CLIMATE CHANGE, WATER AND HEALTH IN COASTAL ZONE OF BANGLADESH

A Local Level Case-Study

Abstract

Bangladesh Centre for Advanced Studies, partner of Capacity Network (Cap-Net) conducted the study to assess how reduction of access to water sources and proper sanitation practice- due to the climate change is impacting the human health in the Coastal Zone of Bangladesh

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Contents

Background

Bangladesh is vulnerable to climate change and with preceding time every year the country is receiving severe consequences through impact on water and health. Climate change is directly linked with water-related problems and deterioration of human health. And these issues have become alarming; especially in the coastal region. The most concerning issue is the availability of safe water in the coastal zone of Bangladesh, which in turn affects the wellbeing of people, as it possesses threat to their health. Since, there is a strong relationship between water scarcity and health in Bangladesh. (*Abedin et al, 2019*). There is an alarming consequence of illness due to unsafe drinking water and the spread of waterborne diseases. Moreover, due to increase in natural disasters, the levels of suffering have increased extensively in various regions of southwestern part of Bangladesh (Vineis *et al, 2011).*

Sea level rise, poor rainfall in winter, high rate of evaporation and various disastrous events like cyclone and storm surge are responsible behind the shortage of fresh water supply as well as inland salinity intrusion. It is stated that, although the salinity of surface and groundwater in Bangladesh was determined by number of factors, i.e, river flow, tidal surges, rainfall and groundwater extraction, in addition, it had been influenced by the sea level rise and other climatic variables *(Vineis et al, 2011).* Salinity is affecting the livelihood of the people as it is affecting fisheries and agricultural production. Thus people are being forced to change their livelihood, which ultimately further increases the salinity, for example, shrimp cultivation is increasing, which is one of the major anthropogenic cause of saline intrusion; because, large areas of paddy fields and cultivable lands had been transformed into shrimp farms which raised the groundwater salinity, soil degradation and lower yield of crops *(Vineis et al, 2011)*.Agriculture and fishery are one of the major sources for the coastal zone of Bangladesh to make a living, and when these are affected, they don't have any other option left to continue their livelihoods *(Abedin et al, 2019)*.

Researchers have found that Increasing salinity levels also lead to increased incidences of hypertension in the coastal areas. The mean sodium intake of the population is higher and it is even more perilous for pregnant women, as their sodium intake is greater than the WHO guidelines, along with risking their life the life of the upcoming generation is also threatened *(Khan et al, 2011).* As the government is not able to find the proper treatment to the salinity contaminated water, people are left with no other option but to use this salty water for their domestic and also irrigation purpose. Thus the community living in these regions requires more attention in terms of water and health.

The impacts of climate change on water supply and sanitation directly affect on how the sustainable development goals of the country would be achieved and therefore put the country at risk of obtaining poverty reduction, overall public health and conserving its ecosystem. By 2021, Bangladesh envisioned a situation where access to clean water and sanitation will no longer remain a luxury (Vision 2021, goal 4.7). In the 7th 5 years Plan, the Government of Bangladesh has targeted an aspect of safe drinking water to be made available for all rural population.

Sustainable Development Goal (SDG 6) has a target to achieve universal and equitable access to safe and affordable drinking water for all. As a result of national and international initiatives, Bangladesh has made

huge progress in sanitation over the last 25 years through reducing open defecation from 32% in 1990, to 5% today. In order to facilitate the promotion of water supply and sanitation among the vulnerable coastal community, different local and international NGOs, Government of Bangladesh (GoB) through the Local Government, along with the investment from Annual Development Program (ADP), are implementing a number of hardware and software based programmes and projects.

Interlinkages: climate change, water, sanitation, and health

According to Bangladesh Sustainable Development Goals (SDG) 2018 report Bangladesh was designated as one of the best in safely using drinking water as 87% of the population have accessibility to safe drinking water. Bangladesh further received limelight when the percentage of open defecation dropped to 1%, with 86.3% of the urban population and 74.4% of the rural population having access to latrines makes it an even more strong entity (Bangladesh Planning Commission, 2018). Moreover, when concentrating on the climate action arena it was evident that Bangladesh is one of the most disaster-prone country and climate change is further intensifying it. According to census flood, cyclone and thunderstorm are the leading disasters in Bangladesh and is responsible for increasing salinity in soil and water. The number of households getting affected by climate change was measured to understand the existing situation, and the data clarified that highest number of households suffer from salinity problem in Khulna which is 22.24% and this was led by water logging 34.88% and cyclone 23.23% (Bangladesh Planning Commission, 2018). Therefore, this can be hypothesized that higher cyclonic events are leading to water logging and salinity leading to multiple health issues in coastal zones.

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) armored that adaptation measures must include human health protection from the adverse consequences of climate change. Bangladesh being one of the most vulnerable to the adverse impacts of Climate Change is losing its adaptive capacity even more with rising global temperature, melting of glaciers, expansion of water bodies and sea level rise. In addition, worst consequences are mostly seen in the Southern zones, Satkhira and Khulna. Khulna being a coastal zone particularly suffers from rapid cyclonic events, which increases the water logging and flooding events leading to saline intrusion in soil and fresh water (IPCC, 2014). These impacts of climate change leads to health issue such as diarrhea, cholera, dengue, malaria and other water borne diseases which can even lead to death events. Saline water often seeps through soil and contaminates ground water as well, and as groundwater is used for drinking purpose these often affect human health leading to hypertension and other related disease (Mininstry of Foreign Affaire , 2018).

The arena of climate change, water, sanitation, and health is not new, but have not been explored much. However it came into attention when in 2007 Bangladesh topped the IPCC's risk index for climate change which was because of its 36 million people residing in coastal zones and attention must be put in their water availability and sanitation issues which are leading to rapid degradation in physical health of the inhabitants (IPCC, 2014). On the other hand, rapid temperature rise has led to increasing pest and pest borne diseases. Rising temperature further leads to drought which increases the need for irrigation and as water fresh water is still a scarce resource, this will lead to lower agricultural productivity and will be a challenge to food security. Cyclone and storm surges

as discussed before are major results of climate change and have direct impacts on human livelihood as well, as they are often hold responsible for destroying latrines and other infrastrures to protect fresh water and ensure better sanitation (Mininstry of Foreign Affaire , 2018). Thus, this research particularly concentrates on this arena to establish the relationship and portray Bangladesh's coastal zone condition and the suffering that it is going through for climate change.

The coastal regions of Bangladesh are extremely vulnerable to climate change and they are suffering from shortage of safe water which possess threat to their health. As the government are not able to find the proper treatment to the salinity contaminated water, people are left with no other option but to use this salty water for their domestic and also irrigation purpose. Thus the community living in these regions requires more attention in terms of water and health.

To that note, as a part of activities, Bangladesh Centre for Advanced Studies, partner of Capacity Network (CapNet) conducted the study to assess Climate Change, Water and Health in Coastal Zone of Bangladesh

Research Objectives

- To assess how reduction of access to water sources and proper sanitation practice- due to the climate change is impacting the human health.

Research Questions

I. What are the major sources and current practices of water collection for drinking and sanitation?

II. What are the current and potential climate change induced hazards that affect/may affect the water resources and sanitation practices, thus impacting human health in respective areas in the coast?

III. What are being done to reduce health vulnerabilities due to climate change induced hazards; and what further could be done?

Methodology

The main purpose of this study was to understand the relationship of climate change, water and health condition in the coastal area of Bangladesh. The study consideres qualitative approach to meet the objectives. The following section provides details of the methodology:

Selection of Study Site

Bagerhat and Satkhira were highly affected by Cyclone Aila in 2009. In addition, both of these districts are exposed cyclone and storm surge, salinity intrusion in soil and water, sea level rise, drought and other hazards. Therefore, these two districts were selected to conduct the study. The study team consulted the Upazilla Nirbahi Officer (UNO) and orin (in times when the UNO was absent), Project Implementation Officer (PIO) and the members of Upazilla Disaster Management Committee, at Upazilla Parishad (UP) to find out the most vulnerable Unions for the study. Thus, the study was conducted in two different Unions under two different Districts.

Data Collection Methods

Based on the qualitative approach of the study, study team followed three different types of data collection methods

(1) Focused Group Discussion

(2) Key Informant Interview and

Focused Group Discussion (FGD)

There were be four (4) FGDs held in total in two districts. The discussion comprised of not more than fourteen (14) people and not less than 6participants. In each district, two (2) FGDs were conducted whereas, one (1) FGD was conducted with only female participants and the other FGD's consisted of both male and female respondents in a mixed group.

Location	Respondents	Type of FGD	Number
Munshigonj Union Shyamnagar Satkhira	Female	Female	1
	Male, Female Disadvantaged	Mixed	1
Chila Union Mongla Bagerhat	Female	Female	1
	Male, Female Disadvantaged	Mixed	1
Total			4

Key Informant Interview (KII)

The study proposed to conduct Key Informant Interviews with local communities, community leaders, representatives of government organizations and non-government organizations. In total of twenty (20) KIIs, ten (10) KIIs in each district was conducted with the stakeholders as follow-

Serial	Interviewee	Number of Interview
1)	DPHE	1

2)	Union Parishad Member	1
3)	NGO (involved with water, sanitation and health)	1
4)	School Teacher (adolescent/ children's health)	1
5)	Community Leader	1
6)	Community people (male)	1
7)	Community people (female)	1
8)	Disabled / Excluded Group	1
9)	Doctor/ Health care provider/ Local level health care provider	2
	Total	10
	Total in Two Districts	(10+10) =20

Findings

Climate Change Scenario

The coastal belt of Bangladesh is highly exposed to various climatic factors including variations in temperature, erratic behavior of rainfall, cyclonic events, droughts and salinity intrusion. These climatic factors are what make the lives of the coastal people vulnerable to climate change. Women from these coastal areas stated that they regularly suffered from more frequently occurred disasters due to lack of access to water and sanitation. The water borne diseased are caused frequently among those people as they have lack of safe drinking water and proper sanitation facilities. All these are the results of saline water in ground and surface water. Moreover, the sanitation infrastructure and water sources are severely affected by Cyclone and other tidal surges. Most recently the drought are sought in this study areas, which is exaggerating the water and sanitation crisis.

Current Hazards

	Current Hazards and Disasters	**Shyamnagar**	**Mongla**
	Salinity	✔ ✔	✔ ✔
	Cyclone	✔ ✔	✔ ✔
	Tidal Surge	✔ ✔	✔ ✔
	Riverbank erosion	✔ ✔	✔
	Higher temperature	✔ ✔	✔ ✔
	Flood	✔ ✔	
	Water logging		✔ ✔
	Drought	✔	
	Erratic Rainfall		✔

Potential Hazards	**Shyamnagar**	**Mongla**
Increased salinity	✔	✔
Increase in drought events during dry season	✔	
Flooding due to heavy rainfall	✔	
Higher tide and flooding	✔	✔
Cumulative Impact of several disasters	✔	✔
Embankment damage and flooding	✔	✔
Siltation and over-flow	✔	✔
Coastal Erosion	✔	✔

Study aimed at revealing the current and potential hazards in the study areas- Shyamnagar Upazilla under Satkhira and mongla upazilla under Bagerhat District. All the two districts are highly prone to be affected by Cyclone and tidal surges every years. In an addition to those disasters, riverbank erosion, variation in temperature drought are intensifying the scenario of salinity which has already been affecting the water and sanitation along with agriculture and other livelihood activities. These areas are expecting to face some potential hazards like intended drought, water logging and erratic rainfall in future.

Current Scenario: Water and sanitation

Water sources

At present, primary source of drinking water has turned into the water by water treatment plant from the earlier most used sources like deep tube-well, shallow tube-well and some open sources like ponds and rivers. Since the massive disasters Aila, all the water sources mentioned have been abandoned due to existing of salinity in the water in all sphere- ground or surface water. There has been an alternative source based on rain water that is – Rain Water Harvesting System (RHS). In mongla area, Rain water harvesting system is the main source for drinking water in the study villages. Apart from it there's couple of freshwater-pond from where the people collect water all through-out the year. But, during the dry season (March-June), the people need to struggle and spend a lot of to find sufficient water. In general, the people of this area face hardship in collecting water despite doing the hard work.

In the study village of Mongla, Majority of the people relies on rain water , and the rest relies on pond water, along with relying on Rain Water Harvesting system, Reverse Osmosis, Water Treatment Plant, Solar Desalination Plant, Mobile Water Treatment Plant (For emergency only), Manage Aquifer Recharge (MAR) and Pipe line water supply only in municipality of Mongla.

	Sources	**Technology**	**Usage/Practice**	**Health Risk**
Surface Water	Ponds	Pond Sand Filter Purification (Alum fitkiri, chlorin) Direct	- Drinking	- Pond Sand Filter is not fully contamination free
		Direct	- Cleaning and washing - Sanitation - livestock feeding	Water borne disease -Skin disease

	River and canal	Water Treatment Plant (Reverse Osmosis and Desalination Plant)	- Drinking -	Safe, but Costly and Laborious; physical health risk -
		Direct	- Livestock feeding - Washing and bathing	Water-borne diseases Skin disease
Ground Water	Groundwater	Deep Tube-well	Drinking and Sanitation And Washing	Failed technology Saline and iron contaminated diseases Higher installation cost
	Ground Water	Water Treatment Plant	Drinking	Safe, but Costly and Laborious; physical health risk
Rain Water	Rain Water	Rain Water Harvesting System	Drinking	Safe but risk of contamination
Other	Pipeline water supply	Pipeline	Drinking Washing Sanitation	Contamination

	Retail Water Distribution	Van-carried Jar Container	Drinking	Physical Labor and physical Risk

Users of water sources

Mongla	People in study village in Mongla	Source of drinking water
	More than half of the people	Rain-water
	More than Quarter of the people	Pond's water (PSF)
	Less than Quarter of the people	River water
Shyamnagar	More than half	Treatment pant
	More than quarter	Deep tube-well
	Less than quarter	Rainwater harvesting system

Almost half of the families depend on rain water collected and stored in tank or consume direct during rainy season, one-fourth of them rely on pond's/lake's water and rest one-fourth rely on rivers. They have to suffer from lack of water for almost 6 months. Deep tube wells never successfully runs in this Upazilla; hence, majority of the people rely on rain water , and the rest relies on pond water, along with relying on Rain Water Harvesting system, Reverse Osmosis, Water Treatment Plant, Solar Desalination Plant, Mobile Water Treatment Plant (For emergency only), Manage Aquifer Recharge (MAR), Pipe line water supply only municipality of Mongla (Pond water).

> *''We don't have any tube well or a pond in our village. We had a pond once 15/20 years ago but it got lost due to river bank erosion. Because of this we have to depend on rain water all year round." Srimaty China, mongla, also added that, they do not have any vessel of such to carry and store rainwater all year round because maximum number of people in her area is extremely poor. Freedom Fighter Animesh babu of kalatola, said that, during the monsoon season they mostly harvested, store and drink rainwater. During the winter season, they drink water from the river nearby but when the salinity of the water increases, they travel 6 kms to collect fresh water, in this case people who are unable to travel they have to buy 30 liters of water for 40 Taka. They depend on pond's water the rest of the year.*

Water Collection: Time, Distance and Labor

Study Villages and Water Collection					
Location	Village	Distance	Time	Source	Collectors
Munshigonj, Shyamnagar,	Jelepara	1 KM	1 Hour	- Deep tube-well	- Mainly Women

Satkhira				- Water Treatment Plan (RO)	- Partially male (During disasters)
	Dakkhin Kadamtoli	2 KM	1.5 Hour	Deep tube well Water treatment plant	
Mongla	Kalatola	6	2 Hour	Pond and PSF	Mainly men
	Amtoli	6	2 Hour	Pond and PSF	Mainly men

Usually, female members of almost all families collect water for their daily drinking. It takes them a huge time, varying from 30 minutes to 2 hours to travel to and back for collecting water from nearby sources, as it has been reported in all the study locations. In Shyamnagar, water treatment plant along with the deep tuebe-well which are the primary sources of water feeding technology situated 2km away, located in Haringar Bazaar. In order to collect water from Haringar Bazaar (Shyamnagar) the transportation costs is 10 Taka whereas if y they buy 15 liters of water it costs 15 Taka. Though, in regular time and situations, women mostly collect water, but, during any natural disaster, the males of the family collect water.

In the study location- Mongla, the situation is bit worse as the respondents have been reported. According to Shonali Gain from Kalatola, chila, mongla “we have to suffer a lot for water, we need to get them from a pond 6 kms away”. She also added that, people who have Rain Water Harvesting System installed in their homes let them a simple life than the ones who don’t as they have to travel a long distance to collect fresh water. Those who can’t travel have to buy 30 litres of water for 40 Taka. This extra expense makes difficult to run their households. Both male and female members of the family have to collect water. As the location for collecting water is far away from their households, men tend to accompany women during the visit. But mostly the collection of both rain water and fresh water from ponds are done by women. When asked about duration of this process Subhas Mistri claimed that “on an average day it takes one and a half hour up-down via boat, during the time of disasters it takes more than 2 hours and via van it takes 1 hour but in that case one has to pay 25 taka as the van fare.

Usage and practice water

Sources of water	Washing Cloth	Washing Dishes	Cooking	Sanitation	Drinking	Bathing	Feeding livestock	Watering Gardens
Rain water Harvesting			✔		✔			
Ponds Water	✔	✔	✔	✔		✔	✔	

River water	✔	✔	✔	✔		✔	✔	
Deep tube-well					✔			
Water plant					✔			
Pipeline water			✔	✔	✔			
PSF					✔			

Water from a deep tube well (in some specific places in Shyamnagar) and river osmosis (RO) is used for drinking purpose and pond water is used for bathing, washing and household works. Some villages in shyamnagar, there is a pipeline installed which has connected almost every household for supplying water on pay. Water from the pipeline supply is used for both drinking and household purposes. But several respondents have been found to claim the pipeline water is contaminated with pathogen which is causing water borne diseases. Moreover, that water contains salt which can cause salinity induced diseases in the body. Along with this health risk, water-subscribers have to carry a monthly bill of supplied water which is about 65/70 Taka.

In the study village of Mongla, Majority of the people relies on rain water for their daily drinking and the rest relies on pond water, along with relying on Rain Water Harvesting system, Reverse Osmosis, Water Treatment Plant, and Pipe line water supply only in municipality of Mongla. Most of the family relies for cooking on pond's fresh water and rain water. For the cattle, bathing, washing the dishes and toilet water from the river and pond is used.

Srimaty Shapna Rani from Kalatola, in Chila Union, said that they use rain water, fresh water from ponds and lakes and also from rivers for cooking and drinking. For various other household activities such as washing dishes, vegetables, taking shower and allocating water for domestic animals is done through pond's and ditch's salty water. Furthermore, for sanitation purposes they use salt water ditches next to their houses.

Recently the fishermen pours direct poison or chemical in the river water to kill fishes, these toxic substances are further polluting the river water (Ms.Monjit Mondal,Health Inspector). Even the hospital does not keep pure water for drinking, which has been found in Mongla as Dr Jibitish Biswas, Medical Officer reported.

Sanitation

All the families in the village now use latrine which are mostly Ring slab having a super-structure of wooden fence, tin-ceiling and bamboo pillar.

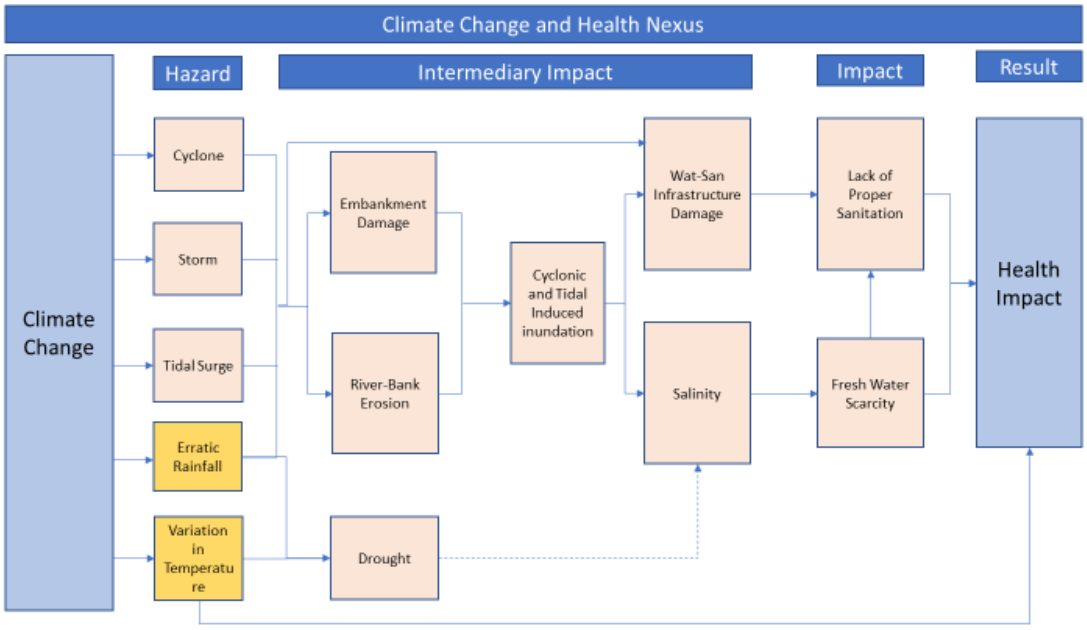
	Types of Latrine	Coverage
Shyamnagar	Ring-slab Latrines	2/3 people use own latrine
Mongla	Ring-slab Latrine	4/5 people use own latrines
	Coverage	Almost all households have access to latrines either- ring-slab or pit latrines; either hygienic or less hygienic

Most of the people in all the study locations use Ring Slab Latrine but its structure is weak with tin shed roof and pillars made from bamboo, wooden fence, wood or leaf. Moreover, almost all of those latrines are unhygienic. Most of the latrines in that area do not have a water seal drainage system. More than half of the families surveyed wear sandals before going into the latrines and they even clean themselves with soap and sand whatever available after using it. One of the major reasons of this situation is their financial ability as most of the people in that area are below the poverty line. Fences made of bamboo, cloth, wires and tins are also used but the structures are extremely vulnerable.

Almost all people from the union uses ring-slab latrines but more than half of the union's people wears sandal to the latrine and sanitises their hand with soap or wooden ash after coming out of the latrine.

It's to say, almost all the village people use ring slab latrine install at almost every households. Majority of the families now uses ring-slab latrines, but, the less effluent ones use septic-tank latrine. In the municipality almost all and in the village area more than half of the people uses sanitary latrine. Sri Shampad, Mongla, said "people are aware nowadays, almost 80% of them use sanitary larine and every household has a bathroom in their house.

Climate change impacts on water and sanitation



River bank erosion engulfs infrastructures of water and sanitation along with built-up and cultivable land of agriculture. A **storm tide** due to rising water commonly associated with low pressure weather system, Cyclone and Sea-level-rise, all these sea sourced disasters hit and destroy the water supply and sanitation technology. Also, salinity intrusion in surface water and ground water were caused by all these disasters as saline water from sea is brought to inland and cause water logging. Water logging is also a result of heavy rain fall which is trapped in low lands within the polders and dams for a longer time. Unlike decades ago, drought also developed that the field work revealed in the study areas. The most common source of potable water for poor people are getting dried up due to seasonal drought and life-threatening temperature rise.

The followings are the most frequent disasters which are prevailing at the coastal belt of Bangladesh. The box bellow shows if the disasters are causing impact on the water and sanitation sectors.

Disasters	Water Sector	Sanitation Sector
Salinity	✔	✔
Cyclone	✔	✔
Tidal Surge	✔	✔
Riverbank erosion	✔	✔
Higher temperature	✔	

Flood	✔	✔
Water logging	✔	✔
Drought	✔	
Erratic Rainfall	✔	

The figure indicated that almost all of the disasters are caused by climate change sternly affects, on both water supply and sanitation sectors not only drought.

Future threats

The 26 k.m long Owapdar dam at point 9 4 k.m is very risky and can get destroyed during flooding, which will flood all the villages of this union as well as destroy all the sanitation system. Breaking of Malancha River embankment inundated the entire area, submerging the freshwater ponds.

Some Major Disasters and its impact on water and sanitation

Salinity: The geographic positioning makes this area vulnerable to climate change related disasters. During cyclone and storm surge the dams gets broken and let intrude salinity into inland. The saline water degrades the soil and water quality and also destroys the infrastructures of water and sanitation. Also, the shrimp cultivation exaggerates the existing salinity. The more freshwater ponds are dug up for this cultivation the more chances of salinity intrusion is to take place and to contaminate more land. During full moon and new moon night the tides get even bigger and flood the low-lying areas and cause more salinity intrusion. Little to no rainfall and the mass commercial shrimp cultivation further intensifies the salinity intrusion in land.

River bank erosion: due to riverbank erosion, either the embankments were destroyed or their structures were affected. The ditches beside homes from where people could extract water got contaminated due to the tidal surges leaving the water saline and unable to be used. The regular tidal surges also submerged the latrines thus making them unable to be used, the ring slab can't sustain long enough due to the increased level of salinity in the water. During the time of disasters, when there is knee level of water and all the latrines are submerged, then people tend to use bathrooms of other people which are located or build in elevated areas. Some even excrete in open waters during that time.

Cyclone and tornados: Due to cyclones and tidal surges the embankments and surrounding areas including ponds and fresh water sources are affected and salt water enters into these sources and contaminate it. Fresh water sources and soil in the nearby are getting contaminated through salt water intrusion. Because of this people are forced to cultivate and harvest shrimps which in turn are increasing the salinity of the area day by day. We have to get fresh water from 6 kms away but during the time of natural disasters we can't do so and collecting drinking water becomes difficult. Because of tornadoes, cyclones and regular tidal surges the tidal waters submerge the latrines nearby making it unable to be used further, as the water contains high concentration of salt the ring slabs don't sustain much longer. The houses which have bathrooms located at high elevated lands are used during that time. Many people even excrete in open waters.

Tidal Surge: Due to frequent tidal surges roads and houses are often submerged alongside the sources of water available in that area. During the rainy season collection and storage of rain water becomes extremely difficult. The deep tube wells available become contaminated with salt water. Sweet water ponds convert into salt water ponds due to salt water intrusion and water supply pipe line ruptures

Salinity: In 2009's Ayla, all the PSF ponds of the area became saline water. Severe scarcity of drinking water was observed.128 PSF was destroyed during the cyclone Aila. There was salinity intrusion in a lot of freshwater pond. Afterwards there has been a scarcity of water in the union for drinking, bathing and household works.

- *128 PSF was destroyed during the cyclone Aila.*
- *The 26 k.m long Owapdar dam at point 9 4 k.m is very risky and can get destroyed during flooding*
- *In 2009 Aila destroyed all the fresh water rivers. Shrimp culture adds up more salinity to river water*
- *100% of villagers uses latrine and 30-40% people are concerned about hygiene and sanitation. But 95% of the water seal are broken and often pollutes the air as releases odor*
- *Salinity causes ring slabs to decay faster. The ring slab in the latrin decays within 1/2 years because of salinity.*
-

Moreover, **Muslim** families do not allow fishermen and other low-caste groups to use their ponds, as the fact has been revealed in Shyamnagar.

Drought: in the recent few years both the study district are facing drought in the dry season. During dry seasons, there is almost no water in the ponds and rivers become dry..

Latrines are often submerged during tidal surges and cyclone destroy or break down the structure of the latrines. A lot of pit-latrine got destroyed after submerging in water from Aila or is flown away by strong winds. Cyclones tend to destroy and blow away pit latrines. Increase in salinity causes the destruction of the ring slab in the latrine at a faster rate.

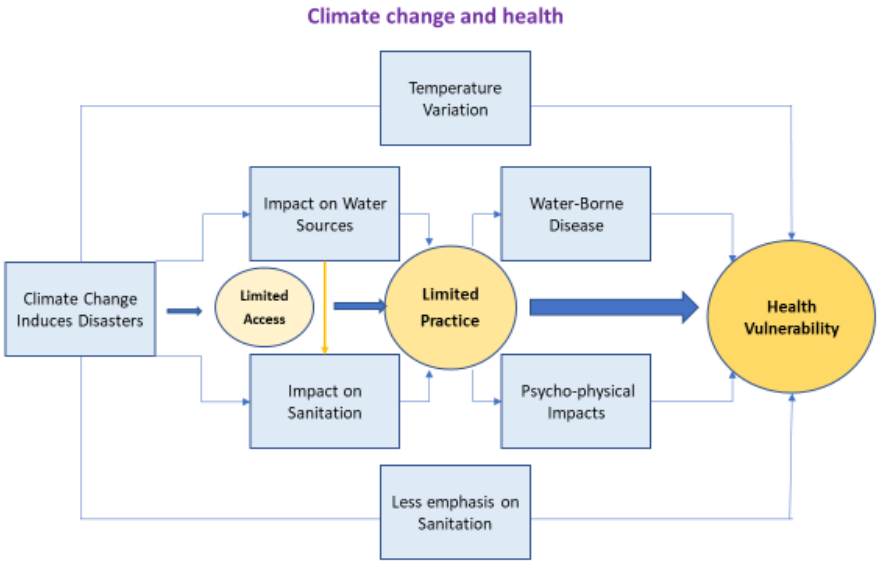
The latrine drowns as it is build on low-laying lands. The structure of the weak latrines breaks or gets blown away by wind from any sort of low-pressure on sea-surface. Participants stated that most of the latrines they use consist of ring slab and few of the study family found who use pit atrines. Cyclones and tidal surges demolish pit latrines. Latrines become unusable during rainy seasons. While using latrines, using saline water for washing causes problems. Women face a lot of troubles using latrines. Heavy rain makes it impossible for many to use the latrines. On the otherhand, during atmospheric low-pressure, because of rain lots of latrine gets submerged under water.

Water and sanitation during emergency

Villagers are aware of the programs conducted by government and NGOs and the shelter center and relief provided. However, the shelter centers do not have any separate latrines for female, also number of shelter center are comparatively less.

Climatic Change and Health interlinked

Climatic hazards have direct impact on water, sanitation and health. During the climatic disasters the source of fresh water gets destroyed as well as the latrines- which cause sewage to spill everywhere. Because of these, people are forced to drink unclean water which gives rise to water-related diseases and various dermatological diseases in the population making them sick. Also, during every disaster more saline water enters inland and contaminates the ground and water which further impacts the health of the people.



Due to climate change there is an increase in the occurrence of tidal surges, storms, cyclones and these are increasing the salinity intrusion into the available water bodies like pons, lakes and rivers as well. Moreover, ground water which is lifted by shallow or deep tube well, are also saline since the major disaster Aila, 2011 in this area. Because of this salt water in tube well and pons the people are forced to drink the

contaminated unsafe water from ponds or saline water from tube-well. As Climate change impacts are destroying all the sources of drinking water, there has given rise to intense water-related problems and give rise to the frequency of water-related diseases: Diarrhoea, Dysentry, Fatigue, Fever, Common-cold, Cough and gastric problems. Climate related disasters damages the ring slab of the latrines which spreads human sewage around the area giving rise to diseases and foul smell.

Due to intaking contaminated water for drinking, the people are suffering from salinity induced diseases like Kidney diseases and high blood pressure. Moreover, days are getting warmer gradually and women, old and child who usually remain at home trend to fall into risk of heart-attack and stroke, and associated heart-diseases as well. Besides, poor marginalized people who cannot afford to adopt technology for water have to take water from ponds that cause water-borne diseases, for example diarrhea, cholera, skin diseases and also aggravating the chances of female infertility.

As the sanitation infrastructures are disrupted because of cyclone and tidal surges the people are forced to excrete in open water or nearby bushes. This not only hampers the environment but also increases the risks of spreading water borne diseases. Many women who refuse to excrete in broad-daylight fearing of shaming, have to wait until night. Thus, all these are intensifying the health risk among women and girls, also posing higher risk of occurring sexual harassment against them. Men take boats to go far away to defecate. During disasters, women cannot use latrines. With much difficulty they manage to defecate surrounded by polyethene in open spaces.

S*rimaty chaina from kalatola Cliha union said that, they learned that the other name of Life is Water, especially safe and clean drinking water, but the fact is they can't find it. Our main source of drinking water is rain water but the way we store and drink it is not safe at all. They use different chemicals to purify the water from nearby sources or drink river's water but we know none of them are clean and safe to drink. We know the health conditions that we are suppose to face by drinking such waters but our body has become accustomed to it. Still we suffer from numerous diseases such as diarrhea, cholera, jaundice, and skin diseases. By drinking saline water for longer period of time people are developing hypertension. Children are suffering from pneumonia for drinking rain water. Many of these people are suffering from different forms of skin diseases by bathing regularly in saline and dirty waters. Not only for drinking but by not using sanitary latrines is also one of the reasons for occurrence of such diseases*

Affected Group of People

Women: Because of climate change impacts, the number of water-borne disease has increased and the poor community is more susceptible to it. It has been evidenced that, women usually compromise their water demand with their male and children in case of shortage of water; rather they take pond water or any easily available water. On the other hand, the poor community can't afford to purchase water nor they can afford transport to travel long distance so. Besides, as water collection take a long time and waste working hours, they are forced to drink saline water.

Poor: Climate change is causing a huge loss and damage and thus causing degradation of economy condition of the people. For the poor or ultra-poor, purchasing water is the most challenging because they cannot afford to buy drinking water. People under the poverty line are mostly to be affected from climate-change related disasters because: Most of these families earn on a daily basis and purchasing water is not within their capabilities. Due to financial constraints these families can't afford to repair their destroyed latrines whenever it is destroyed.

Also, when the latrines get destroyed, the poor people can't always instantaneously repair or build a new latrine, thus it makes them more exposed to water-related diseases. Since, the poor can't afford drinking water and rebuilding latrines, they can't also afford the healthcare bills.

Child and girls Since the children and physically challenged people are dependent on others, they are more endangered in using water and sanitation. Women face a lot of difficulties if the latrine is damaged or the latrine is situated far from their home.

Mrs Momota Rani Mondol gives an example of such a scenario, as she says *'In 2009, our village had gone under the surge induced by cyclone Aila. During that episode, the saline water entered and intruded to all our water bodies, and later, because of this, the people fell in a crisis for getting their hands-on drinking water. The problem still lurks and continues to exist and hamper our daily activities'.*

Inadequate access and higher health vulnerability: women, children and excluded groups

Issues	**Impacts**	**Associated Result**
Unavailability of fresh water and taking saline water	Water-borne diseases Salinity intruded diseases (high blood pressure, kidney failure) Skin diseases	✓ Higher medication cost ✓ Loss of working time ✓ Physical suffering
Contaminated Pipeline water	Water borne diseases	Monthly bill-pay
Financial capability and water treatment plant	Transportation cost and purchasing cost that the poor cant afford	Trend to drink available contaminated water
Social Barriers	Less likely to collect water from water-plant and male don't trend to contribute to water collection (if the source is short way)	Women's double burden work Physical pressure
Compromising productive time	Worsens women's psycho-physical condition and reduce productivity	psycho-physical health deterioration
Gender Role	Double burden works for women	Phycological stress
Health care service	Unavailability of medicine and doctors Less access to medical service	Lessens health support for the affected people

Contaminated Water on Pay

Lalita Mandal, age: 35. Once day she went to her neighbor's house and while talking to them, she drank a glass of tap-water from the supply-line. She started feeling stomach ache as soon as she reached home. She was sick for about 12/15 days and she needed 6 bags of saline injected in her body. Even now, she has not recovered completely from weakness.

Some key Issues

1. According to GM Fazlul Haque (UP Member-4th ward), a **child** of 4 months was suffering from cold and fever once taken to the hospital during the day was discharged within few hours but the conditions started to deteriorate by night (claiming to be pneumonia) later that night the child collapsed that night being unable to fight any longer.

2. Drinking saline water for a long period of time has caused the **pregnant mothers** are suffering from hypertension, high blood pressure and various pregnancy issues following it, sometimes they become victim to miscarriage . They often save drinking waters for other members of the family rather than drinking themselves which leads to scarcity of water in the body. Unable to drink fresh water is leading pregnant women to give birth to immature and jaundice infected children. The children of that area are malnourished. The chances of getting ahead in life are getting bleak among the poor and unfortunate people. The pregnant mother often suffers from swelled up leg or arm, epilepsy and dried up amniotic fluid. Then comes children, especially the ones under the poverty line. Most of those kids are malnourished.

Adaptation

Reservation: They do not have much facilities and capacities to help improve our health conditions and fight with diseases. Many people nowadays are using plastic tanks to hold rain water all year round.

Purification: Sultana banarjee said regarding this issue that we saw that if children drink rainwater they face diseases such as pneumonia, diarrhea, cholera jaundice and common cold. But boiling rainwater and then drinking it benefitial so now they are opting to do that. Dipty rani said that an NGO Karitash invested and promoted a table/chemical named Joler Doctor which claims to purify water and the people use these in their waters.

Institutional initiatives: On behalf of the regional public health department there has been initiative taken of free distribution of water purifying tablets. During any disaster the department also takes initiative to distribute fresh water by travelling to sites using trucks. The department even has program of digging up freshwater pond often. On a regular basis the department arranges motivational programs and has established solar desalination plant and reverses osmosis. Also, the department distributes plastic tanks and slabs. Jagroto Jubo Sangha, Salam and Rupantar Dolphin is running a coastal community resilience project under which they have distributed 34 pieces 1000 plastic tank for storing water in 2018 and established one reverse osmosis plant in 2018-2019.

Technology Adoption: Deep tube wells never successfully runs in both study areas (except some places in Shyamnagar); people are getting accustomed to relying on Rain Water Harvesting System

as well as on Reverse Osmosis, Water Treatment Plant, Solar Desalination Plant, Mobile Water Treatment Plant (For emergency only), Manage Aquifer Recharge (MAR), Pipe line water supply.

Availing health care service: Though it is laborious, time consuming and costly, people stated collecting drinking water from places farther away from their household. As a result of lot of awareness raising program, they are now visiting the doctors in the nearest clinic available within the union, and in severe case, they visit hospital situated in Upazilla level. For treatment they go to community clinics, satellite clinic, Red Crescent clinic, Union health and family welfare center. Sometime, they buy medicine from the local pharmacy stores without being prescribed by doctors.

Proper Sanitation Practice: People are now, more or less, aware of using sanitary latrines and keeping hygiene practice. Almost all the people use sanitary latrines, specially the ring-slab latrines which is less costly and easily installable. Using those latrines resulted as, the flies cannot hover or get in contact with human excretion. They are now use the available water for different distinctive purpose of work like- use pond water for bathing, washing and household work; drink only fresh and clean water.

- Participants informed that ¼ of the people received awareness trainings water and sanitation
- 2/3 of the people of study village do not maintain the proper sanitation practice, but it is better portion than before
- To be noted, a lot of the families can't afford to build their own latrine

Awareness Program

Various NGO's and government organization are running awareness programme among the people on proper usage of water, and how to combat several diseases. The NGOs include Shushilon, World Vision, Community Clinic, Union health and family welfare centre and BCAS provides training for purifying water and increases awareness

Rahima Khatun, Shyamnagar, said, *"NGOs did a lot of work. We received a lot of trainings but that didn't help us or benefit us in any way because the way they tell us to work and participate is tough for us. Regular tidal surges submerge our latrines, we know what to do but we can't act accordingly."*

Both Government and Non-Governmental Organizations provided training but none of them came to any help. But they attended various training programs conducted by different NGOs. Haripod from Kalatola said "numerous people like you came from different organizations asked questions and received answers but none of that helped us in any way". Haripod also said that the chairman and the local members addressed our issues to the government and received funds too but they use that money in some other areas or use/spend that money on themselves, none of them help us. But we learned and know a lot which we received from various trainings but sadly we can't practice them. All of them say to drink clean water and use proper sanitation but where can we find such facilities how can we afford it?". Regular tidal surges submerge the pit latrines we face very difficult situations but an embankment can help recover the situation

Recommendations

Freedom fighter Kamlesh Babu from Kalatola recommended as, “If the embankment is raised and protected with blocks it will solve all water related issues.” He also added that, Increased siltation being deposited in the river bed is causing the overflow of water. The water is getting inland and polluting all the fresh water sources. Regular excavation of river bed will help mitigate this problem.

Summitry Rani, said that, if the saline water is stopped from entering our village, all the problems will be solved. She added that if this is done, we can grow various vegetables in our back and front yards; we can also cultivate fishes in our waters and keep domestic animals to help improve our economic conditions. If the tidal waters do not enter then the latrines will function accordingly and the water won’t be polluted so people will not fall sick so often.

Shrimp Cultivation needs to be stopped (Ms Monjit Mondal, Health Inspector)

1. Community based water treatment plant needs to be established. Union should allocate a budget for water treatment and sanitation.
2. To collect and conserve rainwater, families must take the initiative to invest in tanks that can hold up to 1000/2000 liters of water.
3. 4 villages in the union Shyamnagar, have fresh water points, through massive water treatment plant, the water could be transported to the other villages though pipelines
4. At least 3-4 ponds should be dug up in each village to store fresh water. For rainwater harvesting, the rain water tank should be distributed to each family for free of cost.