

**Climate change or local anthropogenic impacts? Comparing effects on livelihoods  
and sustainable development in a rural coastal village of Bangladesh**

By

Subrina Tanjin Buly

A Thesis Submitted to  
Saint Mary's University, Halifax, Nova Scotia  
in Partial Fulfillment of the Requirements for  
the Degree of Master of Arts in International Development Studies

April, 2017  
Halifax, Nova Scotia

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Subrina Tanjin Buly

Approved: Dr. Anthony (Tony) Charles  
Supervisor

Approved: Dr. Anthony Holland O'Malley  
Reader

Approved: Dr. John Cameron  
External Examiner

Date: 27<sup>th</sup> April, 2017.

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## **Abstract**

Bangladesh is considered as one of the developing countries in the world which is highly adversely affected by climate change. The country's geophysical location makes the coastal area of this country under constant threat of climatic hazards and climate change impacts on the environment and the livelihoods of the people of the coastal region are in constant threat. However, local anthropogenic issues like population growth, unplanned shrimp farming also contribute to environmental degradation and insecure livelihoods. Hence, this research attempts to investigate and compare the effects of climate change and of local anthropogenic impact on the livelihoods of Khutikata village on the coast of Bangladesh, and the role of community-based adaptation to sustain and improve their livelihoods in the context of the sustainable livelihoods approach. Drawing on fieldwork in the village, the thesis explores the real picture of the coastal area which is affected due to climate change and local anthropogenic concerns.

April 27, 2017

## **Acknowledgement**

I would like to give my sincere gratitude to my supervisor Dr. Tony Charles, for his wonderful patience, support and guidance with positive impression to accomplish the research. I am also thankful to my research committee, Dr. Anthony Holland O'Malley and Dr. John Cameron for their precious time and kind contribution in the research.

I would like to thank Mrs. Olena Reza (Research Fellow) and Bidhan Chandra Tikader (senior Research Officer) of my partner organization Bangladesh Center for Advance Studies (BCAS) and most importantly all the participants of Khutikata village who supported throughout the research.

My special thanks go to Tahazzud Hossain and Farzana Karim who I hope will be the top future Environmental Scientist of Canada, for their enormous encouragement and help. I am grateful to my family members including nephew Saim Bin Selim. Last but not the least, I owe to my beloved Parents, husband Mohummad Khairul Basher and my lovely six year old daughter Raesa Bashir for their constant support and patience.

## **Dedication**

*To my lovely daughter Raesa Bashar*

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## **List of Acronyms**

BBS	Bangladesh Bureau of statistics
BLRI	Bangladesh Livestock and Research Institute
BRRRI	Bangladesh Rice Research Institute
BINA	Bangladesh Institute of Nuclear Agriculture
BCAS	Bangladesh Center for Advanced Studies
BARCIK	Bangladesh Resource Center for Indigenous Knowledge
BNIW	Bangladesh Nation Information Window
BRAC	Bangladesh Rural Advancement Committee
CBA	Community-based adaptation
CBN	Cost of Basic Needs
CARE	Cooperative for Assistance and Relief for Everyone (Relief Agency)
CCSAP	Climate Change Strategic Action Plan
DFID	Department for International Development
DRR	Disaster Risk Reduction
DMB	Disaster Management Bureau
EPB	Export Promotion Bureau
FAO	Food and Agriculture Organization of United Nations
FGD	Focus Group discussions
GO	Government Organization
GNP	Gross Net Production
GDP	Gross Domestic Production

HDI	Human Development Index
IISD	International Institute for Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
INFORM	Index For Risk Management
IPM	Integrated Waste Management
LDC	Least Developed Countries'
MDG	Millennium Development Goal
NGO	Non-Government Organization
NEF	New Economic Foundation
NCCF	National Climate Change Fund
NSAPR	National Strategy for Accelerated Poverty Reduction
NAPA	National Agricultural Policy
PDO-ICZMP	Program Development Office for Integrated Coastal Zone Management Plan
PD	Participatory Development
PRA	Participatory Rural Appraisal
REB	Rural Electric Board
RRIB	Rice Research Institute of Bangladesh
SLA	Sustainable Livelihoods Approach
SMU	Saint Mary's University
REB	Research Ethics Board
SRDI	Soil Resource Development Institute
SSN	Social Safety Net program

SUS	Satkhira Unnoyn Shongstha (Satkhira Development Organization)
OPTION	Overcoming Poverty through Innovative Livelihood Opportunities and Sustainable Use of Natural Resources
UNDP	United Nations Developing Programme
UNFCCC	United Nations Framework Convention on Climate Change
VGf	Vulnerable Group Feeding
VGd	Vulnerable Group Developing
WAIS	West Arctic Ice Sheet

## Chapter 1. Introduction

In 1988 when the Intergovernmental Panel on Climate Change (IPCC) was established, the devastating impacts of climate change were disclosed (Houghton, 2007 in Pender, J.S. 2008). Different kinds of climatic changes from global warming have been identified, such as an imbalance in rainfall pattern, melting glaciers that cause sea level rise, rising temperature in the ocean and so on. Moreover, it has been observed that from 1993 to 2003 the polar ice caps were melting because of global warming, and it was causing 3.1 mm rising of sea level per year (Alley *et al.* 2007 in Pender, J.S. 2008, p: 7). Climate experts are searching for suitable methods and technology as a solution to cope with the impacts of climate change that had already been done. Conferences worldwide are still held to address this issue. By 2025, most of the people in developing countries will become vulnerable due to the negative impact of climate change (La Trobe, 2002 in Pender, J.S. 2008, p: 11). Nevertheless, megacities of the world, for example, New York, Calcutta, Tokyo, London, and Mumbai, are at the high threat of coastal surges that will cause flooding (Stern, 2006 in Pender, J.S. 2008, p: 12).

Although delta areas cover only one percent of the world's land, seven percent of the global population lives in these delta areas (Erickson *et al.*, 2006 in Sazbo, Sylvia *et al.* 2016, p: 539). Hence, climate change becomes a threat to these people, especially in the coastal areas of developing countries. However, the impact of climate change varies from place to place (Adger *et al.*, 2004, Kasperson and Kasperson, 2001 in Panthi *et al.* 2016, p: 1). Climate experts and researchers have stated that low-lying coastal regions of the world are going to be the most affected by climate change (Roessig *et al.* 2004 and

IPCC, 2014). Therefore, scientists and climate experts are making efforts to reduce the adverse effects of climate change. Despite the fact that the poor and vulnerable people of the developing world have no or negligible contribution to greenhouse gas emissions at the beginning, they are the people who will suffer the most (Reid and Haq, 2007) especially in agriculture, fishing and tourism sector (Haq and Burton 2003, Haq et al. 2003, Agarawala cited in Haq and Reid, 2004, p: 19). It has been reported that due to climate change, the sea level is rising and therefore, the coastal communities are facing plenty of risks on their livelihoods (Stern, 2006 in Pender, J.S. 2008, p: 12).

Bangladesh is considered as one of the developing countries in the world which is adversely affected by climate change. The country is the most disaster prone due to its geophysical location (Ahmed and Glaser, 2016). In the year of 2012 the Global Climate Risk Index ranked Bangladesh in the first position and 2016 it ranked the country in the sixth position in the list as one of the most vulnerable climate change affected countries in the world (Harmeling and Eckstein 2012, Kreft et al. 2015 in Ahmed and Glaser, 2016, p: 121). The coastal area of this country is under constant threat of climatic hazards and climate change impacts regarding floods, cyclones, droughts, excessive rainfall, high temperature, sea level rise, salinity intrusion and much more ways. The country is known as the “nature’s laboratory on disasters” (Ahmed et al., 2013; Ahmed and Diana, 2015a, 2015b in Ahmed and Glaser, 2016, p: 121). Presently adaptation is given importance in the developing countries to deal with the adverse impact of climate change, and the IPCC Fifth Assessment already has four chapters on adaptation that deals with this concept (Younus, 2016).

However, besides climate change due to greenhouse gas emissions, some other anthropogenic issues are also responsible for the degradation of environment and livelihood of coastal people. It has been found that industrialization in developed countries was responsible for the climate change at the very beginning (Reid and Haq, 2007). Nevertheless, from the literature review, this thesis found that local anthropogenic issues were also responsible for environmental changes and insecure livelihood. Population growth, unplanned shrimp farming in coastal areas, local corruptions are some of the local anthropogenic issues that cause environmental degradation and insecure livelihood.

Therefore, this study aims to find and compare the effects of climate change and of anthropogenic issues on the livelihood of the Khutikata coastal village of Bangladesh and the role of community-based adaptation to sustain and improve their livelihoods in the context of sustainable livelihoods approach. Instead of simply applying this theory in this study, some ideas of this theory were used to explore out the real picture of the coastal area which is affected due to climate change and local anthropogenic concerns.<sup>1</sup>

### **1.1 Statement of problem**

Bangladesh is known as the most densely populated country in the world (Habiba et al. 2015). Out of 177 countries in the world, the position of Bangladesh is 140 in Human Development Index (Human Development Report, 2015, p: 236). The country is ranked in the medium human development categories (Human Development Report, 2015, p: 236). Agriculture is the dominant economic sector in Bangladesh (Haq and Haq,

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<sup>1</sup> In this thesis the local anthropogenic issues refers to the population growth, unplanned shrimp farming, abusage of technological supports, corruption, torment of pirates and kidnappers from the Shundarban forest of Bangladesh.



2015) and the primary source of livelihood for the people of the country. Almost ninety percent of Bangladeshi people's food habit is rice (Habiba et al. 2015). However, the Ministry of Agriculture of Bangladesh reported that due to climate change impact, the country lost around 80,000 ha of arable land (Habiba et al. 2015, p: 21). In this context, the coastal regions of Bangladesh are suffering greatly due to climate change in terms of sea level rise, saline water intrusion and salinity increase in the soil (Sinha, Singh, and Singh, 2014, p: 961). According to the IPCC fourth assessment report global warming caused saline water intrusion in groundwater (DMB GoB, 2010) and by the year of 2050 the production of rice and wheat is expected to decrease 8% and 32% correspondingly (DMB GoB, 2010, p: 23).

Another resource-based economic sector of Bangladesh is the fishery. It is the third largest sector that earns foreign currency for Bangladesh (Dey et al.2008 in Hossain, 2014, p: 111). Due to saline water intrusion, the fishery sector in coastal Bangladesh is in danger (Alam, Ahammad, Nandy & Rahman, 2013). Therefore, it is evident that both agriculture and the fishery sector in a developing country like Bangladesh are at significant risk because of climate change.

On the other hand, from the secondary studies, it is evident that not only climate change but also some local anthropogenic issues are exacerbating the obstacles of development for sustainable livelihood in the coastal Bangladesh (Miah, Bari & Rahman, 2010). In this research, the anthropogenic issues refer to the population growth, unplanned shrimp farming, corruption, and lack of communication between the community, non-governmental organizations, and the government of Bangladesh. It has

been found that overpopulation; shrimp farming at the coastal regions, corruptions, and so forth is the problems in the socio-economic development of the country (Yonus, 2016). A study showed that both climate change and population growth in Bangladesh are responsible for the adverse effect on the agriculture and fishery sector of the country (Ahsan, sultana & Taleb, 2015). Moreover, corruption at the local level is also found in the aid, relief, and rehabilitation system in Bangladesh (Yonus, 2016). Therefore, not only climate change but also local anthropogenic issues have adversely affected the development of sustainable livelihood of the agriculture and fishery sector (Adger et al. 2005 and Lebel, 2012 in Alam, Ahmed, Nandy and Rahman, 2013).

The agricultural economist and ex-director general of Bangladesh Livestock and Research Institute (BLRI) Dr. Alam stated that due to a population increase the land area for net crop production area is decreasing. He estimated that in 1974 the net crop area was 59% which decreased to 53% in 2009 (Ahsan, Sultana, and Taleb, 2016). Therefore he stated that “it is an alarming threat for Bangladesh” (Ahsan, Sultana, and Taleb, 2016, p: 17). The population density of the country is 1100 persons per sq km (Sinha, Singh, and Singha, 2014, p: 961). In Bangladesh, unplanned shrimp farming also plays a destructive role in the degradation of environmental balance (Islam & Haque, 2004). It has been found that rice production decreased seventy-seven percent due to the transformation of rice fields into shrimp ponds in the coastal Satkhira district of Bangladesh (Sinha, Singh, and Singha, 2014, p: 961).

However, in this situation, climate change experts and scientists are focusing on the adaptation strategies for sustainable development in the climate affected area of the

world. Adaptation scientists (Adger, Barnett, Brown, Marshall, O'Brien, 2013; Brooks, et al, 2013; Fenton, Wright, Afionis, Paavola, & Haq, 2014; Schipper & Burton. 2009; Warrick & Ahmed, 1996; Yonus, 2014 in Younus, 2016) are giving importance to community-based adaptation to reduce the future vulnerability caused by climate change (Younus, 2016).

As seen in the above discussion, the agriculture and fishery sectors are the two main economic sectors for livelihood in the Khutikata coastal village of Bangladesh. Presently due to the adverse effects of climate change and local anthropogenic issues, their development of sustainable livelihood is under great threat. Community-based adaptation strategies in this context are supporting these groups to sustain their livelihoods. Therefore, the arguments of this thesis are (1) at the moment local anthropogenic issues are more responsible than climate change for the unsustainable development of livelihood, and (2) adaptation strategies play the vital role in the development of sustainable livelihood. This will contribute to the thinking on global, national and local level governmental policy making, and especially for the coastal zone policy of Bangladesh, aid programs, and its proper implementation at the grassroots level.

### **1.2 Research questions and hypothesis**

To examine the above issues, the following research questions were adopted.

- How are the climate change and local anthropogenic issues affecting the agricultural and fishery sectors in the Khutikata coastal village of Bangladesh?
- What are the adaptation strategies followed by the local people to survive in their changed environment?

- Which sector (fishery or agriculture) is more damaged by climate change and by anthropogenic issues?
- How does community-based adaptation support the villagers to sustain their livelihood and analyze the capabilities and response of the Khutikata community towards the adverse effects of climate change and local human activities?

These questions lead the researcher to explore and compare the most affected community people, their response towards the adverse effects of climate change and local human activities, their livelihood and coping strategies in the coastal region of Bangladesh, and to discover the answer on how the people of the Khutikata coastal village sustain their livelihoods.

### **1.3 Hypotheses**

(i) Climate change is more responsible for the degradation of local environment and insecurity of the sustainable livelihood than local human activities.

(ii) In the face of climate change, community-based adaptation strategies are supporting the development of sustainable livelihood of the Khutikata coastal community to some extent.

### **1.4 Objective of the study**

The purpose of the thesis is to achieve a better understanding of the effects of climate change and local anthropogenic issues on the development of sustainable livelihoods of the Khutikata coastal village of Bangladesh, and their adaptation strategies to cope with the changed environment. The thesis will also compare between climate change and anthropogenic problems regarding their relative adverse impacts, which will

help to reveal which indicators, are more accountable for the insecurity of sustainable livelihood. Drawing lessons from the empirical study this thesis attempts to understand the current development situation at the local level and provide important information for the global policy makers and the government of Bangladesh as well.

The thesis will examine the patterns of climatic and local anthropogenic consequences which are affecting the agricultural and fishery groups of the village. The study will attempt to understand local people's perception of the current situation of climate change and local anthropogenic issues in their village, development of livelihood and their adaptation strategies. Moreover, the thesis will identify the reasons influencing people to adopt the adaptation strategies and to explore the scope and limitation of adaptation strategies in the context of the sustainable livelihood approach.

The result of this research will document the information to the government of Bangladesh to understand the existing situation, problems regarding the adverse effect of climate change and anthropogenic issues not only for producing better policy but also for its proper implementation.

### **1.5 Thesis Outline**

This thesis is arranged in the following chapters.

In chapter two, methodological approaches and techniques of field research methods are briefly discussed, and the study area is described, including the country (Bangladesh) through to the local coastal community Khutikata.

In chapter three, a brief literature review is given that deals with the theoretical concepts of this research. It discussed the existing secondary sources of literature that

deals with sustainable livelihood approach, capability approach, community-based adaptation, the relation between climate changes, adaptation, and development, affect of climate change on agriculture and fishery sector in Bangladesh and their adaptation strategies. It also discussed the existing literature on the effect of some anthropogenic issues like shrimp farming, corruption problem on people's livelihoods.

Chapter four discussed a part of the empirical findings from the field research. It gives the results of the adverse effect of climate change on the agricultural and fishery sector. It also explains the existing adaptation strategies of the Khutikata coastal villagers of Bangladesh.

Chapter five explores the adverse affect of climate change on the whole community of Khutikata. It discovers some crucial anthropogenic criterions that affect the development of sustainable livelihoods of the Khutikata community. This chapter shows a comparison between the adverse affect of climate change and the anthropogenic issues to evaluate the most responsible grounds of unsustainable development of livelihoods of Khutukata community. This chapter also presented the developmental aspect of the Khutikata community. It shows the governmental and non-governmental initiatives for the development of sustainable livelihoods of the community. The perception of the Khutikata community on the development programs from GO and NGO.

Chapter six summarizes the discussion and analysis of the acquired results. It also provides the conclusions and future recommendations of the thesis.

## **Chapter 2. Research Methodology and the Study Area**

### **2.0 Research Methodology**

In this section, the research methods, tools, and research techniques will be discussed. The appropriate methodological approach for this research will be presented in the first phase of this section and the tools and techniques presented in the second phase of this section.

### **2.1 Methodological Approach**

This thesis attempts to search for the answers to the research questions described above in section 1.3. These questions all address how the people of the Khutikata coastal area sustain their livelihoods. All the questions lead the researcher to adopt the case study approach as the questions were exploratory (Yin, 2009) and it helps the researcher to get a “holistic and meaningful characteristics of real-life events” (Yin, 2009, p: 4). Moreover, one of the objectives of the study was to examine the adverse impact of climate change and anthropogenic issues on the sustainable livelihoods of the Khutikata villagers and the role of community-based adaptation in this context. However, to find out the answers to these questions in a most natural way (Willis, 2007, p: 239) the researcher visited the Khutikata coastal village of Bangladesh. She observed the present situation of the study area and made inquiries to find out the real picture of the situation. The researcher also continued her study to analyze and evaluate the opinions of the participants about the impact of climate change and local anthropogenic issues on their livelihoods. Throughout the field study, the researcher had very little, or no control over the participants (Yin,

2009) and most of the interviews were conversational. Case study approach has been criticized as less precise (Berg, 2009) and uncontrollable than other methods (Campbell and Stanley, 1966). However, the researcher had her questionnaires which worked as a guide to run the research process in the right direction. Both case study and qualitative approach helped the researcher to explore and gather satisfactory information that was needed for the research.

Before analyzing and selecting the appropriate method, the following concepts were developed; proper research question, research objectives, and issues that need to be investigated and focus of interest that needs to be studied.

In the first phase, the researcher had an investigative secondary search on the key concepts of this research. A wide variety of secondary search on the issues of climate change, its impact on agriculture and fishery sectors in Bangladesh, adaptation strategies, and the development strategies of coastal Bangladesh were studied. The impacts of anthropogenic issues on the livelihoods of the coastal people were also reviewed. Anthropogenic issues, in this case, include unplanned shrimp farming, population growth, overconsumption, over-exploitation of natural resources, corruption, abuse of technological supports, and the torment of pirates and kidnappers from the Shundarban forest of Bangladesh. A diverse archival research was conducted including the official websites of the government of Bangladesh and some non-governmental institutional websites such as FAO, Bangladesh Center for Advanced Studies (BCAS) and Bangladesh Resource Center for Indigenous Knowledge (BARCIK). Books, articles, journals and some relevant theses were reviewed which were collected from the Patrick Power Library



of Saint Mary's University, Killam Memorial Library of Dalhousie University, Central Library of Dhaka University of Bangladesh and the library of BCAS.

Based on the secondary sources the unit of analysis of this research was demarcated as the Khutikata village of Bangladesh and its agricultural and fishery groups. The village of Khutikata was selected as it is one of the most vulnerable coastal areas of Bangladesh and the livelihoods of the agricultural, and fishery groups were affected adversely due to climate change and anthropogenic issues. Some of the key features that led the researcher to pursue this research in Khutikata village of Bangladesh are poverty, location in the coastal area, vulnerability, shrimp farming, increased sea level and saline intrusion, insecure livelihoods of the agricultural and fishery groups.

In addition, since 2014 a connection was developed with a partner organization 'Bangladesh Center for Advanced Studies (BCAS)' that helped the researcher to select the village by providing the necessary information about the village. A contact was made with Mrs. Olena Reza who is a research fellow and with Mr. Bidhan Chandra Tikadar who is the senior research officer of the partner organization. The organization has been working in that village for several years. The connection was also made with the key informants of the village through the partner organization. Bangladesh Center for Advance Studies (BCAS) is a non- profit research based organization. The researcher worked as a volunteer with this organization earlier as a data collector in different projects of the organization while doing a bachelor degree in Anthropology. Therefore, the organization was familiar with the researcher.

The fieldwork was conducted during the period of 29<sup>th</sup> April to 25<sup>th</sup> May 2015 in

Khutikata village. In this research, the focus of analysis was the livelihoods of the farmer and fishery groups, their adaptation, and developmental strategies to sustain their livelihoods in the changed environment. All the data were collected in the Bengali language as all the participants speak and understand the Bengali language.

In the field research, a qualitative approach was used which included semi-structured interviews and focus group discussion. The qualitative approach was taken because it gives an in-depth understanding of any specific social aspects or activities from the participant's point of view; *"the appropriate research approach is the one that best fits with your research problem"* (Bloomberg and Volpe, 2012, p: 27).

The qualitative research approach had been utilized to investigate the social and climatic changes in the study area. The history of the fishermen and farmers groups had been taken into consideration to understand their relationship with their environment. A significant amount of data was gathered by informal conversations with the participants of the village during the period of fieldwork.

The objective of the research was to discover and compare the adverse impact of climate change and of anthropogenic issues on the livelihoods of the coastal people of Bangladesh and their developmental strategies to sustain their livelihoods in their changed environment. In this regard, they are using adaptation approach which is a bottom-up approach and gives importance to the grassroots level community's people (Schipper et al. 2014). However, despite development programs from the government and non-governmental sectors, the place of Bangladesh in the human development index is still 140. This place of Bangladesh considered as among the "medium human developed"

countries in the world (UNDP Report, 2007-8, p: 239). Therefore, the question arises how and what are the obstacles hindering the development of the selected community regarding livelihoods, income, literacy, health issues, and child care and so on. However, the notion of development varies from person to person which is immeasurable, so it is difficult to get the accurate information on what they think of their development. Hence, it is essential in this research to go through the subjective experience of the community people which is the main reason to employ a qualitative approach instead of a quantitative approach.

## **2.2 Research techniques**

In the first phase of the field work the researcher visited the village several times and tried to know the participants. The researcher built up a friendly relationship with the participants. A friendly and good relationship with the participants of the village was needed to acquire more information about the present condition of the village, history of the village, local politics, economic, social, and environmental issues. This technique also helped to find key informants and some other informative participants for this research.

According to Bernard, “hanging around and rapport building may sound silly” (Bernard, 2006, p: 368) but this technique helped the researcher to build a trustworthy friendly relationship with the participants (Bernard, 2006, p: 368). This was very crucial in the field research because it gives much-unexpected information. Again, the researcher was able to ask questions about any complex or delicate issue to the participants (Bernard, 2006, p: 368-369).

### **2.3 Ethical Consideration**

An ethics application was submitted to the Saint Mary's University (SMU) Research Ethics Board (REB) and approval were given for the field research. All information gathered remained confidential, and only the author had access to the primary data. The data will be stored for five years post thesis publication and will then be destroyed as required by SMU REB Data Storage Guidelines. Participation in the research was completely voluntary, and no compensation was given. Confidentiality of the participants was preserved in the research unless any of the data collected was authorized. (REB form, p: 13).

Before interviews and Focus Group Discussion, verbal consent was taken from the participants. The majority of the participants of this research were illiterate or very little educated and poor<sup>2</sup> people where most of them belong to below poverty line. Taking signature on the consent paper or recording their voice may raise suspicions in them. Therefore, a tape recorder was not used, and any signature or hand print was not taken in any consent letter. However, with their concern, some photographs were taken. Verbal consent forms were presented in the Bengali language for better understandings of the participants.

### **2.4 Focus Group Discussion**

Four Focus Group discussions (FGDs) were employed during the field research.

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<sup>2</sup> Since 1995-96 Bangladesh Bureau of statistics (BBS) has used the method known as the “Cost of Basic Needs (CBN)” to measure the poverty. There are two poverty lines. i) below poverty line and ii) upper poverty line. People who are able to afford the eleven foods item, such as rice, wheat, milk, sweet fresh water, potato, meat, fish, pulse, edible oil, fruits, vegetable and sugar are considered as upper poverty line and people who cannot afford these items are below poverty line and they are in lack of 2122 k.cal per day (Poverty and Inequality of Bangladesh: journey towards progress, Microeconomic Wing, Finance Division, Ministry of finance, Government of people's Republic of Bangladesh, 2014-2015, p: 3).

FGDs are group interviews, which preserve the sense of unique conversation between the researcher and the participants. In the focus group, discussion the researcher plays the role of a moderator and guides the group discussion by providing the participants the appropriate topics (David L. Morgan, 1999, p: 2). Morgan has described the main feature of FGD as “*explicit use of group interaction to produce data and insights that would be less accessible without the interaction found in a group*” (David L. Morgan, 1999, p: 2). Lia has outlined the usefulness of applying FGD in social research as it explores the opinions of a particular community people on any specific problem or any complex, delicate issues, and it examines the reasons for their conception and discusses the possible solutions which are proposed by the community people themselves. (Lia Litosseliti, 2003). The following steps were followed while conducting FGD:

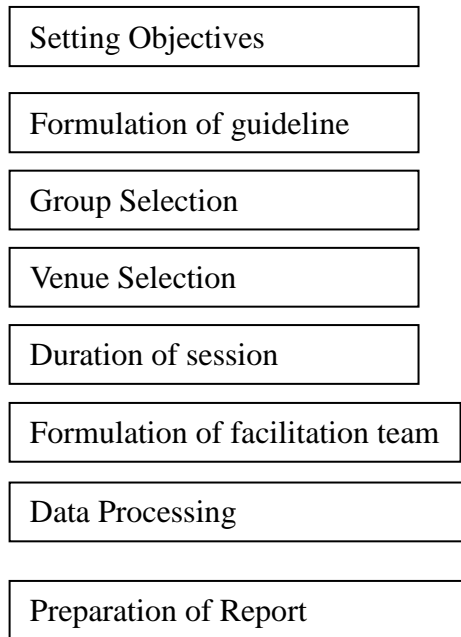


Figure 1.1: “Steps of Conducting FGD” (Source: Neogi, 2001, p: 22).

Bernard said, “FGD and surveys provide similar results, but where the focus group offers more details” (Bernard, 2006, p: 237). Each focus group discussion consisted of six to ten people. Moreover, all the four FGD were conducted separately between men and women. This is because the society of Bangladesh is patriarchal and male-dominated. Therefore, women may not feel comfortable to talk in front of their husband, brother, father or any other male person in the village. Throughout the process of FGD people from the partner organization helped the researcher. The duration of each group discussion was half an hour to one hour. There was no compensation for the participants.

## **2.5 Interviews**

Under the qualitative research approach, interviews were taken among the selected inhabitants of the village of Khutikata. Conversational semi-structured interviews were taken rather than structured questionnaires during the field research (Yin, 2009). Each interview lasted from thirty minutes to one hour. A questionnaire was followed as a guideline to cover all the issues relevant to this research (Bernard, 2006). As the duration of the fieldwork was limited, a semi-structured interview was employed which saved time. It helped the interview to move on with ease without any extreme control from the researcher. Participants felt free to convey their opinion (Bernard, 2006). Nineteen people were interviewed including participants from the GO and NGOs. Three of the interviewees were from different NGOs as they were working in that village for the last five years, and one of the participants was from the local governmental administrative office. A separate file was maintained for each interviewee. Most of the

participants' ages ranged from the 20s to mid-60s or 70s. Most of the participants remained anonymous, as they wished to be, as sometimes they gave internal relevant information for the research. Therefore, throughout the thesis, pseudonyms are used in the quotations.

In this research, all the interviews were taken in the Bengali language; since the researcher of this research is Bangladeshi Citizen, language was not a barrier to this research. The primary focus of this research was to identify the effect of climate change and anthropogenic issues on the agricultural sector and the fishery sector, as well as the adaptation development strategies of the farmers and fishery groups in the coastal area of Bangladesh. As a result, most of the participants were farmers, fishermen, and the day laborer in shrimp farms or former fishermen.

## **2.6 Key informants and partner organization**

Key informants play the role of a representative of their culture and introducer of their society to the researcher (Bernard, 2006). Three key informants were used in this research. These key informants co-operated throughout the field study. Key informants provided many important cultural, social and political aspects of their culture or society which was relevant for this research. Initially, the researcher had a key informant from the partner NGO who worked in the Khutikata village for two years and helped the researcher to enter the village. However, with the help of the key informant from the NGO, the researcher found other key informants from the community who helped in the introduction of the participants of the village community.

The study was accomplished in a coastal area where the people were vulnerable

due to climate change and its adverse effects. The partner research organization Bangladesh Center for Advance Studies (BCAS) has been working in those places to raise awareness and knowledge about climate change and possible alternative ways of livelihoods, and adaptive strategies, and also gives financial supports to the people on the basis of their situation. For example, they give training on how to produce saline tolerant seed in a cost-effective way, techniques to compose organic fertilizers, suitable places and time to sow the seeds, and they connect them with the market chain and so on. People in the village were also supportive towards the organization. BCAS also works to empower women and raise awareness about their rights in the society. However, key informants were selected from direct observation and recommendation from BCAS.

### **2.7 Analysis of the collected data**

All the data was well documented in the Bengali language during the field research. The research process was begun with the analysis of empirical data and initial interviews with key informants who helped to establish the research question, research objective, selection of the study area and pursue the research forward. Data was gathered from the field work, and the coding method was followed to analyze it. Three types of coding were used during data analysis. With open coding, preliminary data was collected, and then it was coded according to the themes and categories; for example, whenever the researcher asked the participants about their opinion on the changes in their environment the researcher coded those answers of the questions with specific code numbers and categorized them as *opinion on the changed environment of the fisherman* and *opinion on the changed environment of the farmers groups*. Axial coding was used where new



information was adjusted or added relevant to this research, and selective coding was used to compare and contrast the data to search for questions which had not yet been asked (Mikkelsen, 2005). However, till the end of the field research the researcher was conscious to document all the necessary information and did continuous coding to find out similarities, dissimilarities, gaps, continuity and relationships between the variables (Bloomberg, Linda and Volpe, 2012, p: 172 and Sophie Laws et.al, 2003, p: 379, 383). The researcher kept in contact with the key informants of the village and the partner NGO after leaving the village. This connection with the key informants helped the researcher to go back and forth if any further information was needed (Bloomberg, Linda and Volpe, 2012, p: 172 and Sophie Laws et.al, 2003, p: 379, 383).

Descriptive field notes were taken through observation, interviews, focus group discussion and from key informant interviews. All these qualitative research tools and techniques helped to gather much information which otherwise could not be acquired from any other sources. A diary was maintained throughout the fieldwork to have the record of the researcher's own thoughts about the field observations. Recorded photographs were also analyzed to explore the affects of anthropogenic issues and climate change on the environment of the village, their livelihood adaptation strategies, the present situation of the village and so on.

## **2.8 Limitation of the methodology**

During the field research, some unanticipated problems appeared as limitations to the research. First of all, during the focus group discussions instead of having six to ten people, eighteen to twenty people arrived which made the FGD chaotic. However, this

incident happened two to three times, and FGD was stopped at that time. The researcher talked with the participants and made them understand that they can join again in any other session as their favorable time.

Furthermore, some participants were more dominant speakers than others. This means some participants did not let others speak their own opinion. Especially while using FGD it was observed that some participants talked more than the others. They sometimes interrupted other people to express their views. Therefore, any one question related to the research was asked several times to have other participant's points of view. For example, one of the dominant participants of the research was Bishoykumar Das. When the researcher asked, - "*what kind of environmental changes have you seen?*" he replied immediately without giving others any chance to speak. His response was beneficial for the thesis work, but other participant's views were also important for this work. Therefore, the researcher cordially asked the same question again and also if anyone else wanted to say something on this subject.

The research depended on qualitative methods to gather the information given by the research participants; it did not use any quantitative methods for collecting data. This could be seen as a limitation.

Another limitation of the study is the problem of women's security in Bangladesh. The Faculty of Graduate Studies and Research Committee reported that Bangladesh was not a safe country for women. The researcher was aware of this fact as she was born and brought up in that country. The problem is a lack of implementation of the law for any women issue cases. However, being a woman I had felt the problem in the fieldwork

which sometimes affected the research. For example, the researcher had to finish her interviews before evening. The researcher had to maintain a certain schedule for her field work. The researcher had to travel along with the male key informant from her partner NGO. Therefore, the researcher felt sometimes her participants were not comfortable enough to talk on many sensitive issues. For example, when the participants were asked how well the NGOs worked there for their development, and are they satisfied with their work or what they want, in these cases the participants may have thought that as the researcher may travel along with the NGO people she may be in favor of them and will disclose the information that they gave the researcher.

Lack of time and resources also appeared as limitations of the field research. The duration of the field research was only three weeks. Therefore, only fifteen semi-structured interviews were conducted. Some relevant local governmental officials were not present in their office as they took leave for their personal reasons. Therefore, it was not possible to schedule interviews with those persons. However, other officials helped to gather some information on researches which were satisfactory enough for the research.

### **The study area**

The field research was conducted in a coastal area of Bangladesh. Brief information of the study area and the country is presented in this section.

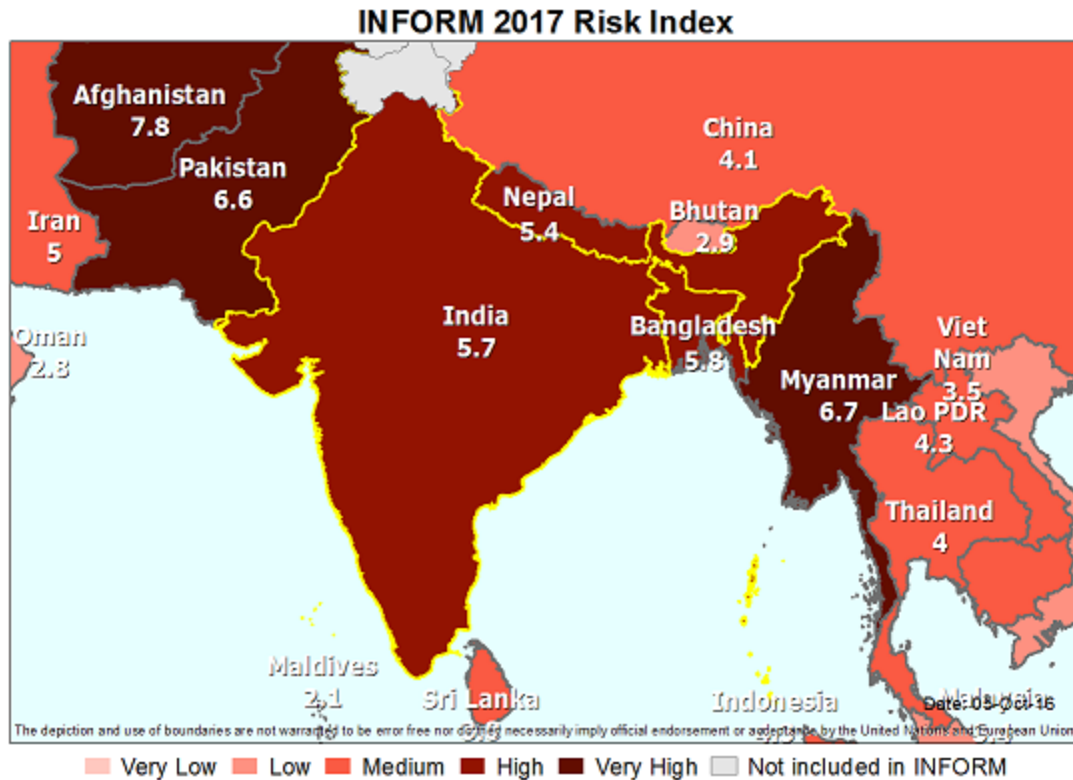
### **2.9 Country Profile of Bangladesh**

The location of Bangladesh is between 20° to 26° north and 88° to 92° east. On the west, north and east part of the country is bordered by India, the southeast surrounded by Myanmar, and the Bay of Bengal is on the south. Most of the land of this country is low-

laying land influenced by the rivers known as Ganges and Brahmaputra (Rashid 1991 in Agrawala et al., 2003, p: 9). The total land area of Bangladesh is 147,570 sq km, and the country had the largest delta in the globe (The Statistical pocketbook Bangladesh, Bangladesh Bureau of Statics BBS, 2015, p: 3). Majority population belongs to the religion of Islam (88.8%), and the national language is Bangla (The Statistical pocketbook Bangladesh, BBS, 2015, p: 3). The country is crisscrossed by numerous rivers and canals (The Statistical pocketbook Bangladesh, Bangladesh Bureau of Statics BBS, 2015, p:3). 80% of the land is filled with floodplains (Rashid 1991 in Agrawala et al., 2003, p: 9), hilly area is 12%, and terrace area is 8% (Durjog Kosh [Disaster Dictionary], 2009 in Bangladesh Disaster-related Statistics, 2015, p: 27)<sup>3</sup>. The monthly mean temperature in January is 18°C, and in April the temperature recorded as 30°C. The highest temperature is 40°C to 43°C in the west (Durjog Kosh [Disaster Dictionary], 2009 in Bangladesh Disaster-related Statistics, 2015, p: 27). The average rainfall of a year is 2,200 mm (Durjog Kosh [Disaster Dictionary], 2009 in Bangladesh Disaster-related Statistics, 2015, p: 27). According to Bangladesh Disaster-related Statistics 2015, the total population of Bangladesh during 2014 is 20204367. The percentage of male and female is 51.96% and 48.04% respectively. The average household size of the country is 4.11 in the year of 2014 (Bangladesh Disaster-related Statistics, 2015, p: 39). According to Index for Risk Management Bangladesh is highly vulnerable and at risk due to both natural and human activities (INFORM, 2017).

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<sup>3</sup> Durjog Kosh (Disaster Dictionary) 2009, Ministry of Disaster Management and Relief, Government of People's Republic of Bangladesh.



*Figure: 1.2. Map of Vulnerability of Bangladesh due to climate change and human activities. Source: Prevention Web and INFORM, 2017.*

The map is showing the position of Bangladesh in the INFORM 2017 Risk Index. According to the Index for Risk Management (INFORM)<sup>4</sup> three aspects are considered to identify the risk and vulnerability of the countries in the world. i) Hazard dimension includes “physical vulnerability and physical exposer” (Prevention Web and INFORM, 2017). ii) Vulnerability refers to the concept of the weakness of the socio-economic structure and iii) coping capacity refers to the lack of adaptation after any disaster (climatic or human hazards) (Prevention Web and INFORM, 2017).

<sup>4</sup> INFORM is a open source of information that assess the risk of the countries in the world. Information from INFORM can help to prepare and response according to any climatic or human induced hazards. (INFORM, 2017).

Country	INFORM	Hazard	Vulnerability	Lack of coping capacity	Rank
Kenya	6.1	6.1	5.9	6.4	20
Libya	6.1	8.4	4.1	6.7	21
Mozambique	6	5.3	6	6.7	22
Uganda	5.9	5	6	6.9	23
Papua New Guinea	5.8	4.5	5.7	7.7	24
Bangladesh	5.8	7.5	4.7	5.5	25
Cote d'Ivoire	5.7	4.3	5.7	7.5	26
Mauritania	5.7	5.2	5.1	7	27
India	5.7	7.3	5.4	4.8	28
Tanzania	5.7	5	5.6	6.5	29
Korea Dem.People's Rep.	5.6	5.1	5	6.9	30

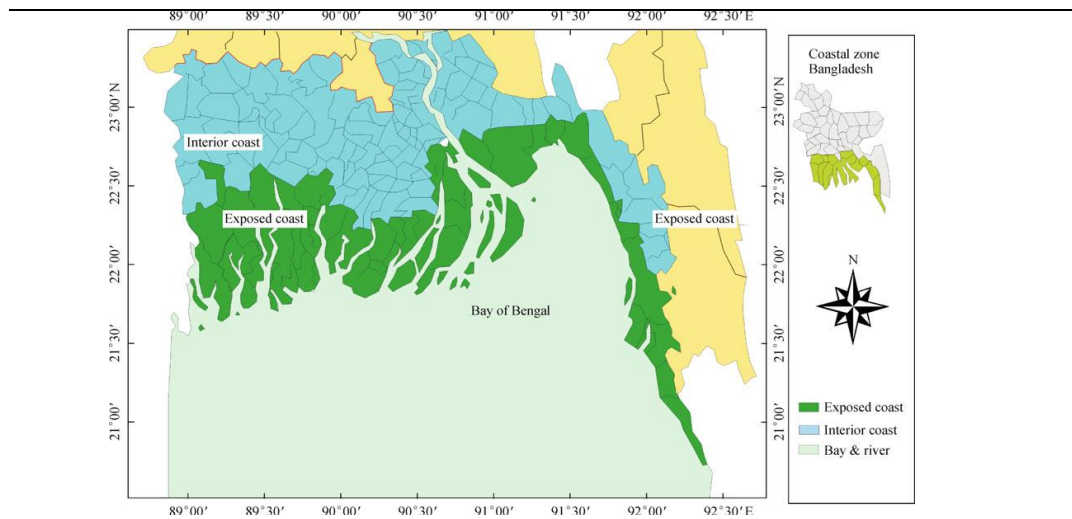
*Table: 1.1. The position of Bangladesh in the global peers, countries shown which have high risk based on the INFORM risk, hazard, vulnerability, lack of coping capacity and rank of these countries. Source: INFORM country risk profiles for 191 countries, Bangladesh, 2017.*

The value of hazards, vulnerability and lack of coping capacity are 7.50, 4.70 and 5.50 respectively (INFORM, 2017). According to INFORM risk index, the position of Bangladesh is shown above in the global peers in Table 1.1.

### **2.10 The coastal Bangladesh and Satkhira District**

Bangladesh is acknowledged as a disaster prone region because of its geophysical location and socio-economic condition (Bass Stephen and Ramasamy Selvaraji, 2008, p: 9). Bangladesh is located in the north-eastern face of South Asia. It has 710 coastal lines that cover 32% of the total land of Bangladesh (MoWR, 2005 in Hasan,

Shamsuddin and Hossain 2013, P: 112). 19 districts located in these coastal regions and around 35.1 million people resided in these regions in 2001 (Islam, 2004, p: 3-4).



*Figure 1.3. Coastal regions of Bangladesh divided in two categories, i) Interior Coast and ii) Exposed coast. Source: Program Development Office for Integrated Coastal Zone Management Plan, 2003, PDO-ICZMP, cited in Miah, Bari, and Rahman, 2010, P: 428.*

According to PDO-ICZMP, the coastal areas of Bangladesh have been divided into two regions. The first one they categorized as a) exposed regions and b) interior regions. The “exposed coast” area is comprised with 48 Upazilas and the “interior coast area” consists of 99 Upazilas (Islam, 2004, p: 4). It has been reported in Miah, Bari and Rahman’s study that geomorphologically the coastal areas are subdivided into three sections, these are, “the West sub-zone, the central sub-zone and the east sub-zone” (Miah, Bari and Rahman, 2010, p: 428-429). The West sub-zone is categorized as “flat and low and is crisscrossed by numerous rivers and canals” (Miah, Bari and Rahman, 2010, p: 428-429).

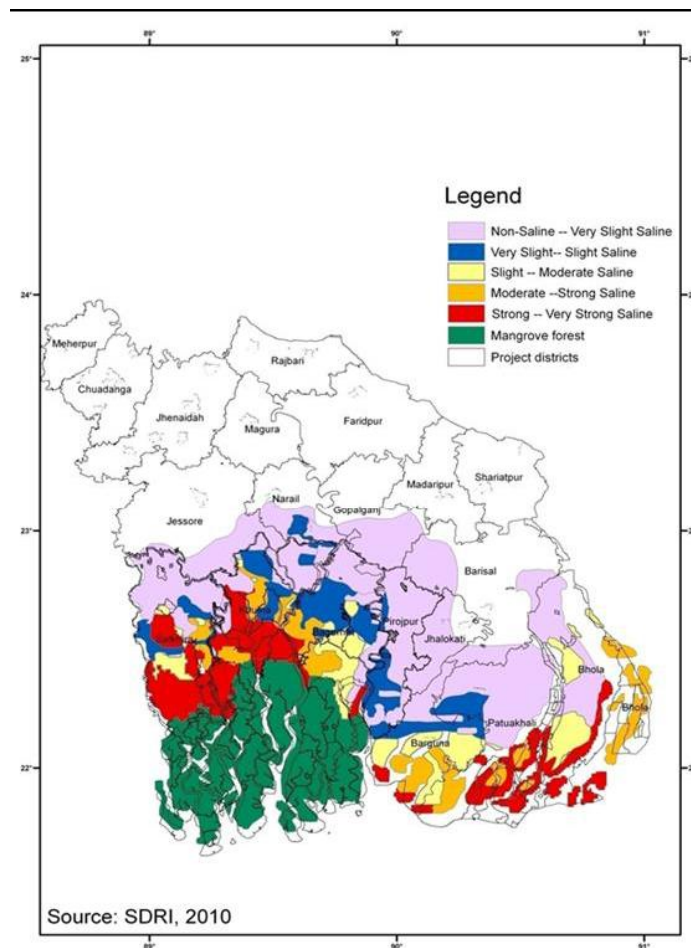


Figure 1.4.: The Level of Salinity in the soil in the coastal areas. Source: SRDI, 2010 in Sinha, Singh, and Singh, 2014, p: 963.

This region also consists the world known mangrove area Sundarban. The central zone is dynamic one with accretion and erosion process. Moreover, the eastern part is characterized by hilly areas and not unstable like the central or the eastern part (Miah, Bari and Rahman, 2010, p: 428-429). The study area is located in the South-east part of the marked green areas, and it is in the exposed area.



A study by Sinha, Singh, and Singh shows that the level of salinity in the coastal zone which is highlighted by red color in figure 1.4 (SRDI, 2010 in Sinha, Singh and Singh, 2014, p: 963) is very strong. The study area of this research is located in that zone.

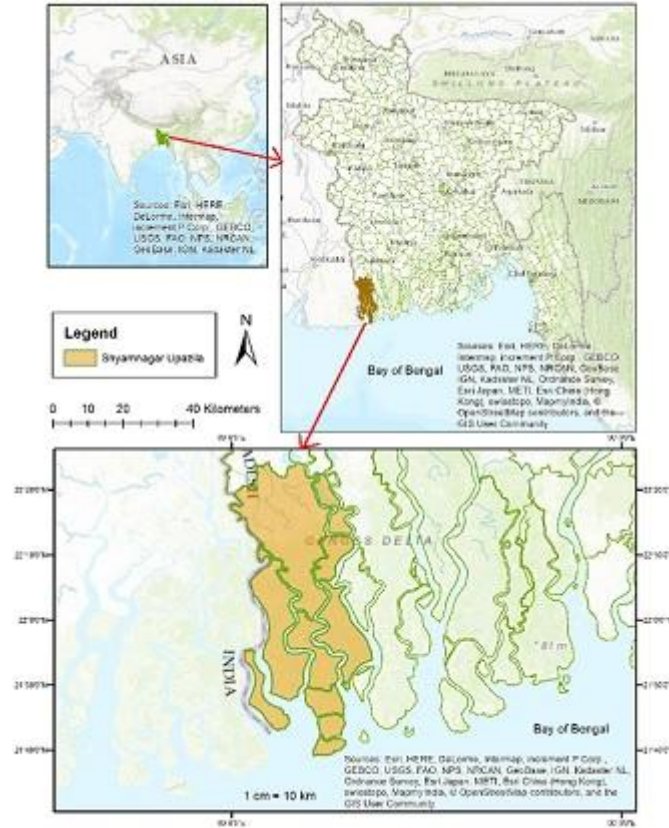


Figure: 1.5 The study area of the research.

The study area of the research is located under the union known as Shaym Nagar of Satkhira district which is located in the exposed coastal zone (Islam, 2004, p: 5). It is in Khulna division. It is located in the south –western side of the country. In 1984 it became a separate district. According to local belief, one of the officials of King Krishna Chandra made seven houses for Brahmins where shat means seven and ghar mean houses. It was known as Satgharia. However, later on, it was known as Satkhira (District Statistics, 2011, p: 3). Geographically Satkhira is surrounded by Jessore

district on the north, Khulna Division on the east, India on the west and the Bay of Bengal on the south. The total region is 3817.29 sq km, and 1534.88 sq km of the land is in reserve forest. It is located between 21°36′ and 22°54′ north latitudes. On the east, it is between 88°54′ and 89°20′ (District Statistics, 2011, p: 3). The economy is dominated by agriculture. Rice crops, jute, potatoes, mustard seed, betel leaf, sugarcane produced in the area. Fruits like jack fruits, papaya, water melon, banana, coconuts are grown in this region. In addition, fishery and forestry are also another economic sources of the Satkhira people (District Statistics, 2011, p: 4).

### **2.11 Shymnagar sub-district**

Shymnagar is the sub-district of Satkhira district. It is a coastal area situated in the south-west of Satkhira district. It is situated 50 kilometer southwest of Satkhira. The Sundarben mangrove is very close to the Shymnagar upozila. Upazila is the Sub-district in Bengali (Rabbani et al. 2013, p: 403). The region is surrounded by Kaligong, Assasuni sub-districts in the north, Koira region of Khulna district in the east and Bay of Bengal in the south. India is in the west of the Shymnagar (Personal communication, 20<sup>th</sup> May 2015). The total area is 1964.23 sq.km where the land area is 429.43 sq km. The reserve forest area is 1534.88 sq. km (District Statistics, 2011, p: 17). Shymnagar sub-district is composed of 13 unions, and Kashimari union is one of them. Kashimari union is 54 no union (District statistics, 2011, p: 4). Khutikata village belongs to Kashimari union. Most of the people's livelihoods in this region are agriculture, fishing, shrimp business and other small business. The main feature of these unions is these regions are very much vulnerable to the climate change (Personal Communication 8-20<sup>th</sup> May 2015 and District

Statistics, 2011, p: 4). Although shymnagar has developmental potentiality as a whole, but it is at risk of being sub-merged by the sea level rise (due to climate change) as it is only one meter or less than one meter above than sea level (Baser, 2010). The regions were hit by the cyclone “Aila” in 2009. Many shrimp farms had been washed away. Embankments, bridges and other infrastructure have been damaged due to cyclone “Aila” and all of these adversely affected the socio-economic condition of shymnagar (Baser, 2010).

### **2.12 Kashomari union**

It is the 54 number union of shaymnagar Upazila. 75% people are now below the poverty line. The literacy rate of the union is 55% (Bangladesh Nation Information Window<sup>5</sup>, Kashimari Union, Village-based population, 2016). The total area is 8025 acres. The number of total households is 6452. Total population in this union is 26657, and the density of population per sq km is 1021 (BBS, community report, C\_01, p: 49). It consists of 4022 ultra poor families, 1789 poor families, 271 middle-class families and 107 rich families. It has four cyclone centers. Three high schools, two collegiate schools (BNIW, Kashimari union, at a glance<sup>6</sup>, p: 1). The union has thirteen bridge, forty-four culverts and a union health care center (BNIW, Kashimari union, at a glance, p: 1).

### **2.13 Khutikata village**

The field research was conducted in Khutikata village. The research area is located in the southwest of Bangladesh. It is in a part of Shymnagor which is the sub-district of Satkhira district. The region is ~4m higher from the sea level

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<sup>5</sup> Bangladesh Nation Information Window, Kashimari union, Village based population, 2016.

<sup>6</sup> Bangladesh Nation Information Window, Kashimari union, Ak Nojore means at a glance, p: 1.

([www.Satkhira.gov.bd](http://www.Satkhira.gov.bd)).

The name of the village is Khutikata, which means the reaped pillars. Some of the participants said that the area used to be a mangrove area and people used to come there to cut the trees. Therefore the area was named as Khutikata, where the “Khuti” refers to the root of the trees and “kata” means chopped off. Around three hundred years ago<sup>7</sup> people started their habitant in this village. Before that this area was in part of Sunderban. Now Sundarben is around 10 – 12 km far from this village. The area is located very near to Sundarben. It should be well noted that “Sundarbens” is one of the largest mangrove and coastal area in the world and also known as World Heritage Site (Gopal and Chuhan, 2006). Many of the villagers of Khutikata still had gone to the Sundarben to collect honey, fishing and to cut the trees as their livelihoods.

The total population is 775. However, there is no floating population in the village (BBS, community report, Satkhira, 2012, C\_02, p: 48). The male population in the village is 389 and female are 386. The sex ratio is 101(BBS, community report, Satkhira, 2012, C\_02, p: 48). The monthly income of the household in Khutikata is BDT. 1143.41 (OPTION Report, 2015, p: 28) which is approximately equivalent to CAD\$20.

#### **2.14 Economic structure of the Khutikata village**

Agriculture and fishing sectors are the primary sources of income of the Khuthikata villagers. Poor people also work as a day laborer. Whenever the poor male villagers did not have any work inside the village they work in the nearby brick field of a nearby village or went to neighbor country India. The male inhabitants of the village also went to other provinces of Bangladesh to work as Boro rice cutter. They went to

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<sup>6</sup> Sub-district is known as Upazilla in Bengali (Rabbani et al. 2013, p: 403)

Gopalgonge, Khulna, and Madaripur regions of Bangladesh. Women of the village use to do small scale poultry (Personal communication, 2015).

The farmers did not have to compete for that much for selling their product. They have a big bazaar place named Noabaki. All of their crop products are sold there. Often the whole seller came to the village and bought their crop productions, cows or goats, vegetables, and fishes. However, in the rainy season, the roads became too muddy. The road makes difficulties in the traveling to the bazaar or in the cold storage. Most of the villagers are farmers. 20% of the production they use for their own need and 80% of the production they sell in the market (Personal communication 10<sup>th</sup> -20<sup>th</sup> May 2015, District Statistics, 2011, and [www.Satkhira.gov.bd](http://www.Satkhira.gov.bd)).

### **2.15 Political aspects of Khutikata village**

The constitution of Bangladesh is a democracy. The lowest political unit of the country is a village. Politically the country is divided into divisions, and then the divisions are divided into districts gradually sub-districts created, after that union, then ward and then the village came. Its looks like

Country → Divisions → Districts → Sub-districts → Unions/Thana → Mauzas  
→ Villages.

The Union is comprised of several villages and mauzas. It is the “smallest administrative rural unit” (District Statistics, 2011, p: 9).

Mauzas: It is the “lowest administrative unit which had its own jurisdictional list no (J.L. no)” (District Statistics, 2011, p: 9). It is comprised of several villages.

Village: It is the “lowest rural geographic unit equivalent to a mauza or a part of a

mauza” (District Statistics, 2011, p: 9).

Ward: this is the “smallest administrative urban unit comprising with mahallas” (District Statistics, 2011, p: 9). It has the institution of ward council.

Mahallas: it is the “smallest unit with identifiable boundaries” (District Statistics, 2011, p: 9).

### **2.16 Electricity in the village**

The Governmental sector of Rural Electric Board (REB) is responsible for the supply of electricity in the rural areas of Bangladesh. However, still today the supply of electricity from REB is not sufficient. The connection of electricity is only 20.5% (BBS, Community Report, 2012, C\_15, p: 52). The electricity supply from REB did not reach to the hard to reach rural areas, like coastal areas, char areas of Bangladesh. Therefore, even in the 21<sup>st</sup> century, many rural areas are deprived of electricity. However, recently many non-governmental organizations are introducing the solar panel for electricity supply. It is portable, easy to move and useful. NGOs like “Grameen Shakti” means rural power, Bangladesh Rural Advancement Committee (BRACK) are introducing the solar panel. These NGOs gave the solar panel to the villages where the villagers used them and gave an amount monthly as credit. These are sustained by the initiatives of donor agencies from foreign countries. The government of Bangladesh is providing subsidy on electricity that is not sufficient. According to one participant from the study area, *“NGOs are doing a good job in this aspect. At least we have light in our home. Our children can study at night. We also watch television sometimes on those neighbors’ house who has television”* (Personal communication, 25<sup>th</sup> May 2015).

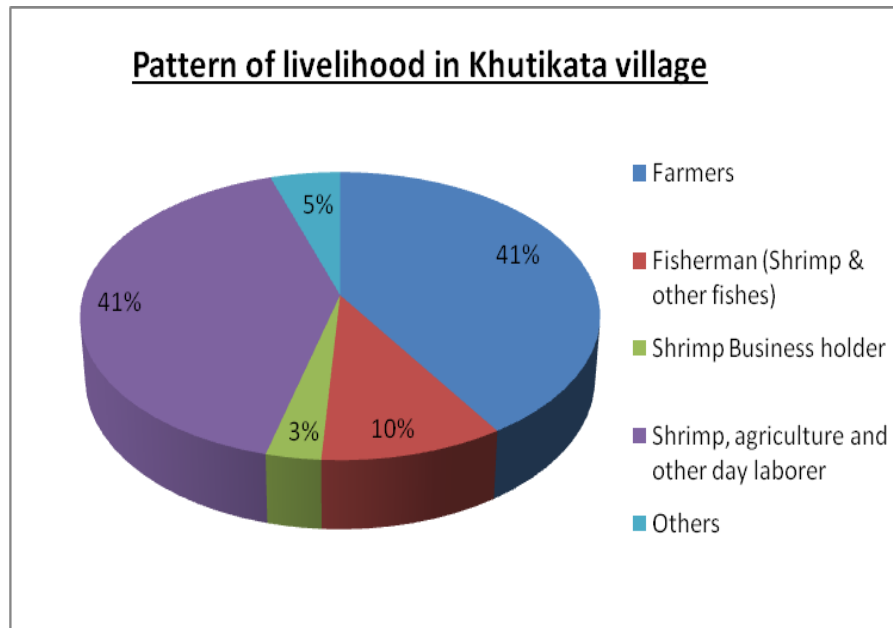


*Picture 1.1: Solar panel on the roof of the house in Khutikata village, Source: Author's photograph.*

With the solar panel, they can light up one or two lights or one fan in their home. Sometimes they watch television also. Participants told that solar panel are easy to handle, and the most important thing is whenever they fear of any climatic hazards they can remove it from their rooftop and kept it in a safe place as it is highly portable.

### **2.17 Patterns of Livelihoods for Khutikata villagers**

The foundation of the most of the livelihoods in this village is natural resources. Most of the people are engaged in agricultural and shrimp farming work. The pattern of livelihoods in this village is shown below:



*Figure: 1.6. The Livelihood Pattern of Khutikata village.  
Source: (Field notes and personal communication, 9<sup>th</sup> -20<sup>th</sup> May 2015).*

In Khutikata village it has been found that the dominant livelihoods are agricultural work, shrimp farming and fishing on the sea, Sundarban forest. In the 1980s the shrimp farming was introduced, and it became a hugely profitable business for the people of that region. Moreover, due to environmental change salinity level increased in those regions which favored the expansion of shrimp farming business. However, presently unplanned shrimp farms and climatic hazards, and climate change almost forcing people to choose other option for their livelihoods.

These are some significant features of the Khutikata coastal village. However, the adverse affect of climate change on the agriculture and fishery sector of the Khutikata villagers is going to be explored in the next chapter. The adaptation strategies to sustain their livelihoods are also discussed in the following chapter.



## **Chapter 3. Literature Review**

This chapter will define the two terms climate change and development, discuss the relationship between these, and the relationship between community-based adaptation, development, sustainable livelihoods approach and climate change. Limitations of community-based adaptation and sustainable livelihood approach will also be discussed. These ideas are used in this thesis, which attempts to examine and understand the importance of utilizing the community-based adaptation for the development of sustainable livelihood in a coastal village of Bangladesh, as the country is facing negative impacts on the development of livelihoods due to climate change and related local anthropogenic issues.

### **3.1 Climate change**

Climate change is the change that transfers “human favored tolerable climate on to unfavorable climate” (Baser, 2010, p: 12). According to IPCC Fourth Assessment Report, climate change is the mean changes in the environment which may carry on for an extended period or decades and the changes may come from the natural variability or human activities (IPCC, 2007, p: 30). However, the United Nations Framework Convention on Climate Change (UNFCCC) defined climate change as the direct or indirect impact of human activities which alter the atmosphere and “it is in addition to natural climate variability observed over comparable time periods” (IPCC, 2007, p: 30). For the purpose of this thesis, climate change means the adverse impact on the environment and natural resources that affect the life and livelihoods coastal

communities.

Climate change is not in a hypothesis or a theory anymore, it is happening and reassured by environmentalists and climate change experts of the globe (MacNamara and Buggy, 2016). In 2005 Adger et al. stated that the climatic hazards including floods, tsunamis, and increasing salinity in the coastal areas are going to be more disastrous because of the adverse effects of climate change. The suffering of people is going to be significant as the velocity and nature of the climate change is not certain (Adger et al. 2005 and Lozoya et al. 2015). A study in 2010 estimated that in the 2070s the suffering of the people may increase three times more due to the effects of climate change (sea level rise), population growth and urbanization (Hanson et al. 2010). It is assured that due to human activities the atmosphere has been changed in a significant way and greenhouse gas emissions are the most influential factor for the changes in the earth's climate (Houghton et al. 2001 in Karl et al. 2003, p: 1720).

One of the most dangerous results of climate change is sea level rise. Greenhouse gas emissions have caused global warming and melting the ice from Greenland and the Arctic region which leads to sea level rise (Susmita et. al, 2007). According to Velicogna and Wahr (2006), the ice sheet is melting from West Arctic Ice Sheet (WAIS) which is  $152 \pm 80$  cubic kilometers of ice per year and this is three times higher than the IPCC Third Assessment had predicted (Velicogna and Wahr, 2006 cited in Susmita Dasgupta, et al., 2007, p:4). According to Intergovernmental Panel Fourth Assessment Report, in 2100 the sea level will have risen ~60 cm because of glaciers melting and sea warming<sup>8</sup>

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<sup>8</sup>School of Civil Engineering and the Environment and the Tyndall Centre for Climate Change Research,

(Nicholls and Cazenave, 2010, p: 1517). In this circumstance, the coastal areas of the world are in great danger (Lozoya et al., 2014, p: 375). Mercer (1978) stated that “human-induced global warming could cause the WAIS to be released into the ocean by a sliding mechanism (also referred to as WAIS collapse)” (Mercer, 1978 cited in Susmita Dasgupta et al., 2007, p: 4). This WAIS collapse could cause a 5-6- meter high sea level rise (Tol et al. 2006).

These changes in climate have a direct impact on livelihoods, especially nature dependent livelihoods such as agriculture and fisheries (Nelson, 2014, p: 3274, Brander, 2009, p: 389). In developing countries, including Bangladesh; people’s livelihoods, heavily depend on natural resources (Baser, 2010, p: 19). However, considering the present circumstances, the question arises how to continue the development in the climate affected areas (developing countries)? Does any relationship exist between climate change and development?

### **3.2 Development**

To examine the relationship between the climate change and development we need to know the definitions of climate change and development. The term development has numerous definitions. According to the liberal economist, development is the incensement of production (GNP) in the realm of capitalist economy. In the shade of Marxist view, the capitalist development is the incensement of production and capability of production which will benefit both the investor and employers. It has been noted that in reality the profits from the investments are being used for reinvestment which benefits

the capitalists rather than the workers or the society (O'Malley and Clow, 2011, p: 211). In this circumstance, Marx and others had viewed a substitute economic developmental structure which will serve the societies and employers in a more useful, egalitarian and in a more democratic way (O'Malley and Clow, 2011, p: 211). According to Escobar, the meaning of development varies from place to place in the developing world. For example, in Nepal development means following the lifestyle of Western, developed and white people. Children in Nepal are taught the lifestyle of "white people" in school (Escobar, 1995, p: 49-50). Whereas people in Gapun, Kenya spent most of their cash in their traditional occasions where Nescafe is the symbol of development (Escobar, 1995, p: 50). As Escobar states, "Development in Gapun is, in fact, a sort of sophisticated cargo cult" (Escobar, 1995, p: 50).

O'Malley and Clow defined development as the improvement of people's living standard through some changes (O'Malley and Clow, 2011, p: 211). Some of these changes refer to the "investment capital, human resources, knowledge, technology, entrepreneurship, a disposition towards change or the capacity and disposition to pursue existing opportunities for self-advancement" (Veltmeyer, 2011, p: 124). However, O'Malley and Clow also stated that any degradation in the environment might become an obstacle in the path of development: it "threatens the sustainability of human economic activities and human health" (O'Malley and Clow, 2011, p: 212). Development of marginal and poor people who live in the isolated, hazardous areas are greatly influenced by negative impacts of environmental degradation (Taylor, 2014, p: 1 and Gillam, 2015, p: 23). Moreover, "it is evident that climate change and climate variability will have

impacts on current development efforts” (Burton, et al. 2002 in MacNamara and Buggy, 2016, p: 6).

Above all this thesis would like to address the definition of development given by Sen where he defined development as the capability of a person “to lead the kind of lives they value-and have reasons to value” (Sen, 1999, p: 18). Sen highlights that the development depends on people’s capability to do the right activities. Sen states that the greater freedom gives greater capability to benefit an individual as well as others and this is the core of development (Sen, 1999, p: 18). Sen stated freedom as “primary ends and principal means of development” which he called as “constitutive role” and “instrumental role” respectively (Sen, 1999, p: 36). Here the constitutive role refers to eliminating deprivations such as the problems of hunger, malnutrition and so on (Sen, 1999, p: 37). The instrumental role refers to “political freedom, economic facilities, social opportunities, transparency guarantee, proactive security” which smoothens the road to development (Sen, p: 38). From the above discussion it can be said that the concept of development does not refer only the economic growth of a person or a country. Rather, it refers to the enhancement of other factors of human life, such as education, healthcare, political freedom and having facilities from international, national or local level with which a person can pursue his/her self-advancement for a better future (Sen, 1999; Veltmeyer, 2011; O’Malley and Clow, 2011). However, the concept of development is a very complex one and varies from person to person and place to place (Escobar, 1995).

### **3.3 Climate change, development, and adaptation**

Climate change in the context of development can be seen in four ways. In the

first place, it is observed that climate change is affecting the poor and vulnerable people in the developing countries around the world (IPCC, 2007 in Cannon and Mahn, 2010). Secondly, it is scientifically proven that climatic hazards are becoming more frequent and intense with more detrimental power on people's life and livelihoods (Wisner et al. 2004). Thirdly, climate change is hindering the development procedures (Berkes et al. 2003; Anderies et al. 2006). And lastly, in the context of global warming, adaptation and mitigation have been given more importance. A significant amount of funds is being raised for adaptation in developing countries. This is because adaptation has a relationship with development (Tanner and Mitchell, 2008).

Saleemul Haq and Hannah Reid acknowledged that adaptation to climate change has a close relationship with development that is applicable for both developed and developing countries. The relationship with adaptation to climate change and development can be identified at the local level, where people live in places that are geographically bare to climatic impacts, such as flood-prone, drought prone areas. Significant numbers of vulnerable and poor people reside in these regions in developing countries. The government or international climate experts can make development programs according to their needs (Pachauri and Agrawala cited in Haq and Reid, 2004). At the sectoral level, policy makers prepare policies of development within countries, based on the predicted impacts of climate change. At the national level, the existing policies need to be examined to reduce "mal-adaptation" (Haq and Reid, 2004, p: 17) which will not decrease the climate vulnerabilities. However, in this regard, Haq and Reid did not clarify how the modification of existing policies of the country failed to

decrease people's vulnerability to climate. According to the authors, adaptation would be most suitable on the regional level and community level. At the global level, the involvement of the international community and the United Nations Framework Conventions on Climate Change (UNFCCC) is needed to protect people from climate change (Haq and Reid, 2004). However, since 1990 the international community of climate change experts had given more emphasis on the mitigation than adaptation process; therefore several funds were created for the mitigation process. Schipper argued that adaptation was not given much importance to UNFCCC (Schipper, 2007, Haq and Reid, 2004). However, the disaster risks reduction community, World Bank, and some other development agencies from different countries such as the UK, Germany, Netherlands, Sweden, Denmark, and the USA have started to work on adaptation (Schipper, 2007). In COP7 several funds were established for adaptation actions in developing and least developed countries, and the LCDF was successful in accumulating US\$ 20 million for the adaptation projects.

Reid and Haq acknowledged that it has been a difficult process for the development region and community-based adaptation (CBA) to reach the poorest and vulnerable people who have no or less contribution to the greenhouse gas emission in the first place for which the problem of climate change has occurred (Reid and Haq, 2007). Furthermore, experts from Bonn and Tehran conventions concluded that Least Developed Countries' (LDCs) economic sectors are in great danger because of harmful impacts of climate change, especially agriculture, fishing, and tourism. Therefore, Haq and Reid suggested integrating the approach of adaptation into the mainstream of development

policies of developing and least developed countries in the world (Haq and Burton 2003, Haq et al. 2003, Agarawala cited in Haq and Reid, 2004, p: 19).

Lisa. F Schipper made a distinctive contribution to the concept of adaptation. She argued that the adaptation may reduce impacts of climate change but not the vulnerability. Adaptation is a complicated process; it needs to incorporate the development process with the reasons as to why vulnerability emerged (Schipper, 2007). In risk reduction, the concept of adaptation and development has an important function to play. Climate change has its effects in all places of the earth but responding to it is different between developed and developing countries (IPCC, 2007; Downing et al., 1997; Bohle et al., 1994 cited in Schipper, 2007). This is because the underdeveloped countries did not have many technologies or good mechanisms to protect themselves from the impacts of climate change (Schipper, 2007).

It has been noted that development strategies in poverty reduction are not going to include the notion of climate change in their context (Adger et al., 2003; AfDB et al., 2003; Gómez-Echeverri, 2000 cited in Schipper, 2007). Therefore, adaptation needs to be included in the mainstream of development policy. Adaptation enhances the resilience power to those people and their livelihoods so that they could cope with the changing environment. In the context of policy making, “adaptation is an integral and urgent part of overall poverty reduction strategies” (AfDB et al., 2003: 1, in Schipper, 2007, p: 7). Therefore, the new issue is that adaptation can contribute to reducing poverty which means adaptation itself is a development process.

However, development does not mean only economic growth. According to



Cannon and Mahn, “Development must be purposeful” (Cannon and Mahn, 2010, p: 4). Purposeful development refers to the poverty reduction, improvement of livelihoods, health and education sectors (Cannon and Mahn, 2010). It has been noted that economic growth polluted the environment by using fossil fuel which causes global warming. According to Cannon and Mahn, economic growth may alleviate poverty, but it is not ensured that poverty alleviation can guard people against climatic hazards or negative impacts of climate change (Cannon and Mahn, 2010, p: 4). Though it has been argued that economic growth reduces poverty and solves unemployment problems, in most instances, it has been observed that economic growth increases “inequality, social conflict, greenhouse gas emission, environmental damage and reduces well-being” as well (Cannon and Mahn, 2010, p: 5). In this regard, adaptation to climate change is resuming the debate between development and economic growth (Cannon and Mahn, 2010, p: 5). According to New Economic Foundation, development cannot be measured by economic growth. They found that “between 1990 and 2001, for every \$100 worth of growth in the world’s per person income, just \$0.60 found its target and contributed to reducing poverty below the \$1- a – day. As a result, to achieve a single dollar of poverty reduction, \$166 of extra global production and consumption is needed” (NEF, 2006, p: 3 in Cannon and Mahn, 2010, p: 5). NEF also stated that poor people suffered numerously by the negative impacts of climate change (NEF, 2006, p: 3 in Cannon and Mahn, 2010, p: 5).

Secondly, it is not worthless to consider climate change as one of the major problems for the people of the developing world in the context of “purposeful

development” (Cannon, and Mahn, 2010, p: 4). In the traditional Disaster Risk Reduction (DRR) approach, the priorities and needs of community people were overlooked. However, from different NGOs, it has been confirmed that communities have their priorities and needs (Cannon, 2008). Therefore, experts have to consider community priorities and needs, not force them to adopt any methods (Cannon, and Mahn, 2010, p: 5).

Thirdly, a conceptual difference exists between adaptation and building resilience. (Sabates-Wheeler et al., 2008). Resilience approach gives importance on the “social-ecological system” which is not adequate to solve other risks and crises of the people whose occupations are related to their ecosystem, such as farmers and fishers (Folke et al. 2005). Resilience approach is more scientific which seems to have no relation to the needs and priorities of ordinary people (Cannon, and Mahn, 2010, p: 6). Finally, institutions who deals with the adaptation approach needs to work in a coherent way where people’s priorities should be focused on rather than giving emphases on adaptation that deals with scientific resilience (Cannon, and Mahn, 2010, p: 6).

In COP 12 Kofi Anan, the former UN-Secretory General stated that the poorest people in developing countries were suffering a lot because of climate change and “for them, adaptation is a matter of sheer survival” (Cannon and Mahn, 2010, P: 6)<sup>9</sup>. However, according to Cannan and Mahn, adaptation process needs to achieve the goal of purposeful development, not only to increase the economic growth (Cannon and Mahn, 2010). Jerneck and Olsson, said that adaptation needs to incorporate many aspects of

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<sup>9</sup> Introductory speech at COP 12 (12th Conference of the Parties to the UN Framework Convention on Climate Change), 15 November 2006, Nairobi

development process, “for example, the participation of marginalized groups, about linking bottom–up and top–down approaches, or about “ownership” of Projects” (Jerneck and Olsson, 2008 in Cannon and Mahn, 2010, p: 13). Adaptation needs to be discussed “in the context of power relations that have hampered development efforts over the past 40 years” (Cannon and Mahn, 2010, p: 13). Cannon and Mahn argued that in the context of climate change economic activities of developed countries are responsible for growing poverty in developing countries. The development process has failed to bring well-being in developing countries as it disregards the “inherent inequalities of power relations” (Cannon and Mahn, 2010, p: 13). Therefore, Cannon and Mahn recommended using the most “relevant and most politically effective concepts for adaptation” (Cannon and Mahn, 2010, p: 13).

Srivastava and Heller (2003) have shown a deep relationship between the reduction of vulnerability and sustainable development. In this context, adaptation capacity is seen as a development mechanism (Srivastava and Heller, 2003 and Smit and Pilifosova, 2001 in Schipper, 2007). Schipper discussed two ways of adaptation, such as “adaptation approach” to the development and “vulnerable reduction approach” to the development. Here, in “adaptation approach” adaptation is seen as “response to the observed and experienced impacts of climate change on society” (Schipper, 2007, p: 7-8) which will reduce vulnerability. Hence, it will decrease the risk and loss from the climatic hazards and with reduced risk, development will occur. Again, “vulnerable reduction approach” means development will help to decrease the vulnerability to climatic impacts or hazards which means “less sensitivity and exposure to the hazards” and this is the

process of “adaptation to climate change” (Schipper, 2007, p: 6-8). Moreover, these two approaches can be shown like this:

*Adaptation approach:* “Adaptation to climate change impacts—vulnerability Reduction—Development” (Schipper, 2007, p: 8).

*Vulnerability Reduction Approach:* “Development—Vulnerability Reduction—Impact Reduction—Adaptation” (Schipper, 2007, p: 8).

Schipper argued that instead of making various types of strategies for adaptation, the reduction of vulnerability should be included in the policy of development. Otherwise, it is going to be “putting the cart before the horse” (Schipper, 2007, p: 7). According to Schipper, adaptation approach, deals with only some definite impacts of climate change, whereas vulnerability reduction approach deals with the reasons of vulnerability that may have or may not have any connection with climate. Watson and Ackermann (2000) said, there is “no need for different or new strategy” (Watson and Ackermann 2000 in Schipper, 2007, p: 8) concerning climate change because the problems induced by climate change are similar to those of other problems that can be solved by development strategies (Watson and Ackermann, 2000 in Schipper, 2007, p: 8). However, in this regard authors ignored the concept of what if development is hindered by the adverse impact of climate change. Schipper did not clearly explain the definition of development she is referring to. Nevertheless, Watson’s and Ackermann’s opinions are not supportive. Problems that are evolving from climate change need special attention. Although we face difficulties from climatic events from the beginning of human life, today from social networks, research works and sometimes with our experience, we

observe that the effects from climatic events have become very dreadful, frequent and disastrous. According to climate change experts, the impacts of climate change are going to become more disastrous. This is especially, true in the vulnerable areas like coastal areas, drought prone areas, developing and least developed countries. Therefore, specific development strategies are needed to protect people from the dangerous impacts of climate change (Schipper, 2007).

Schipper gave an example of El Salvador where she found that they have a lot of socially induced vulnerability that is related to environmental concern and development. As an example, Schipper said that lack of activity in the agriculture sector caused unemployment that in turn increases food insecurity and poverty. Therefore, the vulnerable reduction approach is important to acclimate with the adaptation process (Schipper, 2007). Here, Schipper is in more favor of vulnerable reduction approach. However, the fact is food insecurity and unemployment problems exist almost everywhere in the world, especially in developing countries, and on this issue it can be believed that Schipper is correct in her argument, but we also need a special approach to the impacts of climate change. In this point, both vulnerable reduction approach and adaptation approach are important for development. The adaptation approach needs to be incorporated into the mainstream of development policy.

Schipper argues that adaptation approach is not an “alternative to mitigation” (Schipper, 2007, p: 8) rather adaptation should be seen as a combination of sustainable development and vulnerability reduction approach together. Haq and Reid (2004) mentioned that both mitigation and adaptation are needed to protect people from the

dreadful impacts of climate change (Haq and Reid, 2004). Schipper added that “adaptation is not a solution to existing development problems or an alternative path towards sustainable development instead it guides development successfully in the light of increased risk from global environmental, social and economic change” (Schipper, 2007, p: 9).

On the other hand, it has been found that the funds are more available for mitigation processes than adaptation because mitigation causes “Global benefits” (Haq and Reid, 2004, p: 18-19) and adaptation is more local than global (Haq and Reid, 2004). However, local benefits also may produce global benefits. We have to count every small effort in every country which can make a big change in the global environment which is not impossible. Cole H.Daniel argued that both mitigation and adaptation are necessary to protect people from the dreadful impacts of climate change (Cole H.Daniel, 2007).

### **3.4 Community-based development underlies community-based adaptation**

“Ideally, CBA is a community-led and driven process—a partnership between institutions and communities—rather than something is done for and imposed upon local peoples” (Kirkby, Williams, and Haq, 2015, p: 2).

The concept of community-based adaptation originally came from the theory of community-based development which emphasized the statement that “there should be local action for global problem” (Rashid & khan, 2013, p: 343). This idea may well have first appeared in Lao Tzu’s poem, which is

“Go to the people.

Live with them.

Learn from them.  
Love them.  
Start with what they know.  
Build with what they have.  
But with the best leaders,  
When the work is done,  
the task accomplished,  
the people will say  
‘We have done this ourselves.’

– Lao Tzu

(Lao Tzu, BC 600–525 in Rashid and Khan, p: 343)

Around 2,600 years ago Lao Tzu in China evolved this notion by the above poem where it defined community-based development “as the way of the universe, nature, and balance” (Rashid & Khan, 2013, p: 343). This community-based development is based on “seven principles, these are: 1) community focus, 2) community member’s participation, 3) inter-sectoral collaboration, 4) substantial resource requirements, 5) long - term programme view, 6) multifaceted interventions, 7) population outcome” (Nilson, 2006 cited in Rashid & Khan, 2013,p: 343).

Some renowned people like Paulo Freire (1921–1997); Gandhi (1962) ; Richard Ho Lung who is the founder of Missionaries of the Poor, and academic scholars and researchers such as, Mikloucho-Maclay (1950) ; Malinowski (1922) ; Chambers (1983, 1992) defined “the idea of community - based approach in development by encouraging the ‘community’ as active agent of knowledge not as only passive recipient of

knowledge” (Freire ,1921–1997; Gandhi,1962, Ho Lung, Mikloucho-Maclay ,1950 ; Malinowski ,1922 ; Chambers ,1983, 1992 in Rashid & khan, 2013, p: 342). The notion of “community led approach” (Rashid & khan, 2013, p: 342) appeared from the poem of Lao Tzus (BC 600-525); the founder of Taoism in China. The notion of community development approach consists of two elements, they are “community - based” and “community driven” (Rashid & khan, 2013, p: 342).

However, there are no concrete theories on the community-based development approach but the background of this notion influenced by the “concept of participation” (Rashid & khan, 2013,p: 342) found in the work of Miklou cho-Maclay in Papua New Guinea, Malinowski in Trobriand Islands, in the work of Robert Chambers in the year of 1992 (Rashid & Khan, 2013, p: 342).

Gandhi and Paulo Freire first introduced the notion of community - based development in India and Latin America in 1962 and 1970 respectively (Rashid & Khan, 2013, p: 342). They both emphasized that if the poor, oppressed, marginalized people come together in one shed they may change their fate, and this notion gave birth to “participatory development” (Rashid & Khan, 2013, p: 342). In the decades of 1950s and 60s more than 60 countries in Asia, Latin America, and Africa were influenced by this concept, but as a funding from USAID - ran out the notion lost its value (White, 1999 cited in Rashid & Khan, 2013, p: 342). Therefore, lack of funding stopped initiatives of community based development. The “Big development” (Schumacher, 1973 and Chember, 1984 cited in Rashid & Khan, 2013, p: 343) program appeared which is influenced by “economic model” and initiated by the government. However, in the 1980s



the “big development” was criticized heavily as it did not do any improvement or empower the poor people. Moreover, from the 1950s to the beginning of 1970s the community development approach was bureaucratic and top-down where participation of community people was absent (Dore and Mars, 1981 in Brocklesby and Fisher, 2003, p: 188). However, Schumacher (1973) and Chember (1984) took the initiative to the movement of “participatory development” and according to them in this “participatory development” the poor people knew that they are part of the development and the trainer of the “participatory development” or the donor of such programs are just facilitators (Schumacher, 1973 and Chember, 1984 cited in Rashid & khan, 2013, p: 343). “Peoples participation, empowerment and participatory learning” (Brocklesby and Fisher, 2003, p: 188) became the key concepts of the community development approach (Brocklesby and Fisher, 2003, p: 188). Collective action was started by the community people for their improvement of life and livelihoods. On the whole, the notion of community development became a bottom –up approach rather than a top- down approach (Brocklesby and Fisher, 2003, p: 188).

Nevertheless, Kapoor using postcolonial approach criticized the participatory development as “exclusionary, Western - centric and inegalitarian politics” (Kapoor, p: 1204) that is embedded with the “complicity and desire” (Kapoor, 2005, p: 1204) of the ruling power which Kapoor refers as “our” (Kapoor, 2005, p: 1204). Through the word ‘our’ Kapoor not only refers to the “Western elites” (Kapoor, 2005, p: 1204) but also himself because scholars and development employee like him also get benefits out of it (Kapoor, 2005), and the people of Third world countries are considered as the ‘others’

(Kapoor, 2005, p: 1203).

The most interesting part Kapoor state is that the participatory development (PD) appears in such a way that gives an image that “we (elites and professionals) know better than they (impoverished Third World communities)” (Kapoor, 2005, p: 1206). Kapoor criticizes the Participatory Rural Appraisal (PRA) approach as “religiosity” (Kapoor, 2005, p: 1206) which aims to reform the society. It means that by applying PRA the elite community will think about the poor people, and eventually, they will give some of their power to the poor community, and the society will become equal. Kapoor compares this idea as a religious custom where a religious specialist preaches some wonderful words or methods, and the society became equal and “community is reborn” (Kapoor, 2005, p: 1207). According to Chamber, a facilitator must play a neutral role in Participatory Rural Appraisal (PRA) (Chamber, 1994 in Kapoor, 2005). However, Kapoor argues that this is not possible because while making the “invitation list” (Kapoor, 2005, p: 1206) for participants, giving opportunities to the member of the group to give their opinions, selecting the topic for the meetings all are decided by the facilitator. Therefore, Kapoor believes that the power can be abused rather than used (Kapoor, 2005).

Kapoor compared Participatory Development (PD) with Foucault’s panopticism which means “self-policing” (Foucault, 1984 in Kapoor, 2005). For example, in the whole project of PD the village chief plays the role as authority, the project facilitator is the benign evaluator, women play “the prescribed gender role” (Kapoor, 2005, p: 1212). Again the minor group plays the role of ‘victim’ (Kapoor, 2005, p: 1212) and all of them work to “please the project funder” (Kapoor, 2005, p: 1212). Kapoor also found that “the

authority's biases influence local knowledge and needs" (Kapoor, 2005, p: 1212). For example, in Western Indian indigenous people build their houses with eucalyptus timber not because it is considered as indigenous knowledge, but it is preferred by the "Local Forest Department" (Mosse, 2001in Kapoor, 2005, p: 1212). The PD project is like panopticism where the idea of "everyone is watching everyone" (Kapoor, 2005, p: 1213) is institutionalized.

However, Kapoor suggests that everything about PD is not terrible but it can be abused, and this will appear in a dreadful manner (Kapoor, 2005). Escobar criticizes development as the Western ideology that influences the third world to view the western world as holding an immense source of power for their development and solutions to all problems (Escobar, pp: 5-6). However, Kapoor is suggesting making the participatory development "broaden, deepen, radical" and unbiased (Kapoor, p: 1216).

Moreover, Escobar (1995) and Scott (1998) also argued that the top-down approach is not a good way to do development for the poor, marginalized people (Escobar, 1995 and Scott 1998 cited in Rashid & khan, 2013, p: 343). However, from the 1990s to date the concept of "ownership and empowerment" became the dominant view in the principles of development (Rashid & khan, 2013, p: 343).

### **3.5 Community-based adaptation**

The term "Community-based adaptation" (Rashid & khan, 2013, p: 343) came from the concept of climate change and development, poverty reduction notion. According to IPCC 4<sup>th</sup> Assessment Report, people have adapted to climate change because the change is firm, forceful and vibrant (IPCC 4<sup>th</sup> Assessment Report cited in

Rashid & Khan, 2013). Experts came out with the approach of community-based adaptation that is deeply influenced by community-based development (Rashid & Khan, 2013).

The CBA programs are a combination of indigenous knowledge and scientific knowledge with the participation of community people. The community has to understand the future risk of climate change and to adapt with it they have to participate with the CBA experts for their sustainable development. This is because the effect of climate change are deeply experienced at the local level therefore adaptation needs to apply at the local or community level (Barkes and Jolly, 2001; Rojas Blaco, 2006; Schipper, 2007; Ayers and Forsyth, 2009; Heltberg et al, 2009 in MacNamara and Buggy, 2016, p: 4).

According to Rashid and Khan, “there is no grand theory around community-based adaptation” (Rashid & Khan, 2013, p: 343). Some scholars and institutions such as Bettina and Annecke (2010), CARE (2010) and Haq (2008) said that CBA did not have a comprehensible definition yet; rather it is an uprising approach related to climate change adaptation requirements. CBA is such an approach where it “put people in the center of their development; facilitate the community towards a learning process to increase their resilience and anticipatory capacity” (Bettina and Annecke 2010; CARE, 2010; and Haq, 2008 cited in Rashid & Khan, 2013, p: 344). According to Reid, Huq and Murray “community-based adaptation is a community-led process, based on communities’ priorities, needs, knowledge, and capacities, which should empower people to plan for and cope with the impacts of climate change” (Reid, Huq, and Murray, 2010, p: 5). “Self-

mobilization” is one of the main features of a good CBA (Pretty et al, 1995, Adnan et al. 1992; Reid et al, 2009; Dodman and Mitlin 2011 in Schipper et al. 2014, P: 7) where community people can incorporate their knowledge with the scientific knowledge and act according to their priorities and capacity to make the necessary adjustments by themselves (Reid et al, 2009, p: 23 in Schipper et al. 2014, P: 7). People who are not native should not play the role of a ‘teacher,’ rather they should be the ‘facilitator’ (Schipper et al. 2014, p.7).

In the perspective of CBA, it is important to consider the definition of “the community” (Schipper, Ayers, Reid, Hoq and Rahman, 2014, P: 7). Reid and Schipper noted that “in the context of CBA” (Schipper, Ayers, Reid, Hoq and Rahman, 2014, p: 9) community refers to the people who are affected by the climate change and with the help of outsider struggle to cope with the changed environment (outsider refers to the donor agencies from developed countries) (Schipper, Ayers, Reid, Hoq and Rahman, 2014, p: 9). According to Reid and Schipper, it is important to note that people have different kinds of priorities. Even between male and female there exist differences in needs and priorities. For example, in flooded areas, women tend to think about their children first whereas men tend to think about their crops and lands. Therefore, in the context of CBA, it is important to support the voiceless, poor and vulnerable people in a community rather than benefitting the elite, carpetbagger people. However, community-based adaptation is a part of a “wider policy context” (Schipper, Ayers, Reid, Hoq and Rahman, 2014, p: 9). Therefore, any change or failure in policy will have its impacts on the CBA approach which may fail as well (Schipper, Ayers, Reid, Hoq and Rahman, 2014, p: 9).

Moreover, the affected people of climate change are vulnerable and have limited access to resources, technologies and possess little or no “political voice” (Schipper, Ayers, Reid, Hoq and Rahman, 2014, p: 16). Haq and Reid noted that affected poor people are dependent on the “climate –sensitive sectors such as agriculture and fishing” (Haq and Reid, 2007 in Reid and Schipper, 2014, p: 16). Moreover, it would be ineptitude to think that poor people who are constantly facing the “climatic shock” (Reid and Schipper, 2014, p: 16) does not know any strategies to survive, rather their survival strategies does not enhance their “social status or well-being” (Reid and Schipper, 2014, p: 16) in the society. However, their strategies are not sustainable for more devastating and frequent effects of climate change. For this reason, it needs a blending of their existing knowledge and scientific or modern knowledge and this transforms the term of “community-based adaptation” to “community-led adaptation” (Rashid & Khan, 2013, p: 345) where the community people will make the decision of allowing or refusing the “knowledge, resources and technology” (Rashid & Khan, 2013, p: 345). It is an exclusive feature of “community-led adaptation” (Rashid and Khan, 2013, p: 345). Therefore, empowerment is another characteristic of CBA. However, Rashid and Khan did not clearly articulate if CBA empowered the poor and vulnerable people, whereas, Reid et al. acknowledged that because of power structure it became very difficult for national or international bodies to help the real poor, vulnerable and marginalized people of developing countries (Reid. et al., 2009 in Schipper, Ayers, Reid, Huq and Rahman, 2014, p: 17).

For example, in Bangladesh, a project named “*Participatory Climate Risk*

*Assessment and Development of Local Adaptation Action Plan*” was conducted by North South University and Area Development Organization in Assasuni Upazila (sub-district) of Satkhira District, Porsha Upazila of Naogaon District and Keshobpur Upazila of Jessore District in Bangladesh. Advancing Capacity for Climate Change Adaptation (ACCCA) funded the project in 2007-2008. This project helped around 120 vulnerable households by creating alternative livelihoods. For example, for flood affected areas, people have shifted from agriculture to fishery-based livelihoods. In this occupation, people need fish trappers which can be a good source of income for the affected poor people. Again, ring-based vegetable cultivation, duck rearing, sheep rearing, crab cultivation in saline water, and plantation of Kwera trees, which is a saline water tolerable tree, was promoted in this project. Another option for livelihood was reed cultivation, but this technique was practiced by the local people long before the project was implemented (Rashid & Khan, 2013, p: 348). This means that local people do know how to cope with the climatic change, but because of the increased frequency and disastrous impacts of climatic events, they need a proper guidance and adaptation development policy (Rashid & Khan, 2013).

### **3.6 Sustainable livelihoods approach**

At the community level, the *sustainable livelihood approach* is helpful to understand the adverse impact of climate change on the socioeconomic and environmental issues of the agricultural and fishery sectors (Badjeck, Allison, Halls, and Dulvy, 2009, p: 377). According to Chamber, Gordon, and Conway livelihoods depend on capability, equity, and sustainability (Chamber and Conway, 1991, p: 1). Livelihoods

refer to the “people, their capabilities and their means of living including food, income, and assets” (Chamber and Conway, 1991, p: 1). With the combining the capability, equity, and sustainability issues, the sustainable livelihoods characterizes the interrelationship between the methods and purpose of rural development with other rural development disciplines. According to sustainable livelihoods approach, capability refers to an accomplishment of a person’s basic needs and to “what a person is capable of doing and being” (Sen, 1984, 1987, Dreze and Sen, 1989 in Chamber and convey, 1991, p: 4). Moreover, livelihood capabilities defined as the ability to cope with the shocks and stress and also able to find the alternative opportunities for livelihoods. These capabilities are not only “proactive but also dynamically adaptive” (Chamber and Conway, 1991, p: 4). Equity refers to the equal distribution of assets, opportunities, and capabilities of the underprivileged people (Chamber and Conway, 1991, p: 4). In the context of the environment, sustainability defined as “self-sufficiency, the ideology of long-term self-resistant and self-reliance” (Chamber and Conway, 1991, p: 5). It is “maintaining local or global assets on which livelihoods depends” (Chamber and Conway, 1991, p: 5). Moreover, a socially sustainable livelihood connotes the ability of a person to adapt to the stress or shocks and generates for future generations (Chamber and Conway, 1991).

On the whole, sustainable livelihood is “the livelihoods that can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets both now and in the future while not undermining the natural resource base” (Chamber and Conway, 1991, p:6 and DFID, 1999, sec.2, p: 1). According to sustainable livelihoods framework, five types of livelihood assets plays a crucial role in determining the



responses of the poorest and vulnerable people towards the adverse impact of climate change and gives various options to cope with adaptation procedure. The five assets are Human assets, Socio-political assets, Natural assets, Physical assets, and financial assets. These five livelihood assets were defined by DFID's Sustainable Livelihoods Guidance Sheets and are described below (DFID, 1999, sec 2).

#### *Human assets*

Human Capital is the knowledge, skills, capability to labor and good health to adopt different types of livelihoods approaches to accomplish the aims of their livelihoods. At the household level, human capital measures the quantity that is “number of productive individuals” (IISD, 2003, p: 12) and the quality of human resources that is “what these individuals know and how hard they are able to work” (IISD, 2003, p: 12). Experience and formal educational background are taken as crucial factors in human capital (IISD, 2003, P: 12). Human capital is a significant factor in operating livelihood because good health, knowledge, working skills and experiences have a direct relationship with food security and livelihood (DFID, 1999, sec 2).

#### *Natural assets*

Natural assets are the natural resources with which a person can control his or her livelihoods. Wildlife, forest, marine, land and much more are considered as natural resources, and these resources have a deep relationship with climate change (Scoones, 1998, p: 7 and DFID, 1999, sec 2). Natural capital is crucial for the livelihoods that are based on natural resources, such as farming, fishing, collecting from forests and much more (DFID, 1999, sec 2).

### *Physical assets*

Basic infrastructural facilities such as transportation, buildings, water and power management which help to sustain the livelihoods are considered as physical capital (Scoones, 1998, p: 8 and DFID, 1999, sec 2). It has been found that lack of infrastructural development hinders development progress. For example, lack of well transportation systems, water or energy systems reduces the productive energy and time of human beings which had a negative impact on sustainable livelihoods (DFID, 1999, sec 2).

### *Socio-economic assets*

Social networks, “membership of groups, committee or organizations” (IISD, 2003, p: 12) trustworthy relationships and so on are included in the socio-economic capital (IISD, 2003, p: 12). Social capital helps in innovation, development, and sharing of knowledge which facilitate the “sense of well-being, such as identity, honor and belongings” (DFID, 1999, sec 2, p: 9).

### *Financial assets*

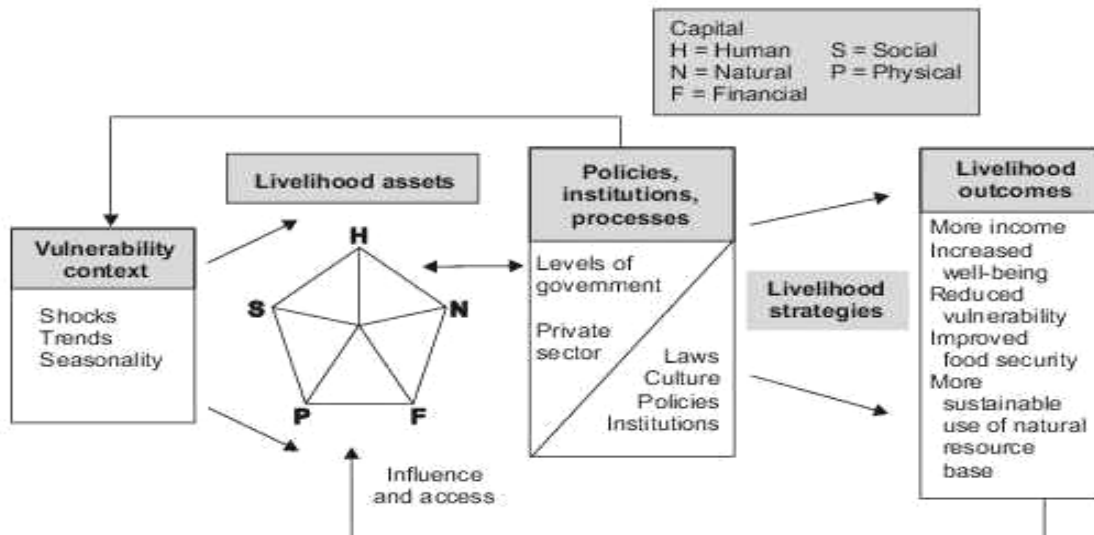
The availability of savings, pensions, credit supplies, insurances and so on are considered as financial capital with which a person can have the opportunity to choose different livelihoods alternatives and achieve the purpose of livelihoods (IISD, 2003, p: 13). Financial capital is significant in livelihood management after any disaster. Moreover, financial capital also plays a fundamental role in recovering or reconstructing the present livelihood and helps to build future livelihood strategies (Basar, 2007-2009, p: 15). However, not everything can be achieved by financial capital, such as “well-being, knowledge of human rights” (DFID, 1999, sec 2).

All of these livelihood assets are very significant to determine livelihood options. However, it has been found that poor and vulnerable people heavily rely on natural resources and do not have easy access to other assets. Therefore, any adverse impact of climate change directly affects their lives and the sustainability of livelihoods (IISD, 2003, p: vii).

The sustainable livelihood approach helps to recognize the strength and the strategies of livelihoods of the poor and vulnerable people. This approach enables the government and non-governmental organizations to format and implement their development policies and achieve the expected goal of development (Basar, 2007-09, p: 15). According to Krantz, the livelihood framework gives a holistic picture of people's livelihoods as it discusses all the assets (natural assets, Physical assets, financial assets, human and social assets respectively) that construct poor and vulnerable people's livelihoods (Krantzs, 2001, p:4). Krantz continues that the livelihoods framework helps to understand the reasons that adversely affect the livelihoods of poor people. It assists in finding the causes that hinder the access of poor and vulnerable people's to the livelihood assets. Above all, the livelihoods framework is pragmatic and multi-dimensional; for which Krantz stated as "this framework helps to assists the direct and indirect effects on people's living conditions than, for example, one-dimensional productivity or income criteria" (Krantzs, 2001, p: 4). Farrington viewed SLA "as a set of principles of guiding development interventions (whether community-led or otherwise)" (Farrington, 2001 in Morse and Mac Namara, 2013, p: 20).

The bottom-up approach is given more importance than the top-down approach in SLA, and it integrates the community knowledge. The framework recognizes what kind of development strategies are going to be needed by surveying the present situation of the available household capitals which includes vulnerability and institutional assessment of a particular community's people (Farrington, 2001 in Morse and Mac Namara, 2016, p: 20). SLA approach also finds out the causes of not accepting the offered prerogatives from the government or non-governmental institutions. For example, cultural rituals, beliefs or gender issues are often obstacles on acquiring the primary education; local level official corruption may hinder to facilitate the poor, vulnerable people (Ferrington, 2001, p: 4).

In 1998 Ian Scoones first formulated “the analytical framework of sustainable livelihood approach” (Scoones, 1998 in Basar, 2010, p: 16). However, DFID, UNDP, CARE (Krantz, 2001) and many other development organizations have altered the framework for their use, but the importance of the original framework remains the same. The most prominent framework of sustainable livelihood approach is has given by DFID as it addresses vulnerability issues and discusses the other significant issues that affect the livelihoods (DFID, 1999, p: 1 and Basar, 2010, p: 16).



*Figure. 1.7. Sustainable Livelihood Framework.*  
*Source: DFID Guidance Sheet, 1999, sec 2, p: 1.*

The framework does not work in an even way; rather according to the DFID the framework “help[s] stakeholders with different perspectives to engage in structured and coherent debate about the many factors that affect livelihoods, their relative importance and the way in which they interact” (DFID, 1999, sec 2, p: 1). The significance of the framework is the five livelihoods assets that are shown in the pentagon in Figure 1 (Basar, 2010, p: 17). In the sustainable livelihoods framework, the core is the Assets Pentagon which represents the interrelationships between different assets. In the framework, the term capital is used to refer to “livelihood building blocks” (DFID, 1999, sec 2, p: 5) rather than any absolute economic sense (DFID, 1999).

According to DFID the “shape of the pentagon can be used to show the variation schematically in people’s access to assets” (DFID, 1999, p: 5). The point that is the center of the pentagon shows “zero access to the assets” (DFID, 1999, p: 5) and the outer lines shows “the maximum access of the assets” (DFID, 1999, p: 5). The full pentagon shows the availability of resources and a squeezed pentagon shows the unavailability of resources for sustainable livelihoods. Based on the available resources one can draw various shapes of pentagon for various communities (DFID, 1999, p: 5). However, the shape of the pentagon changes according to the change of supply of the assets. With three-dimensional frame works the changes can be visualized. DFID, therefore, give emphasis on accumulating of the information for the pentagon on the availability of assets, identifying of “which groups are accumulating assets” and which are the deprived ones, the process of “social exclusion,” and further marginalization of poor people (DFID, 1999, p: 6).

The concept of vulnerability is another feature of the sustainable livelihoods framework where it shows that the sustainable livelihoods depend on the availability of assets and these assets are affected by “trends and as well as by the shocks and seasonality –over which the people have limited or no control” (DFID, 1999, p: 3). “Population trends, resources trends, national/international trends, economic trends, politics, technological trends” are among the trends, shock refers to the “human health shock, natural shock, economic shock, conflict, crop/livestock health shock”, and “price, production, employment opportunities” are included among seasonality (DFID, 1999, p: 3). However, all these trends, shocks and seasonality have significant impacts on the resources of livelihoods and their functional results (Basar, 2010. P: 17).

### **3.7 Limitations of Community-Based Adaptation and Sustainable Livelihoods Approach**

Sustainable livelihoods approach has been criticized for some of its limitations. According to Carswell, the definition of SLA is not comprehensible, extensive and consistent (Carswell, 1997, p: 10 in Basar, 2010, p: 18). The UN Food and Agriculture Organization (FAO) reported that the SLA approach shows the potentiality of action of future projects, but it does not “guide how to prioritize among them” (DFID/FAO, 2000). DFID itself stated that messages could not be understood at the beginning of the SLA frame work, “but building up to the frame work by drawing on examples allows it to be well understood” (DFID/FAO, 2000).

According to Van Dillen the SLA “belongs to the group of a holistic approach that seeks to capture the enormous complexity of development problems, but to do so at the

cost of focus, depth and analytical clarity” (Dillen, 2002, p: 251). Van Dillen stated that the SLA approach is not analytical, but rather it is descriptive (Dillen, 2002 in Basar, 2010, p: 18).

Moreover, in economics, the term ‘Capital’ is debatable and has been used in sustainable livelihood approach without any analytical certainty (Basar, 2010, p: 18). Scoones did not clarify and differentiate the meanings of capital, resources, and assets in his theory (Basar, 2010, p: 18). However, Knutsson stated that in SLA the term economic capital does not refer to any economic theory; rather it is a part of the SLA frame work and shows the interconnection between all the assets or capital (Knutsson, 2006,p: 93). The SLA approach gives importance to the assets of the poor people, but it disregards the fact that assets might be distributed unequally in the community (Akram-Lodhi, 2011, 127).

Nevertheless, CBA has some limitations as well, such as “the partial nature of CBA where it addresses the only one aspect of multiple dimensions of vulnerability” (Dodman and Mitlin, 2013, p: 648). In CBA, it is presumed that the community is homogenous, but it is not. Therefore, the problem of internal power relations and community heterogeneity becomes problematic (Mercer et al. 2008 cited in Dodman. and Mitlin, 2013, p: 648). Another shortcoming of CBA is that experts on CBA did not succeed in conceptualizing the climate risk, uncertainties and the implication of CBA (Dodman and Mitlin, 2013). It is presumed that because of climate change, things will be worse. Hence, affected people need to incorporate their previous knowledge and experiences with the CBA approach (Dodman and Mitlin, 2013, p: 648) and on that basis,



the future adaptation planning will be made. However, the argument is that in the future, the climatic occurrences are going to appear in a more devastating manner (Solomon et al., 2007 cited in Dodman and Mitlin, 2013). Therefore, as Brooks said, “short-term adaptation can result in the long-term maladaptation, increasing vulnerability to climate shocks” (Brooks et al., 2009 cited in Dodman and Mitlin, 2013, p: 649).

According to Bebbington, it is a “new policy agenda that combines neoliberalisation on the one hand with attempts at fostering participatory approaches to development on the other hand” (Bebbington, 2007, p: 158). Another aspect of this CBA is its gap with national political concerns. Therefore as, Green stated, “empowerment though participation is a fantasy divorced from political actions beyond the local community” (Green, 2000, p: 72). Authors recommended that the CBA experts should work with the concept in a broader context in relation to power and governmental bodies because by this method poor people have to be empowered enough that it makes a difference to the society and, therefore, it needs the involvement of government and international agencies (Dodman and Mitlin, 2013). Again, it has been noticed that the funding system in CBA is situated in such a way that it does not give any power to the real marginal, poor people (Dodman and Mitlin, 2013). Moreover, in the issue of mitigation, the authors explained that CBA avoids addressing mitigation because communities that have low-income are not able to bear the costs of mitigation that are related to climate change (Dodman and Mitlin, 2013). However, giving some examples such as Philippines (Dodman et al. 2010 cited in Dodman and Mitlin, 2013), Tanzania (Dodman et al. 2011 cited in Dodman and Mitlin, 2013), and Zimbabwe, Dodmen et al.

commented that, mitigation is possible for low-income people with the collaboration of local community people and the local and national governments' interest (Dodman and Mitlin, 2013).

### **3.8 Bangladesh: Climate versus Shrimp farming as impacts on livelihoods**

This thesis will focus on the example of Bangladesh, where the country is suffering from the impact of climate change that is multifaceted, multidimensional and multisectoral (Atiq, Golam, Mallick, Natasha, 2012). Community- based adaptation was applied by the Government of Bangladesh and NGOs of Bangladesh (Zappia, Josephine 2013), but there is a lack of monitoring and evaluation system from the central governmental and local governmental level, for which CBA projects are not being sustained for a long time especially in the coastal area, for the development of coastal community's sustainable livelihoods (CDKN, 2012). Developed countries and Bangladesh Government jointly formed a fund called the "National Climate Change Resilience Fund" but the money is not being managed or distributed in the right way because of huge corruption in Bangladesh (Bangladesh Government, Ministry of Environment & Forests, 2005 and 2008; the World Bank, 2010; Ministry of Foreign Affairs of Denmark in Bangladesh, 2010; Transparency International corruption in Bangladesh, 2001-2005; cited in Grit Martinez, et al. 2011, pp: 254-255).

Haq and Rabbani suggests that, "there are many challenges [that] remain, not least that actions taken by all actors, including the government, need to be as transparent as possible and that there be a pro-active learning mechanism to inform policies and action as they develop over time" (Huq, S, and Rabbani, G, 2011, p:17). From the

example of Bangladesh, it is evident that CBA needs to be linked with central and local governmental power structures and only then will it may come up with its authentic accomplishment.

Nevertheless, in this thesis, it has been noted that impacts arise not only from climate change but also from shrimp farming (a local anthropogenic issue) causing salt water intrusion into the lands or ponds of coastal areas and that is discussed briefly in the below segment.

In this section, the effects of shrimp farming and climate change on sustainable livelihoods are addressed. This will help to understand that it is not only climate change but also the local anthropogenic issues like shrimp farming that are affecting the development of sustainable livelihoods of the local people. Shrimp farming is a successful business in tropical countries including Bangladesh, and it enhances economic growth. However, shrimp farming results in salt water intrusion that in turn causes environmental degradation. Shrimp farming is causing impacts on the mangrove ecosystem, biodiversity, polluted land, ponds and freshwater fish resources (Paul and Vogl, 2010).

Paul and Vogl noted that in Bangladesh shrimp farming is enhancing the economic growth. Tiger shrimp in Bangladesh is “known as ‘White Gold’ because of its export value” (Ahmed and Diana, 2015, p: 42). Seafood export is in the second position after garments as an export article of trade in Bangladesh (EPB, 2009 in Paul and Vogl, 2010, p: 201). In 2008-09, shrimp farming contributed four percent to the GDP in Bangladesh (BBS, 2009 in Paul and Vogl, 2010, p: 201). In 2007-08, the seafood exports

earned US\$ 550.53 million foreign exchange where 81% of it was from shrimp trade (BSFF, 2008 in Paul and Vogl, 2010, p: 203). Therefore, it is evident that shrimp farming is a high-demand and profitable trade for the people of Bangladesh. However, it has been noted that shrimp farming is ungoverned and unorganized in Bangladesh (Deb, 1998; Metcalfe, 2003; Samarakoon, 2004; Alam et al., 2005 in Paul and Vogl, 2010, p: 202).

It has been found that political issues are responsible for poor management of shrimp farming in Bangladesh (Alam et al., 2007; Ahmed et al., 2002, 2008, 2010; Ali, 2006; Hossain and Khan, 2001; Islam, 2003; Islam, 2008; Islam et al., 2004a, 2004b; Karim, 2006; Paul and Vogl, 2011; Swapan and Gavin, 2011). Islam et al. reported that shrimp farming needs saline water that enhances the salinity level of the non-saline cultivable land. Therefore, it hampers the fertility of the land to grow crops. Freshwater ponds, rivers contaminated by saline water that decreases the freshwater fishes and other species (Islam et al. 1999). Till today, unorganized shrimp farming causing the environmental degradation, for example, saline water intrusion, reduction, and disappearances of freshwater fishes, hampering the agricultural land and trees as well (Sohel and Ullah, 2012). Regarding the above evidence, it is clear that shrimp farming may be supporting the economy of Bangladesh, but it is also responsible for degrading environment, agricultural and traditional fishery sector.

Climate change is also affecting the sustainable development of livelihood. Most of the livelihoods which depend on natural resources are heavily affected by the climate change, especially developing countries like Bangladesh. Still, the agricultural and fishery sectors of Bangladesh depend on natural resources (Baser, 2010, p: 19). Therefore

Rennie and Sing stated that “predominantly the poor of the world depend directly on natural resources, through cultivation, herding, collecting or hunting for their livelihoods. Therefore, for the livelihoods to be sustainable, the natural resources must be sustained” (Rennie and Singh, 1996, p: 16).

According to evaluation, it has been recorded that in developing countries three-fourth of the people from the rural regions heavily depend on natural resource based livelihoods (Bojo and Reddy, 2002 in IISD, 2003, p: 14). In this circumstance, the environmental degradation increases their vulnerabilities and livelihoods insecurity (IISD, 2003, p: 14). It has been projected that between the pre-industrial period and the 21<sup>st</sup> century the mean temperature of the earth has increased around 4°C which unfavorably affecting the agricultural sector, crop production and the fishery sector of the developing countries (MacNamara and Buggy, 2016, p: 1 and IISD, 2003, p: 15). In developing countries including Bangladesh, millions of people will be displaced due to sea level rise and will lose their prior livelihoods as well. Moreover, people who will try to re-establish themselves in urban areas will suffer and struggle in inadequate opportunities for livelihoods, as they will be in lack of specialized skills, any contacts or capital (IISD, 2003, p: 15).

This thesis will address the relative impacts of climate change and local human activities (shrimp farming) by focusing on a specific location, to assess the traditional livelihoods of Khutikata villagers in coastal Bangladesh.

## **Chapter 4. Effects of climate change on farmers and fishers of Khutikata village**

### **4.1 Introduction**

Communities which reside in the coastal areas of the world are more vulnerable due to climate change (Shaw and Krishnamurthy, 2012 in Alam et al. 2013, p: 255). Population growth, overconsumption and overuses of natural resources had already stressed these coastal regions of the world, but in addition, climate change is hindering the well-being and livelihoods of coastal communities (Adger, 2005 and Lebel, 2012 in Alam et al. 2013, p: 255). The adaptive capacity and livelihoods of these communities vary due to climate change, with tropical cyclones, storm, tidal surges, and storm surges having a sudden and disastrous effect on them. Sea level rise and salinity increase having a slow but long-term impact on the socio-economic aspects and environment of the coastal communities (Nicholls et al. 2007, p: 318).

This research was conducted in a coastal village of Satkhira district of Bangladesh. The economy of this country primarily depends on agriculture, which is the source of rural livelihoods and income for generation after generation (Shah, Grant, and Stocklmyer, 2014, p: 157). Presently climate change has become a serious problem in Bangladesh especially, the agricultural sectors in the coastal belt. One study from IPCC based on research of 1990 showed that in 2050 the production of rice is going to reduce 8%, and wheat production will reduce around 32% because of excessive temperature and the higher concentration of CO<sub>2</sub> (Haque and Haque, 2016, p: 11).

Moreover, sea level rise is adversely affecting the fishery sector of Bangladesh

(Alam et al. 2013, p: 255). According to Dasgupta et al. due to increased salinity the “reproductive cycle, reproductive capacity, extent of suitable spawning area, and feeding/breeding/longitudinal migration of fish species” are in great danger (Dasgupta, S., Huq, M., Mustafa, M., Sobhan, M. I., & Wheeler, D. 2016, p: 25). It is noted that most of the fishermen in Bangladesh belong to poor, marginalized community. The fishing communities are in lack of proper infrastructural, educational, and health care facilities. They are vulnerable, in the lack of adaptive capacity, and livelihoods opportunity due to climate change and natural hazards (FAO, 2010-2016 p: 12). One study by Md. Monirul Islam, Sallu, Hubacek and Paavola found that presently cyclones become increasingly frequent with longer duration which damages fishing equipments, boats, kills many fishermen and so on (Islam.M.M et al. 2013, p: 212). Moreover, due to poor radio signal sometimes fisherman cannot get proper weather forecast on time and even if they do they cannot get to the land safely on time “due to the shortcomings in the forecasting of cyclones” (Islam.M.M et al. 2013, p: 212).

This chapter seeks to explain the effects of climate change on the livelihoods of two economic activities agriculture and fisheries in the Khutikata coastal community of Bangladesh. Furthermore, an explanation of their coping strategies will also be discussed. The information will be given from empirical data gathered from field research in 2015.

#### 4.2 Climate change and its impact on agriculture of Khutikata village

Bangladesh is one of the poorest and most vulnerable countries in the world due to climate change (Mallick, Rahman, and Vogt, 2011, p: 630). Agriculture is the dominant sector that contributes to the GDP of Bangladesh, especially the rice crop. In 2010-2011 crop sectors alone contributed 10.9% of GDP (CPD, 2011 in Jaim and Akhter, 2012, p: 4). In Khutikata village, agriculture is the dominant livelihood. Seasonal changes significantly influence this sector. Bangladesh is well known as the country of seven seasons. These seasons are crucial for the agricultural sector, but climate change has affected these seasons severely. Nowadays, summer, winter and rainy seasons are the only distinct seasons (The Statistical pocket book Bangladesh, Bangladesh Bureau of Statics BBS, 2015, p: 9). These changes in the seasons affected the agricultural sector as well.

Bengali Months	Also Known As
Boishakh & Joishtho	Grishho (Summer)
Ashar & Shrabon	Borsha (Rainy Season)
Bhadro & Ashshin	Sarat (Autumn)
Krtrik & Ogrohayan	Hemonto (Late Autumn)
Poush & Magh	Sheet (Winter)
Falgun & Chitra	Boshonto (Spring)

*Table 1.2. Seven seasons of Bangladesh. Source: Rashid, 1991, p: 90.*

Saline intrusion, drought, and high temperature adversely affect the productivity of rice crops in Khutikata village. The main crop of the community is rice.



However, farmers of the village also produce some vegetables and fruits like mango, sapodilla, coconut, and jackfruit. The village also has Neem tree, Rain tree, and plentiful cactus trees. Farmers of the Kuthikata village gave information regarding the impact of climate change on their agriculture. According to one of the farmer participants, they used to grow all kinds of crops in the village twenty years ago, but now due to climate change, climatic hazards became very frequent and more disastrous. For example, Mr. Bijoy Das said that,

*“I have seen plenty of changes and environmental consequences over the last thirty years in the agricultural sector in this village. Once we use to harvest local crops according to the seasons but now it is not possible because of excessive saline in the soil. The leaves of the rice became yellow in color and crinkled. Excessive salinity also reduces the fertility of our soil. Therefore, vegetables, fruits or any other trees do not grow that much and whatever grows died very soon”* (Personal communication 28<sup>th</sup> April 2015).

Mr. Shukumar Shaha said that *“Increased salinity in the soil, excessive rainfall, cyclones, tidal surge, drought, increased temperature, and hailstorm hampered agricultural sector in a significant way. We cannot grow crops or vegetables all year around.”* (Personal communication, 22<sup>nd</sup> May 2015).

Excessive rainfall hampered the growing of crops and vegetables. After any disaster or tidal surge, water clogged at the root of the plants that caused the death of plants. On the other hand, drought increased the salinity of the soil and hindered the irrigation system. Sometimes storms hit including hailstorms that broke the rice plants.

Cyclones damaged the fields of rice and other crops. Moreover, cyclones nowadays come along with storm surges. Saline intrusion contaminated the source of fresh water in the village (Rabbani, Rahman, & Mainuddin, 2013, p: 401). All these climatic hazards used to happen once or twice a year around ten to twenty years ago. However, nowadays these climatic hazards became very frequent. According to a study, for the last fifty years, nine cyclones hit the coastal regions of Bangladesh. However, in the last decade five huge cyclones hit the coastal regions of Bangladesh and Satkhira was one of them. Cyclone Sidr hit in 2007, cyclones Nargis and Reshmi in 2008 and cyclone Aila in 2009. Among these cyclones, Sidr and Aila were most disastrous. Due to cyclone Sidr, more than 3,000 people were killed, and 0.7 million hectares of crops were damaged (Rabbani et al., 2010, DMB, 2010 in Rabbani, Rahman and Mainuddin, 2013, p: 402). Aila caused saline intrusion in the agricultural land which in turn damaged huge amounts of rice crops in coastal areas like Satkhira, Khulna (Rabbani, Rahman, & Mainuddin, 2013, p: 401). According to one of the participants “*recently we are experiencing these climatic hazards three or four times a year. These became very frequent and more disastrous. Whenever any climatic hazards comes it took everything from us, we feel very insecure against nature*” (Personal communication, 23<sup>rd</sup> May 2016).

Three types of rice crops are harvested in the Satkhira district including Khutikata village, locally known as Aus, Aman, and Boro. Farmers usually harvest Boro from December to May. Harvest duration of Aus rice is April to August, and the Aman producing period is June to December (Rahman, M. M., & Islam, A. 2013 p: 102). During the rainy season, they used to have 750 lb to 794 lb of crops from 0.13 hectares of

land (i.e. one Bigha is the unit used to measure land where 1 Bigha = 0.134 hectare in Bangladesh). Irrigation systems in this area still depend on rain water which indicates the heavy reliance on nature for their livelihoods.

Many of the farmers used to harvest wheat around twenty years ago. However, nowadays in some parts of the village wheat did not grow at all and many of the local crops as well because of the increasing salinity in the cultivable land. Following the devastating climatic event 'Aila' in 2009 (Mallick, Rahman, and Vogt, 2011, p: 632). After this natural disaster, the saline increased to such degree in the soil that the production of hybrid crops decreased.

One of the participants, Shuhash Chandra, said that *"This area is not like the areas that are flooded by the Padma, Jamuna, Ganga, and Meghna"* (Personal communication, 8<sup>th</sup> May 2015). The Padma, Meghna, Ganga, and Jamuna are three big rivers of Bangladesh that are prominent for their large size and depth. When the areas around these rivers flood it may cause damage to the people of that area. However, it also deposits alluvium on the land which increases the fertility of the soil. Shuhas Chandra explained that Khutikata village is not flooded by the rivers and does not get any sediment. Moreover, the damage in coastal regions, like Khutikata, is more severe than the areas residing by those three rivers as high tide overflows and pollutes the agricultural land by saline water. For example, in 2009 Aila (Mallick, Rahman, and Vogt, 2011, p: 632) caused the saline water intrusion in the region. Moreover, one interviewer noted that *"around one month ago tide caused saline water intrusion that hampered their agricultural land significantly, and the governmental help was not sufficient at all"*

(Personal communication, 10<sup>th</sup> May 2015). The increased salinity damaged the fertility of the land and hampered the crop production. There are two maps of Bangladesh given below where one is showing the major rivers of Bangladesh, and the other map is showing the coastal area studied in this research. It is evident from the two maps that the research area of Satkhira district is a coastal area very near the Bay of Bengal Sea. Therefore, the statement of the participants is clear that the tidal surge came in their cultivable land in a devastating manner and brings saline water.



*Figure 1.8: Rivers of Bangladesh. Source: Wikimedia Commons, 2005.*



*Figure 1.9: Location of Satkhira region of Bangladesh. Source: Wikimedia Commons, 2009.*

People of the Khutikata village cannot use ground water because of its extreme saltiness. Therefore, farmers of the Khutikata village depend on the rainy season for their

cultivation. If they had a fresh water irrigation system, they could cultivate for the whole year. Extreme temperature and lack of proper rainfall are the barriers to agricultural production in the Khutikata village. Manik Das said that, *“If the government could arrange something for them to supply fresh water then they could produce more crops and do not need to worry about anything”* (Personal communication, 11<sup>th</sup> May 2015).

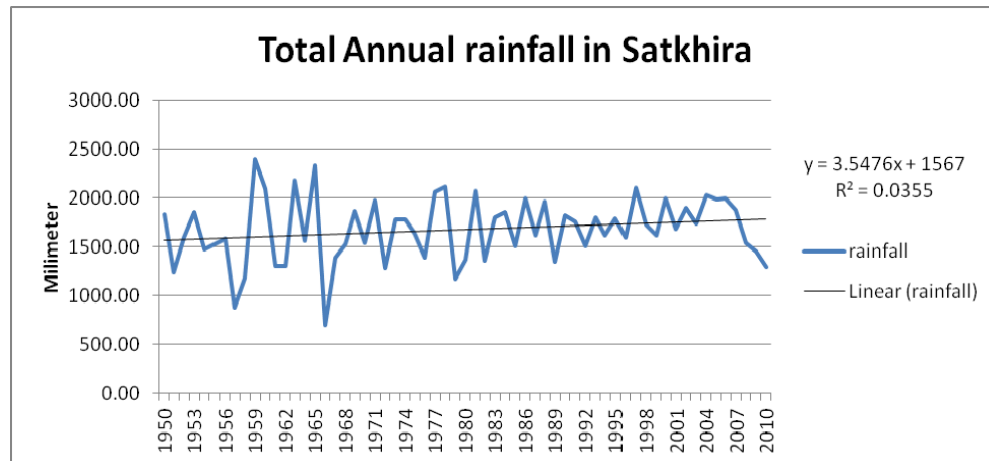


Figure 1.10: Rainfall of Satkhira district 1950-2010. Source: Haque and Haque (2015), P: 13.

Binu Rani said, *“I finish my cooking in the morning as time goes on the temperature increased and it is unbearable to work in that temperature; it feels like my skin is burning, sometimes my eyes also feel irritated”* (Personal communication, 13<sup>th</sup> May 2015). Farmers also went to the field at 5 am or 6 am in the morning and worked until 12 pm. And after that, they cannot work because of excessive heat in the field. Sometimes they started their work at 2 pm and finished it at 6 pm. Crops that they used to grow twenty years ago cannot grow now. Presently, local crops are not growing any longer. Farmers of the village have to buy seeds from the non-governmental companies. Although government distributes seeds, these are not sufficient for them and sometimes

the quality of the seed is poor. Therefore, they have to depend on the non-governmental seed companies.

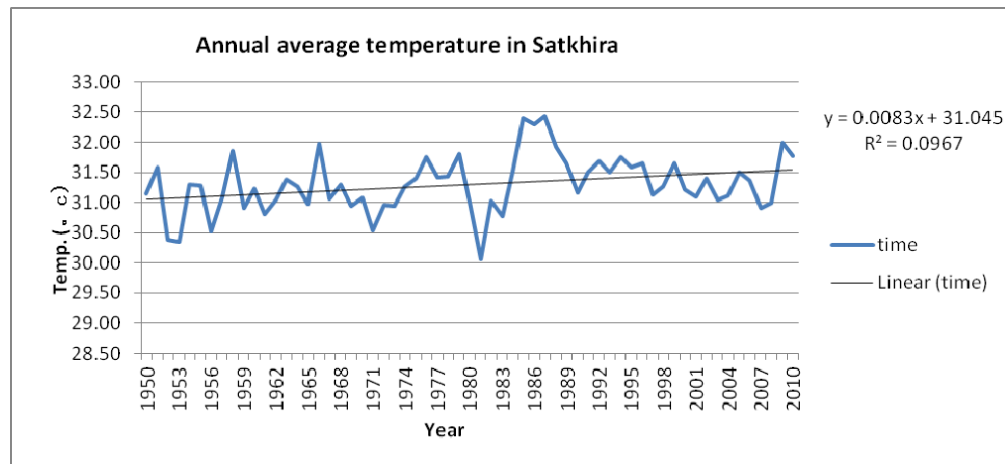


Figure 1.11: Temperature in Satkhira district, 1950-2010. Source: Haque and Haque (2015), p.12.



Picture 1.2: Cracked cultivable land of Khutikata village due to lack of water and high temperature. Source: Author's Photograph.

Lack of fresh water disrupts the irrigation system. The people also suffer from lack of fresh water in their daily household works and for drinking water.

### 4.3 Saline water intrusion

Saline water intrusion polluted 45% of the coastal rivers of Bangladesh since

1948 and it affected the districts known as Khulna, Satkhira, Patuakhali, Pirojpur and Barguna (Khan, AE; Ireson, A; Kovats, S; Mojumder, SK; Khusru, A; Rahman, et al. 2011, p: 1328). The research area is located in Satkhira district. In Bangladesh overall, 30% of the cultivable coastal land had been affected by saline water (Haque, 2006 in Dasgupta, S., Hossain, M., Huq, M., & Wheeler, D. 2014, p: 6). While in Satkhira 70% of the land is saline. The level of salinity in this area is 4/16 dS/m (Karim and Iqbal, 2001 in Lisa, L. A., Seraj, Z. I., Elahi, C. F., Das, K. C., Biswas et al., 2004, p: 214). According to the survey of SRDI (2000), the level of salinity increased exceedingly for the last four decades in the district of Satkhira, shown below:

Name of the District/ Upazila	Salt affected area (000' ha)			Salinity Class*												Salinity increase over three decades	
				S1 2.0-4.0 dS/m			S2 4.1-8.0 dS/m			S3 8.1-16 dS/m			S4 >16.0 dS/m				
	1973	2000	2009	1973	2000	2009	1973	2000	1009	1973	2000	2009	1973	2000	2009		
Satkhira	46.38	47.08	53.11	6.50	9.03	1.00	5.60	9.01	2.96	4.50	0.55	0.90	0.90	2.01	8.58	6.76	4.62

*Table 1.3: Transformation of Salinity level in Satkhira district in four decades. Source: SRDI, 2010, p: 37<sup>10</sup>, \*Salinity level, S1- Slightly Saline, S2- Moderately Saline, S3- Saline, S4- High Saline (Karim et al., 1990 in Basar, 2010, p: 39-40).*

<sup>10</sup> Ministry of Agriculture, Soil Resource Development Institute (2010), Saline Soil of Bangladesh Retrieved from [http://srdi.portal.gov.bd/sites/default/files/files/srdi.portal.gov.bd/publications/bc598e7a\\_df21\\_49ee\\_882e\\_0302c974015f/Soil%20salinity%20report-Nov%202010.pdf](http://srdi.portal.gov.bd/sites/default/files/files/srdi.portal.gov.bd/publications/bc598e7a_df21_49ee_882e_0302c974015f/Soil%20salinity%20report-Nov%202010.pdf).



As Khutikata village situated in under the sub-district of Shyamnagar and seventy-two percent of Shyamnagar is considered as highly saline area (Basar, 2010, p: 40). The transformation of saline affected area is shown below for three decades (Basar, 2010, p: 40).

Number of the Upazila	Total area (000' ha)	Salt affected area (0 00' ha)	Percent	Salinity Class			
				S1 2.0-4.0 dS/m	S2 4.1-8.0 dS/m	S3 8.1-16 dS/m	S4 >16.0 dS/m
	Year 2001	Year 2001	Year 2001	Year 2001	Year 2001	Year 2001	Year 2001
Shymnagar	44.12	38.90	88	2.36	6.7	19.6	10.11

*Table: 1.4 Transformation of salinity level in Shymnagar sub-district. Source: SRDI, 2001 \*Salinity level, S1- Slightly Saline, S2-Modarately Saline, S3- Saline, S4- High Saline (Karim et al., 1990 in Basar, 2010, p: 39-40).*

From the table, it is evident that out of 44.12 ha of land 38.90 ha of land already affected by salinity where 10.11 ha of land is highly saline. (SRDI, 2001 \*Salinity level, S1- Slightly Saline, S2-Modarately Saline, S3- Saline, S4- High Saline [Karim et al., 1990 in Basar, 2010, p: 39-40]).

Saline water intrusion is the major problem in the development of the agricultural sector in Khutikata village. Saline water creates a hydrological situation that makes the

environment unfavorable for regular crop production all year round (Rasel, Miah, Hasan and Ahmed, 2013). For example, they used to grow local rice known as Aus and Boro, but nowadays, farmers cannot grow Aus anymore. They cultivate a small amount of Boro, but saline water and irrigation system hampered the harvest of Boro rice. The farmers now harvest the Ropa rice but only in the rainy season. They used to grow wheat and corn five years ago, but these have now stopped growing. It has been reported in one study that the level of salinity increased ten times higher than the endurable limit in some areas of Satkhira district. Farmers have to dig 500 ft for the supply of fresh water for better irrigation which was available 200 ft to 250 ft before (Rasel, Miah, Hasan and Ahmed, 2013, p: 477). According to Rasel, Miah, Hasan, and Ahmed,

*“Over the last 25 years, sea water from the Bay of Bengal has pushed 40 km inland throughout underground water aquifers, replacing fresh water”* (Rasel, Miah, Hasan and Ahmed, 2013, p: 477)

Vegetables are not growing as they did ten years ago. Again, it should be noted that Bangladesh is a tropical country. Therefore, all the seasons are suitable for the production of vegetables. However, vegetables did not grow all year around in this village. Bimal Chandra said that *“we grow vegetables and some fruit trees in our backyard, but now the taste of these vegetables and fruits are not the same as it used to be in my childhood”* (Personal communication, 22<sup>nd</sup> May 2015). Farmers also cannot harvest different kinds of split peas and Robi crop in the winter season in Bangladesh.

Frequent drought and increasing saline water have led the villager’s lack of the grass on grazing land. The grass they have in the grazing land is not enough for their

cows and goats. Also, the quality of the grass is inferior. Therefore, lack of the grass sometimes results in the death of cattle.

Poultry diseases increased enormously more than five years ago. Lack of fresh water and proper food is hampering the poultry business. According to the participants, due to the tidal storm of Aila, the level of salinity doubled. The study was conducted in the coastal zones of Bangladesh including the study area Satkhira. According to Golam Rabbani, Atiq Rahman, and Khondoka Mainuddin saline intrusion is the key factor for hampering the rice production in the coastal zone of Bangladesh (Rabbani, Rahman, Mainuddin, 2013, P: 409).

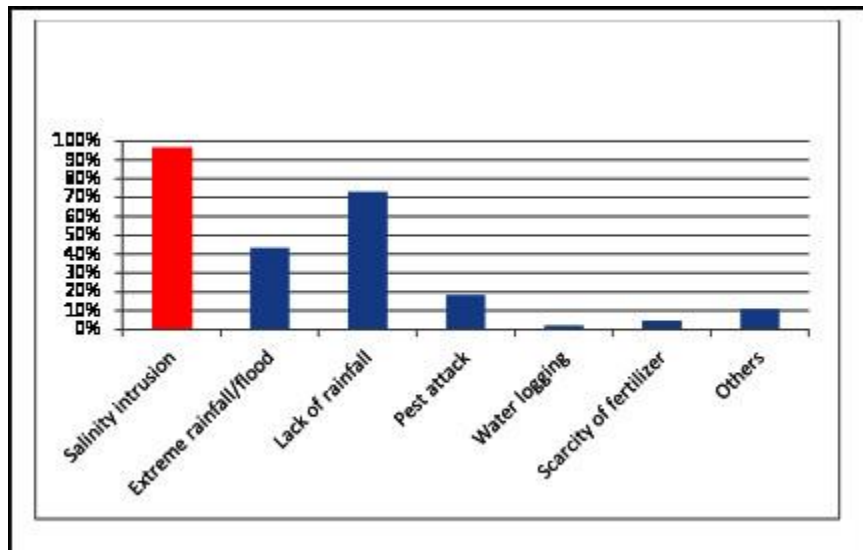


Figure 1.12: Percentage of the reasons that decreased the rice production according to the respondents (Rabbani, Rahma, and Mainuddin, 2013, P: 409). Source: Rabbani, Rahma, Mainuddin, 2013, P: 409.

#### 4.4 The concept of adaptation to the Khutikata villagers

The villagers are familiar with adaptation. They understand that they have to do something new and sustainable for their lives and livelihoods in response to rising

salinity levels, tidal surges, frequent and more disastrous storms. However, lack of capital and inadequate help from the government and non-governmental organization means that poor villagers are limited in what they can do to sustain their livelihood. For example, during focus group discussions, the poor participants stated that they do not possess suitable capital, and the government or organizations did not help them to have the loan without interest or with a low level of interest.

#### **4.5 Adaptive strategies of the farmers in Khutikata village**

Despite these obstacles, people of Khutikata village are trying to cope with the changed environment and in this regard, GO, and NGO is helping the, especially NGOs. Farmers now using different kinds of adaptive strategies to cope with their environments that are discussed below.

##### **4.5.1 Saline tolerant crops**

In Bangladesh traditionally three kinds of rice crops are harvested. These are Aus, Aman, and Boro (Rabbani, Rahman and Mainuddin, 2013, p: 403). “Aus rice variety is planted in April and harvested in August. Aman refers to rice varieties grown between June and December. Boro refers to cultivation between December and May” (Rabbani, Rahman and Mainuddin, 2013, p: 415).

However, researcher from the Bangladesh Rice Research Institute (BRRI) (Rahman, M. M., & Islam, A. 2013 p: 102) and Bangladesh Agricultural Research Council have researched saline tolerant crops; invented different kinds of saline tolerant rice crops and introduced them all to the country especially in climate vulnerable areas like coastal zone or drought prone areas.

In coastal regions like Satkhira, farmers depend on saline tolerant crops due to the increased salinity in the soil. Presently farmers in Khutikata village use different kinds of saline tolerant rice crops. In the rainy season, farmers produce saline tolerant rice crops known as 'Patnai,' 'Boram,' 'Balam' (Personal communication, 20<sup>th</sup> May 2015). Participants expressed that in 2014, they harvested Ropa Aman crop, BR10, BR 22, and BR 23 (BRRI 2012 in Rahman, M. M., & Islam, A. 2013, p: 309-310 and BRRI, 2011). Farmers also harvest BR-47 which is in Boro season (Rahman, M. M., & Islam, A. 2013 p: 310). Farmers also grow BINA 8, 10 and 39. Among these, the saline tolerant level of BINA 8 is >14 dS/m (BRRI, 2011; Salam et al, 2007; The Daily Star, 18 July 2010 cited in Rabbani et al. 2013, p: 9). The level of saline resistance of BR 47 is >12 dS/m (BRRI, 2011; Salam et al, 2007; The Daily Star, 18 July 2010 cited in Rabbani et al., 2013, p: 9). BINA 8 and BR 47 are the most harvested rice crops not only in Khutikata village but also in the entire Satkhira district (BRRI, 2011; Salam et al, 2007; The Daily Star, 18 July 2010 cited in Rabbani et al., 2013, p: 9). Saline tolerant rice crops BINA 8, and BR 47 are famous rice among the farmers as it gives higher production than any other rice crops (Rabbani et al., 2013 p: 9). One participant of Khutikata village said that "*we like the rice crop BR 47 as it gives double production than before*" (Personal communication, 23 May 17, 2015).

Farmers of the village are also harvesting a new kind of vegetables like kakri (one kind of vegetable closer to Cucumber). The fruits that used to grow in sandy areas are growing here as these areas became barren and sandy like desert.



*Picture 1.3: Kakri,*



*Picture 1.4: Watermelons.*

*Source: Author's photograph.*

Farmers nowadays only harvest hybrid crops such as BR 10, 22 and 30 from Aman category. The BR 10 is also locally known as Progoty (BRRI, 2011). They sow these seeds only in the rainy season. However, some saline tolerant crops such as Bina-8, 10 and 49 are harvested all through the year. It results with 1588 lbs of crops. Farmers also use chemical fertilizers, for example, gypsum, DMP, MOP, TSP and Sal-far in their cultivable land and some farmers use sugar in their land. In the rainy season, they harvest Ropa Amon rice, and that is only for one time in a year. They also produce a limited amount of vegetables in the rainy season around their residence area. In 2015, some of the farmers were successfully introduced by some non-governmental organizations to harvest watermelon and nuts.

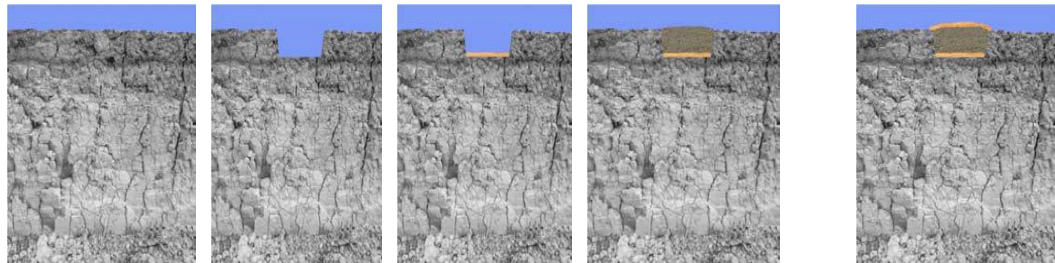
#### **4.5.2 Mulchin Technique**

Participants referred to a new kind of technique to grow plants or rice. As salinity had increased in the soil, therefore, they put husks on their cultivable land for few days. After that time, they put seeds and put straw over the seeds again. The straw/hays

soaks salinity from the soil, although not completely but sufficiently for them. The method is known as Mulchin or “dhaka” technique in the local language.



*Picture. 1.5. The mulchin technique, straw on the cultivable land. Author’s photograph.*



*Picture 1.6: The mulchin technique, step by step. seedlings. Source: SRDI, 2016.*

Here in the picture, husks have been placed on the cultivated land. After this, the farmer put fertilizers and seeds in that area. Then the farmers put the husks again. This technique is called Mulchin or “dhaka” technique (SRDI, 2016) (Personal Communication, 12<sup>th</sup>-20<sup>th</sup> May 2015).

### 4.5.3 Vermiculture

Farmers of the Khutikata village use vermiculture technology to make their land fertile. In this process, the farmer uses earthworms which solve environmental problems “from waste management to land improvement” (Makin, Miah, Yadav, Dev and Khan, 2014, p: 62). Participants said that they get helps from NGOs on vermiculture technique, and this method helped them remarkably.



*Picture 1.7: Vermiculture*



*Picture 1.8: Worms of vermiculture.*

*Source: Author's photograph.*

### 4.6 Mohautshob

The inhabitants of Khutikata village believes that if they worship their deity of Mother Nature in a proper manner, the climate may become favorable for their live and livelihood. Therefore, every year they arrange a religious festival is known as “Mohautshob” means the grand celebration.

In Khutikata village the majority of the people are Hindu in religion. They have many religious occasions throughout the year; one of them is the “Moha-utshob.” At the end of the summer season, they celebrate this occasion.



Mohautshob is a religious ritual to keep Mother Nature happy, satisfied with them and giving them enough rain, sunlight, and good quality of the soil to grow more crops. Therefore, according to the ritual, they fast through the whole summer. In the fast, they are allowed to drink, eat vegetables and fruits only. They are forbidden to intake any meat or fish. At the end of summer, they celebrate the occasion “Moha-utshob”.

In the “Moha-utshob” they cook for the whole community. In the menu, they use to have different kinds of vegetables that grow in the summer. It is celebrated in the house of a Brahman who is the priest of Hindu religion. The researcher has attended the festival and had been seen that many women were cutting the vegetables, some were preparing the spices, cooking materials and some were preparing their deities to worship. The key informant of the research said that they worship their godmother, named “Durga” and offer her different kinds of foods, fruits. After worship and offering foods to the godmother, the people over there equally distributes the foods among the guests to consume.



*Picture 1.9: Vegetables for Mohautshob preparation.*

*Source: Author's photograph.*

#### **4.7 Impact of climate change on the fishing sector in Khutikata village**

Bangladeshi people are known as *Mache vate Bengali* meanings “*Bengali body is made up of fish and rice*” (Ali, 1999, p: 114). Therefore, fish and the fishery sector in Bangladesh is crucial as it is the primary source of protein and other nutritional values, and plays a crucial part in the economic sector of Bangladesh (Ali, 1999, p: 114). According to the Food and Agriculture Organization of United Nations (FAO), fishery sector in Bangladesh plays a crucial role in the GDP and livelihoods opportunities. The fishery sector contributes 3.8% of the GDP of Bangladesh in 2010. It is a source of livelihoods for 0.3 million people in marine fisheries and 1.2 million people in inland fisheries (FAO, 2010). Fish is the source of 55% of animal protein in Bangladesh (FAO, 2010).

From the field observation, there are three types of fishermen exists in the village: (1) full-time fishermen who only fish in rivers, ponds, canals, and sea as a livelihood, (2) part-time fishermen who do agriculture as well as fishing, and (3) seasonal fishermen who do fishing in seasons. Presently most of the poor fishermen participants work in the shrimp farms as day laborers. Very few of the villagers own shrimp farms. Most of the shrimp farm owners are absentee owners who lease the land to other people and collect the profit at the end of the month or year.

##### **4.7.1 Freshwater Fisheries**

The fishing community in Khutikata village is suffering from saline water intrusion due to sea level rise. According to the participants, due to climate change, saline water entered their village ponds, canals, rivers and therefore, all the species of the

freshwater disappeared. One of the participants said that around fifteen to twenty years ago they used to have freshwater fishes like Punt (Swamp barb, *Puntius chola*), Shoul (Snakehead murrel, *Channa striata*), Gozar (Great snakehead, *Channa marulius*), taki (Spotted snakehead, *channa punctata*), boal (Wallago, *wallago attu*), koi, shingi (stinging catfish, *Heteropneustes fossilis*) and so on. Participants of the research said that presently due to saline water these freshwater fishes do not exist anymore. Moreover, due to population growth many of the wetlands are converting into shrimp farms, agricultural land or used for building houses. Therefore, saline water fishes are also decreasing in an alarming way. Many fishes such as Parse, Tengra, Vehtki, Topshe, Magur, Kaem, Vanggar, Golda and Baghda shrimp (locally known) had decreased from the river.

Some fisherman of the Khutikata village used to go to Sundarban Rivers to catch fish, but nowadays fishes and crabs from the rivers of Sudarban are not available. One of the participants said that “*very few fishes comes in the estuary of Sundarban for breeding, they do not come nowadays that much*” (Personal communication, 17<sup>th</sup> May 2015). When the researcher asked one of the participants Sri Ram Chandra about the reason for the decline of fishes in their village, he replied:

*“The main reason of declining of fishes is excessive saline water intrusion; the level of salinity increased so much that it is crossing the endurance of fishes on Sundarban. Moreover, siltation of ponds, rivers, canals, drought and increased temperature due to weather change results reducing of fish breeding in those areas.”*(Personal communication, 23<sup>rd</sup> May 2016).

Similarly, when the researcher asked one of her participants, Kishorilal, about the

impact of climate change in their fishing sector, he replied that,

*“I have seen plenty of changes in our environment. Around seventeen to eighteen years ago we used to have ponds and canals in our village, where we used to catch different kinds of freshwater fishes but now due to saline water intrusion all the freshwater fishes are gone. The ponds and canals are also dried up because of drought.”* (Personal communication, 19<sup>th</sup> May 2015).

Other participants in Khutikata village also noted that they are suffering from saline water intrusion due to sea level rise. Salinity caused disappearance of many freshwater fishes and less production of crabs. Furthermore, they used to fish in the rivers, ponds, and canals inside their village, but now they have barely any ponds or canals. Most of the ponds have dried out because of drought in the summer and high temperature. Droughts result in decreasing oxygen in the water of ponds (and shrimp farms) causing high levels of death. Therefore, the people often go to the neighboring villages. One of the participants said that:

*“for the last three-four years the temperature rose very high, this year in April it was around 38 to 40 degree Celsius, and I can feel that the situation was not like this before”* (Personal communication, 20<sup>th</sup> May 2015).

The inhabitants of the village produce shrimp categorized as “Bagda” or tiger shrimp and few amounts of Rohu fish (*Labeo Rohita*). Most of the land in Khutikata village had been used for shrimp farming. The villagers use to do fishing in the village ponds, canals, and rivers as their livelihood. However, participants of the research stated that this sector is affected by the unfavorable impact of climate changes. According to the

participants, increased salinity, drought and high temperature became an obstacle to the shrimp farms and natural freshwater fishes. Salinity caused the death of Ruhi and Karp fishes. Shrimp farms are affected by the virus from the frequent tidal surges and cyclones. Excessive salinity resulted in the disappearance of many freshwater fishes and less production of crabs. In contrast, some fish (shrimp) are flooded away because of excessive rain, frequent tidal surges or cyclones and sometimes excessive rainfall caused a decrease in the salinity, and this resulted in the death of shrimp and crabs. Hailstorms sometimes kill the fishes in the ponds, rivers and the shrimp with falling ice.

#### **4.7.2 Sea Fisheries**

Very few in the village go to sea for fishing. The reason for not going to the sea is the frequent tidal surge, cyclone and constant threat of pirates. A fisherman named Nilkomol said,

*“We could not go for fishing to the sea because of cyclones. Cyclones became very frequent due to climate change, and it makes us very insecure. There is some weakness of weather forecasting as well, we could not do fish as we used to do even five or four years ago and feel insecure from the storm and also from sea rovers.”* (Personal communication, 12<sup>th</sup> May 2015).

Cyclones started at high-speed and mixed with the seafront waters to create high waves. These waves enter the coastal areas in a devastating manner and damage most of the infrastructures, shrimp farms and took many lives (Islam, 2004, p: 92). This kind of climatic hazards caused saline water intrusion as well.

Despite these obstacles, some of the fishermen go to sea for the sake of their

livelihood. In this aspect, shrimp farms helped the villagers innumerable. It became a new source of livelihood. Most of the women and men in the fishing community work in the shrimp farms as day laborers. Women work as weed custodians where they clean the fish.

#### **4.7.3 Shrimp ponds**

Most of the land in Khutikata village is now used for shrimp farming, but workers of shrimp farms state that shrimps farms are declining. According to the participants, increased salinity, drought and high temperature became an obstacle to the shrimp farms, as well as natural freshwater fishes. Shrimp farms are also affected by viruses from the frequent tidal surges and cyclones.

Some shrimp farmers said that they used to harvest tilapia fish in the shrimp farms two-three years ago which they cannot harvest now due to excessive saline water. According to one participant, the PPT of saline water increased to such levels that it created the virus which is nowadays affecting the shrimps. He continues by saying that,

*“The water, as well as the ground of the shrimp ponds, became hot because of the high temperature which results in the death of shrimp”* (Personal communication, 23<sup>rd</sup> May 2016). Moreover, the high temperature helps to evaporate the water of the shrimp ponds. According to the shrimp farmers and workers, this is another reason for the death of the shrimps.

People who are engaged in fishing noted that larvae in the river are decreasing. The shrimp farmers have to depend on the larva that is produced in the hatchery, but the quality of that larva is not satisfactory and causes the virus and other diseases of the

shrimp in the shrimp farms. Therefore, sometimes shrimp farmers face severe loss in their income. A shrimp farmer stated that

*“I bought around 1 acre (0.4046 hectares) of land to do shrimp farming, but after few days my shrimps got the virus. It was a total loss. It makes me frustrated. If the government would supply us a good quality of larva on time, we could do better”* (personal communication, 16<sup>th</sup> May 2015).

#### **4.7.4 General Fishery Impact**

The researcher asked one of the participants about the changes of their environment and how it affected their fishing. The participant replied that he had observed numerous environmental changes around him, and not only he but also everyone in the village had felt it. He said that temperature increased more than ten years ago, the tide became higher, and frequent cyclones showing the changed environment. The pace of the storms became very high; frequent tidal surges are seen nowadays and last but not the least, the villagers observe irregular rainfall.

The participants were asked about their perception of their future environment, and they replied that they think their future environment is going to be inferior. They have heard about climate change and also the prediction of the environmental scientist that their land is going to be under the sea in near future as the sea level is rising. They knew about these from newspapers and NGO people. These environmental changes are going to damage their livelihood and harm their habitat. One of the participants said that,

*“the weather is changing enormously; we are observing it and feeling it. My childhood memory was very sweet in this village. I saw my father use to fishing and we*

*were a happy family. We did not suffer from food insecurity”* (Personal communication, 20<sup>th</sup> May 2015). He continues that *“we use to eat koi fish. It was very big in size and was very tasty but now we this kind of fish completely disappeared because of saline water”* (Personal communication, 14<sup>th</sup> May 2015).

The participants complained about the boiling temperature and increasing drought in the summer. They explained that the temperature of Bangladesh was not like this in the summer. They stated that they had experienced the highest temperature in the summer that is around 38 to 39 degree Celsius. Rainfall decreased in the summer. Sometimes it rains excessively in the offseason, which causes flooding.

Storms and tidal surges increased more than before because of frequent depression and low pressure in the sea. One of the participants Raju Das said,

*“The height of the sea and rivers waves became very high, and the pressure of the tide is very rough”* (Personal communication, 22<sup>4th</sup> May 2015). Moreover, this discouraged them from going fishing in the sea. The livelihood of the villagers became vulnerable due to climate change. Most of the year they do not possess permanent any work for their livelihood.

Despite these problems, fishermen of Khutikata are attempting to adopt different a kinds of adaptation strategies to survive.

#### **4.8 Adaptation strategies of the fishing sector in Khutikata**

Climate change is harming the environment of Khutikata village. And the livelihood of the inhabitants becoming miserable. One of the participants stated that,

*“It is hard to live and to cope in this environment. The sea, Sundarban, shrimp*



*farms, these are everything for us. I do not want to leave my village, but I have to arrange food for my family. Therefore, I have to search for work, and if I do not get in the village I have to go somewhere else”* (Personal communication, 23<sup>rd</sup> May 2015).

The empirical evidence showed that the fishing community is adopting different kinds of adaptation strategies to cope with the changed environment.

#### **4.8.1 Cage fishing, Fish culture, and Crab cultivation**

In cage fishing process, the fishermen make a small pond and remove all the salt water from it. Then filled it with fresh water and cultivated freshwater fishes (Personal communication, 20<sup>th</sup> May 2015).

In the process of fish are cultivated with technological support. Monosex Tilapia, parse fish are some of the culture fishes. These are not cultivated in a modern scientific way but various NGOs and GO help the fishermen to cultivate these fishes. (Personal communication, 20<sup>th</sup> May 2015).

Nowadays most of the fishermen are cultivating crabs instead of fish as they can be cultivated in saline water and according to the fishermen, this is profitable (Personal communication, 20<sup>th</sup> May 2015). Fishermen took loans from different NGOs, and some NGOs provide fishing boats or fishing nets with installment (Personal communication, 20<sup>th</sup> May 2015).

#### **4.8.2 Shifting livelihoods**

However, besides the above techniques, most of the poor fishermen of the fishing community do not want to continue the fishing occupation and prefer to adopt other occupations than fishing. The reason is decreasing income in this sector which is

not supporting them. They cannot afford three meals in a day. One of the participants Neel Kanto said that,

*“It was very difficult for me to manage three times full meals for my family. However, I was undone. I had nothing to do. I have tried to take a loan from the bank so that I can start a small business. However, nobody helped me. When cyclone “Aila” came, it damaged many of my assets, my livelihood. I had nothing to do, no food in the home to eat. I was totally helpless.”*

Thus, many of them changed their occupation. For example, they started to engage themselves in agricultural work or the brick field as day laborers. Sometimes some of them run a small grocery shop. Moreover, most of the women of the village work in shrimp farms as day laborers and cleans the shrimp.

Many of the fishermen became interested in agriculture as they can use saline tolerant rice paddies, for example, BINA 10 and 8, BR 10, 20. Moreover, the seeds of these crops are provided by the government and NGOs (personal communication, 15<sup>th</sup> - 20<sup>th</sup> May 2015)

Nirmal Mondol used to be a fisherman. Presently he started working as a tailor. He got training and support from the NGO. He has now become a professional tailor, and he is satisfied with his decision. He is happy with this profession. He said that

*“I used to do fishing on the rivers, ponds and sometime in the sea but nowadays the sea became very unrest. I am now afraid of going into the sea. It is very hazardous. The fishing boat is not that much secured which could face any hazards in the sea. It is not that we have never gone to the sea and face any climatic hazards. The problem*

nowadays is the climatic hazards are becoming more disastrous.”(Personal communication, 13<sup>th</sup> may 2015). He continues by saying that,

“As the climate is continuously changing here, new kinds of problems arise every time. Therefore, the acquired knowledge sometimes became useless for us. Moreover, we suffer more than before.” (Personal communication, 13<sup>th</sup> May 2015).

Participants said that they are receiving training on sewing, agriculture, poultry and so on. Like Nirmal Mondol many of the poor fishermen are now engage in tailoring, small business or working as a rickshaw puller. They got some credit help from the NGOs.



Picture 1.10: Precursor board in the village that written “Sustainable Livelihood Venture, type of work: tailoring work” by LEDARS, Bred for world, and soil and agriculture development Institute of Bangladesh. Shop of the new tailor and the former fisherman who started his tailor occupation. Source: Author’s photograph.

The poor fishermen of the village either change their occupation, or they migrate to other places in the country. A majority portion of the participants of the research stated that they do not want their next generation to engage in the fishing occupation as nowadays it is not profitable for them. They want their children to have a good education and migrate from that place. They came to know that sooner or later their place is going

to be under water due to sea level rise.

#### **4.8.3 Shrimp farming adaptation**

The shrimp farmers use different kinds of chemicals to protect their shrimp from the virus, which is caused by excessive salinity and dirt. They consult with the governmental people and other researchers from NGOs on how to protect the shrimp. For example, they use of lime (kind of chemical) in their shrimp farm to adjust salinity of the ponds. They change the water of the ponds of shrimp farms and sometimes sell all the shrimps earlier in fear of virus attack (personal communication, 15<sup>th</sup> -20<sup>th</sup> May 2015). The shrimp farmers make walls on the sides of shrimp ponds to protect the shrimp and other fishes from the tidal surges and storms.

#### **4.9 Comparing climate change impacts and adaptations in agriculture and fisheries**

In this section, a brief comparison is given between the agricultural and the fishing sectors of the community in terms of impacts and adaptations relating to climate change. Both empirical and secondary data were utilized. This comparison is crucial for this research as one of the objectives of the study was to identify the most affected livelihood of the two sectors due to climate change, even though, throughout the study, it has been observed that both the livelihood sectors in Khutikata village are suffering from the disadvantageous impact of climate change. The comparison will be presented by the following factors:

- a) Impact of climate change
- b) Adaptation strategies

- c) Livelihood
- d) Migration
- e) Future generation
- f) GO and NGO support.

#### ***4.9.1 Summary of Impact of climate change***

Both of the agricultural and fishing groups of the Khutikata community affected by the adverse impact of climate change. However, the fishery sector seems more affected negatively than the agricultural sector. It has been found that due to increased salinity, farmers cannot harvest their traditional crops anymore. Increased salinity causes the poor production of rice crops even during the rainy season. The leaves of the rice crops became crinkled. The fertility of the soil decreased and vegetables do not grow well. Vegetables that do grow in that soil are not of high quality. Farmers can harvest only once in a year due to the salinity intrusion in the soil. Excessive temperature, cyclones, strong tidal surges, and excessive rainfall or irregular rainfall lead to the uncertain and inadequate production of rice crops. Greater salinity makes the irrigation more difficult.

On the other hand, the fishing community in the village suffers from climatic hazards and climate changes. According to the fisherman of the village who participated in the research, they used to go to the sea for fishing, but now they seldom go, as the sea became very unreliable and often their boats hit by big waves or high tidal surges. Fishes are decreasing from the mangrove areas as well because of increased salinity. On freshwater, there used to be some ponds and canals inside the village, but presently they

have no more freshwater sources. Participants said that Ruhi Carp fishes have disappeared. The fishermen feel very insecure.

It has been observed in the research area that some of the traditional fishermen who used to go to the sea are now engaged in shrimp farming, but in shrimp farms, they are again facing numerous problems due to climate change. According to the participants, with excessive rainfall or tidal surges, the shrimp ponds overflowed. Therefore, shrimps move from one farm to another which makes the shrimp farmers unsure of ownership over the shrimp. Evaporation takes place due to the extremely high temperature which lessens the water from the shrimp ponds and causes the poor production of shrimp and crabs (Personal communication, 14<sup>th</sup> May to 20<sup>th</sup> May 2015). In sum, both of the agricultural and fish sectors are adversely affected by climate change. However, farmers and fishermen are adopting different sorts of strategies to survive their livelihoods that are discussed below.

#### ***4.9.2 Adaptation strategies***

In Khutikata village the agricultural and fishing livelihoods are based on their environment, which is extremely influenced by the negative impact of climate change. As mentioned in earlier paragraphs, due to climate change farmers cannot grow many rice crops, vegetables, and fruits and on the other hand, the fishermen cannot fish as they used to do five or ten years ago.

However, presently they are adopting some strategies to overcome or cope with this situation. Farmers adopted saline tolerant crops to survive. One of the members from an NGO informed the researcher that as the country is agriculture based, therefore,

the government is conducting many studies on inventing different kinds of saline tolerant rice crops. For example, farmers of khutikata village use BR 10, 20, 30 or BIRI 47. These types of saline tolerant rice crops helped the farmers to double production of rice; farmers can use the land twice or thrice a year for production. Moreover, new kinds of vegetables and fruits are suggested by the governmental and non-governmental agricultural experts to the farmers of the village. For example, farmers are now growing watermelons, nuts, limes, fruits like kiwi locally known as shofeda and fruits like berries with the seed inside, locally known as Bau-KUL or boroi (Personal Communication, 10<sup>th</sup> -20<sup>th</sup> May 2015). A study noted that “*three-year-old Guava plants can yield 100-125 kg of fruits, and BAU KUL can yield 8-12 ton fruit per hector of lands*” (Alam, Ahammad, Nandy and Rahman, 2013, p:265). These are high harvesting fruits.

The fishermen, on the other hand, stated shrimp farming though the shrimp farm also suffers from the adverse impact of climate change. Due to excessive salinity, shrimp die. Therefore the shrimp farmers use lime and other chemicals to protect their shrimp. Many of the poor fishermen who live ‘hand to mouth’ cannot afford three daily meals nowadays, and are adopting alternative occupations. According to the poor fishermen who participated in this research, with an interest in changing their profession, and with help of NGOs, they started work like tailoring, pulling rickshaws or vans, agricultural work, day laborer in shrimp farms and so on (personal communication and field observation, 10<sup>th</sup> -20<sup>th</sup> May 2015). To summarize, it seems the agricultural community is continuing their profession with different kinds of saline tolerant, hybrid rice crops but on the other hand, comparatively, the fishing community intends to change

their profession than the farmers.

#### ***4.9.3 Livelihoods***

Livelihoods of the Khutikata villagers have been immensely influenced by the climate change, but the coping strategy related to livelihoods is different between the agricultural and the fishing sectors.

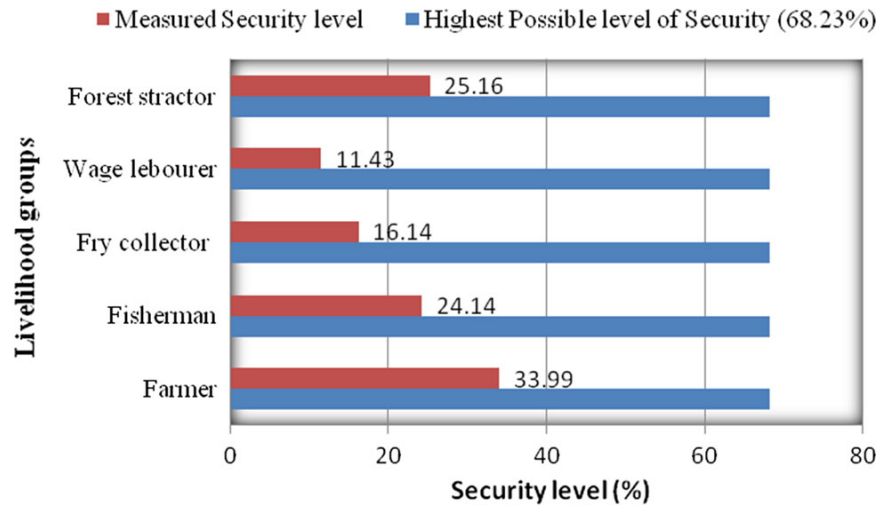
Farmers are interested in continuing their occupation. The results of empirical evidence showed that most of the middle class and rich farmers had started to harvest saline tolerant rice crops, new kinds of fruit or vegetables that suit the changed environment. The poor farmers who have no land works in agricultural land as day laborer and grow fruits or vegetables in their yard, as well as raising cattle and receiving help and training from NGOs.

On the other hand, in fisheries, the majority of the poor fishermen were interested in changing their profession, and many already had done so.

The present study found that people who are engaged in agriculture are not interested in changing to another occupation, while fishermen do wish to change, and indeed, most of the poor fishing people are already choosing an alternative livelihood. This fits with research by Mutahara and colleagues in Shaymnagar, Satkhira, exploring the effect of climate-induced storms and cyclones on the livelihood of that area. They developed a “livelihood security model” (Mutahara et al., 2016, p: 1301) and reported that agriculture is a more “secure livelihood group” than fishing (Mutahara et al., 2016, p.1310). They note that the level of livelihood security of farmers in the Satkhira district is 33.99% whereas the level of fishing livelihood security is 24.14%. These researchers



used a quantitative methodology to compare and find out the security of livelihood in two different coastal areas of Bangladesh.



*Figure 1.13: the level of livelihood security for different occupations. Source: Mutahara and Haque 2011; Mutahara et al. 2013 cited in Mutahara, Haq, Khan, Warner and Wester, 2016, P: 1310.*

Interestingly, the results above, showing that farmers wish to maintain their occupation while fishers tend to change theirs, in the face of climate change – are reflected in their feelings about the future generation. The farmer participants were interested in engaging their children in their occupation and want to continue it, while participants from the fishing community were not interested in passing on their occupation to their children, and instead, want their children to be educated and do any good well-paid job in urban areas or any small business.

#### **4.9.4 Migration**

From the empirical study it was found that migration happen in two ways, 1)

migration to other places and 2) migration into other livelihoods. As noted above, in Khutikata village most of the poor fishermen are now interested in migrating to other parts the country or the neighbor country India. Many of them already migrated to other regions of the country in search of their livelihood, often working as day laborers in the agricultural fields, and in the brick field. Many of them migrated to the cities of Bangladesh, but most migrate to Gopalgong, Barisal, Jessore, and Khulna. In India, they work in the brick fields as day laborers. Though some of them went to the port cities of Chittagong and Khulna and worked as day laborers in the shipyards. Sometimes fishermen engage in agricultural work or in other professions introduced by NGOs such as tailoring, van pulling and so on.

On the other hand, farmers of the Khutikata village are not interested in migrating to other places of the country as they adopted different kinds of saline tolerant rice crops, different fruits, and vegetables that grow in their present environment.

#### ***4.9.5 Governmental and non-governmental support***

From the field observations, it seems that the agricultural sector is getting governmental and non-governmental support comparatively more than those in fishing. The government is inventing different kinds of saline tolerant rice crops and promoting those in the coastal regions like Satkhira. Governmental and nongovernmental organizations are counseling the farmers on how to have more production in such an environment. However, the farmers are not satisfied as some of the participants said that:

*“The government does not supply the seeds on time. Therefore they have to rely on some private organizations where we have to buy the seeds with the high price.*

*Sometimes the seeds that are provided by government became very poor quality”* (Personal communication, 23<sup>rd</sup> May 2015).

In contrast, comparatively, the fishing people did not have as much support from the government as the farmers. Some NGOs are helping the fishermen by introducing different kinds of alternative occupations. One of the shrimp farmers said that *“if the government could do some research and give us good, high-quality larvae like saline tolerant rice crops for the farmers then we could do better”* (Personal communication, 21<sup>rd</sup> May 2015). Many of the shrimp farmers are suffering from excessive saline water in their shrimp farm, and due to the lack of fresh water, fishes have disappeared now.

#### **4.10 Discussion and conclusion**

This chapter was intending to explore and compare the adverse impact of climate change on the livelihood of the farmers and fishers in Khutikata village in Bangladesh, and the corresponding adaptations. The results showed that not only livelihood but also social life are affected by climate change and increased vulnerability.

It is evident from the empirical evidence that the fishing people and their livelihood are more affected than the farmers. This is because the economy of Bangladesh is agriculture based which led the government and non-governmental organizations to do more research on different varieties of crops. However, the government and non-governmental organizations nowadays are aiming to produce cultured fishes, and new kinds of techniques and scientific methods are being applied for more production of fish in the changed environment. Crab cultivation is introduced to the fishing community.

People of Bangladesh are experiencing the impact of climate change, and it is no longer a premise. They need suitable knowledge to make new viable, more proactive coping strategies to sustain their development within the community. Moreover, training, education, and continuous monitoring are needed to continue any development projects undertaken by the government or NGOs. Moreover, last but not the least, a bottom-up approach from government and NGOs is desired that give significant importance to the local people's perception, an opinion which will help to sustain the development of the communities in the long run.

**Chapter 5. Climate change versus anthropogenic impacts: resources of the  
Khutikata village based on the sustainable livelihoods approach and  
interrelationships of external actors and Khutikata community**

**5.1 Introduction**

Bangladesh's geophysical position makes it one of the most vulnerable countries in the world due to climate changes especially, in its coastal regions (Hermelings, 2010 in Ahmed, Occhipinti-Ambrogi, & Muir 2013, p: 225). In this chapter, development issues in Khutikata village will be explained, and the impact of climate change on the community, as well as their adaptation strategies will be discussed, drawing on empirical and secondary evidence. It will compare climate change and local anthropogenic impacts in terms of the environmental degradation they cause and their effect as obstacles for the development of sustainable livelihoods in Khutikata village, and the gap between the adaptation process and its implementation. In so doing, the thesis will examine the role of community-based adaptation and the applicability of the sustainable livelihoods approach.

**5.2 Assets of Khutikata village for sustainable livelihoods**

Based on qualitative methods, this section assesses the assets of the Khutikata community drawing on some features of the sustainable livelihood approach.

*i) Natural assets*

Land is a crucial natural asset, but most of the poor farmers in the Khutikata village possess the very little cultivable land (only about 0.13 hectares). The amount of

land is very small because Bangladesh is a small country of 147,570 sq km with a large number of people of 152.25 million (The Statistical Pocket Book Bangladesh, BBS, 2015, p: 3). Most of the land and shrimp farms are private except the roads, ponds, and rivers. These belong to the government of Bangladesh. The Khutikata village does not have any big rivers but it has some ponds, and all people have access to these ponds. They use them for everyday household work or sometimes for irrigation. However, villagers cannot drink the water from ponds because it is saline water. Therefore, they use to walk for three miles away from their village to collect fresh water from a nearby village. However, some NGOs have built filter stations to supply fresh water which discussed in the section of the community and the impact of climate change.

Due to frequent climatic hazards and high temperatures, most of the natural resources have declined, such as there are no fresh water ponds and freshwater fishes. Most of the land is affected by saline water intrusion. The trees of the village are not growing, and some of the vegetable plants stopped growing. One of the participants, Mr. Nishikanto, stated that mango trees and banana trees are not fully grown. He showed the researcher one of the mango trees and said that “*see how undernourished the tree is!*” he continued that, “*plants and trees do not grow like other places of Bangladesh because of excessive heat and increased salinity*” (Personal communication, 20<sup>th</sup> May 2015). However, numerous cactus plants have been observed in the village due to the desert form of weather in the area.



*Pictures 1.11: Undernourished trees due to increased salinity and cactus trees in the village of Khutikata. Source: Author's photograph.*

According to the participants, working during daytime has become almost unbearable for farmers, rickshaw pullers, fishermen and day laborers due to high temperatures. Other changes in weather such as erratic or uncertain excessive rainfall, and sudden climatic hazards, interrupted the daily income of the villagers which forces the poor villagers to borrow money from the elite individuals in the village with high interest or from Dadandars (Local money lenders). They are suffering from food insecurity as climatic hazards hamper their crop production.

The participants noted that excessive saline intrusion and sea level rise are hampering the biodiversity and assets of the mangrove forest Sundarban. Many of the fishermen went to the forest Sundarban to fish, and some people went to collect honey, nipa palm-leaves, and wood. However, presently villagers are facing the problem of the lack of fishes, trees, and honey as well. Moreover, due to kidnappers, pirates and tigers

attack people feel disinterest to go to the Sunderban which became factors to limit the access of poor people in the natural resources.

In sum, the condition of natural resources is not satisfactory which makes limited opportunities in the livelihood that are based on natural resources. In this circumstance, the role of GO and NGOs is discussed in the development section.

*i) Social assets*

The village has local government offices and twenty-nine NGOs who are working in the Khutikata village for the development of livelihood options for the poor villagers. The GO and NGOs give training on the agricultural problems, such as how to grow saline tolerant crops, proper use of pesticides or fertilizers and so on. Sometimes governmental agricultural officers visit the field and answer the questions of the farmers. GO, and NGOs also give training on shrimp farming. Such factors as saline water intrusion, sea level rise, high temperatures, erratic rainfall, and changes in seasonal periods cause the people of Khutikata village to suffer from a lack of livelihoods opportunities; therefore some NGOs presently give training on livelihoods options, such as fish culture, tailoring or any other small business, rickshaw pulling, and so on.

Most of the villagers have a membership with NGOs. With the membership they get facilities from those NGOs, such as they can attain all the necessary training, can borrow money from those NGOs and so on. The rich people in the village have political influence as they have a well relationship with different political parties. Therefore, the rich people have access to facilities more than the poor people in terms of economic, political or social supports from GO and sometimes NGOs as well. Moreover, it has been



observed that most of the participants were not interested to talk about the politics or political situation.

Therefore, with the supports, the elite people are getting more privilege while poor people are getting poorer. There is a vast social difference between poor and elite people by financial ability and political power.

*i) Human assets*

In 2011, the literacy rate of people in Khutikata village was 59.2% based on villagers aged seven years and above (BBS, community report, 2012, C\_06, p: 52).

Both		Male		Female	
Yes	No	Yes	No	Yes	No
752	519	430	238	322	281

*Table: 1.5, Literacy rate (can read and write a letter) in Khutikata village. (Source: BBS, Community Report, C\_06, and p: 52.)*

Most of the participants acknowledged that they are in need of more schools and teachers. Presently most of the NGOs are initiating educational programs for children and older people as well. The GO and NGOs are also promoting some educational programs for older people so they can at least write their name. Moreover, GO, and NGOs are working together to raise awareness of the importance of girl's education.

However, good health is a very crucial factor for the development of livelihoods. With poor health conditions, one cannot maintain their livelihood properly. At present, the people of Khutikata village are suffering from different kinds of health issues. The participants of this research reported that they are suffering from skin diseases due to

saline water. Especially women are the victim of skin diseases as they work in shrimp farms. Participants also stated that after any climatic hazards like drought, frequent cyclones and floods they suffer from diarrhea, skin diseases, and jaundice. Especially, children suffer from diarrhea. Saline water causes different sorts of gynecological problems for the women in the village. In 2008 research conducted by Khan et al. reported that the number of pregnant women who were suffering from eclampsia, pre-eclampsia and hypertension were greater in southern coastal regions than that of other parts of Bangladesh. Khan et al. also found that drinking water had been contaminated by salinity that results from these diseases (Khan et al. 2008, p: 385). Khan et al. reported in their study that the presence of the hypertensive disorder is higher among the woman who resides in coastal regions than that of non-coastal areas (Khan et al. 2008, p: 385).

Participants also complained that they are losing their hair, especially women. The researcher asked one of the participants *“don’t you think that everybody loses hair to some extent? Is there any difference?”* The participant replied, *“This losing hair is not healthy, and it is not like any other situation, I know everybody loses their hair a bit less or more, but here the case is different. Due to excessive heat and saline water, we start losing our hair earlier than any other people, and whenever I comb, I lose lots of hair. Moreover, our skin sometimes feels too dry and irritable”* (Personal communication, 16 May 2015). Some of the participants also stated that due to the high temperature they became weak, and people died out of heat stroke. Their skin color is becoming blacker.

The climatic hazards, like cyclones, are becoming more frequent and calamitous. Lightening is increasing, and many people died from it. The height of the waves in the

river has risen. The fog became very dense in the winter. Moreover, the level of salinity increased in water and air as well. When the researcher asked a participant what she meant by increased salinity in the air, she replied that they have a kind of layer of salt on their skin which in the long run results in skin diseases. In general, when someone sweats he/she got minerals as sweat, and it can be wiped off. However, in this case, the sweat is very much sticky, and when it dries, one can see the white salt on the skin. Skin diseases are very common in the area, especially in women.

Frequent cyclones and lightning caused deaths of many people. Excessive rainfall, frequent changes of weather, for example, high temperature in the daytime and suddenly cold in the night, makes fever, cough; especially children suffer from coughs and pneumonia. Participants also informed that elderly people died out of heat stroke due to excessive heat in the summer. Sometimes heat waves caused sickness for many of the farmers who worked in the field during the daytime. One of the participants said that *“we start our work in the field in the morning from 6 am to 12 or 1 pm, and again we start work from 3 pm to 6 pm when the sun is not directly giving its rays and heat to us. It is too sunny and hot weather. We feel weak as we sweat a lot”* (Personal communication, 12th May 2015).

The participants of the research stated that they went to the local doctors and sometimes buy medicines from the local market as a solution for their diseases. They had sub-district (Upazila) Health Complex where they went if they had any severe cases. The participants said that they are not satisfied with the health care from the Health complex as it does not have enough doctors or nurses to help them. They do not have enough

doctors inside their village as well. However, some NGOs are giving some health benefits to the women and children in the village. For example, NGOs educated the women of the village about the family planning.

The main cuisine in this region is rice with mashed potato, lentils (dal) or any leafy vegetables that grow in the back yard. However, due to excessive salinity, the quality of vegetables and fruits decreased. Some varieties of vegetables are already lost. Cattle, chicken, duck and fish are the source of protein. Increased salinity, high temperature, climatic hazards, privatized lands, unplanned shrimp farms caused less grazing land for the cattle, and lack of fresh water caused different kinds of diseases of the poultry farms and disappearances of many aquaculture species. Therefore, poor people and children experiencing the scarcity of food and nutritional deficiency.

The condition of women in Khutikata village is severe. As migration is considered a favorable livelihood option for the men of the village, with most of the men presently moving from the village in search for their livelihood opportunities, women of the houses are left alone with their children, and this circumstance makes them more vulnerable. Many of the women came out of their house looking for work. As Islam stated, “women did not come out for ‘women’s freedom’ but ‘in search of freedom from poverty’” (Islam, 2004, p: 110). Nevertheless, most of the poor women of the village worked as a day laborer in shrimp farms. As a day laborer, they are the victim of salary discrimination. As the man gets 150BDT, which is equivalent to \$1.50, women get 100 or 120 BDT equal to \$1. The poor female participants were asked why they get less payment than men, and they answered that women do not have strength like men - that is

why they get less payment. However, again some of the participants said that they might not possess the strength of men, but they not only work at shrimp farms but also at home. They work more than a man, but nobody understands it. However, presently they became psychologically sick and insecure. One of the participants, Bina Rani Das, said that, if men had better livelihood options in the village then her husband would not have to go outside of the village, and she would not feel insecure. She continued, whenever any climatic hazard occurs, females suffered and died more than men because women are weaker than men. They cannot run like a man (Personal communication, 12<sup>th</sup> May 2015). Moreover, women have to think about their children, and they cannot leave without them. Sometimes women sacrifice their lives to protect their children. One of the participants informed that sometimes the man of the house went some other places for work and got married over there and never came back, which is a severe irony for them. At that point of time, the victim does not know what to do or where to go with her kids. In sum, the village still has poor human assets which they need to increase otherwise it will lead their livelihoods unsustainable.

*i) Financial assets*

Many of the villagers could not start any new kind of work or business because of the lack of capital. Whatever, loan facility they got from GO and NGOs is not adequate for them, and the interest rate is high for them to bear. Villagers are not satisfied with the work of NGO's and GO as their support is limited. According to the participants, many of the organizations did not understand their need and tried to impose their decision on them.

Most of the participants in this study belong to the poor and middle class. So while they have hardly anything to put away at savings, they have an interest for savings. Most of the poor and middle-class people save their money in banks that are operated by NGOs. Some of them also save money to their own co-operative societies. For example, one of the participants said that they started a youth co-operative society which is known as “Student Club” where they give 10 tk (CAD16 cents) per month. The aim of the club is to give loans with lower or no interest, plant trees along the roadsides, to arrange entertainment for the youth of the village, such as sports or buying books, and to build a library in the future. Most of the poor people have a tendency to borrow money. Their sources to borrow money are the NGOs, Dadandars (local money lenders), the local elite people and co-operatives. Most of the time people lend money from the NGOs or co-operatives. From the field research, it has been found that many of the villagers could not start any new kind of work or business because of the lack of capital. Whatever, loan facility they got from GO and NGOs is not adequate for them, and the interest rate is high for them to bear. Villagers are not satisfied with the work of NGO’s and GO as their support is limited. According to the participants, many of the organizations did not understand their need and tried to impose their decision on them.

However, most of the participants are not interested in having a loan from GO banks because of some official difficulties, and the process is time-consuming. Moreover, it is very easy to loan money from local money lenders or rich people, but their interest rate is very high for which most of the time poor people gets into trouble. Therefore, almost all the poor and middle-class people are interested in loan money from NGOs or

their own co-operative as they face fewer problems than under engaging with GO, dadandars and the local elite.

In Khutikata village while many of the middle-class farmers work as sharecroppers, taking a lease of land for cultivation, most of the poor men and women work as a day laborer in shrimp farms and agricultural land. (Field notes collected during on-site research in Khutikata coastal village, Bangladesh). Women get 100 BDT, equivalent to US\$, and men get 120 to 150 BDT, equal to US\$1.20 -\$1.50 per day. Poor men and women also cut soil or land to make roads or dig land to make ponds as day laborers. They get paid 200 BDT per day, which is equivalent to US\$2. When the participants were asked why women get less money than men, they replied that women do not do any heavy work that needs physical strength, for example, cleaning weeds from the field, working in the fields and so on (Field notes collected during on-site research in Khutikata coastal village, Bangladesh). In sum, the quality and quantity of financial assets are poor in this village.

### *ii) Physical assets*

The Khutikata village belongs to the Kashimari Union. The total area of Kashimari Union is 8025 acres. Total households in Khutikata are 176. The houses are structured in four categories, i) pukka<sup>11</sup> (6.8%), ii) semi-pukka (1.7%) iii) kucha (91.5%) and iv) jhupri (0.0%) (BBS, community report, 2012, C\_14, p: 52). 94.2% of the people have sanitary facilities, and 4.8% have no sanitary facilities (BBS, community report,

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<sup>11</sup> Pukka refers to the houses where the floor, walls and roof are made of cement, brick, rods and so on; in semi-pukka houses floor, walls are made of brick, cement and the roof is made of tin, kucha refers to the houses where walls, floor are made of clay, husks and the roof made of nipa palm leaves (golpata) ; and in jhupri the floor made of clay or mud, roof and walls are made of husks, plastic bags, old clothes, nipa palm leaves and the roof made of nipa palm leaves (Field observation, 9<sup>th</sup> May-20<sup>th</sup> may 2015).

2012, C\_14, p: 52). People of this village are suffering from a lack of fresh water supply. Saline water intrusion contaminated the source of freshwater in the village, leading to a severe lack of fresh drinking water. The source of drinking water is shown below.

### **Drinking Water Facility**

Tap water	Tube-well	Other
0.0%	0.0%	100%

*Table 1.6. Drinking water facility in Khutikata village. Source: BBS, Community Report, 2012, C\_15, p: 52.*

From the above figure, it is evident that the Khutikata villagers have no facility of tap water or tube-well water. The other source refers to the stored rain water or water from another village. Salinity has increased in the ground water and also contaminated the surface water supply. For example, there is no more fresh water found in ponds, rivers or canals. According to the participants, high tidal surge, floods, and sea level rise had made the water saline. Due to drought, the water dried up in the summer season. In the village, women – who are responsible for all household work – have to walk around three miles to fetch fresh water from neighbor’s tube well or from the places where they can find water with a bearable level of salinity. However, fetching water from neighbor’s tube well or other remote places take a major portion of the time.

Nowadays, some NGOs took initiatives for safe drinking water supply. They have educated the community to save the rain water for the summer season. People save rain water in huge jar known as “motka” technique (personal communication, 20-22<sup>nd</sup> May 2015).





Pictures 1.12: Water filter made by NGO Shushilon. A village woman is taking water from the water filter. Source: Author's photograph.

However, research participant Mr. Kishorilal informed that the NGO known as “Shushilon” did great work for them. They built a water filter for them with which they could purify water. Nevertheless, they are still in need of more water purifier as the population is enormous and the need for drinking water is increasing.

Only 20.5% of the villagers (BBS, Community Report, 2012, C\_15, p: 52) get electricity from the government, and most of the houses nowadays use solar panels for electricity introduced by NGOs.

Based on interviews and FGD reports from the fieldwork it is found that the physical structure assets are not satisfactory. Inside the village, there is no cyclone center. During cyclones, they take shelter in the school, mosque or temple. Moreover, there is a 7.5-kilometer road that connects the Khutikata village with the Shaymngar sub-district. 5 kilometer of this road is pukka but presently the condition of this road is terrible as the pitch, and other materials of the road have destroyed. The rest of the 2.5-kilometer road which leads to the village is khacha. Even inside the village most of the road is muddy.

According to the participants, due to the muddy road, they are having troubles traveling outside the village; especially in the rainy season, the roads are flooded which hamper their business and everyday work as well.

Frequent cyclones, tidal surge, floods, excessive rainfall, caused damage to infrastructure in the village. According to the informants of this research, this included houses, roads, different religious institutions, and schools. Salinity caused weakening of the infrastructural materials of houses, educational institutions, roads, bridges and other institutions.



*Pictures 1.13: One side of the railing of the bridge has been disappeared, and another side is also damaged due to cyclone 'Aila' that occurred in 2009. Source: Author's photograph.*

One of the participants showed the researcher their bridge and said that due to Cyclone "Aila" in 2009 this bridge had been damaged greatly. No governmental help has arrived yet to renovate it. One of the participants said that they do not have any Cyclone shelter at their village. They went to the school or run off to another village to protect them if any climatic hazards hit their village (Personal communication, 24<sup>th</sup> May 2015).

According to the participants, due to different climatic hazards, their sanitation system is hampered. In the cyclone, heavy winds blow their latrines roof and fence, and their latrines flooded due to tidal surges and excessive rainfall. Moreover, salinity caused decaying of latrine's ring slab or the wall made of cement. In this situation, they make temporary latrines with bamboo or go to any bushes.

However, one of the participants of this research Mr. Kishorilal said that he wanted to make pacca latrines. Pacca latrines refer to latrines made out of cement. He said, *"I got training of how to make pacca latrines and wanted to make one. The NGO is going to help me in this regard, and I hope it will not be flooded out this time but don't know if cyclones appear"* (Personal communication, 20<sup>th</sup> May 2015).

### ***Summary***

In conclusion, it seems that the village is still in lack of the five sustainable livelihood assets. Nevertheless, different NGOs and the government of Bangladesh are planning and trying to implement different sorts of development programs for the development of the coastal areas of the country. However, there seems a complex relationship between the community, GO, and NGOs which is discussed in the development section of this chapter.

### **5.3 An analysis of climate change versus anthropogenic impacts on the community**

In this section, a comparison has been made between climate change and anthropogenic factors to explore which are more responsible for degradation of the environment and livelihoods in Khutikata village.

### 5.3.1 Climate change impacts

The research participants of Khutikata village were asked about the impact of climate changes on their environment, and they replied that they had noticed many changes in their environment that have adverse effects on their livelihood, health, infrastructures and so on. The inhabitants of Khutikata village are not environmentally illiterate. Most of the participants said that the environment of the village is going to be worse in the near future. They knew about climate change and their changed environment from their observation, experience, and also from governmental and non-governmental organizations.

Participants noted increased drought, sea level rise, saline intrusion, and irregular rainfall as a result of climate change. For example, during the winter season sometimes they feel too cold, but then suddenly they feel warm. They feel that there is no steadiness in the weather compared with even ten years ago. According to the participants, they are now experiencing only three seasons instead of six seasons. These are winter, summer and rainy season. Again, rainy season did not appear in due time, and the heat in the summer became unbearable now. However, it has been found that not only climate change but also some local anthropogenic issues are hindering their development of sustainable livelihood which is discussed below.

Climate change has its effects on the infrastructure of the village. According to Taposhi, “*climate change is not only destroying the environment of the village but also our home and our lives*” (personal communication, 14<sup>th</sup> May 2015). Here, the participant mentioned for them home does not refer to the infrastructural form rather it refers to their

personal and social life.

The farmers and the fishermen's livelihoods are dependent on the environment; therefore climate change in Khutikata village has become a vital factor for their livelihoods. Due to climate change, the communities are suffering from a livelihood crisis, health problems, freshwater problem and much more. Farmers cannot grow their local crops, such as Aman rice crop. Farmers also struggle with irrigation problems due to lack of freshwater. Most of the farmers of Khutikata village stated that their cultivable land had been affected by the adverse impact of sea level rise that results from climate change. Moreover, frequent climatic hazards like cyclones, floods, high tidal surges, and erratic rainfall hinder their cultivation.

Climate change is almost forcing these people to change their livelihood, as many villagers could not maintain their families and are obliged to change their occupation. Many of them already changed their occupation, e.g. those working as a rickshaw puller who used to be farmer or fisherman before. Moreover, many of them have become professional van drivers and transport goods in the marketplace or other villages. Some of the villagers started their own small business. Poor villagers do not have earnings for most of the year. Therefore, they are obliged to go outside of the village for work. Most of the time farmers and fishermen have gone to nearby districts of Satkhira such as Gopalgong, Khulna, Madaripur or they went to the city of Dhaka or Chittagong. Sometimes they have gone to the neighboring country, India and worked as a day laborer in the brick field as the region is very near to the border of India. Most of the participants reported that their income level became minuscule.

### **5.3.2 Anthropogenic impacts**

The previous section described how climate change had damaged the environment of Khutikata village. A description was given of the adverse effect of climate change on the life and livelihoods of the villagers. Nevertheless, some anthropogenic issues are also responsible for the degradation of the environment and become an obstacle for the sustainable livelihoods of the farmers and fishermen.

#### **Shrimp farming**

Shrimp farms are also responsible for the increased salinity in cultivable land. The shrimp farmers install saline pools in their expected land for shrimp farming which also affects other parts of the area as it increases the overall level of salinity. Therefore, many of the local rice crops have stopped growing. One of the participants said that “*shrimp farming made our land unfertile, it also polluted our ponds. We cannot have freshwater anymore*” (personal communication, 20<sup>th</sup> May 2015). However, a shrimp farmer stated that the land is already affected by salinity due to climate change, so they cannot grow as many rice crops as they used to do in the past. They need to find alternatives to maintain their livelihoods. Therefore, they began shrimp farming.

However, shrimp farms also have a positive effect. They created an opportunity for employment for the poor people of the village, especially for the women. Most of the poor women of the village work in shrimp farms as day laborers. They get 100 BDT, which is \$1.25 per day. Shrimp farming, therefore, became a source of income for poor villagers. Therefore, it can be said that shrimp farms have some benefits for the Khutikata villagers. Nonetheless, due to climate change, most of the cultivable land is

already affected by salinity. The farmers cannot produce their local rice crops; therefore, many of them started shrimp farms. However, the government of Bangladesh has invented different kinds of saline tolerant rice crops that have helped farmers of this village. In this context, it seems that climate change has the more adverse effect on the agricultural sector of the village than anthropogenic issues.

### **Population growth/overconsumption**

Salinity has increased to a dangerous level for the local fish. Most of the freshwater ponds and canals of the village have dried up or have been affected by saline water intrusion. Therefore, freshwater fishes have disappeared. The participants of the research stated that freshwater fishes like Punti (Swamp barb, *Puntius chola*), Shoul (Snakehead murrel, *Channa striata*), Gozar (Great snakehead, *Channa marulius*), Taki (Spotted snakehead, *channa punctata*), Boal (Wallago, *wallago attu*), Koi, Shingi (stinging catfish, *Heteropneustes fossilis*) and many more have already disappeared due to saline water intrusion. Fishermen cannot go fishing in the sea as they are facing frequent climatic hazards. Also, salinity intrusion in the village ponds and canals are responsible for the disappearance of freshwater fish. This is considered to be due to climate change, but also to increasing shrimp farming.

Human-induced activities result in the degradation of the environment and social life of the communities. For example, population growth and overconsumption have a negative impact on the environment as well as the socio-economic condition of the village. They put constant pressure on the natural resources of the village. According to one participant, “for the last ten years fishermen had been doubled and caught fishes

*more than the past; therefore the number of fishes had been reduced, and we cannot find fishes as we used to get previously”* (Personal communication, 23<sup>rd</sup> May 2015). This means, around five to ten years ago, only about five to ten fishermen would go fishing per day. However, nowadays thirty to forty fishermen go fishing regularly. Therefore, this puts pressure on natural resources resulting in decreases of the fish resource (Personal communication, 23<sup>rd</sup> May 2015).

### **Use of inappropriate fishing method**

Using inappropriate fishing techniques or methods has become another problem for the fishermen. Nowadays, many of the fishermen use small meshed nets for fishing. It is locally known as “Current Jal” (Ghulam Kibria, M., & Ahmed, K. K. U. 2005, p; 45). The current fishing nets are made of “monofilament fixed gill net” (Ghulam Kibria, M., & Ahmed, K. K. U. 2005, p: 45). The netting of the net is so small that the small fishes and other aquatic species cannot get through it (Ghulam Kibria, M., & Ahmed, K. K. U. 2005, p: 45). The aim of using this kind of fishing nets is to catch more fishes. However, “Current Jal” (Ghulam Kibria, M., & Ahmed, K. K. U. 2005, p; 45) not only catch fishes but also kill juvenile fish, small fish and other types of aquatic species. This causes damages to the biodiversity of the underwater world and accountable for decreasing fish population (Personal communication, 23<sup>rd</sup> May 2015 and Ghulam Kibria, M., & Ahmed, K. K. U. 2005, p; 45). Therefore it is forbidden by the Bangladesh government (Ghulam Kibria, M., & Ahmed, K. K. U. 2005, p: 45-46) but still today sometimes fishermen uses it for more profit (Personal communication, 23<sup>rd</sup> May 2015). While many of the fishermen do not want to use this “monofilament fixed gill nets”



(Ghulam Kibria, M., & Ahmed, K. K. U. 2005, p: 45) but sometimes they are bound to the money lenders or the stakeholders they work for (Personal communication, 23<sup>rd</sup> May 2015).

### **Problem of pirates and corruption**

Pirates are another problem for the fishermen who used to fish in the sea and the rivers of the mangrove forest. Recently the pirates have become very common and dangerous. They take everything from the fishermen and sometimes kidnap them. They demand an amount of money as ransom. Sometimes the fishermen have to sacrifice their lives if their family cannot provide the money to free them from the pirates. Participants said that some of the pirates reside in the deep forest of Sundarban. The fishermen who go fishing in the Sundarban are in fear of these bandits and also from the Royal Bengal Tiger. The Royal Bengal Tiger (*Panthera tigris tigris*) is the national animal of the country (Khan, 2004, p: 1 and Iftekhar and Islam, 2004, p: 123). A study by Azad, Hashem and Hassan showed that 90% people from Satkhira district were attacked by a tiger as they went to the Sundarban in search of livelihoods (Azad, Hashem, and Hossain, 2005, p: 251). According to a fisherman participant, “*you never know from where the Tiger will come from. We are going there with holding our lives in our hand*” (Personal communication, 15<sup>th</sup> May 2015). The government of Bangladesh is giving support to the fishermen to protect them from pirates of the sea and the bandits of the Sundarban, but the governmental protection is not adequate as they cannot arrest all the crooks from the Sundarban.

Fishermen have to depend only on their fate when they go fishing. Most of the

poor fishermen cannot afford a licensed weapon for their safety. However, they keep knives which are less effective against the modern weapons of the pirates and the sudden attack of tiger. Moreover, some participants stated that there are some dishonest forests officials who have connections with the pirates and help them stay inside the forest in return for bribes on a monthly basis (Personal Communication, 15<sup>th</sup> -20<sup>th</sup> May 2015). However, one of the key informants mentioned a very interesting and important issue; he stated that *“due to frequent climatic hazards many people lost their home, livelihoods, capitals, and everything. This creates an unemployment problem. Some people could not find anything, and sometime this poverty, unemployment, and overall hunger made them pirates and doing wrong things”* (personal communication, 23<sup>rd</sup> May 2015).

### **5.3.3 Comparing climate change and anthropogenic impacts on the community**

To compare the effects of climate change and local anthropogenic issues a chart is shown below. Comparison between climate change and anthropogenic effects on the community:

Issues	Impacts	Responses
<b>Effects of climate change on agriculture</b>		
Saline intrusion due to sea level rise	The decrease in rice production, vegetable, and plants. The Leaves of rice crops becomes crinkled and yellow in color. Farmers cannot cultivate crops for multiple times.	Using saline tolerant crops, putting gypsum, DMP, MOP, TSP and sometimes sugar on the soil to increase its fertility.
High temperature or dry season	Excessive heat increases the level of salinity which harms the crop production, and irrigation system becomes difficult.	Adopting the Mulchin technique and vermiculture technique to grow crops, vegetables and fruits. Farmers cut small ponds to collect rainwater which could be use later.
Hailstorm, cyclones or any climatic hazards.	Damages and breaks crops, vegetables, and newly grown plants.	Collects the rest of the crop residue.
<b>Effects of climate change on fishing</b>		
Saline intrusion due to sea level rise.	Due to excessive virus spread out and kills shrimp and crabs. Cultured fish like Rohu and Carp fish dies.	Adopting different strategies such as, cage fishing, fish culture, and crab/ shrimp cultivation.
Tidal surge, excessive rainfall	Shrimp ponds flooded away due to the tidal surge. Sudden excessive rainfall can decrease required level	Shrimp farmers increase the bank's height of the shrimp ponds which

Issues	Impacts	Responses
	of saline and oxygen from the shrimp ponds which kill shrimp.	could prevent the shrimp being flooded away or mixed with other ponds.
Hail storms, lightning, cyclone and other climatic hazards	Sometimes the large size of hails kills shrimp, crabs, fishes and other aquatic species. Cyclones and other climatic hazards damage the shrimp ponds. Freshwater species has already disappeared.	Prays to God for his mercy.
<b>Effects of climate change on livelihoods</b>		
Saline intrusion	Farmers cannot cultivate land for agricultural purpose due to the excessive saline intrusion in the cultivable land.  Fresh water fishes disappeared, shrimp production decreases which is insecure the fishermen's livelihood.	Farmers are using saline tolerant crops, vegetables and fruits.  Many of the fishermen are interested to shift their livelihood. They are doing tailoring, van pulling and so on. Sometimes poor farmers and fishermen went to other places inside the country or neighboring country India to work as a day laborer.
Frequent cyclone, tidal surge, high temperature, drought and other climatic hazards	Many of the farmers lost their land due to saline intrusion and devastating climatic hazards. Fisherman cannot go to work which decreases their daily earning. Agricultural and fishing livelihoods are in danger as the	Poor farmers and fishermen took loans from NGOs or elite people of the village. They also make co-operatives with the support from NGOs.

Issues	Impacts	Responses
	<p>climate is becoming unfavorable towards their work. Cattle die due to the scarcity of food and water which increases the insecurity and vulnerability of women's earnings in the society. Decreases work of day laborers from the agricultural field and shrimp farms. This entire situation creates food, fresh water, and livelihood insecurity.</p>	<p>Waits for relief. Changing their livelihoods or went to other places in search of work, like day laborer in brick fields and so on.</p>
<p><b>Climate change induced other effects</b></p>		
<p>Saline intrusion, high temperature, floods, frequent climatic hazards such as drought, cyclones, tidal surge and so on.</p>	<p>Health: Skin diseases, excessive hair loss, increased gynecological problems.</p> <p>Freshwater supply: Decreased freshwater supply as rivers, ponds, and canals dried off.</p> <p>Infrastructural problems: Due to climatic hazards sanitary materials, houses damages. Loss of village infrastructure; for example bridge, embankments, roads and so on.</p>	<p>Different NGOs are supporting by giving health care facilities, education on primary health care and gynecological issues of women.</p> <p>NGOs such as, Shushilon, LEADERS, Nakshikatha helped to make a saline water filter for drinking water supply in the village.</p>
<p><b>Effects of local anthropogenic activities on agriculture</b></p>		

Issues	Impacts	Responses
Unplanned shrimp farming	Increases the level of salinity in the cultivable land which damages the crop production. Vegetables and plants do not grow.	Raising awareness on how to protect their environment and how it can be saved from being more damaged, the instance to protect the “Shota” canal in the village is an example of how the people came together and protest against the elite shrimp businessman who wanted to transform the canal for shrimp farming.
Socio-political corruption	Rich, local elite or absentee shrimp businessman holds political powers which lead them to occupy lands of poor farmers for their shrimp farming. Therefore, many farmers lost their lands	
<b>Effects of local anthropogenic activities on fishing</b>		
Unplanned shrimp farming increases saline level	Unplanned shrimp farming causes lack of fresh water and disappearances of freshwater fishes.	
Problem of pirates on the sea and kidnappers of the forest	Fisherman feels insecure to go to the sea as the pirates attack them and take all of their earnings, fishing boats and fishing equipment. Fisherman also feels insecure to go to the Sundarban forest as kidnappers kidnapped them and charged for ransom	

Issues	Impacts	Responses
<b>Effects of local anthropogenic activities on livelihoods</b>		
Unplanned shrimp farming	Unplanned shrimp farming increases the level of salinity in the cultivable land and also contaminated the sources of fresh water which limits the opportunities for farming and fishing livelihoods. However, people employed in shrimp farms, especially women as day laborers but the payment is lower than man.	GO and NGOs are supporting the community to have alternative livelihoods options.
Lack of governmental support, lack of infrastructural development and maintenance	There exists a lack of maintenance of infrastructure in the village from the government. For example, the villages still have roads made of mud which gets flooded in the rainy season and makes the problem of transportation. This damages their everyday livelihood procedure. The government did not repair the only embankment they have for the last five years. Still, the village did not have any cyclone center. Honey, wood collectors, and fishermen feel insecure to go to Sundarban for their livelihood due to the attack of kidnappers. The police force is not enough for their security.	Supporting the villagers to make network with government, for example, the memorandum to protect the “Shota” canal was given to government with the help of NGOs.
<b>Other effects of local anthropogenic activities</b>		

Issues	Impacts	Responses
Unplanned shrimp farming	<p>Health: Working in shrimp farm caused people skin diseases.</p> <p>Freshwater supply: Decreasing freshwater supply as many ponds or canals contaminated by saline water from shrimp farms.</p>	Giving education on family planning, gynecological issues and other health issues.

In light of what has been discussed above, it is difficult to explain which factors are more responsible for the vulnerability, environmental damage, and development of livelihood problems of Khutikata villagers. Nonetheless, it seems both anthropogenic issues and climate change are responsible for the degradation of the environment and livelihoods of the village. However, regarding climate change the community-based adaptation is supporting the community to some extent in terms of adapting different types of strategies or techniques to cope with the changed environment and continue the development of sustainable livelihoods. On the other hand, regarding anthropogenic issues there are community-based responses supporting the community to raise awareness on their environment and how it can be saved from being more damaged? The case of protecting the “Shota” canal in the village is an example of how the people came together and protested against the elite shrimp businessman who wanted to transform the canal for a shrimp farm (discussed below in the section of NGOs development program). Both the government and NGOs are also working for educating villagers for family planning



which could contribute to controlling overpopulation.

#### **5.4 Development in Khutikata village as response to impacts of climate change and anthropogenic drivers**

Khutikata village is located in the most climatic hazard prone and vulnerable coastal region of Bangladesh. Climate change and frequent climatic hazards are affecting their livelihoods and the development of the village. The researcher asked about participant's perception of the concept of development, and most participants stated that development is to have sustainable livelihood with which they can afford three meals each day and other necessary things like health care, education for their children and maintenance of their household. However, in this village, most of their livelihoods are environmental based, like agriculture, fishing or collecting honey from the forest. Presently due to climate change, frequent climatic hazards and anthropogenic problems these professions are in danger. However, there are efforts of the government of Bangladesh and the non-governmental organizations to overcome these problems that the people of Khutikata villagers are facing.

##### **5.4.1 Governmental development programs**

The government of Bangladesh is supporting its agricultural sector as agriculture is the major economic source of the country. However, due to climate change and anthropogenic causes the agricultural sector and fishing sector of the coastal area is in danger. Saline intrusions, irregular rainfall, and a lack of fresh water supply for irrigation, are the obstacles that hinder sustainable development in agriculture. Moreover, anthropogenic issues like population growth, unplanned shrimp farming, and

overconsumption create massive pressure on natural resources. In this regard the prime minister of Bangladesh initiated the Climate Change Strategic Action Plan in 2009 where 44 development programmes were undertaken to build the capacity to adapt to the impact of climate change (Habiba et al. 2015, p: 31). Multi-Donor Trust Fund was also created. It has been reported that the government of Bangladesh has urged leaders of seventy-four countries to support Bangladesh with its inventions of high yielding crops which can adapt to climate change impacts and will make the country self-sufficient in the next 25 years in food sector (Habiba et al. 2015, p: 31). The Rice Research Institute of Bangladesh has invented varieties of saline tolerant rice crops. The government of Bangladesh has formed the National Climate Change Fund (NCCF) (Habiba et al. 2015, p: 33). A loan system has been developed by the government for poor farmers. The Bangladesh Bank and the Central Bank of Bangladesh have decided to distribute US\$1,616,113,744.07 (BDT 12,617 crore) to the poor farmers in 2010-2011. The amount of loan increased to US\$1,767,644,421.67 (BDT13, 800 crore) in 2011-2012 (Habiba et al. 2015, p: 34). The government started subsidies for poor farmers from 2001. The “Agriculture Input Assistance Card” was introduced by the government of Bangladesh, so poor and middle class farmers can have subsidies directly from the bank as they do not need to go to any middleman for the subsidies. The middlemen used to take most of the subsidies and poor farmers were left with little of it. Presently, the farmers have no need to depend on the middlemen to collect their subsidies. In addition, poor farmers can also open bank accounts with only US\$ 1.28 (BDT 10 tk.) with the card; they do not require any identification (Habiba et al. 2015, p: 34).

The government also initiated a Master Plan for the coastal zone of the country. The aim of this Master Plan is to increase the productivity of rice crops, enhance the fishery sector, managing of salinity intrusion, and so on (Habiba et al. 2015, p: 35). The government launched “Vision 2021” to enhance “the social and economic wellbeing of all Bangladeshi citizens” (Habiba et al. 2015, p: 35). The government of Bangladesh also supplies fertilizers and seeds at a low price so that poor farmers could buy it easily. Moreover, the government took initiatives to improve the agricultural sector, ensure food security and employment through the National Strategy for Accelerated Poverty Reduction (NSAPR), National Agricultural Policy (NAPA) and Millennium Development Goal (MDG) (The government of Bangladesh, Ministry of Finance, chapter 7, 2012-13, p: 83). The governmental agriculture officer gives training to the farmers on how to grow high yielding hybrid crops, tools, and techniques on the usage of pests, fertilizers, and also went to the field on a monthly basis to observe if farmers have any problems or questions regarding their agricultural work.

The government of Bangladesh is also working to protect and preserve the fishes of the country. In this regard, fishing is not permitted during the rainy season (from June - August) as it is the breeding season for the fishes. In this season the government gives forty kg of rice and three to four thousand BDT that is equivalent to \$50-\$60 as a subsidy (Personal communication, 10-20<sup>th</sup> May 2015).

#### **5.4.2 Participant’s perspectives on governmental initiatives**

The participants of this research stated the governmental programs are not satisfactory for them as most of the programs are not implemented yet. According to the

research participants, the programs from the government are not always useful for them. The researcher asked one of the participants, Bimal Kanto Sen, what kind of governmental help they got, and he replied that “*Over the last five years, the government helped them to make a road. While building the road, few poor people in the village got the chance to work as a day laborer. They used to cut the soil for making the road, but this work lasted only for 40 days*” (Personal communication, 3<sup>rd</sup> May 2015). In those days few people of the village got work to survive. Moreover, due to internal corruption very few families got the facility from the government by having the Vulnerable Group Feeding (VGF) card and Vulnerable Group Developing (VGD) card. With the VGF and VGD card, people get some food every month, in a ration system. People who are extremely vulnerable and poor, frequently affected by flooding or storms in the climate-vulnerable areas, are chosen by Government for appropriate VGF and VGD card.

The government also launched the Social Safety Net program (SSN). In this program, the government provides financial subsidies such as elder allowance, a widow allowance, a freedom fighter allowance, and a disability allowance in Khutikata village. The allowance is 300 BDT per month which is equivalent to CAD\$5. According to most participants of this research, this allowance is not enough to meet their monthly expenses.

Most participants argued that the government not helps them in the development of sanitation and fresh water supply, which is a significant problem for them. Again, they complain that Khutikata village has an embankment on the Kopotakkho River, 45 km away from the village, to protect the community from tidal surges and floods. However, this embankment is not in a suitable condition now. Bimal Kanto Sen said that “*The*

*Governmental Water Development Board irregularly repaired it and did not help them sufficiently to overcome the environmental hazards”* (Personal communication, 5<sup>th</sup> May 2015). The participants also said that they are in urgent need of fresh water supply and well-constructed roads because in the rainy season the road becomes muddy and it sometimes gets flooded. Therefore, most of the participants argued that the governmental support not be sufficient for them.

#### **5.4.3 Non-governmental development programs**

More than twenty-nine non-governmental organizations are working in this region for the improvement of the living condition of farmers and fishermen in Khutikata village. Some of these non-governmental organizations are Leaders, Sathkhira Unnoyn Shongstha (SUS: Sathkhira Development Organization), Gonomukhi Shongstha (Development Organization for People), Shushilon, Nokshikatha, Bangladesh Resource Center for Indigenous Knowledge (BARCIK), Bangladesh Center for Advance Studies (BCAS), World Vision and much more.

According to the participants most of the people of Khutikata village are satisfied with the work of Leaders, Sathkhira Development Organization and Bangladesh Resource Center for Indigenous Knowledge (BARCIK), Shushilon, and World Vision are locally well known because World Vision worked after the cyclone “Aila” but recently it stopped working because of a lack of money from donor agencies; BARCIK worked for the benefit and wellbeing of the community with participation of the community; Shushilon helped the villagers to make a water purifier for fresh water supply.

People of the Khutikata village are not environmentally illiterate and are

concerned about their environment as it is their source of livelihood. Due to climate change, the villagers of Khutikata village have employed some adaptation strategies to survive, but faced with unplanned shrimp farming, they rarely could do anything as most of the shrimp farm owners were very powerful both economically and politically. However, with the support of non-governmental organizations, the poor and general people of the community became unified, and the whole community took proper steps to protect their village environment. In this aspect, the NGO Bangladesh Resource Center for Indigenous Knowledge (BARCIK) supported and encouraged the community to stand against the people who built the embankment for saline water intrusion in the Shota canal for shrimp farming. It is one of the achievements of the community to protect their environment.

The wealthy elite and politically powerful people of the village have occupied most of the land, ponds, and canals of the village for shrimp farming. These elite communities have large-scale shrimp farm businesses. Most of the ponds and canals are contaminated by salt water. However, one canal locally known as Shota is the only source of freshwater for the villagers. The elite group of the village made an embankment on the Shota canal, which has resulted in water logging. After that, they were about to make saline water intrusion in the canal for their shrimp farming. This act of the elite people was going to increase the salinity in the cultivable land of Khutikata village and for villagers could no longer use the water of that canal. In 2013, with the help of the NGOs Leaders, and BARSICK, people of Khutikata, not only arranged a protest and procession and news conference but also sent a memorandum to the local administrative

governmental office (locally known as Upojela Nirbahi Officer, UNO). In the memorandum, they urge the government to stop mixing the saline water with natural freshwater. The whole community, except the local elite people, participated in this movement. As a result, the government took the step and stopped the action of mixing saline water in the Shota canal. This act of the villagers clearly shows their concern for their environment and unity to protect their mother nature.

#### **5.4.4 Participant's perspectives on NGO initiatives**

Most of the villagers were content with the initiatives taken by NGOs like BARSICK, World Vision, and Shushilon, to protect the "Shota" canal. World Vision helped the villagers after the devastating storm "Aila" and trained the victims of Aila to adapt to the changed environment. World Vision also supplied the villagers with cattle, rickshaw, vans, agricultural materials, fishing materials and a small amount of capital for small business. Therefore, most of the villagers are very content with the works of World Vision.

However, according to key informants, most of the poor inhabitants of Khutikata village are not satisfied with the work of organizations which supplied loans with high-interest rates. When the villagers, who had taken the loans, could not pay the interest on time, the organizations started to put pressure on them. The researcher asked the participants if this is the case then why did they take loans with high-interest rates? The participants replied that in the bank they face some difficulties on the paperwork or the loan procedure sometimes took a long time for which most of the time they do not feel interested in going the bank. Moreover, sometimes they had no other sources to have

some financial support; therefore they became bound to take some loans with high interest.

#### **5.4.5 The community and GO/NGO interventions**

According to the participants of this research, most of the people in the village are struggling with financial problems. As the main occupations of Khutikta village are agriculture and fishing, while the farmers and fishermen are highly professional in their work, still these sectors are heavily dependent on the environment. Due to climate change, frequent climatic hazards, unplanned shrimp farming, population growth, overconsumption and unemployment problems, people need to adapt to the changed environment and to have sustainable scientific-technological supports with which they can survive. Hence, they are not only in need of different types of training, such as Community Based Adaptation (CBA), and training for agricultural work and fishing, but also in need of financial support. With the financial support, they can do any alternative work or run a small business to sustain their household and families.

Most of the villagers would like to have continuous monitoring of the projects and plans introduced and implemented by GO and NGOs to sustain and improve their livelihoods. On the other hand, villagers also complained that a lack of proper communication with GO and NGOs is a problem for them. For example, one NGO gave vans to many of the poor people affected by “Aila” but did not conduct a proper feasibility study to determine if they really needed those vans or not. Therefore, the project was not successful. In fact, most of the people of Khutikata are farmers or fishermen, who do not know how to drive a van or any vehicle. Moreover, the villagers



do not need vans all the time, but only for selling their products to other villages or going outside of their village. Most of the villagers walk for their daily routine work, so vans were not their primary concern. Their primary concern was related to their livelihood in agriculture and fishing.

However, on the positive side, villagers get useful advice on sanitation, health, fresh water and family planning from NGOs. People used to go to different NGOs to acquire new scientific knowledge and training on CBA, tools, and techniques for sustainable agricultural production or fishing. Many of the villagers are members of these NGOs, for example, Shushilon or Nokshikatha and the Integrated Waste Management (IPM) organization.

According to some participants, the training, tools, and techniques they get from the CBA training help them in the improvement of their livelihoods, including agriculture, fisheries, poultry, cattle rearing and small business. They also received a small amount of capital and other materials from the NGOs, for example, seeds, fertilizers, pesticides and so on. However, these are not enough for their sustainable livelihood, and many of the people who are really in need of this help do not get it from the NGOs. As one of the participants, Mukesh Chandra Das, said: *“People who have good relations with the governmental workers in offices or with NGO are favored more than other people”* (Personal communication, 20<sup>th</sup> May 2015).

There exist a complex relationship and a climate of distrust between the GO, NGOs, and communities. Some concerns about community attitudes arose from those intervening in the village. For example, with Khutikata village located in one of the

climatic disaster prone areas of Bangladesh, according to NGO officials, the villagers get relief after any climatic disaster. One of the participants from an NGO stated that *“plenty of relief makes villagers dependent on relief. Whenever the poor villagers see any NGO people, they think that they are here to distribute relief.”* (Personal communication, 12<sup>th</sup> May 2015).

This NGO officer also stated that *“Whenever the villagers get relief for the improvement of their livelihood, for example, cattle, vehicles, or any other commodities, they sold it.”* (Personal communication, 12<sup>th</sup> May 2015). The reason for selling the relief items is that they think if they keep the relief material, they will not get more relief from other NGOs or GOs. According to the NGO officer, *“people in that village are not financially solvent, and these kinds of activities where they sell or hide their relief items; the sustainable development projects from GO or NGOs are not sustained”* (Personal communication, 12<sup>th</sup> May 2015).

In particular, the farmers and fishing groups are not satisfied with the work of GO and NGOs, while on the other hand, the GO and NGOs complain about the non-cooperative attitudes of the villagers. However, according to this research, the villagers are not non-cooperative but rather – due to poverty, environment dependent livelihoods, and an unfavorable environment – they feel insecure regarding basic needs of human life, such as food, clothing, shelter, education and healthcare. Therefore, whenever they receive any relief or financial supports from any GO or NGO they would like to store it as much as possible to secure their life and livelihood.

## **5.5 Conclusion**

The first objective of this chapter was to provide information on how the whole community of Khutikata village is suffering from the adverse effects of climate change and to compare the effects of climate change with the anthropogenic impacts on the inhabitants. On the one hand, sea level rise, saline intrusion, erratic rainfall, excessive rain, flooding, and frequent cyclones can be the results of climate change, while on the other hand, a lack of knowledge, unplanned shrimp farming, unemployment problems, pirates, population growth, and overconsumption are among the anthropogenic issues that have been affecting the environment, life, and livelihoods of the village. However, some human activities can have certain positive effects. For example, shrimp farming is supporting many poor families of the region as it provides employment opportunities to the villagers, especially women. Therefore, the answer in comparing climate change and anthropogenic impacts is complicated, in terms of their relative effect on the environment and livelihoods of the villagers.

The second objective of the chapter was to explore the aspect of development, in which the villagers are still struggling to maintain their basic needs, and to examine the complex relationship existing in-between the community, GO, and NGOs which in turn sometimes hinders the development process. There is a tendency of blaming each other rather than coming up with new ideas to co-operate with each other for the sake of development and to protect the environment. Hence, the participants of the village desire that the government should take immediate actions to make a better plan for shrimp farming and educate people about shrimp farming, and to upgrade its police force at sea

and in mangrove areas to protect people from pirates. Moreover, the government and NGOs need to work cooperatively and create new job opportunities for the poor and young people which will enhance the socio-economic development of the inhabitants. A clear and transparent relationship needs to build up between the GO, NGOs and the village where everyone can listen to each other's voice. This transparent, communicative relationship will assist the government to upgrade and create new development policies to protect the environment and develop the well-being of the coastal communities.

## **Chapter 6. Conclusion and Analysis**

The research of this thesis started with the attempts to examine and understand the role of community-based adaptation for the development of sustainable livelihoods in a coastal village of Bangladesh. This was crucial because the country is facing unfavorable impacts on livelihoods due to climate change and related local anthropogenic issues.

This chapter sums up the analysis and conclusions. The research concerned climate change and local anthropogenic issues, communities' response towards the adverse effects of climate change and local human activities, their livelihoods, and coping strategies to sustain the development of their livelihood. The research included assessment of whether the agricultural or fishery sectors were most affected in the coastal area of Bangladesh.

From the literature review and empirical study, it has been proven that both the agricultural and fishery sectors in the village are adversely affected by climate change as well as local human activities. However, comparison has been done because Bangladesh is an agriculture based country and the government policies prefer agricultural activities than fisheries. For example, Bangladesh has inland floodplain areas crucial for “biological management of fish production” (Hossain, 2015, p: 115) but the government cultivates crops in those lands (Hossain, 2015, p: 115). Moreover, it has been reported that “loss of wild and farmed fish stocks has been long going on. There are conflicts among different water users and irrigation to crop fields always gets the priority” (Hossain, 2015, p: 122). Therefore, this comparison explored whether the agricultural or

the fishery sector was most affected due to climate change and local anthropogenic issues in the southern coastal part of this country. The result of the research is that relatively, the fishery sector needs more attention from the government and NGOs of Bangladesh.

According to literature review, it is clear that climate change is not a presumption anymore. It is happening, and the most affected areas are the developing countries, especially the coastal regions (IPCC, 2007 in Cannon and Mahn, 2010). Climate change has a relationship with development as climate change becomes an obstacle for the development process (Berkes et al. 2003; Anderies et al. 2006). Regarding the issue of climate change and development; adaptation and mitigation have been given more importance by the climate experts (Tanner and Mitchell, 2008). Researchers like Huq, Burton, Agarawala, Reid and many more climate change experts are giving more emphasis on adaptation approaches to control the present situation and development of livelihoods (Haq and Burton 2003, Haq et al. 2003, Agarawala cited in Haq and Reid, 2004). However, there has been a huge debate on the need for adaptation approaches for development; especially for climate change, do we need any adaptation approach? For example, Lisa F. Schipper has emphasized a vulnerability reduction approach for development (Schipper, 2007). Watson and Ackermann (2000) stated that any developmental policies for climate change are unnecessary (Watson and Ackermann 2000 in Schipper, 2007, p: 8). Therefore, one of the research questions and hypothesis of this thesis was to find out how does adaptation (community-based adaptation) is supporting the Khutikata's agricultural and fishing community? The research shows how the environment, livelihoods, and everyday life of Khutikata village are negatively affected

by climate change issues, such as saline intrusion, frequent climatic hazards, change in seasons and so on. In this circumstance, the research found that community-based adaptation is supporting the community people to some extent but it is not the ultimate solution for their sustainable livelihoods development. Therefore, concrete development policies regarding climate change and its proper implementation are extremely necessary. Regarding local anthropogenic issues, the community-based responses support the community people to increase their awareness about survival strategies and sometimes raise their voice to protect their environment. The example to protect “Shota” canal is one of them that is discussed briefly in chapter five.

To do this research, some aspects of the sustainable livelihood approach and community-based adaptation approach were adopted. From the secondary review and empirical evidence, the key findings of this study are discussed below.

One of the hypotheses of this research was to identify if climate change is more responsible for the adverse affects on sustainable development of livelihoods and environmental degradation. However, this research disproves the hypothesis and found that both climate change and local anthropogenic issues are responsible for the degradation of environment and negative impact on the sustainable development of livelihoods. Climate change has already adversely affected the life and livelihoods of the people of Khutikata village. High temperature, erratic and excessive rainfall, sea level rise, salinity intrusion, and frequent, devastating climatic hazards affected the crop production, production of local vegetables, fruits, trees, and decreased fertility of the soil. Moreover, the freshwater supply has been lost. There are no freshwater ponds or rivers,

and freshwater aquatic species are gone as well. According to sustainable livelihoods approach these conditions reflects the lack of natural assets of the village.

However, human activities, such as unplanned shrimp farming, overpopulation, use of inappropriate fishing methods, pirates/kidnappers in the sea and Sundarben forest, socio-political corruption, and lack of infrastructural development are responsible for further limiting the opportunities of livelihoods for the villagers (discussed in chapter five). Therefore, it appears that the village is still in lack of physical and human assets respectively.

A complex relationship exists between the villagers, non-government organizations and the government. Participants from NGOs think that people in this region are poor and vulnerable due to climatic hazards and climate change. Therefore, many NGOs are working to support them regarding financial and social issues with the help from donor agencies. However, some of the participants from NGOs stated that help (national and international reliefs) is making the villagers lazy and relief dependant. Nevertheless, the opinion of the participant from the local governmental office was neutral.

On the other hand, the participants from the village stated that they do not have enough natural or financial resources to sustain their livelihood. People from the government and non-government organizations are not always cooperative. After any climatic hazard, the affected people did not get any relief on time, and even if they do get relief, it is not enough for them. Furthermore, the elite and powerful persons of the village get the authorization and controls of the relief materials, but sometimes they store



them for sale.

However, shrimp farming is profitable. Even if a farmer does not want to sell their land for shrimp farming, the elite shrimp businessmen occupy all the nearby surroundings land which forces the farmer to sell their land at last because the salinity of shrimp farms contaminated the targeted cultivable land. The complex relationship between the poor villagers, GO, NGOs and elite people of the village indicates there is still a lack of financial and social assets.

All these lead to another finding of this research which is, most of the poor participants are not interested in continuing their forefather's profession, whether that is agricultural or fishery work. It seems that the productivity of both the fishermen and agricultural farmers has been depreciated due to climate change and local anthropogenic issues, although comparatively with the support of NGOs and GO, the farmers are getting used to cultivating saline tolerant crops, vegetables, and fruits. Fishermen are also adopting different kinds of adaptation strategies introduced by the GO and NGOs but it appears that the options are limited compare to the agricultural sector. Furthermore, support from the government and non-governmental organizations are not enough for them.

From the field research, some recommendations are provided for the better opportunities for livelihoods and lives of the poor communities of the Khutikata village.

- i) The villagers are in need for infrastructural development. Poor infrastructure like muddy roads, lack of maintenance of embankment, lack of cyclone centers, lack of fresh water supply and so on make their

livelihoods as well as lives difficult.

- ii) The government, NGOs, and villagers need a cooperative, transparent relationship between them. The GO, NGOs need to value the villagers' opinions on their life and livelihoods.
- iii) Continuous monitoring and development of the police department are needed in the coastal zone to arrest the pirates and forest kidnappers to make an easy access to the Sunderban forest fisherman, honey and wood collectors of the village.
- iv) The government needs to create and identify more options for livelihood opportunities in the saline prone coastal zone like Khutikata.
- v) There should be a security zone for the honey, wood and leaf collectors and fisherman so that they can save their lives from the attack of the Royal Bengal Tiger in Sunderban area and continue their livelihood.
- vi) The government and NGOs need to grow social awareness not only on the negative impact of climate change but also on the adverse impact of local actions, such as unplanned shrimp farming, over catching of fishes and so on.
- vii) The government of Bangladesh needs to listen to the voice of the vulnerable, marginal and poor people.
- viii) Government and non-governmental organizations should raise their voice to show the international bodies the present situation and future scenario of Bangladesh due to climate change and take their actions

according to it.

- ix) Above all, the government of Bangladesh and NGOs needs to give higher priority to invent some techniques or methods to identify the progress of development of each regions in the country so that they can measure and compare the consequences of development and act according to it.

Above all the outcome of the literature review and empirical research of this thesis is that there is an urgent need for separate development policies and its proper implementation for climate change affected people. The Bangladesh Government has already initiated Climate Change Strategic Action Plan in 2009 (Habiba et al. 2015, p: 31) and many more (discussed briefly in chapter five) but no matter how many policies the government of Bangladesh or international bodies are going to make if the policies are not properly implemented on appropriate time with the concern of the affected communities then the policies are of no use.

It is hoped that this thesis will contribute to the development issues related to climate change and local human activities in developing countries. The thesis portrays the current condition of Khutikata coastal village of Bangladesh, and the negative impact of climate change and local anthropogenic issues. However, it should be well noted that Khutikata village does not necessarily represent the situation of development of sustainable livelihood of Bangladesh's entire coastal belt. Therefore, there is still scope for further in-depth research in this field to explore the conditions of the development of livelihoods in other coastal areas of this country.

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## Annex A Proposed questionnaires Guideline

### Proposed Interview Questions for local farmers, peasants.

**Research Title:** “Climate change or local anthropogenic impacts? Comparing effects on livelihoods and sustainable development in a rural coastal village of Bangladesh”

**Principal Researcher:** Subrina Tanjin Buly, International Development Student, Saint Mary’s University, 923 Robie Street, Halifax, Nova Scotia B3H 3C3, Canada, Telephone. +1 (902) 802-3294; E-Mail: [subrina\\_tanjin.buly@smu.ca](mailto:subrina_tanjin.buly@smu.ca); or, [subrinatb@gmail.com](mailto:subrinatb@gmail.com)

যোগাযোগ তথ্য:

প্রধান গবেষক: সাবরিনা তানজিন বুলি, ইন্টারন্যাশনাল ডেভেলপমেন্ট এর মাস্টার্স ছাত্রী, সেন্ট মেরিস বিশ্ববিদ্যালয়, ৯২৩ রবি স্ট্রিট, হ্যালিফ্যাক্স, নোভা স্কোশিয়া, B3H 3C3, কানাডা. ফোন:+1-902-802-3294, ই-মেইল: [subrinatb@gmail.com](mailto:subrinatb@gmail.com)

**Supervisor:** Dr. Tony Charles, Management Science and Environmental Science Saint

Mary’s University, 923 Robie Street, Halifax, NS B3H 3C3

Phone: (902) 420-5732; Fax: (902) 496-8101, [tony.charles@smu.ca](mailto:tony.charles@smu.ca)

সুপারভাইজার: ডঃ টনি চার্লস, ম্যানেজমেন্ট বিজ্ঞান ও পরিবেশ বিজ্ঞান সেন্ট মেরিস বিশ্ববিদ্যালয়, ৯২৩ রবি স্ট্রিট, হ্যালিফ্যাক্স, নোভা স্কোশিয়া, B3H 3C3, কানাডা।

ফোন: + 1-902-420-5732; ফ্যাক্স: + 1-902- 496-8101,

ই-মেইল : [tony.charles@smu.ca](mailto:tony.charles@smu.ca)

### **Proposed question for agricultural people (Farmers, peasants):**

কৃষি মানুষ (কৃষক, কৃষক) জন্য প্রস্তাবিত প্রশ্ন:

1. Name.

নাম

2. Age.

বয়স

3. Sex.

লিঙ্গ

4. Level of education.

শিক্ষাগত যোগ্যতা

5. How many family members you have?

পরিবারে কয়জন সদস্য

6. For how many years have you lived in this community?

আপনি কত বছর ধরে এইখানে আছেন?

7. Have you lived here since you were born?

আপনার জন্ম কি এ গ্রামে?

8. If you did not born in this village from where did you came and when did you move to this village?

আপনি কি এ গ্রামে জন্ম নিয়াছিলেন নাকি অন্য গ্রাম থেকে এসেছেন? কবে এসেছেন?

9. For how long you have been related with fishing as livelihood?

আপনি কতদিন ধরে এ পেশাই আছেন?

10. Do you see any changes in this area regarding agricultural environment ?

আপনি কৃষি পরিবেশ সংক্রান্ত এই এলাকায় কোন পরিবর্তন দেখতে পান?

11. For how many years have you lived in this community?

আপনি এইখানে কতদিন যাবত আছেন?

2. Have you lived here since you were born?

আপনি কি জন্ম থেকে এইখানে আছেন?

3. If you did not born in this village from where did you came and when did you move to this village?

যদি এখানে জন্ম না নিয়া থাকেন তবে কথা থেকে এবং কবে এসেছেন?

4. Do you work for someone or are you self-employed?

আপনি কি অন্য কারো জন্য ইজারা এ কাজ করেন নাকি আপনি স্বনিযুক্ত?

5. What paying arrangements you have as you work in someone's farm?

মহাজন আপনাকে কেমন পারিশ্রমিক দে?

6. What do you produce in the farm?

খামারে কি কি উত্পাদন করেন?

1. Have you seen any implementation of government programs on your community in the last five years aiming to improve your livelihoods?

গত ৫ বছরে আপনাদের উন্নয়নে কোনো সরকারী পদক্ষেপ নেয়া হাইছে?

7. How many times were you unable to do your agricultural work due to the weather, floods, or saline intrusion in the field?

বননা, লবনাক্ততার কারণে আপনার কৃষিকাজ কি বাধাপ্রাপ্ত হয়?

8. How much competition is there to sell product?

আপনার উত্পাদিত পণ্য বিক্রিতে কেমন প্রতিযোগিতা করতে হয়?

9. Is this your only source of income?

এটা কি আপনার একমাত্র আয় এর উত্স?

10. Do you see any changes in this area regarding farming environment?

এইখানে পরিবেশে কোনরকম পরিবর্তন কি মনে হয়?

11. What do you think about it?

কি মনে করেন আপনি এতে?

12. Have you heard anything about climate change?

আপনি জলবায়ু পরিবর্তন সম্পর্কে কি কিসু শুনেছেন বা জানেন?

Yes (হা)

No (না)

Not known (জানি না)

If yes what noticeable changes that you observe?

যদি হা হয় তবে কি ধরনের পরিবর্তন লক্ষ্য করেছেন?

If yes what noticeable changes that you observe?

যদি হা হয় তবে কি ধরনের পরিবর্তন লক্ষ্য করেছেন?

Sl.	Climatic factors	Comments
1	High temperature in summer than ever before অতিরিক্ত গরম গ্রীষ্মকালে	
2	Long summer without rain (Heat wave) বৃষ্টি বিহীন গ্রীষ্মকাল	
3	Shorter winter with less cold অল্প ঠান্ডা যুক্ত স্বল্পকালীন শীতকাল	
4	Long cold winter দীর্ঘকালীন শীতকাল	
5	Heavy rainfall অতিরিক্ত বৃষ্টি	
6	Late start of rainy season দেরিতে বর্ষাকাল শুরু	
7	Early start of rainy season দ্রুত বর্ষা কালের শুরু	
8	Shorter rainy season স্বল্পকালীন বর্ষাকাল	
9	Longer rainy season	

	দীর্ঘকালীন বর্ষাকাল	
10	Lack of rainfall. বৃষ্টির স্বল্পতা.	
1.	Frequent storm surge and cyclone ঘন ঘন ঝর, সাইক্লোন	
2.	Higher tide and salinity intrusion বড় বড় ঢেউ, লবনাক্ততা.	
3.	Frequent flood  ঘন ঘন বন্যা	
4.	Others (please specify)  অন্যান্য	

13 How do you adapt with it?

আপনি কিভাবে এ পরিবেশে খাপ খাওয়ান?

14. How climate induced hazards like Aila did affect your family member's livelihoods?

জলবায়ু পরিবর্তনে যেসব বিপর্যয় হয় যেমন আইলা, এসব প্রাকৃতিক বিপর্যয়ে আপনাদের জীবন ও জীবিকা এ কি রকম প্রভাব পরে?

Affects on livelihoods জীবিকা এ প্রভাব	Yes হা	No না	Comments মন্তব্য
Being workless for some period কিসু সময়ে কোনো কাজ থাকে না			
Migrate another area for job কাজের সন্ধানে অন্য এলাকাএ চলে			
Changes the earlier job to new one জীবিকার পরিবর্তন			
Reduce income due to low payment আয় কমে যাই কম পারিশ্রমিক এর কারণে			
Decline of job opportunity কাজের সুযোগ কমে যাচ্ছে			



Increase job opportunity কাজের সুযোগ বেড়ে গেছে			
Others specify অন্যান্য			

15. What are the most impacted sectors by salinity and climate extremes?

জলবায়ু পরিবর্তন এ ও লবনাক্ততার কারণে কি কোন কোন ক্ষেত্র বেশি ক্ষতির সম্মুখীন হইছে?

Crop agriculture:

Rice (Aus, Aman and Boro) ধান

Wheat and Maize

গম এবং ভুট্টা

Vegetable

শাকসব্জি

Pulses

ডাল

Fisheries

মৎস্য

Poultry

পোল্ট্রি

Homestead garden

বাস্তু বাগান

16. In your opinion, what is the level of salinity you guess in rice field in your village?

কি পরিমান লবনাক্ততা আপনাদের গ্রামের কৃষি জমিতে ঢুকেছে বলে আপনি মনে করেন?

17. How salinity affects your rice cultivation? A) – Inundation of rice fields by Coastal flood B).

cyclone C)- Saline intrusion from the shrimp farms near my field D)– other.

আপনার ধান চাষে লবনাক্ততা কিভাবে প্রভাব ফেলে ? ক) উপকূলবর্তী বন্যা দ্বারা ধান ক্ষেত্র প্লাবন, খ) সাইক্লোন গ) আমার খেতের কাছের চিংড়ির ঘেরের লবনাক্ততার অনুপ্রবেশ.

18. Which crop did you cultivate last year?  
গতবছর কি কি চাষ করেছিলেন?
19. If you cultivate rice, how many times of the year do you cultivate?  
যদি ধান চাষ করেন তবে বছরে কতবার ধান চাষ করেন?
20. If you did not cultivate rice, please explain the reasons...

আপনি যদি ধান চাষ না করে থাকেন তাহলে তার কারণ কি একটু বলেন?

21. What is the main source of water for rice cultivation?  
ধান উৎপাদনে পানির উৎস কি?  
1 – Deep Tube Well/Tube-well (গভীর টিউব অইল) 2 – Rain (বৃষ্টি), 3 – Pond/canal (পুকুর, খাল) 4 না– None 5. Others, please specify ইত্যাদি
22. Do you think local human activities are responsible for environmental degradation and your insecure livelihoods?  
আপনি কি মনে করেন এখানকার স্থানীয় মানুষের দ্বারা কিসু কাজের জন্য এই গ্রামের পরিবেশ ও আপনাদের জীবন-জীবিকা সমস্যায় পড়ছে?
23. What kind of local human activities are affecting?  
কি ধরনের স্থানীয় মানুষের কার্যক্রম আপনাদের জীবিকাতে ও পরিবেশে নেতিবাচক প্রভাব ফেলছে?
24. What do you think about it? Can you please describe a little bit?  
এ ব্যাপারে আপনার বক্তব্য কি? একটু বিস্তারিত বলবেন কি?
25. Is there any solution to protect the environment and the livelihood crisis due to local human activities?  
এই সমস্যার কি কোনো সমাধান আছে বলে আপনি মনে করেন? কি ধরনের, একটু বিস্তারিত বলুন.
26. Do you receive any kind of governmental support regarding your livelihoods and environment? if yes what are those? Please describe.  
কি ধরনের সরকারি সাহায্য পেয়ে থাকেন? একটু বিস্তারিত বলুন
27. What kind of non-governmental support you are getting here regarding your livelihoods and environment?
28. কি ধরনের বে-সরকারি সাহায্য পেয়ে থাকেন? একটু বিস্তারিত বলুন
29. What do you think about the NGO working here?  
যেসব NGO এখানে কাজ করছে তাদের বেপারে আপনার কি ধারণা?

30. Have you heard about Community – based adaptation? What do you think about community – based adaptation?  
আপনি কি community-based adaptation সম্পর্কে শুনেছেন? আপনি এ সম্পর্কে কি মনে করেন?
31. Are you a member of any CBA training session?  
আপনি কি CBA প্রশিক্ষণে যান? আপনি কি সেখানকার সদস্য?
32. What kind of facilities you get from CBA training sessions? Please describe.  
আপনি কি ধরনের সুবিধা পান CBA প্রশিক্ষণ থেকে? একটু বলুন.
33. Did the NGO people help you to build this connection?  
NGO সদস্যরা কি এ যোগাযোগ তৈরিতে সাহায্য করেছে?
34. What are the trainings you get from the NGO people?  
NGO সদস্যদের কাছ থেকে আর কি কি ধরনের প্রশিক্ষণ পান?
35. What happen when the NGO trainer left? Can you manage to sustain their trainings for the development of your livelihood?  
যখন প্রশিক্ষকরা চলে যাই তখন কি হয়? আপনারা কি তাদের দিয়া প্রশিক্ষণগুলো নিয়া আপনাদের জীবিকার দীর্ঘস্থায়ী উন্নয়ন করতে পারেন?
36. If not then why, do you face any kind of problem? Can you please explain?  
যদি না হয়, তবে কেন? একটু বিস্তারিত বলবেন?
37. What would be the initiatives after the trainings you think could be beneficial for your sustainable livelihood?  
সুতরাং, আপনি কি মনে করেন? ট্রেনিং এর পরে র কি কি করলে আপনি মনে করেন আপনাদের জীবিকার জন্য ভালো হত?
38. Do you think local human activities are responsible for environmental degradation and your insecure livelihoods?  
আপনি কি মনে করেন এখানকার স্থানীয় মানুষের দ্বারা কিসু কাজের জন্য এই গ্রামের পরিবেশ ও আপনাদের জীবন-জীবিকা সমস্যায় পড়ছে?

### **Proposed Interview Questions for local fisherman**

**Research Title:** Climate change or local anthropogenic impacts? Comparing effects on livelihoods and sustainable development in a rural coastal village of Bangladesh.

**Principal Researcher:** Subrina Tanjin Buly, International Development Student, Saint

Mary's University, 923 Robie Street, Halifax, Nova Scotia B3H 3C3, Canada,  
Telephone. +1 (902) 802-3294; E-Mail: [subrina\\_tanjin.buly@smu.ca](mailto:subrina_tanjin.buly@smu.ca); or,  
[subrinatb@gmail.com](mailto:subrinatb@gmail.com)

যোগাযোগ তথ্য:

প্রধান গবেষক: সাবরিনা তানজিন বুলি, ইন্টারন্যাশনাল ডেভেলপমেন্ট এর মাস্টার্স  
ছাত্রী, সেন্ট মেরিস বিশ্ববিদ্যালয়, ৯২৩ রবি স্ট্রিট, হ্যালিফ্যাক্স, নোভা স্কোশিয়া, B3H  
3C3, কানাডা. ফোন:+1-902-802-3294, ই-মেইল: [subrinatb@gmail.com](mailto:subrinatb@gmail.com)

**Supervisor:** Dr. Tony Charles, Management Science and Environmental Science Saint  
Mary's University, 923 Robie Street, Halifax, NS B3H 3C3

Phone: (902) 420-5732; Fax: (902) 496-8101, [tony.charles@smu.ca](mailto:tony.charles@smu.ca)

সুপারভাইজার: ডঃ টনি চার্লস, ম্যানেজমেন্ট বিজ্ঞান ও পরিবেশ বিজ্ঞান  
সেন্ট মেরিস বিশ্ববিদ্যালয়, ৯২৩ রবি স্ট্রিট, হ্যালিফ্যাক্স, নোভা স্কোশিয়া, B3H 3C3,  
কানাডা।

ফোন: + 1-902-420-5732; ফ্যাক্স: + 1-902- 496-8101,

ই-মেইল : [tony.charles@smu.ca](mailto:tony.charles@smu.ca)

### **Proposed Interview Questions for local Fisherman:**

স্থানীয় জেলে জন্য প্রস্তাবিত সাক্ষাৎকার প্রশ্ন:

1. Name.

নাম

2. Age.

বয়স

3. Sex.

লিঙ্গ

4. Level of education.

শিক্ষাগত যোগ্যতা

5. How many family members you have?

পরিবারে কয়জন সদস্য

6. For how many years have you lived in this community?

আপনি কত বছর ধরে এইখানে আছেন?

7. Have you lived here since you were born?  
আপনার জন্ম কি এ গ্রামে?
8. If you did not born in this village from where did you came and when did you move to this village?  
আপনি কি এ গ্রামে জন্ম নিয়াছিলেন নাকি অন্য গ্রাম থেকে এসেছেন? কবে এসেছেন?
9. For how long you have been related with fishing as livelihood?  
আপনি কতদিন ধরে এ পেশাই আছেন?
10. How many trips you made for fishing (annually)? Where do you fish most of the time (sea, rivers)?  
আপনি বছরে কয়বার যান মাছ ধরতে? কোথাএ বেশিরভাগ যান ( সাগরে, নদীতে)?
11. What paying arrangements you have with the middleman?  
মহাজন কত করে দায়?
12. Have you seen any implementation of government programs on your community in the last five years aiming to improve your livelihoods?  
গত ৫ বছরে আপনাদের উন্নয়নে কোনো সরকারী পদক্ষেপ নেয়া হাইছে?
13. How many times were you unable to fish last year due to the weather, floods, or pollution?  
খারাপ আবহাওয়ার কারণে কতবার মাছ ধরতে যেতে পারেন নি?
14. How much competition is there among fishers to sell their product?  
আপনার পণ্য বিক্রির প্রতিযোগিতা কেমন?
15. Do you work for someone or are you self-employed?  
আপনার কি নিজের জাল, নৌকা আসে নাকি অন্যের জন্য কাজ করেন?
16. How much you got (payment) working in crab, shrimp harvesting farm?  
চিংড়ি, কাকরা খামার থেকে কেমন আয় হয়?
17. Is it enough for you?  
এতে কি আপনার চলে?
18. Did you notice any changes in the quantity of fishes? If yes, what do you think about it?  
মাছের পরিমানে কোনো পরিবর্তন দেখসেন? যদি, হা তাহলে কি রকম পরিবর্তন আপনার মনে হাইছে?
19. What are the reasons you think are responsible for decreasing fishes?  
মাছের পরিমান কমে যাবার কারণ কি মনে করেন?
20. Is this your only source of income?  
এটাই কি আপনার একমাত্র আয়ের উত্স?
21. Do you see any changes in this area regarding fishing environment?  
এইখানে পরিবেশে কোনরকম পরিবর্তন কি মনে হয়? যেমন: সগরের ঢেউ, ঝর ইত্যাদি.

22. What do you think about it?

কি মনে করেন আপনি এতে?

23. Have you heard anything about climate change?

আপনি জলবায়ু পরিবর্তন সম্পর্কে কি কিসু শুনেছেন বা জানেন?

24. Have you noticed any Changes in climate in the recent years in your locality?

আপনি জলবায়ু পরিবর্তন সম্পর্কে কি কিসু শুনেছেন বা জানেন?

Yes (হা)

No (না)

Not known (জানি না)

না)

If yes what noticeable changes that you observe?

যদি হা হয় তবে কি ধরনের পরিবর্তন লক্ষ্য করেছেন?

Sl.	Climatic factors	Comments
1	High temperature in summer than ever before অতিরিক্ত গরম গ্রীষ্মকালে	
2	Long summer without rain (Heat wave) বৃষ্টি বিহীন গ্রীষ্মকাল	
3	Shorter winter with less cold অল্প ঠান্ডা যুক্ত স্বল্পকালীন শীতকাল	
4	Long cold winter দীর্ঘকালীন শীতকাল	
5	Heavy rainfall অতিরিক্ত বৃষ্টি	
6	Late start of rainy season দেরিতে বর্ষাকাল শুরু	
7	Early start of rainy season দ্রুত বর্ষা কালের শুরু	
8	Shorter rainy season স্বল্পকালীন বর্ষাকাল	
9	Longer rainy season দীর্ঘকালীন বর্ষাকাল	
10	Lack of rainfall. বৃষ্টির স্বল্পতা.	
5.	Frequent storm surge and cyclone ঘন ঘন ঝর, সাইক্লোন	
6.	Higher tide and salinity intrusion বড় বড় ঢেউ , লবনাক্ততা.	
7.	Frequent flood ঘন ঘন বন্যা	

8.	Others (please specify) অন্যান্য	
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25. How do you adapt with it?

আপনি কিভাবে এ পরিবেশে খাপ খাওয়ান?

26. How climate induced hazards like Aila did affect your family member's livelihoods?

জলবাত্ত পরিবর্তনে যেসব বিপর্যয় হয় যেমন আইলা, এসব প্রাকৃতিক বিপর্যয়ে আপনাদের জীবন ও জীবিকা এ কি রকম প্রভাব পরে?

Affects on livelihoods জীবিকা এ প্রভাব	Yes হা	No না	Comments মন্তব্য
Being workless for some period কিসু সময়ে কোনো কাজ থাকে না			
Migrate another area for job কাজের সন্ধানে অন্য এলকাএ চলে যাই			
Changes the earlier job to new one জীবিকার পরিবর্তন			
Reduce income due to low payment আয় কমে যাই কম পারিশ্রমিক এর কারণে			
Decline of job opportunity কাজের সুযোগ কমে যাচ্ছে			
Increase job opportunity কাজের সুযোগ বেড়ে গেছে			
Others specify অন্যান্য			

27. What do you think about the NGO working here?

যেসব NGOএখানে কাজ করছে তাদের বেপারে আপনার কি ধারণা?

28. Have you heard about Community – based adaptation? What do you think about

community – based adaptation?

আপনি কি community-based adaptation সম্পর্কে শুনেছেন? আপনি এ সম্পর্কে কি মনে করেন?

29. Are you a member of any CBA training session?

আপনি কি CBA প্রশিক্ষণে যান? আপনি কি সেখানকার সদস্য?

30. What kind of facilities you get from CBA training sessions? Please describe.

আপনি কি ধরনের সুবিধা পান CBA প্রশিক্ষণ থেকে? একটু বলুন.

31. Do you go to market or have any direct connection with market now to sell your fishes, crabs or shrimps?

মাছ, কাকরা, চিংড়ি বিক্রির জন্য কি বাজারের সাথে আপনার সরাসরি যোগাযোগ আছে?

32. Do you think local human activities are responsible for environmental degradation and your insecure livelihoods?

আপনি কি মনে করেন এখানকার স্থানীয় মানুষের দ্বারা কিসু কাজের জন্য এই গ্রামের পরিবেশ ও আপনাদের জীবন-জীবিকা সমস্যায় পড়ছে?

33. What kind of local human activities are affecting?

কি ধরনের স্থানীয় মানুষের কার্যক্রম আপনাদের জীবিকাতে ও পরিবেশে নেতিবাচক প্রভাব ফেলছে?

34. What do you think about it? Can you please describe a little bit?

এ ব্যাপারে আপনার বক্তব্য কি? একটু বিস্তারিত বলবেন কি?

35. Is there any solution to protect the environment and the livelihood crisis due to local human activities?

এই সমস্যার কি কোনো সমাধান আছে বলে আপনি মনে করেন? কি ধরনের, একটু বিস্তারিত বলুন.

36. Do you receive any kind of governmental support regarding your livelihoods and environment? if yes what are those? Please describe.

কি ধরনের সরকারি সাহায্য পেয়ে থাকেন? একটু বিস্তারিত বলুন

37. What kind of non-governmental support you are getting here regarding your livelihoods and environment?

38. কি ধরনের বে-সরকারি সাহায্য পেয়ে থাকেন? একটু বিস্তারিত বলুন

39. What do you think about the NGO working here?  
যেসব NGO এখানে কাজ করছে তাদের বেপারে আপনার কি ধারণা?

40. Did the NGO people help you to build this connection?

NGO সদস্যরা কি এ যোগাযোগ তৈরিতে সাহায্য করেছে?



41. What are the trainings you get from the NGO people?  
NGO সদস্যদের কাছ থেকে আর কি কি ধরনের প্রশিক্ষণ পান?
42. What happen when the NGO trainer left? Can you manage to sustain their trainings for the development of your livelihood?  
যখন প্রশিক্ষকরা চলে যাই তখন কি হয়? আপনারা কি তাদের দিয়া প্রশিক্ষণগুলো নিয়া আপনাদের জীবিকার দীর্ঘস্থায়ী উন্নয়ন করতে পারেন?
43. If not then why, do you face any kind of problem? Can you please explain?  
যদি না হয়, তবে কেন? একটু বিস্তারিত বলবেন?
44. What would be the initiatives after the trainings you think could be beneficial for your sustainable livelihood?  
সুতরাং, আপনি কি মনে করেন? ট্রেনিং এর পরে র কি কি করলে আপনি মনে করেন আপনাদের জীবিকার জন্য ভালো হত?

**Proposed Questions for local government person and non-governmental person in the study area**

**Research Title: “Climate change or local anthropogenic impacts? Comparing effects on livelihoods and sustainable development in a rural coastal village of Bangladesh”**

**Principal Researcher:** Subrina Tanjin Buly, International Development Student, Saint Mary’s University, 923 Robie Street, Halifax, NS B3H 3C3, tel. 902-491-6437.  
[subrina\\_tanjin.buly@smu.ca](mailto:subrina_tanjin.buly@smu.ca) and [subrinatb@gmail.com](mailto:subrinatb@gmail.com)

যোগাযোগ তথ্য:

প্রধান গবেষক: সাবরিনা তানজিন বুলি, ইন্টারন্যাশনাল ডেভেলপমেন্ট এর মাস্টার্স ছাত্রী, সেন্ট মেরিস বিশ্ববিদ্যালয়, ৯২৩ রবি স্ট্রিট, হ্যালিফ্যাক্স, নোভা স্কোশিয়া, B3H 3C3, কানাডা.

ফোন:+1-902-802-3294 ই-মেইল : subrina\_tanjin.buly@smu.ca

**Supervisor:** Dr. Tony Charles, Management Science and Environmental Science Saint

Mary’s University, 923 Robie Street, Halifax, NS B3H 3C3

Phone: (902) 420-5732; Fax: (902) 496-8101, [tony.charles@smu.ca](mailto:tony.charles@smu.ca)

সুপারভাইজার: ডঃ টনি চার্লস, ম্যানেজমেন্ট বিজ্ঞান ও পরিবেশ বিজ্ঞান সেন্ট মেরিস বিশ্ববিদ্যালয়, ৯২৩ রবি স্ট্রিট, হ্যালিফ্যাক্স, নোভা স্কোশিয়া, B3H 3C3,

কানাডা ।

ফোন: + 1-902-420-5732; ফ্যাক্স: + 1-902- 496-8101,

ই-মেইল : [tony.charles@smu.ca](mailto:tony.charles@smu.ca).

Proposed research questions for the local governmental persons and non-governmental persons:

স্থানীয় সরকারি ও বে-সরকারি জন্য প্রস্তাবিত সাক্ষাৎকার প্রশ্ন:

1. Name.

নাম

2. Age.

বয়স

3. Sex.

লিঙ্গ

4. Duration of work in this village.

কাজের সময়কাল

5. Do you think is there any changes here due to climate change? If yes, what kind of changes you see? Does these change affects the sustainable livelihoods development of this village? Please describe.

আপনি কি মনে করেন জলবায়ু পরিবর্তনে এখানকার পরিবেশে কোনো পরিবর্তন এসেছে? যদি হ্যা, তবে কিধরনের পরিবর্তন দেখেন? এই পরিবর্তন কি জীবিকার উন্নয়নে ও পরিবেশে কোনো পরিবর্তন এনেছে একটু বিস্তারিত বলুন।

6. Do you think is there any changes here due to local human activities? If yes, what kind of changes you see? Does these change affects the sustainable livelihoods development of this village? Please describe.

আপনি কি মনে করেন মানুষের কার্যক্রমে এখানকার পরিবেশে কোনো পরিবর্তন এসেছে? যদি হ্যা, তবে কিধরনের পরিবর্তন দেখেন? এই পরিবর্তন কি জীবিকার উন্নয়নে ও পরিবেশে কোনো পরিবর্তন এনেছে একটু বিস্তারিত বলুন।

7. What kind of supports you are giving to these people for the environmental and sustainable livelihoods development?

গ্রামের পরিবেশ ও মানুষদের জীবিকার উন্নয়নে কি ধরণের সহযোগিতা করছেন?

8. What is your opinion about the situation of the villagers?

গ্রামের মানুষদের সম্পর্কে আপনার অভিমত কি।, একটু বলুন।

## Annex B



SMU REB File #15-231

### INFORMED CONSENT FORM

**Research Title:**

Climate change or local anthropogenic impacts? Comparing effects on livelihoods and sustainable development in a rural coastal village of Bangladesh.

You are being asked to participate as a volunteer in a research that aims to contribute to the study of the adverse affects of climate change and local anthropogenic issues; coping strategies for sustainable development of livelihood in the changed environmental situation in the coastal area of Sathkhira in Bangladesh.

**Benefits:**

The importance of this research is to know about how the livelihoods of the people of the coastal region in Bangladesh are affected by change and local anthropogenic issues, their coping strategies, current problems and development related to these strategies. There is no direct benefit to the research participant.

If you agree to be part of this research, you will respond to an interview, which may be recorded and/or photographed, and you might be observed by me, in some of the places you are frequent. Through an interview, information will be gathered on the current problems regarding the development of your sustainable livelihood in the changed environment with any kind of new coping system or strategies and if you are facing any problem to deal with the new coping strategies and so on. People in other parts of the world will know about you, and policy makers in Bangladesh will be more aware of your problems. Therefore, if you want to participate in an interview, it will last no more than one hour.

There are no foreseeable risks to this research. If you don't feel comfortable in answering any questions, you are able to withdraw from the research without any penalty. Participants have the right to withdraw of data by June 31, 2015.

The collected data will be confidential and protected from any third party access during the research (unauthorized by the interviewee). Identifiable data will be shared only with my supervisor, Dr. Tony Charles and research committee during the research period. And after the research I will send the result of the study through postal mail to the NGO worker who works there. The NGO worker will describe any interested participants about the results my research in Bengali language. I will also send a paper copy to the NGO whom I am going to work with. Again if any participants want to know more about the results or any want to have access in any other resources then the contact information of the partner NGO will be provided. The contact information is: Bangladesh Center for Advance Studies (BCAS), House # 10, Road # 16/A, Gulshan Avenue, Dhaka-1212,

Bangladesh. Phone: +88029851237, Fax: +88029851417, E-Mail: [info@bcas.net](mailto:info@bcas.net), Web: [www.bcas.net](http://www.bcas.net). Data analysis will be presented in my results, and only in case the research participants authorize his or her name, video or photos to be disclosed. The content of the interviews will be communicated in my research results

Anonymous information provided by you will be kept in the strictest of confidence. The data will be stored safely in the possession of the principal investigator in his office and will be shared with the research committee without identifying the individuals who participated in the research. Within 5 years of the initial interview, the data will be destroyed in a manner ensuring privacy and confidentiality.

### **Questions about the Study**

You may contact the researcher, Subrina Tanjin Buly, [subrina\\_tanjin.buly@smu.ca](mailto:subrina_tanjin.buly@smu.ca); and [subrinatb@gmail.com](mailto:subrinatb@gmail.com); or Phone: +1 (902) 802-3294 for any information and clarification about the study, before, during and after your participation, feedback and to find out the results of the study.

This research has been reviewed and approved by the Saint Mary's University Research Ethics Board. If you have any questions or concerns about ethical matters, you may contact the chair of the Saint Mary's University Research Board at [ethics@smu.ca](mailto:ethics@smu.ca) or +1-902-420-5728. If you have any questions or concerns of ethical matters, you may contact the Chair of the Saint Mary's University Research Ethics Board at [ethics@smu.ca](mailto:ethics@smu.ca)

**Principal Researcher:** Subrrina Tanjin Buly, International Development Student, Saint Mary's University, 923 Robie Street, Halifax, NS B3H 3C3.

[Subrina\\_Tanjin.Buly@smu.ca](mailto:Subrina_Tanjin.Buly@smu.ca) & [subrinatb@gmail.com](mailto:subrinatb@gmail.com)

**Supervisor:** Dr. Tony Charles, Management Science and Environmental Science

Saint Mary's University, 923 Robie Street, Halifax, NS B3H 3C3

Phone: (902) 420-5732; Fax: (902) 496-8101, [tony.charles@smu.ca](mailto:tony.charles@smu.ca)

### CONSENT

By having been advised (a) the contents of all here mentioned and understood the nature and purpose of the cited study, I manifest my consent to participate, being fully aware that there is no economic value, receivable or payable for my participation.

This study has been explained to me and any questions I had have been answered.

I know that I may leave the study at any time. I agree to take part in this study.

_____	_____	_____
Print Study Participant's Name	Signature	Date

_____	_____	_____
Print Name of Person Obtaining Consent	Signature	Date

I declare to be aware of the above and wish to participate in the research project.

I authorize my name, video or photos to be disclosed Yes ( ) No ( )

Sathkhira \_\_\_\_\_ of \_\_\_\_\_, 2015.

## Annex C



SMU REB File #15-231

### Letter of Appreciation and Feedback to Participants

Climate change or local anthropogenic impacts? Comparing effects on livelihoods and sustainable development in a rural coastal village of Bangladesh.

**Principal Researcher contact information:** Subrina Tanjin Buly;  
[subrina\\_tanjin.buly@smu.ca](mailto:subrina_tanjin.buly@smu.ca); & [subrinatb@gmail.com](mailto:subrinatb@gmail.com); Tel. +1-902-802-3294.

**Supervisor:** Dr. Tony Charles, Management Science and Environmental Science  
Saint Mary's University, 923 Robie Street, Halifax, NS B3H 3C3

Phone: +1 (902) 420-5732; Fax: +1 (902) 496-8101; Email: [tony.charles@smu.ca](mailto:tony.charles@smu.ca)

**June 30, 2015.**

Dear Participant,

I would like to thank you for your participation in this study.

You were being asked to participate as a volunteer in a research that aims to contribute to the study of the coping strategies for sustainable livelihood in the changed environmental situation in the coastal area of Sathkhira, Bangladesh.

The collected data is confidential and protected from any third party access (unauthorized by the interviewee). The data was shared only with my supervisor, Dr. Tony Charles, the research committee and the Research Ethics Board, Saint Mary's University, Canada.

If you are interested in receiving more information regarding the results of this study, or if you have any questions or concerns, please contact me at either the phone number or

email address listed at the top of the page. And after the research I have sent the result of the study through postal mail to the NGO worker who works in this Kuthikata village, Satkhira, Bangladesh. The NGO worker will describe any interested participants about the results of my research in Bengali language. I have also sent a paper copy to the NGO whom I have worked with. Again if any participants want to know more about the results or want to have access for any other resources then the contact information of the partner NGO is provided here. The contact information of the partner NGO is Bangladesh Center for Advance Studies (BCAS), House # 10, and Road # 16/A, Gulshan Avenue, Dhaka-1212, Bangladesh. Phone: +88029851237, Fax: +88029851417, E-Mail: [info@bcas.net](mailto:info@bcas.net), Web: [www.bcas.net](http://www.bcas.net).

If you would like a summary of the results, please let me know by providing me with your contact information. When the study is completed, I will send it to you via mail or email. The study is expected to be completed by August 31<sup>st</sup>, 2015.

In the occurrence of a difficult event please immediately contact with me, my supervisor or the SMU REB directly. A decisive plan on how to alleviate the situation will then be implemented.

As with all Saint Mary's University projects involving human participants, this project was reviewed by the Saint Mary's University Research Ethics Board. Should you have any comments or concerns about ethical matters or would like to discuss your rights as a research participant, please contact the Chair of the Research Ethics Board at +1-902-420-5728 or [ethics@smu.ca](mailto:ethics@smu.ca)

Sincerely,

Subrina Tanjin Buly.

Saint Mary's University.

923 Robie Street, Halifax, NS B3H 3C3

Tel. 001-902-491-6437

[subrina\\_tanjin.buly@smu.ca](mailto:subrina_tanjin.buly@smu.ca); or

[subrinatb@gmail.com](mailto:subrinatb@gmail.com)



## Annex D



### **BANGLADESH CENTRE FOR ADVANCED STUDIES**

House 10, Road 16A, Gulshan-1, Dhaka-1212, Bangladesh  
Tel: (88-02) 8818124-7, 9852904, 9851237; Fax: (88-02) 9851417  
E-mail: [info@bcas.net](mailto:info@bcas.net) Website: [www.bcas.net](http://www.bcas.net)

To  
Subrina Tanjin Buly  
Department of International Development Studies,  
Saint Mary's University  
923 Robie Street, Halifax, NS B3H 3C3  
Canada.

Date: March 19, 2015

#### **RE: Invitation for field research for Subrina Tanjin Buly**

It is our immense pleasure to invite Subrina Tanjin Buly to join us for her MA field research. We are in agreement to the researcher to support her research on “Comparison between fishing and agricultural livelihoods through Community-based adaptation for sustainable development in the coastal region of Bangladesh”. We are a National organization in Bangladesh who deals with many projects before and know the importance of such research. We have been awarded the UN Highest Award for Environment 'Champions of the Earth 2008'. This award recognizes the extraordinary leadership and our contribution to environmental issues, sustainable development and climate change. As Bangladesh is facing the negative impacts of climate change, people in the coastal region are the most affected and vulnerable. Their livelihoods are in great danger. However, adaptation is one of the solutions that are suggested by the climate experts. Community – based adaptation is one of the method through which the climate change affected people are trying to sustain their livelihood. The research will provide the information about the response of the community towards community – based adaptation which will help the community and experts to develop policies for the climate change affected people. Data will be collected by interviews and listening the community members about their problems, pollution, saline intrusion in their fields and water resources, history of the changes of livelihood patterns, etc.

We appreciate the ideas in the project proposal and pray that the results will help us to develop a balanced situation for both social and ecological. Please be assured that both of us and the community will provide all support needed to make this study a success.

Sincerely Yours,  
**Olena Reza**  
Senior programme Manager  
BCAS  
E-Mail: [olena.reza@bcas.net](mailto:olena.reza@bcas.net)  
Mobile: +880 17113248361

**Annex E**  
**Author's Photographs from the field research**



Cooking with hays as fuel.



Cow manure as fuel.



Dried up canal.



Houses of the village



Home of a research participant.



Researcher while Focus Group Discussion.