

# Conservation and Uses of Water Resources as Climate Change Adaptation in Komolchari Village Common Forest (VCF), Khagrachari, Bangladesh

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**Abstract**— Impact of climate change on natural resources and people's livelihoods is increasing day by day in Bangladesh. Because of less capacities, indigenous communities in Chittagong Hill Tracts areas of Bangladesh are most vulnerable to climate change. To conserve natural resources, local tribal people were applying indigenous knowledge as community based adaptation. The major objective of this research work is to explore ways of local indigenous people of Komolchari Village Common Forest (VCF) in Khagrachari in conserving their water resources. To address this theme, we conducted six focus group discussions and field survey following two questionnaires. Four key person interviews were also conducted with local leaders and non-governmental officials who were working with communities around komolchari VCF. This paper is designed on following major points: (a) available edible aquatic fauna of Komolchari VCF, (b) changing status of livelihood due to climate change, (c) application of indigenous knowledge to conserve water resources, (d) community based management for VCF. Community based approach to cope against climate change in disadvantageous CHTs is important to maintain a sustainable conservation and use of water. Findings of this research will help policy makers, governmental and non-governmental authorities to initiate suitable adaptation activities in areas vulnerable to climate change.

**Index Terms**— Conservation, Water sources, Climate Change, Adaptation, Village Common Forest

## 1 INTRODUCTION

Change in the water balance like the timing and magnitude of runoff and soil moisture can be altered in near future by global warming or climate variability (Jakimavicius and Kriaciuniene 2013). Due to increased urbanization, industrialization and agricultural demands, water stress has been accelerated more in semi-arid and arid regions of the world (Aiwen, Y. 2000). During past 40-year period the temperature has been increased within the range of 0.4–0.65°C and created both positive and negative impacts on hydrological balance in Bangladesh. Increased evapotranspiration, higher irrigation requirement in the winter, reduced transboundary flow, longer and frequent floods, slower recession of flood water, slower accretion of coastal lands etc. are the potential impacts of climate change on Bangladesh, described by The National Water Management Plan (2001). Although climate change affects all spheres of people, but due to lack of capacity the people of hilly areas in Bangladesh are more vulnerable to climate change. They are facing extreme constraints to get available water and resources to maintain a sustainable life.

Long term impacts of climate change, for example, changes in the frequency of major droughts, flooding, extreme temperature, or climate-induced diseases disturb agricultural production (Ali, 2013; Nishat and Mukherjee, 2013). On the contrary, in 2050, the increased agricultural water demand for food production may cause insufficient water supply for other purposes like domestic and commercial water supply, fisheries, ecosystems and navigation (Faisal and Parveen, 2004). Moreover, fishery sector will become vulnerable due to changes in temperature and rainfall for example- in the hilly area reduction of water flow in the small water bodies creates declining of biodiversity as well as source of livelihood.

Hundreds of millions of people in the world, especially a large amount of people in Southeast Asia are depended on the

forest directly or indirectly for various purposes such as, food, sustainable water supply, security, different goods, medicine including various ecosystem services for example, soil protection and conservation, wild life etc. (Guariguata and Balvanera, 2009; Roy 2001; Chomitz et al., 2006). In Chittagong Hill Tracts (CHTs) of Bangladesh, Chakma community used to collect firewood, timber, wild fruits and vegetables, medicinal plants from forests (Miah et al. 2012) and growth of the national economy if the different countries depends on the forest products too (Cavendish, 2000; Godoy and Bawa, 1993; Barham et al., 1999). The culture, livelihood and lifestyle of the ethnic peoples in the CHTs are strongly related to the forest resources (Jashimuddin and Inoue, 2012, Miah and Ahmed, 2013).

Village Common Forest (VCF) plays an important role in conserving forest resources and to preserve the drinking water sources. The indigenous communities are protecting VCF around their areas where many VCFs contain headwaters of streams, natural springs and other aquifers (Baten et al., 2009). Community applies their indigenous knowledge through community base adaptation approach which is a cost-effective bottom-up process to tackle climate change as well as to reduce water resource depletion. (Reid H. 2014). Since, there are shortages of modern technology, governmental and non-governmental supports, education etc. in VCF area of CHTs, community based approach to conserve water sources is very fruitful because local people can apply their own experiences and resources to protect forest for ensuring sustainable flow of water in small spring or canal.

Along with water resource climate change was affecting livelihood pattern of the people of CHTs. Water sources and flow of water in canal and springs were decreasing while people were applying indigenous knowledge to conserve water

sources and other resources need for their daily life. Several studies were conducted in Chittagong Hill Tracts (CHTs) and VCFs on bio-cultural diversity and richness in natural resources (Miah and Ahmed, 2013; Jashimuddin, 2012; Baten et al., 2010) and on degradation of natural resources including reasons and consequences (Nath and Inoue, 2009; Hamid, 1974). Again, several studies were also conducted on importance of indigenous knowledge to maintain VCFs and manage natural resources including land, water etc. in the CHTs (Rasul, 2007; Jashimuddin, 2012; Misbahuzzaman, 2006; Halim, 2002; Roy and Halim, 2001; Roy, 1996; Huq, 2000). But research work on water resources and aquatic resources management in VCF level in CHTs areas through using indigenous knowledge and community based approach were not noticed in adequate scale. This study will highlight the applied indigenous knowledge in Komolchari VCF to conserve water and help others to understand adaptation approach in the case of ensuring livelihoods against climate change in Bangladesh.

## 2 METHODOLOGY

The study was conducted in Komolchari VCF area (fig1) of 316 acre and was being managed by local ethnic community in Khagrachari district which is locally called "Reserve forest" in Buarchari Mouza (Mouza no-264).

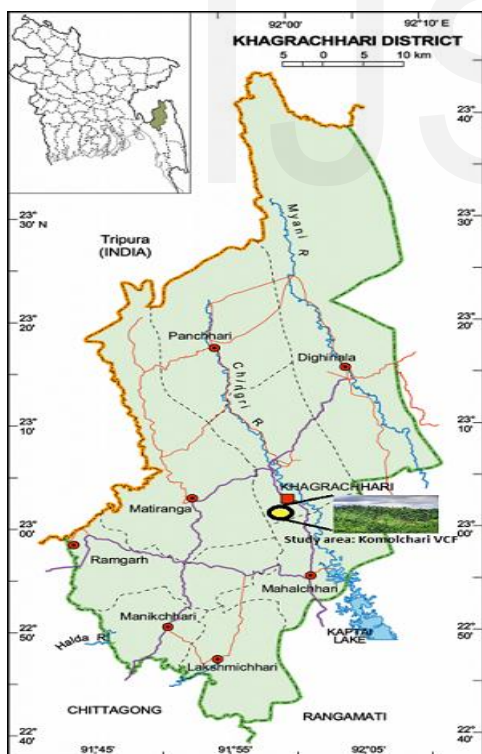


Fig1: Komolchari VCF area, Khagrachari, Chittagong  
A reconnaissance survey was carried out to know the existing situation of the study area and prepared a semi-structured questionnaire for fulfilling the research objective. To conduct household survey, six Focus Group Discussions (FGDs) containing 10-12 persons in each group, were done. Among six

FGDs, three were done in Thana Chandra Para, two were done in Jadu Ram Para beside Komolchari VCF and one was done in the settler community in the VCF area. The percentage of people responses was determined through calculating the frequency of respondents about livelihood pattern.

Besides FGDs, four key person interviews were also conducted with headman and 'karbari' of VCF committee, two officers from Non-Governmental Organizations (NGOs) who were working in VCF's community.

Moreover, to find out available aquatic resources in water bodies and applied indigenous knowledge to conserve water resources in Komolchari VCF areas, field level study was also conducted in Komolchari VCF area.

## 3 RESULTS

### 3.1 AVAILABLE EDIBLE ITEMS IN WATER BODIES OF KOMOLCHARI VCF

VCF not only provided good management practices of water but also different kinds of enriched exceptional resources which could reduce increased pressure on food security as well. There were found several types of edible items in the study area (table 1) which were mainly consumed by tribal people. Of them, 'Isa mach', 'putimach', 'takimach', 'kakra' and 'belemach' were widely used by both tribal and local non-tribal people of Chittagong. These fish species can decrease the pressure on fish consumption caught from the river. Furthermore, frog which was locally known as 'Beng' was most popular in the ethnic community because of its availability in VCF area.

Table 1: Available edible items in water bodies of Komolchari VCF of Khagrachari

Local name	English name	Scientific name
Belemach	Bailla	<i>Awaous guamensis</i>
BoroShamuk	Large snails	<i>Helix pomati</i>
Beng	Frog	<i>Litoria caerulea</i>
ChotoShamuk	Small snails	<i>Helix pomatia</i>
Isa mach	Shrimp	<i>Macrobrachium rosenberghi</i>
Kakra	Crab	<i>Liocarcinus vernalis</i>
Kuiccha	-	<i>Monopteru scuchia</i>
Putimach	-	<i>Puntius ticho</i>
Takimach	Taki fish	<i>Channa puncpatus</i>

### 3.2 LIVELIHOOD PATTERN

#### 3.2.1 FORMER LIVELIHOOD PATTERN

Earlier people of Komolchari were engaged in different types of activities for earning of which "Jhum" cultivation (40%) was mostly adopted by them (fig2). Besides "jhum" cultivation, they depended on the locally available edible fauna such as, fish species, crab, frog and snails (17%) and forest products (26%). They were comfortable and efficient in cultivation and collection systems in hilly area using their traditional knowledge. Without depending on natural resources small

portion (3%) of them were working as rickshaw puller in Kha-grachari Sadar.

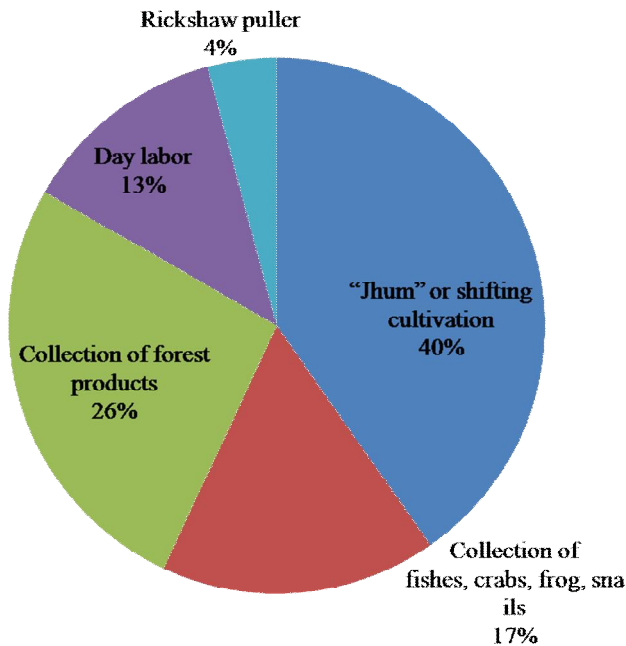


Fig2: Former livelihood patterns in Komolchari Village Common Forest, Khagrachari

### 3.2.2 PRESENT LIVELIHOOD PATTERN

Now days, ethnic people are being engaged with various kind of activities and most of them are managing their income through rearing calf (35%) (Fig3).

With the help of different NGOs, most of them have started to generate income from horticulture (25%). Still, 15% of the inhabitants in hilly area depends on forest products but the collection of fishes, crab, frog, snails has become only 4% which is optimized and to conserve the biodiversity.

### 3.2.3 FORMER LIVELIHOOD VS PRESENT LIVELIHOOD

However, due to increased climate change, in VCF area, water flow in the streams are getting reduced as well as biodiversity is also getting declined. In order to raising awareness among people and understand regarding depletion of naturally available resources, different NGOs were working and providing the people of hilly area different training programs. The main aim of these training program was to raise their standard of living by ensuring alternative livelihood and to strengthen the grassroots institutions. Therefore, there are some significant differences in past and present livelihood patterns of people living in the Komolchari VCF. Previously people were very much used to jhum cultivation but now the percentage shifted to calf rearing. There were eleven settlers who lived around the VCF who consumed the forest products from the VCF.

Those settlers are still involved in collection of various aquatic species (fig2 and fig3) and also interested in new kind of livelihood pattern. A study which was conducted by Miah and Ahmed (2013) in Bandarban, it was found that the monthly meeting of VCF committee was considered as a training opportunity to create awareness in the conservation of VCF as well as in organizational and technical capacity building for alternative livelihood and VCF management.

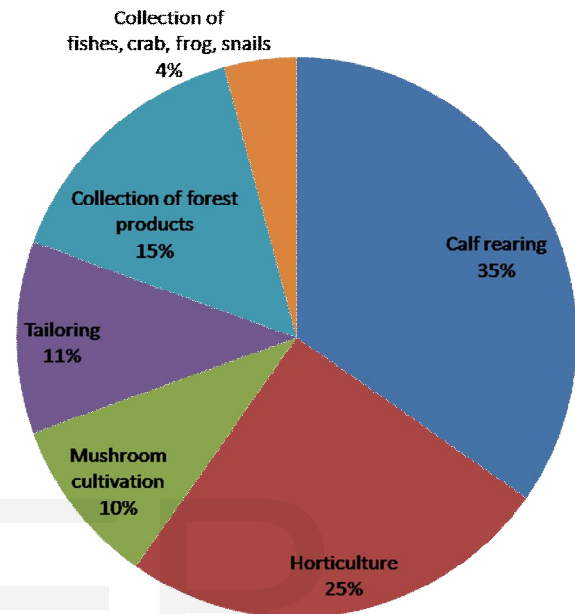


Fig3: Present livelihood patterns in Komolchari Village Common Forest, Khagrachari

Furthermore, Aranyak Foundation supported the NGO Proshika to provide them revolving funds worth Tk. 587000. Under a Saving-Credit program local people deposit a fixed amount of money per month which was lent to help a member for doing income generating activities. Members of the committee could take a loan from the fund with 1% of interest. The borrower had to make monthly payments and the entire loan which will not exceed the limit of Tk. 7000 had to be returned within one year. From the research work, it was found that, 67% of the stakeholders were members of that credit program.

### 3.2.4 APPLICATION OF INDIGENOUS KNOWLEDGE

The indigenous community of the CHTs not only assembles massive importance to their traditional values, morals and institutions but also apply them in sustainable use of water resources like water harvesting and drinking as it is scarce in hill area (Hoque and Myant, 2011). They dug a hole on the toe of the hill (fig4) to store seepage water from the hill which was locally know as "Kua".

Moreover, indigenous earthen dam is built from earth, bamboo and wood, on a small stream in which water level is raised by a few days of rain. Though the size of the earthen dam and its watershed, varies from place to place but most common size of watershed is about 100ha (Hoque and Myant, 2011) and the size of the total watershed in the VCF was 127.881ha

(316acre). By increasing vegetation coverage, the water flow had been increased and there was much water flow than before. Previously, they were used to 'Jhum' cultivation only, but now because of water availability they were adopting different livelihood activities like mushroom cultivation, calf rearing and horticulture etc.



Fig4: Application of Indigenous technique "Kua" in the Komolchari VCF, Khagrachari, Bangladesh

VCF is managed by local ethnic communities and their management has set a standard model for the protection of biodiversity, environment and natural resources in the CHTs (Baten et al., 2010). It was found from this study, that most of the 93% of the respondents believed that temperature was increasing and 92% of the respondents thought that rainfall pattern was also changing in the country. When there was mismanagement, like illegal cutting of trees by strangers in VCF, people felt that all of the local sources of water such as, canal locally known as "Chora" and small sized water springs were closely related to the presence of forest. The Chakma Community specially gave importance to protect the fixed water collecting places to ensure sustainable supply of drinking water. VCF mainly provided all tangible products such as, wood, foods, bamboo, and wild animal etc. but according to the Headman of Komolchari VCF, conservation of forest directly and indirectly helped to increase the quantity of water flow in the "Chora". Local indigenous communities without any institutional support, were managing VCFs around their homesteads to preserve the drinking water sources as many VCFs contain headwaters of streams, natural springs and other aquifers

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(Baten et al., 2009). There had been evolved some specific rules such as, prohibition of all fireworks, no access to VCF without prior permission of the management committee, new plantation by the members every year etc.

#### 4 CONCLUSION

The study confirms that the community based approach with application of indigenous knowledge in Komolchari VCF is a successful adaptation approach to climate change for conserving water resources especially. The findings of the study highlight the application of local knowledge to protect the density of VCF, available fauna and supply of water resources. All of the findings revealed that, Komolchari VCF had a good approach of community based adaptation to conserve water resources through protecting forest density and for this, availability of other forest products were also increasing. People of this area were getting engaged with alternative livelihoods to reduce pressure on forest products. They were also following own rules and regulations to ensure sustainable management of forest and water resources. To cope against water scarcity in hilly areas, all these practices can help to increase the abundance of natural resources, water availability and can be contributed in enhancement of production and economic activity.

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