

Impacts of Climate Change on Water Supply and Sanitation: A Case Study in Char Area

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Abstract

Nowadays climate changes are an important issue in the world. Khulna, the third-largest city in Bangladesh, is located in the southwest of the country, where the consequences of climate changes are expected to be particularly severe because of its geographical location and low elevation (Four meter above the sea level). For 2050, according to IPCC the sea level rise for the low scenario is 20 cm and for the high scenario is 40 cm. For this reason the situation of water supply and sanitation condition would be highly vulnerable in near future due to climate change. The Natun Bazar Char area under Khulna district has been experiencing frequent water logging during rainy season. The sanitation facilities become unusable during floods and rainy season. The objectives of this study is to analyze the impact of climate change on water supply and sanitation (WSS) facilities in Natun Bazar Char areas in Khulna, where the status of health and hygiene is very poor and the awareness level at the dimming condition. This study revealed that 78% tube wells will be inundated and 58% latrines will be water logged and lost their usability by 2050.

Keywords: Climate Change, Water Supply, Sanitation, Sea Level Rise, Health and Hygiene

1. Introduction

Climate includes patterns of temperature precipitation, humidity, wind and seasons. “Climate change” affects more than just a change in the weather; it refers to seasonal changes over a long period of time. The global climate change is one of the most significant environmental issues of the present world [1]. The world has began to witness the consequences of climate change with the increased frequency of Tsunami, cyclones, and devastating floods which are seriously affecting its helpless populace and leaving them in limitless miseries. Rosenberg and Maheswary [2] mentioned that the effects of global climate change are evident now, as we are experiencing through irregular weather conditions, these effects are multidimensional and the effects are not the same across the globe, because of geographic locations and different levels of development. In recent years, climate change related on water supply and sanitation impacts have also taken precedence. According to IPCC [3], global warming would cause pollutes the water source thus increase of vector borne and water borne disease in the tropics [4]. Due to climate change, sea level, humidity, rainfall and temperature is changed. Bangladesh is a low-lying deltaic country in South Asia formed by the Ganges (Padma), the Brahmaputra (Jamuna) and the Meghna rivers and their respective tributaries. The country has been suffering from various types of major natural disasters like floods, cyclone, storm surge, tidal bore, river bank erosion, salinity intrusion and drought etc. Currently climate change poses a new threat to life and livelihood of the people of Bangladesh. Climate change is recognized as a key sustainable development issue for Bangladesh [7]. These risks will be additional to the challenges the country already faces. Long-term changes in temperature and precipitation may impact on water supply and sanitation. Sea level rise may have severe implications on water supply and sanitation of coastal area through inundation and salinity. It has also various impacts on Bangladesh, a coastal country with a 710 km long coast on the Bay of Bengal. A sea level rise of 1m will inundate 17.5% of the country’s vast coastal area and flood plain zone. The possible increase in precipitation due to climate change coupled with sea level rise will make

the situation even worse to rivers. Temperature rise in the atmosphere causes sea level rise (SRL) and affects low lying coastal areas and deltas of the world. Global mean surface air temperature has increased by between about 0.3 and 0.6°C since the late 19th century. The additional data available since 1990 and subsequent reanalysis have not significantly changed this range of estimated increase. Data show that recent years have been among the warmest since 1860 [6]. This study has been carried out in one zones representing high vulnerability in Khulna district with an aim to explore and find the effect of climate change on water supply and sanitation in the study area. It is based on the available secondary resources such as IPCC reports, books, government policy documents, international reports and scientific journals. Emphasis was placed on assessing the impacts rather than measuring the rate of sea level rise, or the root causes of global warming.

2. The study area

Khulna is the third largest metropolitan city of Bangladesh (46 sq. km.). Once it was known as an industrial city with a large sea port at Mongla. Geographically, Khulna city is located on the natural level as the Rupsha and Bhairab rivers and characterized by Ganges tidal floodplains with low relief, criss-crossed by rivers and water channels, and surrounded by tidal marshes and swamps. Figure1 shows the map of Khulna. The average land surface elevation of Khulna is about 3.32 m from the Mean Sea Level (MSL) (Adhikari et al., 2006). The study area, Natun Bazar Chor, is a part of 22 no ward of Khulna City Corporation (KCC). It is situated on the bank of Rupsha River in the east side of KCC and merging the border line of KCC. It is one of the undeveloped areas under KCC which population is around 17 thousands in 2011 according to KCC report. Water supply and sanitation facilities of these people are very worst in condition.

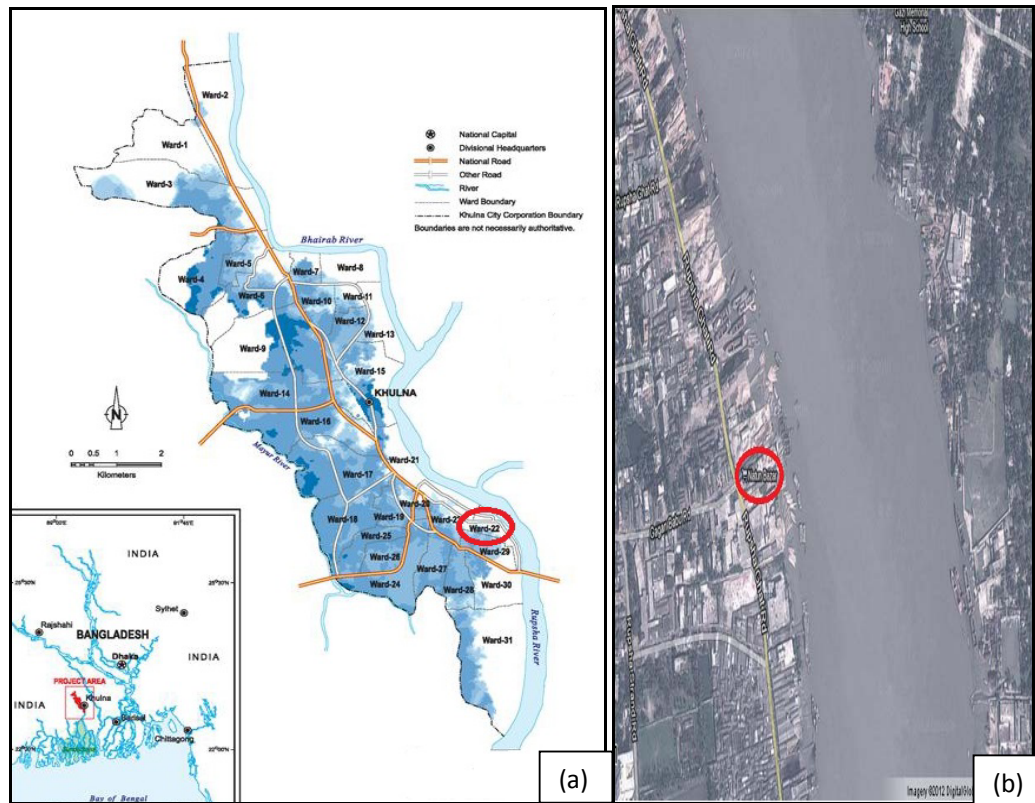


Fig. 1. (a) KCC map showing study area; (b) Satellite view of study area

3. Materials and methods

At first, preliminary field survey was conducted and tube wells (50 nos) and latrines (50 nos) are selected in such a way that it represents the entire study area. After finalizing the points final field

survey was done to collect the reduced level of the selected tube wells and latrines. In the mean time a detail questionnaire survey was conducted to investigate the present water supply and sanitation situation. To assess the impact of climate change on water supply and sanitation additional secondary data was also collected from Water Development Board, KCC and various journal and scientific research paper.

4. Result and Discussion

Present situation

It is observed from the questionnaire surveys that water supply situation in the study areas are not satisfactory (Fig.2.a, Fig.2.b). Moreover, the other services like sanitation, drainage and waste disposal are not adequate and needs improvement in most of the low cost areas and slums. However, the main source of drinking water is the tube well supply water. Around 65%, 25% and 10% water are used for drinking and other purposes from tube wells, rain water and river water, respectively (Fig.2.c). Most of the people use pit latrine (75%), but these latrines are not hygienic (Fig.2.d).

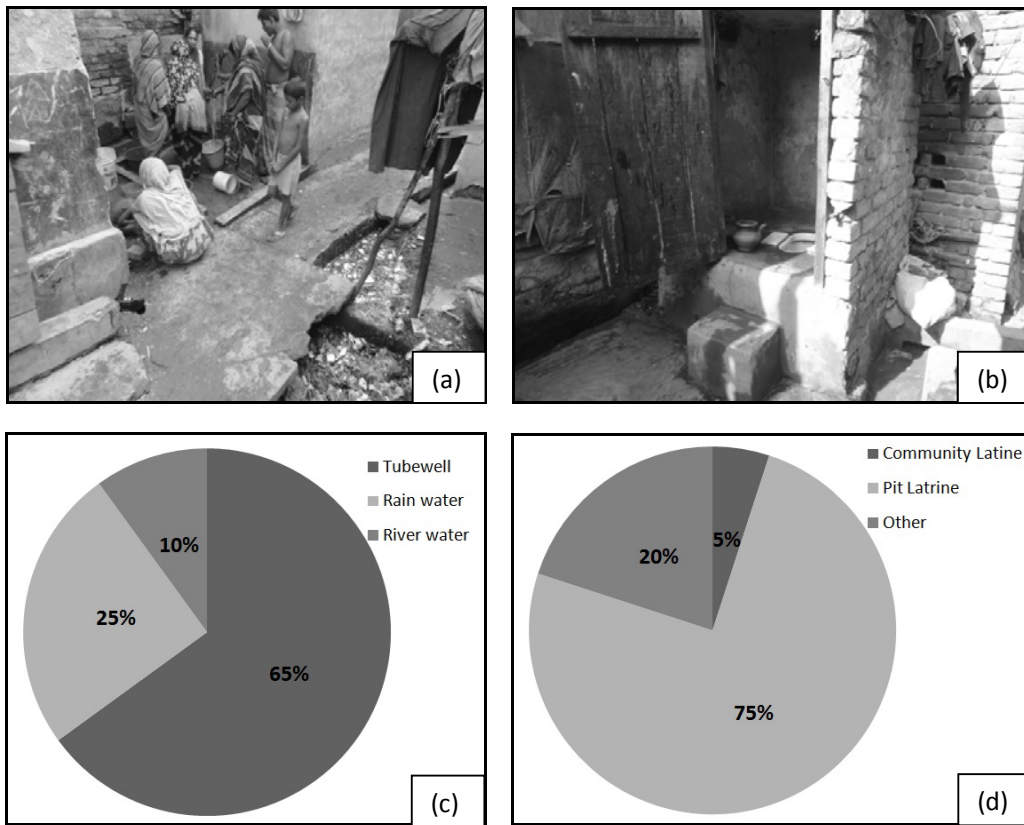


Fig. 2. (a). (b). Pictorial view of water supply and sanitation, (c). Source of water for drinking and other purposes, (d). Practice of sanitation.

Precipitation and temperature

The major climate change impacts which will affect the study area will be (i) increased salinity intrusion in surface and ground water due to sea level rise, which will make it difficult to secure sufficient fresh water, and (ii) more frequent and intense rainfall, which will aggravate water logging and flooding. Previous data for last 60 years (1948-2008) shows that maximum precipitation 233.25mm and minimum precipitation 71.83 mm occurred in year 1974 and 1971, respectively (Fig.3). Over the last 60 years the year 1969 was the hottest, when the average annual air temperature was recorded at 32.02 °C. The coldest year was 1981, when the average annual air temperature was 28.89

°C (Fig.4). The observation records of the past 60 years show the average annual air temperatures varying between 29.89°C to 32.02°C. However, this data shows that precipitation and temperature of this region is varying frequently, but due to green house effect temperature of the world increasing rapidly. Temperature effects the consumption of water. Hot season express higher water consumption than cold season. With the high increase rate of global temperature, sea level will rise at a faster rate of 2-6 times than the present rate. Hence, the sea level is rising; it affects the water supply and sanitation facilities of the study area as it is situated in coastal region. Considering predicted sea level, according to IPCC, reduced level (RL) of highest water level (HWL) of Rupsha River will be 3.6 m and 4.45 m in year 2020 and 2050, respectively. Tube wells and latrines, which base RL are below HWL will be flooded. Fig 5 and 6 show the RL of tube wells and latrines. Straight lines of the Fig 5 and 6 represent the HWL of Rupsha River. Fig 5 represents that 7 nos and 39 nos of tube wells will be inundated in year 2020 and 2050, respectively which is 14% and 78% of total tube well examined. Fig 6 represents that 5 nos and 29 nos of latrines will be water logged and lost their usability by 2020 and 2050, respectively which implies 10% and 58% of total latrine.

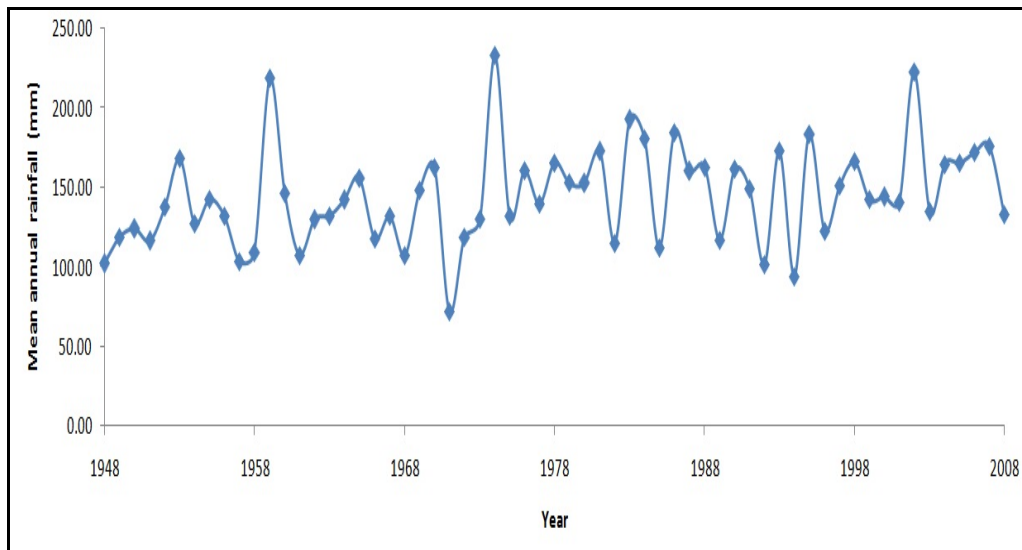


Fig. 3. Variation mean annual rainfall of previous year

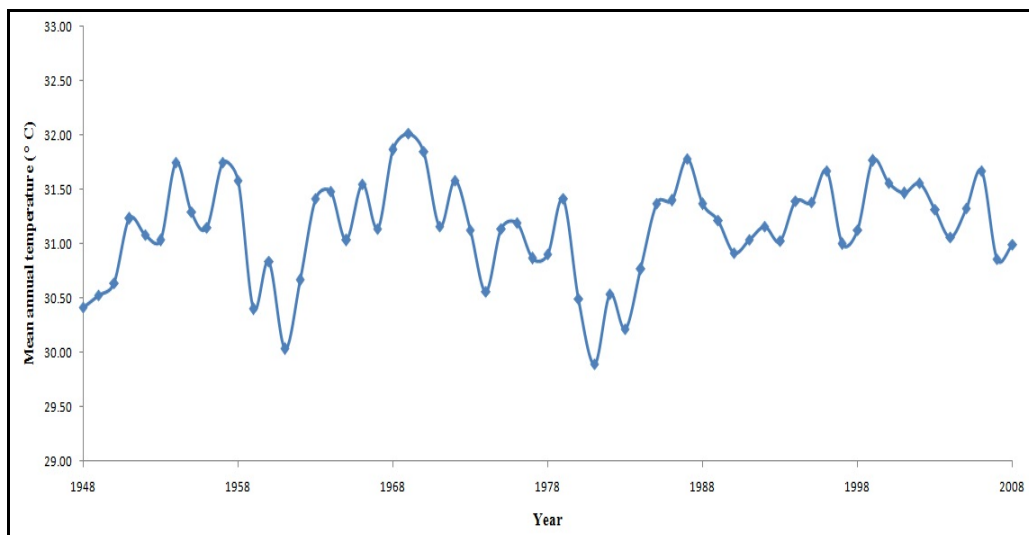


Fig. 4. Variation mean annual temperature of previous year

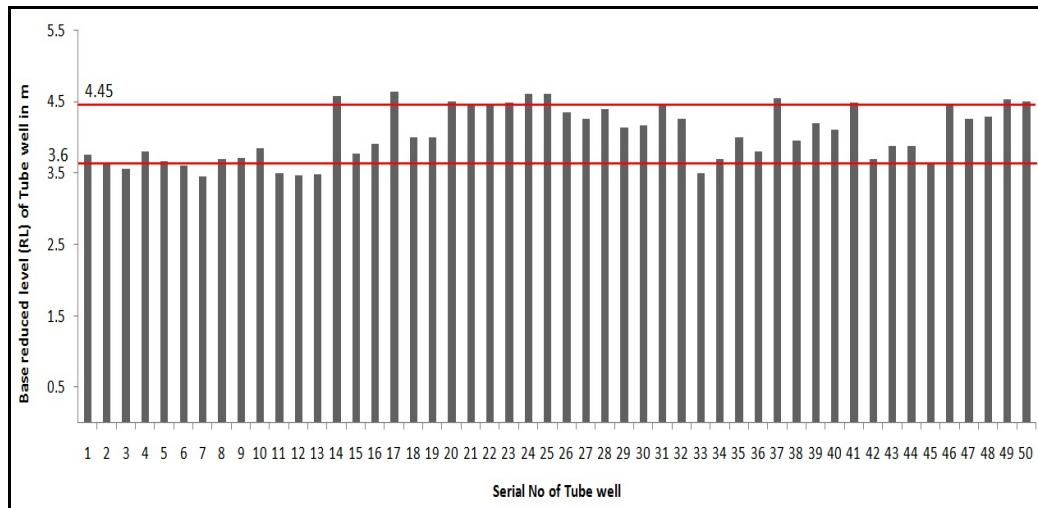


Fig. 5. Base reduced level (RL) of selected tube wells.

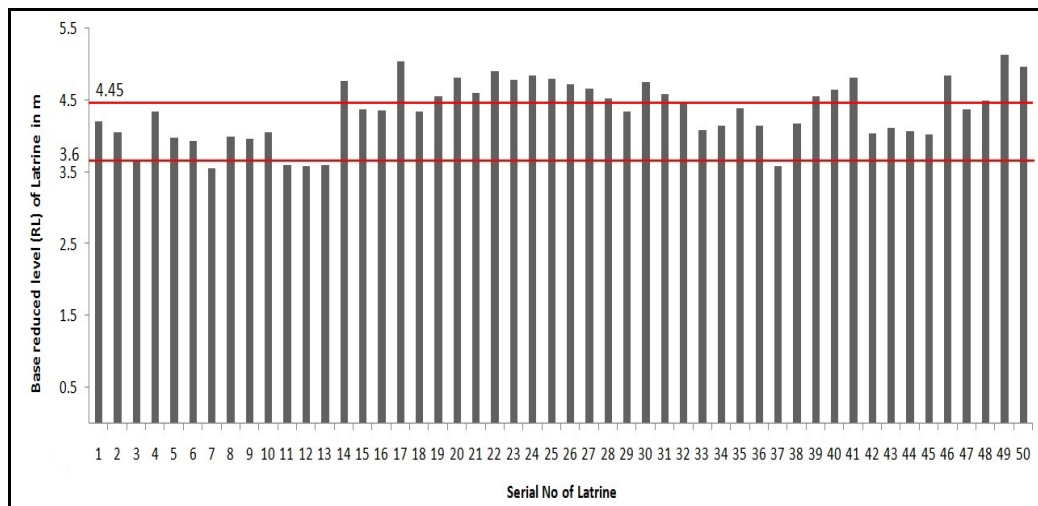


Fig. 6.: Base reduced level (RL) of selected latrines.

5. Conclusions

Water supply and sanitation facility in Natun Bazar Chor area is poor and it's become worsen day by day due to climate change. Due to sea water level rise, these facilities become flooded and spread water borne disease as well as health risk of peoples. It is not wise to think that the sea level will not rise, or to wait and see what will happen in the future. Instead, development and implementation of adaptation policies and appropriate mitigation strategies must be identified to respond to the issue of sea level rise. Base of the tube wells and latrines should make sufficient high. Research is needed to find practical solutions to the potential problems and to develop knowledge and capability in order to facilitate improved future water resources management plans. Adequate coastal protection must be developed including drainage facilities. Research is also required to ascertain how to save the country's coastal people threatened by the sea level rise. Technical and financial support from the international community is necessary to combat the impact of sea level rise in Bangladesh. Bangladesh alone is not able to face such a large scale problem.

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6. References

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