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Impact of Water Scarcity on Domestic Water Use in Drought-prone Barind Tract, Bangladesh: A Sociological Perspective

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ABSTRACT

The Barind tract (northwest part of Bangladesh) is facing the prevailing disaster of drought due to extreme climatic conditions, including low rainfall. This research attempts to measure the character of the domestic water crisis and the adaptation capacity of the drought-affected Barind people. It also investigates the impact of climate-induced water scarcity on the socioeconomic livelihood of respondents in two villages of the Tanore sub-district in Rajshahi district, which is the most drought-prone area in the Barind tract. In the study area, face-to-face interviews (n = 246) through a structured questionnaire with the respondents of two villages were conducted in an affable environment to collect primary (quantitative) data. In-depth interviews were also conducted with two farmers to collect qualitative data for the study. So it is mixed-method research. All the gathered data were examined using Atlas TI, SPSS, and GIS software. The results of this research show an extended scenario of excessive use of groundwater for domestic purposes due to water table depletion. It presents a portfolio of the sufferings of domestic water users in the study area, not only during the load-shedding period but also during the lack of technical support. Few people are bound to use more contaminated pond water for applying artificial fish feed. Poor inhabitants who depend on others for domestic water are facing more critical conditions due to the inability to install deep-tube wells at a higher cost. As a result, people need to move further away to collect fresh groundwater for domestic use.

INTRODUCTION

The Barind tract is characterized by less rainfall and higher temperatures compared to other parts of the country (Hasan et al., 2020). Various surface water sources, such as ponds, rivers, and other surface water sources in this part, become dry owing to the high rate of evapotranspiration during the summer season, which creates a crisis in the drinking and domestic use of water (Habiba et al.,2011; Shakil et al.,2020). Monsoon rainfall and flooding are mainly used for groundwater recharge in Bangladesh. Barind is located in a flood-free zone owing to the high elevation of this part. Rainfall is the main source of groundwater recharge in this part, but the lowest volume of rainfall is received in the northwestern area of Bangladesh, and the Barind has become a seriously drought-affected area (Hasan et al., 2018).

One of the most visible effects of climate change is drought. Drought has received the least attention among all of these calamities in Bangladesh's disaster literature (Ahmed et al., 2014; Rahman et al., 2016). Furthermore, the thick, viscous clay surface of the Barind acts like an aquitard, hampering the process of groundwater recharge and increasing surface drying (Rahman & Mahbub, 2012). The economy of the Barind region relies mostly on agriculture, domestic animal rearing, and fish farming. Approximately 82% of the participants in the study participated in these occupations, where agronomy took up a significant percentage (Kamaruzzaman and Huq, 2020). Drought is a dangerous climatic natural disaster that collectively creates hazards for the environment, agriculture, and socio-economic conditions, resulting in serious destruction and influencing

more people than any other type of natural disaster (Rahman et al., 2017). Some examples are drying up ponds and natural water sources; inactive shallow depth tube-wells; arsenic-contaminated groundwater; etc. The interconnection among socioeconomic development, water scarcity, and environmental deterioration has become gradually dangerous (Ali et al., 2012).

The north-western part of Bangladesh is covered by 7,770 sq km of land and comprises the greater Rajshahi, Rangpur, Pabna, Dinajpur, Bogra, Naogaon, and Joypurhat districts of the Rajshahi division (Banglapedia, 2021). This northern part of Bangladesh is called the Barind tract Pleistocene deposits mainly covered Bangladesh's north-western region (Morgan & McIntire, 1959; Ali et al., 2012). The Barind tract is categorized by two different landforms: (a) the Barind tract and (b) the floodplains (Jahan et al., 2015). The northwest part of Bangladesh is known for its typical red and yellow clay soil, limited rainfall, and shortage of water resources in the dry period of the year (Hossain et al., 2022; Hasan et al, 2013). Owing to clayey, semi-permeable, and impermeable Barind clay with massive surface runoff, the high Barind tract is characterized by lower infiltrations (Hasan et al., 2012).

Water scarcity is the situation of a water crisis and the shortage of supply of water compared to the demand due to the non-availability of water for existing lives in the world. According to the United Nations, the world population is expected to peak current 8 billion to 9.7 billion in 2050 (United Nation) and 70% more food will be needed to feed this increasing population (FAO, 2009). It is assessed that 2.7 billion people in the world were affected by droughts directly, leading to an assessed 11.7 million deaths (UNDRR, 2021). Water is one of the scarce resources in the southwestern and northwestern regions of Bangladesh during the drought season due to insufficient annual rainfall (Hossain & Siddique, 2015). The main source of irrigation is groundwater in the northwestern districts of Bangladesh. For irrigation and other purposes, people in this region bound to use ground water. Due to over overmining of groundwater becomes exhausts the groundwater table roughly (Hasan et al., 2018; Kamaruzzaman and Huq, 2020).

The specific objectives of this research are: (1) To study the sources, nature, and consumption patterns of domestic water in the study area; (2) To explore the adapting strategies of people to face the crisis of domestic water.

MATERIALS AND METHODS

At the start of the study, the existing literature, such as newspapers and articles, was reviewed. By studying the literature, research gaps and ideas were found. An investigational survey was implemented in Tanore Upazila (sub-district) of Rajshahi district to inquire about the scenario of drought-affected areas appropriate for directing the case study. Mixed methods have been used in this study. The data collection methods were interviews, scheduled with a structured questionnaire for quantitative data. Other data collection techniques for the qualitative part of the study were observation, in-depth interviews, and focus group discussion (FGD). A well-organized interview schedule was also developed to analyze the scenarios of the sources of domestic water, the availability of domestic water use, the storage of domestic water, the collection of time, the collection of remoteness, the process of adaptation during the domestic water crisis, and ideas to resolve the crisis. Questionnaire surveys were sent to 246 households. All data were collected from two different communities (Bangalee and Santal). Quantitative data were analyzed using Statistical Package for Social Science (SPSS) software. Qualitative data were examined using Atlas TI software.

This research was conducted in two specific village communities named Harishpur and Jhinaikhoir in Badhair Union, which are situated under Tanore Upazila of Rajshahi district in northwestern Bangladesh (Figure 1). The study area named Tanore sub-district in Rajshahi covers a part of about 295.40 sq. km., with a population of 191323. The Tanore sub-district is placed between 24°29' and 24°24' north latitudes and 88°24' and 88°38' east longitudes (USGS, 2021). The respondents from the two villages in the Tanore Upazila of Rajshahi District were randomly selected. The groundwater level remains very low, creating more hazards for groundwater mining due to the highland elevation in this part. The sample size of the study is 246. Among these 246 respondents, 165 were selected from the Bangalee

community and 81 were selected randomly from the Santal community to conduct the research. According to the report (BBS, 2011), in two selected study villages, around 418 households have a total population of 1696, of which about 48% are male and about 52% are female. Most of the inhabitants are Bangalees, and the rest are tribal people belonging to the Santal community. The majority of the Santal people are illiterate, landless, and below standard.

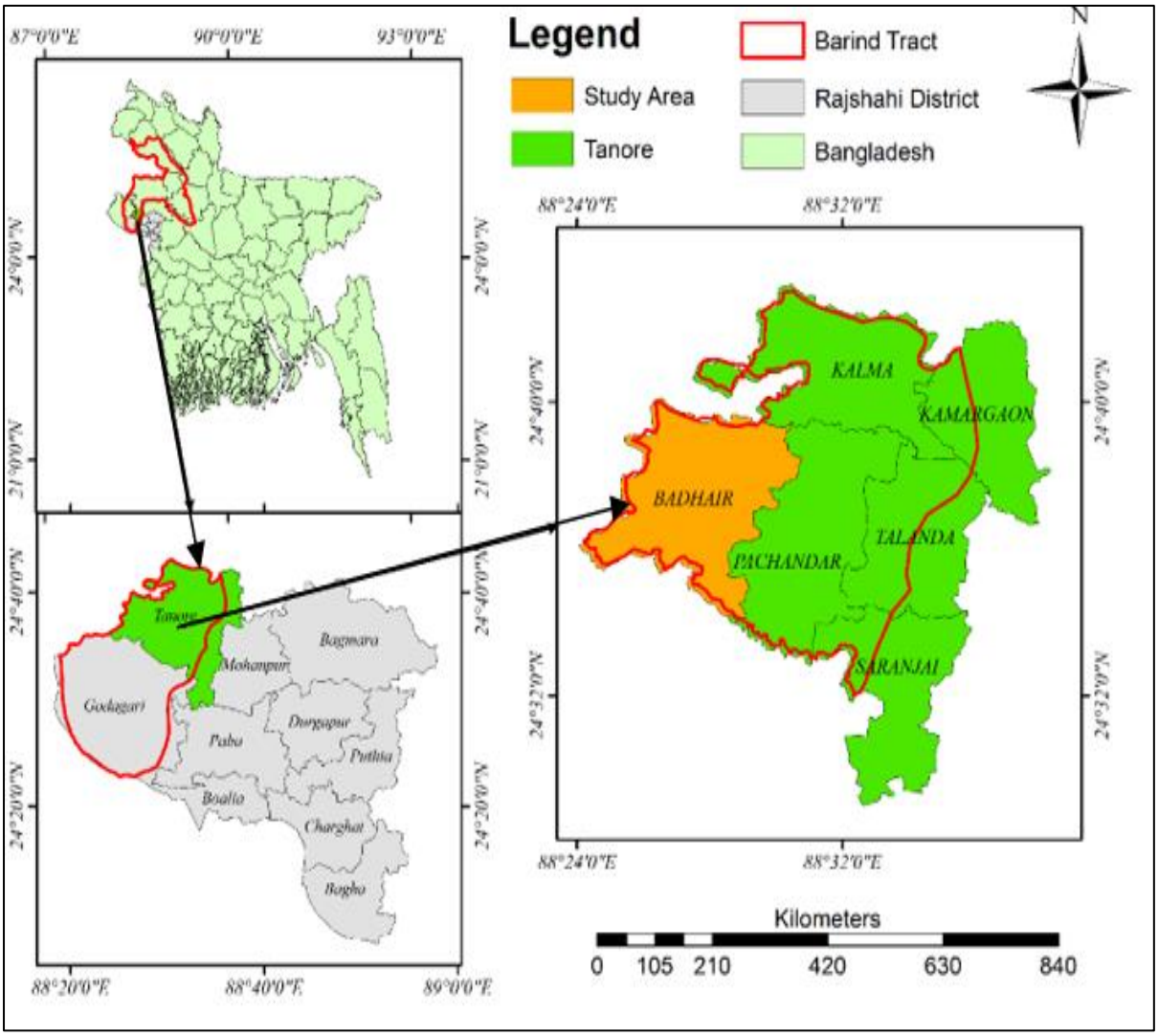

Figure 1. Tanore sub-district in Rajshahi of Bangladesh (Source: GIS Software).

RESULTS AND DISCUSSION

This research has attempted to draw a scenario of the domestic water crisis in the two villages (Harishpur and Jhinaikhoir) of the Tanore sub-district, structured on the following three indicators. These three indicators are (1) Sources and accessibility of domestic water; (2) Uses and consumption of domestic water; and (3) Adapting processes for domestic water preservation.

Sources and Accessibility of Domestic Water

People in the research area rely completely on deep tube-well water and pond water to fill up their domestic water needs. Therefore, 100% people of the villages depend on deep tube-well water to meet their drinking needs (Table 1). Because the shallow tube-wells and dug-wells are dried up due to depleting groundwater levels.

Table 1. Sources of Drinking Water

Source	Frequency	Percent
Deep tube-well	246	100
Pond	0	0
Sink	0	0
Khari (canal)	Not use	-
Total	246	100.0

Table 2. Sources of Bathing Water

Source	Frequency	Percent	Cumulative Percent
Deep tube-well	151	73.5	73.5
Pond	57	23.2	96.7
Sink	08	3.3	100.0
Khari (canal)	Not use	-	-
Total	246	100.0	

Above 70% of villagers in the study area mostly depend on deep tube wells to meet their bathing and cooking demands. There are very few ponds and sinks for domestic water in the villages. In the Harishpur village, there is a Khari (small-sized canal) in which water is used very little in crop production during the monsoon and dried up during the summer.

Table 3. Sources of Cooking Water

Source	Frequency	Percent	Cumulative Percent
Deep tube-well	174	70.7	70.7
Pond	66	26.8	97.6
Sink	06	2.4	100.0
Khari (canal)	Not use	-	-
Total	246	100.0	

Some of these shallow-depth ponds in the study village are contaminated. Some of these are not capable of use due to the regular practice of artificial fish feed. So, the villagers no longer use pond water for bathing and cooking needs. (Table 2 and Table 3). Some people are not able to install their own deep tube-wells due to a lack of money. In this situation, they have no choice but to fill up their daily water crisis through their own capability. Above 42 % of the respondents travel on foot to the farthest deep tube-wells to fill up their domestic demand daily (Figure 2).

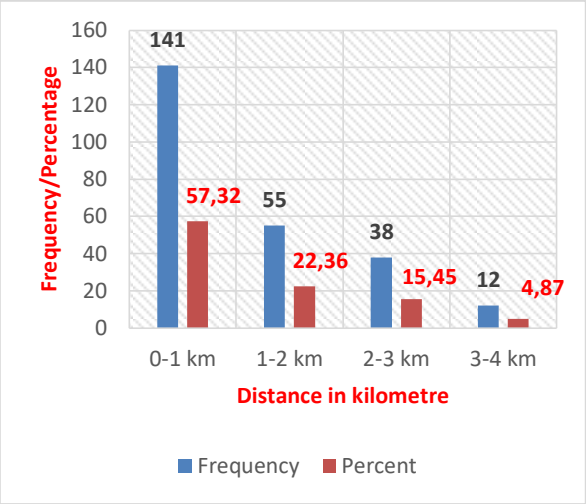

Figure 2. Distance of Deep Tube-well Water Collection

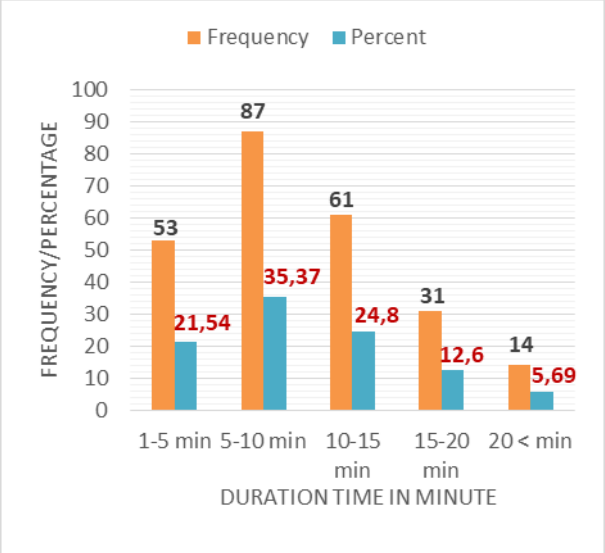

Figure 3. Duration of deep tube-well water collection

Every day, 35% of the people in the community spend 5 to 10 minutes collecting domestic water. Above 43% of the people were found to have spent more than 10 to 20 minutes collecting domestic water from deep tube-well (Figure 3).

Table 4. Sources of Rearing Cattle Water

Source	Frequency	Percent	Cumulative Percent
Deep tube-well	161	65.4	65.4
Pond	61	24.8	90.2
Sink	24	9.8	100.0
Khari (canal)	Not use	-	-
Total	246	100.0	

Uses and Consumption of Domestic Water

The consumption level of domestic water among the respondents in the study area is increasing day by day due to population growth. The water consumption problem per person has been increasing much faster than population growth (Finance, 2016).

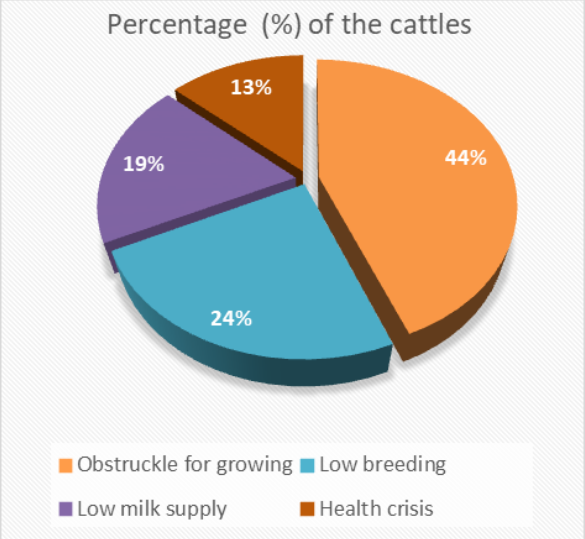

Figure 4. Obstructions on domestic animals for water scarcity

The consumption of domestic water varies from a minimum of 5 pitchers to a maximum of 20 pitchers per day, conserved in big drums. For example, the daily demands of the respondents are higher during the hot summer season than any other season for other purposes like cattle rearing and producing crops. The domestic water demand is remarkable. 65% of the people in the community were found to use deep tube-well water for rearing domestic animals (Table 4).

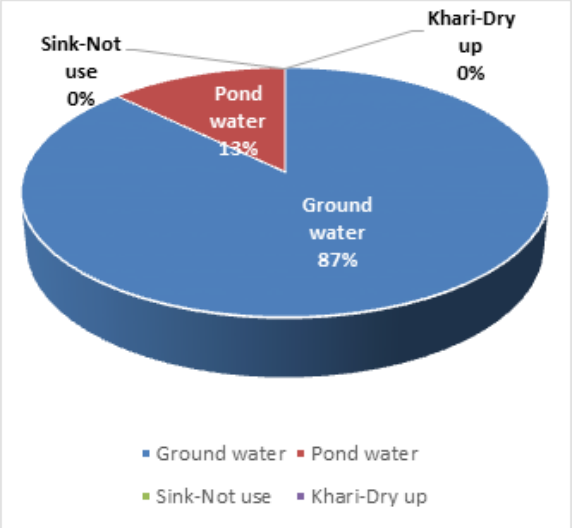

Figure 5. Source of water for agricultural production during the dry season

According to the respondent, 44% of domestic animals are affected in terms of their normal growth, and the rest of them are also affected in terms of low breeding, low milk production, and various health crises due to daily water scarcity (Figure 4). At present, people are affected by various water-borne diseases such as diarrhea, fever, dehydration, heatstroke, etc. due to the use of contaminated pond water for their daily activities during the load-shedding period. Cattle are also affected by various diseases, such as heatstroke, badla, and dehydration. Due to drought, rural communities suffer from scarcity of drinking water and shortages of food for cattle, all of which have harmful effects on health, nutrition, education level, hygiene status, and the safety of women and children (Crumbles, 2015). During the dry season, 87% of farmers in the villages totally use groundwater for agricultural activities, and very few farmers use pond water to produce vegetables beside their houses (Figure 5). Villagers have no alternate source for producing crops. They are left with hardly any work and have no choice but to migrate for other livelihood options. Fish farming has become impossible due to shallow-depth ponds.

Figure 6. Inactive/Abandoned sink, tube-well, and dug-well

The poor, landless, and more deprived people of the societies victimize underlying income security (Rauf et al., 2017). Day by day, food production in the region is under threat. In developing countries from 2005 to 2015, more than 80% of drought-induced economic damage and loss was suffered in terms of livestock, crops, and fisheries (Denchak, 2019) The surface water sources are gradually drying up due to faster evapotranspiration, water level depletion, and high temperatures (Figure 6). The contaminated pond water is difficult to use for domestic purposes. In this situation, the respondents create more pressure on groundwater and create a risky scenario, such as over-mining groundwater. In Bangladesh, drought is a slow-onset natural disaster that has become more frequent in the past few years. (Habiba et al., 2011). During the high level of load shedding in Palli bidyut, the respondents in the study area go beyond the tolerable limit for the domestic water scarcity in the dry period. The visible observation of dried-up surface water and over-depleting groundwater shows an unpredictable drought condition that has made the villages unlivable places. For this reason, the people of the study area may be forced to migrate as refugees in the near future. It is expected that about 1800 million people will live in countries or areas with shortages of water in 2025 (Denchak, 2019; FAO of the United Nations, 2015).

Adapting Process for Domestic Water Preservation

In the past, people in the research area used pots, and mud pitcher pitchers for preserving water daily. But now, due to a greater scarcity of water, they use various storage systems daily such as; mud pitchers, silver pitchers, cooking pots, plastic pots, plastic bottles plastic buckets, and drums (Figure 7). Some storage systems are covered, and some are opened which are not secured for human beings.

According to respondents; they had no alternative source of electricity. So, they struggle with their daily water demand and try to maintain their consumption level at a minimum to manage the condition during load shedding. To handle this critical moment, respondents preserve water in a drum or pot to meet their daily domestic use. People collect the water three to four times daily. So, it is measured by the observation that the consumption rate decreases due to distant water sources during the summer season. People mentioned that sometimes they had no drop of water to satisfy their thirst in a crisis moment during the summer season.

Figure7. Daily Preserving Pots for Domestic Water

Qualitative Findings from In-depth Interview

In the in-depth interviews, two farmers were asked to find the causes and impact of the problem of water scarcity on domestic water use in the drought-prone Barind tract. They described some causes and impacts from their perspective, which is given below through the themes and sub-themes. A content analysis was performed to develop the themes and subthemes.

1. Causes of Water Scarcity in the Barind Tract

High installment costs of deep tube wells

Respondents told me that the installation of deep tube wells is a very expensive one. Most of the

villagers are lower-income people who cannot install their own deep tube-well due to the high cost. Due to their poverty, they depend on their nearer or sometimes distant neighbors, NGOs, and the government to meet their daily needs. They have no other option to fulfill their daily demand. Because the maximum amount of pond water is shallow, it is polluted, and the rest of it is runoff.

Highly expensive deep tube-well water

According to the first participant, they access deep tube-well water in exchange for money. On the one hand, fertilizer, seeds, and labor prizes are high; on the other hand, they pay for deep tube-well water in the agricultural producing sector at 65 taka per hour. Access to water depends on money. Due to the cost of deep tube well water increasing in such a way, recently some farmers have shown their interest in producing other crops like wheat, maize, potatoes, lentils, mango, and others in the event of a water shortage. The second participant identified that he gets water through a 2.5-inch pipe with an exchange rate of 150 taka per hour. He cannot bear it without drawing a loan with compound interest.

Insufficient technical support

According to the first participant, sometimes the deep tube well is inactive due to disturbed machinery, and they cannot find the technician easily within two or more days. As a result, they face scarce water for their domestic basic needs such as drinking, cooking, maintaining hygiene, bathing, and livestock management.

Lack of proper knowledge

The interviewee (first) stated that most of the villagers' lives are below standard and their educational level is also very poor. As a result, villagers do not cope with their daily scarcity of water due to their lack of knowledge. They also lack knowledge about the practice of using and preserving rainwater. The yearly rainfall of this part is less than the average rainfall record of the country (Mohsenipour et al., 2018). They do not know how to preserve water for future use. Due to the shortage of knowledge among most of the farmers, they practice high delta crops, which require more water than any other crop. The reason for this water scarcity was the growth of high delta crops and a lack of crop knowledge among the farmers, which led to the over-irrigation of crops (Kakar et al., 2018).

The lower layer of groundwater

The interviewer (second) stated that villagers have severely faced drought hazards due to hot weather and extreme climatic conditions, including less rainfall. According to the climatic pattern, the study area takes place in a dry, humid zone, where the average yearly rainfall diverges between 500 mm and 2100 mm (Uddin et al., 2017). Water is a vital component of the planet, and water resources are intricately connected to climate change dynamics (Bates et al., 2008; IPCC, 2014). Climate change is projected to reduce renewable surface water and groundwater resources significantly in most dry subtropical regions (high agreement, robust evidence) (Hohenthal & Minoia, 2017). Due to the high elevation of Barind, it is located in a flood-free zone (Rahman & Mahbub, 2012). So, they cannot reach a layer of groundwater easily. As a result, they have to pay the cost of getting water from such low-level groundwater. If they habituate themselves to deep tube wells in such a way, this problem will gradually increase instead of decreasing. All these factors are creating pressure on groundwater storage, which has been declining at an alarming rate (Islam et al., 2020). As a result, they have to pay the cost of getting water from such low-level groundwater. If they habituate themselves to deep tube-wells in such a way, this problem will gradually increase instead of decreasing. All these factors are creating pressure on groundwater storage, which has been declining at an alarming rate (Islam et al., 2020).

Poverty

The interviewer (first) described that sometimes they need to preserve water before load shedding, but they have no money to buy big preserving pots. So, they cannot preserve more water for their daily demand. Due to their poverty, most of the time they cannot collect money in time, and they are deprived of supplying water in their field. Farmers are not able to preserve the rainwater for future use, especially for crops that are totally damaged by the scarce water during the drought period. They said, "Where can we get those types of big pots for preserving water?" Interviewee (second) explained that they do not have enough money to install their own deep tube well, so they are bound to depend on others for water. As a result, they need to preserve water for daily activities. They have no proper big pots; they collect the

domestic water through small pots. Inhabitants in the study location use various types of conservation pots for preserving water. Sometimes they have no drinking water preserved in our house to satisfy their thirst. According to the people's opinion during the water crisis period, they cannot even propose a single glass of water to their guests (Huq, 2020).

Power cut/load shedding

According to the interviewee (first), during the dry period, the level of load shedding increases at a high rate. Interviewee (second) also acknowledged that sometimes it is announced that they will have no electricity for two or three days during the drought period, and then they face more terrible situations than the other times. Because they have no alternate way to drive the deep tube well, they face a tremendous shortage of water for daily activities. Sometimes they face a shortage of pond water during the dry period.

Scarcity of water resources

Interviewee (second) experienced that in the past, villagers depended significantly on ponds for their domestic water due to the low number of remote tube wells. Often, farmers satisfy their thirst with crop field water. Still, the water resource shortage problem is not solved in the village. In recent times, there were very few ponds to use for domestic purposes in the village. They also said that recently, wells and tube wells have become inactive due to a gradual water level change. So, the main source of groundwater recharge in this area is rainfall, but the lowest amount of rainfall occurs in the northwestern part of Bangladesh, and the area has become a very severely drought-prone area. Moreover, the thick, sticky clay surface of Barind Tract acts as an aquitard, which impedes groundwater recharge and increases surface runoff (Rahman & Mahbub, 2012). For domestic purposes, we are dependent on ponds and a small number of distant or remote deep tube wells. Clean water facilities are unavailable, and people rely on distant sources to access water (Chaudhry, 2017). During the dry period, they found a lack of water due to the cut-off of power. Intermittently, they rely on contaminated pond water for their domestic purposes.

Interviewee (second) told me they live on high land, so they cannot reach the layer of groundwater easily. It is found 140 to 180 feet below. On the other hand, there are very few ponds and sinks in the village, according to requirements. They have no river near the village. Only a Khari is run off most of the time, especially during droughts. So, the village is a more drought-prone area compared to other areas. According to their experiences, water problems in their daily lives exist not only in the past but also in the present, which also creates a negative alarm for the future. All these factors are creating pressure on groundwater storage, which has been declining at an alarming rate. Unless the balanced situation between demand and finite supplies is restored, the area will face increasingly severe water scarcity in a short time (Islam, et al., 2020).

Water resources at a long-distance

The interviewee (first) stated that he or his wife collected water from the neighbor's deep-tube well from a distance of more than ten minutes' walk for their daily use. Whenever this deep tube well is inactive due to technical problems or a lack of electricity, he or she collects domestic water from faraway places on foot. For bathing and other activities, it is terrible for them to collect domestic water from a far distance.

2. Impact of Water Scarcity on Domestic Water Use

Water scarcity affects various domestic purposes, the availability of water for agricultural activities, health issues, the education sector, and occupational opportunities. The socio-economic impact of water scarcity is frequently severe and dangers on societies differ dimensionally depending, first, on the socially created vulnerability and adaptive processes of the affected Barind societies. These are given below:

Children, the elderly, and females are vulnerable

Interviewee (first) stated that when they face scarce water due to load, the elderly, children and a female person face more problems while cleaning and bathing than a male person. Moreover, the effect of drought tends to diverge with age, class, gender, and ethnicity. These indicators determine the vulnerability of people (Zarafshani et al., 2016). Women's experiences of drought are largely overlooked because of scholars' attention to the adverse effects of drought on children. However, as one study has found, the onset of drought aggravates women's health conditions, specifically

those of older rural women (Algur et al., 2021; Sorensen et al. 2018).

Dependency on loan

Interviewee (First) reported that he took a loan from a money lender NGO with interest for supplying water to the crop fields during the drought period. So, the amount of loans for producing crops is increasing with compound interest. With the compounding of interest, we cannot pay this loan within due time. Interviewee (Second) also shared his experience that he also had a 10000/- loan from Caritas at the beginning, and now it is 100000/- due to bearing this expensive cost of water. Most of the farmers in the villages like them usually take loans to produce their crops with compound interest. This condition continuously makes their normal lives more critical. On one side, they have no food for their child, and on the other, they face the pressure of loans with interest due to paying the cost of water during the drought period. Children involves in work instead of study to maintain their family. When Guardians are not afforded school fees not be during the drought, children might drop out of school (Hallmann, 2016; Shah& Steinberg, 2017) The adversity of drought creates problems for landless Dalits, who did not have seeds for the subsequent period (Action Aid, 2016). According to their interviews, it is estimated that their lifestyle is "no money, no water." Scarce water disrupts their daily lives, and their agriculture has no value without water. Water is a resource that is essential to all human activities (Black, 2016).

Polluted water

Interviewee (first) declared that most of the time they are bound to use polluted pond water for drinking, bathing, cooking, utensil washing, washing clothes, and rearing domestic animals. Most of the ponds in the village are unable to be used due to chicken droppings, guts, dust, and chemical food for commercial fish culture. As a result, we cannot think of other daily activities and find it impossible to drink due to ill-smelling water. As a result, we cannot think of other daily activities and find it impossible to drink due to ill-smelling water during dry periods.

Risk of waterborne diseases

The interviewer (first) reported that due to meeting their daily needs with polluted water, the rate of waterborne diseases is very high. Most of the time, they cannot fulfill their domestic water demand with safe water during the dry period. The most common diseases in the area include diarrhea, vomiting, different types of fever, urine infections, eye irritation, itch, etc. This makes the situation even worse for the people, as there is no medical facility within a ten-mile radius of the area. People have to deal with seasonal and other viral diseases on their own (Chaudhry, 2017). According to Ahmad (2006) and Kakar et al., (2018), water scarcity causes a poor state of human health. The most common health complaints due to water scarcity are diarrhea, vomiting, and fever among children.

Scarcity of water for domestic purposes

The interviewee (First) stated that for domestic purposes, we are dependent on ponds and a low number of distant deep tube wells. For bathing and other activities, collecting domestic water at a distance is terrible for us. When guests come on occasion or without occasion to our home, they face more pressure for water due to load shedding during the dry season. No social functions such as marriages, annual fairs, or social gatherings were held as the existing structures could not cater to the population's requirement for drinking water (Patil et al., 2020).

3. Possible Solutions to the Problem of Water Scarcity

According to the interviewee; there are some strong solutions to solve the water-scarce problems for the study area. These are given below:

Financial support from both government and non-government sectors

Interviewee (second) said that the villagers need government and non-government economic support to access water easily. Moreover, villagers demand highly important government and NGO roles to solve their crucial water scarcity problem. Therefore, water resources managers need to pay high attention to the potential impact of drought and explore in advance scientific and effective drought adaptation measures to minimize loss (Rahman et al., 2017).

Government initiative

Interviewee (First) demanded that the government take some initiative to provide short-yielding crop seeds and fertilizer at low or no cost and arrange the correct selling price for crops. Interviewee (second) also suggests that the

government should take some steps to dig deeper ponds immediately; then they think the solution to the problem of water scarcity for domestic uses will be minimized. So, it is very necessary to install the deep tube well with the help of the government to fulfill our domestic water crisis.

Installing solar panels

The first interviewee stated that it was a good initiative for them that some solar panels were installed with the help of the government by driving deep tube wells. Then they get water for their domestic uses without paying power costs during not only the load shedding period and cut-off of electricity but also other normal times. So, they can live free from loans and also improve their standard of living standard.

Preserving rainwater

The interviewee (first) told me that rain falls at a low rate in the village. The decreasing trend of rainfall in the Barind area has already created stress on groundwater resources (Jahan, et al. 2015; Rahman et al. 2017). In the village, the housewives collect a small amount of rainwater for cooking. They cannot preserve it properly due to old-age tin shed roofs and a lack of big pots. If the government takes the initiative to train them about the benefits of preserving rainwater and provides the technical support to do it, that can be a more effective solution for fulfilling their daily demand without the cost of water.

Production of short-yielding crops

The interviewee (first) claimed that some farmers in other villages gain huge profits by producing wheat and other short-yielding crops. So, the farmers of the village show more interest in diversifying their crop patterns. They want to produce short-yielding crops like wheat, maize, potatoes, pulses, mangoes, and others instead of high-yielding rice due to scarce water. But they have some problems, such as when, at the beginning of a sheaf of wheat, big climbing rats cut the sheaf easily. They lack good seeds, fertilizers, and pesticides. If they get proper knowledge, techniques, good seeds, proper fertilizers, and quality pesticides and produce short-yielding crops to save water, it may be helpful for them. For dryland crops, if farmers apply irrigation after calculating how much available water is stored in the soil, it will also contribute to water savings (Hossain & Siddique, 2015). So, the dependency of Boro on the Barind area should be reduced (Rahman& Mahbub, 2012).

CONCLUSION

Conclusively the research analyzed the impact of water scarcity on the domestic water use segment in the Barind tract region. In the past, the irrigation system in this area relied on rainwater and surface water. But since 1990, Including the shortage of rainfall, the temperature has increased notably, which finally forced the people to rely on groundwater instead of rainwater for harvesting. At present villagers in the study area have installed 100% deep tube-well to satisfy their daily demands instead of tube-well after getting the connection of electricity. The respondents used deep tube-well water in terms of 100% drinking purposes, above 70 % bathing and cooking needs, 65% rearing cattle, and mostly agriculture activities. According to the respondents, they were habituated to cultivate high-yielding rice, which preferred more water, instead of other short-yielding crops.

This conventional practice of production created more water crises in the study area. So, the agricultural production of the villages is under threat due to the high cost of groundwater. Some of the pond water is unsuitable for their health applying dirty and artificial fish feed in the study area. Few ponds are gradually drying with low rainfall, faster evapotranspiration, and high temperature during the dry period. Most of the respondents could not install their own deep tube-well due to poverty. Due to this reality, above 42% of people travel to collect their domestic water from more than one kilometer away. The hard and dry Barind clayey disrupts the natural groundwater recharge process. People have exploited the groundwater table purposively. Therefore, both types of natural and manmade causes are responsible for hazardous disasters, such as the drought in the Tanore sub-district. As a result, people tolerate water crises in different sectors of domestic use, such as drinking, cooking, hygienic health, rearing cattle, and agricultural activities. During the summer season, people face a tremendous domestic water crisis due to a lack of electricity. Research findings suggest that some important initiatives are required to solve this problem in this region, such as digging deep ponds deeply and digging into existing ponds with the help

of government and non-government support. They can be used as water hyacinths for storing rainwater to control high evapotranspiration rates. The respondents' feedback and field observation claimed that the respondents should practice short-yielding crops instead of high-yielding crops or rice. The people should have been restricted to using deep-tube water or mining groundwater.

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