

RESEARCH PAPER

Impact of Climate Change on Urban Slum Dwellers in the Barishal City Corporation of Bangladesh

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ABSTRACT

The impact of climate change in Bangladesh is visible now and it is becoming more unpredictable every year. Living with the phenomenon of climate change is a daily issue for the residents of Barishal's slums, as different seasons bring different types of climatic hazards. The specific objectives of the study were to assess the impact of climate change on slum dwellers; current interventions on Disaster Risk Reduction, Climate Change Adaptation and mitigation and response to Climate Change Adaptation and other coping mechanisms adopted by the slum dwellers at Barishal City Corporation (BCC). To carry out this study, both primary (individual surveys, group meetings, focus group discussions, and key informant interviews) and secondary (books, newspapers, journals, online articles, websites, and UNICEF offices) data were gathered. Water logging and high population density are the main problems in the study area, according to the findings. Water logging (38%) and river bank erosion (26%) are categorized main problems of BCC. The findings show that poor communities are more vulnerable to climate change as a result of their geographic location and population size. Sixteen percent of respondents used non-sanitary latrines and 26% of people used sanitary latrines at present. Sanitary latrines should be assured in slum areas to reduce to water pollution and health risk. The study identifies that due to waterborne diseases, the majority of the respondents (95.44%) suffered illness in the last decade, and in that area, the community is deprived of regular food consumption (66%) and faced limited access to information (82%). In the slum community, the drainage system is too much poor. Eve-teasing, child mortality, drug addiction, and child labor are regular problems; another problem is protecting children. Indirect impact on income loss, migration, loss of land etc. Another issue is child protection, income loss, migration, and land loss. The study found several existing DRR and CCA-related activities and implemented mechanisms in the study area that need to be improved, as well as relevant policy responses to mitigate the impact of climate change on slum inhabitants.

Key words: Adaptation, Climate Change, Impact, Urbanization.

Introduction

Climate change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years). Climate change may refer to a change in average weather conditions, or in the time variation of weather within the context of longer-term average conditions (Alam 2004). Climate change is caused by factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruption. Certain human activities have been identified as primary causes

of ongoing climate change, often referred to as global warming (IPCC 2007).

In terms of the impact of climate change, few places in the world will experience the range of effects and the severity of changes that will occur in Bangladesh, which will include: temperatures rise; extremely hot and cold spells; less rainfall, yet more in the monsoon; and sea level rise, turning freshwater saline and facilitating storm surges (Gruebner *et al.* 2009). Climate change is one of the greatest concerns to humanity in our generation,

posing a risk to individuals' and communities' fundamental rights to health, food, and a decent standard of living around the world (UNEP 2015). Although the effects of climate change are felt worldwide, the impoverished and marginalized populations of developing countries are the most susceptible, as they rely on local ecosystems for their existence. These are the same people who are least able to adjust to the rapid changes that are affecting their surroundings (WHO 2008), who do not have appropriate safe drinking water, proper sanitation, or access to land, credit, or knowledge (www.thelancet.com). Few places on the earth are experiencing the same range of effects and levels of change like Bangladesh as a result of climate change, which includes rising temperatures, extreme hot and cold spells, and less rainfall overall but more during the monsoon; and sea level rise, turning freshwater saline and facilitating storm surges (Khan *et al.* 2009).

The majority of households in the slums of Barishal have already experienced at least one major river bank erosion and water logging in and around their dwelling. They have failed to secure a sustainable livelihood in the city despite living for a long period of time (Hossain 2005). The climatic disasters cause loss of lives, damage to properties, impacts on livelihoods, etc. which leads to retard the country's economic growth. It is common knowledge that the poor are more exposed to such shocks since they have fewer opportunities and are less connected to social networks (Wickramasinghe 2009). To date, efforts to mitigate the effects of these shocks and stressors have primarily focused on measures from three distinct domains: social protection, catastrophe risk reduction, and climate change adaptation (World Bank 2011).

Limited work has been done on the overall climate change impact on health, education, nutrition, WASH, child protection sector in the urban slum area of Bangladesh. So, there need to identify climatic risks faced by the slum dwellers and to prioritize them. And also assess and analyse the impact and finally preparing national climate change adaptation plan for slum dwellers. In this regard, the community people are the prior experienced. So, their perception, knowledge, ideas

on the impact of climate change should be given high priority to prepare local adaptation measures. This research will also make the concerned people aware of thinking about various alternatives to adapt to climate change. The purpose of the present study is to assess the impact of climate change on slum dwellers and know the existing program and response to climate change adaptation in Barishal City Corporation.

Materials and Methods

Description of the study area

For the research purpose, 5 slums such as ward number 4, 5, 6, 9 and 10 of Barishal city were selected respectively. These Slums were selected regarding location, type of structure, density and size. Ward 05 is one of the largest slums in the study area. Around 85040 peoples live here. A lot of slums have been built along with riverside. (Source: Field survey-2018)

Sampling Procedure

In this study, both qualitative and quantitative approaches were used. For the quantitative method, face to face individual survey was conducted with selected respondents. The qualitative approach has been applied to understand the experiences of the affected slums and also to verify and enrich the quantitative results. The questionnaire was pre-tested before the final data collection. In each ward, 50 respondents were selected from the list of population, thereby the number of respondents for this study totaled 250. The respondents belonged to the age 20 years and above. The data were collected from February 2018 to April 2018.

Besides quantitative surveys, some qualitative studies were performed using ward consulting meetings, eight Key Informant Interviews (KII), and five FGD. For Key Informant Interview (KII) and FGD, a short questionnaire was developed focusing on key issues and it was administered to community leaders.

Variables and Indicators

All essential variables and related indicators for analyzing the five slums have been created in accordance with the scope of the evaluation. The variables and indicators used are presented in Table 1.

Table 1. List of variables and indicators consider to measure the climate change impact on urban slum dwellers (Adapted from Yasmin, 2016)

Variables	Indicators	Description
Shelter/ mobility	Migrations	-Displacement from another place
Food security and nutrition	Effect of temperature and water logging and dietary practice.	- Percentage of respondents faced health problems due to temperature variation and water logging Food Dietary practice
	Food problem faced	- Consumption pattern of respondents living in five slums Food problems faced - Able to eat a normal amount of food during water logging and rainfall -Percentage of respondents who faced problem in food preparation, storage, and collection
WASH	Management problem	-Percentage of water sources for drinking and household purposes.
Education and knowledge	Availability of education	-Percentage of reasons of drop out from the school
Health	Disease occurrence	-Major climate-sensitive diseases suffered by the respondents -Percentage of respondents who suffered from climate related diseases
Child protection	Lack of awareness	-Who are mostly suffered
Income	Increasing severity, intensity and frequency on climate	-Decreasing livelihood option related hazard and income activity

Methods of Data Collection

The primary data for this research was collected through field survey, data collection, interviews and public consultation with community people. The primary information was collected, compiled, and analyzed. The data obtained from the study were analyzed statistically using Microsoft Excel-2013 (v15.0). Finally, the analyzed data have been presented as tables and graphs.

Face to face individual survey

Data were collected from respondents of separate households through a structural questionnaire. The researcher first established rapport with the respondents and clearly explained the objective of the study using the local language as much as possible. As a result, the respondents furnished proper responses to the questions without any hesitation.

Focus Group Discussion

Authors have facilitated five focus group discussion in respective five wards in Barishal city. A semi-structured FGD checklist was used to conduct FGDs. In focus group discussion, various topics like about climate change, risk, adaptation mechanisms and resilience of the community people were discussed.

Key informants interview (KII)

During the study period many five key informants' interviews about climate change impact in Barishal city and its effects before, after and during a climatic hazard/disaster was completed. A checklist was prepared to fulfill the objectives of KII.

Secondary Sources

In order to develop the conceptual basis of study, information was collected from different relevant sources such as books, journals, thesis, abstracts, reports and websites etc. Documents were collected from various organizations like UNICEF, Barishal office, KFW office.

Results and Discussion

Respondent's profile

During the study, it has been seen that the maximum respondents were females (33.68 %), 37.31% were males and 29.01% were children (Figure 1).

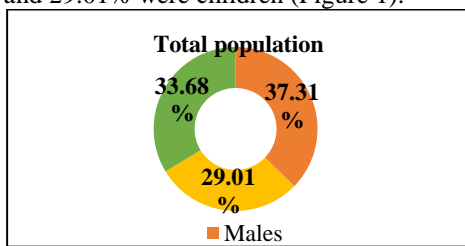


Figure 1: Percentage of total population (Source: Field Survey-2018)

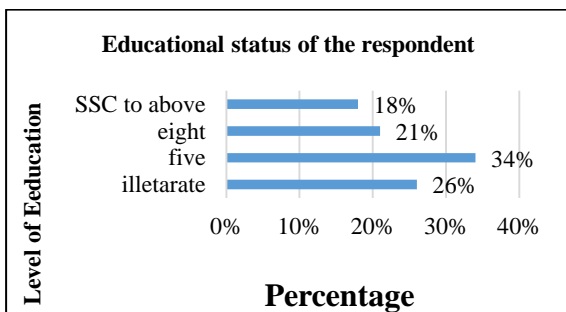


Figure 2: Educational status of the respondent based on questionnaire survey (Source: Field survey-2018)

Figure 2 describes that more than 26% of the respondents are illiterate, 34% is under grade five, and 21% grade eight, grade ten educational attainments are 18%. That means from illiterate to class five cover 60% and from class six to class ten or more cover 30% respondents population.

The livelihood pattern of the study area is given below: A livelihood consists of the resources (such as skills, technology, and organizations) and activities necessary to maintain a high standard of living. Understanding livelihoods entails not just looking at people's primary source of work or income, but also all of the numerous activities and adoptions that offer food, health, money, shelter, and other advantages within the home and community.

Figure 3 shows that income source of most of the people is from housewife (50.00%), student (13.01%), day labor (16%), small business (13.59%), business (0%), NGO worker (6%), etc.

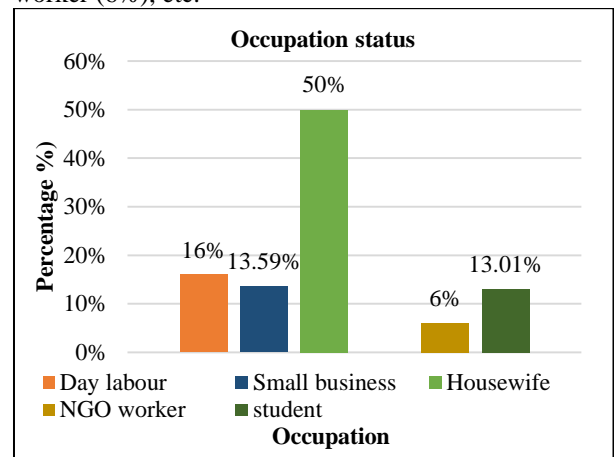


Figure 3: Livelihood pattern of the study area (Source: Field Survey- 2018)

Climatic hazard in the study area

Every year, residents of the Barishal slum confront a variety of climate hazards. Climate change increases the intensity and frequency of natural hazards and its effect are created on people's life, livelihood and property. According to people perceptions water logging, riverbank erosion, cyclone and high temperature occurred due to climate change.

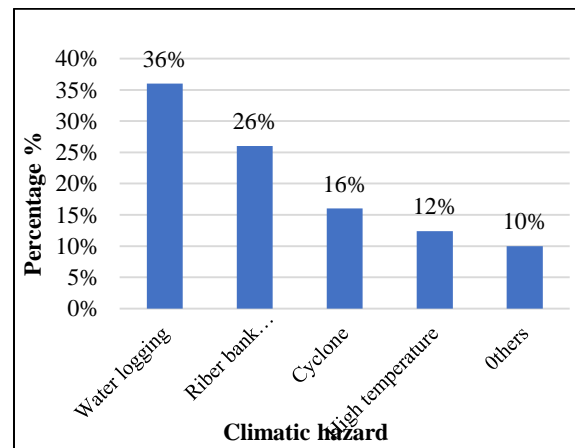


Figure 4: Climatic hazard in study area (Source: Field survey-2018)

Figure 4 indicates that highest number of people (36%) said that water logging are exists in the study area and occurring most due to climate change. The second number of people have said that river bank erosion is exists in this area and this percentage is more than 26%. Most of all people said that extreme heat and cold occurring in this area. More than 10% of the respondents have said that high temperature occurring most in author study area. 16% people said that cyclone occurring in this study area. Others such as flood, excessive fog, higher rainfall, increasing wind spread are occurred every year in Barishal 10% of people said it.

Impact on the life of people and service facilities

Migration and population pressure particular in slum area

One of the immediate impacts of riverbank erosion is displacement. The people usually move to nearby areas but sometimes migrations to distant place are not unusual (CUS, 2005). The study found that most families have witnessed a migration in their original place to urban area. From the baseline survey it was found that, Most of this area already is or will become flood prone from rains (water logging) and from river flooding. The most vulnerable communities live in Wards 5, 6 (Palashpur), 9 and 10. Due to inferior building materials, the houses are vulnerable to cyclones and wind damage as well as migration to urban areas is a regular phenomenon but climate induced displacement forced to migrate to Barishal cities over the recent years is a matter of concern. According to the baseline survey increased frequency and severity of natural disasters by climate change over the past recent years are not only displacing people physically but also exposing to enhanced poverty by threatening their livelihoods temporarily and permanently in Barishal City Corporation. Growing number of people rush to Barishal city’s slums creates urban crisis. Climate change threatens peoples’ access to food as they become socioeconomically susceptible. Displaced people (due to river bank erosion) living in urban slums are in search of better and secure life. But, Barishal slums area located mostly in low-lying environmentally hazardous area coupled with inadequate facilities like food, shelter, sanitation, health care make their life even worse. Growing number of people in Barishal urban slums over the recent past creates extra pressure on existing systems and challenge to government development activities like slum development and poverty reduction strategy.

Wash

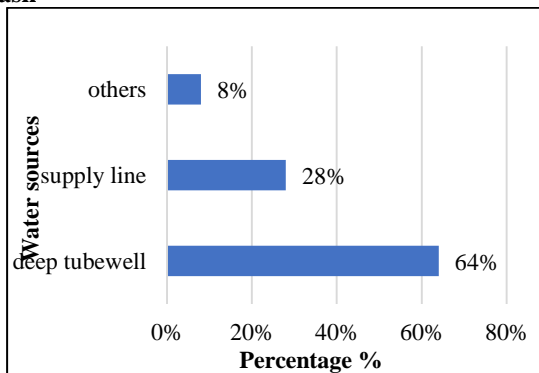


Figure 5: Sources of water for drinking and household purposes (Source: Field survey-2018)

Most of the people used shared latrine and also used non-sanitary latrine. People used supply line, deep tube-well, river and pond water for the purpose of drinking, cooking and washing. Figure 05 revealed the findings that the majority of the respondents (64%) utilized water from deep tubewell for drinking and household purposes. While 28% of respondents used water from the supply line as well as other sources (pond, river) for everyday washing and cooking. Almost everyone in ward no. 05 has a water and sanitary problem, especially during the monsoon period.

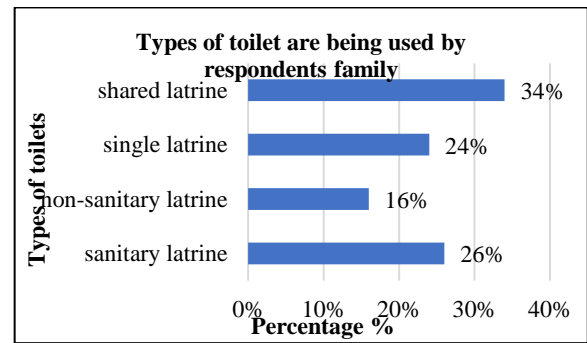


Figure 6: Types of toilets are being used by respondent’s family (Source: Field survey-2018)

Figure 6 showed that 34% respondents are being used shared latrine at slum area. Where 24% of respondents used single latrine. Studied on the respondents of the urban slum of Barishal where they found that 16% of respondents used non-sanitary latrine and 26% of people used sanitary latrine.

Education

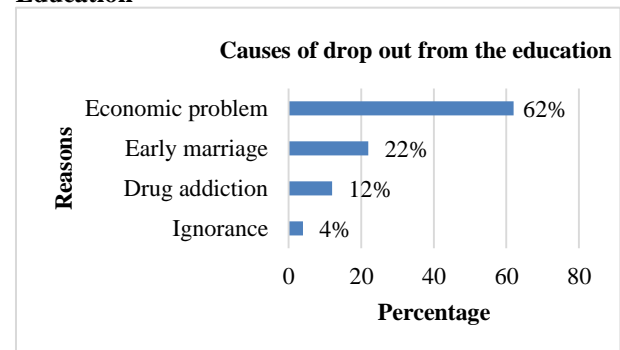


Figure 7: Causes of dropout from education (Source: Field survey-2018)

Figure 7 revealed that economical problem is the main reason for children to drop out of education. 4% of respondents agreed that ignorance of education is another problem. Most of the family members avoid the education system. While, 12% of respondents said child-labor is a burning issue recently. Different climatic disasters occurred that directly affected poor families especially those are living in riverside areas. Most of the families lost their home and land. They are migrating in urban area and children started labor work such as, tokai, rickshaw puller, domestic worker etc. Early marriage and drug affected another cause’s drop out of education.

Food Security and Nutrition

Table 2 showed that 68% of respondents faced problems in food preparation and 60.59% of respondents faced problems in food collection during water logging conditions followed by heat stress at slum household

where 66.15% of respondents faced problems with food storage and decaying (Table 2). Due to a lack of pure water and food preparation arrangements they face problems in food consumption. At first few days of

Climate change impact on urban slum water logging condition, they consumed the food which they already have in household but if the condition continues for long time they fall in to a worse situation and children become the most sufferer for the situation.

Table 2. Effect of Climate Change on Food Security and Nutrition

Problem due to the climatic hazard	Yes (%)	No (%)
Able to eat normal amount of food during water logging and rainfall	66	34
Problem faced in food preparation during water logging and rainfall	68	32
Problem faced in food storage and decaying during heat stress	66.15	34.85
Face difficulty in food collection during water logging and rainfall	60.59	40.01

(Source: Field survey-2018)

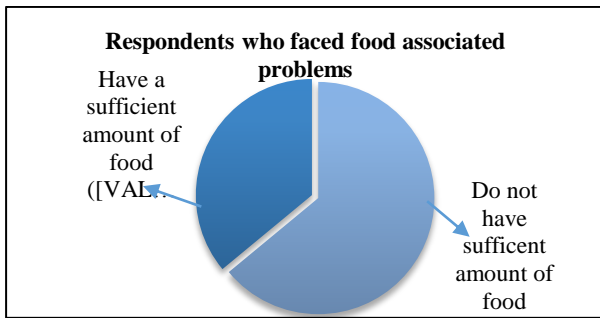


Figure 8: Percentage of respondents who faced food associated problems in hazardous situations (Source: Field survey-2018)

From figure 8, it has been shown that 34% of households are unable to eat a normal amount of food during hazardous conditions. Food collection and preparation become difficult for dwellers during water logging condition. Slum dweller face problems to go outside for food collection. At high temperature and heat stress condition the people of slums face the problem of food decaying. The food spoils as they have no alternative storage facilities like refrigerator.

Health

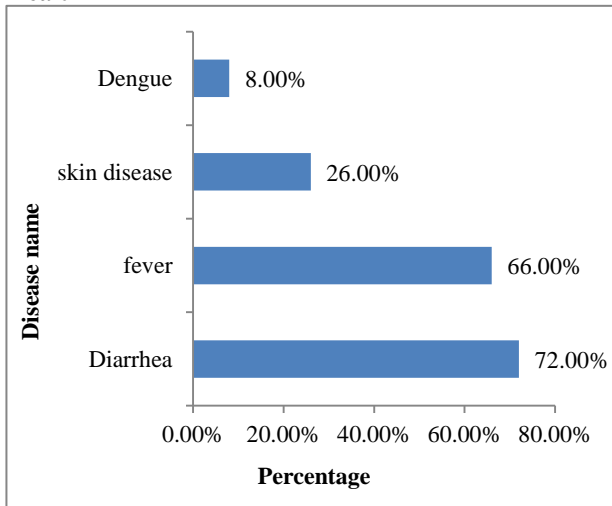


Figure 9: Major climate sensitive diseases suffered by the respondents (Source: Field survey-2018)

The incidence of some of the major climate-sensitive diseases at the selected slum has been presented in figure 9. From five slums it has been found that a major percentage of respondents, 71.29% suffered from diarrhea and also a noticeable percentage of respondents suffered from skin diseases and fever. 25.46%, 62.39% and 7.1% of respondents of five slums reported that they have suffered from dengue. Other diseases such as malaria, pneumonia, food poisoning, jaundice etc. are

common sicknesses among 95.44% of respondents and the reasons identified by the respondents are heat stress, decayed food, impure water, stuffy household environment etc. The prevalence by disease is high in the slums. Waterborne, temperature related diseases goes up.

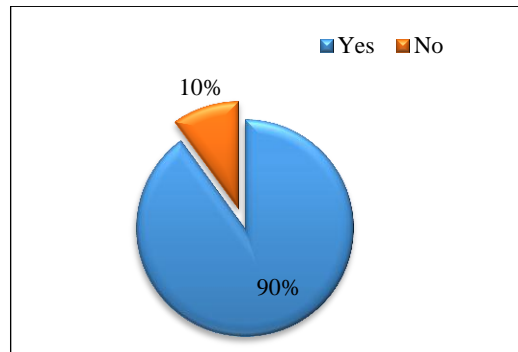


Figure 10: Respondents who suffered from climate-related disease (Source: Field survey-2018)

The participants who suffered from climate-related diseases have been presented in (Figure 10). The figure reveals that 90.00 percent of respondents became ill due to climate variability in the last decade and 10.00 percent of respondents have no problem.

Respondents of the study expressed that water logging conditions, temperature variation, heat stress, and poor sanitation conditions increase the emergence of diseases. Mosquito breeding sites were found in areas adjacent to heaps of waste, poor sanitation, and polluted ditches. The slum dwellers visit local pharmacies, quack doctors and traditional practitioners for health problems. For serious illnesses, they go to nearby or major public hospitals.

Child protection

In every crisis, children are the most vulnerable. Climate change is no exception. Slum children are most vulnerable, especially child protection system. Girls are mostly harmed. They faced many problems such as sexual harassment, early marriage, child labor, etc. Here are some impacts on child protection:

From the five slums, it has been found that a percentage of respondents said girls are mostly affected. Sexual harassment, eve-teasing, child abuse, child marriage is the main issue. Boys are affected due to being separated from family, dropping from school, drug addiction. In the research area, 92% of respondents said that girls are highly affected due to climatic disasters. 8% of people said that boys are little affected by the climatic disaster (Figure 11).

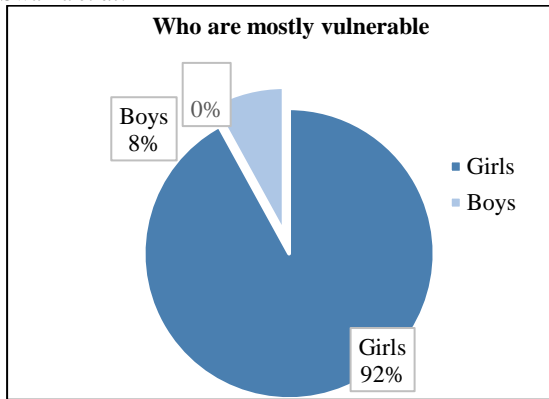


Figure 11: who are mostly vulnerable (Source: Field survey-2018)

Income

Impact on income:

According to the baseline survey, the author found that the occupation of a different earning member in slum households is one of the determining factors of livelihood status. Most of the slum dwellers are unskilled, and involved in the informal sector, such as day labor, small businessman, business, housework, domestic worker and few numbers of people involved in the job sector.

For climatic hazardous event such as water logging, heavy rainfall, high temperature, cyclone, river bank erosion and flood etc. at the slums dwellers saved little money. 80.09% of respondents in the study answered that they lost their savings due to climate change related disaster. Very few households can save from what they earn. The respondents said their income becomes less during heavy rainfall, heat stress.

Existing program and response for adaptation of climate change and its limitation:

As per as Bangladesh is one of the victims of climate change of being coastal area, Barishal City Corporation has prepared to survive. The Barishal area worked two theme “what they do leave and how better the services facility”

Three on-going projects in Barishal City Corporation:

KFW

Floods, cyclones and rising sea levels disrupt the lives of many people around the world. Communities will face more damage as urbanization advances and climate continues to change.

To address this challenge, KFW and Barishal City Corporation teamed up to develop an adaptation strategy for Barishal in Bangladesh. This will help the people there adapt to the impacts a changing climate will bring. The main objectives of the project were (From the key informant’s interview of KFW expertise):

- Establishment one Climate Change Adaptation Learning Centre (CCALC) at project city to enhance the knowledge, skills about climate change adaptation and urban resilience as well as ensure sound relationship between city authority and community people
- Suggestions to Improve the Climate Change Adaptation Strategies for BCC
- Technical Support on Water Bodies Management in Barishal City Corporation (BCC)
- Technical Support on Operation and Maintenance of Barishal City Corporation (BCC)

Climate change impact on urban slum

- Organize census for the primary settlements and organize base line survey at the selected slums level
- Situation Analysis on urban management and governance for Barishal City Corporation
- Conduct Participatory Community Development Process workshop at selected community in Barishal City

Youth conference of climate change (YCCC)

The divisional commissioner of Barishal division, the office of the divisional director of the department of environment and forest, Barishal and UNICEF Barishal office jointly organized the Youth Conference on Climate Change on 10th April, 2018 in Barishal engaging Youth groups, Universities, international and local NGOs aiming to promote and engage the youth to address the challenges of the impact of climate change. The conference also tried to engage youth people with policy makers, government officials and NGOs through different interactive sessions. .

The main objectives of the conference were (Attending Youth conference on climate change):

- Develop “Barishal declaration” by engaging youth and adolescent to face the upcoming challenges of the impact of climate change
- Build capacity and strong partnership among the youth of Barishal division so that they may understand the urgency of the situation and take necessary actions against the impact of climate change for both present and future generations
- Contribute to establish an enabling environment for children and adolescents by engaging policy makers, Government counterparts, NGOs, youth and adolescents
- Develop adolescent and youth ambassadors to raise voice against the adverse effect of climate change
- Identify areas of advocacy for reducing the impact of climate change at national and global forum and take necessary action.

Community Risk Assessment (CRA)

Workshop for Community Risk & Vulnerability Assessment has been organized on 18th March, 2018. Secretary of Male Councilors, Secretary of Female Councilors, Teachers, Adolescent and Social women and men leader had participated in that workshop.

The entire participant had given data about city disaster risk and vulnerability by group work. They have given data about probable risk, at a glance of last 10 years disaster, present awareness systems, shelter centers, problems of shelter centers, probable time of disaster etc. They have also given data about volunteer, media workers, local doctors, fuel businessman, owners of vehicle, fire brigades worker, rich & elite persons, cleaning worker, service provider organizations etc. Except those, they also gave data about community risk and vulnerability. Participant had raised different problem of during disaster, they also told how they advise on that situation and how much they suffer. Which organizations work there, how many those organizations capable to remove their current problem issue?

As a first step, the team brought together all relevant stakeholders to discuss the main threats to the community. This unique collaboration between local decision-makers highlighted the most relevant hazards, the most vulnerable people and the most exposed areas.

Swarna *et al.*

The entire participants identify the disaster and climate change related risk in city area.

And also identified the impact on health, education, WASH, child protection, nutrition's etc.

Limitation of this program

From the study and FGD when completed, authors observed that 82% of peoples are not participated climate change adaptation training and only 18% of people participated it. Most of the organizational activities worked about climate change and its adaptation system but they are not concern about community based adaptation, community involvement, mainstreaming. In baseline survey community involvement, mainstreaming and community based adaptation is very important issue for reducing impact of climate change.

Community based adaptation

When author will complete primary data collection, observed that , "Local people are the real experts" in terms of climate change, as they know about any changes that are occurring best, as well as having traditional responses to cope with many of them.

Mainstreaming

Climate change threatens the success of almost all development activities currently carried out in Barishal City Cooperation and will need actions across the whole range of development projects to address it. Basically climate change adaptation and mitigation measures will be needed in almost all areas of life and therefore development interventions.

Community Involvement

The level of awareness on climate change issues is therefore rather low, especially in Barishal slum area. However, awareness on climate change related matters is essential for looking at any meaningful adaptation. Stakeholders at different levels including communities need to know about climate variability, change, impacts and risks related to such issues in order to prepare for the coming changes.

Initiatives can be taken for the address of the impact of climate change

From the baseline survey researcher realized that some initiatives can be taken to reduce the impact of climate change. The initiatives are given below on the basis of their geographical location such as:

1. Increases public awareness
2. Elevating roads and constructing submergible RCC roads for slum areas
3. Constructing multipurpose Cyclone shelters for the slum or urban poor
4. Controlling further river bank erosion in the North western bend of the Kirtonkhola river
5. Embanking the river side of the Palashpur Slum Area and possibly also Rasulpur Island.
6. Promoting open spaces in the city (incl. road surfaces) for rainwater infiltration
7. Give training and awareness about climate change.
8. Building social safety network by youth club, councilor, mayor, teacher etc.
9. Proper drainage management.

Conclusion

Adaptation with the adverse impact is a normal tradition of the people of this area. The riverbank erosion, cyclone, water-logging and high temperature are the most

Climate change impact on urban slum common climatic phenomenon in the area. The findings of the study provide an overview of how the climate change impacts of slum dwellers. Every year people losses their homestead and property due to river bank erosion and finally migrate in Barishal city area. The slum dwellers face problems of food storage, decaying, preparation and collection during water logging, heat stress and unpredictable rainfall. Most slum dwellers are not well educated and involved in the informal sector, such as day labor, small business, NGOs worker, student etc. Their poor income and fewer saving make them more vulnerable to the hazards. The relief coverage of Government and non-Government organizations in slums are very limited but the initiative is very remarkable. Many of the children are domestic worker and home servant. Lower economic condition is the main problem. Most of the people used shared latrines. Clear and forward-looking policies on urbanization and urban slum settlements are vital for long term thinking and interventions to improve the slum settlements. Already there are three organizations working in Barishal City Corporation for climate change adaptation. The impact of climate change needs to be considered while formulating policies for all development sectors. The measures related to climate change impacts must be given a wide layout of different developmental activities like water and sanitation activities, health, food security, solid waste management, drainage system improvement, awareness rising etc. for the wellbeing of the poor slum dwellers.

Recommendation

The following recommendations are made to enhance the resiliency of the community people of the study area against the impact due to frequent change in climate.

1. Government and Non-governmental organizations should increase their ambition with respect to both climate change mitigation and adaptation, and work cooperatively to ensure the improvement of living standard of the slum dwellers in Barishal city.
2. Construction of cyclone shelter should be in proper design and suitable distance from the community people.
3. Awareness rising program about climate change.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Swarna *et al.*

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Climate change impact on urban slum

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