Thompson Rivers University (TRU)

The Impact of Climate Change on the Lives of Poor Migrants to Dhaka City

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Abstract

For low-lying Bangladesh, climate change is not just a harbinger of devastation. Effects of climate change are seen in the form of flood, drought and cyclone and this not only leaves irreparable damages but also gives rise to a mass number of climate refugees or environmentally displaced people. Due to direct and indirect impacts of climate change, the propensity for city-centric migration is increasing. This rural-urban migration partly occurs as migrants seek for a healthier place to settle down and the assessment is done by trying to find relatively better social, economic and environmental conditions in the city areas. This research is an intensive exploration of the lives in slums in Dhaka City, where a significant percentage of the dwellers are climate-affected drifters. It scrutinizes the livelihood problems that migrants face after coming to Dhaka City slums and how their problems are intensified due to climate change. The study uses four slums at Bosila, Korail, Badda, and Agargaon in Dhaka. It investigates the reasons for migration and the socio-economic and health problems the migrants face afterwards. The research also answers questions to what challenges they face in the process and what coping mechanisms they adopt to combat them. In addition to primary data, secondary data from various books, journals, and other sources were also analyzed to probe into the issue. The study hypothesizes that climate induced migrants to Dhaka City slums are not immune to miseries from further climate related problems. The analysis adjudicated that there is a major void in the implementation of rules, regulations, and policies from different levels of governing bodies, and therefore, the slum dwellers are prone to scores of socio-economic & health related problems due to environmental change**.**

Keywords: Climate change, migration, urban slums, Dhaka City, Bangladesh

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This thesis paper is a priceless achievement for me because of a number of reasons. I always wanted to do something for the society where I grew up in a rather productive fashion. When I first sat down to decide my thesis topic, I looked at the various opportunities available for me to do so. As an Environmentalist with altruistic ardor at heart, I thought of delving deep into interweaving an environmentally sound approach to later help the society. I hope with the motivation and untainted intention with which I started this paper, my hard work does justice to serve the true purpose of this paper.

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Ashikur Rahman

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List of Abbreviations

ADB – Asian Development Bank

BCAS - Bangladesh Centre for Urban Studies

CUS - Centre for Urban Studies

CFC- Chlorofluorocarbon

DCC - Dhaka City Corporation

GDP- Gross Domestic Product

GHGs – Green House Gases

ICDDRB - International Centre for Diarrheal Disease and Research, Bangladesh

IOM – International Organization of Migration

IPCC - Intergovernmental Panel on Climate Change

MDGs – Millennium Development Goals

MVCs – Most Vulnerable Countries

NGO - Non Governmental Organization

RAJUK – Rajdhani Unnayan Kartripakkha (Capital Development Authority)

SATU – Social Advancement through Unity

UN – United Nations

UNHRC – United Nations High Commissioner for Refugees

UNFCCC - United Nations Framework Convention on Climate Change

WASA - Water Supply and Sewerage Authority

WB - World Bank

WHO- World Health Organization

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Chapter 1
Introduction

Climate change is one of the biggest concerns in Bangladesh. It involves complex interactions and changing livelihoods, especially among the people who are directly affected by the events that come uncalled. A new report by a risk analyst, Bangladesh is set to suffer more from climate change by 2025 than any other country(RTCC, 2013).Bangladesh has its own innate reasons for its vulnerability towards climate change. This is primarily due to many factors like its demographic aspects, economic dependence on sectors that are dependent on climate and other social factors (Azam & Falk, 2013).But considering the scenario on a broader spectrum, developing countries are usually seen to suffer by the strike of hazards in the livelihood of people due to their less adaptive capacity and technological innovation.

Changes in the environment are inevitable and it influences various decisions taken by the victims of environmental calamities, one of which is migration. Environmental change and migration is an integral part of worldwide discussions and debates taking place at international forums and discussions (Azam & Falk, 2013).According to previous studies, major impacts of climate change fall on the residents of the coastal areas, which happen to be the place that gets significantly affected after a climatic hazard. The city-centric migration may take place due to several case-specific problems (Azam & Falk, 2013).

In Bangladesh, there is quite an apparent disparity in the living condition of the poor and the rich. To exacerbate this issue, there is a major dearth of corrective policies and actions to ameliorate the situation. The majority of people who are affected by climate induced hazard are the low-income population groups, whose livelihood in adjusting to the new urban environment becomes an essential challenge along with combating to the still-existing climate hazards.

1.1 Background

Climate change and migration are the two concerns that entangle themselves in a very complex mode. For Bangladesh meeting both geographic and economic challenges are of utmost importance and needs serious spotlight in terms of disentangling the perplexities of the existing scenario.

Though the role of a developing country like Bangladesh in climate change is very limited, but its impact for our country is disastrous. One of the main reasons of why the amount of greenhouse gas is increasing in the atmosphere is due to industrialization and urbanization, mainly because of excessive use of fossil fuels in these sectors. Greenhouse gas emissions hinder the atmospheric heat to enter the space, thereby causing a continuous rise in the earth's temperature. Results of changing environment in a not-so-normal fashion include irregular rainfall, increase in natural disasters, changes in annual crop cycles, transformations in the types of diseases, rise in the sea level and even change in biodiversity. Among the greenhouse gases, most important are carbon dioxide, methane, chlorofluorocarbon (CFC), sulphur hexafluoride, nitrous oxide, hydro fluorocarbon and per fluorocarbon (EPA, 2015).
Over the past century, effects of climate change have been observed through diverse changes in the physical system. Changes in the biological systems are also observed in the Earth's ecosystem. Climate change is now an axiomatic reality and is widely accepted by the whole scientific community of the world. A lot of attention is being drawn to this issue today as it's an ominous threat to a much dangerous future to the fate of mankind. Also, it has been bringing various extreme weather events at a much frequent rate with elevating magnitude of impact than that earlier. These climate events include floods, storms and droughts that lay harsh consequences on the livelihood of people living in vulnerable areas.

There is mounting disparity between the slum dwellers and the elite population who reside in the high-class areas of the town. This difference may lead to enhances social and political instability. The challenges of urbanization include unplanned housing, lack of advanced planning and comprehensive approach and several others but improving city governance, decentralization of functions and responsibilities and good urban planning and sound

incentives are logical recommendations that may provide some solution to these problems (Helal uz Zaman, Khan & Islam, 2010).

On the other hand, migrants are also influenced by indirect economic impacts. They include circumstances like lesser yield of crops, falling down of economy and water scarcity. Quite a few studies have been conducted on this issue and a lot is to be done to delve more intricately into this crucial matter. People who are made to leave their own area of settlement to migrate somewhere do not get the legal status as 'refugees'.

Even after migrating to a new place in the urban sector, they develop various strategies to cope with the climate variability, which is still present but possibly in a different form now. Because in the city, the effect of climate change might be new but is still persistent. On their constant struggle to adjust to the new environment, people also combat to fight against extreme shock or stresses. The overall scenario makes attaining sustainable development very difficult here in Bangladesh. Already it is considered that if the situation continues to be so, it will be even more hindering to attain the Millennium Development Goals (IPCC, 2007). Their capacity to cope with the problems might be limited due to a number of factors. They primarily encounter the problem of lack of assets for which accessibility to many solutions face stymie.

1.2 Climate Change and Migration

Along with the several ways that the changing climate lays permanent changes in the lives of people, migration is still one of the biggest problems. During every catastrophic events of natural disasters that cause hundreds and thousands of lives to be taken away, people who do survive from the fiasco plan to move on to a safer ground with their remaining family. The population growth in the country is already high and along with that, adverse climatic impacts fall on the more vulnerable portion of the country's citizens, causing them to get displaced. This causes much disruption in the social, political and also economic advancement of the country.

It is expected that due to the adverse effects of climate change, Bangladesh will have 78 million people displaced in 2020 (Akter, 2009). People have a plan to settle down with better livelihood patterns when they reside in the urban areas. But the question is if they actually find that peaceful settlement once moved. Usually the time to adjust to the new environment, coupled with other concerns to find employment and set the children into a certain pathway takes a big challenge. They also have to struggle to fit in to the new environment and new occupation from agricultural to non-agricultural.

1.3 Problem Statement

Climate change puts an onus on the already-existing problems of the poor, which include social, economic, and environmental challenges.

One of the many problems that it entails is the destruction of the natural resources, resources on which the poor people mainly depend on. Hence, devastation of mass amount of natural resources makes poor people to fall into the crevasses of poverty.

Environmental degradation leads to escalating poverty in Bangladesh. People living in the villages have very little scope and source of income since their occupations range from being farmers of little available land, agricultural workers and fishermen. As such these people depend a lot on natural resources for their livelihood.

Not only does the massacre cause infrastructural devastation, it also leaves a lifetime trauma within the hearts of the people. It includes the grief of losing their family members, takes them all that's there in their capacity to recuperate from the damage and also a big amount of mental strength to reconstruct what has already been lost. The constant rehabilitation and reconstruction of the damages occur in the Northwestern and Southwestern parts of Bangladesh, which is particularly vulnerable to disasters (Akter, 2009). But these are inherent problems that the Bangladeshi climate victims have been encountering and combating since the birth of the very country. All these make them push themselves to the population-poverty-environmental nexus (Akter, 2009).

Lack of identification of the climate refugees is another big issue. Dhaka is not ready for climate challenges at all. Clearly Dhaka does not have any utility service that can serve the purpose of proper livelihood of urban poor. But then, they are bound to migrate to Dhaka in search for better economic facilities. When local work is not obtainable these people migrate outside (starting from migrating regionally outside the villages while also moving to urban and semi-urban places) (Azam & Falk, 2013).

During the rainy seasons, it gets extremely problematic for the compact families to move and find a safer place since their poorly-built slums already get more vulnerable. The city itself is very compact as it is. Buildings and other infrastructures are being constructed as if there is no space to walk through in between them. There is a huge fragility of infrastructure in the slum and squatter surroundings along with lack of sanitation and employment security.

Slums also have the least maintained drainage system, which is why once affected by flood or having experienced a continuous rainfall, water-logging and other severe problems arise.

There are major limitations in accessing the utility services of the slums. Even though water supply has experienced an ameliorating condition, there is not enough hygiene safety for such a big cluster of population.

All these problems become whole under one concept and in fact even bigger while seen from a broader lens. Having the whole family migrated, the main income earner of the family have to struggle his or her way to attaining marginal stability.

By no means, it is easy. For the family is not only coming across the constant battle of readjustments of lifestyle, they also have to struggle in getting used to their new jobs. Earlier if a person was a farmer or was engaged in the informal sector, this time after the evacuation, he has to move to a completely new job like rickshaw pulling or getting involved in the construction services. Migrants also take a great deal of effort to overcome the emotional trauma of having all their assets devastated. Some lose their family members while running away to the cities to save themselves. These grieves entail till the end of time and also bounds as one of the major post-migration problems.

1.4 Context and Rationale

According to The World Bank, Bangladesh is listed in the top most vulnerable countries for climate induced hazards like flood, cyclone and storm surges (Khan, 2013).The four slums that were selected for this study were chosen on the basis of few crucial characteristics. The slums are Bosila, Korail, Badda and Agargaon. These slums do not only accommodate the already residing poor inhabitants of Dhaka, but are also an attraction for climate refugees because of the availability and access to various important resources. They include ease in employment opportunities for men and women both, already migrated refugees have communities built up and several other reasons.

1.5 Hypothesis

Following hypothesis will be tested in this study:
Those who live in slums in Dhaka City, they are permanently or temporarily settled there for various reasons. A large percentage of them are voluntary or forced migrants from other regions of the country. Quite a few of them are "climate refugees". We hypothesize that the climate induced migrants to Dhaka City slums are not immune to miseries from further climate related problems. They are prone to many socio-economic & health related problems due to environmental change. The nature and magnitude of their sufferings may be different, but flood, rain, temperature change – all of those make their slum lives far from being immune to climate-related problems.

1.6 Aim

The aim of the study is to identify the livelihood problems that the migrants, a significant percentage of which are climate-induced migrants, face after coming to Dhaka City slums, and how their problems are intensified due to climate change.

1.7 Objectives

Following are our objectives:

1. To study four big slums of Dhaka to get a picture of the post-migration livelihood patterns.
2. To investigate the reasons for migration from climate change perspective.
3. To depict the social, economic, and environmental problems being faced after shifting to these places.
4. To find out about their coping mechanisms in order to combat the challenges.

1.8 Significance of the Study

This study will essentially give a big picture of the currently existing condition of climate refugees and others in Dhaka City slums. The research will not only provide a holistic view of factors motivating the migration but also provide underlying circumstances that the migrants experience in day-to-day life basis. The study will essentially develop into a mechanized report focusing on the social and economic livelihood struggles that hinder the smooth living after migration. It will also highlight the climatic hurdles faced by the people that lay as environmental impacts on the city slums. It will identify the crucial problems and propose feasible recommendations as identified problems can be of major help to understand the real causes.

The study will hopefully encourage government bodies, NGOs, donor agencies, and other stakeholders to see the real scenario of the environmental refugees. The outcome of the report may have been identified by some non-governmental bodies too, who actively function in the amelioration of social status of climate migrants. As such, they may adopt specific actions to help these people overcome the constant battle of struggling livelihood. The suggested recommendations in this study may help the policy makers identify, scrutinize and formulate case-specific policies against each of the issues to bring about better social and economic conditions for the poor.

Chapter 2
Literature Review

2.1 Climate Change

2.1 What is Climate Change?

Intergovernmental Panel on Climate Change (IPCC) explicitly proclaims that human-induced climate change is unequivocal and evident (Rogner et al., 2007)

According to United Nations Framework Convention on Climate Change, climate change is defined as: ‘‘a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods’’(Field et al., 2014).

It is a long shift in the weather statistics and it is inclusive of all averages. It may include the expected average temperature and precipitation values for a given time and venue, from one decade to the next (NOAA National Weather Service, 2007).

2.1.1 Why does climate change occur?

Causes of climate change are wide-ranging. Climate change occurs because of the fact that large quantity of greenhouse gas is radiated out in the atmosphere due to different activities. Some of these activities are mainly human-induced and lay a severe impact on the health of the environment. While some of the solar energy that reaches Earth is absorbed into the atmosphere, there are only some portions of it that leaves the Earth. It is the greenhouse gases that causes prevention of the solar energy from going back to space and remain inside the atmosphere (Saha, Ali, Jonsson & Haque, 2014).

2.1.2 Climate Change: Worldwide

According to a statistical study of the observed impacts of changing climate, it has been seen that the last decade has been the warmest. This record also shows that over the last hundred years, surface temperature of the world has gone up by 1.3ºF. Also, the rate of warming of the world over the last hundred years has been double of that of the last fifty years (EPA, 2010).

Among the many reasons why climate is changing every day, one of the major actors playing an important role in the irreparable change is humans. In fact, as of today's date, human beings doing harm to the environment leads as the main cause to climatic problems. Excessive burning of fossil fuels releases harmful greenhouse gases to the environment. These gases trap heat in the atmosphere, which was on its way out to space. This causes the global temperature of the world to increase at a significant level.

There are changes in the way that land is being used. Trees that are being cut down as a result of rapid industrialization and act of deforestation, the amount of the potent greenhouse gas called carbon dioxide is increasing. These trees which were to absorb all this carbon dioxide produced in uncountable amount, are no longer absorbed and hence remain suspended in nature. Agricultural production leaves a huge impact on climate change too as farm animals release methane and factory made fertilizers release nitrous oxides- both of which are harmful greenhouse gases. All these come as a consummating result of human actions (Scied.ucar.edu, 2015).

2.1.3 Observed Impacts in the Complex and Changing World

Among the many changes that have taken place in the changing world today, in the recent decades climate change impacts have had its effect on both natural and human systems. This has occurred and laid its impacts in almost all the continents across the world and across the oceans. The changing precipitation, melting snow and ice are altering the hydrological systems. This is largely affecting the water resources in terms of the quality and quantity and it is seen quite evidently. Due to climate change, glaciers are continuing to shrink and are happening almost worldwide. This is affecting runoff and water resources downstream. It is

also so impactful that permafrost is warming and thawing in latitude regions and in high-elevation regions. Moreover, a major change in the movement of the aquatic animals.

Terrestrials, freshwater and marine species have shifted their geographical locations, ranges, seasonal activities and also the migration patterns. Some statistics show that in response to climate change their abundance has changed along with species interaction. The negative changes in climate change have also been apparent on crop yields. Climate change has negatively impacted on wheat and maize yields for many regions. The worldwide burden of human ill-health from climate change is relatively small compared with effects of other stressors and is not well-quantified. (Saha, Ali, Jonsson & Haque, 2014).

2.1.4 Climate Change Impact on Bangladesh

Bangladesh is a small country that is based on a low-lying delta, formed by the dense network of mighty Ganges, the Brahmaputra and the Meghna and their distributaries. The total land area is 147,570 sq. km. It has a network of more than 230 major rivers and their tributaries crisscross the country. Bangladesh has a population of about 160 million and Gross Domestic Product (GDP) of US$ 67.7 billion per annum. Cyclones in Bangladesh are responsible for 60% of the deaths in the world (Sdwebx.worldbank.org, 2015).

From meteorological point of view, the climate of Bangladesh can be classified according to the following seasons: dry and cold winter, which is from December to February; Pre monsoon, which is from March to May; Monsoon, which is from June to September and Monsoon that lasts a span from October through November. The hottest season of the year is pre-monsoon. Some extent of rainfall is seen during this period and it is accompanied by Norwester, hailstorm and often with the recurrence of tornadoes (Choudhury, n.d.).

Myriad anticipated adverse consequences of climate change including sea level rise, unmanageable deluge, fluctuating temperature or precipitation patterns and increase in cyclone intensity has aggravated the existing stresses in Bangladesh. This impedes the development in both the rural and urban sectors and lays a detrimental impact to its socio-economic structure, environment, national growth and most importantly- the people of Bangladesh.

Although the climatic system of Bangladesh is cardinally determined by temperature, rainfall, wind pattern and solar radiation, frequency and extent of feeling the impact varies from occasions to occasions. Massive flood disrupting endless communities have devastated livelihood patterns of myriad amount of people. Historically it can be seen that these climate victims get affected by yet another climatic incident before fully recovering from a certain disaster (Rashid, 2013).

2.1.5 Climate Change Impact on Dhaka

With the growing population in Dhaka City, the use of more motor vehicles is increasing, so is electricity consumption. Dhaka is also subjective to flooding from rivers that bound it along with the rainfall that causes runoff. This runoff is more than what the city's drainage capacity is (Alam & Rabbani, 2007).

Mainly, the capital is at a threat of elevating temperature because there is massive amount of vehicles that are on the city streets. All these vehicles emit volume of emissions that are very harmful for the environment. Also, the city has in place hundreds of industries which are both publicly and privately owned. The industrial activities also add to the harmful impacts of climate change because they not only give out excessive amount of debilitating gases to the environment, but also incorporate massive use of energy. Flood and congestion due to drain blockage are predicted to be the most daunting ways the capital could get affected. 2-13 meters of elevation above the sea level may lead to a major part of the city getting inundated in the near future (Monsur, 2011). Hence climate change does pose a very big threat to the future of the capital of Bangladesh.

2.1.6 Climate Change and Dhaka Slums

Despite trying for a long time, not only the existing residents of the slums, climate migrants and other people in the slums have been constantly failing to secure a descent livelihood in the city. They are not only in a state of vulnerability to social and physical capital, but environmental constraints also push them to an unstable form of livelihood.

Safety of the slum inhabitants is at risk because factors like temperature, rainfall, and humidity affect the incidence of water borne diseases. In such cases various parasites like bacteria and other vectors get accessibility to breed faster as they can live longer in conditions that are warmer and wetter. The slum conditions after such incidents become suitable to best fit the breeding conditions of the parasites (Aßheuer, Thiele-Eich & Braun, 2013).

2.2 Migration

2.2.1 Ways Climate Change affects Migration

Not only Bangladesh, a number of other countries are facing similar climate related problems. The extents of the problems are different in different countries. For example, "About 85 per cent of the Maldives' main island, which contains the capital Male, would be swamped. Most of the Maldives would be turned into sandbars, forcing 300,000 people to flee to India or Sri Lanka. Vietnam could lose 500,000 hectares of land in the Red River Delta and another 2 million hectares in the Mekong Delta, displacing roughly 10 million people. In West Africa, up to 70 per cent of the Nigerian coast would be inundated by a one-meter rise, affecting more than 2.7 million hectares and pushing some beaches three kilometers inland. Gambia's capital, Banjul, would be entirely submerged. In the Mediterranean, Egypt would lose at least 2 million hectares of land in the fertile Nile Delta, displacing 8–10 million people, including nearly the entire population of Alexandria. The demise of this historic city would cost the country over $32 billion, close to a third of its annual gross national product (GNP) in 1999. South American cities would suffer some of the worst economic effects. In Guyana 600,000 people would be displaced 80 per cent of the population. The cost would be $4 billion, or 1,000 per cent of Guyana's tiny GNP'' (Shamsuddoha & Chowdhury, 2009).

The main ways that climate change affects migration are:

(i) The overall warming of the global environment has an impact on the agricultural sector, which undermines the healthy augmentation of 'ecosystem services'.

(ii) There is an onset of climate events like deluge and heavy rainfall in most of the tropical regions that proves calamitous to the whole community residing there.

(iii) The deadliest consequence is the sea level rise that destroys immeasurable assets and inundates home to million people, forcing them for a massive evacuation (Shamsuddoha, & Chowdhury, 2009).

One of the largest challenges faced by the migrants is the change in profession. While in the village, the people might have been involved into agricultural sector or was a fisherman. However, after the migration in the city, they are forced to work in professions that they have never had experiences in before. For instance, a fisherman's profession changes into that of a construction helper in the city. It takes immense pressure and patience for someone who has been engaged with a certain kind of work in the rural sector to drastically change profession in a completely new area. But they are compelled to do so because after the migration, they have the burden of the whole family to be taken care of. If that is not sufficient, finding an employment in the first place also becomes challenging. It is also seen that the new migrants who were boatmen before are now forced to pull the three-wheeler cart called rickshaw in the city. They do it without any prior skill or knowledge on traffic management. They are also involved in informal nature workings and deprived from entitlements of fundamental rights. The seasonal migrants also have to send remittance, a majority of which is mostly used for daily expenditure. These regular expenses include money for education for the children, health, loan payments, investments and so much more (Rashid, 2013).

Most of them live in cheap rental houses or slums; even on footpaths where they have serious problems regarding water supply, sewerage, sanitation, electricity, and other basic utilities. It also creates social relation problems because some married migrants are compelled to move to the city for supporting their families in the village. Some gradually cut their ties with their families staying in the village. The absence of migrants has negative impact on the well-being and security of the family that is left behind in the village.

2.2.2 Situation of Migrants after Migration:

Currently approximately four million people, about ten thousand people per square kilometer, are living in Dhaka City which was originally designed to accommodate just one million people during the 1960s. The climate affected migrants move to Dhaka City with an aspiration of a better life.

Scopes of employment in garments factory, communication system, and social networking facilities are better in Dhaka than any other city in Bangladesh. Access to facilities and greater amenities, like higher education and better medical care are act as pull factors to come to Dhaka (Rashid, 2013).

2.2.3 Status of the urban poor people in Dhaka slums

Slums and squatter surroundings are densely populated areas with three or more adult people in each room and the houses' infrastructure is extremely poor and weakly built. They are either mud-homes, semi- concrete or ram shackled building and are either rented or owner occupied. The inside scenario is much unfortunate because along with having no livelihood facilities many other important accessibility structures are missing,

2.2.4 Migration as Livelihood Adaptation Strategy

In the light of environmental change and climate impact, mobility can be the outcome of immediate stress resulting from natural disasters. But it can also be an income-diversification strategy undertaken in anticipation of or in response to environmental shocks, as well as to cope with a long-term decline in livelihood. Communities, whose livelihoods are closer to the agricultural or naturally based resources, are closely tied to poverty related shocks right after climate change impacts (Gioli, Khan, Bisht & Scheffran, 2014).

Migration is a way of managing the risk associated with vulnerability. And for people who are suddenly displaced off their lands, it takes huge pressure while small time to be decisive of the best policy to lead a safe life in the future. The decisive casual linkages with migration are therefore difficult to identify. What is seen in majority of the cases is that the rural areas have a dearth of adaptation, mitigation and preparedness measures to support a sustainable livelihood of the people. (Walsham, 2010).

2.2.5. Conceptual Framework

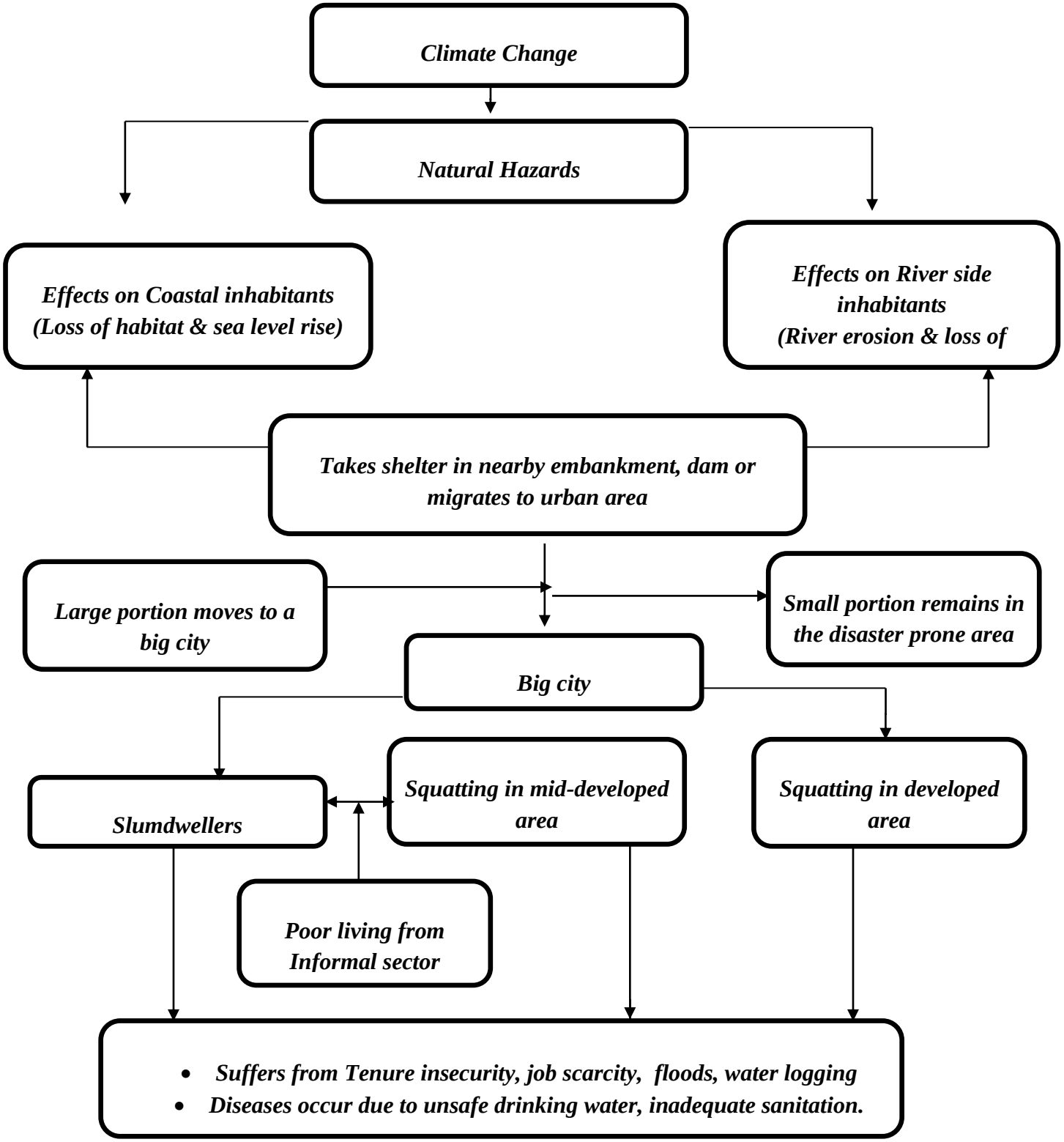


Figure2.1: A conceptual framework for climate change impact on the lives of poor migrants

2.3 Climatic Conditions

2.3.1 Temperature and Rainfall

Climate change has brought about erratic rainfall patterns in different corners of the world. And this change is ought to bring about changes not only in the economic aspect, but also social and environmental well-being. Over the last ten years, the amount of irregular rainfall has increased rapidly in Dhaka city. This has been shown in both regional climate model and as well as observed data present (Murshed, Islam & Khan, 2011).The amount and frequency of rainfall has increased. Rainfall causes various kind of other problem, especially in the slums and squatter surroundings where the facility of well-maintained drainage is not there. In places like Bashundhara, which are newly developed model towns in Dhaka; one onset of rainfall brings about absolute inundation of the whole place. For a rapidly growing urban area, this is a big problem.

"The Fourth Assessment Report of IPCC (2007) has observed that the 100-year linear trend (1906-2005) of global average surface temperature is 0.74 (0.56 to 0.92) degree Celsius and is larger than the corresponding trend of 0.6 (0.4 to 0.8) degree Celsius (1901-2000). The report also states from 1900 to 2005, precipitation has found to either increase or decrease in different parts of the world and globally, the area affected by drought might have increased since the 1970s" (Basak, Titumir & Dey, 2013).

It is predicted that heavy rainfall will become more common in the near future. This problem will create problem on occupations and activities that are directly related to the climatic condition of the country. An important occupation in the country is agricultural occupation. But this kind of hurdles will bring about large damage as far as the farm incomes are concerned. There is chance of increased amount of soil erosion and the farmers will not be able to cultivate the land properly. It may also bring about problems like contamination of water supply and rise of various other water borne diseases (Pender, 2008).

2.3.2 Cyclones

Twenty six major cyclones have hit the country since 1970; among them eighteen have occurred in the last twenty years (Siddiqui, 2011). Hence a severe ominous sign is already being seen as this is a harbinger to a worse climatic situation in the coming future. The data that has been acquired over the years have constantly been signaling that situation is worsening with every passing day and serious concern should be diverted to rapidly changing climatic problems. Factors that are ascribable to such changes need to be seriously monitored and studied so that the future can be saved from deadly consequences.

Two devastating cyclones hit Bangladesh recently and these two cyclones had the strongest intensities. One of the cyclone Sidr that took place in the year of 2007 and the other one being cyclone Aila in 2009. They happened in two-year time span, which caused massive damages in the coastal areas.

Cyclone Sidr, 2007

Cyclone Sidr is one of the biggest cyclones that have ever been faced by the people of Bangladesh. One of the causes of the cyclone is the country's severe susceptibility to frequent hydro-meteorological hazard. It stands to be further aggravated due to the different aspects of climate change seen today. Cyclone Sidr had hit the south-west part of the country's coastal side on 15 November 2007. The intensity of the cyclone was one of the strongest recorded seen so far. It had a wind speed of up to 240 kmph. The high winds and floods had resulted in massive damage to a large number of houses, roads, bridges and other infrastructural establishments. Repair to these damages was difficult and funds from different organizations could barely make up for the radical damage that it caused (ReliefWeb, 2008).

Maximum damage occurred to 6 different districts of the Barisal division as 40 upzilas were affected. The number of families that had been affected and the amount of missing people was maximum recorded in this district. According to the report, a total of 7,613,612 people were affected by the cyclone (Ministry of Food and Disaster Management, 2007). A lot of the affected people were helpless and compelled to go for a forced migration to a safer region. However, the country was affected by yet another big cyclone just in two-year time.

Cyclone Aila, 2009

Cyclone Aila hit the South-Western side of the country on 25 May, 2009. The cyclone took shape as a sign to colossal destruction on 23 May and then finally hit the coastal region of Bangladesh on 25 May, 2009. It severely damaged the Shatkhira and Khulna districts of the country and took lives of about 325 people. Needless to say it destroyed almost everything that it passed next to. The entire incident of cyclone and its damages occurred within a very short period of time (Kumar, Baten, Masud, Osman & Rahman, 2010).

After cyclone Aila of 2009, migration from the areas that had been affected has multiplied. Statistics mentions that it is about 100,000 people who have migrated from areas like Koyra, Dakope, Paikgacha, and Batiaghata (Siddiqui, 2011).

2.3.3 Flood

The intensity of the flood varies from year to year. It varies according to different factors that maneuver the intensities of flood. Among them, the level of precipitation plays an important role. According to IPCC's Fourth Assessment Report (2007) heavy precipitation events will augment the risk of flood (Rahman, 2014).

Historical data of the flood that has previously affected Bangladesh shows that a quarter of the country's land that's affected by flood leaves massive destruction. The frequency of the flood and its effect has intensified over the last 25 years (Siddiqui, 2011). Due to this kind of massive devastation, a large group of people are forced to be displaced temporarily. Water-logging after the flood takes place is a common problem and majority of the flood affected victims have to face this problem.

Flood affects both the urban and rural areas in separate and detrimental ways. In the rural areas, the people mostly rely on the agricultural sectors for their livelihood. A sudden outbreak of such deluge destroys huge areas of paddy fields and other harvesting land much defectively. Strong currents not only destroy the houses, roads and other structures but most importantly take away thousands of lives of the village residents. For several months after the calamity, these impoverished victims suffer endlessly. They look forward to relief from the

government, rehabilitation for the destroyed homes and employment opportunity to support their families. It also takes them immense strength to recover from the traumatic mental shock after having experienced such a colossal damage.

In the urban side, the scenario is much more complicated and adverse if not any less. Dhaka is a rapidly growing megacity with numerous locations that are very much prone to natural disasters. It's not only overpopulated but lays high pressure on any remaining land that is there. People living in fragile and flimsy slums and squatter surroundings in the city watch their homes getting destroyed by flood. As such they are forced to move somewhere else like roadsides or road embankments.

In these conditions it becomes extremely difficult for the families to move with their remaining assets to seek out alternative and ad-hoc accommodation. Once water inundates the whole area, a lot of other related problems start arising. The flood affected victims starve in order to keep enough food to run the whole family for some more time. Presence of stagnant water gives rise to the risk of outbreak of various diseases. (Ryan, 2011).

Severe floods have been repeated in 2002, 2003, 2004 and 2007(Rahman, Islam, Ahmed & Georgi, 2012).

2.4 An Overall Effect on Socio-Economic and Environmental Sectors

The number of Dhaka City slums has increased over time, but based on various alum studies we find that the socio-economic conditions inside the slums have not improved significantly. Migration is an option for many people to get settled away from their native disaster-prone homelands. As such the climate induced displacement is causing a large number of people to migrate to the city slums. This has become a major area of concern now.

Access to food is threatened by climate change and they become even more socio-economically susceptible. They are in a constant search for a better life and a healthier living standard. Availability of the proper forms of all these becomes very expensive. Also, growing number of people in the urban slums creates an extraneous onus on the existing

challenges to the government development activities and hence the slum development strategies and poverty reduction strategies are getting harder to achieve.

2.4.1 An Evaluation of Food Safety and Security

Bangladesh has done considerably well in food production in recent years. However, individual access to food availability is limited to one's affordability. From macro perspective, there are many other things that needed to be taken into consideration when food security is addressed. "Availability of ground water is crucial for agricultural farming and irrigation. Delayed monsoons and less and or an uneven distribution of rainfall under the impact of climate change have aggravated water availability and increased water scarcity apparently that has contributed significantly to crop productivity in Bangladesh" (Alam, 2015). Food shortage at home accelerates the decisions by many to migrate to city slum areas.

However, there is not enough food available to supply to the slum dwellers particularly during climate hazards. There is also a void of clean eating practice in the slum and is seen as an outcome by the various diseases that occur because of it. Children are not taught to properly clean their hands right after eating or before. And this causes a lot of vector borne diseases to spread out within the place. They get affected by the diseases but don't necessarily find a possible solution to cure it. So there are clearly inadequate hygiene practices among children and adults within this cluster. In addition to that, there is insufficient ventilation in the cooking area which causes major health impacts to be apparent in the society.

2.4.2 Human Health and Livelihood

Even after coming and residing in slums the health issue becomes a major problem in regular livelihood of the people. After the migration the migrants have to get accustomed to a new way of living and hence combat the different health attacks they are most possibly prone to. This is especially an issue of concern because there is a lack of hygienic living condition in the slums, which attracts a lot of vectors to breed. The stagnant water in many cases due to lack of proper drainage system makes the place a good breeding ground for insects to grow and develop. These in turn travel from the ruins to even lay eggs in food particles which are

ingested by people in the slums, including young children and pregnant women. And all the cycle leads to detrimental effect on the health of these people, which too becomes another start of a new problem. Once affected by the disease, these people rarely have enough monetary support to find themselves proper health benefits. Hence, they lack the availability to get the medical support that they much admittedly deserve.

2.4.3 Water and Sanitation

Water is an important component for living. Unavailability to safe and clean water may not only hinder the regular livelihood capacities to a healthy life but it may also bring about damaging impacts to the community. In the slums of Dhaka, the accessibility to safe and pure water is competitive and highly demanding. It is a matter of sheer luck to avail oneself to pure and clean form of water.

Sanitation is another major issue that is of major concern in the city slums. Generally wastes are disposed wherever possible. Starting from roads, side pathways to above the water body, there is no law for this and hence people are least bothered about the safety issues. It is also due to the fact that these people are not educated enough to know that improper sanitation may bring about a lot of undesirable impact to the society.

2.4.4 Trade and Commerce

The slums that were selected for this study are situated in the hub of the city. Climate migrants choose to reside in the slums that are located in such a cosmopolitan zone for the sole purpose of finding themselves employment opportunities.

People who came from the villages were either engaged in the agricultural sectors or they were involved with fishing. But a major occupational change occurs right when they come to the city sides because those opportunities are no longer available to them. They now see themselves in the construction services and other forms of city-based work opportunities. Most of the time, men are seen to drive rickshaws while the women are seen to work for the houses which are there around the slums.

2.4.5 Adaptation Capacity and Coping Mechanisms

In order to combat the climate change impact to reduce vulnerability, the society of climate vulnerable community adopts multiple possible strategies. These strategies mainly fall under the two broad forms of responses, them being adaptive capacity and coping mechanism. The short term responses to any crisis can be categorized as coping mechanism. These include the real and spontaneous responses to crisis in the face of unwelcomed situations. It is not possible to clearly draw a line between adaptation capacity and coping mechanism as coping mechanism may develop into adaptive strategies.

Chapter 3
Methodology

3.1 Introduction

The inception of the research began with an intensive overview of why climate change is affecting Bangladesh. The question filtered through several underlying chapters concentrating on which sector of the community gets more affected along with which part of the country too. It was more streamlined to fetch information about the target community who are forced to get displaced from their homelands and hence, climate migrants were chosen as the target group of the study. As per the aforementioned research and the results following, a hypothesis was formulated questioning about the current status of the climate migrants and researching on the fact that despite of the mass movement from their homelands to an 'apparently safer' zone, they are still affected by various social, economic and most importantly environmental factors. For the following purpose, the research design was established according to the following work-breakdown categorization:

a. Primary data analysis – Field research and study via survey
b. Secondary data analysis – Literature review
    i. Field study and research by others
    ii. Review on the climatic factors affecting Bangladesh
    iii. History and statistics of previous climatic events
c. Designing the research area and developing the hypothesis
d. Developing a holistic questionnaire demonstrating questions towards hypothesis
e. Data analysis
f. Findings
g. Recommendations
h. Conclusions

This study does an in-depth literature review of the past in general and in relation to climate change variability to find out the potential climate related migration (long/short term, seasonal, internal/ international; explicitly incorporating different non-climatic push and pull drivers) and its focus mainly on the following fields: Route of migration: The origin and destination of climate induced migrants. Poverty, vulnerability and risk: Survey on different socio-economic, age and gender groups. Climatic data: Temperature, rainfall and flood data, as well as newly available satellite imagery and remote sensing data.

The research is a compendium of various analyses, merged from desktop research to field investigations, carrying out surveys based on specific questions targeted at the migrants. Primarily, the research started via thorough and rigorous literature review of journal articles, published papers on similar work done earlier and researching through various books and relevant documents. Once the study delineated itself to a streamlined area of focus, a systematic and holistic set of questionnaire was built up, which delved to seek answers to the supposed or proposed hypothesis.

Once the data was collected they were analyzed under different components, which included areas of social, economic and environmental categories. All these information was carefully handled and analyzed to search for the real scenario. It was a constant search to find out the true picture; just not to simply prove the hypothesis correct. The whole research was carried out intensively to identify the livelihood problems that the migrants, which include a significant percentage of climate-induced migrants, face after coming to Dhaka slums and how their problems are intensified due to climate change.

The compilation of all these deep-delving investigations gave rise to a methodical output in the form of this paper. All the achieved data was systematically arranged to produce an immaculate piece of work to serve the true purpose of the paper.

3.2 Areas of Research

This research is an intensive study to analyze livelihood hurdles encountered by climate refugees once they have migrated to the city. A thorough survey provides the best possible answers to case-specific questions, answers to which prove worthy of being amalgamated for further inspection, till a logical inference is made. The inference later justifies if the proposed hypothesis was met in accordance.

The research begins with a basic understanding of climate change as a whole. Causes, impacts and symptoms are given a cursory synopsis. After a chronological outlook on the preceding circumstances, climate change status in the context of Bangladesh is overviewed. Different climatic hazards that mercilessly disrupt the lives of hundreds and thousands of people are then seen. Events like cyclone, flood and erosion cause hundreds of people to get displaced from their own lands.

Following this the other key area of the research is viewed, which is migration. The patterns and causes of migration are observed, along with migration as an adaptation for many people, who are the essential victims. The primary area of this study is then reviewed, which is climate change and migration in Dhaka City, where four spots in the city are chosen as sites to interview climate migrants. The chief intention is to get the real picture of the research's main theme. As such a set of questionnaire, pre-produced, was used to grasp answers shooting the underlying question of the research.

The study trekked through several dimensions of the associated factors that affect livelihood of climate refugees in Dhaka. Various lights of the livelihood factors were taken into consideration such as the condition of proper hygiene and sanitation measures, the associated health impacts and many other allied conditions. The respondents tried to come up with the closest answers to truth, which made the research very transparent. The respondents were selected by avoiding any form of biasness.

With ice-breaking sessions of knowing the correspondents a little further, basic questions about the reason of migration and current status were asked. The research also delved to seek answers to certain questions, ones including if the climate victims really knew what climate change really is. It was explored if they could relate and attribute the changes in their lives to the different changes in nature and how the weather pattern has been changing drastically over the years. Areas related to water and sanitation, health and income were touched and the data was analyzed by using SPSS, STATA and Excel software.

Major findings along with logical discussion then extend to the other half of the paper, after a thorough summary of its methodology. Challenges and limitations being highlighted, the paper also emerges with some attempts to suggest recommendations to ameliorate the situation. Hence the paper evolves as it extends towards the end as a comprehensive study, starting from pinpointing the problem, breaking it and then exploring it to its maximum profundity.

3.3 The Survey

Four slums were targeted for this research. The questionnaire was prepared as a comprehensive tool to bring out answers to the broader spectrum of socio-economic and environmental factors impeding smooth livelihood of the migrants to the city.

The reasons for the migration were first targeted to be found, which included seeking for job opportunities, flood occurrences causing them to forcefully move out of their previous home and become environmentally displaced, people coming and dwelling in slums frothy had no home or they intended to do small business. Some associated problems that entail with their livelihoods were analyzed by asking relevant questions. The problems that are generally encountered in these types of congested slums are lack of proper water and sanitation facilities, health issues and constraints, flood problems when the rate of rainfall increases, and also people's hurdle in commuting. By asking appropriate questions, I gathered information on these different aspects of the lives of slum dwellers.

Dhaka slums are clustered areas of human settlement, consisting of closely located blocks where individual families reside. As such, the area seems almost cluttered in the form of

patched section of livelihood. This, therefore, entails the risk of being too bounded within one community when survey analysis is carried out. In order to avoid this, attempt to keep the data collection was made to keep as unbiased as possible. In order to do so, a variety of approaches were taken while site visit. The most important of them was to be inclusive of not a particular patch of slums clutter, rather trying to fetch information from atleast one member of the household of an individual family of each block. As such, biasness in collecting data from only a particular geographical area was, to a great extent, minimized. Other measures including picking a range of visiting hours was allocated to make sure a wider range of people could be surveyed. It was inclusive of being elective in peak and off peak hours of maximum presence of people, within the zone of interest. Weekly analysis was split into working and non-working hours, as observed attendance of respondents varied on weekdays or during weekends. Additionally, the survey process in itself discarded gender biasness, biasness towards taking information from just a particular working class or age group. Hence, all these variety to endeavors prepared a much-reliable source of data collection with minimal predisposition or preconceived inclination. Selection bias which could have occurred during the identification of people in the study was therefore lessened. However, the study population was clearly defined and its accessibility and reliability was first affirmed but with the applicability of maximum random sampling of household data, proneness to selection bias was lessened to a great extent in the study. I also cross-checked the data obtained from one slum with another to see any significant differences or inconsistencies. I believe that the data that I obtained are quite robust.

3.4 Site Overview

3.4.1 Korail

The Korail slum covers 90 acres with over 100,000 people living in it. Korail is considered the largest slum in the city and is thought to have started during the late 80's. It was situated on empty elevated grounds while it gradually swelled by reaching the highly vulnerable water edges. It is located near the commercial areas of Gulshan. This is why there is a good opportunity of employment for low income people in jobs like cleaning, household helping, pulling the three wheeled carts called Rikshaws and also ample amount of jobs for the Ready-Made Garment sectors. The people live in quite an unhealthy environmental condition if sanitation and safety is concerned. However, they are accustomed to the changes that follow, be it climatic problems or social hindrances (Khan, 2010).

3.4.2 Bosila

The living condition here is quite unsuitable if considered for safety point of view. The water under the settlement has tarnished black in color and is absolutely hazardous to be used for any purpose at all. Employment opportunity for the slum dwellers is available to a good extent since it sweeps across the commercial areas. The slum dwellers, especially the men, get involved in informal sectors while the women get hired as cleaners or household workers in various houses across that place in the residential areas (Khan, 2010).

3.4.3 Badda

The Badda slum covers a big portion of the area and is at a consolidated development stage. There are mostly single storied houses with tins and 'kutcha' materials to build up the houses. There is a high population density in the slum with some open spaces within the area of the slum.

3.4.4 Agargaon

This is a highly dense slum with a population of about 10,000 people in 1,200 households. People here live the under poverty line. The facilities are not sufficient to meet the standard need of the living. Different types of crimes occur often. Parents cannot afford to send their children to school. The environment is not favorable (Hoque, Sarker, Udoy and Khan, 2013).

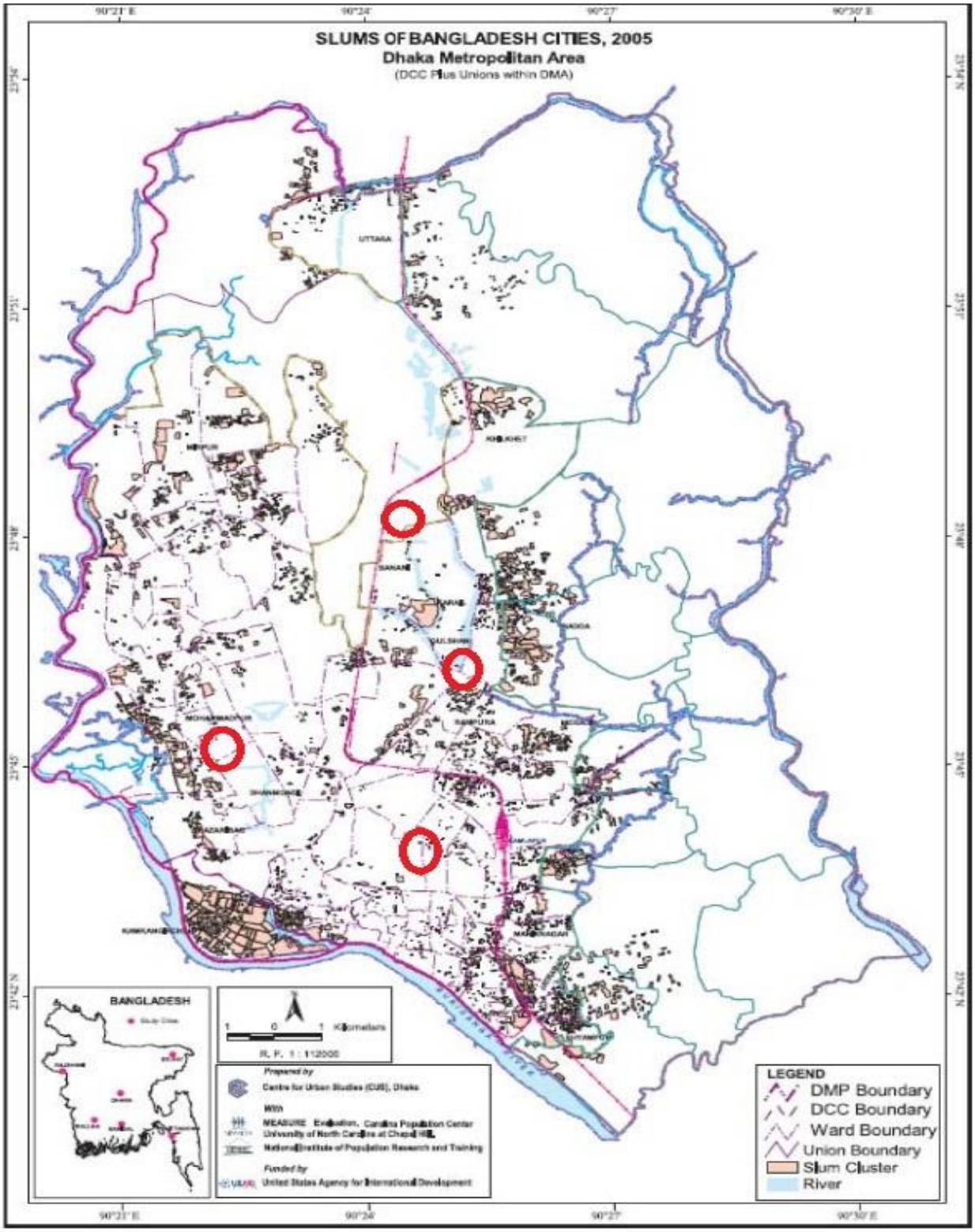


Figure 3.1: Slums of Dhaka city (◯ indicates 4 slums from where data has been collected) (Census and mapping of slums in Bangladesh, 2005).

3.5 Data Analysis

In this section, we analyze the data based on the information obtained via survey.

3.5.1 Summary Statistics

Table 3.1: Summary Statistics

Name of the Slums		**All**	**Bosila**	**Korail**	**Badda**	**Agargaon**
No. of Respondent		108	25	34	28	21
Reasons for coming and staying in Dhaka (%)	**Job & Business**	61.11 %	64%	76.47%	50%	47.61%
	Flood & Homeless	23.14%	16%	14.70%	21.42%	47.61%
	Permanent Resident	4.62%	8%	0%	7.14%	4.76%
	Others	12.96%	12%	14.70%	21.42%	0%
	Fisher's exact test	P value: 0.051				
Years in Dhaka (%)	**1 < 5**	25%	12%	8.82%	64.28%	14.28%
	5 < 10	24.07%	28%	26.47%	17.85%	23.80%
	10 < 15	31.48%	40%	47.05%	17.85%	14.28%
	> 15	19.44%	20%	17.64%	0%	47.61%
	Fisher's exact test	P value: 0.000				
Age (%)	**< 30**	54.62%	52%	47.05%	75%	42.85%
	30 < 35	17.59%	16%	20.58%	17.85%	14.28%
	35 < 40	15.74%	20%	17.64%	7.14%	19.04%
	> 40	12.03%	12%	14.70%	0%	23.80%
	Fisher's exact test	P value: 0.234				

Four slums were studied for this research while identifying the important reasons for coming and staying in Dhaka city, number of years of residing in Dhaka, and the average age of the inhabitants. While majority of the slum-dwellers had moved from their original point of residence to the slums due to similar over-arching reasons, the survey showed several differences as well. Majority of the slum dwellers had shifted to the slums for economic purposes, in the way to finding a better form of livelihood. This is reflected in the Summary Statistics table showing a marker of 61% of total respondents in all four slums choosing better job and business opportunities to be a cardinal reason for their stay. It should be noted that environmental victims may also have mentioned economic reasons as their motivation to move to the city. Other similarity within the respondent group shows most survey-takers being less than 30 years in age, which shows the presence of young working class surpass ones who are older, in terms of (age) and number. However, the number of people being surveyed being different in all four slums and as such, the number of years they lived within the slum showed variation within the four slums. There were respondents who lived in the slums for 1-5 years, 5-10 years and 10-15 years in all four slums. However, none of the respondents lived for more than 15 years in Badda in contrast to Bosila, Korail and Agargaon. While a certain percentage of people were permanent residents of the slums, none of the respondents were lived in Korail permanently. This indicated a marked difference about the state of residence-ship within the slums community.

a) Age:

Bosila: 52% of the respondents who were surveyed were below 30 years of age in Bosila while 16% of them were between 30 and 35, 20% of them being between 35 and 40 and just 12% being above 40 years of age.

Korail: 47.05% of the people surveyed in the slum of Korail were below 30 years of age, 20% being between 30 and 35, 17.6% being between 35 and 40 years old and around 14.7% being more than 40 years of age.

Badda: Out of the 28 people surveyed in Badda, 75% of the respondents were below the age of 30 and 17.85% of the people were between 30 and 35. None of the people surveyed were above 40 years of age

Agargaon: In Agargaon slum, 21 people were surveyed and among them around 43% of the respondents were below the age of 30. Around 24% were above 40 and the percentage of people between 30-35 and 35-40 were 14.28% and 19.04%.

As some of the expected frequencies in the contingency table are smaller than 5, we cannot use Pearson Chi-square test in this case. Fisher's exact test gives a p-value of 0.051 indicating a statistically significant relationship between the slums and the reasons for settling there.

b) Reasons for Coming and Staying in Dhaka:

Bosila: 25 respondents were surveyed. 64% of the respondents said that the reason for them to come and stay in Dhaka was to look for a better employment while 16% mentioned they lost their previous home. While only 8% were permanent residents, there were others of around 12% who had various miscellaneous reasons to stay in Dhaka

Korail: Out of the 34 respondents, none of them were permanent residents of the slum. Around 76% mentioned that searching for a better job or business was a reason for them to come and stay in Dhaka. 14.7% of them were homeless in their origins while another 14.7% had other reasons to stay in Dhaka

Badda: 28 respondents were chosen to be surveyed, of which 14 mentioned they were in Dhaka for better jobs and business. 21.42% had other reasons and another same percent of respondents were flooded and homeless in their homelands.

Agargaon: 21 respondents were chosen to be surveyed. 47.61% of the people mentioned that they were in Dhaka for better job and business placements while another same percent of respondents mentioned they were flooded and homeless at their homelands.

As some of the expected frequencies in the contingency table are smaller than 5, we cannot use Pearson Chi-square test. Fisher's exact test gives a p-value of 0.000 indicating a statistically significant relationship between the slums and the length of stay there.

We should note here that those who were flood victims and who were homeless due to natural calamities or other reasons, they might also mention that they came to the city for job or business. Therefore, the number of respondents in that category may be overstated, and the number of respondents for climate-related cause understated.

c) Years in Dhaka

Bosila: Majority of the people living in this slum had been residing in Dhaka between 10 to 15 years. That counts to a percentage of 40.

Korail: Majority of the people living in this slum had been residing in Dhaka between 10 to 15 years. That counts to a percentage of 47.05 and only 8.82% of the people were living in the slum for just 1 to 5 years.

Badda: 17.58% of people were living in this slum for 5-10 years and 10-15 years respectively while a majority of 64.58% of the respondents was living in this slum for 1-5 years.

Agargaon: Almost half of the people were living in this slum for more than 15 years which is a long time. Only 14.28% of the respondents were living for 1-5 years and 5-10 years respectively.

Like the previous two cases, we cannot use Pearson Chi-square test in this case for smaller than 5 expected frequencies in some cells of the contingency table. Fisher's exact test gives a p-value of 0.234 indicating a statistically insignificant relationship between the slums and the age distribution.

3.5.2: Charts, bar graphs, tables

a) Rain Problem

Table 3.2: Rain Problem

Slum area	Problem during occasional rain
Korail	59%
Badda	46%
Agargaon	81%
Bosila	52%
Total	58%

	Value	df	Asymptotic Significance
Pearson Chi-Square	5.889	3	.117
Cramer's V	.235		

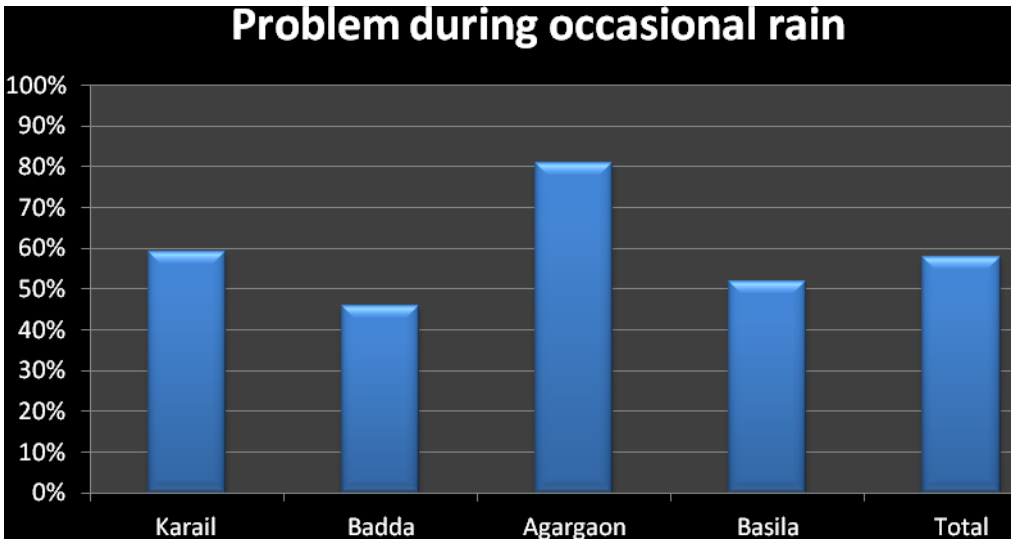


Table 3.2 and the above graph show the percentage of the slums being affected by occasional rainfall, not even monsoon rain. Agargaon slums have been found to experience the most adverse of effects. It mounts the highest of 81% while Badda slum shows the minimum of 46%. The total comes out on a percentage of 58%. That means over half of the slums are affected by even occasional rain. Pearson Chi-square value shows no significant difference in four slums. Cramer's V shows a moderate association between slums and problem due to rain.

b) Difficulty during summer

Table 3.3: Problems due to high temperature

Slum area	**High temperature related problems**
Korail	88%
Badda	82%
Agargaon	95%
Bosila	80%
Total	86%

	Value	df	Asymptotic Significance
Pearson Chi-Square	2.577	3	.462
Cramer's V	.155		

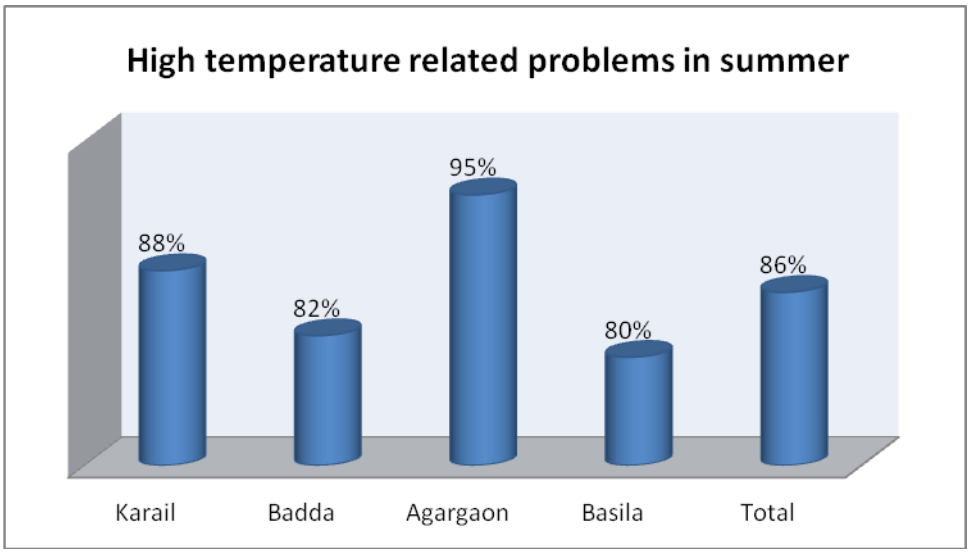


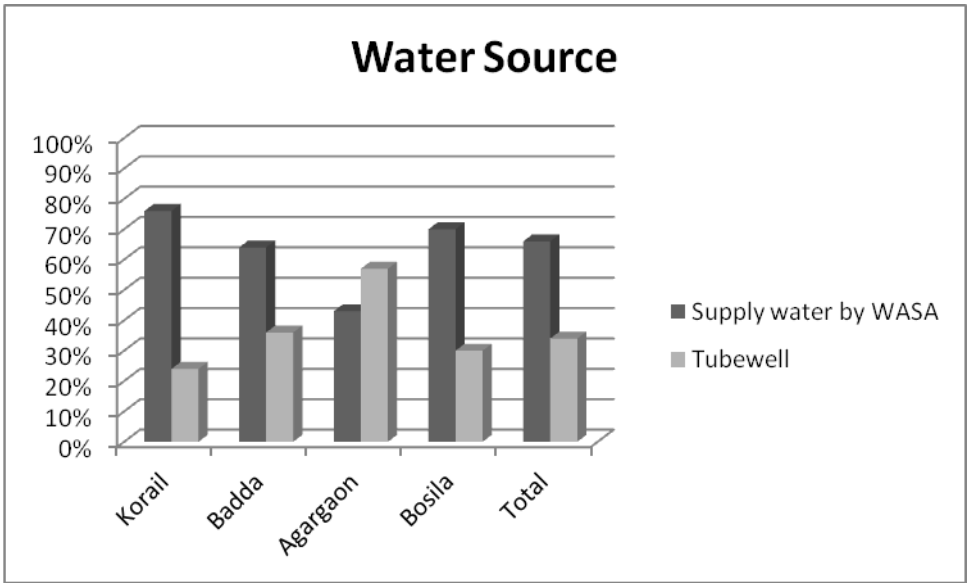
Table 3.3 and the graph show the percentage of slums facing difficulty during summer seasons. A striking percentage of 95% is seen to face hurdles due to high temperature in the Agargaon slums. Korail, Badda and Bosila take percentages of 88, 82 and 80 respectively when the difficulty due to high temperature is concerned. The total comes out on a percentage of 86%. Pearson Chi-square value shows no significant difference in four slums. Cramer's V shows the relationship to be weak.

c) Water Sources

Table 3.4: Sources of water

Area	WASA
Korail	95%
Badda	67%
Agargaon	45%
Bosila	76%
Total	73%

	Value	df	Asymptotic Significance
Pearson Chi-Square	19.240	3	.000
Cramer's V	.426		



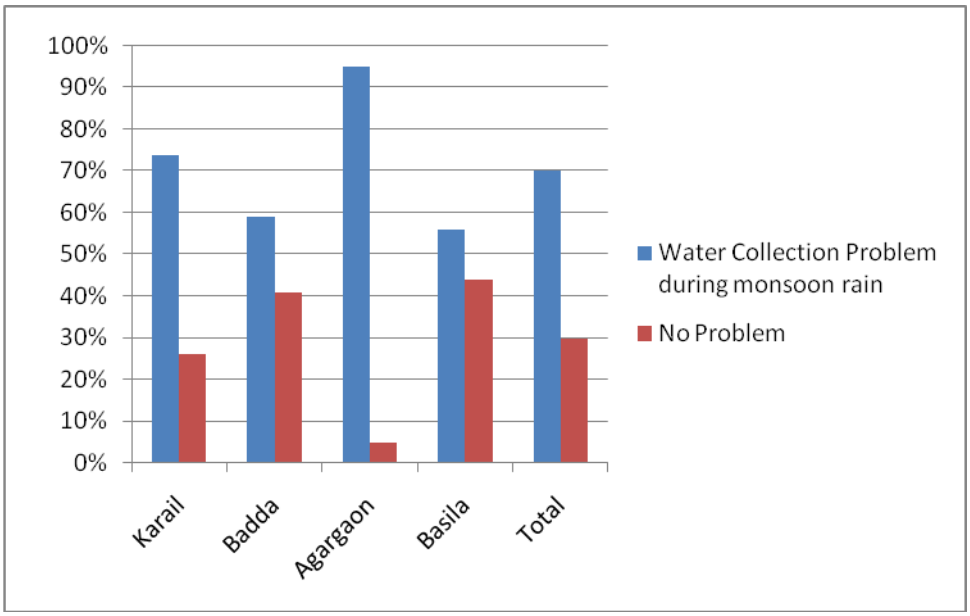
The chart shows the percentage of water supplied by Water Supply and Sewerage Authority (WASA) and Tubewell respectively. It is seen that Korail slum get the maximum supply of water from WASA whereas Agargaon receives the least. Tubewells provide most of the water supply in Agargaon slum. Pearson Chi-square value shows a significant difference in four slums. Cramer's V shows a very strong association between slums and water source.

d) Water Collection Problem

Table 3.5: Water collection problem during rain

Area	**Water Collection Problem during monsoon rain**	**No Problem**
Korail	74%	26%
Badda	59%	41%
Agargaon	95%	5%
Bosila	56%	44%
Total	70%	30%

	Value	df	Asymptotic Significance
Pearson Chi-Square	9.933	3	0.019
Cramer's V	.306		



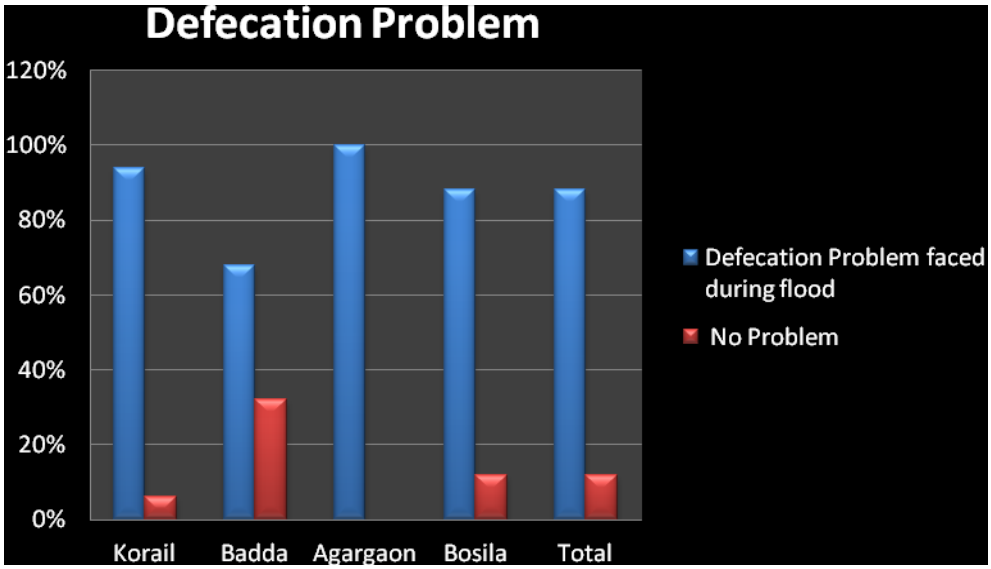
The chart shows the statistics of water collection problem during heavy rainfall. It is observed that Agargaon slums experience the maximum problem for collecting water during rainfall. The least problem is experienced by slum dwellers in Bosila. And respondents were also asked if there wasn't any problem at all regardless of the scenario put forward. The bars in red show how they have responded to it. Pearson Chi-square value shows a significant difference in four slums. Cramer's V shows that the association is strong.

e) Defecation Problem

Table 3.6: Defection Problem

Area	Defecation Problem faced during flood
Korail	94%
Badda	68%
Agargaon	100%
Bosila	88%
Total	88%

	Value	df	Asymptotic Significance
Pearson Chi-Square	12.89	9	.167
Cramer's V	.204		



The chart shows the percentage of people facing defecation problem during flood. Agargaon slum is the only slum where the problem spikes to 100 percent. More or less all the slums face this particular problem because the percentage of people facing problem is 68% and above. Pearson Chi-square value shows no significant difference in four slums. Cramer's V shows the relationship to be moderate.

f) Diseases problem

Table 3.7: Diseases problem

Area	**Diseases Problem**
Korail	76%
Badda	37%
Agargaon	81%
Bosila	80%
Total	69%

	Value	df	Asymptotic Significance
Pearson Chi-Square	15.975	3	.001
Cramer's V	.388		

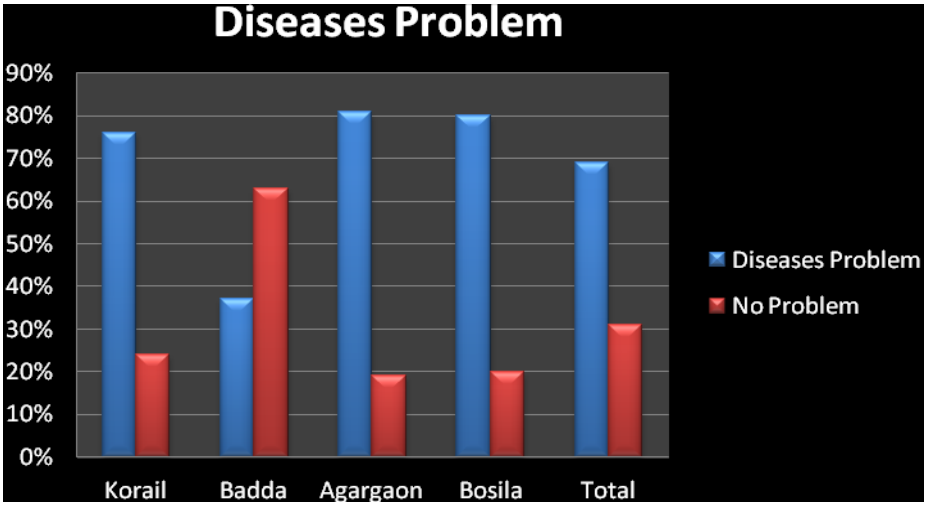
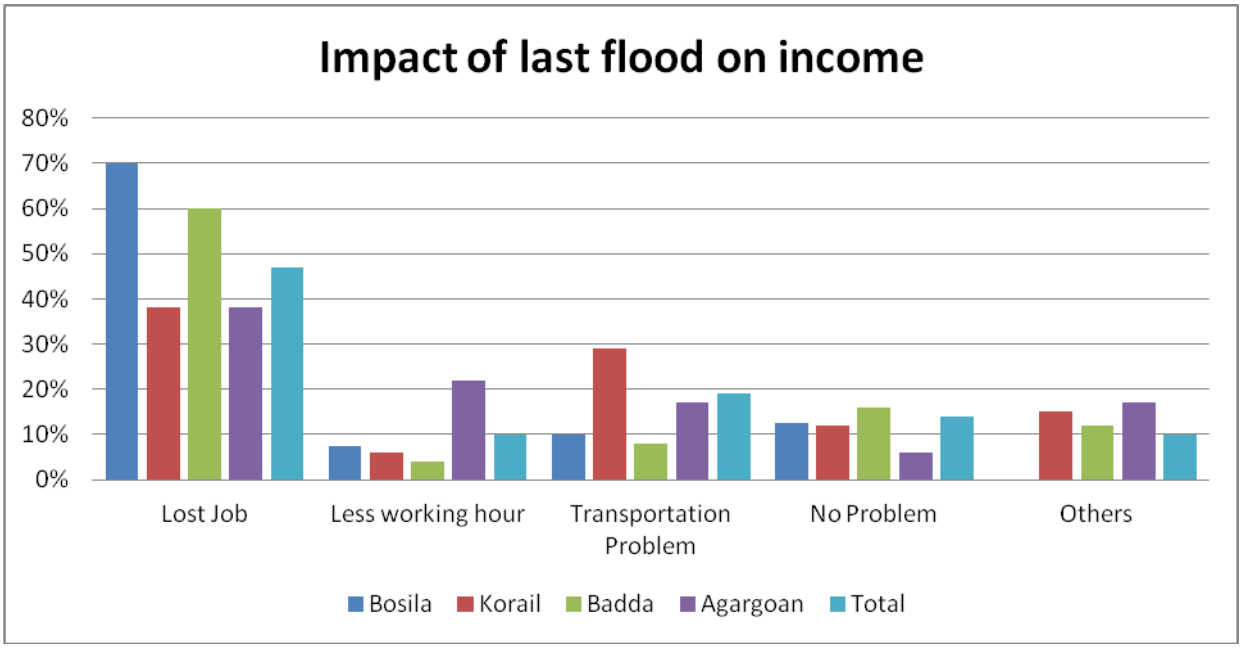


Table 3.7 shows the percentage of slum dwellers facing diseases. The maximum problem related to diseases of different types is seen to occur in Agargaon slums and it takes a value of 81%. The next slum is Bosila which faces problem taking a statistical value of 80%. The slum that faces the least amount of problem is Badda, which is 37%. The graph shows another piece of information. Respondents were asked if there was any problem at all regardless of the scenario put forward. The bars in red show how they responded to it. Pearson Chi-square value shows a significant difference in four slums. Cramer's V shows that occurrence of disease is dependent on which slum the respondent lives.

f) Impact of last flood on Income

Table 3.8: Impact of last flood on income

Slums	Lost Job	Less working hour	Transportation Problem	No Problem	Others
Bosila	70%	7.5%	10%	12.5%	0%
Korail	38%	6%	29%	12%	15%
Badda	60%	4%	8%	16%	12%
Agargoan	38%	22%	17%	6%	17%
Total	47%	10%	19%	14%	10%



The chart shows the impact on income due to flood. Reasons of lower income include loss of job, absence from work or being late to work. It is observed that 57% of the respondents either lost jobs or worked less hours. 19% of the respondents mentioned that they faced problems going to work.

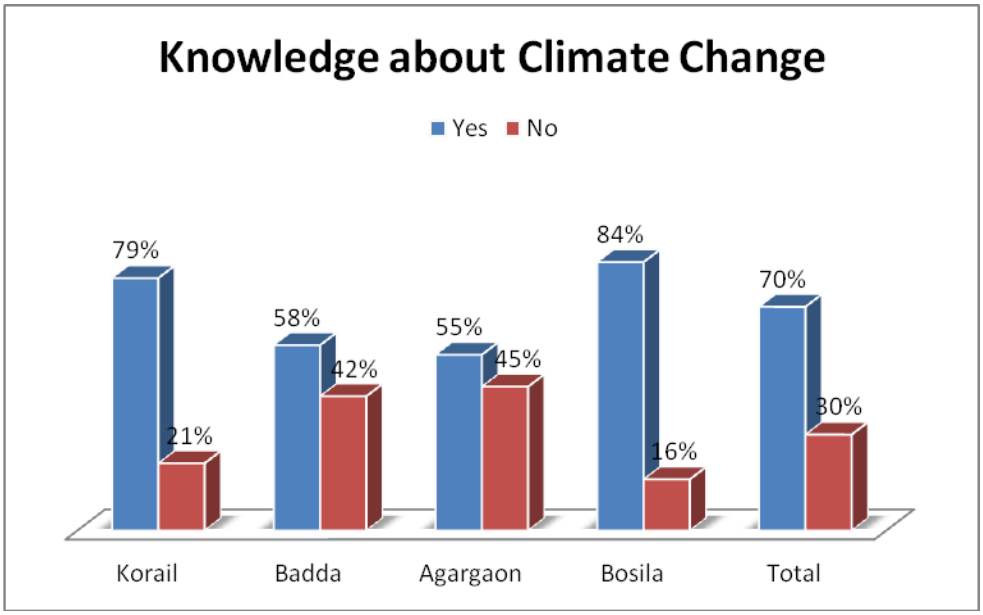
As some of the expected frequencies in the contingency table are smaller than 5, we cannot use Chi-square test in this case. Fisher's exact test gives a p-value of 0.119 indicating a statistically insignificant relationship between the slums and the impact on income.

g) **Climate change Perception**

Table 3.9: Climate Change Perception

Area	Yes
Korail	79%
Badda	58%
Agargaon	55%
Bosila	84%
Total	70%

	Value	df	Asymptotic Significance
Pearson Chi-Square	7.847	3	.049
Cramer's V	.273		

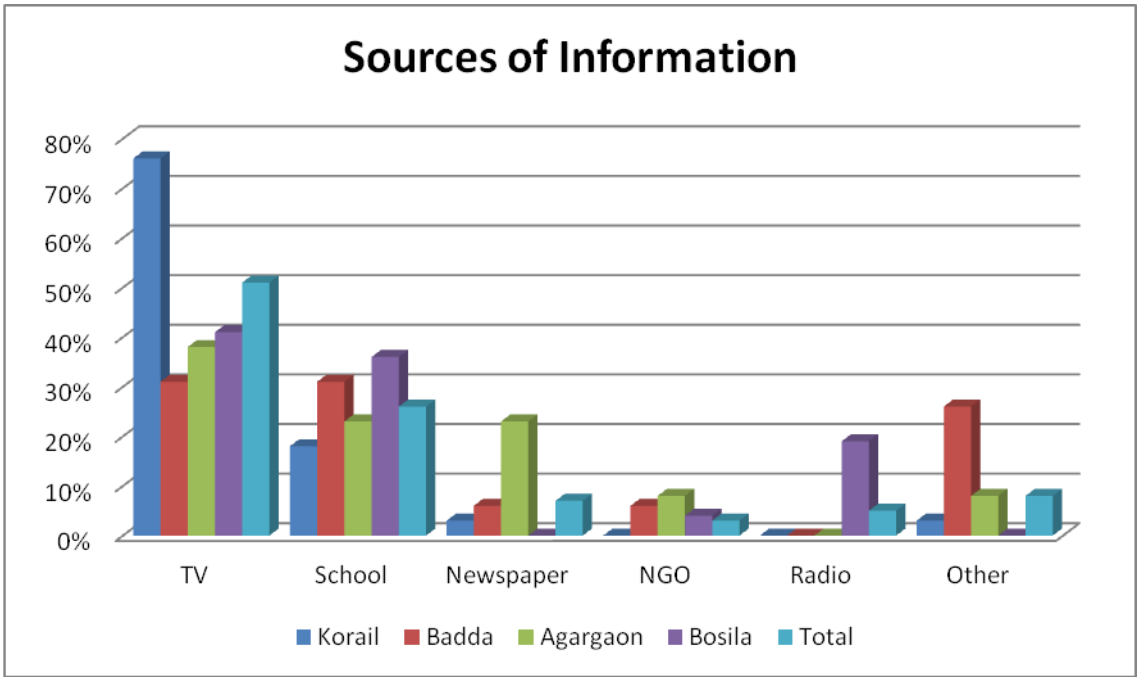


84% respondents have knowledge about climate change in Bosila. Korail and Badda came out as second and third in terms of their knowledge about climate change. Data shows that 70% of the residents of these four slums had some idea about climate change, while the rest had no idea. Pearson Chi-square value shows a significant difference in four slums. Cramer's V shows a moderate relationship between slums and the knowledge about climate change/

h) Sources of information about climate change

Table 3.10: Sources of information about climate change

Area	TV	School	Newspaper	NGO	Radio	Other
Korail	76%	18%	3%	0%	0%	3%
Badda	31%	31%	6%	6%	0%	26%
Agargaon	38%	23%	23%	8%	0%	8%
Bosila	41%	36%	0%	4%	19%	0%
Total	51%	26%	7%	3%	5%	8%



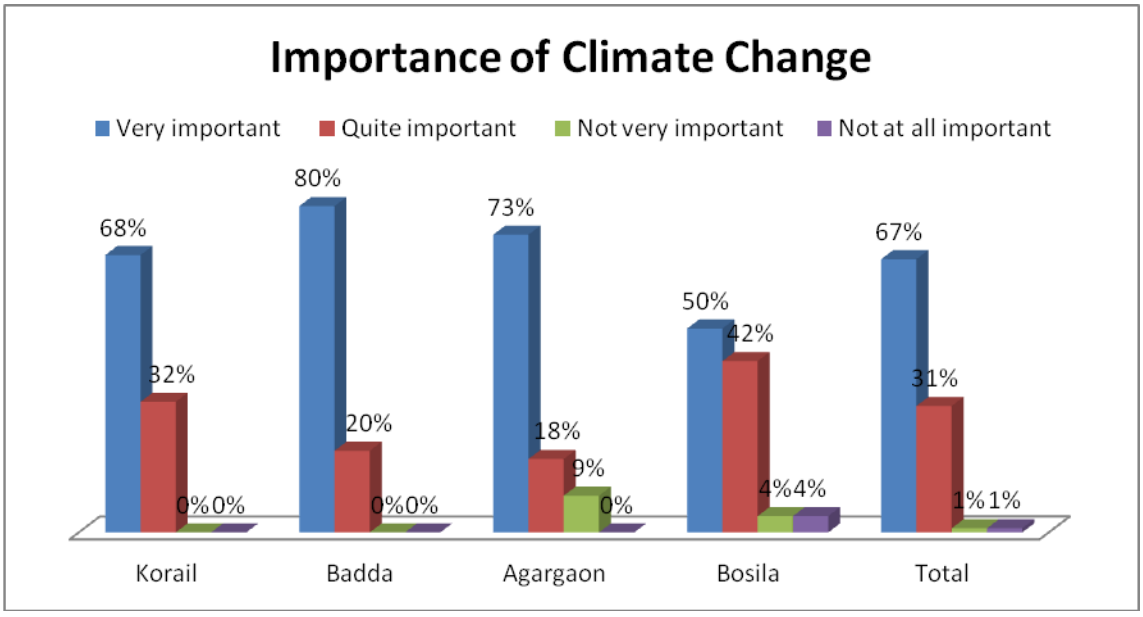
76% of the respondents in Korail slum learned about climate change from television, which is the maximum of all. Respondents from Korail slum were not exposed to NGO or radio as a source of information about climate change. TV and school are the two most important sources of information for disseminating knowledge about climate change in all four slums.

As some of the expected frequencies in the contingency table are smaller than 5, we cannot use Chi-square test in this case. Fisher's exact test gives a p-value of 0.001 indicating a statistically significant relationship between the respondent's residence and the sources of information.

g) **How important is the issue of climate change?**

Table 3.11: Importance of Climate Change

Area	Very important	Quite important	Not very important	Not at all important
Korail	68%	32%	0%	0%
Badda	80%	20%	0%	0%
Agargaon	73%	18%	9%	0%
Bosila	50%	42%	4%	4%
Total	67%	31%	1%	1%



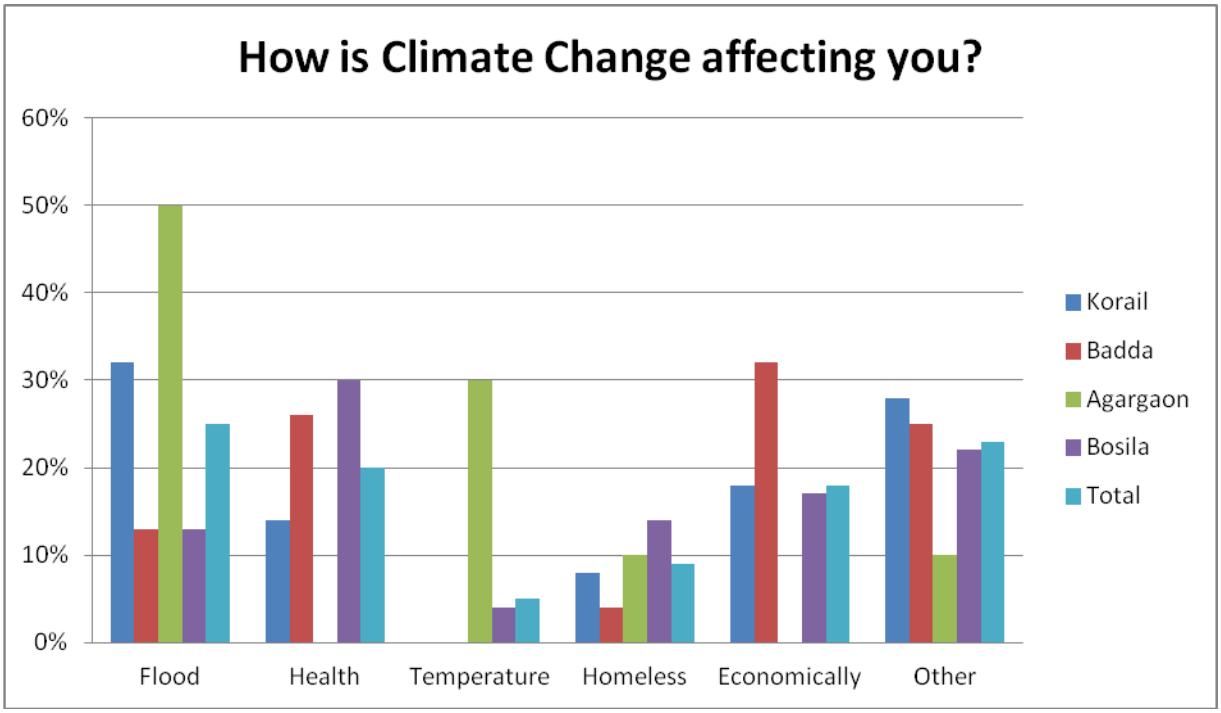
Respondents from Badda appeared to top others in terms of considering climate change as a very important issue. Korail and Badda had no respondents mentioning it is not important at all. In total among the four slums, 67% of the people considered climate change as a highly important matter, 31% mention it is quite important and 1% each thinks that is not very important or not important at all.

Again, due to small number of expected frequencies in the contingency table, we cannot use Chi-square test in this case. Fisher's exact test gives a p-value of 0.361 indicating a statistically insignificant relationship between the respondent's residence and the perception about the importance of climate change.

h) How is climate change affecting you?

Table 3.12: Climate change effect

Area	Flood	Health	Temperature	Homeless	Economically	Other
Korail	32%	14%	0%	8%	18%	28%
Badda	13%	26%	0%	4%	32%	25%
Agargaon	50%	0%	30%	10%	0%	10%
Bosila	13%	30%	4%	14%	17%	22%
Total	25%	20%	5%	9%	18%	23%



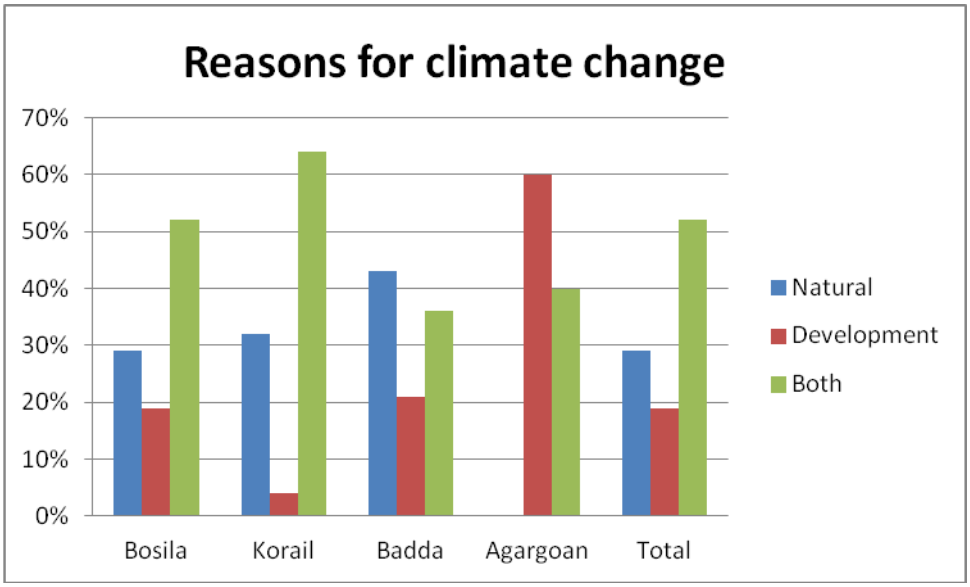
50% of the people in Agargaon slum were affected by flood, 30% were affected by changes in temperature, and 10% were homeless. According to the respondents of Agargaon slum there was no health or economic effects due to climate change. Varying trends were observed in the other slums as per the data.

Fisher's exact test gives a p-value of 0.01 indicating a statistically significant relationship between the respondent's residence and how they were affected by climate change.

i) Reasons for Climate Change: Natural/ Economic Development

Table 3.13: Reasons for Climate Change

Slums	Natural	Development	Both
Bosila	29%	19%	52%
Korail	32%	4%	64%
Badda	43%	21%	36%
Agargoan	0%	60%	40%
Total	29%	19%	52%



64% respondents of Korail believe that the reason for climate change is both natural and development-related. In a stark contrast, 43% respondents from Badda blamed nature for climate change, while none in Agargaon.

Fisher's exact test gives a p-value of 0.006 indicating a statistically significant relationship between the respondent's residence and their perception about the cause of climate change.

3.5.3 Correlation Matrix

The correlation matrices are shown below. They are important to understand the nature and magnitude of relationship between different factors. They could also be useful to identify any possible multicollinearity problem in our regression models. We have reported only those correlation coefficients that are higher than 0.5 and significant.

a) Korail (p-values are in parenthesis)

Table 3.14: Korail slum (Correlation Matrix)

	Def-rain	Disease	Important
H-Temp		.561 (.001)	
Sick 04/07		.553 (.001)	
Job loss	-.504 (.002)		
Important	.534 (.003)		
Nat/Dev	-.526 (.004)		-.650 (.000)

The strongest correlation coefficient (-0.65) that we see is between the respondents' perception about the importance and the causes of climate change. Those who believe that the cause is development or both natural and development, they are more likely to say that climate change is important than those who believe that it's all natural.

b) Bosila (p-values are in parenthesis):

Table 3.15: Bosila slum (Correlation Matrix)

	Age	Reason	Stay	Hot	Def-rain	Disease	Work 04/07	Climate change	Important
Hot	-.609 (.001)								
W-rain				.564 (.003)					
Def-rain				.604 (.001)					
Work 04/07		.506 (.010)							
Job loss							-.567 (.003)		
Climate change						.600 (.002)			
Important								-.669 (.001)	
Victim								.690 (.000)	-.764 (.000)
Nat/Dev					-.662 (.001)				
Govt			.581 (.006)						

At Bosila, older people complained less about hot summer. Those who are knowledgeable about climate change a larger fraction of them consider themselves victims of climate change (correlation coefficient is 0.69). Those who believe that they are victims of climate change consider this as an important issue (correlation coefficient is -0.764).

c) Badda (p-values are in parenthesis)

Table 3.16: Badda slum (Correlation Matrix)

	Hot	W-rain	Def-rain	Def-04/07	H-Temp	Job loss
W-04/07	.514 (.009)	.774 (.000)				
Def-04/07			-.507 (.016)			
Climate change					.533 (.005)	
Govt				.690 (.019)		.564 (.029)

At Badda, those who had defecation problem during the last big flood believe that the government is doing enough to prevent climate change. It could be because they might have seen some improvement in conditions there since the big floods of 2004/07.

d) Agargaon (p-values are in parenthesis)

Table 3.17: Agargaon slum (Correlation Matrix)

	Age	W-Rain	W-04/07	Disease	Job loss	Nat/ Dev
Stay	.586 (.007)					
W-04/07		1.000 (.000)				
W-Hot			1.000 (.000)			
Govt				-1.000 (.000)	-1.000 (.000)	-.632 (.068)

At Agargaon, several variables show perfect correlation coefficients. Water collection during rain, flood and hot summer seem to be problematic. Those who suffered from diseases or lost jobs felt that the government was not doing enough to prevent climate change.

e) All (p-values are in parenthesis)

Table 3.18: All slums (Correlation Matrix)

	Age	W-Rain	Important
Stay	.512 (.000)		
W-04/07		.571 (.000)	
Victim			-.569 (.000)

Overall, water collection problem in rain and during the last two floods were significantly correlated (0.571). Those who were older had been living in the slums for longer time, which makes sense. Those who are older have been living in the slums for longer time, which makes sense. Those who perceive them as victims of climate change consider it to be an important issue.

3.5.4 Regression Analysis

We intend to identify the effects of various climate-related factors on health and income of the slum dwellers, of which a number of them are climate refugees, by controlling for other relevant factors. Also, we want to understand their perception about climate change. Sample size from each slum was not adequately large for regression analysis to be carried out for individual slums. That is the reason why we pooled the data and used dummy variables for the slums.

Model specification

Based on our data, a binary logistic regression model is appropriate for the data analysis. The dependent variables of our 8 model specifications are all binary variables. Therefore, the model is:

$$\text{Prob}(Y_i = 1|\mathbf{X_i} = \mathbf{x_i}) = \frac{e^{(\beta_0 + \beta_1 x_i)}}{1 + e^{(\beta_0 + \beta_1 x_i)}},$$

Where Y is a binary response variable and X is a set of explanatory variables. Green (2011) has a good discussion on logistic regression

Following are the variables used in different specifications of our models as dependent or independent variables:

Age= Age of the respondent.

Stay= Number of years the respondent is staying in a particular slum.

Rain= Problems during occasional rainfall.

Hot= Difficulty during hot summers.

Wrain= Drinking water collection problem during rain.

Water= Sources of drinking water.

Flood= Problem of flooding during times of heavy rainfall.

Defrain= Sanitation problem during rainy periods.

Disease: Whether or not the respondent or a family member suffered any climate or water-related illness.

Sick0407= Whether or not the respondent or a family member suffered illness because of floods.

HTemp= Weather-related health problems.

Def0407= Defecation problem during 2004 & 2007 floods.

W0407= Drinking Water problem during 2004 & 2007 floods.

Work1 = Whether or not the respondent lost job or worked less hours.

Wher1= Sources of information about climate change – TV or others

Wher2= Sources of information about climate change – School or others

D_BO= Dummy variable for Bosila slum

D_KO= Dummy Variable for Korail Slum

D_BA= Dummy Variable for Badda slum

Agargaon, which is a relatively new slum with road access and other facilities that are not available in other slums, is used as the reference category.

a) Health:

We will examine general health problems, sickness during 2004/07 floods, and weather-related health problems in different slums. Following independent variables are used in three specifications of our model for health problems:

Health Problems = f (Age, Stay, Rain, Hot, Wrain, Defrain, Water, Def0407, W0407, Location dummies)

The results are shown in the following table.

Table 3.19: Binary Logistic Regression of Disease, Sickness during 04/07 Floods, and Weather-related Health Problems

	Disease		Sick during 04/07 floods		Weather-related health problems	
	B	S.E.	B	S.E.	B	S.E.
Age	.102**(.012)	.040	.168***	.062	.117*	.067
Stay	-.044	.041	-.161**(.017)	.067	-.146**(.028)	.066
Rain	.140	.543	.614	.720	-	-
Hot	.557	.820	-.006	1.189	.764	1.039
Wrain	.800	.594	-1.583*	.943	-	-
Defrain	-.598*(.069)	.329	-.055	.446	-	-
Water	.444	.633	-.236	.809	-1.774(.143)	1.210
Def0407	-	-	.953	1.093	-	-
W0407	-	-	1.240	1.221	-	-
D_BO	-.028	.886	-20.175	9297.584	.513	11241.784
D_KO	-.436	.854	-20.362	9297.584	-18.122	8415.673
D_BA	-1.885**	.872	-22.275	9297.584	-20.429	8415.673
Constant	-.958	1.676	18.393	9297.584	19.974	8415.673
Pseudo R^2 (Cox &Snell/Nagelkerke)	0.242/0.377		0.299/0.473		0.224/0.463	

***, **, and * refer to level of significance at 1%, 5%, and 10% level respectively.

According to Model specification 1, age, defecation problem during rain, and the dummy variable for Badda are statistically significant in explaining the variation in the occurrence of diseases. Age has positive effect on disease, but the other two variables have negative effects. It is somewhat surprising to see that defecation problem does not increase the probability of disease.

Age, the length of stay in the slum, and water collection problem during rainfalls are significant in explaining the variation in sickness during 2004/07 floods (Model specification 2).

Those who have been living in the slums for longer time became less sick. Water collection problem also did not contribute to more sickness. Age and the length of stay in the slum are significant factors for explaining weather-related health problems (Model specification 3).

b) Income:

We will examine the effect on income due to job loss or less working hours for flood or climate-related problems in different slums. Following independent variables are used in two specifications of our model:

Income = f (Age, Stay, Rain, Hot, Disease, HTemp, W0407, Def0407, Location dummies)

The results are shown in Table 3.20

Table 3.20: Binary Logistic Regression of Job Loss/Less Working Hours during 04/07 Floods, and Weather-related Job-Loss

	Job loss / Working hour loss during 04/07 flood		Weather-related job loss	
	B	S.E.	B	S.E.
Age	.002	.037	.015	.039
Stay	.012	.043	.030	.043
Rain	1.079**(.025)	.482	.914*(.065)	.494
Hot	-.025	.747	.086	.761
Disease	.433	.582	1.235**	.613
HTemp	.103	1.046	-.943	1.007
W0407	.543	.798	1.289(.113)	.813
Def0407	1.179(.180)	.879	.708	.847
D_BO	.608	.763	-.694	.850
D_KO	-.598	.672	-1.452*(.065)	.787
D_BA	1.180(.206)	.932	-.399	.980
Constant	-2.552	1.920	-1.902	1.988
Pseudo R^2 (Cox &Snell/Nagelkerke)		0.163/0.218		0.220/0.296

***, **, and * refer to level of significance at 1%, 5%, and 10% level respectively.

The first specification of the model shows that rain is the only significant factor in explaining income loss (significant at 2.5% level). Defecation problem during big floods of 2004/07 and residence at Badda slum are found to be significant at 18% and 20.6% respectively. Both have negative effects on income.

Model specification 2 shows that rain, disease, and residence at Korail slum are significant at less than 10% level of significance. Water collection problem during 2004/07 flood is significant at 11.3% level. Except the residence at Korail, other three variables have negative effect on income. Korail residents seem to be immune to weather-related income loss.

c) Climate Change Perception :

We will examine whether or not the slum dwellers know about climate change, whether or not they consider themselves as victims of climate change, and whether or not they believe that the government is doing enough to mitigate climate change effects. Following independent variables are used in three specifications of our model:

Climate Change Perception= f (Age, Stay, Rain, Hot, Defrain, W0407, Disease, HTemp, Sick0407, Work1, wher1, Wher2, Location dummies)

The results are shown in Table 3.21.

Table 3.21: Binary Logistic Regression of Slum Dwellers' Knowledge about Climate Change and Some of their Perceptions.

Variables in the Equation

	Knowledge about climate change		Victim		Govt is doing enough	
	B	S.E.	B	S.E.	B	S.E.
Age	.160	.210	1.706	557.343	-.082	.079
Stay	.193	.401	1.018	669.506	.143(.104)	.088
Rain			17.774	6321.424	.918	1.031
Hot			11.808	18566.580	.668	1.778
Defrain			-20.559	6744.079	-.160	.501
W0407			46.255	16351.676	.432	1.788
Disease			3.485	7941.552	-2.754***	1.059
HTemp			-16.305	26807.077	-.800	1.922
Sick0407			-51.586	29905.588	-.656	1.060
Work1			-36.277	17625.814	.694	.972
Wher1	-13.367	7112.941			-	-
Wher2	2.649	9549.967			-	-
D_BO	.134	11855.947	-34.113	11689.578	-.967	1.498
D_KO	-16.480	9302.047	-27.916	17042.528	.828	1.357
D_BA	1.045	12565.566	-4.777	15398.005	1.934	1.635
Constant	27.260	11709.909	79.224	33386.453	.056	2.884
Pseudo R^2 (Cox &Snell/Nagelkerke)	0.660/0.499		0.222/1.000		0.310/0.484	

***, **, and * refer to level of significance at 1%, 5%, and 10% level respectively.

The results show that none of the coefficients are significant in the first two specifications of the model. The length of stay in the slum and disease are significant in the third specification of the model. Those who have been living in slums for longer time believe that the government is doing enough to reduce climate change effect. On the other hand, those who have been suffering from diseases believe that the government is not doing enough.

Chapter 4

Limitations

One of the most crucial impacts of climate change is that mass body of climate victims are compelled to migrate. Researches mainly navigated around the topics such as the causal factors of migration, the route of migration and the subsequent impacts. However, very little work was found on the livelihood patterns of the people after beginning their new lives in the slums. Hence there is a major void in literature when it comes to find climate change impacts on migrants. As a flowing reason to this not much information was available about the four slums that were selected for this study. Hence not much data or information was found prior to visiting the slums in person, when the real picture was seen.

To approach the slum dwellers in order to be questioned for the survey required time for gaining their faith and attention. They doubted the purpose of the survey; many were unwilling to answer sensitive questions while some were simply shy. Similar challenges were faced in all four slums and it took a good understanding level to be reached before the respondents were actually willing to answer all the questions in the survey.

The study could have given an even better picture of the current scenario of climate vulnerable slum residents, had more slums were taken into consideration. Due to time constraint and limited availability of resources, only four slums were surveyed, on the basis of which a holistic estimation of the whole city's scenario was assumed. However, considering this limitation, the largest slums in the city was chosen to overcome such barrier. Thus the results obtained are quite convincing. We also compared any significant differences between slums.

Chapter 5

Recommendations

The research calls for government attention on critical health and livelihood issues that the migrants and the slum dwellers in general encounter, while it strongly encourages comprehensive efforts and work by various NGOs, INGOs, and other voluntary bodies that are committed to help environmentally displaced migrants and others in need. It is clear that climate change is an inevitable issue in their lives, hence defending their safety should be one of the main objectives of those concerned. It would be helpful to ensure proper health and safety of the already-residing migrants in Dhaka slums while building a robust habitat for any potential migrant to the city.

Arranging education programmes is also essential for the climate affected victims prior to their making any decision to move. Low cost rehabilitation and reconstruction of damaged or lost properties with government assistance can also encourage people to stay back at their original homeland. Sustainable and rapid actions after any natural calamity are very important. This includes health-care teams to be sent with adequate relief funds which would help the community. It can also encourage the affected people to start new life at the old location, instead of moving to an entirely new place. Therefore, these people may not always have to choose migration as the only option.

Nevertheless, we must note that a mass number of people have already migrated to Dhaka. Therefore, slums have to be considered a part of the city, not just an illegally occupied area. Once their rights are recognized, the government will be able to work on its deficiencies. The government can then improve the water and sanitation system, clogged and unhygienic living conditions, and other associated problems. It will only happen when slums are legally considered an integral part of Dhaka. All of these call for government attention in order to reduce the sufferings and ensuring their safety, security, and satisfaction of the slum dwellers including the environmental refugees.

Chapter 6

Conclusions

Even though broad-based growth is important to achieve poverty reduction (Khandker, 1998), Bangladesh is still at its struggling phase. A country that experiences frequently occurring natural disasters (Ali, 1996), rapid urbanization, and dense urban population add to the existing environmental problems (Pryer, 2003) especially in Dhaka City. Climate change impacts in the city become unmanageable, especially after onsets of heavy rainfall or flood (Alam & Rabbani, 2007). Problems such as water-logging conditions, blocked sewage, lack of sanitation facilities causing endless misery is inevitable and it is mostly seen in the informal sectors (Rashid, 2000).

While climate change impacts are not any less severe in rural areas, people from vulnerable communities move to the cities as act of mass evacuation or purposeful choices. This research is an attempt to find out if these migrants have escaped the desolations of climate change after migration. Indicators to measure health, economic and social status were used to assess environmental and living conditions in the slums. As an overarching inference, the research shows that migration to Dhaka City is not a solution for the climate affected people in different regions of the country, it only adds to the existing problems that the slum dwellers in the city are already facing. While poor migrants move towards the Capital City with an expectation of safe livelihood, many studies have shown that poverty still trails towards a path of 'urbanization without development' in Dhaka (Hossain, 2008).

While research also shows poor health conditions such as malnourishment are widespread phenomena in Dhaka slums (Uzma, Underwood, Atkinson & Thackrah, 1999), this study reinforces all such arguments. It's still arguably interesting that even though fifty percent of the slum population live below the poverty line (Pryer, Rogers & Rahman, 2003), the flow of city-centric migration has not slowed down. A city where influential lobbying results in better social and employment status of an individual (Open, 2000), this research shows how fresh migrants struggle to make their place in the already-existing crowd. Hence health, social, environmental and economic problems become worsened, if not ameliorated. As a result, the incoming environmentally displaced refugees have only found themselves in

deeper crevasses of poverty and have not rescued themselves from the problems that climate change brought in their lives.

It can be clearly understood that climate change impact is prevalent all across the country, despite any rural-urban parting. This makes city-centric migration quite an ineffective tool to be saved from climate hazards. However, as noted earlier, the nature and magnitude of climate-related problems are different in their original homeland and the new location. This research was carried out to test an initial hypothesis regarding the state of livelihood conditions and the impacts of climate change on the migrants to Dhaka City. It was, therefore, hypothesized that despite the migration, the environmentally displaced people are not entirely rescued from the problems that they encountered earlier. The tests and the study results of this research show that our hypothesis is true, and that climate affected migrants face a myriad of social, economic, and health problems despite moving to Dhaka City.

References

Alam, K. (2015). Farmers' adaptation to water scarcity in drought-prone environments: A case study of Rajshahi District, Bangladesh. *Agricultural Water Management, 148,* 196-206. doi:10.1016/j.agwat.2014.10.011

Alam, M., & Rabbani, M. G. (2007). Vulnerabilities and responses to climate change for Dhaka. *Environment and urbanization, 19*(1), 81-97.

Akter, T. (2009). *Climate Change and Flow of Environmental Displacement in Bangladesh*. Dhaka, Bangladesh: Unnayan Onneshan-The Innovators. Retrieved fromhttp://www.unnayan.org/documents/Climatechange/climate_change_flow_environmental_displacement.pdf

Ali, A. (1996). Vulnerability of Bangladesh to climate change and sea level rise through tropical cyclones and storm surges. *Water, Air, and Soil Pollution, 92*(1-2), 171-179.

Alam, M., & Rabbani, M. (2007). Vulnerabilities and responses to climate change for Dhaka.*Environment And Urbanization, 19*(1), 81-97. doi:10.1177/0956247807076911

Aßheuer, T., Thiele-Eich, I., & Braun, B. (2013). Coping with the impacts of severe flood events in Dhaka's slums – the role of social capital. *Erdkunde, 67*(1), 21-35. doi:10.3112/erdkunde.2013.01.03

Azam, M., & Falk, C. (2013). Governance of Climate Induced Migration in the Coastal regions of Bangladesh: New Transformation Required?. In *Earth System Governance Conference*. Tokyo, Japan: ResearchGate. DOI:10.13140/2.1.4918.5604. Retrieved from http://ww.researchgate.net/publication/270779787_Governance_of_Climate_Induced_Migration_in_the_Coastal_regions_of_Bangladesh_New_Transformation_Required

Basak, J., Titumir, R., & Dey, N. (2013). Climate Change in Bangladesh: A Historical Analysis of Temperature and Rainfall Data. *Journal Of Environment, Vol. 02*(Issue 02), 41-46. Retrieved from http://www.scientific-journals.co.uk

Census and mapping of slums in Bangladesh: Design, select results and application,.(2005). Scientific Figure on Research Gate. Retrieved 02 February 2016, from https://www.researchgate.net/26275061_fig1_Slum-map-of-Dhaka

Choudhury, A. (n.d.). CLIMATE OF BANGLADESH.

EPA, (2010). *Climate Change Science Facts*. United States Environmental Protection Agency. Retrieved fromhttp://www.epa.gov/climatechange/Downloads/Climate_Change_Science_Facts.pdf

Epa.gov, (2015). *Greenhouse Gas Emissions: Greenhouse Gases Overview | Climate Change | US EPA*. Retrieved 7 September 2015, from http://www.epa.gov/climatechange/ghgemissions/gases.html

Field, C., Barros, V., Mastrandrea, M., Mach, K., Abdrabo, M., & Adger, W. et al. (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. IPCC. Retrieved from https://ipccwg2.gov/AR5/images/uploads/IPCC_WG2AR5_SPM_Approved.pdf

Gioli, G., Khan, T., Bisht, S., & Scheffran, J. (2014). Migration as an Adaptation Strategy and its Gendered Implications: A Case Study From the Upper Indus Basin. *Mountain Research And Development*, *34*(3), 255-265. DOI:10.1659/mrd-journal-d-13-00089.1

Green, W. H. (2011). Econometric Analysis (7th Edition). Prentice Hall: London.

Hossain, S. (2008). Rapid urban growth and poverty in Dhaka city. *Bangladesh e-Journal of Sociology*, *5*(1), 1-24.

Hoque, S., Sarker, T., Udoy, T., & Khan, F. (2013). *Condition of Basic Services-Water Supply, Sanitationand Waste Management in Slums of Dhaka City: An Assessment* (Bachelor). Ahsanullah University of Sscience and Technology.

Helal uz Zaman, A., Khan, M., & Islam, M. (2010). Urbanization in Bangladesh: Present Status and Policy Implications. *ASA University Review*, *4*(2). Retrieved from http://www.asaub.edu.bd/data/asaubreview/v4n2sl1.pdf

Ipcc.ch, (2007). *AR4 SYR Synthesis Report Summary for Policymakers - 4 Adaptation and mitigation options*. Retrieved 7 September 2015, from https://www.ipcc.ch/publications_and_data/ar4/syr/en/spms4.html

Khan, A. (2013). *Bangladesh – The Most Climate Vulnerable Country*. *End Poverty in South Asia*. Retrieved 10 September 2015, from http://blogs.worldbank.org/endpovertyinsouthasia/bangladesh-most-climate-vulnerable-country

Khandker, S. R. (1998). *Fighting poverty with microcredit: experience in Bangladesh*.

Oxford University Press.

Kumar, U., Baten, M., Masud, A., Osman, K., & Rahman, M. (2010). *Cyclone Aila: One Year on; Natural Disaster to Human Sufferings*. Dhaka, Bangladesh: Unnayan Onneshan-The Innovators. Retrieved from http://www.unnayan.org/documents/Climatechange/ailareport_humansuffering.pdf

Ministry of Food and Disaster Management,. (2007). *Bangladesh Super Cyclone 'Sidr' 2007*. Government of the People's Republic of Bangladesh. Retrieved from http://www.lcgbangladesh.org/DERweb/cyclone/docs/Sidr-12-12-07/2007-12-12_Bangladesh%20Super%20Cyclone%20%27SIDR%27%202007_MoFDM.pdf

Monsur, S. (2011). Dhaka's vulnerability to climate change. *Thedailystar*. Retrieved from http://archive.thedailystar.net/newDesign/news-details.php?nid=194224

Murshed, S., Islam, A., & Khan, M. (2011). Impact of Climate Change on Rainfall Intensity in Bangladesh. In *3rd International Conference on Water & Flood Management*. Institute of Water and Flood Management, BUET.

NOAA National Weather Service,. (2007). *Climate Change*. NOAA. Retrieved from http://www.nws.noaa.gov/om/brochures/climate/Climatechange.pdf

Opel, A. E. (2000). The social content of labour markets in Dhaka slums. *Journal of International Development*, *12*(5), 735.

Pender, J.S. 2008. What Is Climate Change? And How It Will Effect Bangladesh. Briefing Paper. (Final Draft). Dhaka, Bangladesh : Church of Bangladesh Social Development Programme.

Pryer, J. A. (2003). *Poverty and Vulnerability in Dhaka Slums*. Ashgate Publishing Limited, Aldershot.

Pryer, J. A., Rogers, S., & Rahman, A. (2003). Factors affecting nutritional status in female adults in Dhaka slums, Bangladesh. *Social biology*, *50*(3-4), 259-269.

Rahman, M., Islam, M., Ahmed, A., & Georgi, F. (2012). Rainfall and temperature scenarios for Bangladesh for the middle of 21st century using RegCM. *Journal Of Earth System Science*,*121*(2), 287-295. DOI:10.1007/s12040-012-0159-9

Rahman, S. (2014). *Impacts of Flood on the Lives and Livelihoods of people in Bangladesh: A Case Study of a Village in Manikganj District* (Postgraduate). BRAC University, Dhaka, Bangladesh.

Rashid, M. (2013). Migration to Big Cities from Coastal Villages of Bangladesh: An Empirical Analysis. *Global Journals Inc.*, *13*(5).

Rashid, S. F. (2000). The urban poor in Dhaka City: their struggles and coping strategies during the floods of 1998. *Disasters*, *24*(3), 240-253.

ReliefWeb,. (2008). *Cyclone Sidr in Bangladesh: Damage, loss, and needs assessment for disaster recovery and reconstruction*. Retrieved 7 September 2015, from http://reliefweb.int/report/bangladesh/cyclone-sidr-bangladesh-damage-loss-and-needs-assessment-disaster-recovery-and

Rogner, H.-H., D. Zhou, R. Bradley. P. Crabbé, O. Edenhofer, B.Hare (Australia), L. Kuijpers, M. Yamaguchi, 2007: Introduction. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

RTCC (2013). *Bangladesh rated world's most vulnerable country to climate change*. Retrieved 7 September 2015, from http://www.rtcc.org/2013/10/30/bangladesh-rated-worlds-most-vulnerable-country-to-climate-change/

Ryan, S. (2011). *Flooding leaves thousands homeless in Bangladesh villages*. The International Federation of Red Cross. Retrieved 14 September 2015, from http://www.ifrc.org/es/noticias/noticias/asia-pacific/bangladesh/bangladesh-floods/

Saha, S., Ali, M., Jonsson, G., & Haque, N. (2014). Climate Change Adaptation: A Trainer's Handbook.*Comprehensive Disaster Management Programme (CDMP II), Ministry Of Disaster Management And Relief (Modmr)*. DOI:http://hdl.handle.net/123456789/374

Scied.ucar.edu (2015). *Why is Climate Changing Today? | UCAR Center for Science Education*. Retrieved 7 September 2015, from http://scied.ucar.edu/shortcontent/why-climate-changing-today

Sdwebx.worldbank.org,. (2015). *Climate Change Knowledge Portal*. Retrieved 7 September 2015, from http://sdwebx.worldbank.org/climateportalb/home.cfm?page=country_profile&CCode=BGD

Shamsuddoha, M., & Chowdhury, R. (2009). *Climate Change Induced Forced Migrants: in need of dignified recognition under a new Protocol*. Dhaka, Bangladesh: Equity and Justice Working Group Bangladesh (EquityBD). Retrieved from http://www.equitybd.org

Siddiqui, T. (2011). Climate change induced displacement: Migration as an adaptation strategy.*Thedailystar*. Retrieved from http://archive.thedailystar.net/newDesign/news-details.php?nid=210113

Uzma, A., Underwood, P., Atkinson, D., & Thackrah, R. (1999). Postpartum health in a Dhaka slum. *Social Science & Medicine*, *48*(3), 313-320.

Walsham, M. (2010). Assessing the Evidence: Environment, Climate Change and Migration in Bangladesh. International Organization for Migration, Dhaka, Bangladesh.

Appendix

Images

Questionnaire:

A. General Information:

ক সাধারণ তথ্য

১ উত্তরদাতার সংখ্যাSerial #

২ বস্তির নাম Name of the slum

৩ বয়স Age

৪ঢাকায় আসার কারণ : Reasons for coming to Dhaka City……

B. Settlement

1. How many years you have been living here?

১ কতদিন ধরে সেখানে আছেন?

……..

2. Does water enter into your slum during occasional rainfall?

২ সাধারণ বৃষ্টির সময় কি আপনার বাসায় পানি ঢোকে?

a. Yes b. No

ক হ্যাঁ খ না

3. What are the problems that you normally observe during monsoon rainfall?

৩ অতিরিক্ত বৃষ্টির সময় কি ধরনের সমস্যা হয়?

……

4. What are the problems that you faced in last flood?

৪ বন্যার সময় কি ধরনের সমস্যা হয়েছিল?

……

5. Have you ever faced any difficulty to live in your slum during summer time?

৫অতিরিক্ত গরমের সময় রুমে থাকতে কি সমস্যা হয়?

a. Yes b. No

ক হ্যাঁ খ না

C. Water and Sanitation

গ পানি এবং শৌচাবস্থা?

1. What are the available sources of drinking water in your slum?

১ খাবার পানি কোথা থেকে আনেন?

ক নলকূপ

খ কুয়া

গ পুকুর

ঘ ডিসিসি/ ওয়াসা থেকে

ঙঅন্যান্য……

a. Tube well

b. Well

c. Pond

d. Supply water by DCC/WASA

e. Others……

2. Do you face any troublewhile collecting drinking water during monsoon rain?

২ অতিরিক্ত বৃষ্টির সময় পানি আনতে কি সমস্যা হয়?

a. Yes b. No

ক হ্যাঁ খ না

3. Do you face any difficulty while collecting drinking water during summer time because of excess hot weather?

৩অতিরিক্ত গরমের সময় পানি আনতে কি সমস্যা হয়?

a. Yes b. No

ক হ্যাঁ খ না

4. Where do you go for defecation during extreme rainfall?

৪ অতিরিক্ত বৃষ্টির সময় কোথায় মলত্যাগ করেন?

……

6. Have you faced any problem regarding defecation during last flood?

৬ বন্যার সময় কি সমস্যা হয়েছিল?

a. Yes b. No

ক হ্যাঁ খ না

D. Health

ঘ স্বাস্থ্য

1) Have you or your family members ever suffer fromdiarrhea/malaria/cholera/dengue?

১) আপনি বা আপনার পরিবারের কোন সদস্য কি ১৯৯৮ সাল থেকে কোন সময় ডায়রিয়া/ ম্যালেরিয়া/ কোলেরা/ ডেঙ্গু রোগে আক্রান্ত হয়েছে?

a. Yes b. No

ক হ্যাঁ খ না

2) Didany health relateddifficulties occur in your family during high temperature insummer and low temperature in winter?

২ আপনি বা আপনার পরিবারের কোন সদস্য কি অতিরিক্ত গরমের সময় এবং অতিরিক্ত ঠাণ্ডার সময় কোন স্বাস্থ্য সমস্যায় ভোগেন?

a. Yes b. No

ক হ্যাঁ খ না

3) Did you or any of your family members suffer anyillness because of the consequence of the flood?

৩ বন্যার পর আপনি বা আপনার পরিবারের কোন সদস্য কি অসুস্থ হয়েছিল?

a. Yes b. No

ক হ্যাঁ খ না

E. Income

ঙআয়

1. How your work was affected during the last flood?

১ শেষবন্যার সময় আপনার কাজের কি হয়েছিল?

.....

২ আপনি যখন অসুস্থ হন তখন আপনার পরিবার কি ----- ?

2. When you fall sick how do you take care of your household?

……...

৩ আপনি বা আপনার পরিবারের কোন সদস্য কি অতিরিক্ত গরমের সময় এবং অতিরিক্ত বৃষ্টির সময় কখনো চাকরি হারিয়েছেন?

3) Have you or any of your family members ever lost job due to extreme weather condition like for heavy monsoon rain or high temperature?

a. Yes b. No

ক হ্যাঁ খ না

F. Climate Change Perception

চ জলবায়ু পরিবর্তনের ধারণা

1. Have you ever heard of the term "climate change"?
১ কখনও কি জলবায়ু পরিবর্তনের কথা শুনেছেন?

a. Yes (go to question 2) b. No

ক হ্যাঁ (২ নম্বর প্রশ্নতে যান) খ না

2. Where have you heard about climate change?
২ জলবায়ু পরিবর্তনের কথা কোথায় শুনেছেন?

(Please *write in* _____)

(অনুগ্রহ করে এখানেলিখুন_____)

3. How important is the issue of climate change to you personally?
৩ এই ব্যাপারটা আপনি নিজে কতটা গুরুত্বপূর্ণ মনে করেন?

a. Very important (go to question 4)
b. Quite important (go to question 4)
c. Not very important
d. Not at all important

ক খুব গুরুত্বপূর্ণ (৪ নম্বর প্রশ্নতে যান)
খ _____ গুরুত্বপূর্ণ (৪ নম্বর প্রশ্নতে যান)
গ অতটা গুরুত্বপূর্ণ না
ঘ একদম গুরুত্বপূর্ণ না

4. Do you think climate change is something that is affecting or is going to affect you, personally?
৪ আপনি কি মনে করেন যে জলবায়ু পরিবর্তনের জন্য আপনি নিজে ভুক্তভোগী হবেন?

a. Yes (go to question 5, 6, 7,8) b. No

ক হ্যাঁ (৫,৬,৭,৮নম্বর প্রশ্নতে যান) খ না

5. If yes, in what way(s) is it affecting you, or is it going to affect you?

৫ যদি হয়ে থাকেন তাহলে কিভাবে হচ্ছেন বা হবেন?

_____

৬ আপনি কি বিশ্বাস করেন যে জলবায়ু পরিবর্তনের জন্য প্রাথমিকভাবে প্রাকৃতিক শক্তি বা উন্নত দেশের মানুষের কাজকর্ম দায়ী?

6. Do you believe climate shifts that occur are primarily driven by natural forces or human activity of the developed countries?

_____

8. Who do you think should have the main responsibility for tackling climate change?

৮ আপনি কি মনে করেন যে জলবায়ু পরিবর্তনের সমস্যা সমাধান করার প্রধান দায়িত্ব কার?

a. International organizations (e.g. the UN)
b. The national government
c. Local government
d. Business and industry
e. Environmental organizations/ lobby groups (e.g. Worldwide Fund for Nature)
f. Individuals
g. Other (*please write in*: _____)

ক আন্তর্জাতিক সংস্থা (যেমন ইএন)
খ সরকার
গ স্থানীয় সরকার
ঘ ----- প্রতিষ্ঠান
ঙপরিবেশ বিষয়ক সংস্থা(যেমন বাপা)
চ সাধারণ মানুষ
ছ অন্যান্য (অনুগ্রহ করে এখানে লিখুন_____)

6. Do you think the government is doing enough to prevent climate change?

৭ আপনি কি মনে করেন যে সরকার জলবায়ু পরিবর্তন প্রতিহত করার জন্য যথেষ্ট?

_____