

Sumon Kumar Biswas / Ajita Mitra

People's Perception on Climate Change Vulnerabilities of South-West Coastal Bangladesh

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People's Perception on Climate Change Vulnerabilities
A Study in South-West Coastal Bangladesh

Sumon Kumar Biswas
Ajita Mitra

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ACCRONYMS

ADB	Asian Development Bank
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Center for Advanced Studies
BIDS	Bangladesh Institute of Development Studies
BUP	Bangladesh Unnayan Parishad
CARE	Cooperation for American Relief Everywhere
CDM	Clean Development Mechanism
CH₄	Methane Gas
CIDA	Canadian International Development Agency
CCC	Climate Change Cell
CCCDF	Canadian Climate Change Development Fund
CFC_s	Chlorofluorocarbons
CO₂	Carbon Dioxide
COP	Conference of Parties
FAO	Food and Agricultural Organization
GCM	General Circulation Model
GEF	Global Environmental Facility
GHG_s	Greenhouse Gases
GOB	Government of Bangladesh
IPCC	Intergovernmental Panel on Climate Change
LDC_s	Least Developed Countries
MEND	Moving Towards Emission Neutral Development
NAPA	National Adaptation Programme of Action
NCSA	National Capacity Self Assessment
NCP	National Communication Project
NGO_s	Non-Government Organizations
N₂O	Nitrous Oxide
NEP	National Energy Policy
OECD	Organization for Economic Cooperation and Development
PY	Projection Year
RVCC	Reducing Vulnerability to Climate Change
SAARC	South Asian Association for Regional Corporation
SEMP	Sustainable Environmental Management Project
SIDS	Small Island Developing States
SLR	Sea Level Rise

SMRC	SAARC Meteorological Center
SSC	Secondary School Certificate
SSN	South-South-North Project
TA	Technical Assistance
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank
WMO	World Meteorological Organization
WRI	World Resource Institute

ABSTRACT

This study aims to measure the people's perception regarding climate change vulnerabilities in south-west coastal Bangladesh. The broader objective of the study is to assess the climate induced vulnerabilities and to view their adaptive capacity with the climate change vulnerabilities. Both purposive and simple random samplings were used to conduct this study. Data were collected from 120 respondents through interview schedule technique. In the interview schedule technique, question was asked and filled by the interviewers in face-to-face situation.

Climate induced changes such as extreme cyclone, devastating tidal surges, severe floods, tremendous river erosion, excessive rainfall, overwhelming salinity intrusion etc, are occurring more frequently in greater intensities and in an unpredictable manner around the world including Bangladesh. To perceive the vulnerability, the southwestern coastal Bangladesh is selected as a research area where high vulnerability to natural climate is due to its low lying delta. The research mainly focuses on the perception level of the people on climate change vulnerability and its impact on their livelihood patterns. The research revealed that various climatic events adversely affect the people of the study area. Among all natural disasters like cyclone affects severely the livelihood pattern of the study area. Peoples of the affected area experienced that disproportionate rate of salinity intrusion into the land mass increased less fertility that causes failure of crop production. As a consequence, most of the low income families are now facing food insecurity and a huge amount of potable water crisis that makes the people more vulnerable along with a threat of different water borne diseases. Finally consideration of the mentioned vulnerable factors, a simplified adaptation strategy based on the respondent view is recommended. The findings of this study explicate that climate change resulted the vulnerability of the people in the coastal areas of Bangladesh.

Chapter One: Introduction

- 1.1: Statement of the Problem
- 1.2: Rationale of the Study
- 1.3: Objective of the Study
- 1.4: Literature Review
- 1.5: Operational Definitions
- 1.6: Conceptual Framework
- 1.7: Importance of the Study
- 1.8: Limitation of the Study

1.1 Statement of the Problem

Climate change is considered as one of the most serious threats to the world's environment with its potential negative aspects on human health, food security, agriculture, fisheries, biodiversity, water, economic activities and other natural resources. The global warming is apprehended to lead a higher atmospheric temperature, high intensity of rainfall, increased natural disasters, more frequent and prolonged draughts and sea level rise along the coastal areas of low lying Bangladesh (NCSA, 2007).

Bangladesh is one of the most climate vulnerable countries in the world and will become even more so as a result of climate change. Floods, tropical cyclones, storm surges and droughts are likely to become more frequent and severe in the coming years. These changes will threaten the significant achievements. Bangladesh has made over the last 20 years in increasing incomes and reducing poverty, and will make it more difficult to achieve the MDGs.

The impacts of climate change are worldwide. For Bangladesh they are most critical as large part of the population is chronically exposed and vulnerable to a range of natural hazards. Already, the human suffering and cost to development is massive to this country and its people who are victims of human induced global warming.

Climatic hazards, including extremes like floods, cyclones, tornado, storm surge, tidal bore, water logging, saliently etc are not new to Bangladesh and the country has a scarred history claiming many lives and resulting in losses of assets. Bangladesh scientists believe that because of sea level rise coastal Bangladesh has already experienced the worst impacts especially in terms of coastal inundation and erosion, saline intrusion, deforestation, loss of bio-diversity and agriculture, and large scale migration (UNEP, 2008).

It is well recognized both in the scientific and negotiating community that Bangladesh would be one of the most adversely affected country to climate change. low economic strength, inadequate infrastructure, low level of social development, lack of institutional capacity, and a higher dependency on the natural resource base make the country more vulnerable to climate stimuli including both variability as well as extreme events and the country has a history of extreme climatic events claiming millions of lives and destroying past development gains, for example up to 500,000 people lose their lives and 5 million people are affected during the cyclone of 1970, the cyclone of 1991 kill the estimated people of 140000 and the official death of cyclone Sidr 3300 (CDPBD, 2008).

Scientists and researchers are now claiming that this type of event is due to the global climate change.

People's perception about mentioned types of loss and destruction are different among different groups in the society, in particular who are always suffering and facing these types of disasters. In reality, coastal peoples of Bangladesh are the real victim to the climate induced disasters. In this view, the perception about climate change vulnerability is very much desirable to understand by the people of Bangladesh who are really vulnerable due to climatic disruption.

1.2 Rationale of the Study:

The vulnerability of people in south-west coastal Bangladesh is discussed in terms of how they cope with continued deprivation and poverty during and in response to climatic disaster. Bangladesh, with a population nearing 130 million (BBS, 2008), is one of the poorest countries in the world while also being one of the most vulnerable to the impacts of climate change. Bangladesh, as one of the most densely populated low lying developing countries is likely to be severely impacted by any such global climate change that might occur in future.

At the most basic level, Bangladesh is likely to be impacted by climate change by a number of factors including droughts, floods, cyclones and long term sea level rise. In the short term, this means that the peoples are likely to be hit by more and more natural disasters in future coming years. In the longer term, the peoples need to incorporate for accounting the climate change into the country's development strategies and plans along with the incorporate the issue of adaptation to climate change with its development goals.

Various natural hazards like waster logging, salinity, river silting etc. became the principal environmental issues of the region. As a result huge damage has been caused to bio-diversity and people's livelihoods. Furthermore, though the introduction of HYV of rice in the region saw high productivity in the first few years, it resulted in the near extinction of over a hundred indigenous varieties of rice. In addition, extensive shrimp cultivation resulting in increased soil salinity has caused massive damage to agriculture

For mitigating the future demand, research from different angles on climate change vulnerability is very much indispensable along with it should be given emphasize on awareness growing about the climate change impacts which makes their life vulnerable.

After conceptualize this truth, a special consideration has been paid to know the existing perception level about climate change in particular to the selected community and try to reach the goal by evaluating how much awareness and motivational works needs to the community's people (Prodipan, 2007).

The Study provides an overview of the perception level about climate change vulnerability of the south west coastal people of particular villages, Podderganj, Chunkuri, Jaliakhali and Botbunia under Daccop upazilla of Khulna districts with an attempt to the assessment of their vulnerability. During the vulnerability assessment, the well-being indicators that were tried to identify different stakeholder groups, such as income, food, potable water, health and personal safety, housing and safety of property etc are being considered as important. The study also portrays the existing adaptation strategy taken by the coastal people of Bangladesh. Finally, would also an attempt to develop a conceptual model for developing a better adaptation strategy with the climate induced adversity over the study area, and if possible to Bangladesh.

1.3 Objective of the Study:

The main objective of the study is to assess the people's perception on climate change vulnerability that affects the livelihood pattern of the study area. This objective is further subdivided into the following way:

- To explore the nature and extent of climate change.
- To evaluate the vulnerabilities of human populations due to results of climate induced changes associated with natural hazards.
- To assess the adaptation approaches practiced by the villagers to cope with the climate change vulnerabilities.
- To find out the possible causes of climate change.

- To identify those who are the worst victim of climate change.
- To explore the socio-economic outcome of climate change.
- To know the GO and NGO services in this areas.

1.4 Literature Review:

IPCC (2001) Intergovernmental Panel on Climate Change, Geneva in a report entitled **Climate Change around the World** reveals, there will always be uncertainty in understanding a system as complex as the world's climate. However, there is now strong evidence that significant global warming is occurring. The evidence comes from direct measurements of rising surface air temperatures and subsurface ocean temperatures and from phenomena such as increases in average global sea levels, retreating glaciers, and changes to many physical and biological systems. It is likely that most of the warming in recent decades can be attributed to human activities (IPCC, 2001). This warming has already led to changes in the Earth's climate.

The existence of greenhouse gases in the atmosphere is vital to life on Earth. In their absence, average temperatures would be about 30 centigrade degrees lower than they are today. But human activities are now causing atmospheric concentrations of greenhouse gases including carbon dioxide, methane, tropospheric ozone, and nitrous oxide to rise well above pre-industrial levels. Carbon dioxide levels have increased from 280 ppm in 1750 to over 375 ppm today higher than any previous levels that can be reliably measured (i.e. in the last 420,000 years). The Earth's surface warmed by approximately 0.6 centigrade degrees over the twentieth century. The Intergovernmental Panel on Climate Change (IPCC) projected that the average global surface temperatures will continue to increase to between 1.4 centigrade degrees and 5.8 centigrade degrees above 1990 levels, by 2100.

Climate Change Briefing from Rio to Kyoto Protocol, stress on importance of the atmospheric composition for the global heat balance was recognized already in the early 19th century. The possibility of human influence on climate was discussed around 1900, and the first indications that the globe was heating up concurrent with the emissions of carbon dioxide were found in the 1930s. At that time, the interest was negligible, since it was assumed that a possible global warming would probably be an advantage. Global concern over a series of catastrophes in the 1970s led to the establishment of the world climate program and eventually to a breakthrough in the scientific and political awareness of the scope of the problem climate with the conference “The Green House Effect, Climatic Changes and Ecosystem” in Villach, Austria in 1985 (Bolin et al., 1986). In 1987, the so called Brundtland commission published its now classical report “Our Common Future” (Brundtland commission, 1987) and indicated the growing world population and the increasing poverty as some of the most pressing problems. However, whereas the technical development had previously been seen as a threat to the environment and discussed in terms of “limits to growth”, the Brundtland Report argued that development is a prerequisite for the fight against poverty and environmental degradation but it must be sustainable in the sense that it “meets the needs of present generations without compromising the ability of future generations to meet their own needs.”

Bangladesh Strategies Based on Bali Declaration ‘2007 and Upcoming Copenhagen Summit Preparation for 2009At Bali, during 3-14 December 2007, delegations from all Parties to the UN Framework Convention on Climate Change and the Kyoto Protocol will start engaging on how to respond to global warming and climate change for the decades ahead. Our hands hold our future. We must secure the well-being and development of Bangladesh by making the people and country resilient, through necessary resource and support, both internal and external.

Together, we must address this challenge and demonstrate our environmental integrity to the human race. Sufficient and collective actions to combat global warming and climate change must take now, without further delay. Millions are already suffering. The poor of this world are already victims and will suffer most from unavoidable global warming and adverse future impacts. To prevent dangerous climate change, we must all address the interlinked challenge of energy for their sustainable development without adding more greenhouse gas to the atmosphere.

International support for adaptation to climate change is paramount since links between development and adaptation has implications for official development assistance, in scale as well as focus. Adaptation to climate change will add a massive burden to Bangladesh's budgets and development assistance. In this regard, commitments made already to double international aid flows by 2010 must be delivered. Climate Change Negotiations provide a unique platform for the global community to come together and work towards protecting the global commons and ensuring a common future. It should be re-emphasized that the UNFCCC process and funds are essential to support capacity building, identifying and addressing urgent and immediate priorities.

Key expectation from the global community is that equity is ensured, justice delivered, and commitments are adequate and in time while compensating climate victims, climate refugees, and helping those vulnerable to cope with climate challenges. Climate risk management and adaptation is a survival as well as development concern. The international community should ensure an equitable regime that proactively applies "precautionary" and "no regrets" principles while funding adaptation needs and priorities (Climate Change Cell, 2008).

Durgadas Mukhopadhyay, in a study on, **Cultural values, indigenous knowledge for climate change adaptations in developing countries** reveals 30% of animal and plant species will be vulnerable to extinction if global temperature rose by 1.5 to 2.5 degrees Celsius. It says the world's have-nots would be worst hit by climate change, predicting greenhouse gases would change rainfall patterns, intensify tropical storms, accelerate the melting of Arctic ice and mountain glaciers and amplify the risk of drought, flooding and water stress. As with disaster risk management, policies and measures concerned with climate change represent a risk management approach. Both disaster prevention measures and climate adaptation measures aim to address underlying vulnerabilities, which would otherwise put the natural and human systems at risk. Indigenous knowledge is knowledge unique to a given culture or society, acquired through accumulation of years of experiences of local people passed on from generation to generation. Any adjustment (economic, ecological or social), whether passive, reactive or anticipatory is used as a means to ameliorate the anticipated adverse consequences associated with climate change. Indigenous knowledge is a precious national resource that can facilitate

the process of disaster prevention, preparedness and response in cost-effective participatory and sustainable ways.

A recent study on climate change conducted by **Dr. Mahbuba Nasreen** in the article entitled '**Climate Change and Food Security**' (Nasreen, 2008), pointed out 'Growing scarcities of water, land and fuel are likely to put increasing pressure on food prices, even without climate change. Additional pressures on these resources due to climate change, the introduction of mitigation practices that have the potential to create land use competition, and the attribution of market value to environmental services to mitigate climate change, also have the potential to cause significant changes in relative prices for different food items and an overall increase in the cost of an average food basket for the consumer'.

Achieving food security and reducing poverty in Bangladesh has been a major challenge for both governments and development agencies due to vulnerability of Bangladesh agriculture. Currently, much more people in the rural Bangladesh are considered food insecure due to recurrent different events like flood, storm, river bank erosion, salinity intrusion, and drought. This unfortunate situation is the result of many factors, some of which are:

- * The poor nature of soils due to intensive cultivation and cropping (most soils are now low in organic matter content, low in carbon and poor in different micro-nutrients);
- * The rapid population growth, which has led to continuous cropping, expansion of agriculture to marginal areas and overgrazing;
- * The low use of technologies such as improved varieties, fertilizers, mechanization and irrigation that have stimulated agricultural development; and
- * The absence of adequate technologies and policies that take into account the specific needs of the small-scale farmers.

This study can immensely make able to correlate the climate change and food security, but the geographical heterogeneities that the main victims of coastal regions are somehow excluded to discuss.

Another important study on the climate change in south-western coastal areas made by Asraful-ul-Alam Tutu (**CDP, 2008**) is '**Issues of Climate Change in South west coastal region**', 'Climate change may undermine human security by reducing access to the

quality of natural resources that are important to sustain livelihoods. Bangladesh is one of the most susceptible to the negative impact of climate change. The coastal region of country where mean elevations are within 1 to 3 meter are identified as the most vulnerable part due to climate change. In Bangladesh, coastal areas encompasses majority of the heavy industries, sea port and the Sundarbans, the largest single block mangrove ecosystem in the world.

Climate change imposes serious concern about agriculture of Bangladesh. It has to be noted that this sector contributes 30% to the GDP and employs roughly 63% of the labour force. It is not just farmers whose livelihoods are at risk from climate change, but also those whose livelihoods depend on agricultural production such as supplies of inputs, people who works in transporting and processing agricultural commodities’.

The Committee on Economic, Social, and Cultural Rights has given its interpretation of the right to adequate food. ‘The right to adequate food is realized when every man, women and child, alone or in community with others, have physical and economic access at all times to adequate food or means for its procurement’ (Committee on Economic, Social and Cultural Rights 2002). The right to adequate food implies the availability of food in quantity and quality which is sufficient to satisfy the dietary needs of individuals. The food has to be free from adverse substances and acceptable within a given culture. Furthermore, the food has to be accessible in ways which are sustainable, which implies that the access and the availability needs to be given long term. Several components of this definition are of particular importance in properly understanding the content of the right to adequate food. Food must be physically available. Availability implies either a possibility to feed oneself from productive land or the existence of a well-functioning food distribution system that guarantees food is always there. Availability in a region or a village alone does not mean that a person or a household has access to the food. The food needs to be accessible both physically and economically. Sometimes minorities are hindered in getting access to food. Sometimes they do not have the economic means to buy food.

SAARC Meteorological Research Centre (SMRC) has studied surface climatological data on monthly and annual mean maximum and minimum temperature, and monthly and annual rainfall for the period of 1985-2007. The study showed increasing trend of mean maximum and minimum temperature in some seasons and decreasing trend in

some other seasons. Overall trend of annual mean maximum temperature has shown significantly increasing trend over the period of 1985-2007.

The results revealed that the average increase in temperature would be 1.30C and 2.60C for the years 2030 and 2070, respectively. It was found that there would be a seasonal variation in changed temperature, 1.40C change in the winter and 0.70C in the monsoon months in 2030. For 2070, the variation would be 2.10C and 1.70C for winter and monsoon, respectively. For precipitation it was found that the winter precipitation would decrease at a negligible rate in 2030, while in 2075 there would not be any appreciable rainfall in winter.

Table 1.1: Extent of Changes in Temperature, Precipitation and Evaporation

Year	Average Temperature			Temperature Increase			Average Precipitation			Precipitation Increase			Changes in Evaporation		
	W	M	AV	W	M	A	W	M	A	W	M	A	W	M	AV
	(0C)			(0C)			mm/month			mm/month					
Base (1990)	19.9	28.7	25.7	0.0	0.0	0.0	12	418	179	0	0	0	0.6	14.6	83.7
Output from GCM															
2030	21.4	29.4	27.0	1.3	0.7	1.3	18	465	189	+6	47	10	0.9	15.8	83.9
2075	22.0	30.4	28.3	2.1	1.7	2.6	00	530	207	-12	112	28	Inf.	135	87.9

It was found that there would be excessive rainfall in the monsoon causing flooding and very little to no rainfall in the winter forcing drought. It was also found that there would be drastic changes in evaporation in both winter and monsoon seasons in the projection year 2075. It was inferred from the GCM output that moderate changes regarding climate parameters would take place for the projection year 2030, while for the projection year 2075 severe changes would occur.

The results also reveal that there is a general increasing trend regarding temperature. In 2030, the increase is much pronounced in winter months, although the maximum change is observed for post-winter months i.e., April, May and June.

Sea Level Rise

The SAARC Meteorological Research Council (SMRC) carried out a study on recent relative sea level rise in the Bangladesh coast (SMRC, 2003). The study has used 22 years historical tidal data of the three coastal stations. The study revealed that the rate of sea level rise during the last 22 years is many fold higher than the mean rate of global sea level rise over 100 years, which shown the important effect of the regional tectonic subsidence. Variation among the stations has also found. Table 2.4 represents the trend of tidal level in three costal stations.

Table 1.2: Trend of tidal in three coastal stations

Tidal Situation	Region	Latitude (N)	Longitude (E)	Datum (m)	Trend (mm/year)
Hiron Point	Western	21 ⁰ 48'	89 ⁰ 28'	3.784	4.0
Char Changa	Central	22 ⁰ 08'	91 ⁰ 06'	4.996	6.0
Cox's Bazar	Eastern	21 ⁰ 26'	91 ⁰ 59'	4.836	7.8

Source: SMRC

1.5 Operational Definition of Concepts:

People's perception:

People's perception denotes what people think and feel about anything. Their views and opinions regarding any occurrence.

Climate change:

The regional or global-scale changes in historical climate patterns arising from natural and man-made causes and resulting in both intermittent but increasingly frequent, extreme impacts and slow on-set, pervasive, cumulative effects; climate change involves the interactions of many systems, such as the atmosphere, hydrosphere, cryosphere, and biosphere, as well as the human social systems.

Vulnerabilities:

Vulnerability is the conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

Vulnerability is the degree to which a system is susceptible to or unable to cope with, adverse effect to climate ability is a function of the character, magnitude and a rate of climate change and variation to which a system is exposed its sensitivity, and its adaptive capacity.

South-west coastal Bangladesh:

The South-east coastal region of Bangladesh is situated in the central portion of Ganges delta with the Sudnarban, the largest mangrove forest in the world, situated between the inhabited portion and the bay of Bangle. This region comprises the district of Jessore, Khulna, Satkhira, Bagerhat, Gopalgange and Narail in Bangladesh

1.6 Conceptual Framework:

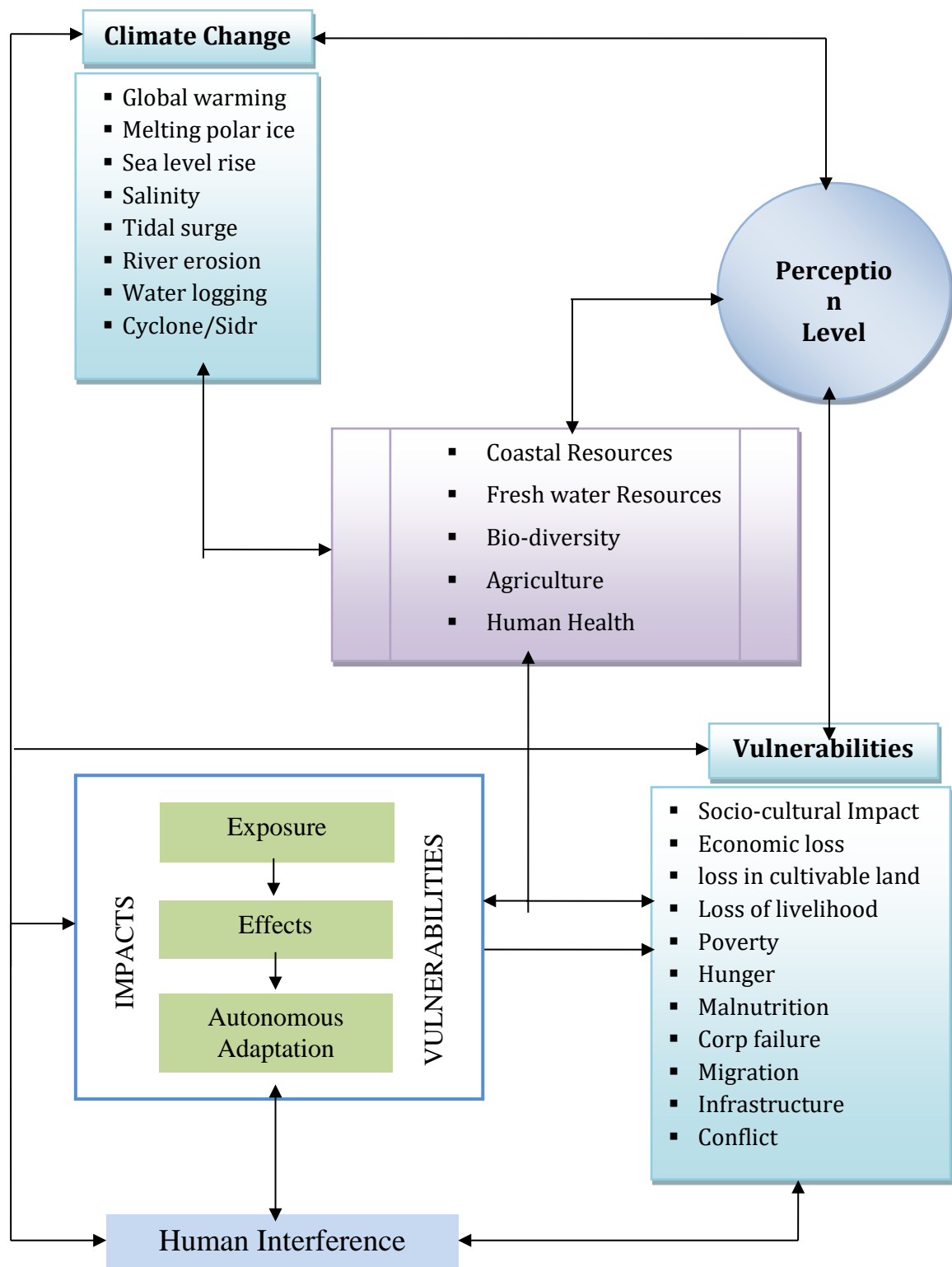


Figure 1.1 Conceptual Framework

1.7 Importance of the Study

Bangladesh, with a population nearing 130 million, is one of the poorest countries in the world while also being one of the most vulnerable to the impacts of climate change. Bangladesh, as one of the most densely populated low lying developing countries is likely to be severely impacted by any such global climate change that might occur in future. After conceptualize this truth the study has been selected to know the existing perception level about climate change in particular to the selected community and try to reach the goal by evaluating how much awareness and motivational works needs to the community's people.

At the most basic level, Bangladesh is likely to be impacted by climate change by a number of factors including droughts, floods, cyclones and long term sea level rise. In the short term, this means that the peoples are likely to be hit by more and more natural disasters in future coming years. In the longer term, the peoples need to incorporate for accounting the climate change into the country's development strategies and plans along with the incorporate the issue of adaptation to climate change with its development goals.

For mitigating the future demand, research from different angles on climate change vulnerability is very much indispensable along with it should be given emphasize on awareness growing about the climate change impacts which makes their life vulnerable.

1.8. Limitations of the Study

It is apprehended that, the collected data of the study area may not represent the overall situation of the area. There may be some shortcomings in the data collection procedure. It is suspected that, unconsciousness and lacks of knowledge of the inhabitants about climate change has not provided adequate information relevant to the purpose of the study. Around half of the people of the study area are female and they know a very little about climate change so some information could not be collected to fulfill the purpose of the study.

It most cases, the people of the villages had to be motivated first to make them answering the questions along with hampering them while asking each question with some probable alternative answers to get the real picture. There are some problem arising

during the collecting information from different organization and conducting the research properly, which have been presented here:

- Some non-cooperation faced during the time of collecting data.
- During the survey most of the people in the study area think that it was a survey for giving them aid after the fatal cyclone “AILA” but when they know the real thing, they were uninterested to give the answer to the respective question.
- Lack of quantitative data from respective authority as a result there was some problem to make an assessment for producing the past impact features on climate change vulnerability of the study areas.
- Most of the people are illiterate. So the data may not be fully appropriate.
- Lack of time and fund.

Besides, while reviewing literature about the related aspect, inconsistent data often fumbled the researcher about the reliability of the same data.

Chapter Two: Methodology of the Study

- 2.1 Methodology of the Study
- 2.2 Physical profile of the Study Area
- 2.3 Map of the Study Areas

2.1 Methodology of the Study:

An appropriate and systematic methodology is always expected in every study. It will help to organize the scattered views, information and the steps required in goal reduction process. Proper working procedure helps to capture the right things at right periods and finally fulfill the objectives. It prevents the encroachment and haphazardness. This section presents the sequential order and description of the different steps followed in the study. It is very difficult to explore data from direct field survey.

2.1.1 Research Design: The study has been adopted by observational survey research design. Data have been collected from people living in coastal area in south-western part of Bangladesh and analyzed through statistical tools. To realize the other objectives of the study data about respective concepts have been collected through incorporating relevant items (variables) in the questionnaire and analyzed and interpreted using descriptive techniques.

2.1.2 Unit of analysis : Head of the household.

2.1.3 Study area: Four villages namely Chunkuri, Botbunia, Poddarganj and Jaliakhali in Dakop upazila under Khulna District.

2.1.4 Population: All people living in Chunkuri and Botbunia villages.

2.1.5 Sampling: Both Simple random and purposive sampling have been used for this study. Purposive sampling has been adopted to select the four villages and simple random sampling has been used to select the representative sample through using random number of all households

2.1.6 Sample Size:

120 persons were selected from four villages of the study area in order to do the interview.

2.1.7 Sources of data: Two sources of data have been used in this study, these sources are following-

a) **Primary Source**- Primary source includes the field where the incidence occurs.

Through face-to-face interviews data will be collected. Here primary sources are those people who are the victim of climate change.

b) **Secondary Sources**-Secondary data is such a data, which is supplied by Non-Government Organizations, and other relevant organizations. Then it will collect some booklets, pamphlets and brochures from the below department such as-

- Demographic information was obtained from Bangladesh Bureau of Statistics: Population census 2001; Community series, Upazilla Daccop, Khulna.
- Social information from Chalna Upazilla Parishad office, Daccop, Khulna.
- Local NGO's and other relevant organization
- BBS
- Regular web publication FAO; NAPA, UNDP
- Relevant books of Climate Change, ecosystem management and others
- Books, Journals and daily newspapers etc.

2.1.8 Instrument of data collection: An interview schedule in English have been developed and finalized through pre-test and used for data collection.

2.1.9 Method of data collection: Data have been collected through interview schedule method, which have been asked and filled by the interviewers in face-to-face interview situation.

2.1.10 Pre-test: A pre-test of the questionnaire was done to understand if the questions are enough to fulfill the objectives. It also helped to finalize the probable options in the answers. After pre-testing, some new options were added to the code list and the questionnaire was finalized.

2.1.11 Data processing and analysis: Data have been analyzed and interpreted through different statistical techniques and computerized using software's like SPSS, GIS, Excel etc.

2.1.12 Presentation of findings: Findings have been presented through written research report. A draft report have been prepared and given to the proper authority for comments and suggestion, and then finally submitted to the authority.

2.1.13 Flowchart of the Methodology

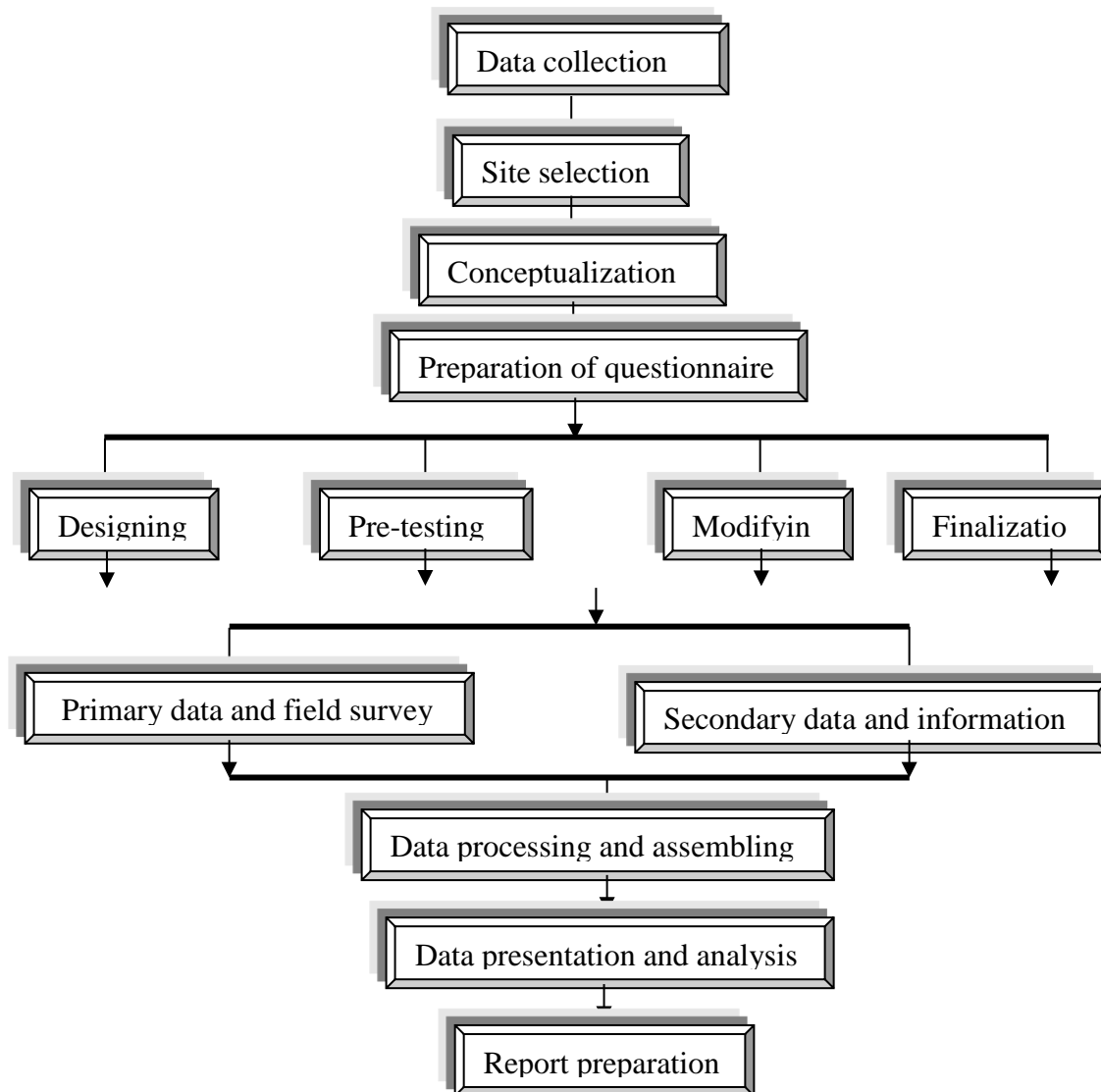


Figure 2.1: Flowchart of Methodology

2.2 Physical profile of the Study Area:

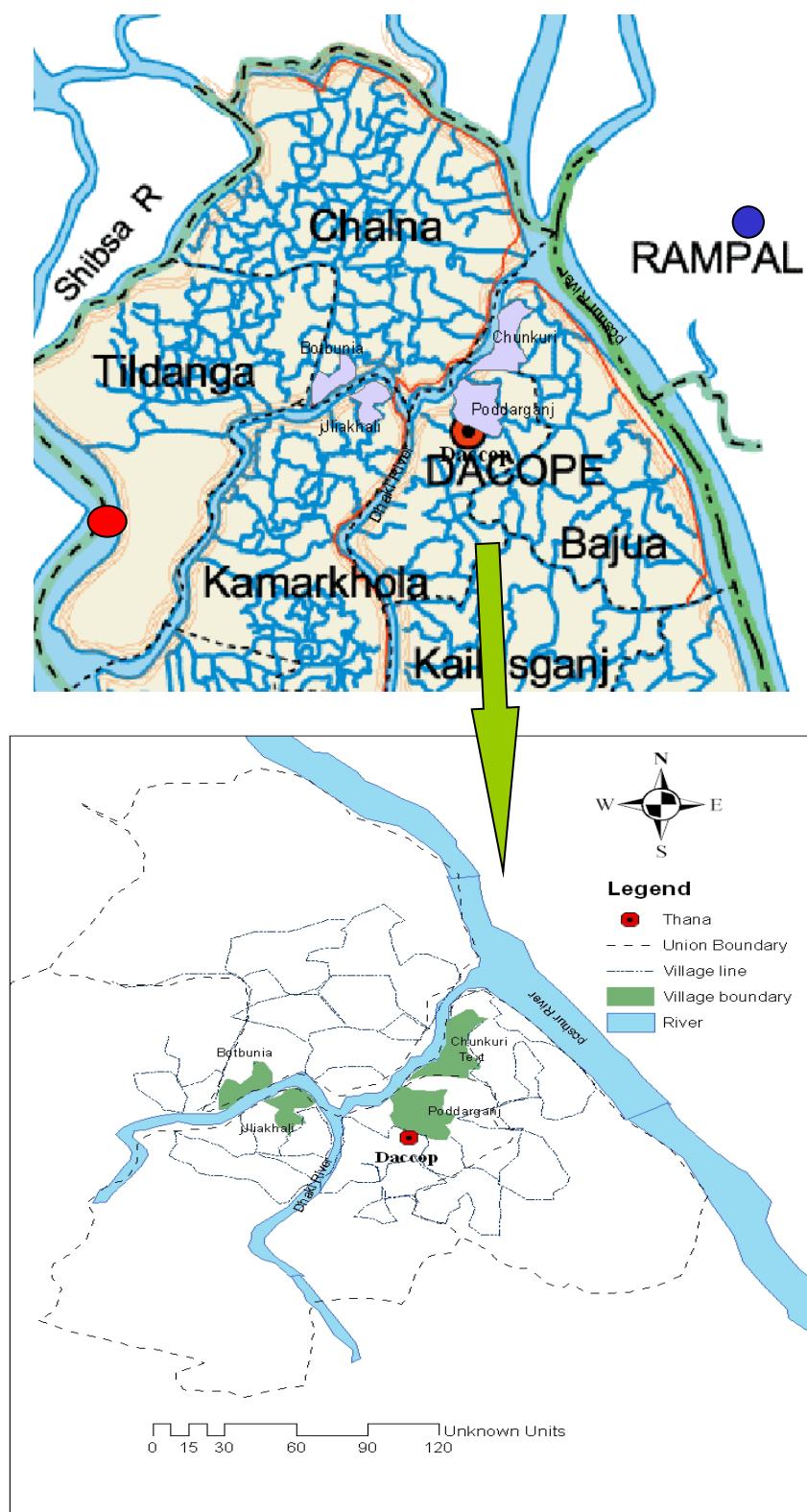
Distinct selection of the study area is very imperative for any study. The eventual success of any kind of research study fully depends on the selection of study area. The main impacts of the climate change have been faced by the coastal zone due to its vulnerability over various coastal resources. The study area is located, village Chunkuri, Botbunia, Poddarganj and Jaliakhali in Dakop upazila under Khulna District.

As it is a coastal region, as well as impact zone of Sundarbans, climate induced natural disaster like cyclone, river erosion, saline water intrusion, flood, tidal surges and sea level rise and man made activities are prominent feature of the study area. Another way, human induced shrimp farming initiates salinity which seriously affects the agricultural production, and makes this region vulnerable to safe potable water.

Most of the population of the study area is living below the poverty line. Besides, proximity of the area made it easier to collect information from different sources that represent different degrees of physical and socio-economic changes initiate to select the area. Climate change vulnerability studies have used different climate change scenarios to assess impacts, adaptation and vulnerability for different sectors. This community has been selected due to its high vulnerability for the result of various climatic factors.

2.3 Map of the Study Area:

Figure 2.2: Map of the Study Area



Source: Banglapedia (National Encyclopedia of Bangladesh)

Chapter Three: Understanding Climate Change

3.1: The Issues and Threat of Climate Change

3.2: Adaptation strategies in Institutional Level

3.3: Perspectives for Dealing the Issues and Threats of Climate Change

3.1 Understanding the Climate Change

The earth's climate is driven by a continuous flow of energy from the sun. This energy arrives mainly in the form of visible light. About 30% is immediately scattered back into space, but most of the 70% that is absorbed passes down through the atmosphere to warm the earth's surface. (Without this natural greenhouse effect the earth would be about 30 degrees Celsius cooler and would be unfit for us to live on!). The earth must send this energy back into space in the form of infrared radiation. Being much cooler than the sun, the earth does not emit energy as visible light. Instead, it emits infrared or thermal radiation.

"Greenhouse gases" in the atmosphere block infrared radiation from escaping directly from the surface to space. The main greenhouse gases are water vapor, carbon dioxide, ozone, methane, nitrous oxide, and the chlorofluorocarbons (CFCs).

Levels of all key greenhouse gases (with the possible exception of water vapor) are rising as a direct result of human activity. Emissions of carbon dioxide (mainly from burning coal, oil, and natural gas), methane and nitrous oxide (due to agriculture and changes in land use), ozone (generated by chemical reactions to the fumes in car exhausts) and CFCs (manufactured by industry) are changing how the atmosphere absorbs energy. This is all happening at an unprecedented speed. The result is known as the "enhanced greenhouse effect". The climate system must adjust to rising greenhouse gas levels to keep the global "energy budget" in balance.

In the long term, the earth must get rid of energy at the same rate at which it receives energy from the sun. Since a thicker blanket of greenhouse gases helps to reduce energy loss to space, the climate must change somehow to restore the balance between incoming and outgoing energy. This adjustment will include a "global warming" of the earth's surface and lower atmosphere. But this is only part of the story. Warming up is the simplest way for the climate to get rid of the extra energy. But even small rise in temperature will be accompanied by many other changes: in cloud cover and wind patterns, for example. Some of these changes may act to enhance the warming, others to counteract it.

3.1.1 The Issues and Threat of Climate Change

Human societies have long been subject to disruption by climate change. In the past, most of these variations have reflected natural phenomena, from fluctuations in levels of solar radiation to periodic eruptions of volcanoes. But in future most climate change is likely to result from human actions and in particular from the burning of fossil fuels and changes in global patterns of land use.

However, the effects of climate change will be not being uniform. The social consequences too will vary, depending, for example, on levels of development; in South Asia extra tropical storms could kill tens of thousands of people, while in the United States they might kill fewer people but lead to billions of dollars worth of damage. And even within the same society there will be differential social impacts; for young people greater heat stress may simply be a minor inconvenience, while for the elderly it can be fatal.

But across the world and in every country those most at risk will typically be the poorest, and in developing countries these will often be those who depend most for their survival on a healthy natural environment, such as ethnic tribes or nomadic groups, fishing communities, smallholders and livestock herders (UNFC,2006).

Climate Change is likely to have a significant impact on the global environment. In general, the faster the climate changes, the greater will be the risk of damage. Mean sea level is expected to rise 15-95 cm by the year 2100, causing flooding of low-lying areas and other damage. Climatic zones could shift towards the poles by 150-550 km in the mid-latitude regions. Forests, deserts, rangelands and other unmanaged ecosystems would face new climatic stresses. As a result, many will decline or fragment and individual species will become extinct.

Human society will face new risk and pressures. Food security is unlikely to be threatened at the global level, but some regions are likely to experience food shortages and hunger. Water resources will be affected as precipitation and evaporation patterns change around the world. Physical infrastructure will be damaged, particularly by sea-level rise and by extreme weather events. Economic activities, human settlements, and human health will experience many direct and indirect effects. The poor and disadvantaged are the most vulnerable to the negative consequences of climate change.

3.1.2 Perspectives for Dealing the Issues and Threats of Climate Change

Article II of the United Nations Framework Convention on Climate Change (1992), specifies the ultimate goal of international climate policy as follows:

“The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.” (UNFCCC, 1992)

Since the Third Assessment Report of the Intergovernmental Panel on Climate Change, considerable attention has been devoted to identifying what magnitude of climate change comprises “dangerous anthropogenic interference” and, subsequently, assessing the risk of exceeding this temperature threshold under different scenarios of future growth in greenhouse gas emissions and/or efforts to reduce or mitigate those emissions.

Conducting such a risk assessment involves integrating estimates of the threshold for ‘dangerous’ climate change with the likelihood of different increases in future global temperatures. Various international estimates of the global threshold for ‘dangerous’ climate change were reviewed by Preston and Jones (2006). The international community appears to have arrived at a consensus estimate of approximately 1.5°C above 1990 temperatures or approximately 2°C above pre-industrial temperatures. This represents a threshold beyond which there is a significant risk of damage or loss to unique or threatened systems (such as coral reefs), local to global economies, or large-scale and potentially irreversible changes in the climate system.

3.1.3 Needs for People’s Perception on Climate Change Vulnerability in Coastal Bangladesh

The Geographical situation, land characteristics, multiplicity of rivers and the monsoon climate render Bangladesh highly vulnerable to natural disasters. The Southwestern region is affected by floods, tropical cyclones, riverbank erosion, siltation, salinity intrusion, and tidal surges. In recent years this area has also faced occasional tornadoes, drought and heavy rainfall. Bangladesh, on behalf of its vulnerable people, and also as a voice for the vulnerable communities and countries all over the world establishes the case for global consensus and urgent action to address climate change. Bangladesh needs to act urgently to address climate change. It is necessary now to provide guidance to

policy makers and development practitioners to utilize opportunities emerging from negotiated outcomes. For example, opportunities are emerging in capacity building, technology transfer, education and public awareness, adaptation fund, etc. A systematic and holistic approach to this is to establish and operationalize a country framework to mainstream climate risk management and adaptation in the development planning and management policies, institutions and processes. People in South-West region are highly dependent on the natural resource base in the sustaining their livelihoods. Various unwanted climatic behaviors make all of the natural resource vulnerable and thus needs for the perception about climate change vulnerability is indispensable for the coastal people of Bangladesh.

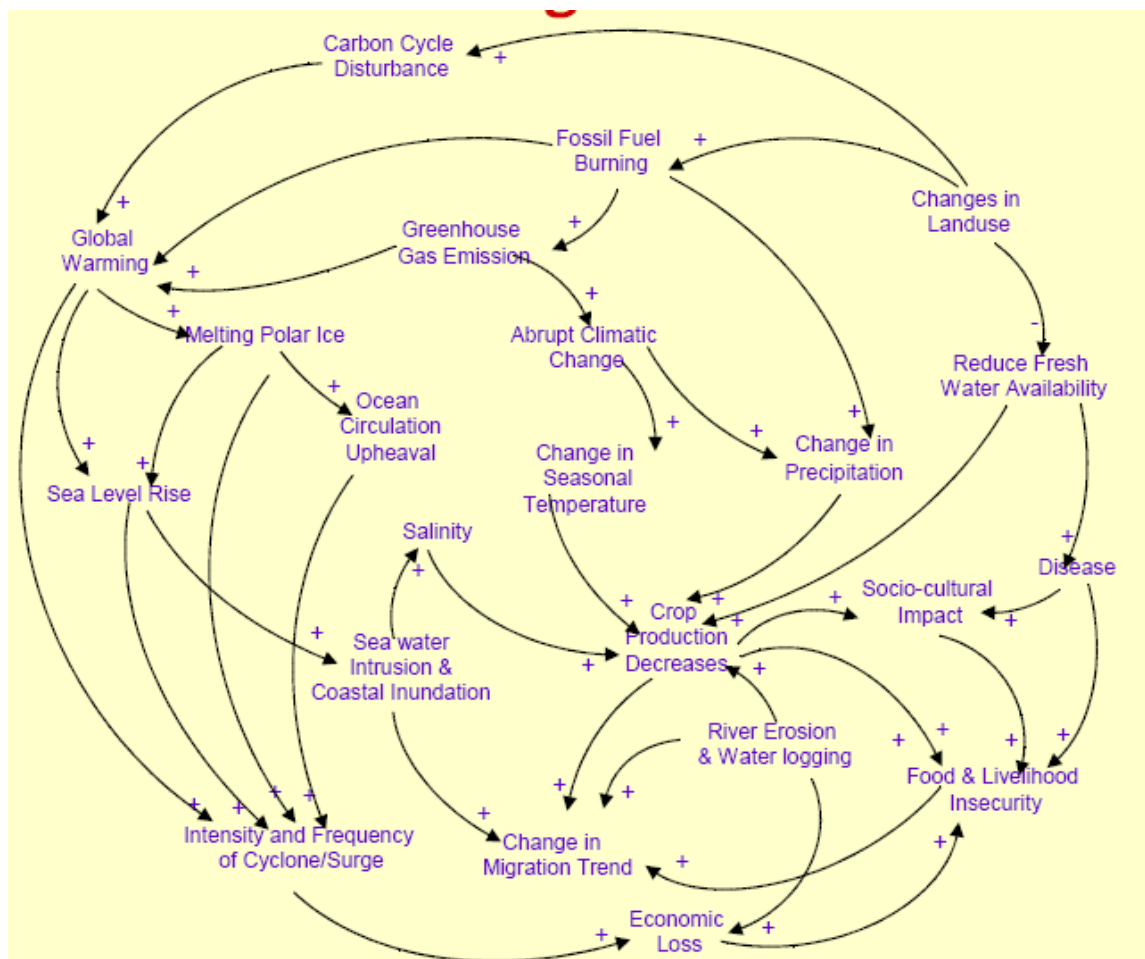


Figure: 3.1.1: Climate Change Induced Impact and Vulnerabilities (Prodipan, 2006).

3.1.4 Adaptation Strategies in Institutional Level

Institutional adaptation would facilitate the various types of adaptation provided by the government and non government organization in national, regional, and local levels. These may include socio-economic measures such as changing the use of the resources through non structural measures, such as crop diversification and sustainable shrimp cultivation, changing planning procedure and increasing awareness levels etc. against existing vulnerability contexts. In the study area there is no significant government level of adaptation except some procedure to construct a drinking water tank and giving some aid after strikes the cyclone Sidr over the community.

In the study area there are different non government organizations such as World Vision, CARITAS, PRODIPAN etc. provides institutional adaptation strategy to the community level aiming at sustainable environmental management and sustainable resource use. The NGOs are tried to make the people aware about how to cope with the natural disaster. They helped the affected people after any type of disaster with variety of aid to sustain their life. Now PRODIPAN has take the initiatives for training the local people about *gher* farming and this would help the people to cope with the salinity intrusion.

3.1.5 Conceptual Model for the Adaptation with Climate Change Vulnerability

The climate change increases extreme weather events like Cyclone, tidal surges, floods, river erosion, heavy rainfall, salinity intrusion, potable water crisis and water borne diseases. All these climate change compounds increase the risks of the disasters which are already a threat to our development, wellbeing and future. We have to take a comprehensive approach in designing and implementing disaster management in a changing climate. Conceptual model for the adaptation with climate change vulnerability mainly promotes defining and redefining risks incorporating technical knowledge, impacts of climate change analyzing vulnerability and risks factors focusing all hazards; all risks and all sectors. In order to reduce the vulnerability of the study area towards sustainable development and livelihoods leading to poverty reduction, the entire society has to work as a unit. The whole process need to harmonize towards a common goal. Above all it is very much necessary to strengthen the capacity building of affected people for identifying and assessing the vulnerability. We have to identify the existing vulnerabilities and the causes of changing these vulnerabilities into more severe forms.

Defined all the vulnerabilities face by the selected community clearly. Then incorporate the possible adaptation strategy into the development plans, policies and project design under development planning frameworks. With the help of development partners strengthen the existing adaptation techniques and implement planned adaptation towards the sustainable development of the community. The following figure 3.2 shows an overview of a conceptual model to cope with the climate induced hazards for the study areas.

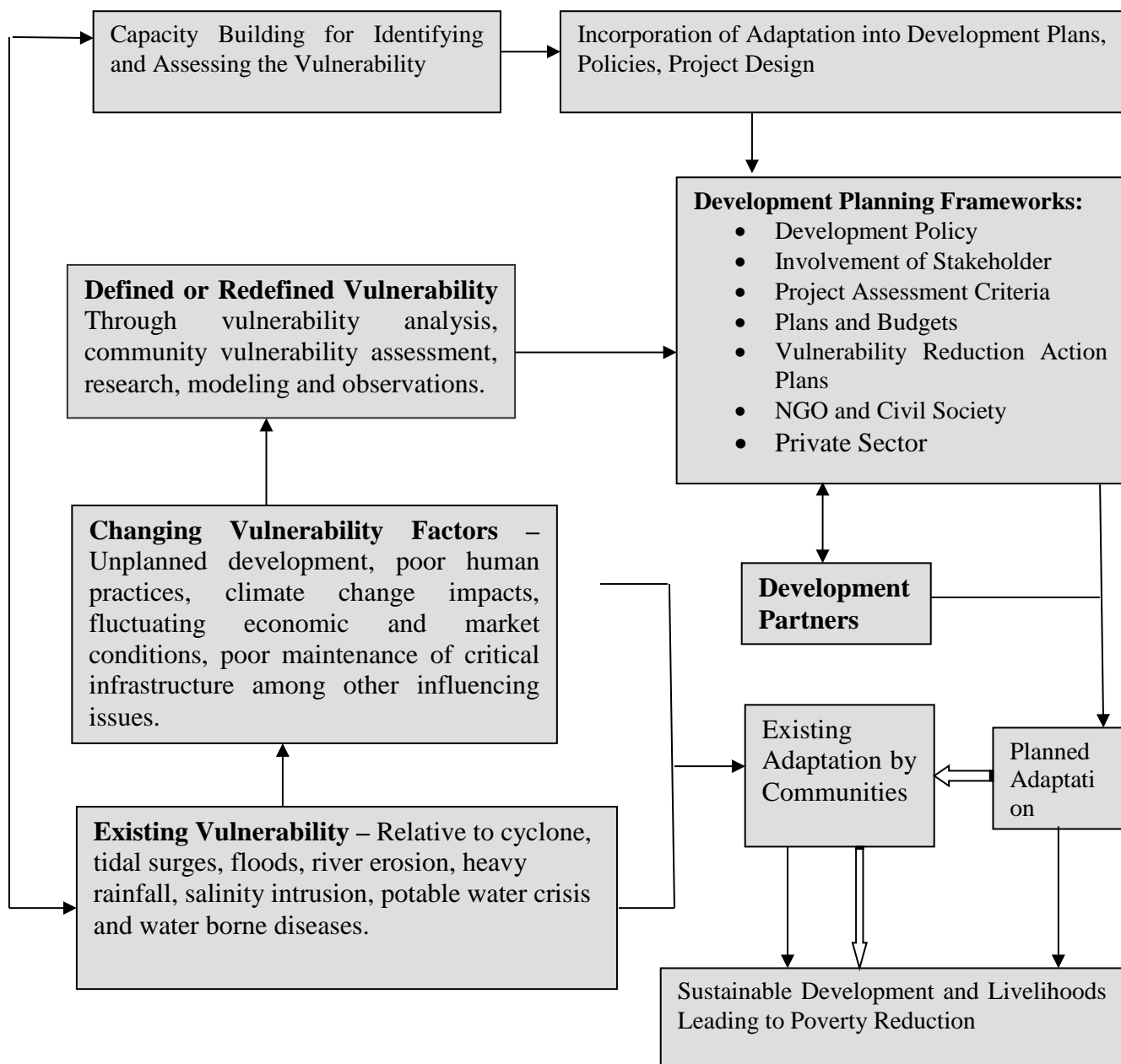


Figure 3.2 Conceptual Model for the Adaptation with Climate Change Vulnerability in the Study Area (Modified from the model of Development Risk Reduction by CDMP).

Chapter Four: Data Analysis

- 4.1: Socio-economic and Demographic characteristics of the Respondents
- 4.2: Perception Assessment Regarding Climate Chang
- 4.3: Vulnerability Assessment due to Climate Change
- 4.4: Adaptation Strategies of the Respondents

4.1: Socio-economic and Demographic Characteristics of the Respondents:

4.1.1 Age Distribution of the Respondents

The age distribution of the respondents is presented in the following table:

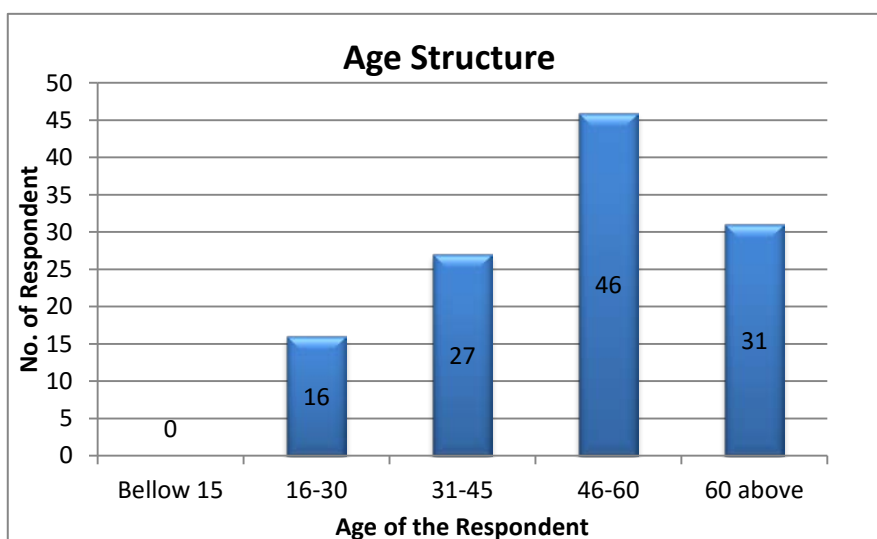
Table 4.1.1-Age Structure of the Respondent

Age	Respondents	
	N	%
15-30	16	13
31-45	27	22
46-60	46	38
Above 60	31	25
Total	120	100

Source: Field Survey, 2009

The data on age distribution of the respondents is illustrated in Table 4.1.1. The table shows that most of the respondents (38%) were age between 46to 60 years and 22% respondents whose age was between 31 to 45 years, 25% respondents was found who were above 60 years whereas only 13% respondents had the age between 15to30 years.

Figure 4.1.1- Distribution of the Respondent by Age Group



4.1.2-Sex Status of the Respondents

Sex status of the respondent is quiet a significant demographic variable to compare it with perception level of climate change The distribution of the respondents by Sex Status is presented in the following table

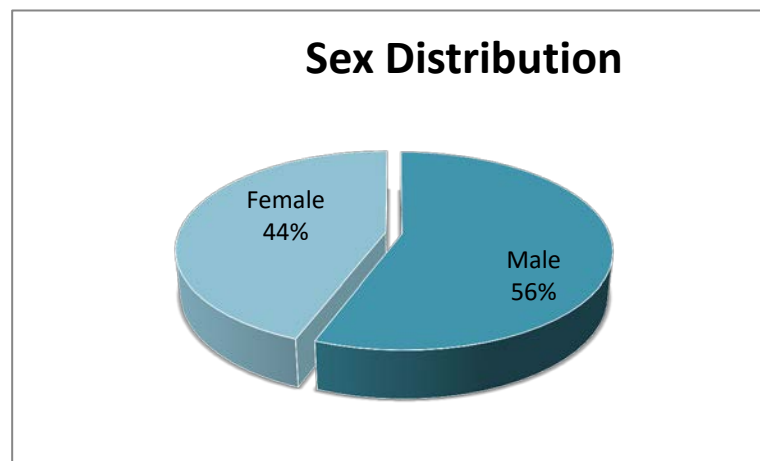
Table 4.1.2-Sex Status of the Respondent

Sex	Respondents	
	N	%
Male	67	56
Female	53	44
Total	120	100

(Field Survey 2009)

Table 4.1.2 represents that majority (56%) of the respondents were male, whereas only 44% respondents were female.

Figure 4.1.2 Distribution of the Respondent by Sex Status



4.1.3 Marital Status

The number of respondent who were married and unmarried is shown in the table below

Table-4.1.3 Distribution of the Respondents' Marital Status

Marital Status	Respondents	
	N	%
Married	97	80
Unmarried	23	20
Total	120	100

Source: Field survey, 2009

The above Table 4.1.3 shows the marital status of the respondents. It indicates that most of the respondents were married (80%) while only 20% were married.

4.1.4 Religious Status of the Respondents

Religion is fundamental social institution that shape human life in a variety of ways. The distribution of the respondents by religion is presented in the following table

Table-4.1.5 Distribution of the Respondent by Religion

Religion	Respondents	
	N	%
Muslim	20	16
Hindu	73	60
Christian	27	22
Total	120	100

(Field Survey 2009)

The table shows that majority (60%) of the respondents were Hindus, followed by 22% Christian and only 16% were Muslims.

4.1.5: Educational Status

Educational status is one of the most important indicators of standard of living. The distribution of respondents according to their education status is given in the bellow table

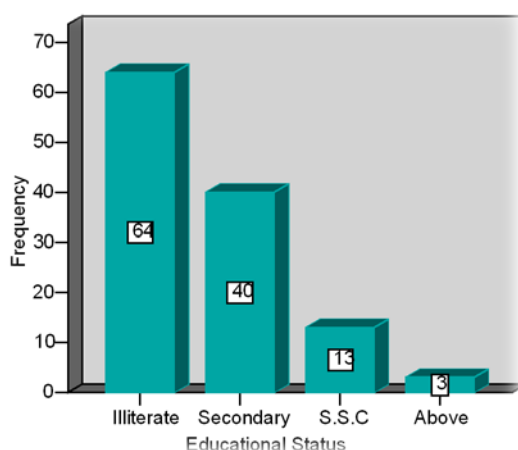
Table-4.1.5 Distribution of the Respondent by Educational Level

Education Level	Respondents	
	N	%
Illiterate	64	54
Secondary	40	33
S.S.C	13	11
Above	3	2
Total	120	100

(Field Survey 2009)

The table represents that among the respondents, 67 respondents (54%) were found Illiterate out of 120. 33% respondents found who were at the secondary levels and 11% respondents were SSC passed, where very few (2%) found who were belonging higher degrees.

Figure 4.1.3 Distribution of the respondent by Sex Status



4.1.6: Occupational pattern of the Respondents

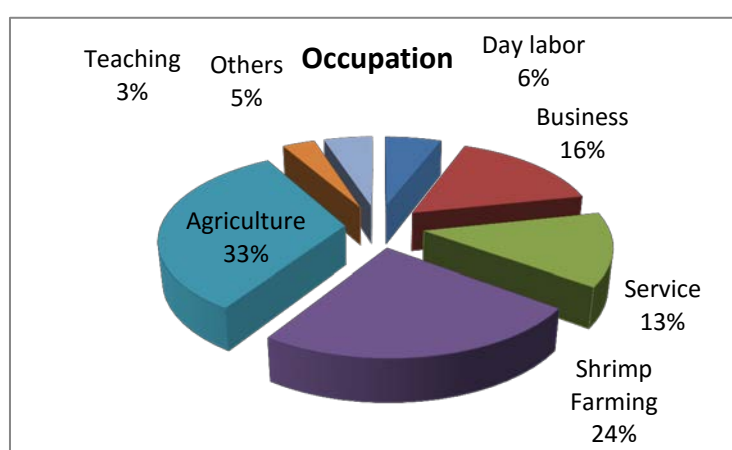
Occupation is one of the important ways to earn money for living. In the study area, most of the respondents were directly or indirectly related with the agriculture due to lack of industrial sector. In spite of this relation some respondents were engaged in various types of occupation.

Table 4.1.6: Occupational Pattern of the Respondents

Occupation	Respondent	
	N	%
Day labor	7	6
Business	19	16
Service	16	13
Shrimp Farming	29	24
Agriculture	39	33
Teaching	4	3
Others	6	5
Total	120	100

Source: Field survey2009

In the above table, most of the respondents (33%) were involved in agriculture. It implies that the basic economic activities of this area was agriculture oriented. Then the second majority (24%) covers respondents who were directly involved with shrimp farming along with small scale of agriculture. Besides 16% respondents found who were related with small and large scale business. 13% respondents were involved in various level of services and among them very lowest portion (6%) were day labour and 3% respondents were involved in teaching profession and 5% were involved in various types of other professions.

Figure 4.1.4: Occupation of the Respondent

4.1.7: Monthly Income of the Family

Respondent's monthly family income distribution is presented in the following table

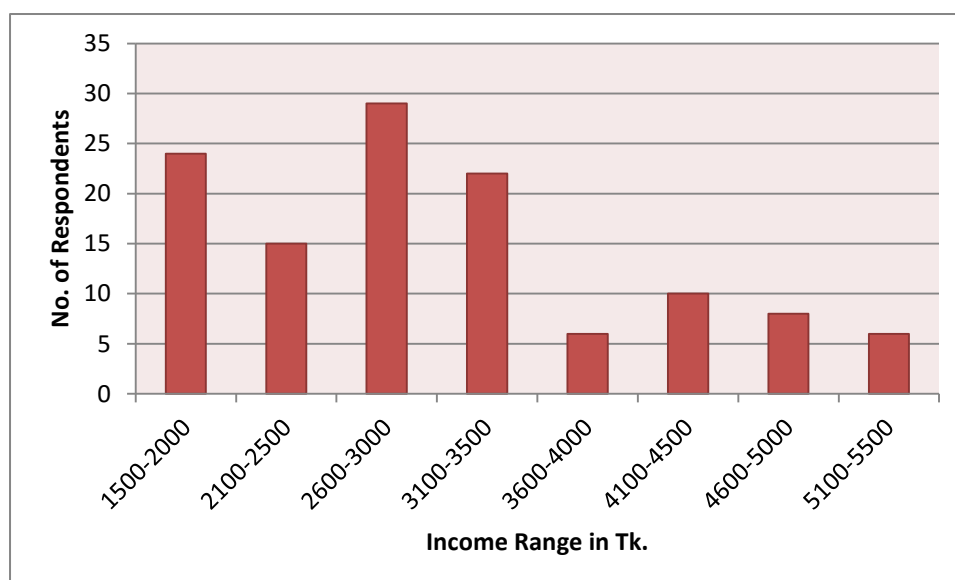
Table: 4.1.7 Monthly income of the family of the respondent

Income	Respondents		
	N	%	Average
1500-2000	24	20	4393.75
2000-2500	15	13	
2500-3000	29	24	
3000-3500	22	18	
3500-4000	6	5	
4000-4500	10	8	
4500-5000	8	7	
5000-5500	6	5	
Total	120	100	

Source: Field Survey 2009

It was evident that the most of the families (24%) possessed income range between Tk. 2500 to 3000 and followed by 20 % respondents whose family income between 1500 to 2000 and around 3000 to 3500 income range and 18% families of the respondents and others 13% family were in income between 2000-2500. Very few families (5%) found whose income between 5000 to 5500 and income level 4000-4500 earned by 8% family. Only 7% families found whose income between 4500 to 5000. The average income of the respondents was 4393.75 taka.

Figure 4.1.:5 Family income level of the Respondent



4.1.8: Family Type of the Respondents

Different types of family, mainly joint and nuclear, was found in the study, which reveal the difference in the attributes according to the family type. The distribution of respondents is shown according to their family type.

Table-4.1.8: Family Type

Family Status	Respondent	
	N	%
Joint family	98	82
Nuclear family	22	18
Total	120	100

Source: Field Survey 2009

Table 4.1.8 represents that among the number of respondents, 82% respondents were found joint family out of 120, and rest 18 % were found who were in nuclear family.

4.1.9: Daily Menu of Food Item Taken by Respondents

The daily food item of the respondents is presented in the following table

Table 4.1.9: Daily food item of the respondents

(N=120)*

Menu of Food	Respondents	
	N	%
Rice	120	100
Wheat	27	23
Milk	21	18
Meat	19	16
Vegetable	112	93
Fish	91	76
Fruits	31	26

Source: Field Survey 2009

*Multiple responses

The following table reveals that the food items of different categories, rice taken by all (100%) the respondents, vegetables taken by 93% respondents, fish taken by 76%, whereas fruits only taken by 26 % of the respondents, wheat taken by 23% and milk taken by 18% and few respondents had taken meat regularly in their regular food menu.

4.1.9.1: Changes food Habits

The following table presents changes food habits by the number of respondents

Table 4.1.9.1: Changes food item of the respondents

Responses	Changes food item	
	N	%
Yes	82	68
No	38	32

N=120Source: Field Survey 2009

Table 4.1.9.1 shows that majority (68%) of the respondents had unable to bring any changes in their food item in daily basis, whereas only 32% respondents were afforded to take changes in their food habits.

4.1.10: Dynamics of land Use Pattern of the Respondents

The following table provides the categorical data on comparative analysis of land asset in terms of aggregate of total amount of land possessed by the total number of respondents at present and

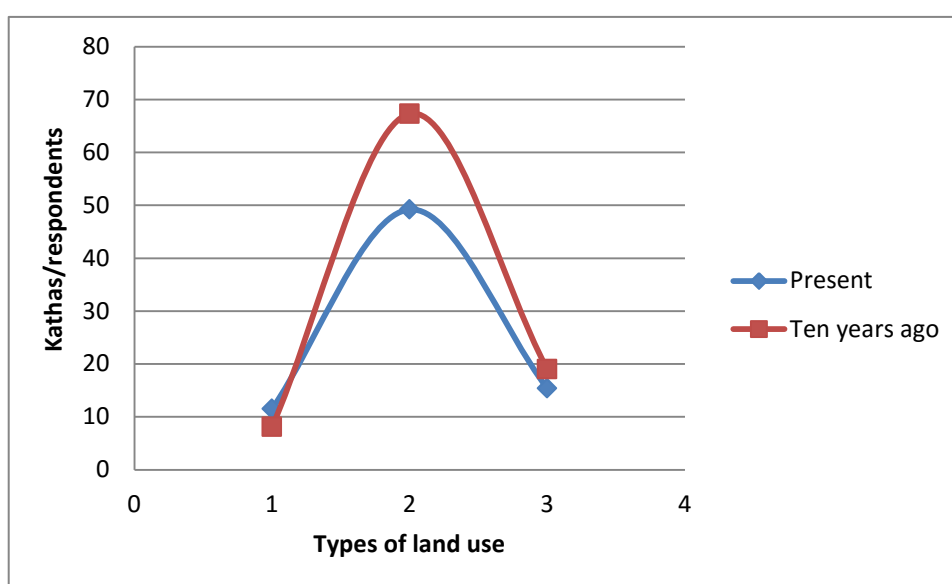
Table 4.1.10: Dynamics of the land use pattern of the respondents (N=120)

Type of land	Present amount of average land (Katha)/respondent	Amount of average land ten years ago (Katha)/respondent
Dwellings	11.5	8.1
Cultivable land	49.2	67.3
Uncultivable	8.4	7.6
Shop, market etc.	3.1	2.4

Source: Field Survey 2009

The table depicts that at present the all respondents possessed average 8.1 kathas land in dwelling purposes but it was around 11.5 kathas average ten years ago. On the other hand, about 49.2 kathas land was used in the cultivation purposes, whereas it was more than 67.3 kathas about ten years ago. This exhibits the declining nature of the land use pattern for cultivation. Besides, only average 3.1 kathas land was used in shop and market building purposes, but this amount was somewhat low (average 2.4 kathas) around ten years ago. Uncultivable land was found 8.4 katha average in present time which was almost 7.6 kathas per average.

Figure 4.1.6: Dynamics of land use pattern of the respondents



4.1.10.1: Causes of Declining the Land Property

The table provides the data on the possible causes of declination of the land property

Table 4.1.10.1: Causes of Declining the Land Property

***N=120**

Causes	Respondents	
	N	%
Cyclone	82	68
River erosion	111	93
Salinity intrusion	91	76
Land fragmentation	46	38

Source: Field Survey 2009
*Multiple responses

The following table reveals that majority of the respondents (93%) demonstrated river erosion was the cause of damage the land property, followed by 91 respondents (76%) stressed on Salinity intrusion and 68% respondents viewed cyclone as the causes of property losses whereas only 38% respondents argued land fragmentation as the causes of declination of land.

4.1.11: Property Handled by the Respondents

The table describes the persons who handle the property of respondents

Table 4.1.11: Property Handled by Respondents

Property handled by	Respondents	
	N	%
Own	42	35
Son	50	42
Daughter	15	12
Spouse	13	11
Total	120	100

Source: Field Survey 2009

It is seen from the above table that most of the family property (42%) was handled by the son in the household and 35% family property was handled by respondents own-selves. On the other hand, only 12% property was handled by the daughter and 11% was handled by the spouse.

4.1.12: Housing conditions of the Respondents

The table provides the data of housing conditions which represents standard of living of the respondents.

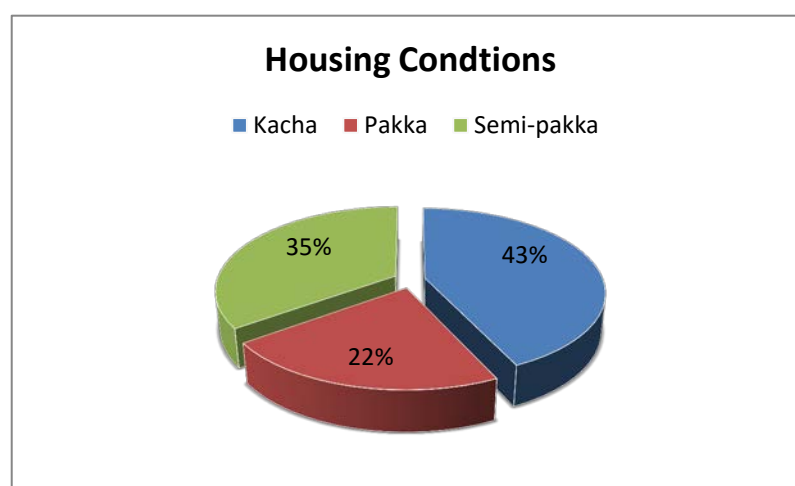
Table 4.1.12: Housing conditions of the respondents

Housing Conditions	Respondents	
	N	%
Kacha	51	43
Pakka	27	22
Semi-pakka	42	35
Total	120	100

Source: Field Survey 2009

The table 4.1.12 represents that most of the house (43%) of the respondents were Katcha, whereas the number of Pakka house was only 22% and 35% were semi-pakka house.

Figure 4.1.7: Housing conditions of the respondents



4.1.13: Sources of Drinking Water Used by the Respondents

The present sources of drinking water and previous sources are presented in the bellow table

Table 4.1.13: Sources of drinking water of the respondents

***N=120**

Sources	Present Sources		Sources ten years ago	
	N	%	N	%
Rain Water	61	51	58	48
Pond Water	116	97	72	60
Deep Tube-well	13	11	86	72
Others Sources	5	4	11	9

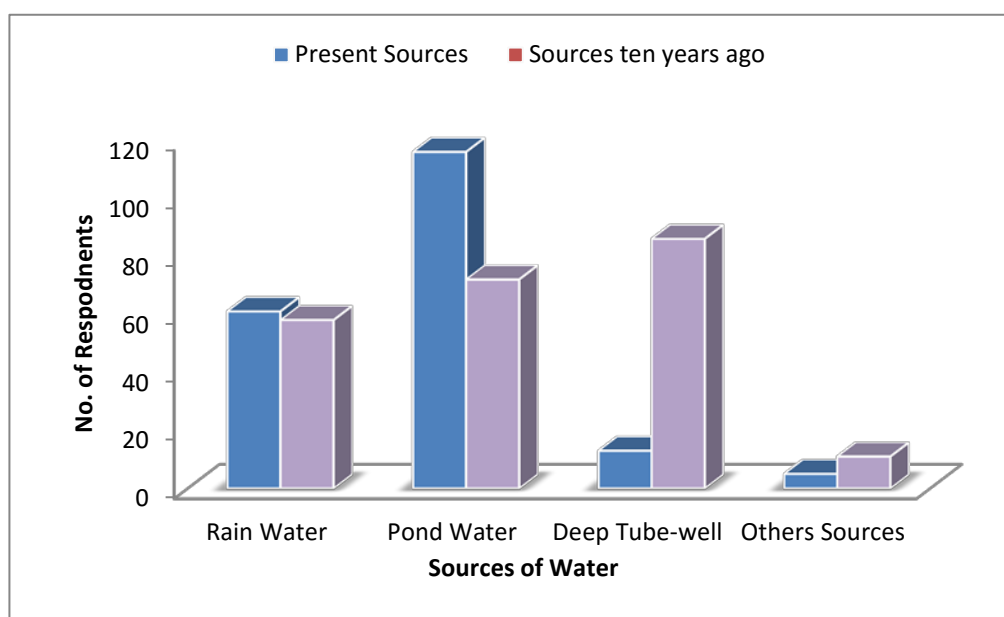
Source: Field Survey 2009

*Multiple responses

Multiple responses were found with regard to the present sources of drinking water compared to sources of drinking water ten years ago. Table reveals that at present 51% respondent relied upon stored rain water as the chief sources of drinking water which used 485 respondents ten years ago. Besides, majority of the respondents (97%) used filtered pond water as the main sources of drinking water that was 60% ten years ago.

Deep tube-well was used by 72% respondents ten years ago but at present it had declined and only 10% respondents used tube-well. Only 4% respondents were dependent on other sources of drinking water whereas it was 9% ten years ago.

Figure 4.1.8: Sources of drinking water of the respondents



4.2: Perception Assessment Regarding Climate Change:

4.2.1: Perception of Respondents regarding Climate Change

The perception level of climate change to measure wheatear it is known or unknown to the respondents and how much they know about this is presented bellow

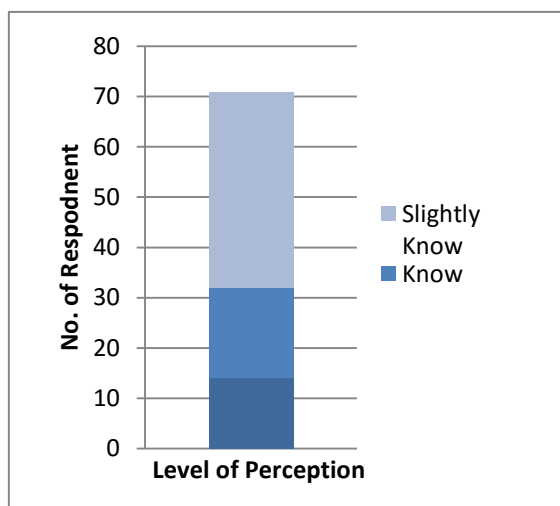
Table 4.2.1: level of knowledge of respondents regarding Climate Change

Number of Respondent		Known about Climate change			
		Yes	%	No	%
N=120		71	59	49	41
Level of Knowledge	In case of YES	Respondents			
		N=71		%	
	Know well	14		20	
	Know	18		25	
	Slightly Know	39		55	
Total		71		100	

Source: Field Survey 2009

The table contains the data that among 120 respondents, 59% respondents were known and 41% respondents did not have any knowledge about climate change in which only 20% respondents were ‘know well’ and other 25% respondents were ‘know’ and most of the respondents (55%) were ‘slightly known’.

Figure 4.2.1: Level of knowledge regarding Climate Change



4.2.1.1: Sources of Getting Knowledge regarding Climate Change

This describes the sources from which respondents got knowledge regarding climate change.

Table 4.2.1.1: Sources of Getting Knowledge regarding Climate Change
*N=120

Sources of getting knowledge regarding climate change	Respondents	
	N=71	%
NGO	42	71
Radio, TV	55	77
Newspaper	44	62
Others	29	41

Source: Field Survey 2009

*Multiple responses

The above table represents that 71% respondents got knowledge regarding climate change from local NGOs and major portion of respondents (77%) got knowledge from Radio and TV. 62% respondents claimed Newspapers as the sources of getting knowledge about climate change and only 41% respondents informed it from others sources.

4.2.1.2: Relationship between Sex Status and Level of Perception

Bellow table signifies the relationship between sex status and the level of perception.

Table 4.2.1.2: Relationship between ‘Sex status’ and ‘level of perception’

Level of Perception	Sex				Total	
	Male		Female			
Know well	11	89%	3	21%	14	100%
Know	10	56%	8	44%	18	100%
Slightly Know	27	69%	12	31%	39	100%
Don't know	19	61%	30	39%	49	100%
Total	67	56%	53	44%	120	

$X^2=11.556$, $df=3 = 7.815$ Source: Field Survey 2009

The data presented in the Table 4.2.1.2 signified the relationship between ‘sex status and the level of perception’. The data table exhibits that among the 120 respondents, majority (67 respondents) were male, while female were only 53. Regarding climate change 89% male respondents know well whereas only 21% respondents were female. Besides, 56% male respondents know about climate change and other 44% female respondents know. 69% male respondents slightly know about climate change whereas only 31% female respondents were followed by the same. 61% male respondents did not know about climate change and 39% respondents were unknown about climate change. Thus the data Table reveals the relationship of the two variables that the level of perception regarding climate change varies in terms of gender. Male were more known about climate change than female.

Null Hypothesis of this Chi-Square test was that *there is no relationship between the Sex Status and Level of Perception of the respondents*. Here the calculated value of the Chi-Square is **11.556** at 3 degree of freedom. At 3 degree of freedom the critical value of Chi-Square is **7.815** with the **0.05** level of significance (under the two tailed test). Thus the calculated value of Chi-Square is greater than the critical value at the **0.05** level of significance. Hence Here the Null hypothesis is rejected with the 0.05 level of

significance. Therefore the result of the chi-square signifies that *there is a relationship between the Sex Status and Level of Perception of the respondents*.

Correlation signifies **0.243** at the 0.01 level (2-tailed, Pearson Correlation). It indicates the Sex Status and Level of Perception are poorly and positively correlated.

4.2.1.3: Relationship between Educational Status and Level of Perception

The table describes the interrelations hip between educational status and level of perception

Table 4.2.1.3: Relationship between ‘Educational Status and ‘level of perception’

Level of Perception	Education								Total	
	Illiterate		Secondary		SSC		Above			
Know well	1	13%	3	38%	2	25%	2	25%	8	100%
Know	14	54%	8	31%	3	12%	1	4%	26	100%
Slightly Know	18	50%	13	36%	5	13%	0	0	36	100%
Don't know	31	62%	16	32%	3	6%	0	0	50	100%
Total	64	53%	40	33%	13	11%	3	3%	120	

$X^2=24.576$, $df=12= 21.026$

Source: Field Survey 2009

The Table 4.2.1.3 represents the relationship between the ‘Educational Status and ‘level of perception of the respondents’. Here the table data illustrated that the majority of the respondents did not know about climate change and very few, only 13% respondent ‘know well’ and 50% respondents slightly know. 32% respondents whose educational status was secondary level did not know about climate change and other 38% respondents know well, rest 56% respondents were ‘slightly known’. Those who were in status of SSC level, 13% respondents were slightly known about climate change. 25% respondents belonging higher degree were best known about climate change.

Null Hypothesis of this Chi-Square test was that *‘there is no relationship between the ‘Educational Status and ‘level of perception’*. Here the calculated value of the Chi-Square is **24.576** at 12 degree of freedom. The critical value of Chi-Square is **21.026** at **12**

degree of freedom with the **0.05** level of significance (under the two tailed test). Thus the calculated value of Chi-Square is greater than the critical value with the **0.05** level of significance. Thus the null hypothesis is rejected here. Therefore it can be recommended that *there is a relationship between the 'Educational Status and 'level of perception'*. Here the Chi-Square test signifies that, the level of perception motivated by the educational status of the respondent. Correlation signifies **0.010** at the 0.01 level (2-tailed, Pearson Correlation). It depicts the Educational Status and Level of Perception is poorly and positively correlated.

4.2.1.4: Relationship between Educational Status and Level of Perception

The table provides the data about relationship between Educational Status and Level of Perception

Table 4.2.1.4: Relationship between 'Occupation and 'level of perception'

Level of Perception	Occupation							Total
	Day labor	Business man	Service	Shrimp Farming	Farmer	Teacher	House wife	
Know well	0	1	3	1	3	2	0	10
Know	0	4	4	11	6	1	0	26
Slightly Know	1	9	2	9	11	1	2	35
Don't know	6	5	7	8	19	1	3	49
Total	7	19	16	29	39	4	6	120

$X^2=34.392$, $df=18= 28.869$ Source: Field Survey 2009

In the cross tabulation of Table 4.2.1.3, data signifies the relationship between 'Educational Status and 'level of perception of the respondents'. Here the cross tabulation reveals the relationship between the two variable. The data explains that among the 120 respondents 1 day labour was slightly known about climate change and rest 6 were did not know. 9 businessmen were 'slightly known' and 4 respondents 'know'. 7 service men did not have any idea about climate change whereas only 4 respondents were 'known'. Those who were related with shrimp farming 11 respondents had general knowledge about climate change but 8 respondents were 'unknown' about

climate change. 19 farmers did not know whereas 11 respondents had slight conception about this. Majority respondents who were related to teaching profession know better.

Null Hypothesis of this Chi-Square test was that *there is no relationship between the 'Educational Status and level of perception'*. Here the calculated value of the Chi-Square is **34.392** at 18 degree of freedom. The critical value of Chi-Square is **28.869** at 18 degree of freedom with the **0.05** level of significance (under the two tailed test). Thus the calculated value of Chi-Square is greater than the critical value with the **0.05** level of significance. Thus the null hypothesis is rejected here. Hence it can be concluded that *there is a relationship between the between the Educational Status and level of perception*. Thus here the chi-square test signifies the linkage between the educational Status and level of perception regarding climate change.

4.2.2: Perception of Respondents regarding Causes of Climate Change

The table provides the data on respondent's perception regarding causes of climate change

Table 4.2.2: Perception of Respondents regarding Causes of Climate Change

Causes	Respondents	
	N	%
Global warming	97	81
Deforestation	71	59
CO₂ emission	58	48
Urbanization	6	5
Industrialization	19	16

***N=120**

Source: Field Survey 2009

*Multiple responses

The following table represents that most of the respondents (81%) had given much stress on global warming as the root cause of climate change and 59% respondents meant that deforestation. 48% respondents implied their views to condemn on CO₂ emission as the chief causes of climate change, while only 16% respondents indicated industrialization and 5% argued on urbanization as the causes of climate change.

4.2.3: Respondents Feel Victim of the Climate Change

The following table presents the data on respondents their feelings about whether they feel themselves as the victim of the climate change

Table 4.2.3: Respondents Feel Victim of the Climate Change

Responses	Feel Victim	
	N	%
Yes	97	81
No	81	19

N=120

Source: Field Survey 2009

The table 4.2.3 shows that major portion of the respondents (81%) felt themselves as the victim of the climate change whereas only 19% respondents did not mean so.

4.2.3.1: Causes of Feel themselves as the Victim of Climate Change

Possible causes through which climate change made them vulnerable is represented by the follow

Table 4.2.3: Causes of feel victim of the climate change

***N=120**

Source: Field Survey 2009

Causes of feel victim	Respondents	
	N	%
Natural calamities	82	68
Salinity Intrusion	76	63
River erosion	57	48
Temperature rise	105	88
Drought	67	56
Heavy rainfall	39	33

***Multiple responses**

From the above table, it is manifested that most of the respondents (88%) argued on temperature rise as the major causes of victimization of climate change. Besides, 68%

respondents claimed natural disaster as the root causes of this victimization and salinity intrusion had been claimed by 63% respondents whereas 56% respondents stated on drought and 48% on river erosion, followed by only 33% respondents argued on heavy rainfall as the major causes that widening their vulnerabilities through changing climatic conditions.

4.2.4: Respondents Suffer Health Hazards

The following table brings out the health related hazards due to climate change

Table 4.2.3: Suffer Health Hazards of respondents

Responses	Feel Victim	
	N	%
Yes	89	74
No	31	26

N=120

Source: Field Survey 2009

The table 4.2.3 reveals that among the 120 respondents, majority (74%) were victimized of health related hazards due to climate change whereas only 26% respondents did not fell themselves as the victim of health hazards.

4.2.4.1: Types of Health Hazards Suffered by the Respondents

The table describes the types of disease occurred by climate change

Table 4.2.4.1: Types of Health Hazards suffered by respondents

***N=120**

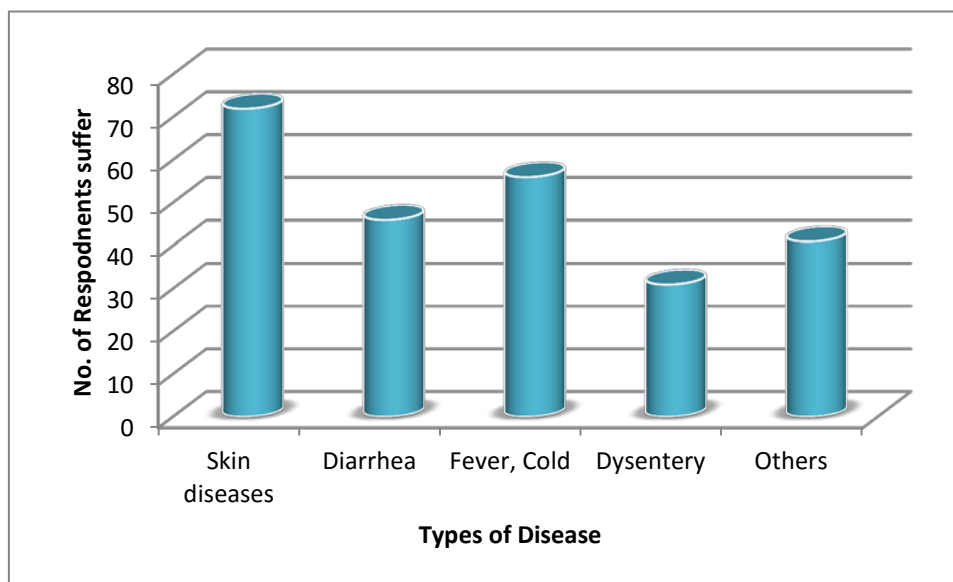
Source: Field Survey 2009

*Multiple responses

Causes	Respondents	
	N	%
Skin diseases	86	72
Diarrhea	55	46
Fever, Cold	67	56
Dysentery	37	31
Others	49	41

The following table brings out the evidence that majority (72%) of the respondents suffered skin disease and 56% respondents suffered from various types of fever and cold. 46% respondents frequently victim of diarrhea and only 31% respondents were victimized of dysentery and other 41% respondents suffered from various frequent and occasional disease.

Figure 4.2.2: Types of Health Hazards suffered by respondents



4.3: Vulnerability Assessment due to Climate Change:

4.3.1 Vulnerability Ranking in Study Areas

Livelihoods are vulnerable when they are unable to cope with and respond to risk, stress and shocks. On the basis of the field survey, the four villages in study areas focused on the vulnerability contexts that interrupt their livelihood. The vulnerability contexts of the study area are classified as high, medium and low which is shown in the table

Table 4.3.1. Problem Ranking and Frequency of the Study Area *N=120

Climatic Problem	Respondents		Average Frequency per year	Ranking Problem Based on Vulnerabilities					
	N	%		High		Medium		Low	
				%	N	%	N	%	N
Cyclone	120	100	2~3 times	71	85	29	35	0	0
Tidal Surge	42	35	1~2times	67	80	23	28	0	0
Floods	71	59	1~2 times	40	48	40	48	60	72
River Erosion	120	100	Throughout the year	100	120	0	0	0	0
Heavy Rainfall	85	71	2~5 times	17	20	50	60	33	40
Salinity Intrusion	120	100	Throughout the year	100	120	0	0	0	0
Portable Water Crisis	120	100	Throughout the year	100	120	0	0	0	0
Water Borne Disease	57	47	Throughout the year	50	60	25	30	25	30

Source: Field Survey 2009

*Multiple responses

The table indicates that 100% respondents claimed cyclone as the high degree of climatic problem which occurred 1~3 times per year. Recent cyclone AILA carried out a devastating result to the study area which might make the ranking high score, 71%

responses had given upon and 29% responses on medium problem ranking and no respondent could think it as lower level problem. Tidal surge occurring 1~2 times per year paid a considerable responses, 42% respondents stressed on tidal surge in which 67% respondents ranked high, 23% respondents ranked medium and no responses had been taken to the lower score. Flood come up 1~2 times a year and 71% respondents felt flood as a major problem. 40% respondents scored flood as high ranking and same number of respondents ranked it medium and rest 60% respondents ranked it 'Low'. All the respondents (100%) gave responses that river erosion occasionally occurred throughout year and 100% respondents meant it as the high scored climatic problem and no responses had been come up to rank medium and low scores. Heavy rainfall occurring 2~3 times per year was claimed by 71% respondents whereas 17% respondents ranked it 'high', 50% medium and rest 33% respondents ranked it as a major climatic problem. 100% respondents claimed salinity intrusion as the major climatic problem existing throughout the year, among them all the respondents thought it as a high ranked problem. Portable water crisis which evident as a mainstreaming problem as all the respondents claimed it on and 100% respondents ranked it high scored climatic problem. Various types of water borne disease existing throughout the year had a devastating impact upon the study areas. Among all respondents, 50% respondents argued it as a high ranked and 25% on medium ranking whereas rest 30% claimed on low ranking.

4.3.2 Vulnerability Effect on the Study Areas

Household suffer not only from natural disaster but also from a broad range of other factors. Rahman (1995) maps out the risks factors that create vulnerability to rural respondents and led to downwards spirals and trends in livelihoods. As defined earlier, livelihoods are vulnerable when they are unable to cope with respond to risk, stress, and shock. Based on the field survey, the vulnerability context that is identified in the study area creates several threats on their lives, property, settlements and livelihood patterns. The effect for the vulnerability contexts of the study were assessed as a percentage of population affected by the problem, based on the respondent of the village East Chila.

Table 4.3.2 Problem and its Effects of climate change on the study areas.

Vulnerability contexts	Homeless	Food Shortage	Property loss	Diseases	Shortage of Drinking Water	Decrease of Production	Reduce Income	Sanitation Problem	Snake Attack	Home Damage	Damage communication system
	%	%	%	%	%	%	%	%	%	%	%
Cyclone	42	71	65	12	89	42	59	70	6	55	88
Tidal Surge	29	24	47	12	51	42	33	55	7	77	61
Floods	47	47	35	35	35	59	29	59	29	29	29
River Erosion	31	0	35	0	0	21	11	3	0	47	36
Heavy Rainfall	4	29	11	2	0	24	18	4	0	4	47
Salinity Intrusion	0	35	12	0	24	47	29	0	0	0	0
Portable Water Crisis	0	0	0	44	81	0	0	0	0	0	0
Water Borne Disease	0	0	0	59	0	0	0	0	0	0	0

*Multiple Responses

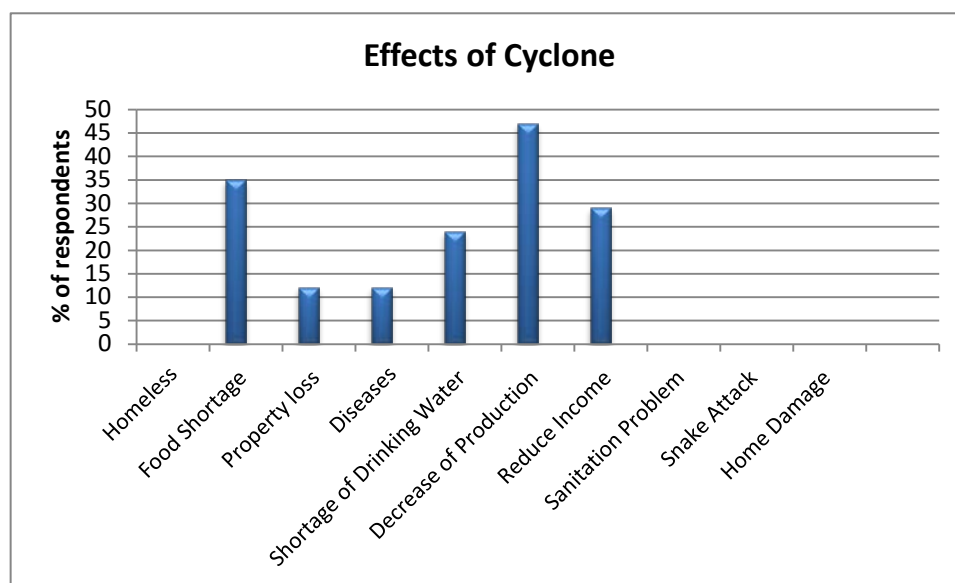
Field survey, 2009

*N=120, No. of Respondent Affected by Specific Effect to the Vulnerability Contexts

The following table brings out that cyclone resulted 42% respondents of homeless, creates 71% respondents of food shortage, damaged 65% respondents of property loss, 12% respondents of them faced the problem of diseases. Due to cyclone 89% of population suffered for shortage of drinking water, cyclone resulted decrease of production had argued by 42% respondents. Reduce income 59%, 70% suffered sanitation problem and damages the home of about 55% population and 88% of

population faced the problem of communication. It is established that cyclone had severe effect on livelihood over the study areas.

Figure: 4.3.1(A) Effects of cyclone on the study areas



On the other hand the effect of tidal surges on the study areas shows that 29% of respondents were homeless, 24% population faced the problem of food shortage, damages the property of about 47% respondents, 51% respondents faced shortage of water, 55% felt sanitation problem, and 12% population suffer the problem of disease and shortage of drinking water due to tidal surges.

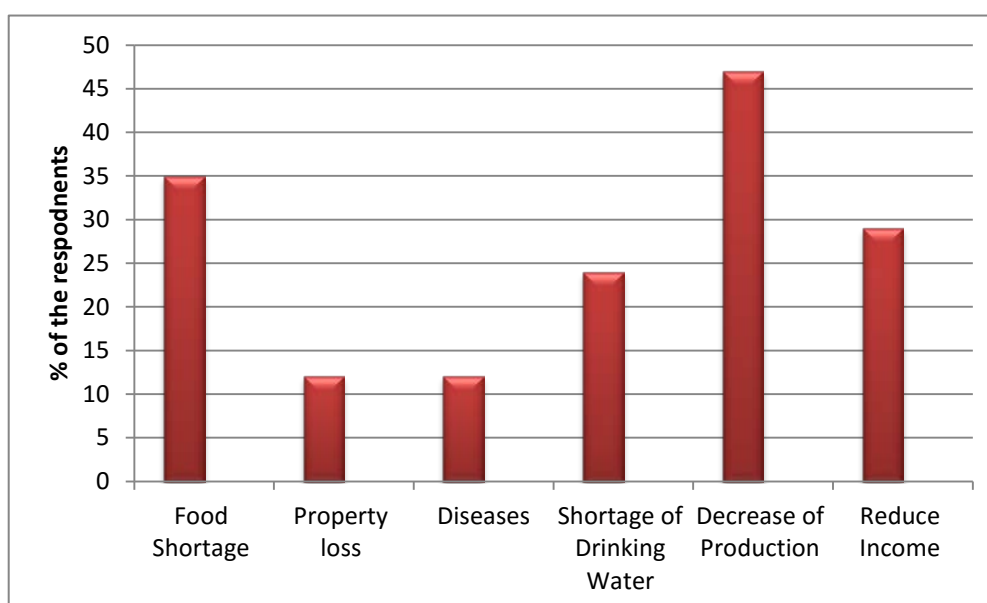
River erosion was felt one of the major problems in this area. Most of the houses were situated at the bank of the river and these were in potential risk to diminish through the river. Based on the field survey shows that 20% of the land was lost forever by the continuous river bank erosion. Due to river erosion 31% respondents were bound to be homeless, property lost more than 35% respondents and damaged home about 49% respondents.

Heavy rainfall occurred 3~4 times per year which brought a devastating impact in the study areas. 29% respondents faced shortage of food due to heavy rain fall. 11% respondents lost their property and 29% respondents argued that due to heavy rainfall the production loss. Communication system damaged due to heavy rainfall had argued 49% respondents.

The effect of saline water intrusion was highly seasonal in the study area. Saline water reached its minimum during the monsoon (June- October), and in winter months saline fronts begin to penetrate inland. Climate change would increase saline water intrusion through several ways such as directly pushing the inland the saline-fresh water front in the rivers through higher sea level, upwards pressure on the saline fresh water interface.

Based on the field survey, about 35% respondents faced the problem of food shortage and due to saline water intrusion in the agricultural field the production decreased of about 47% respondents. In the long term their property had been lost of their 12% of respondents and shortage of drinking water cussed problem to 24% of the respondents.

Figure: 4.3.1(B) Effects of Salinity intrusion in the study areas



Ensure safe potable water is very much necessary for a community. To ensure safe health condition supply of safe potable water is inevitable. The potable water crisis was a major problem for the study areas. All the respondents (100%) viewed that it was a major problem for their livelihood and the entire respondents perceived it as a high ranking problem. The effects of potable water crisis on the study areas resulted about 44% of population faced the problem of water-borne disease and 81% respondents felt crisis of drinking water. The respondents were mainly dependent on the pond water and there was few tube well in the study areas.

4.3.3 Climate change s and Well-being Indicators

Well- being ranking covers broader issues, and is now more commonly used, as there are a number of criteria other than wealth, which satisfy household's socio economic status. The range of indicators used, as so far includes the number of animals of household, material indicators, housing type, access to credit, household composition, access to food security etc. the objectives of vulnerability contexts versus well being ranking are to find out how respondents define well-being of good quality of life or bad quality of life due to climate change vulnerability

Figure: 4.3.3 The Vulnerability contexts Versus Well- being ranking

Vulnerability Contexts	Respondent		House	Occupation	Income	Wealth
	N	%				
Cyclone	114	95	+++	++	+++	+++
Tidal Surge	42	35	+++	++	++	+++
Floods	70	59	+++	+	++	++
River Erosion	112	93	+++	+	+	+
Heavy Rainfall	85	71	++	-	+	+
Salinity Intrusion	109	91	-	+++	+	+
Portable Water Crisis	98	82	-	-	+	+
Water Borne Disease	56	47	-	-	++	++

Source: Field Survey, 2009

Notes: - = Not vulnerable, + = slightly vulnerable, ++ = moderately vulnerable, +++ = Severe vulnerable.

The following table explores the level of vulnerability due to climate change based on well-being indicators of life is house, occupation, income and wealth. The vulnerability contexts well-being ranking is assessed on the basis of percentage of the respondent of as the respondents identifies how severe the impacts of vulnerability contexts on the well-being of human life and their socio-economic status. Cyclone, tidal surge, flood and river erosion causes the most devastating effect on houses which ranked as most vulnerable and salinity intrusion as the worst affected in the area of occupation.

4.3.4 Plant and Agricultural Production

The following table provides a comparative analysis of present agricultural production and the amount of production which produced ten years back

Table 4.3.4 Crops present time and ten years ago

Crops ten years ago	Production Kg/Begha	Crop at present	Production
Rice	600-800	Rice	200-300 Kg/Begha
Water melon	200-320	Water melon	350-600
Brinjal	160-200	Brinjal	Low quantity in homestead gardening.
Aurum	400-500	Aurum	
Vegetable varieties	300-400	Vegetable varieties	
Cabbage, coli flower, beans,			

Source: Field Survey, 2009

Based on the data collected from the respondents in the study areas, ten years rice was grown

4.4: Adaptation Strategies of the Respondents

4.4.1: Identification and Measurement of Adaptive Strategy in the Study Area

Table 4.4.1- Adaptation Strategies of the Respondents with vulnerable climatic conditions

***N=120**

Vulnerability contexts	Migration (%)	Drink/ use rain water (%)	Collect rice or food as a loan (%)	High mud wall with bamboo (%)	Wait for relief (%)	Repair houses (%)	maintain livelihood	Lease out resources or land (%)	Use potash alum (%)	Boil water (%)	Take oral saline (%)	Stay in house (%)	Govt. /NGOs help
Cyclone	59		71		71	88	59					35	29
Tidal Surge	29		41		35	71	35					59	29
Floods	47			12	12	71	29						
River Erosion	88		35	29		88	41	12					18
Heavy Rainfall				41		71	12						
Salinity Intrusion		18					47		35				24
Portable Water Crisis		41							59	47			47
Water Borne Disease		41								41	59		

% Indicates Percentage of Population Adapted with the Vulnerability Contexts

*N =120, No. of Respondent Adapted by Specific Adaptation Strategy

During the cyclonic storm surges occurred in the study areas, adapted with vulnerability contexts by migrating from locality to other safe place about 59%, about 71% respondents collected rice or food as a loan, about 71% respondents waited for relief, about 88% respondents repaired houses and about 59% respondents took loan to maintain livelihood, 35% respondents stayed in house and 29% respondents waited for Govt. / NGOs help.

On the other hand during the tidal surges 29% respondents migrated from their locality to safe place, 41% respondents collected rice or food as a loan, about 35% respondents waited for relief and about 71% repaired their house as soon as possible, 35% respondents took loan to maintain the livelihood, 59% respondents stayed in houses and waited for govt. / NGOs help of about 29% respondents.

The respondents adapted with river erosion through 88% of respondents had been migrated; about 35% of respondents collected rice or food as a loan, 29% respondents made their houses by high mud wall with bamboo, 88% of respondents repaired their houses in a safe place, 41% of respondents took loan to maintain their livelihood, 12% respondents leased out resources or land and 18% respondents of the community waited for Govt. /NGOs help.

Adaptation strategy with salinity is found that 18% respondents used drink rain water to meet their demands, 47% respondents took loan to maintain their livelihood, about 35% respondents used potash alum to purify the saline water and 24% of population waited for Govt. / NGOs help

Adaptation strategies with potable water crisis, about 41% respondents used drink rain water, 59% respondents used potash alum, 47% respondents took boil water for drinking purposes and 47% respondents waited for Govt. /NGOs help.

Adaptation strategies with water borne diseases, about 41% respondents drink/use rain water, 41% respondents took boil water and 59% respondents took oral saline to remove/ protect water borne

4.4.2: Govt. and Non-govt. help to boost up the Conditions of the respondents:

The respondents of the study areas demanded the institutional adaptation from government and non government organization to adapt to these existing environmental conditions and to boost up their socio-economic status. The view of the respondent was that they wanted to require non refundable financial assistance to boost up their economic condition. The respondents of these areas faced a measurable problem during cyclone AILA and their views was to build enough cyclone shelter in their area thus they could get shelter into it. One of the major problems in this region was salinity intrusion and then most of the agricultural land had been deteriorated by the effect of salinity and their production would decrease day by day. So they wanted some help from different government and non government organization to secure them or giving them support to cope with this problem. Another problem in the village community was their potable water crisis. If government or non government organization had given the support to mitigate this problem then they can easily reduce their various types of water borne diseases. Due to river erosion most of the household in these areas was in vulnerable condition and they demanded for government's initiative to protect their settlement from river bank erosion.

Chapter Five: Major Findings, Recommendations and Conclusion

5.1: Major Findings

5.2: Recommendations

5.3: Concluding Remarks

5.1 Major findings, Recommendations and Conclusion:

5.1.1 Major Findings:

The study has carried out a board spectrum findings regarding people's perception on climate change vulnerabilities and their responses towards disaster risk and their way to cope with these hazardous physical and social environment in the disaster porn areas. Among the respondents, majority (38%) were belong to age group 46-60 years, followed by age above 60 years were 25%, Most of the respondents (56%) were male and married (80%).Majority (60%) of the respondents was Hindus and Christian (22%) and only16% were Muslims.

Among the respondents, around half of the respondents (54%) were Illiterate and very few found who belongs to higher degrees. Significant numbers of the respondents (33%) were involved in agriculture and only (6%) were day labours. Most of the families (24%) possessed income range between Tk. 2500 to 3000 and very few families (5%) were found whose income between 5000 to 5500. The average income of the respondents was 4393.75 taka.

Notable number of respondents, 82% respondents were found joint family and rest 18 % were found who were in nuclear family The following table reveals that the food items of different categories, rice taken by all (100%) the respondents, vegetables taken by 93% respondents, fish taken by 76%, whereas fruits only taken by 26 % of the respondents, wheat taken by 23% and milk taken by 18% and few respondents had taken meat regularly in their regular food menu.

Majority (68%) of the respondents had unable to bring any changes in their food item in daily basis, whereas only 32% respondents were afforded to take changes in their food habits. All respondents possessed average 8.1 *katha* land in dwelling purposes but it was around 11.5 *katha* average ten years ago in that an increasing trend of dwelling land manifested. On the other hand, about 49.2 *katha* land was used in the cultivation purposes, whereas it was more than 67.3 *katha* about ten years ago. This exhibits the declining nature of the land use pattern for cultivation.

Most of the respondents (93%) demonstrated river erosion was the cause of damage the land property, followed by 91 respondents (76%) stressed on Salinity intrusion whereas only 38% respondents argued land fragmentation as the causes of declination of land.

Most of the family property (42%) was handled by the son in the household and only 12% property was handled by the daughter and 11% was handled by the spouse.

Significant number of the house (43%) of the respondents was *Kacha*, whereas the number of *Pakka* house was only 22% and 35% were semi-*pakka* house. At present 51% respondent relied upon stored rain water as the chief sources of drinking water which used 85 respondents ten years ago. Besides, majority of the respondents (97%) used filtered pond water as the main sources of drinking water that was 60% ten years ago. Deep tube-well was used by 72% respondents ten years ago but at present it had declined and only 10% respondents used tube-well. Only 4% respondents were dependent on other sources of drinking water whereas it was 9% ten years ago.

Regarding climate change 59% respondents were known and 41% respondents did not have any knowledge about climate change in which only 20% respondents were 'know well' and other 25% respondents were 'know' and most of the respondents (55%) were 'slightly known'.

Most of the respondents (81%) had given much stress on global warming as the root cause of climate change and 59% respondents meant that deforestation. 48% respondents implied their views to condemn on CO₂ emission as the chief causes of climate change, while only 16% respondents indicated industrialization and 5% argued on urbanization as the causes of climate change.

Significant number of respondents (88%) argued on temperature rise as the major effect of climate change. Besides, 68% respondents claimed frequent natural disaster and 63% respondents on salinity intrusion as the ultimate effect of climate change whereas 56% respondents stated on drought and 48% on river erosion.

Most of the respondents (72%) suffered skin disease and 56% respondents suffered from various types of fever and cold. All the respondents claimed cyclone as the high degree of climatic problem which occurred 1~3 times per year. Tidal surge occurring 1~2 times per year paid a considerable responses, 42% respondents stressed on tidal surge. Flood come up 1~2 times a year and 71% respondents felt flood as a major problem. All the respondents (100%) gave responses that river erosion occasionally occurred throughout year and 100% respondents meant it as the high scored climatic problem. Heavy rainfall occurring 2~3 times per year was claimed by 71% respondents. All the respondents claimed salinity intrusion as the major climatic problem existing throughout the year. Portable water crisis which evident as a mainstreaming problem as all the respondents claimed it on and 100% respondents ranked it high scored climatic problem. Various types of water borne disease existing throughout the year had a devastating impact upon the study areas.

The following table brings out that cyclone resulted 42% respondents of homeless, creates 71% respondents of food shortage, damaged 65% respondents of property loss, 12% respondents of them faced the problem of diseases. Due to cyclone 89% of population suffered for shortage of drinking water, cyclone resulted decrease of production had argued by 42% respondents. Reduce income 59%, 70% suffered sanitation problem and damages the home of about 55% population and 88% of population faced the problem of communication. It is established that cyclone had severe effect on livelihood over the study areas.

5.2 Recommendations

Impacts of climate variability, change and extreme events will lead to severe stress on overall development, environment and human well-being, for decades ahead. The study area is likely to be impacted by climate change by a number of factors including cyclone and tidal surges, floods, heavy rainfall, salinity intrusion, river bank erosion, potable water crisis, water borne diseases and long term sea level rise. In the short term this means that the peoples are likely to be hit by more and more natural disasters in coming years. In respect with all these vulnerability the study assumes the following recommendation which could helpful to adapt or mitigate the future climate change vulnerability.

- Local voluntary organizations should be strengthened and worked as a unit.
- Arrangement of proper and accurate weather forecast. Special arrangement should be taken to disseminate weather information.
- Increase the number of cyclone shelter.
- Design and build new infrastructure to cope with the cyclone and tidal surges.
- Flood management infrastructures have to be constructed and effectively maintained.
- People should be encouraged to adopt with alternative professions and they should be given skill development training.
- Disaster management training at local level should be launched.

- Proper operation and maintenance of new regulator and tidal basin.
- Effective land use planning has to be implemented.
- To stop intrusion of the tidal water, height and width of embankment should be increased.
- Ensure natural flow of river.
- Traditional/indigenous saline tolerant varieties of crop should be restored and introduced widely.
- Increase drainage capacity to reduce water logging.
- Awareness should be build for rain water harvesting.
- Water purification plant should be implemented by the government.
- Health related information should be provided and improved health services. Mobile medical service should be available. Special health services for newborn and pregnant mothers should be ensured.
- Awareness building to use oral saline and safe water.

5.3 Concluding Remarks:

Coastal Bangladesh is one of the victims of global climate change. The people of coastal inhabitants are always suffering from the impacts of climate changes, especially the peoples of south west coastal Bangladesh are in vulnerable situation in this regards. The study findings again proved this vulnerability to climate change. The local people of study areas perceived this climate change impact as “we are in vulnerable to disaster like cyclone, salinity intrusion, river bank erosion, and safe drinking water supply and food production systems.” They are suffering again and again since last century and locally adapted themselves with low-cost available indigenous technologies with their limited resources. But they are unable to adapt with recently happened AILA like disaster and future possible calamities like cyclone, big tidal surge and others, due to the peoples are poor- unable to adapt with big change. The future changes needs more adaptable

infrastructure with the improvement of their socio-economic capability. And it needs supports from the government or other organizations.

Climate change is considered as one of the most serious threats to the world's environment with its potential negative aspects on human health, food security, agriculture, fisheries, biodiversity, water, economic activities and other natural resources. Bangladesh is likely to be among the countries that are the worst affected by climate change. The Government of Bangladesh is acutely conscious of this, and has in fact been preparing to face this challenge for several years now. We realize that Climate Change is now an environmental as well as a developmental issue. Bangladesh is one of the most climate vulnerable countries in the world and will become even more so as a result of climate change. Floods, tropical cyclones, storm surges and droughts are likely to become more frequent and severe in the coming years.

So the study regarding people's perception of climate change vulnerabilities is essential to conduct for the betterment of those who are the worst victim of climate hazards.

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