

Original Article

WATER CRISIS AND ADAPTATION STRATEGIES BY TRIBAL COMMUNITY: A CASE STUDY IN BAGHAICHARI UPAZILA OF RANGAMATI DISTRICT IN BANGLADESH

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Abstract: Water crisis under changing climate is one of the major environmental challenges in Bangladesh. Tribal communities of Chittagong Hill Tracts (CHTs) have been suffering from water scarcity since long. This study aimed to identify the available water sources, extent of water scarcity and traditional adaptation practices to cope with water scarcity in hilly area of Bangladesh. This study was conducted by face-to-face interview using a structured questionnaire in 6 villages of three union of Bagaichari upazila which were selected through stratified random sampling method. The main sources of water for drinking, domestic use and irrigation were river, streams, dam over streams (*Godha*), very small stream (*Thagalok*), well dug on hill bottom (*Shilaw hoo*), springs, big dug well, tube-well, ring-well, river, and pond. In every year December-April is the dry and water crisis period. To overcome the severity, people built small dams (*Godha*) to raise water level and use in irrigation and domestic purposes. For drinking water maximum 42% people dependent on *shilaw hoo*. For domestic purposes 38% households dependent on streams and 65% dependent on *Ghoda* for irrigation water. Tribal people of the study area have to walk a long hours to collect water from sources located about 1-2.5 kilometers away from the settlement with

earthen or plastic buckets sized 10 to 15 liters. Water crisis was found in severe condition since last 5-10 years. Before that water was available in hilly region. Maximum people (89%) reported deforestation as the main reason of water crisis. This study suggests both government and non-governmental professionals to foster local communities' adaptation capacity against the water scarcity in *Bagaichari* upazila. This study will play a vital role to take relevant adaptation policies both by the policy makers and practitioners.

Key words: Tribal, Chittagong Hill Tracts, water crisis, adaptation strategies, deforestation.

1. Introduction

Water is an important element of environment. People need water for drinking, washing, cooking, planting and many other uses. About 97% of the earth's water is in the ocean and unfit for human consumption because of its high salt content. Of the remaining 3%, 2% is locked in the polar icecaps and only 1% is available as fresh water in rivers, lakes, streams, reservoirs and ground water which is suitable for human consumption (De, 2003). Over 98% of available global fresh water is stored as ground-water in the saturated zones within pores and fractures in rocks (Hiscock, 1994).

Bangladesh is a developing country with rising population, increased crop production and economic growth. During dry period, it needs 147 BCM (billion cubic meters) water in the country but only 90 BCM is available. This 40% deficit leads to drought in some regions (Bangladesh, 2007). Chittagong Hill Tracts is the region where water scarcity is major problem (Kabir and Faisal, 1999). During water crisis period people of the hill tracts collect water and use without filter resulting various water borne diseases such as diarrhea, cholera, typhoid, boil etc. According to World Water Organization (2010), safe drinking water and freshwater are imperative for development and public health since 21 of the 37 primary diseases in developing countries are related to water and sanitation. Many children and women are died in every year in CHTs due to water borne diseases. They don't get medical facilities for treatment because of unavailability of clinic and hospital otherwise communication facilities are very poor. However, during crisis period they adopt some adaptation measures to cope with the water crisis situation.

Bagaichari upazila is very remote area of *Rangamati* District near the Indian border. The communication systems are very poor here. Consequently the government and non-government agencies do not get proper information regarding water crisis. People of this upazila are suffered from acute water crisis every year. Increasing population day by day and deforestation through various means including shifting cultivation caused reduction of water flow in the natural water sources and had created water scarcity. Every year the ground water level seems to be drowned deeper level due to indiscriminate loss of forest cover. The people mainly suffer from drinking water in dry season. Water is a vital factor for high yield. Since people started growing more crops in the hills and valleys round the year, they are facing severe water scarcity and farmers cannot produce their crops properly. As a result they depend on forest for their livelihood. People are facing a lot of problems collecting sufficient water due to less availability of tube well. In some areas, women need to carry water from a long distance from well, stream, tube well to their homes during the crisis period. As the ethnic groups of *Bagaichari* upazila of CHTs facing severe water scarcity, but information regarding the water crisis and relevant adaptation capacity of the local people is scarce, so, this study was undertaken to identify the available water sources, extent of water scarcity and traditional adaptation practices to cope with water scarcity in the study area.

2. Materials and methods

Background information of study area

The study area *Baghaichhari* was selected purposively considering the water scarcity faced by the local peoples which was covered by several daily newspapers. Stratified Random Sampling method was followed. At first, three unions from *Baghaichhari* upazila and two villages from each union were selected through random sampling (Table 1). For interview six individuals from each village were selected randomly.

Baghaichhari is the largest upazila of *Rangamati* district covering an area of 1931.28 sq. km. The upazila is bounded by Tripura and Mizoram on the north, *Langadu* upazila on the south, Mizoram on the east and *Dighinala* upazila on the west. Main rivers are *Kachalang*, *Shijakh*. The upazila was established in 1965. Now, it consists of 7 Union Parishads, 19 mouzas, 178 villages. 75% people of this upazila are tribal 93% of these tribal are Chakma, whereas Tripura, Pangkuya and others casts constitute 7%. This upazila has one river named *Kasalong* which is originated in Mizoram and most of the people here dependent on the River for water for household use and irrigation purposes. Pump machines are used to draw water for the irrigation of agricultural fields.

Data collection

A structured questionnaire was designed for collection of data through interviewing the inhabitants of the study area. It was designed based on questions relating to main water crisis, available water sources and their adaptation practices in dry season. At first reconnaissance survey was done to collect primary information in the study area. Preliminary information about the available water sources, water scarcity, communication networks and systems were collected from the unions and villages. Help was taken from a local field guide from each village. The questionnaire was tested at that time to check field applicability and necessary adjustments were made based on the field situation. Then the main interview was done in the same villages which were visited during reconnaissance survey.

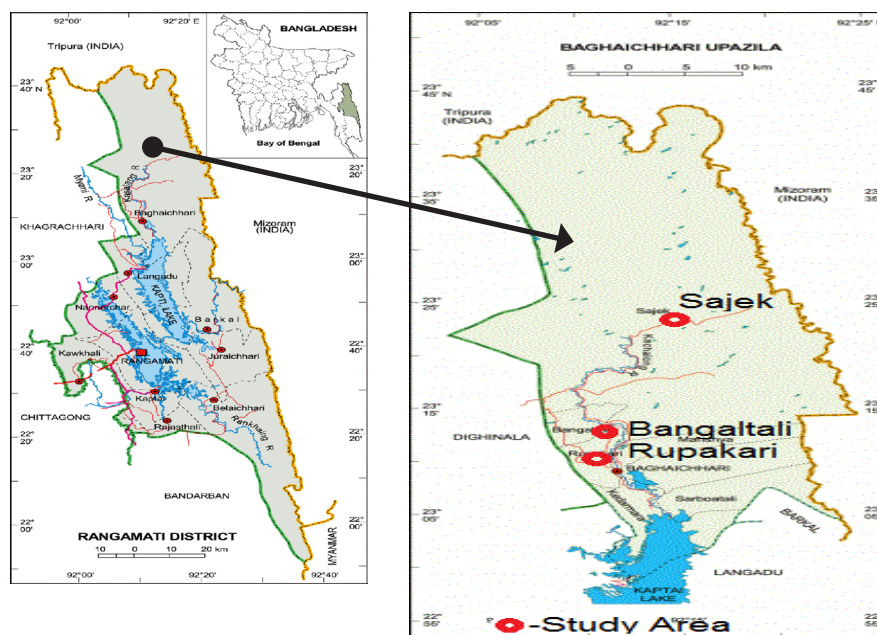


Figure 2.1

Figure 1. Location and map of Baghaichhari upazila showing study areas.

Secondary data and relevant literature were reviewed related to water scarcity, water harvesting practices, various water borne diseases etc. Data were collected from published research papers, websites and reports of various projects conducted by government and non-government organizations. Primary data were collected through personal interview using the designed questionnaire. Data related to earthen size, daily water requirement, distance of water sources, seasonal availability of water, adaptation practices, reasons and historical perspective of water scarcity from the interviewer were collected.

Table 1. Selected unions and villages from Bagaichari upazila for study.

	Union	Village	No. of Respondents/ households	Total
Bagaichari Upazila	Bangaltali	B. Block	6	36
		Dulubannya	6	
	Rupakari	Boradam	6	
		Golachari	6	
	Sajek	Vei-bon Chara	6	
		Nandaram	6	

For data collection, available sources of water for drinking, domestic or household uses and irrigation in the crop lands were found out. Daily requirements of water for drinking, domestic or household purposes were also explored. The distances of different water sources i.e. well, stream, tube well, *thagolok*, *shilaw hoo*, pond, lake etc. from respondents' houses in different seasons were also revealed through questioning of respondents. Information were also collected about seasonal availability of water, various water borne diseases suffered by different family members, frequency and duration of the water borne diseases, adopted treatment, and respective cost incurred for treatment of the diseases. Present study also focused on traditional or indigenous adaptation practices practiced by respondents of the study area in dry season. A historical perspective of water availability was tried to found out by taking data for previous 5 years, 10 years and 15 years along with present data. Finally a comparison between previous and present data was made. The data obtained through questionnaires were compiled in Excel2013 for analyze and to get final result.

3. Results and discussion

Socioeconomic information about the respondents

The respondents were from different occupation. Among them maximum (56%) were farmer followed by job holder (22%), women (14%) and businessmen (8%). The respondents interviewed were adult and age ranges from 25 to 60 years. Family members of the households ranges from 4 to 10 members containing nuclear and joint families (table/figure??).

Available sources of water

The available water sources found in the study area were tube-well, ring-well, spring, *Chara*(stream), *Shilaw hoo*(well dug on hill bottom), well, river, pond, *Ghoda* (dam over stream), *Thagalok* (very small stream) and rainfall. Almost all the households use rain water for both drinking and domestic use purposes. During rainfall no irrigation is needed in the crop lands. Maximum households (42%) depend on *Shilaw hoo* for drinking water followed by tube-well (27%) and *Thagalok*(18%). In case of domestic use i.e. bathing, washing

and cooking etc. water was collected from streams, tube-well and river by 38%, 17% and 17% households' respectively. During dry period farmers collected water for irrigation from Ghoda (65%) and adjacent rivers (35%) (Figure 2).

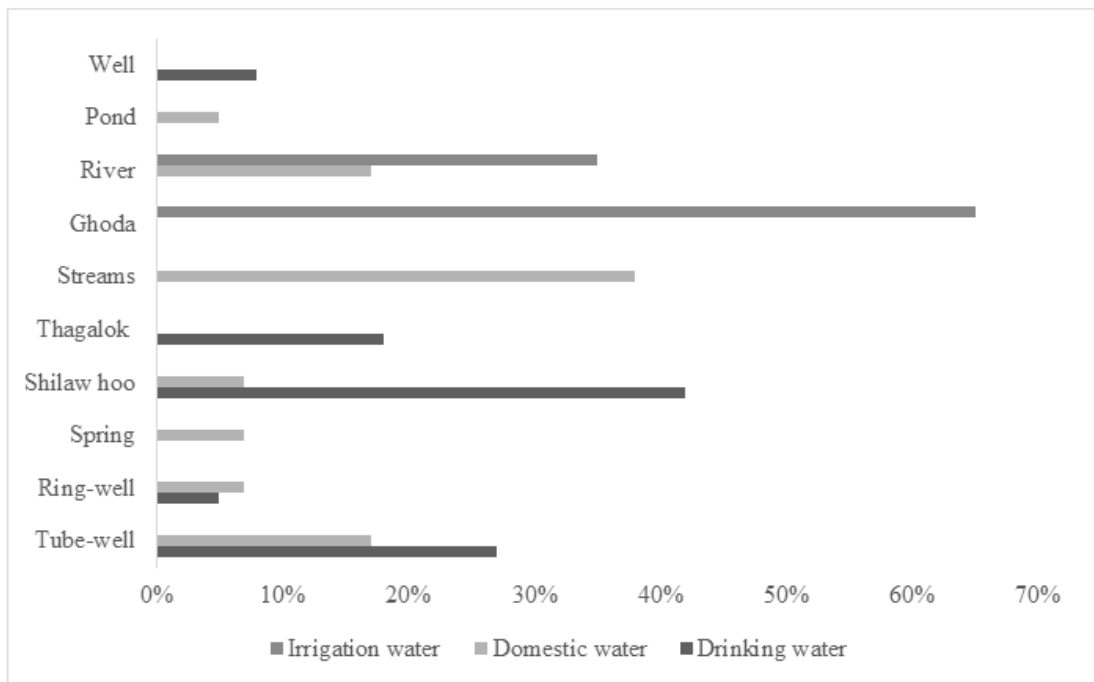


Figure 2. Peoples' dependency on various water sources for drinking, domestic and irrigation purpose.

Water availability period and main sources of drinking water

The availability of water was measured through scoring it from 1 to 5, where, 1 represents water scarcity, 2 for moderate-scarce water, 3 for moderate water availability, 4 for available-moderate water and 5 for available water. According to the respondents score following water availability chart it is found that during May to October water remain available due to monsoon rainfall. In the months from December to March the water became scarce for all purposes due to dry condition. The research revealed that during water scarcity period people collect drinking water from tube-well, *Shilaw hoo* and *Thagalok*. The study also indicated that, both in *Sajek* and *Bangaltali* union *Shilaw hoo* is the main source of drinking water during water crisis period where 50% people (respectively) collect water from it. In *Rupakari*, Tube-well is the main source of drinking water and 58% people dependent on it during dry period (Figure 3).

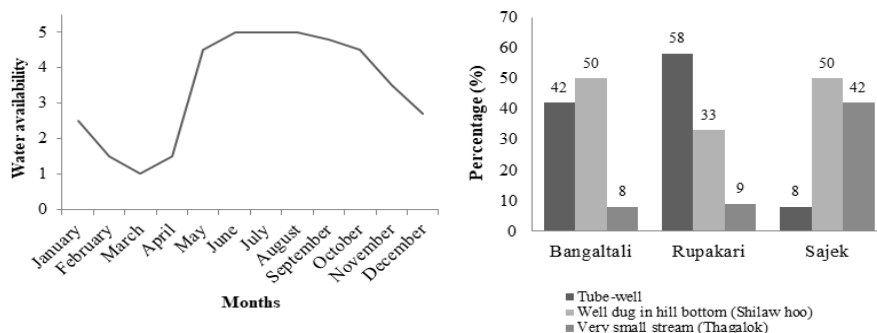


Figure 3. Seasonal water availability (left) and Main sources of drinking water (right) in Bagaichari upazila during water crisis period.

Water crisis faced in Bagaichari upazila

The study revealed that, in average 70% households living in the remote areas of *Bagaichari* are suffered from water crisis. It is due to drying out of the natural pure drinking water sources and insufficient number of tube-wells. Most of the families (92%) suffered from water crisis in *Sajek* union. In *Bangaltali* union 67% families faced water crisis in the dry season and in *Rupakari* union it was 50% (Figure 4). Water crisis found comparatively lower in *Rupakari* union. After analyzing data it was found that in this union number of service holders was comparatively higher than other two unions that enabled them to install tube-wells.

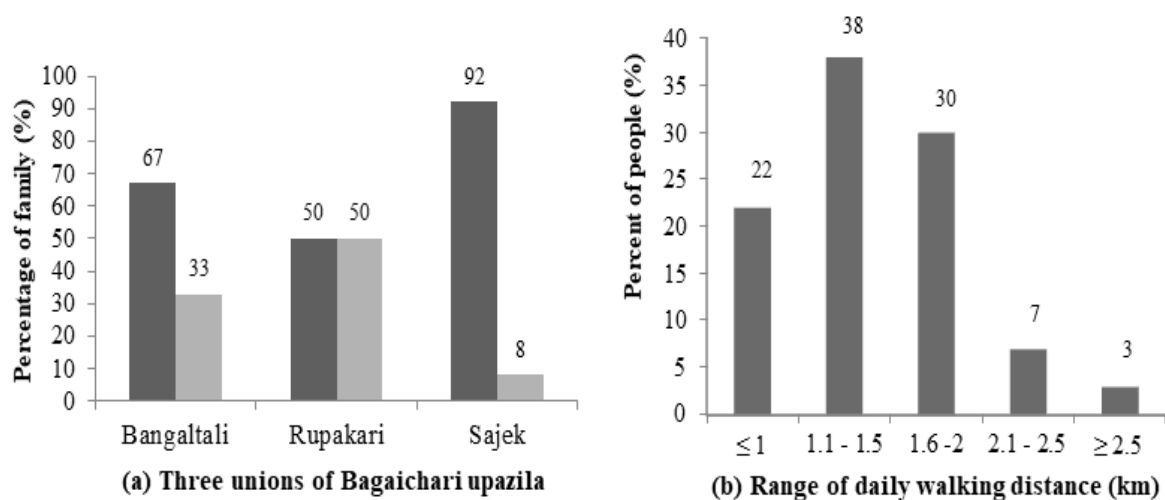


Figure 4. (a) Households (%) suffered from water crisis;
(b) people (%) walked different distances every day to fetch water

Adaptation techniques adopted by ethnic families during crisis period

The ethnic people face severe pure drinking water crisis in dry season especially from January to April. Most of the water sources become dried during December-April. Very few *shilaw hoo* and *thagalok* contain water at that time. The people of *Bagaichari* upazila have to fight with the pure drinking water in dry season. The tribal people maintain the forest cover near the well or stream to get the drinking and domestic water in dry season. They maintain the *ghoda* or dug well for irrigation purpose. They use it as a means of keeping the water cool.

In the study area, a remarkable number of people usually had to fetch drinking water from remote natural water sources. They exited early in the morning from house to fetch drinking water. The results of the study indicated that 38% people had to walk from 1.1 to 1.5 km for collecting water followed by 1.6 to 2 km (30%). There were some families (7%) found living in the remote hills who had to walk from 2.1 to 2.5 km daily to fetch water (Figure 4). Some people used to harvest rainwater and store in water reservoir for future use. Reduced use of water also found another strategy mentioned by some respondents.

Extra time spent for bringing water

It is clear from the results of the present study that, the tribal people specially women spend most of their time to bring water during dry period. In *Sajek* union, people have to walk an average of 1.3 km more path to fetch water during water scarce season than that of water available season. People of *Rupakari* union have to walk 0.5 km more in water crisis time and in *Bangaltali* union it is 0.9 km more than that of non-crisis period. The result of the study revealed that people need at least 1 more hour in average to bring drinking water and ½ an

hour to collect water for domestic purposes. Among three unions, people have to walk more distance in *Sajek*, and hence spend more time in comparison to others unions (Figure 5).

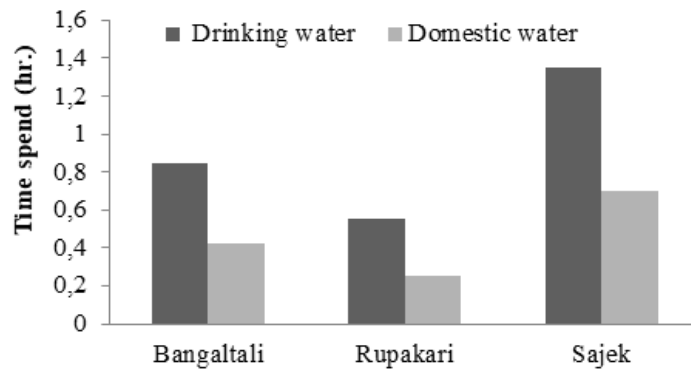


Figure 5. Extra time (hr.) spend to fetch drinking and domestic water in dry season.

Historical perspective of water availability in dry season in the hilly areas

Peoples' opinion about the water availability in the previous years was gathered through interviewing to get the idea about its historical perspective. The local people opined that the water status was very good at 15 years ago in this hilly area. Water from different natural sources was good in terms of availability as most of the respondents mentioned water was available or moderately available at that time (Table 2). There was no need of tube-wells at 15 years ago but now it is moderately needed and available in the study area. Total forest cover is destroyed due to increasing population and demanded decreased rotation of shifting cultivation. As a result, the infiltration rate is declined and surface runoff water increased due to lack of forest cover. The tribal people said that all of the water sources are in bad condition except tube-well. From their opinion some of the water sources were in medium condition still before 10 years ago (Table 2).

Table 2. Percentage of historical availability of water in dry season at Bagaichari upazila.

Source of water	Present status	5 years back	10 years back	15 years back
<i>Shilaw Hoo</i>	Scarce (100%)	Scarce (100%)	Scarce (80%) Moderate (20%)	Available (60%) Moderate (40%)
<i>Chara</i>	Scarce (100%)	Scarce (100%)	Scarce (60%) Moder- ate (40%)	Available (67%) Moderate (33%)
<i>Normal Hoo</i>	Scarce (100%)	Scarce (100%)	Scarce (67%) Moderate (33%)	Available(50%) Moderate (50%)
<i>Thagolok</i>	Scarce (100%)	Scarce (100%)	Scarce (63%) Moderate (37%)	Available(63%) Moderate (37%)
<i>Spring</i>	Scarce(100%)	Scarce (100%)	Scarce (79%) Moderate (21%)	Available(64%) Moderate (36%)
<i>Tube-well</i>	Moderate (100)	Moderate (100)	Scarce (100)	Scarce (100)

Reasons behind water crisis

Deforestation was found the common reason for water crisis in *Bagaichari* upazila. About 89% family reported about that. From the perception of 55.5% family, practice shifting cultivation indiscriminately is another reason of water crisis (Table 3). Actually it is an indirect reason of water crisis as it caused forest cover loss in the hilly terrain and induced deforestation.

Table 3. Peoples' perceived reasons of water crisis in Bagaichari upazila.

Union	Village	De-forestation (%)	Shifting cultivation (%)	Soil erosion (%)	Insufficient precipitation (%)	Insufficient tube-well (%)	Poverty (%)
<i>Bangaltali</i>	B. Block	83	67	33	67	55	67
	Dulubanya	100	83	17	50	67	50
Rupakari	Boradam	100	50	17	83	50	50
	Golachari	100	67	33	67	45	67
<i>Sajek</i>	Vei-bon Chara	67	33	17	67	67	45
	Nandaram	83	33	17	50	83	55
Average in Bagaichari upazila		89	55.5	22	64	61	56

Soil erosion is happening due to the loss of forest cover. It reduces the infiltration rate through the seepage. It is another cause of flood and flash flood. About 22% families think that, soil erosion is the reason of water scarcity. Insufficient tube wells were another important issue in *Bagaichari* upazila and 61% respondents thought that water crisis occurred due to insufficient tube wells. Poverty is one of the main issues as it provokes people to depend on forests for their livelihoods and 56% family agreed with it as the indirect issue to create water scarcity during dry period. Due to climate change the rain fall rate is also reduced in the hilly areas that create water crisis too.

4. Conclusion

This study ended with some important findings concerning the available sources for drinking, domestic and agriculture water, extent of water crisis and respective traditional adaptation practices. The result of the study revealed that water scarcity is increasing day by day and from peoples' perception it is found that the mother cause of water scarcity is loss of forest cover. Moreover, deforestation induces other causes like shifting cultivation, reduced surface runoff, reduced water table, soil erosion etc. To cope with water crisis during dry season people adapted some strategies by building dam on streams, digging wells or ponds. But with loss of forest cover the water table lifted down and causes minimum or no water flows in natural water sources. Increase of forest coverage through assisted natural regeneration, afforestation and reforestation could uplift the ground water table, slow down surface runoff and increase the water availability in the natural water courses, thus reduce water scarcity in the hilly region.

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