d	H _d	R _d	H _d	R _d	H _d	R _d	H _d	R _d
Fuelwood (kg)	76	100	1930	2470	2.00	2.00	3860	4940	85	73	15	27
Bamboo (No.)	70	100	280	320	12	12	3360	3840	54	42	46	58
Timber (cft)	32	40	21	32	700	700	14700	22400	92	76	08	24
Pole (cft)	82	85	150	192	15	15	2250	2880	40	55	60	45
Broom stick (bundle)	47	60	11	8	25	25	274	200	36	30	64	70

[Here, HH= Household; Hd = Haduk Para, Rd= Hridoy Member Para, Tk= BDT
(US \$ 1.00= Tk. 84.517 in 2018-2019; Source: www.exchangerates.org.uk)]

Table 4. List of some edible flora collected from VCF

Local name	Scientific name	Family	H _d	R _d
Tara shak	<i>Alpinia nigra</i> (Gaertn.) B. L. Burt	Zingiberaceae	√	×
Kanthal	<i>Artocarpus heterophyllus</i> Lamk.	Moraceae	√	√
Dumurshumishak	<i>Cajanus cajan</i> (L.) Millsp.	Fabaceae	√	×
Pape	<i>Carica papaya</i> L.	Caricaceae	√	√
Thankuni shak	<i>Centella asiatica</i> (L.) Urban	Apiaceae	√	√
Lebu	<i>Citrus aurantifolia</i> (Cristm. & Panzer) Swingle	Rutaceae	√	√
Narikel	<i>Cocos nucifera</i> L.	Arecaceae	√	√
Ban kochu	<i>Colocasia esculenta</i> (L.) Schott	Araceae	√	√
Tita shak	<i>Crataeva nurvala</i> Buch.-Ham.	Capparaceae	×	√
Halud	<i>Curcuma longa</i> L.	Zingiberaceae	√	√
Dheki shak	<i>Dicranopteris linearis</i> (Burm.f.) Underw.	Gleicheniaceae	√	√
Maitta alu	<i>Dioscorea esculenta</i> (Lour.) Burkill	Dioscoreaceae	×	√
Kusumgulu	<i>Elaeocarpus angustifolius</i> Blume	Elaeocarpaceae	√	×
Jog dumur	<i>Ficus racemosa</i> L.	Moraceae	√	×
Pakur	<i>Ficus virens</i> Ait.		√	√
Chongi shak	<i>Lassia spinosa</i> (L.) Thwaites	Araceae	×	√
Amm	<i>Mangifera indica</i> L.	Anacardiaceae	√	√
Bansh Korol	<i>Melocanna baccifera</i> (Roxb.) Kurz	Poaceae	√	√
Kola	<i>Musa paradisiaca</i> L.	Musaceae	√	√
Lalompata	<i>Premna obtusifolia</i> L.	Lamiaceae	√	×
Peyara	<i>Psidium guajava</i> L.	Myrtaceae	√	√
Tit bugun	<i>Solanum americanum</i> Mill.	Solanaceae	×	√
Jongli alu	<i>Solanum</i> L.		√	√
Tak Begun	<i>Solanum virginianum</i> L.		√	×
Ojan shak	<i>Spilanthes calva</i> DC.	Asteraceae	√	×
Roshko	<i>Syzygium balsameum</i> (Wight) Wall. exWalp.	Myrtaceae	√	√
Putijam	<i>Syzygium fruticosum</i> DC.		√	×
Tentul	<i>Tamarindus indica</i> L.	Fabaceae	√	√
Kharman	<i>Typhonium trilobatum</i> (L.) Schott	Araceae	√	√
Panchamukhikatchu	<i>Xanthosoma sagittifolium</i> (L.) Schott		×	√
Baruna Shak	<i>Xanthoxylum rhetsa</i> (Roxb.) DC.	Rutaceae	×	√
Ada	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	√	√
Boroi	<i>Ziziphus mauritiana</i> Lamk.	Rhamnaceae	√	√
Anaigota	<i>Ziziphus rugosa</i> Lamk.		√	×

[Here, Hd = Haduk Para; Rd= Hridoy Member Para; √= species present, ×= Species absent]

Table 5. List of some major edible fauna collected from VCF

Local name	Scientific name	English name	Family	H _d	R _d
Koi	<i>Anabas testudineus</i> Bloch	Climbing perch	Anabantidae	√	√
Chanda	<i>Chanda nama</i> Hamilton	Elongate glass perch	Ambassidae	√	√
Taki	<i>Channa punctata</i> Bloch	Spotted snakehead	Channidae	√	√
Shol	<i>Channa striata</i> Bloch	Banded snakehead		√	x
Magur	<i>Clarias batrachus</i> Linnaeus	Air-breathing catfish	Clariidae	√	√
Khalisha	<i>Colisa fasciatus</i> Bloch & Schneider	Striped gourami	Anabantidae	x	√
Bele	<i>Glossogobius giurus</i> Hamilton	Tank goby	Gobiidae	x	√
Shamuk	<i>Helix pomatia</i> Linnaeus	Snails	Helicidae	√	√
Kakra	<i>Liocarcinus vernalis</i> Risso	Crab	Portunidae	√	√
Cingrimach	<i>Macrobrachium rosenbergii</i> De Man	Shrimp	Palaemonidae	√	√
Kuchia	<i>Monopterusuchia</i> Hamilton	Gangetic mud eel	Synbranchidae	√	√
Tengra	<i>Mystus vittatus</i> Bloch	Striped dwarf catfish	Bagridae	√	√
Foli	<i>Notopterus notopterus</i> Pallas	Gray featherback	Notopteridae	√	x
Puti	<i>Puntius ticho</i> F. Hamilton	Ticto barb	Cyprinidae	√	√
Darkina	<i>Rasbora rasbora</i> Bleeker	Rasbora		√	√

[Here, Hd = Haduk Para; Rd=Hridoy Member Para; √= species present, x= species absent]

3.6.3 Rules and regulations for community people of VCF

For conservation and management of both the VCFs, an executive committee was formed comprising 20 members in Haduk Para and 15 members in Hridoy Member Para with a Karbary (local name for Headman) heading the committee (Source: FGD). The committee will last for 3 years in Haduk Para and 5 years for Hridoy Member Para. The committee has a written constitution and rules on forest use and management. The committee accordingly sets the commandment for VCF management and takes the necessary actions against persons who break the rules. The following proclamations were found common to both VCFs communities (Source: FGD):

- I. Without taking the permission of the management committee, access to any person in the VCF area is the violation of rules and he/she may go under penalty due to his unlawful act.
- II. Agricultural expansion, as well as Jhum cultivation, has been restricted in the VCF area.
- III. Illegal felling and bamboo stump collection is prohibited as it is the main cause of landslide in this region. However, in case of common interest like Mosque and School construction activities, they may collect trees and bamboo from VCF.
- IV. Grazing and non-wood forest products collection in the core zone of the VCF area is strictly prohibited.
- V. Carrying firebox, cigarettes and lighting fires while going through the forest is restricted.
- VI. Hunting of birds and animals is prohibited.
- VII. Every year a new plantation should be established in VCF.
- VIII. Preservation of drinking water sources is a priority.
- IX. VCF executive committee has the cardinal power to impose a monetary penalty and formulate the existing rules according to the emergency circumstances and for the betterment of the community people.

3.6.4 Initiatives taken for reinforcement of VCF

To enrich native flora and conservation of fauna within the VCF and homestead area, VCFs committee had taken some initiatives like nursery development and enrichment planting activities. Barren areas which were very prone to cyclone and landslide were planted up with some deep-rooted species like Garjan, Chapalish, Kanjol Badi, Bohera, Mango, Chuckrassi, Pitraj, etc. (Source: FGD). Fruits including medicinal tree species were planted around the homestead of each VCF family to domesticate the valuable species and also to get some quick economic return. Such species comprised of Amropali Amm, Ramgoi Am, Jolpai, Chalta, Amloki, Lebu, Peara (guava), Kanthal, Amra, Arjun, Haritaki, Bohera, Gamar, koroi, etc (Source: FGD). Therefore, to mitigate the pressure and dependency on VCF, a committee of both the

Table 6. Major medicinal plants found in studied VCFs

Local name	Scientific name	Family	Diseases/ailment	Part used	H _d	R _d
Basok	<i>Justicia adhatoda</i>	Acanthaceae	Cough, asthma, tuberculosis, cold	leaf, Root	√	×
Ulotcombol	<i>Abroma augusta</i> (L.) L.f.	Sterculiaceae	Sexually transmitted diseases	Root, Leaf, Bark	√	√
Teorakanta	<i>Acacia concinna</i> (Willd.) DC.	Mimosaceae	Asthma, jaundice, constipation	Bark, leaf, Seed	√	×
Apang	<i>Achyranthes aspera</i> L.	Amaranthaceae	Snake, dog and fox bite, piles	Leaf, Root	√	√
Bandorhola	<i>Adiantum philippense</i> L.	Pteridaceae	Boils, fevers	Leaf, Root	√	√
Khetranga	<i>Alpinia conchigera</i> Griff.	Zingiberaceae	Gastic pain, inflammation, stimulant	Rhizome	×	√
Neem	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Skin disease, jaundice, tooth disease	Root, Leaf, Bark	√	√
Arhor	<i>Cajanus cajan</i> (L.) Millsp.	Fabaceae	Diabetes, energy stimulant, Jaundice	Leaf, Fruit, Flower	√	√
Thankuni	<i>Centella asiatica</i> (L.) Urban	Apiaceae	Metabolic problem, dysentery, cough	Whole plant	√	√
Bhant	<i>Clerodendrum viscosum</i> L.	Verbenaceae	asthma, skin diseases	Leaf, Root	√	√
Marissa	<i>Croton caudatus</i> Geiseler	Euphorbiaceae	Paralysis, arthritis, purgative	Seeds	×	√
Halud	<i>Curcuma longa</i> L.	Zingiberaceae	Inflammation, Allergy	Rhizome	√	√
Swarnalata	<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Hypertension, liver problem	Stem	√	√
Datura	<i>Datura metel</i> L.	Solanaceae	Pain killer, asthma, scabies	Root, Leaf, Seed	√	√
Maitta Alu	<i>Dioscorea esculenta</i> (Lour.) Burkill	Dioscoreaceae	Constipation	Tuber	√	√
Kalokeshi	<i>Eclipta prostrata</i> (L.) L.	Asteraceae	Hair tonic, cough, lung infection	Leaf	√	√
Jamra	<i>Glochidion multiloculare</i> (Rottler ex Willd.) Voigt	Phyllanthaceae	Mosquito repellent or bites, anti-inflammatory	Leaf, Fruit	√	×
Dhoacharpata	<i>Glycosmis pentaphylla</i> (Retz.) DC.	Rutaceae	After childbirth, diarrhea	Leaf, Stem	√	√
Monshimais	<i>Grewia laevigata</i> Vahl	Malvaceae	Paralysis, stomach pain	Leaf	×	√
Moricchalodi	<i>Jasminum scandens</i> (Retz.) Vahl	Oleaceae	Red-eye, typhoid fever	Bark, Root	√	√
Kalahalood	<i>Keampferia parviflora</i> Wall. ex Baker	Zingiberaceae	Diarrhea along with Vomiting, sexual disorder	Rhizome	√	√
Assamlata	<i>Mikania cordata</i> (Burm. f.) B.L. Rob.	Asteraceae	Bleeding control, Daud	Leaf	√	√
Lajjabati	<i>Mimosa pudica</i> L.	Mimosaceae	Piles, wound, skin diseases	Whole plant, Root	√	√
Nagaghossia	<i>Perilla ocymoides</i> var.	Lamiaceae	Sore, Cut, Bruises, antioxidants, skin disease	Leaf	√	×
Amloki	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Jaundice, anti-inflammatory, diarrhea,	Seed, Fruit	√	√
Ashok	<i>Saraca indica</i> L.	Fabaceae	Bleeding, Dysentery	Bark, Leaf	√	×
Pipul	<i>Scindapsus officinalis</i> Schott	Araceae	Asthma, diarrhea, rheumatism	Fruit	√	√

Local name	Scientific name	Family	Diseases/ailment	Part used	H _d	R _d
Kuchbihari	<i>Solanum sp.</i> L.	Solanaceae	Sore, Wounds, panic in head	Leaf, Fruit	×	√
Arjun	<i>Terminalia arjuna</i> (Roxb.) Wight & Arn.	Combretaceae	Heart disease, piles, diarrhea	Bark	√	√
Bohera	<i>Terminalia bellerica</i> (Gaertn.) Roxb.	Combretaceae	Asthma, allergy	Fruit	√	√
Horitoki	<i>Terminalia chebula</i> Retz.	Combretaceae	Stomachache, acidity.	Bark	√	√
Kharman	<i>Typhonium trilobatum</i> (L.) Schott	Araceae	Piles, stomach complaints, ulcer of cattle	Tuber, Root	√	√
Koishanglota	<i>Vitissp.</i> L.	Vitaceae	Broken bones	Leaf	×	√
Bon ada	<i>Zingiber roseum</i> (Roxb.) Roscoe	Zingiberaceae	Digestion	Rhizome	√	√
Anaigota	<i>Ziziphus rugosa</i> Lam.	Rhamnaceae	Diarrhea	Bark, Flower, Fruit	√	×

[Here, Hd = Haduk Para; Rd= Hridoy Member Para; √= species present, ×= species absent]

Table 7. Respondent households' reasons (%) for VCF conservation

Reasons	Name of villages		Mean
	Haduk Para (%)	Hridoy Member Para (%)	
To conserve water source	28	40	34
To avert natural calamities	30	20	25
To collect fruit and other materials	20	15	17.5
For medicinal purpose	10	12	11
For vegetable and spices production	12	13	12.5

paras have taken different initiatives of income-generating activities. Such activities include (Source: FGD):

- i. Twenty people from Haduk Para and fifteen people from Hridoy Member Para were trained on poultry, fishery and livestock rearing.
- ii. Twenty women from each VCF were trained to make different handicraft and blanket weaving.
- iii. Ten people from each VCF were trained on grafting at BARI training center, Khagrachari.
- iv. Ten people from Haduk Para were trained on Leadership or Organizational Development.
- v. Agroforestry projects have been introduced for the sustenance of the community people.
- vi. A fund has been developed by the VCF committees for emergencies to use as capital for alternative income activities.

4. DISCUSSION

Forest is one of the main sources of livelihood for indigenous people especially those living in CHTs of Bangladesh where ethnic communities are managing VCFs for conserving different sources of food, fuelwood, water, timber, etc. [5,8]. The perception of the indigenous people is vital for conserving different types of edible forest products including edible flora, fauna, and medicinal plants to ensure the sustainability of daily life in the CHTs [1]. The perception-based findings of this study also revealed that these VCF's are the main source of fuelwood, bamboo shoots, wild fruits, fishes, vines or leaves for cooking or medicinal purposes necessary to sustain the lives of the indigenous communities. From this study, a total of 34 species of edible flora were identified (28 species are available in Haduk Para and 25 species are available in Hridoy Member Para). In addition, 15 species of edible fauna were found in this study with 13 species common to both study areas. People in both areas are mostly dependent on this edible flora and fauna. Another study [28] showed that People depended on the forest for seeds, grains, roots, rhizomes, leaves and fruits for their very survival whereas fruits were among the most important foods that helped man to survive from the very beginning. According to Chowdhury et al. [9], VCF is one of the most important sources of edible items to maintain the sustainability of ethnic communities in the CHTs.

The tribal people of Khagrachari conventionally use medicinal plants when they suffer from various diseases. Most of the forest areas contain the herbaria of medicinal plants, which the local herbal doctor (known as Boiddya, Ojha or Kabiraj in Bengali) used to prepare their traditional medicine, while some were regarded as sacred [29]. From this study, a total of 35 species of medicinal plants were found with 30 species and 29 species available in Haduk Para and Hridoy Member Para, respectively. Ethnic communities live far from the mainland and are not financially strong to visit a doctor in the mainland. They are therefore mostly dependent on the herbal doctor who uses different parts of plants e.g. leaf, root, bark, seed, rhizome, flower, etc. to prepare herbal medicine for their treatment. Edible plant parts used by community people including fruit production in VCF has closely supported the findings of Rahman et al. (2017) who reported that 34 fruit plants were cultivated in the whole Khagrachari Sadar Upazila [30].

The present study revealed that (75.55%) of respondents were dependent on agriculture in Haduk Para VCF whereas 82.3% of respondents were involved in agriculture followed by gardening (10.21%) in Hridoy Member Para. This study supports the findings of Chowdhury et al. [1] which found that the main occupations of the households of the indigenous people of CHT's are agriculture (64%) followed by agricultural labor (12.5%). It also found that the community people mostly depend for their livelihood on VCF from edible forest products, fish, and medicinal plants collection a similar finding to Kamrul et al. [6] who stated that some native flora growing in the hilly area fulfill the demands of VCF's community people of Bandarban. As people are involved in Business and gardening in Haduk Para they contribute more income to the family compared to Hridoy Member Para. Female members are also contributing to the family income as they take part in jhum cultivation, fuelwood collection and other activities with the male members.

Besides, Baten et al. [4] found that livelihood, conservation of native species, water, etc. were the purpose for the conservation of VCF in CHTs which support the findings of the present study. Village Common Forests (VCF) are used sustainably for water source conservation, livelihoods and other biomass needs of ethnic communities in the hilly areas of Bangladesh. The stream flowing through the VCFs are the

only source of drinking water for the community people residing within the study area [6]. Furthermore, according to Miah et al. [31] the participation of people in income-generating activities and self-reliance can reduce the dependency from VCFs. The present study revealed that alternative livelihood activities e.g. gardening, livestock rearing, handicraft, etc. were adopted by various agencies with juvenile training activities which subsequently affected the conservation of VCF [32]. In addition, Rahman et. al. [33] stated that nowadays fruit cultivation practices in Khagrachari hill district dramatically increased in the last 10-12 years [33]. Others Miah and Ahmed [34] have reported that alternative income-generating (AIG) opportunities in horticulture, tailoring, handicrafts, cattle rearing, vegetable cultivation, etc. are helpful in minimizing the extraction of resources from VCF which ultimately provides an effective path to conserve forests [13,35]. In the aspect of conserving VCF, majority of the respondents from Hridoy Member Para stated that their priority for conserving the forest was to protect the source of water. The majority from Haduk Para, on the other hand, replied that their priority was to avert natural calamities. To protect the VCF from stealing of forest products, the community people formed 3-4 patrol groups each consist of 7-8 members. Unfortunately, the patrols failed to protect the VCFs from illegal cuttings which occurred during the night. So the committee settled some of the villagers in the periphery areas of the VCFs to prevent such unlawful acts. However, some NGOs have initiated programs to develop the VCF territory and at the same time enhance the livelihood facilities of the community people in order to reduce their dependence on forests as there is no government initiative to protect these forests. Other studies [6,14,36,37] have reported similar findings. In addition, regular meetings with proper goals and management aspects including different initiatives help the communities to manage VCF in a sustainable way. Another study by [38] in Bandarban declared that regular monthly meetings of VCF committees were a way of offering opportunities for increasing awareness of the conservation of VCFs.

5. CONCLUSION

The VCF's are managed, protected and utilized by indigenous village communities with their traditional knowledge, innovations, and practices which set a model for the conservation of biodiversity in Khagrachari. Formation of a local

VCF committee and setting of forest management practices by local NGO's restrict users from over-exploitation of forest resources. Both communities consider the conservation of water sources, protection from natural calamities, food, and medicinal safety to be of critical importance. The executive committee took several initiatives to improve forest resource sustainability and reduce dependence on the forest. These include enrichment planting to fill areas with gaps in the native flora of VCFs, providing training for more income-generating activities, making laws to protect the forest and backing these up with safety /security patrols and resettlements for added surveillance. Further modification of VCF's rules and regulations is required to protect and manage these VCFs from being degraded for the sake of indigenous people and the ecosystem as a whole.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Chowdhury P, Hossain MK, Hossain MA, Dutta S, Ray TK. Status, wood properties and probable uses of lesser used species recorded from Sitapahar Reserve Forest of Bangladesh. *Indian For.* 2017;143(12): 1241–8.
2. Mehta JN, Kellert SR. Local attitudes toward community-based conservation policy and programmes in Nepal: A case study in the Makalu-Barun Conservation Area. *Environ Conserv.* 1998;25(4):320–33.
3. Sah JP, Heinen JT. Wetland resource use and conservation attitudes among indigenous and migrant peoples in Ghodaghodi Lake area, Nepal. *Environ Conserv.* 2001;28(4):345–56.
4. Baten MA, Khan NA, Ahammad R, Misbahuzzaman K. Village common forests in Chittagong Hill Tracts, Bangladesh: Balance between conservation and exploitation. *Unnayan Onneshan-The Innov Dhanmondi, Dhaka, Bangladesh*; 2010.
5. Rasul G. Political ecology of the degradation of forest commons in the Chittagong Hill Tracts of Bangladesh. *Environ Conserv.* 2007;34(2):153–63.
6. Kamrul KI, Jashimuddin J, Hossain N. Tree diversity and management of Village

- Common Forests in Bandarban. *Environ Earth Ecol.* 2017;1(2).
7. Jannat M, Hossain MK, Uddin MM, Hossain MA, Kamruzzaman M. People's dependency on forest resources and contributions of forests to the livelihoods: a case study in Chittagong Hill Tracts (CHT) of Bangladesh. *Int J Sustain Dev World Ecol.* 2018;25(6):554–61.
 8. Misbahuzzaman K, Marma C. Traditional indigenous knowledge based conservation and livelihood strategies for sustainable forest resources management in the uplands of Bangladesh. *IUFRO World Ser.* 2008;21:116.
 9. Chowdhury MA, Zahra FT, Rahman MF, Islam K. Village common forest management in Komolchori, Chittagong Hill Tracts, Bangladesh: An example of community based natural resources management. *Small-scale For* [Internet]. 2018;17(4):535–53. Available:<http://link.springer.com/10.1007/s11842-018-9402-9>
 10. Misbahuzzaman K, Smith-Hall C. Role of forest income in rural household livelihoods: The case of village common forest communities in the Chittagong Hill Tracts, Bangladesh. *Small-scale For.* 2015;14(3):315–30.
 11. Halim S, Roy RD. Lessons learned from the application of human rights-based approaches in the indigenous forestry sector in the Chittagong Hill Tracts, Bangladesh: A case study of the village common forest project implemented by Taungya. Taungya, Rangamati; 2006.
 12. Saha PS. Parbattya Chattagramer Mouza Ban: Prachin Praggyar Arek Rup. In: In P. Gain; 2010.
 13. Sunderlin WD, Hatcher J, Liddle M. From exclusion to ownership? Challenges and opportunities in advancing forest tenure reform. *Rights and Resources Initiative*; 2008.
 14. Jashimuddin M, Inoue M. Management of village common forests in the Chittagong Hill Tracts of Bangladesh: Historical background and current issues in terms of sustainability. *Open J For.* 2012;2(3):121.
 15. Hossain MA, Hossain MK, Alam MS, Al Mamun MMA. Structural composition and distribution of tree species of Dudhpukuria-Dhopachori Wildlife Sanctuary, Chittagong, Bangladesh. *J Biodivers Conserv Bioresour Manag.* 2017;3(1):17–30.
 16. Uddin MS. Sustainable forest management and policy issues in CHT's Bangladesh. 2017.
 17. Roy S. Livelihood resilience of the indigenous Munda community in the Bangladesh Sundarbans forest. *Handb Clim Chang Resil.* 2018;1–22.
 18. Chowdhury MSH, Gudmundsson C, Izumiyama S, Koike M, Nazia N, Rana MP, et al. Community attitudes toward forest conservation programs through collaborative protected area management in Bangladesh. *Environ Dev Sustain.* 2014; 16(6):1235–52.
 19. Ahmed MNQ, Haq SMA. Indigenous people's perceptions about climate change, forest resource management, and coping strategies: a comparative study in Bangladesh. *Environ Dev Sustain.* 2019; 21(2):679–708.
 20. Kibria ASMG, Jashimuddin M, Makoto I. Effects of participatory forest management on livelihood capitals of the community in Cox's Bazar, Bangladesh. *J For Res.* 2014;19(1):42–51.
 21. Chowdhury Q, Rashid AZMM, Afrad M. Socio-economic significance of reed forests in a rural community: A case study from the greater Sylhet Region of Bangladesh. *Small-scale For Econ Manag Policy.* 2004;3(1):121–30.
 22. Miah MD, Chowdhury MSH. Traditional forest utilization practice by the Mro tribe in the Bandarban region, Bangladesh. *Schweizerische Zeitschrift fur Forstwes.* 2004;155(3–4):65–70.
 23. Rahman MDR, Rahman MM, Chowdhury MA, Akhter J. Tree species diversity and structural composition: The case of Durgapur Hill Forest, Netrokona, Bangladesh. *Asian J For.* 2019;3(1):10–9.
 24. Rahman MR, Rahman MM, Chowdhury MA. Assessment of natural regeneration status: The case of Durgapur hill forest, Netrokona, Bangladesh. *Geol Ecol Landscapes.* 2019;1–10.
 25. Chowdhury MA, Islam KN, Hafiz N, Islam K. Diversity of trees in a community managed forest: The case of Komolchori VCF, Khagrachari, Bangladesh. *Geol Ecol Landscapes.* 2019;3(2):95–103.
 26. Upazila KS. khagrachari upazila. [Internet]; 2019. [Cited 2019 May 1] Available:<https://chittagong.com/khagrachari-upazila-upazila/>

27. Upazila M. Matiranga Upazila. [Internet]; 2019. [Cited 2019 May 1] Available:<http://matiranga.khagrachhari.gov.bd/>
28. Hossain MK, Hossain MA. Biodiversity of Chunati Wildlife Sanctuary: Flora. In: Arannayk Foundation; 2014.
29. Siddiqui KU, Islam MA, Ahmed ZU, Begum ZNT, Hassan MA, Khondker M, Rahman MM, Kabir SMH, Ahmed M, Ahmed ATA, Rahman AKA, Haque EU (eds.). Encyclopedia of flora and fauna of Bangladesh. Angiosperms: (Agavaceae - Najadaceae). Dhaka Asiat Soc Bangladesh. 2007;11:399.
30. Rahman MR, Hossain MK, Alam M. Prospects and problems of fruit tree cultivation in Khagrachari Sadar Upzila. Int J Usuf Mngt. 2017;18(2):13–24.
31. Miah D, Chakma S, Koike M, Muhammed N. Contribution of forests to the livelihood of the Chakma community in the Chittagong Hill Tracts of Bangladesh. J For Res [Internet]. 2012;17(6):449–57. Available:<https://www.tandfonline.com/doi/full/10.1007/s10310-011-0317-y>
32. Ahmed ZU, Begum ZNT, Hassan MA, Khondker M, Kabir SMH, Ahmad M, et al. Encyclopedia of flora and fauna of Bangladesh. Asiat Soc Bangladesh, Dhaka; 2008.
33. Zeven AC, De Wet JMJ. Dictionary of cultivated plants and their regions of diversity: Excluding most ornamentals, forest trees and lower plants. Pudoc; 1982.
34. M Danesh Miah FUA. Conservation of a tropical wet semi-evergreen forest ecosystem by an Indigenous community in the Bandarban Hill District of Bangladesh: the role of intervention. Small-scale For. 2014;13:319–331.
35. Rahman MR, Hossain MK, HMA. Ethnomedicinal practices by Garo Community of Madhupur National Park, Tangail, Bangladesh. Int J Usuf Mngt. 2017;18(1):48–60.
36. Mukul SA, Herbohn J. The impacts of shifting cultivation on secondary forests dynamics in tropics: A synthesis of the key findings and spatio temporal distribution of research. Environ Sci Policy. 2016;55:167–77.
37. Nath TK, Inoue M. Impacts of participatory forestry on livelihoods of ethnic people: experience from Bangladesh. Soc Nat Resour. 2010;23(11): 1093–107.
38. Nishat A, Biswas SR. Community-based restoration of degraded tropical hill forests: Experiences from Krykhong Para, Chittagong Hill Tracts, Bangladesh. Bull Natl Inst Ecol. 2005;16:1–11.

© 2019 Alam et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<http://www.sdiarticle4.com/review-history/51421>