



**THE SOCIOECONOMIC IMPACT OF CLIMATE
CHANGE: ASSESSING THE VULNERABILITY AND
ADAPTIVE CAPACITY OF THE COASTAL PEOPLE IN
BANGLADESH**

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Degree of
Doctor of Philosophy**

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Declaration by the Researcher

I declare that, '**The Socioeconomic Impact of Climate Change: Assessing the Vulnerability and Adaptive Capacity of the Coastal people in Bangladesh**' is my own work and all the sources that I have quoted have been indicated and acknowledged by means of complete references and this dissertation has not been submitted for any other degree at the University of Dhaka or any other institution.

Signature

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Certificate from supervisor

In my capacity as supervisor of the dissertation, '**The Socioeconomic Impact of Climate Change: Assessing the Vulnerability and Adaptive Capacity of the Coastal people in Bangladesh**' submitted by Mrs. Farhana Zaman for pursuing Doctor of Philosophy degree in Institute of Disaster management and Vulnerability Studies, I do hereby declare that the dissertation has been conducted by the researcher's own efforts. The candidate declares that neither of this dissertation nor any part of it has been submitted anywhere else for the award of any degree.

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Abstract

Bangladesh is at a high risk of various forms of climatic changes including both extreme events and slow onset processes like salinity. The current study aims to measure the socioeconomic impacts of salinity on coastal people's livelihood of the southwest coastal zone of the country. Both qualitative and quantitative tools have been used to get the wholeness of data and information. A total of 318 households were selected purposively from two villages, Keyabunia of Chilla union of Mongla and Katabunia of Pankhali union of Dacope. To supplement the quantitative data and information, the study also conducted 8 FGDs, 18 case studies and 3 in-depth interviews.

It was found that both of the study areas were adversely affected by the very high prevalence of salinity. The study, thereby, specifically focused on the vulnerability and adaptation capacity of these coastal people with intense salinity problem in their localities. The result of Logit model showed that salinity kept significant negative impact on the food security status of the respondents due to the experience of crop failure that happened year after year. Consequently almost all the respondents had to face acute food crisis and under compulsion, changed their normal and usual food consumption behavior. The practice of 'having major meals twice in a day' instead of three times is customary over the study areas. It was found that the average calorie intake by a coastal man or a woman is only 1414 kilocalorie which is much less than the average bodily requirement. Smaller meals, skipping meals, avoiding rich diet, reducing expenditure on non-food items, drawing down social network, bartering for food are few other strategies which also respondents habitually follow to cope up with food insecurity.

Salinity also kept significant negative impact on respondents' income and livelihood. In 1990s, most of the respondents would earn US\$ 83 monthly by selling paddy which has been decreased up to US\$ 39 in 2014. Consequently, 97 per cent respondents of Keyabunia and 85 per cent respondents of Katabunia diversified themselves in a number of alternative livelihood options. During the lean period of the year, respondents of both study areas highly depend on mangrove forest and forest products. About 90 per cent male respondents of Keyabunia go to deep sea for catching fishes and crabs. Many of them also collect *golpata*, honey, wax etc. On the other hand, around 66 per cent respondents of Katabunia turned into seasonal day laborer. About 38 per cent respondents of this village also raise various types of livestock. Many men of these study areas have already started migrating in other places in search of livelihood as more than 50 per cent respondents of both study areas mentioned it.

In addition to the threat to traditional livelihood option, respondents especially women were highly suffering from acute crisis of pure drinking water. Saline water was responsible for various types of health problems. About 54 per cent female respondents of Keyabunia and 72 per cent female respondents of Katabunia were suffering from various forms of gynecological problems due to using saline water. A number of ponds has been re-excavated by GO and NGOs over time in different places of the unions to

reduce the threat to pure drinking water. Women used to collect water of those ponds or tube wells from distant places which would even take more than 2-3 hours per day. Sometimes they would become the victim of various forms of violence including eve teasing, rape etc. Rain water harvesting was one of the major adaptation strategies that they used to follow to cope. Almost 100 per cent respondents of Katabunia village received training from NGOs on rain water harvesting.

Women were also in the face of great challenges due to lack of energy resources. As both agricultural production and homestead plantation were severely affected by salinity, almost 90 per cent respondents of Keyabunia village and 85 per cent respondents of Katabunia were fully dependent on *golpata*. About 68 per cent respondents of Keyabunia need to buy this *golpata* from local market. On the other hand women in Katabunia used agricultural residues as a source of fuel resources as 74 per cent respondents stated. They could also use cow dung as most of the people of this village used to raise different types of livestock.

It was evident in qualitative data that respondents received various forms of supports from different non-government organizations. Respondents of both study areas mostly received livestock like cows, goats etc. as grants. The estimated result of logit model showed that grants had significant positive impact on respondents' food security status. Thereby, it can be assumed that grants can increase the probability of household's food security.

In order to adapt with the negative impact of salinity on agriculture, about 62 per cent respondents of Katabunia brought significant changes in the production season, seed varieties and land use pattern. They started growing *BIRRI dhan 47* and *BIRRI dhan 55* which are relatively saline tolerant. Some of the female respondents of Keyabunia made artificial seed bed in drums or any other reservoir where they used to plant different kinds of fruit plants. Few of them were also found cultivating fish fry in a reservoir in order to grow them comparatively bigger for getting better price.

Despite having better adaptation capability women had poor capacity to adapt due to having less access to resources. The study establishes the fact that women's adaptation capacity depend on their access to various forms of resources like income, savings, land, training, freedom, networking etc. which women are usually deprived of due to traditional patriarchy. This social construction of disaster needs to be addressed immediately. Thereby, the conceptual framework of the study suggested that if peoples' access to various forms of economic, social, political as well as cultural resources can be ensured, that would contribute to develop a sustainable adaptation capacity for the coastal people. In addition to that, promotion of aquaculture and commercial plantation, implementation of short term seasonal seeds and crop insurance, channelizing rain water in different lands by pumping out saline water, building sluice gates for regulating saline water and most importantly capacity building of community people are needed to be ensured. The study thereby recommends that in order to ensure the above mentioned measures both GO and NGOs should view 'salinity' within the broader social context and 'its impact' through the lens of a woman.

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ACRONYMS

ACIA	Arctic Climate Impact Assessment
ADB	Asian Development Bank
ADIP	Agricultural Disaster Insurance Program
AGRI	Agricultural Research Institute
AIACC	Assessments of Impacts and Adaptations to Climate Change
AR5	Fifth Assessment Report
BADC	Bangladesh Agricultural development Corporation
BBS	Bangladesh Bureau of Statistics
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BELA	Bangladesh Environmental Lawyers Association
BRAC	Bangladesh Rural Advancement Committee
BRDB	Bangladesh Rural Development Board
BWDB	Bangladesh Water Development Board
CARE	Cooperative for Assistance and Relief Everywhere
CC	Climate Change
CCA	Climate Change Adaptation
CCC	Climate Change Cell
CCDP	Climate Change and Disaster Preparedness
CCDR	Climate Change and Disaster Reduction
CCP	Crisis Counseling Program
CCT	Climate Change Trust
CDMP	Comprehensive Disaster Management Program
CEGIS	Center for Environmental and Geographic Information Services
CIDA	Canadian International Development Agency
CPD	Centre for Policy Dialogue
CVA	Community Vulnerability Assessment
CVAT	Community Vulnerability assessment Tool
COP	Conference of the Parties
DAE	Department of Agricultural Extension
DCRMA	Disaster and Climate Risk Management in Agriculture

DFID	Department for International development
DG	Director General
DLS	Department of Livestock Services
DM	Disaster Management
DMB	Disaster Management Bureau
DoE	Department of Environment
DPHE	Department of Public Health and
DR	Disaster Recovery
DRR	Disaster Risk Reduction
EPAC	Earthquake Preparedness and Awareness Committee
ERM	Emergency Response Management
EU	European Union
FAO	Food and Agricultural organization
FD	Forest Department
FGD	Focused Group Discussion
FTF	Feeding Task Force
GB	Grameen Bank
GDP	Gross Domestic Production
GEF	Global Environment Fund
GMSLR	Global Mean Sea Level Rise
GOB	Government of Bangladesh
HBF	Heinrich Boell Foundation
HFA	Hyogo Framework Action
HH	Household
HIES	Household Income and Expenditure Survey
Icddr,b	International Centre for Diarrhoeal Disease Research, Bangladesh
IFAD	International Fund for Agricultural Development
IGAs	Income Generating Activities
IMDMCC	Inter-Ministerial Disaster Management Coordination Committee
IDF	Iswaripur Development Foundation
INGO	International Non Government Organization
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change

IUCN	International Union for Conservation of Nature
JJS	Jagrata Jubo Shangstha
KII	Key Informant Interview
LACC	Loss Angeles City College
LDCF	Least Developed Countries Fund
LDCs	Least Developing Countries
LFA	Livelihood Framework Approach
LGED	Local Government and Engineering Development
LRP	Land Reclamation Program
MDG	Millennium Development Goal
MES	Meghna Estuary Study
MoEF	Ministry of Environment and Forest
MoDMR	Ministry of Disaster Management and Relief
MSL	Mean Sea Level
MWCA	Ministry of Women and Children Affair
NAEP	New Agricultural Extension Policy
NAPA	National Adaptation Plan of Action
NDMC	National disaster management Council
NDRCG	National Disaster Response Coordination Group
NGO	Non Government Organization
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Square
PRSP	Poverty Reduction Strategic Paper
PSF	Pond Sand Filtration
RSLR	Relative Sea Level Rise
RVCC	Reducing Vulnerability to Climate Change
SOD	Standing Order on Disaster
SAARC	South Asian association for Regional Cooperation
SCUK	Save the Children United Kingdom
SDC	Swedish Development Cooperation
SFA	SAARC Framework for Action
SLR	Sea Level Rise
SMOS	Soil Moisture and Ocean Salinity

SRDI	Sustainable Development Research Institute
SRF	Sundarban Reserve Forest
TERI	Tata Energy and Resource Institute
TNO	Thana Nirbahi Officer
TSLS	Two Stage Least Square
UK	United Kingdom
UNDP	United Nations Development Program
UNEP	United Nations Environment
UNFCCC	United Nations Framework on on Climate Change
UNICEF	United Nations Children's Fund
US	United States
USAID	United States Agency Program
VWU	Vietnam Women's Union
WEO	World Economic Outlook
WFP	World Food Program
WHO	World Health Organization
WLS	Weighted Least Square
WWF	World Wildlife Fund
WARPO	Water Resource Planning Organization
WB	World Bank
WTSLs	Weighted Two Stage Least Square

GLOSSARY

Abar	Again
Ayla	The name of a devastating cyclone in Bangladesh
Aloo vorta	Smashed potato
Blouse	A traditional outfit of South Asian women
Bigha	One bigha means 33 decimals
Bine	The name of a tree
Borka	Veil/Cover
Buno	Wild
Chhata dewa	Leaving locality for a particular time period
Chira	Flattened rice
Chouki	A kind of small bed
Chula	Cooker
Curfu	The name of a fish
Dal	Pulse
Dhoron	Type
Kacha kola	Raw banana
Khira	A kind of cucumber
Ejmali shompotti	Property which belongs to villagers
Gher	Land of saline water where shrimp is cultivated
Golpata	A familiar palm
Kolmi shak	A water plant that grows in marshy area
Kochu shak	Colocassia
Kabiraj	A practitioner of Ayurvedic system of medicine
Kalboishakhi	The name of a storm usually takes place in summer
Kamiz	A traditional outfit of South Asian
Kanta	Ear bones of fish

Karu	A protecting weapon
Katha	Quilt
Keura	The name of a timber tree
Khabar	Food
Khabo	Shall eat
Khash land	The land owned by the government
Khichuri	Hotchpotch
Kochur mukhi	Taro Corms
Kodek	The name of a voluntary association
Lalshak	Red spinach
Lau	Bottle gourd
Mastan	A rogue person
Malopara	A hindu community
Mola	The name of a fish
Morich	A kind of spicy vegetable
Mouali	The person who collects honey
Muri	A traditional puffed rice
Nara	The residues of paddy after harvest
Nai	Have not
Nakshi katha	A traditional designed quilt
Oshudh	Medicine
Palong shak	Spinach
Panta vaat	Leftover rice soaked in water overnight
Peyaj	Onion
Pona chingri	Shrimp fry
Pona mach	Fish fry
Potol	Pointed gourd

Pui shak	Basella leaf
Purdah	Veil
Roja	Fasting
Salwar	A kind of dress
Semai	A traditional sweet dish of Bangladesh
Shutki mach	Dry fish
Shapla	National flower of Bangladesh
Shitol pati	Cooling mat
Sidr	The name of a cyclone
Sundori	The name of a tree
Telapia	The name of a fish

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

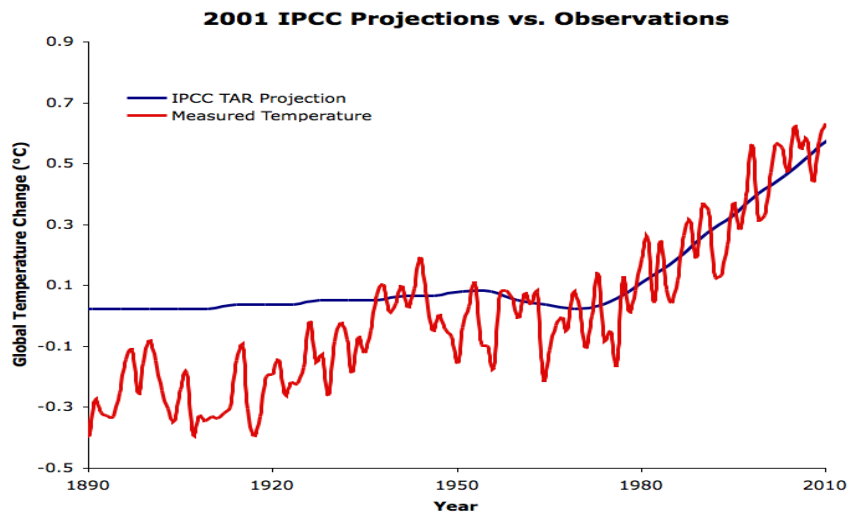
World's climate has been changing extraordinarily since the recent past with the ever-accelerating pace of globalization (Dasgupta et al., 2010). It is dubiously considered to be the most persistent threat to global stability in the coming century (Adger et al., 2003). It has brought about severe changes to the planets' geological, biological and ecological systems (Committee on America's Climate Choices, 2011). It has become such a complicated issue currently that different scientific communities are already roaring. An increasing body of science pointed towards a rising dangers being formed from the ongoing human-induced greenhouse gases — produced mainly by the burning of fossil fuels and forests (Walmsley, 2010). According to the Intergovernmental Panel on Climate Change (IPCC), there is new and stronger evidence that human activities are highly accountable for most of the warming observed over the last 50 years (IPCC, 2001). This evidence is again substantiated in IPCC 5th assessment report highlighting that much of the warming due to human activities is now upgraded to 'extremely likely,' from 'very likely' in the last report of 2001 (IPCC, 2014).

Many observed changes such as warming of the atmosphere and ocean, sea level rise and melting ice etc. are 'unprecedented over decades to millennia' according to IPCC fifth assessment report (IPCC, 2014). These are leading to the emergence of large-scale environmental hazards, such as ozone depletion, loss of biodiversity etc. putting stress to food-producing systems which is simultaneously being accompanied by the spread of diverse infectious diseases. Threats are definite and are highly uncertainly associated with these changes. Societal vulnerability due to threats may exacerbate ongoing social and economic challenges (Adger, 2003).

IPCC projects an increase of global mean temperature from 1.1°C to 6.4°C by 2100, which is likely to lead to a rise in sea level due to the thermal expansion of the oceans and the melting of ice sheets and glaciers. This will ultimately affect storms and floods

(IPCC 2007a). Eleven of the last twelve years (1995-2006) is ranked among the twelve warmest years in the instrumental record of global surface temperature since 1850, according to IPCC third assessment report. Consequently, global warming has become perhaps the most complicated issue surfacing over the globe.

Figure 1: Projections of Global Temperature



Source: IPCC Third assessment Report

South Asia is already experiencing a warming climate. A report, prepared for the World Bank (WB) by the Potsdam Institute for Climate Impact Research and Climate Analytics and peer reviewed by 25 scientists worldwide, says that the consequences for South Asia of a warming climate are even worse if global temperatures increase by an average of 4°C by 2090. Under such projection, South Asia would suffer more extreme droughts and floods, rising sea levels, melting glaciers, and declining food production, unless steps are taken immediately (Adams et al., 2014).

South Asia is home to 563 million inhabitants with population rising by almost 2 percent annually with the 1.4 percent global average (Zhuang et al., 2010). In addition to the unsafe geographic condition, this high rate of population density and poverty made South Asia more susceptible to these consequences. Among the South Asian countries, Bangladesh is at a higher risk (Ahmed, 2006). In Bangladesh, 93 disasters have occurred over the period from 1991 to 2000 and incurred the loss of US\$ 590 crore in agriculture

and infrastructure sectors (Ahmed, 2006). In 2010, the Global Climate Risk Index stated that during 1990–2008, 8,241 people died in Bangladesh while the cost of damage was US\$ 2.2 billion per year and the loss of Gross Domestic Product (GDP) was 1.81 percent (Pervin, 2013). About 830,000 ha cultivable land has been damaged by saline water intrusion from Bay of Bengal (SHISUK, 2011). Rainfall patterns have already been changed due to climate change and consequently agricultural production is affected significantly. It is estimated that crop production will decrease 30 per cent in 2100. Production of rice and wheat will decrease by 8.8 per cent and 32 per cent respectively by 2050 (CCC, 2006). At present around 13 per cent areas are under salinity at Bagerhat, Khulna & Sathkhira, the southwest coastal districts of Bangladesh which will increase up to 16 per cent in 2050 and 18 per cent in 2100 (Ahmed, 2006). Death rate of shrimp's fingerlings will increase if the water temperature is more than 32°C (CEGIS in Jahan and Quddusi, 2013). Global average water vapor concentration and precipitation are projected to mount more in the coming century. If the global temperature rises by 2° Centigrade, 30 per cent of all land species will be extinguished by the threat to be imposed (IPCC 3rd Assessment Report, 2001). The consequent sea level rise will contribute to the breakdown of the traditional livelihood options. It will also bring changes in topographical factors (like flooding), bio-physical factors (like changes in the crop yields and vegetation pattern etc.) as well as in socio-economic factors (like per capital income, health, education, population density etc.) (WB, 2001). Based on this background, the current study narrows down its focus on these multi-dimensional impacts tempted by saline water intrusion due to sea level rise in the southwest coastal zone of Bangladesh.

1.2 Statement of the Problem

The coastal areas of Bangladesh have already been facing salinity problem which is expected to be exacerbated by increasing sea level rise causing unusual height of tidal water. The Intergovernmental Panel on Climate Change Special Report on the Regional Impacts of Climate Change indicates that Bangladesh is 'especially at risk' from sea level rise and its implications: coastal erosion and land loss, inundation and sea flooding, and increasing salinity of rivers (IPCC, 2007). Different estimates of probable sea level rise

range between 1.5 metres and as high as 6 metres by 2100. Dhaka, being the 23rd largest city in the world with the most rapidly growing population, is just 5 metres above current sea level. If some of the more pessimistic predictions of Arctic ice-cap melting and the collapse of parts of the Antarctic ice shelf come about, it is expected to face an even more rapid sea level rise (icddr,b Fact Sheet, 2011).

Khulna, the third-largest city in Bangladesh, is sited on the banks of the Rupsha and Bhairab rivers in the southwest of the country, where the consequences of climate change are projected to be particularly severe (Murtaza, 2001). SRDI (1997) reported that, soil salinity levels in south of Khulna and Bagerhat towns ranged between 8 to 15 dS/m during the low flow season (SRDI, 1997 in Abedin et al., 2012). Salinity near Khulna recorded in 2007 is in its highest level for the past 32 years. Sea level rise and prolonged dry weather are expected to further elevate salinity levels in Khulna. In dry season, when the flows of upstream water reduce drastically, the saline water goes up to 240 kilometers inside the country (Abedin et al., 2012). It is reported that, several sub-districts (such as Kachua, Mollahat, and Fultali) in the south of the Sundarbans, known to be non-saline in the pre-Farakka period, have begun to develop soil salinity during the low-flow seasons of 1980s (Shamsuddoha and Chowdhury, 2007). Presently around 31 upazillas of Jessore, Satkhira, Khulna, Narail, Bagerhat and Gopalganj districts are facing severe salinity problem. Agricultural activities, as well as cropping intensities in those upazillas, have been changing; now farmers cannot grow multiple crops in a year (ibid). The impact of salinity is most serious for agricultural production which is a substantial part of the rural livelihoods (FAO, 2011; ADB, 2011a). Agriculture provides 62 percent of total employment in Bangladesh. Its contribution to the GDP had sharply declined from around 26 percent in 1997 to about 20 percent in 2006 (BBS, 2006; MoA, 2007). About 65 percent rural people of Bangladesh depend on agriculture for their livelihood and this sector feeds about 150 million people (Habiba et al., 2010). But salinity has significantly affected this sector which has a key role to play in tackling the challenges of the growing population, poverty alleviation, maintaining food security and adapting to climate change (BCCSAP, 2010; BPRSP, 2005). Thus, it is the time to emphasize on exploring the coastal resources (Dasgupta and Sarathi, 2009).

Bangladesh is one of the world's poorest countries with over 33 per cent of the people categorized as poor, according to the latest Household Income and Expenditure Survey (HIES, 2011), Bangladesh. Typically victims of environmental hazards and natural disasters are mostly the economically marginalized group whose capacity to respond to such hazards is the lowest (Dasgupta et al., 2010). For the livelihood these people mostly depend on natural resources which are highly susceptible to the climate (Olmos, 2001). For example, agriculture, forestry and other farm activities are dependent on local weather and climate conditions; any threat to those conditions directly puts a negative impact on productivity and thereby diminishes their livelihoods. Sometimes they need to sell their animals in order to be able to send their children to schools, as well as cover their basic needs. Sometimes rural residents may be forced to leave their native land and to migrate in search of work (Walsham, 2010; Yusuf, 2010).

Natural disasters impacts multiple forms of cruelty against women in Bangladesh (Nasreen, 2012). Thus, incorporating gender issues into disaster management should be a priority agenda (Dasgupta et al., 2010). It is estimated that women account for 70 percent of total poor population (Fact Sheet MDG 1). Climate change treats men and women differently as because women have limited access to resources. Unprotected rights, limited social mobility and a quiet voice make them highly vulnerable in shaping decisions concerning climate change (UNDP, 2009). They are the least equipped to adopt with weather extremes such as storms, floods, eroding coastlines, heat waves, and droughts. There are also clear gender differences in the prevention of disasters, in emergency response and in the reconstruction phase (Abedin et al., 2013). Stereotypically women are in the face of extensive gender inequalities. This inequality tends to be exacerbated due to climate change, as highlighted by the 2007 UNDP Human Development Report (Agostino, 2011). Salinity is not an exception—the subsequent loss of which costs women's assets a lot. In addition, the spread of malaria and other heat-related diseases due to lack of pure drinking water impose direct threats to women's health and survival. Hence, there is a need to explore gender dimension of salinity problem as well as to identify gender-sensitive adaptation strategies. This will help to promote an understanding of how men and women are differently impacted by salinity as well as climate change.

Least developed countries often lack the requisite capacity to mitigate the threats through the proper implementation of adaptation projects (Sovacool et al., 2012). Many natural elements emerge as a hazard when these probable threats to human lives and resources, in terms of loss and damage, intersect with extreme socio-political events and a vulnerable human community. To understand the lives and livelihoods of the people of a disaster-prone country like Bangladesh and their vulnerability to disasters, the study aims at exploring how human needs and wants intersect with nature, and transform nature into resources by modifying its different facets. To serve this purpose, the current study attempts to assess the socio-economic impacts of salinity of southwest coastal people of Bangladesh. The study also initiates to focus on coping and adaptation strategies that men and women follow in order to survive as residents of such saline prone areas.

1.3 Objectives of the Study

Drawing on the above-mentioned background, it is important to understand the nature of the risks from climate change in the places where natural and human community are likely to be most vulnerable, and what may be achieved by strengthening resilience of the local authorities and appropriate adaptive responses. Thus, the broad objective of the study is to make a gender-based assessment of the overall socio-economic vulnerability as well as the adaptation capacity of the salinity-affected coastal people.

Drawing on the broad objective, the study purports to achieve few other specific objectives. Specific objectives are:

- a. To assess the overall vulnerabilities of coastal people due to frequent and unpredictable climatic variability,
- b. To understand how men and women perceive climatic shifts and how this affects their social and economic security,
- c. To examine the gender-based vulnerabilities and social threats—especially of the poor women and adolescent girls—due to salinity,

- d. To identify the nature of coping and adaptation strategies that men and women adapt in order to survive in respect to salinity,
- e. To assess the extent to which institutional support is available, accessible and usable by men and women to increase their adaptation capacity with the salinity.

1.4 Hypotheses of the Study

Based on the above-mentioned objectives, the study hypothesized that

- a. Coastal people are more vulnerable to climate change due to their more exposure to the unsafe natural conditions than the people who are less exposed.
- b. Women and men perceive and experience the impact of climate change differently.
- c. Women are more vulnerable to salinity than men.
- d. Women can cope and adapt better with the vulnerability than that of men.
- e. People with various institutional supports develop better adaptation capacity to face any sort of climatic stressor than those without any institutional support.

1.5 Rationale of the Study

The main feature of the climatic condition of Bangladesh is the severity of natural calamities and disasters because of reverie and coastal flood, tropical cyclone, storms surges, tornadoes, Sidr and droughts. Inconsistent rainfall coupled with other climatic stressors has adverse effects on the wetland resources, ecosystems, biodiversity and eventually on the overall livelihood of the coastal people (CCC, 2009). This country, being a densely populated coastal country of smooth relief comprising broad and narrow ridges and depressions, is highly vulnerable due to sea level rise (Nishat and Mukherjee, 2013). This would continue to aggravate further, unless it is addressed in time.

The Government of Bangladesh (GOB) has invested more than US\$ 10 billion during the past 35 years to make Bangladesh less vulnerable to natural disasters. Despite these efforts, the direct annual cost of natural disasters over the last 10 years is estimated to be

between 0.5 per cent and 1 per cent of Bangladesh's GDP (MoEF, 2008). The economic impacts of future climate change are expected to be larger which might be negatively correlated to the recent achievements in economic growth and population control (IPCC, 2001).

In recent years, addressing the issue of salinity has become vital for a least developed country like Bangladesh—particularly for two reasons. The first is the inadequate resources of the country to provide institutional support to the social and economic effects of saline water intrusion; and the second is the country's economy's heavy dependence on sectors highly sensitive to salinity, such as agriculture, coastal resources, water resources and infrastructure. Consequently, adapting to such natural disasters, and climate variability and change is a major concern on the sustainable development policy agenda.

Governments have traditionally approached climate change as an ecological problem, or more recently, as an economic one. But its social and human rights implications have not yet been widely addressed (O'Brien and Leichenko, 2007). The effects of climate change may create threats to a large number of human rights, including the rights to life, food, education, shelter, work so on. Most of the discussions on climate justice ignore the incidence of climate change impacts, and much less research has been conducted on the adaptation to them. Furthermore, certain regions of the developing countries are more severely affected by the effects of climate change which have not received the proper focus of the climate justice yet. The Yokohama World Conference on Natural Disaster Reduction (1994), a mid-term review of the International Decade for Natural Disaster Reduction, placed greater emphasis on the role of social sciences in research, policy development and implementation and emphasized the links between disaster reduction and sustainable development (Yokohama Strategy and Plan of action for a Safer World, 1994).

Since 1979, a large number of international conferences on climate change have been convened. Important meetings have been held in Toronto, Hague, Noordwijk, Bergen and elsewhere, and they all have addressed both scientific and policy issues. The Second World Climate Conference was held in 1990 in Geneva. It was a particularly crucial step

towards a binding global convention on climate change. The 1992 UN Framework Convention on Climate Change is the first binding international legal instrument to address the issue. Countries which have signed on to the UNFCCC have been meeting annually in Conferences of the Parties (COP) to assess progress in dealing with climate change since 1995. The Kyoto Protocol is another international agreement linked to the UNFCCC (UNEP, 1990). So far, climate change issue has been measured globally. Its in-depth country-based local assessment is required for future development policies for overcoming impending threats and challenges. This will also help the nation for developing coping mechanism and enhancing the resilience of the institutional supports. Thereby, individual countries are also expected to start working on a voluntary basis and set out more specific commitments for them. Climate change creates both risks and opportunities worldwide. By understanding, planning for and adapting to a changing climate, individuals and societies can take advantage of opportunities and reduce risks.

As a part of UNFCCC, NAPA Bangladesh has taken so many policy initiatives. Disaster Management Bureau, MoEF, Disaster Management and Relief Division, Ministry of Food and Disaster Management are all working together to fight with threats imposed by disasters. All these departments are busier with the mitigation process of sudden onset disasters like cyclone, flood etc. But the potential and existing impacts of slow onset climate change like salinity, on human life and livelihoods are huge and are needed to be addressed immediately. For this reason, it is important to get deeper into the local impacts of salinity which are not yet fully explored. Unless local impacts, the mitigation of which is directly correlated with the overall economic growth of the country, are exposed widely and brought under the policy agenda, the country's sustainable development will remain as a big question mark.

1.6 Organization of the Study

The purpose of the study was to understand the extent of impact of climate change on vulnerable groups, their gender-based coping strategies and to assess the adaptation capacity and weakness of the services received by these groups. The study consists of the following major chapters:

Chapter one is the introductory chapter comprising statement of the problem, objectives of the study, hypothesis, rationale of undertaking the study and its implication for Bangladesh.

Chapter two is the foundation of the study, where extensive literature review has been made to develop the overall framework of the study. In this regard a review of the earlier studies on climate change has been made briefly.

Chapter three consists of salinity situation of Bangladesh and overview of few global and national policy initiatives.

Chapter four includes the theoretical background, model and conceptual framework of the study.

Chapter five comprises the methodology of the study; different quantitative and qualitative methods applied to attain the objectives are discussed here.

Chapter six focuses on the findings of the study. This chapter centers at the climatic conditions and the geophysical situation of the coastal people and their nature of exposure to it. It also focuses on the perception of the people about the climatic shifts of the study area. This chapter is divided into four major parts. Part one comprises eleven sections that contains socio-demographic information, people's perception, threat to agriculture due to salinity, alternative livelihood options and their related problems, food insecurity, coping and adaptation mechanisms with food insecurity, health and housing problems, impact factor analysis of salinity etc. Part two is concerned with the findings of qualitative parts consisting of case studies, FGDs and in-depth interviews respectively.

Chapter seven highlights the results and discussions of the descriptive data. It also shows the similarities and dissimilarities of the current data with existing literatures.

Chapter eight concludes by highlighting the importance of determining the individual vulnerability of humans, both men and women, including their adaptive and coping strategies and collective vulnerability of local authorities and resilience of local resources, which is very essential for future planning and design of the country as a

whole. It is expected that the conclusion will make the country prepare for a more fruitful climate change negotiation, demand and seek necessary and adequate investment funding to ensure climate resilient development for the future.

CHAPTER TWO

LITERATURE REVIEW

Literature review allows a reader to know about the previous studies already conducted in almost similar fields. It helps the researcher to know the limitations of previous studies and scopes of new studies as well. Thereby, literature review helps a researcher to select a research problem by finding out the gaps of previous studies. Moreover, literature review helps the researcher to find the similarities and dissimilarities of the present study with the previous one. It also plays an important role to supplement the primary data of the current study. In fact, literature review helps in concrete conceptualization. Keeping all these in mind, the researcher has grounded the current study on extensive literature review about different dimensions of climate change.

Climate Change and Global Warming: Global Scenario

The latest scientific evidence indicates that human activities are leading to increased accumulations of greenhouse gases in the atmosphere, which are altering the Earth's climate patterns at unnatural rates (Austin et al., 2003, Mondal et al., 2011b). In 2011, the biggest contributors to the rise in emissions were China, accounting for 28 percent of global emissions, the US at 16 percent, the European Union at 11 percent, and India at 7 percent of global emissions. Though China was responsible for a significant majority of carbon emissions, on the basis of emissions per person China produced 6.6 tonnes in 2011, compared with 1.8 tonnes per person in India, 7.3 tonnes per person in the European Union, and an astounding 17.2 tonnes per person in the United States. Thus, United States is still the world's largest greenhouse gas emitter per capita with 17.2 tonnes of carbon dioxide (CO₂). The latest United Nations Climate Change Conference in Doha, Qatar, emphasized on putting a limit on future carbon emissions that was expected to prevent a rise in global temperatures by 2 degrees Celsius (Olivier et al., 2011). However, another study presented disturbing evidence to the UNFCCC. According to this study, to prevent a 2 degree Celsius rise in temperatures by 2050, it will be necessary to

reduce global emissions by 3 per cent every year which will be virtually impossible (UNEP, 2012).

Climate change is expected to increase during the next hundreds of years contributing to diversified changes such as physical, ecological, economical and social. Many of these changes are already taking place and putting extreme pressure on the globe. The increase on precipitation, shorter and warmer winters, decreases in snow and ice cover, rising of the sea levels are projected changes that will likely to persist in the long term (Pechsiri et al., 2010). Global warming is a major consequence of climate change particularly the depletion of the Ozone layer by green house gases (Aluko et al., 2008b). According to IPCC third assessment report, from 1995 to 2006, these eleven years rank among the twelve warmest years in the instrumental record of global surface temperature since 1850. As a result global warming has become perhaps the most complicated issue facing the world today. The US Environmental Protection Agency listed the major causes of global warming which includes energy use and production (57%), chlorofluorocarbons (17%), agricultural practices (14%), changes in land use (9%) and other industrial activities (3%) (WB / UNDP, 2003 in Agbogidi, 2011).

Due to the above-mentioned atmospheric changes, the Intergovernmental Panel on Climate Change warned of ‘unprecedented extreme weather and climate events’ in future in a special report published in March 2012. The report passed on the information that many parts of the world have observed new records set in 2012 alone. For example, July 2012 was the USA’s hottest month on record; the UK got the heaviest rainfall from April to June 2012 ever experienced before, and in 2011, the highest ever maximum temperature in October and the warmest November in 100 years; China experienced the heaviest rainfall to hit Beijing in a 14-hour period ever recorded before July 2012; June 2012 was the 328th consecutive month with a global temperature above the 20th century average (Oxfam, 2012). The ultimate result of this increasing global temperature is sea level rise.

Different studies indicate different level of severity at different levels of temperature rises. According to the studies summarized by the IPCC (2007) and WEO (2009), a 6°C increase in global temperature could lead to damage to ecosystems, with extinction of

over 40 percent of the world's species, sea level rise of up to 3.7 metres with 50 percent loss of coastal wetlands, the loss of several islands and experience of floods almost in every year, water droughts in mid-to-low latitudes, disappearance of glaciers, decreased productivity of all cereal crops directing towards food shortages etc. (Mondal et al., 2014). Under the most severe climate scenario it is assumed that 22 percent of the species considered would become critically endangered, and 2 percent committed to extinction in Europe (IPCC, 2007).

Climate Change and Sea Level Rise

Increase in sea level is consistent with warming. Vermeer and Rahmstorf (2009) estimated a global sea level rise of between 50 cm and 190 cm from 1990 to 2100. The new projections made by IPCC fifth assessment report show an increase of 0.26-0.55 meters by 2100 under a low emissions scenario and 0.52-0.98 meters under the high emissions scenario. The AR5 also projects that there is more than 66 percent chance for Arctic Ocean to be ice-free during part of the summer before 2050 under a high emissions scenario (IPCC, 2014).

Climate Change: An Asian Perspective

Asia, considered as the largest continent of the Earth, is extended over four climatic zones. These are boreal, arid and semi-arid, tropical and temperate. Many of the largest cities in Asia are located on the coast and within major river deltas which are gradually becoming even more prone to increased flooding due to sea level rise and river flooding (WWF, 2009 in Shaw et al., 2010). The cascading effects of rising temperatures and its consequent ice and snow melting in the region are affecting water availability, biodiversity, ecosystem boundary shifts and global feedbacks (monsoonal shifts, loss of soil carbon).

Burtis (2006) said that ecological impacts of climate change vary depending on regional and local situations. Thereby climate change also keeps significant socioeconomic

impacts increasing uncertainty for human populations in this region (Jianchu, 2009 in IPCC, 2007).

There are increased evidences on the intensity and frequency of many extreme weather events in South Asia such as the 2004 Indian Ocean Tsunami, the 2005 Pakistan Earthquake, the 2006 landslides in the Philippines as well as heat waves, tropical cyclones, prolonged dry spells, intense rainfall, tornadoes, snow avalanches, thunderstorms, and severe dust storms in the region (Cruz et al., 2007).

Maldives is one of the least defensible countries to the expected impacts of climate change and associated sea level rise. Presently, 50 percent of all inhabited islands and 45 percent of tourist resorts of the country experience varying degrees of beach erosion (MHAHE, 2001).

As climate models project an increase in monsoon precipitation, it brings an increase in flashfloods to occur. These floods affect thousands of people every year in the Himalayan region of Nepal. Other types of floods caused by rapid snowmelt occur too. Impacts of such disasters cause vulnerability in multifarious ways ranging from hunger and susceptibility to disease, to loss of income and livelihoods, threatening human survival and well-being (Webersik and Thapa, 2008).

Bhutan being a least developed country in the Himalayan Mountains faces five major climate change related vulnerabilities. These include landslides and flooding, deteriorating agricultural production, impoverished forests, worsening health security, and impaired hydroelectricity generation (Meenawat and Sovacool, 2010).

Only in a single year 2006, the extreme weather events included major storms and flooding in the east and south, as well as heat and drought in central, western and northeastern regions of China. These killed more than 2700 people and caused US\$ 20 billion in damages (UNFCCC, 2006).

Climate Change and Its Socioeconomic Impact

Climate Change, Health and Vulnerability

Increasing extreme weather events destroy homes, medical facilities and other essential services. More than half of the world's population lives within 60 km of the sea (WHO, 2014; Creel, 2003). People may be forced to move, which in turn heightens the risk of a range of health effects, from mental disorders to communicable diseases (Coleman et al. cited in IPCC 2007b). The number of reported weather-related natural disasters has more than tripled since the 1960s. Yearly these disasters result in over 60,000 deaths, mainly in developing countries (WHO, 2014).

Climate change directly or indirectly affects the environmental determinants of health such as clean air, safe drinking water, sufficient food and secured shelter. A lack of safe water can compromise hygiene and increase the risk of diarrhoeal disease, which kills 2.2 million people in each year. In extreme cases, water scarcity even leads to famine (Arnell, 2004b). Most of the killer diseases like diarrhea, malaria and dengue are highly climate-sensitive. The February 2009 heat wave across south-east Australia caused 374 heat stress deaths (Australia's Fifth National Communication on Climate Change, 2010). A WHO assessment concluded that the modest warming that has occurred since the 1970s caused over 140 000 excess deaths annually by the year 2004. The direct damage costs to health (i.e. excluding costs in health-determining sectors such as agriculture and water and sanitation), is estimated to be between US\$ 2-4 billion/year by 2030 (WHO, 2014).

As the climate changes, temperature will rise and lead to an increasing frequency of heat waves, ultimately increasing incidences of illness and death. The rate of disease will escalate, mostly affecting the poor and marginalized who are often forced to live in unsafe natural conditions with limited access to water and sanitation (Cohen, 2008). The global burden of climate change-attributable diarrhoea and malnutrition is already the highest in the world in Southeast Asian countries including Bangladesh, Bhutan, India, Maldives, Myanmar and Nepal in 2000 (IPCC, 2007). Notable relations between climate change and dengue and dengue hemorrhagic fever have been seen in the Maldives. Although malaria has already been eradicated from Maldives, there might be a threat of

malaria outbreak again in the country due to climate change. The poor sanitation in the islands of the Maldives, combined with any future increase in rainfall, would cause more outbreaks of waterborne diseases, such as diarrhea (MHAHE, 2001). High temperatures and polluted urban air could contribute to extensive heat stress and smog induced diseases among urban populations in Chongqing, China and in Jakarta, Indonesia (UNFCCC, 2006).

Climate Change, Food Insecurity and Vulnerability

The impact of climate change on food production is already seen, and will worsen as climate change keeps pace (Apata et al., 2009). First, slow-onset climatic changes are sliding down the average production of global yields. Climate change becomes more significant when crop losses resulting from more frequent and intense extreme weather events are added up to this. It is projected that a range between 5 million and 170 million additional people are supposed to be food insecure by 2080 (Schmidhuber and Tubiello, 2007).

Higher precipitation and reduced frost may trim down nutritional status of cultivated fields in Europe (Eisenreich, 2005 in IPCC, 2007). In addition, increasing crop yield and decreasing or stabilizing food and fibre demand might lead to a decrease in total agricultural land area there (Rounsevell et al., 2005).

In case of Central and South Asia, crop yields are predicted to fall by up to 30 percent, promoting a very high risk of hunger in several countries (IPCC, 2007). Seo and Mendelsohn (2008b) made another assumption about the Pacific Islands and Indonesia that these countries would be more dependent on imports and would face more poverty due to climate change.

A quantitative study by Parry and Livermore (1999) made an estimate of climate change impacts on global food production for the UK-based on the previous work. According to the study climate change was likely to affect crop yields differently in different regions across the globe. It was expected to increase yields at high and mid-latitudes, and led to decreases at lower latitudes like Africa under the HadCM2 and HadCM3 scenario. The

study also asserted that if this was exceeded, then even high mid-latitudes would experience adverse affects of climate change on agriculture.

Shaffril et al. (2011) found several negative impacts in Malaysia due to climate change. Sea was unpredictable to fishermen due to the unpredictable water current, wind velocity and wave action patterns affecting the total number of fish in the coastal areas. The fishermen of Malaysia opined that lots of coral reef had already been destroyed, mangrove forests were being reduced and the coastal areas had been eroded due to climate change.

Hanjra and Qureshi (2010) expected that India's agricultural capacity might decrease up to 40 percent by changing spatial and temporal distribution of rainfall, land, water availability, biodiversity and terrestrial resources. The hydrological cycle in many climate regions and river basins of India had been modified due to changes in cropping pattern and land-use pattern, over-exploitation of water storage and changes in irrigation and drainage. As a result, food security has deteriorated in India since 1995. This led child malnutrition to deny the target set by the Millennium development goals (MDGs) by 2015. Mall et al. (2006) predicted that to meet the demand of food for increased population, the country's farmers needed to produce 50 percent more grain by 2020. At the same time, it was feared that the fast increasing demand for food in the next two or three decades could be quite grim particularly in view of the serious problem of soil degradation and climate change.

Hanjra and Qureshi (2010) stated that African countries would experience prolonged droughts and food shortages, consequently affecting livestock seriously. Seo and Mendelsohn (2008) mentioned that a number of beef cattle would sharply decrease due to increase in temperature. They also stated that increased precipitation was responsible too as this would raise the diseases among the livestock in Africa. A total damage to the African livestock was estimated to be between US\$ 9 to 12 billion due to global warming in the next two decades. Especially, large commercial farms would be hard hit due to climate change, and their income would reduce considerably. Not only livestock, another study by Parry et al. (2004) focused on cereal production in the African region which

would decrease a lot leading to an increase in the risk of hunger. Increasing demand for food and decreasing supply would raise the prices as well (Parry et al., 2004).

Three ways by which climate change reduce the micronutrient consumption were identified by several studies. These are: (i) by changing the yield of important crop sources of micronutrients, (ii) by changing nutritional contents of a specific crop, and (iii) by influencing to grow crops of different nutritional value. It is assumed that climate change might affect the food price, and the net consumers of the rural household in the poor countries would be hurt due to increase in food price (Lobell and Burke, 2010; Parry et al., 2004).

Climate Change, Water Shortages and Vulnerability

According to IPCC (2007) there is high confidence that by mid-century, annual river runoff and water availability are projected to increase at high latitudes (and in some tropical wet areas) and decrease in some dry regions in the mid-latitudes and tropics. The report also showed high confidence on decrease in water resources due to climate change in many semi-arid areas e.g. Mediterranean Basin, western United States, southern Africa and north-eastern Brazil. It is predicted that about 250 million people in Africa could be exposed to greater risk of water stress by 2020 (IPCC, 2007). Arnell (2004b) said that the drought will be more prevalent by the 2090s. The study said that climate change is likely to double the frequency of extreme droughts and increase their average duration six-fold. Prevalence of drought in Asia and its consequent water shortages were emphasized by few other studies. They said that by 2050s, one billion people could face water shortage leading to land degradation throughout the whole Asia (Christensen et al., 2007; Cruz et al., 2007).

Mall (2006) said that demand for water has already increased manifold in India over the years due to urbanization, agriculture expansion, increasing population, rapid industrialization and economic development. Climate change has also affected the water availability status of Maldives. National Communication of Maldives to the UNFCCC (2001) stated that the population of the Maldives mainly depends on groundwater and

rainwater as a source of freshwater. Both of these sources of water are largely affected due to changes in the climate and sea level rise.

Badjeck et al. (2010) mentioned that global warming and its consequences would affect world's 36 million fisher folk and nearly 1.5 billion consumers who rely on fish. They said that sea level rise and storm surges would lower the availability and quality of freshwater sources and would also disrupt fishing operation. They also said that climate change would reduce the total revenue of the fishers and may increase the harvesting cost for the fishers. According to them, climate change such as flood, sea level rise or storms would not only reduce harvesting capacity but also damage public infrastructure and productive assets.

Climate Change, Population Displacement and Vulnerability

Shamsuddoha and Chowdhury (2009) asserted that by 2050, 150 million people could be displaced by climate change related phenomenon like desertification, increasing water scarcity, floods and storm etc. The First Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR1) in 1990 noted that the maximum impact of climate change might be on human migration. El Niño events from the 1970s through the 1990s caused extensive droughts in Ethiopia which were followed by famine and political turmoil. This ultimately resulted in radical changes of government, secession, and a massive program of population redistribution (Comenetz and Caviedes, 2003).

Barnett and Webber (2010) discussed the relationship between climate change and migration based on critical reviews and synthesis of literature. They expected that climate change was likely to increase baseline rates of migration in the next forty years mostly in the developing countries. The study argued about the positives of this population displacement. They said that many of the dire risks arising from this increased mobility were amenable to management through aid, development, and migration policies. At the same time, there was little reason to think that such migration would increase the risk of violent conflict. Movements in response to climate change do not necessarily have negative outcomes for the people who move, or the places they come from and go to. Sometimes migration might enhance the adaptation capacity of communities as well.

Specific recommendations were made about policies and institutions to maximize the benefits and minimize the costs of migration arising from climate change.

Climate Change: Bangladesh Perspective

The 2011 Climate Change Vulnerability Index put Bangladesh at top in the list of 170 vulnerable countries to the impacts of climate change (Maplecroft, 2011). This is owing to its geographical location coupled with socio-economic conditions (Kamal, 2012).

Climate Change and Its Ecological Impact in Bangladesh

Vulnerability to climate change differs within countries, within communities and even within households. In Bangladesh, climate change effects usually take the form of calamities such as cyclones, floods, droughts, rainfall, erosion, salinity etc.

Increasing Frequency and Intensity of Tropical Cyclones: Bangladesh is the most vulnerable country in the world to tropical cyclones. Cyclone hits the coastal areas of Bangladesh almost in every summer (Dasgupta et al., 2010). Deaths caused by cyclones here have been almost half of the world deaths in the last 20 years. In the last decade, 9 major cyclones hit the coast of Bangladesh. The frequency of cyclone from the Bay of Bengal has also evidently increased (Rabbani, 2013). For instance, Super Cyclone Sidr hits on 15 November 2007, Cyclone Nargis on 2 May 2008 hit Myanmar but had less impact on Bangladesh, Cyclone Rashmi occurred on 27 October 2008, and Cyclone Ayla hit on 26 May 2009 (Kamal, 2012). In fact, a severe tropical cyclone hits Bangladesh on an average in every 3 years (Strategic Program for Climate Resilience, 2010).

Sea Level Rise: Global climate experts warned that Bangladesh would face acute climate vulnerabilities. Water related crises will be increased as the country is not that high from the mean sea level (Shamsuddoha and Cowdhury, 2009). Strategic Program for Climate Resilience (2010) stated that two-third of the country is highly susceptible to sea level rise and as tidal flooding. This paper also highlighted a study of WB which projected 10 cm, 25cm and 1 m rise in sea level by 2020, 2050 and 2100 in Bangladesh. If it happens then the SLR only will affect 2 percent, 4 percent and 17.5 percent of total land mass

respectively. Agrawala et al. (2003) suggested that 1 (one) meter rise in sea level would inundate 18 percent of Bangladesh's total land mass which will ultimately turn the whole southern region into a sea.

Unpredictable Rainfall and Floods: Strategic Program for Climate Resilience (2010) affirmed that Bangladesh ranks sixth among the most vulnerable countries to floods in the world. In the last 25 years, Bangladesh has experienced six severe floods. In 2007, two successive and damaging floods inundated the country in the same season (Sikder, 2013). Due to its topography and position the country experiences floods in its 30-50 percent area almost in every year (Strategic Program for Climate Resilience, 2010). This causes losses in agriculture and especially to crop agriculture. WB (2014) stated that flood areas could increase by as much as 29 percent for a 2.5 ° C in Bangladesh.

Erosion: Ali (2000) identified the causes of erosion in Bangladesh. Their study said that erosion in the coastal regions of Bangladesh is caused by a number of factors, including high monsoon wind, waves, and currents, strong tidal actions, and storm surges. An increase in rainfall in summer due to climate change would in turn increase the surface erosion. Land erosion is also intensified through current deforestation, and other land use practices (such as Jhum cultivation). Hasan et al. (2006) identified land erosion and desertification as responsible in some countries for having reduced productivity by 50 percent.

Droughts: SDC (2010) stated that droughts mainly occur in the western parts of Bangladesh and in the Chittagong Hill tracts. Their frequency and intensity is gradually increasing during the last few years.

Bangladesh experienced droughts in 1973, 1978, 1979, 1981, 1982, 1989, 1994, and 1995 (Habiba et al., 2013). Dey et al. (2011) said that on an average, groundwater level declined more than one meter compared to the previous years due to drought. As a result many of the tube wells turned dry or failed to supply the required quantity of water for household and irrigation purposes.

Salinity: The coastal areas of Bangladesh have already been facing salinity problem which is expected to be exacerbated by climate change and sea level rise, as sea level rise

is causing unusual height of tidal water. The Intergovernmental Panel on Climate Change Special Report on the Regional Impacts of Climate Change indicates that Bangladesh is 'especially at risk' from sea level rise and its implications: coastal erosion and land loss, inundation and sea flooding, and increasing salinity of rivers. Different estimates of likely sea level rise will range between 1.5 metres and as high as 6 metres by 2100. Icddr,b (2015) reported that Dhaka, the 23rd largest city with the most rapidly growing population worldwide, sits only 5 metres above current sea level. If some of the more pessimistic predictions of Arctic ice-cap melting and the collapse of parts of the Antarctic ice shelf come about, it is expected to have an even more rapid sea level rise (Icddr,b, 2015).

As sea level continues to raise the associated effects of permanent inundation is likely to increase the salinity near coastal areas. A study of IPCC first assessment report showed that 5 ppt saline front would penetrate about 40 km inland for SLR of 88 cm which is going to affect the only fresh-water pocket of the Tetulia River in Meghna Estuary. A big chunk of the fresh-water zone which is expected to disappear due to sea level rise near to the estuary will have a far reaching effect on the country's ecology and will extinct some of its species forever (Shamsuddoha and Chowdhury, 2007).

Rabbani et al. (2013) found that 81 percent households of four villages of Satkhira district experienced high salinity compared to only 2 percent a decade ago due to gradual sea level rise.

Khulna, the third-largest city in Bangladesh, is sited on the banks of the Rupsha and Bhairab rivers in the southwest of the country. The consequences of climate change are projected to be particularly severe in that region (SRDI, 1997). The study reported that, soil salinity levels in south of Khulna and Bagerhat towns ranged between 8 and 15 dS/m during the low flow season. Salinity near Khulna recorded in 2007 is in its highest level for the past 32 years. Sea level rise and prolonged dry weather are expected to further elevate salinity levels in Khulna. In dry season, when the flows of upstream water reduce drastically, the saline water covers up to 240 kilometers inside the country. Shamsuddoha and Chowdhury, (2007) reported that, several sub-districts (such as Kachua, Mollahat, and Fultali) south of the Sundarbans known to be 'non-saline in the pre-Farakka period'

have began to develop soil salinity during the low flow seasons of 1980s. The report also mentioned that presently around 31 upazillas of Jessore, Satkhira, Khulna, Narail, Bagerhat and Gopalganj districts are facing severe salinity problem. Agricultural activities as well as cropping intensities in those Upazillas have been changing. Now farmers can't grow multiple crops in a year.

Alam et al. (2011) said that the possible factors resulting in an increase of salinity intrusion are decrease of fresh water flow during the dry season and/or due to penetration of tide into the river system. Intrusion may also be aggravated by upstream withdrawal of water or by climate change impacts like a decrease in dry season rainfall and sea level rise. Basar (2012) also identified many of these factors as responsible for salinity ingress. Mahmuduzzaman et al. (2014) said that salinity intrusion is not only natural phenomenon; it's also a human one. They mentioned several other reasons of saline water intrusion such as untimely water use, unplanned shrimp culture, insufficient or poorly maintained infrastructure, and inadequate management systems etc.

Shamsuddoha and Chowdhury (2007) said that salinity intrusion in Bangladesh coast is very seasonal. In the rainy season (June-October), intrusion of saline water is minimum due to extreme flow of fresh water, but in the dry season, especially in winter, saline water goes upward gradually. In the rainy season where saline water ingress to 10 percent of country's area, in the dry season saline water reaches to country's 40 percent area even. According to an estimate of the Master Plan Organization, about 14,000km² of coastal and offshore areas have saline soils and are susceptible to tidal flooding. If some 16,000 sq km of coastal land is lost due to a 45cm rise in sea level, the salinity front would be pushed further inland. The present interface between freshwater and saline water lies around 120 to 160km inland in the southwest, and this could well be pushed northward as far as central Jessore region in the event of a sea level rise (Shamsuddoha and Chowdhury, 2007) .

Salinity and Its Socioeconomic Impact in Bangladesh

Saline water intrusion is expected to exacerbate many of the current problems, though many projects are working to increase the adaptation capacity and resilience of local communities. Since 2009 (after the devastating cyclone Ayla), Save the Children UK (SCUK) has been implementing its Household Economic and Food Security (HEFS) project in six upazilas (sub-districts) of two coastal districts Khulna and Bagerhat. The project aimed to graduate 70 percent of its 15000 extreme poor beneficiaries' households from extreme poverty by strengthening their income sources and diversifying their employment opportunities through a variety of interventions. But the findings revealed that climate related disaster events made the poorest more vulnerable by destroying or damaging the minimum assets they owned. The majority of the beneficiaries tried to apply their own ex-ante resilience strategies but these were inadequate in the face of increasing severity of disaster events (Nokrek and Alam, 2011).

Saline Water Intrusion and Threat to Agriculture and Food Insecurity

Effect of saline water intrusion in the estuaries and into the groundwater would be enhanced by low river flow, sea level rise and subsidence. Mahmood et al. (2010) said that the adverse effects of saline water intrusion will be significant on coastal agriculture and the availability of fresh water for public and industrial water supply will fall. The impact is most serious for agricultural production which is a substantial part of the rural livelihoods (ADB, 2011a). In Bangladesh, 40 percent of productive land is projected to be lost in the southern region for a 65 cm sea level rise by the 2080s (WB, 2012). Agriculture is the key to Bangladesh's economy. The coastal area of Bangladesh is very fertile for growing paddy. But increase in salinity intrusion and increase in soil salinity will have serious negative impacts on agriculture (Mahmood et al., 2010). The food production does not seem to have a better future with presently practiced rice varieties which may not be able to withstand increased salinity. Thereby, it is predicted by IPCC (2007) that in Bangladesh, rice production may fall by 10 percent and wheat by 30 percent by 2050 (IPCC, 2007).

Shamsuddoha and Chowdhury (2007) said that increased soil salinity would significantly reduce food grain production. The study stated that some parts of coastal lands were not being utilized for crop production, mostly due to soil salinity; and this situation would aggravate further under a climate change scenario. A modeling exercise mentioned in the study indicated that, the index of aridity would increase in winter. Consequently, higher rates of capillary action from an increased rate of topsoil desiccation would intensify the salinity problem.

IPCC (2001) affirmed that around 13 percent areas were already under salinity at Bagerhat, Khulna & Sathkhira, the southwestern coastal districts of Bangladesh, which was supposed to increase up to 16 percent in 2050 and 18 percent in 2100. The report also confirmed that death rate of shrimp's fingerlings would increase if the water temperature is more than 32°C (CEGIS, 2011 in IPCC, 2001). In the coming century, global average water vapor concentration and precipitation were projected to mount more. The report projected that if the global temperature rises by 2° Centigrade, 30 percent of all land species will be extinguished by the threat to be imposed (IPCC 3rd Assessment Report, 2001).

Akanda (2009) stated that crop farming in Bangladesh was negatively influenced by the climate change and the water crisis, the frequency and intensity of flood, cyclones and other natural hazards had increased because of the climate change. The author anticipated that sea level would rise by 0.5 meter by the year 2030 which would lead to 11 percent loss of landmass submerging about 395,000 hectares of agricultural land of the country. According to the author, this rise of sea level would increase inundation of coastal areas causing saline water intrusion which would raise soil salinity. The author also said that a decrease in the river flow with too little rainfall in the dry season would create unavailability of surface water, and these causes would induce crop farming to be more dependent on groundwater. Due to water-intensive production practices and crop losses due to natural hazards, the food security of the country might be threatened in future (Akanda, 2009).

Uddin et al. (2011) focused on the constraints and management strategy of crop production in the salinity areas of Bangladesh. After giving a brief introduction about the

country and its land characteristics in the coastal belt, the study explored various physical, chemical and social factors as the major constraints of agricultural development in those areas. The study proved by different statistical calculations that salt tolerant accession found in the diverse germplasm of wheat, examined in this experiment, could be useful for the screening of salt tolerant genotypes. The study also revealed that, germination and other parameter viz, root and shoot lengths were markedly reduced at salinity above 12 dS/m. Finally, the study recommended few strategies for the management of the coastal saline soils.

Saline Water Intrusion and Threat to Pure Drinking Water

Climate change induces a great threat to fresh and pure drinking water (Mahmood et al., 2010). About 20 million people in the coastal areas of Bangladesh are already affected by salinity in drinking water (WB, 2012).

Nokrek and Alam (2011) conducted a survey in Koyra union of Khulna and Nishanbaria union of Bagerhat districts, found that primary sources of drinking water in Koyra were shallow or deep tube wells (5 households) and hand tube wells (for 3 households). These water sources were privately owned by few rich people and the quality of water was safe and good. On the other hand all sample respondents (8 BHHs) from Nishanbaria used drinking water from ponds/rivers/canals and it was unsafe drinking water. These water sources particularly ponds were privately owned by others (5 households) and three were a public resource. People in this coastal region usually use rain water during monsoon, as the study mentioned.

Rabbani et al. (2013) found that salinity has affected almost all the ponds of four villages of Shymnagar Upazilla of Satkhira districts on which 90 percent respondents were dependent for drinking water.

Ahmed (2008) aimed to find out the adaptation options already being followed by the coastal people of Bangladesh. The study also analyzed the barriers of existing adaptation measures in meeting up the adaptation needs of these people. Means used to incorporate the concerns of vulnerable people and to analyze their contexts of vulnerability were to

employ the Livelihood Framework Analysis (LFA) technique and Participatory Vulnerability Analysis (PVA) technique. By applying these two techniques the study explored that the most threatening hydro-geophysical vulnerability was created by the prolonged water logging as observed at Manirampur in Jessore and its adjoining sub-districts. Besides water logging, salinity ingress was endangering safe drinking water.

Saline Water Intrusion and Threat to Traditional Livelihood Option

According to Kessy and Tarmo (2010), ‘vulnerability is the increased probability of the lower income strata of the community to fall below the poverty line and for those already under the poverty line to remain in or fall further into poverty’ (Nokrek and Alam, 2011).

Olmos (2001) said that typically poor people are likely to be the worst victims of climate change, and that the capacity to respond to such change is the lowest among the poorest people of developing countries. He also stated that for their livelihood, they mostly depend on natural resources such as agriculture, forestry and other farm activities which are highly susceptible to the climate. These resources are dependent on local weather and climate conditions; any threat to those conditions directly put a negative impact on productivity and thereby diminishes their livelihoods. Sometimes they need to sell their animals in order to be able to send their children to school, as well as meet up their basic needs.

Ahmed (2008) stated that saline water intrusion was putting small holders out of the agriculture based livelihoods in the sub-districts of Satkhira and Khulna. The rising sea surface temperature during the monsoon and post monsoon seasons affected the livelihood of the coastal people of Chakaria, Maheshkhali, and Cox’s Bazar sub-districts of Southeast region. They used to struggle hard to maintain their livelihoods, due to frequent rough sea events. In addition poverty worked as major predicament that intensified the vulnerability induced by the other hydro-geophysical conditions. Water logging along with the Kobadak and Benta basin had increased food impoverishment and given rise to matri-lineal descent among the affected people. A large population of Shyamnagar, Kalaroa and Assasuni sub-districts was badly affected by a continual high

salinity in ground water aquifers. This problem had also been detected in Laxmipur and Noakhali districts. Finally, the study highlighted few government steps taken to overcome all these vulnerability which could not be successful due to increasing vulnerability in Char lands and existing population pressure.

Infectious Diseases due to Saline Water Intrusion

Rising sea levels and more intense cyclones and storm surges could intensify the contamination of groundwater and surface water causing more diarrhea outbreaks (WB, 2012; Mahmood et al., 2010). Iccdr,b (2007) confirmed that currently malaria is not considered a major challenge in the national health sector program because it is limited to 'minority' populations in the Chittagong Hill Tracts and similar areas, though over 10 million people are at risk of malaria. Dengue is also a periodical problem for Bangladesh. Government emphasized on improving treatment, mainly through rehydration. The study mentioned that global warming would produce more rapid replication of the dengue virus. Visceral leishmaniasis (VL), also known as kalaazar in this region, occurs in approximately 14 northern districts (of 64 nationwide) and is moving south. Cholera and other diarrhoeal diseases are considered as obvious in Bangladesh. There is a link between cholera outbreaks and blooms of blue-green algae (Iccdr,b, 2007).

Rahman et al. (2011) applied structural equation models to test the propositions by the tool, survey with a random sample of 300 general populations in Dhaka city of Bangladesh. These people perceived that the intensity of physical and psychological problem might increase due to climate change. The study showed an association between this situation and future environmental disorder followed by economic loss.

Basar (2012) said that people of coastal areas need to rely on saline water as they have no other alternative. It has led them to live with several health problems, including cholera, diarrhea, kidney and several skin diseases.

Vineis et al. (2011) stated that about 884 million people had no access to clean drinking water in the world. Increasing salinity of natural drinking water sources had been reported as one of the many problems affecting especially poor countries. The study took Bangladesh as a model country and indicated that the problem of salinity could have

serious implications with regard to rising rates of hypertension and other public health problems among large sectors of the worldwide population.

Khan et al. (2010) investigated the relationship between salinity in drinking water and the risk of (pre)eclampsia and gestational hypertension in a coastal community of Dacope. They found that Salinity in drinking water is associated with increased risk of (pre)eclampsia and gestational hypertension among them. The study affirmed that Bangladesh is confronted with high salinity exposure due to sea level rise and other environmental influences. The study recommended to develop as well as to evaluate affordable approaches for providing water with low salt content.

Population Displacement due to Saline Water Intrusion

GOB (2014) stated that by 2050 one in every 45 people in the world and one in every 7 people in Bangladesh will be displaced by climate change. Rabbani (2009) stated that climate change keeps negative impact on rural livelihoods. Consequently migration from rural to urban areas is increasingly likely to become one of the favored adaptation strategies of the mobile, rural poor. According to a recent report, over 35 million people were expected to be displaced from 19 coastal districts of Bangladesh in case of 1 meter sea level rise in this century (Rabbani, 2009).

IOM (2009) indicated that many people have already migrated to the urban slums from the coastal zones of Bangladesh due to frequent cyclones, storm surges, river erosion, etc. This will further exacerbate the problem of people living in urban periphery accompanied by hazardous environments with potential risks of social unrest. The climate-induced migrants are often discriminated and face different problems during or after the displacement (Roy, 2011). Yusuf (2010) mentioned that sometimes rural residents might be forced to leave their native lands and to migrate in search of work.

Bose (2013) analyzed the environmental crisis of Bangladesh. She mentioned the crisis like SLR, tropical cyclones, soil salinity and mangrove depletion. She stated that these environmental crises are highly responsible for large scale population displacement, human insecurity and migration to India.

Shamsuddoha et al. (2012) identified salinity as one of the major causes of migration in Khulna area of Bangladesh. Young women are remaining unmarried due to salinity related diseases which ultimately force the families with adult daughters to move elsewhere where their daughters are unknown to people. Within a period of time, they become able to get their daughters married of.

Damage and Loss due to Climate Change in Bangladesh

A warming climate will contribute to slowing down the reduction of poverty. Though everyone will be at risk of climate change, the impacts of progressive global warming will fall hardest especially on the poor (WB, 2012). Mirza (2003) also stated that extreme weather events had generated enormous pressure on poor economies, shattered infrastructure and made the poor more vulnerable.

According to the latest Household Income and Expenditure Survey, Bangladesh is one of the world's poorest countries with over 33 percent of the people categorized as poor (HIES, 2011). According to Global Climate Risk Index (2010) extreme weather conditions of Bangladesh cause damage amounting to over US\$ 2 billion a year and a GDP loss of 1.81 percent between 1990 and 2008 (Harmeling, 2009). Eventually they constrain the sustainable development of the country (Sayeed, 2012).

The south-west coast of Bangladesh was hit by 'Sidr' in November 2007 which had damaged 2.3 million households. This was equivalent to about US\$ 1.7 billion. 'Ayla' hit the southern coast of Bangladesh in May 2009 which was more severe in nature. It affected nearly 5 million people and causing infrastructure damage of over US\$ 60 million (Strategic Program for Climate Resilience, 2010).

Introduction of Shrimp cultivation due to saline water intrusion brought devastating impacts in the coastal areas of Bangladesh. Rabbani (2009) found zero rice production the four villages of Shymnagar Upazilla where rice crops (Aman) declined from average 2.9 tons/ha in 2008 to '0' ton/ha in 2009 due to high salinity in the rice fields. Crop production was also hindered by the frequent experiences of floods in Bangladesh as the study said.

Khandker (2007) stated that natural hazards like flooding reduced consumption and asset and increased vulnerability and poverty in Bangladesh. The author also said that flood in 1998 was the most severe in the history of flooding in Bangladesh which affected about one-third of the country causing damage to the sectors like poultry, livestock, crops, fisheries and rural infrastructure. The damage was equivalent to about US\$ 2 billion which was about 9 percent of the country's GDP (Khandaker, 2007). The flood of 1998 and 2007 inundated over 70 percent of the country which destroyed over 85,000 houses, affected almost 1 million households and destroyed 1.2 million acres of crops (Strategic Program for Climate Resilience, 2010).

Drought is also severely prevalent in our country. The 1978-79 drought, one of the most severe ones, resulted in widespread damage to crops (rice production was reduced by about 2 million tons) and directly affected about 42 percent of the cultivated land (FAO, 2008). Coastal people's livelihood in Bangladesh is also highly challenged by river erosion. About 8,700 ha of land are eroded due to river erosion displacing about 200, 000 people annually (Habiba, et al. 2010).

Climate Change, Gender and Vulnerability

Among the poor, women are particularly affected because they constitute the largest percentage of the poor population. It is estimated that women account for 70 percent of total poor population (Fact Sheet MDG 1). Climate change treats men and women differently as because women have limited access to resources. Restricted rights, limited mobility and a muted voice in shaping decisions make them highly vulnerable to climate change (Revelo et al., 2009).

Dankelman (2010) attempted to link gender dimension with the climate change issue in this edited book 'Gender and Climate Change: An Introduction'. In order to serve the purpose, several case studies of different regions like Philippines, Andhra Pradesh and Delhi of India, Vietnam are nicely depicted here by different authors. In all these countries, the vulnerability of women due to climate change was significantly proved by these case studies.

Mukherjee (2009) reflected on the seasonal gender-specific vulnerabilities to show how the problems compound for poor women in Bangladesh during the deficit season, who have limited mobility and increase in workload and ill-health. This is true for women suffering the effects of floods as well in coastal Bangladesh who are often left with their children and other dependents whilst men migrate; during this period they may not receive remittances and may be forced onto a labour market with few opportunities and low wages, and may even be abandoned at such times with limited means of survival, as men who migrate may not return (Nokrek and Alam, 2011).

Women are the least equipped population to adopt with weather extremes such as storms, floods, eroding coastlines, heat waves, and droughts. The spread of malaria and other heat-related diseases impose direct threats to their health and survival. The subsequent economic loss due to extreme weather events put obstacles in proper nutritional intake of women. Not only that climate change will also increase the time taken to collect water in rural areas, a task mainly done by women and girls, due to travelling greater distances to find water (Brody et al., 2008). Sometimes they become the victim of sexual assault while crossing that long distance. Stereotypically women are in the face of extensive gender inequalities. Thus, this inequality tends to be exacerbated due to climate change, as highlighted by the 2007 UNDP Human Development Report (Agostino, 2011). Hence, there is a need to explore gender dimension of climate change as well as to identify gender sensitive adaptation strategies.

Ribeiro and Chauque (2006) aimed at investigating the gender differentiated impacts of the climate change in South Africa, Namibia, Botswana and Mozambique which have been hard hit by climate change due to their geographical location. This study was conducted as part of a regional project funded by the Heinrich Boll Foundation (HBF) through its Southern African Regional office. To achieve the objectives of this study, a qualitative study based on structured and semi-structured interviews of households and key informants, FGD and histories of life of the oldest man and women of each community was conducted. Data analysis was performed combining tools such as Gender Matrix Analysis (GMA), Impact Assessment, Influencing factors, Institutional analysis, Access and Control and Social Profiles and Capacities and Vulnerabilities Analysis and

Needs Assessment. The findings revealed that women and men were differentially impacted by climate changes due to the existing power relations and the differentiated roles in those communities. Women had access to but not control over natural resources and other property rights. Since the agriculture is the main women's activity in those communities, the study strongly recommended capacity building of women in agriculture and agro-processing techniques (Ribeiro and Chauque, 2006).

Thus the conceptual linkages between the issue of land rights for women, with household food security on the one hand and gender equality on the other is very important. Rao (2005) stated that in a context of diversified rural livelihoods in India, the contribution of agricultural production to household subsistence had been declining. This situation led men towards better paid and non-farm jobs, while leaving women behind to manage agricultural production. Though this right to land for women was a positive development, it seems to increase their work burdens without much change in their status of decision making authority (Rao, 2005).

Enarson and Fordham (2001) highlighted few fundamental rights of women which are violated during any disaster. These rights included right to life, right to economic and housing security, right to health and safety and right to self determination. Based on an extensive literature review, the study also highlighted the processes that increase women's biological, socio-economic, political as well as environmental disaster vulnerability.

Denton (2002) made a qualitative analysis of the gender related inequalities in the developing world. The study explored that seventy percent of the 1.3 billion people in the developing world living below the poverty line are women. She mentioned that the consequences of climate change should not lead already marginalized communities into further deprivation. The threats posed by global warming failed to impress on policy-makers the importance of placing women at the heart of their vision of sustainable development. She also argued that in order to ensure a sustainable future by combining development and environment issues, climate change policy must take into account the interests of all stakeholders. The Global Environment Facility and the Clean Development Mechanism of the Kyoto Protocol should play a role in ensuring

sustainable development, provided they be implemented in a way that would not disadvantage women and the poor. Similarly Enarson and Fordham (2001) argued that women's empowerment is the linchpin of progress toward more sustainable ways of living that promote justice by reducing risk. Women as well as men must be empowered in disaster decision making, both at the household level, where men's and women's interests so often diverge, and in national and international disaster and development organizations, where women's political voice is still too rarely heard.

Petrie (2010) noted that women seems to cope better with the impacts of changing circumstances than the men, by exploring opportunities that enable them to cope better, although they lack power in policy making processes that in turn impact their operational capacity and ability. Thus, the necessity to mainstream gender issue into the national policy should be truly realized (Dankelman, 2010; Petrie, 2010).

Climate Change, Coping, Adaptation and Resilience

A core concern of the research is how humans can best anticipate and respond to change in a sustainable manner. Concepts 'adaptation' and 'Resilience' are vitally related to climate change. Increased understanding of these concepts through practice and empirical research can contribute to the long-term viability of human societies and their physical environments. Nelson (2011) focused three issues concerned with the ability to respond to and manage change. First, although adaptation responses can help to build resilience, they just as easily can undermine resilience. Second, the magnitude of change may be outside people's abilities to adapt, and thus it is not always possible to maintain system resilience. Finally, both adaptation and the desirability of a resilient system, or community, may require challenging long standing and powerful social institutions.

Four climate change adaptation projects were implemented in Asia in 2001 under the Global Environment Facility's (GEF) Least Developed Countries Fund (LDCF) from the perspective of a selected group of experts. Sovacool et al. (2012) discussed the ongoing adaptation efforts of four of these countries, Bangladesh, Bhutan, Cambodia and Maldives, on the basis of original data collected from more than one hundred semi-

structured research interviews. He found that projects enhanced infrastructure resilience by building relevant, robust and flexible technologies and built institutional resilience by creating strong, permanent and legitimate organizations in place to respond to climate change issues. The projects also promoted community resilience by enhancing local ownership, building capacity and creating networks that would help ordinary people learn and adapt to climate change. The adaptation interventions include multiple spheres. It is the combination of putting up hardware and infrastructure with efforts that attempt to address coordination issues, overcome limited execution capacity and improve human potential constraints. In addition, knowledge gained has to be disseminated finally. Thus, all four of these case studies coupled adaptive improvements in technology and infrastructure with those in governance and community welfare. Instead of an asset based approach, the study also demonstrated the salience of a functions-based approach to resilience and adaptive capacity.

Apata et al. (2009) stated that climate change will have a strong impact on agricultural production in Nigeria. Thereby, people took multiple adaptation strategies including diversifying into mixed crop-livestock system, switching from crops to livestock and from dry land to irrigation, practicing zero tillage, making ridges across farms and cereal/legume intercropping etc. The result suggested that the larger the occurrence of the climate change, the poorer the adaptation. The study also conducted FGD to know the solutions which included agricultural insurance, effective weather alert through media, effective meteorological facilities in keeping adequate records of weather forecast and finally felt the necessity of extension agents to educate people more on zero tillage, organic agriculture and better land management techniques (Apata et al., 2009). In the same way, farmers' experience, access to free extension service and markets were reported as important determinants of adaptation in coastal areas of Bangladesh (Sarkar and Padaria, 2010).

Nuorteva et al. (2009) analyzed the resilience and adaptive capacity of rural livelihoods around Cambodia's Tonle Sap Lake, an exceptional lake-floodplain system dominated by the flood pulse. The findings from research conducted in 2008 in the rural villages of the Tonle Sap Lake demonstrated people's tradition of adapting to the remarkable seasonal

variation of water and related resources. The level of livelihood diversity in this area became relatively higher due to the supplementary livelihood strategies. But even their capacity to adapt to unusual environment seemed weakening by maintaining existing power imbalances, unjust governance practices and by denying particularly the poorest and ethnic minorities' equal access to common resources and more generally to the decision making processes at the village and communal level. The author finally concluded with an appeal to realize the close linkages between climate change adaptation and other general actions like poverty reduction, fostering the development etc. and to deal the climate change adaptation activities under the broader socio-political context.

Pettengell (2010) drew on case studies from around the world and its own experience working with rural communities to set out what is needed, and a range of interventions that are available, to enable people living in poverty to adapt to climate change. According to these cases, existing gender inequalities combine with poverty to magnify women's vulnerability to climate change undermine their ability to adapt. The report identified that there were limits to adaptation, and without rapid and significant global mitigation, these options would be quickly lost. So, the Oxfam's approach to climate change adaptation focused on two factors: building adaptation capacity and addressing the issues that limit adaptive capacity. Adaptation is therefore not a choice between reducing general vulnerability or preparing for specific hazards, such as floods; adaptation requires an ongoing change process whereby people can make informed decisions about their lives and livelihoods in a changing climate. According to Oxfam experience, both bottom-up and top-down processes are required to empower communities to manage risk and uncertainty.

UNDP (2008) published a project report on the Community-based Adaptation to Climate Change through Coastal Afforestation in Bangladesh. The project was proposed by the Government of People's Republic of Bangladesh to reduce the vulnerability of coastal communities to climate change-induced risks in 5 coastal districts (Barguna, Patuakhali, Bhola, Noakhali, and Chittagong) under 4 coastal forest divisions. The components that the project was based on are: a. enhancing the resilience of coastal communities and protective ecosystems through community-led adaptation interventions, focusing on

coastal afforestation and livelihood diversification; b. Enhancing national, sub-national, and local capacities of government authorities and sectoral planners to understand climate risk dynamics in coastal areas and implement appropriate risk-reduction measures; c. Reviewing and revising coastal management practices and policies with a view on increasing community resilience to climate change impacts in coastal areas; and d. Developing a functional system for the collection, distribution and internalization of climate-related knowledge.

Badjeck et al. (2010) synthesized the pathways through which climate variability and change impact fisher folk livelihoods at the household and community levels by using a livelihoods framework. Drawing upon the research and the available literature, the author explored the wider implications of the fisheries management and climate policies on the local livelihoods. This paper suggested that the vulnerability to multiple stressors can be reduced by building resilient livelihoods through different institutions which can foster socio-ecological systems providing the building blocks for the maintenance of the livelihoods in the face of critical and pervasive threats. Existing pattern of adaptation required specific policy to move towards more planned adaptation strategies with a multi-sector perspective to minimize the net impacts. As the impact of climate change is not negative for all, opportunities brought by climate change should be identified successfully. Finally, to tackle all the challenges posed by climate change, the author felt the necessity of a diverse portfolio of responses where poverty and vulnerability, fisheries governance and climate policies agenda are reconciled.

Uddin (2012) attempted to understand and describe the household food security status of the marginal farmers in a selected storm surge prone coastal area of Bangladesh. To collect data from the 30 randomly selected respondents a pre-tested structured interview schedule was administered. The findings revealed that maximum marginal farmers were food insecure (56.67%), while 30 per cent were moderately food secured and only 13% were food secured. Though adequate food was available in local markets those were beyond affordability. The most three vulnerable livelihood options for the marginal farmers were crop farming, fish farming and livestock farming. The respondent farmers adopted six self coping strategies and three assisted coping strategies to cope with the

vulnerability and food insecurity. The self coping strategies were decreasing the number and size of daily meals, consumption of wild food, selling labour at very low rate, selling fixed and movable household assets, contracting new loan at a high interest rate and cultivation of short duration crop. On the other hand, assisted coping strategies include relief food, social network and begging.

Mirza (2003) depicted the impacts of climate related extreme events in some developing regions like Africa, Asia, Latin America and Small Island States. As part of this, the study specifically focused on the vulnerability, coping capacity and adaptation of three developing societies like Mozambique, Orissa and Bangladesh. The author argued that adaptation to climate change in the developing countries is largely dependent on the current adaptive capacity and on the different development models which are already being pursued by them. As investment in developing countries are more focused on recovery from disaster than on the creation of adaptive capacity, the author strongly recommended the lending agencies and donors to reform their investment policies in developing countries to focus more on capacity building instead of just investing in recovery operations and infrastructure development (Mirza, 2003). More so, better appreciation of the relationship between the concepts of adaptation and resilience would provide more effective tools to plan for, and respond to, current and future change (Nelson, 2011). It is also necessary to make people aware of the severe consequences of disaster which might help in designing adaptation strategies for future disaster (Dai, 2011).

In order to guide development of mitigation and adaptation strategies, stakeholders will require information on baseline conditions and projections of change. But the interpretation of impact assessments is not always straightforward given the uncertainties in measuring relative sea level rise and thus the challenges in predicting the magnitude of change, and the difficulty in acquiring appropriate data and methodologies for quantifying impacts (Kettle, 2012). Neumann et al. (2011) stated that a common mistake in climate impact and adaptation analyses is estimating the effects of future climate on current resources. So a better approach, where possible, is to project both the level of threat and the resources at risk. They intend to present a framework for evaluating the

economics of adaptation to permanent inundation from SLR that employs detailed local scale data and is spatially comprehensive, and apply the framework to estimate costs of adaptation for the full coastline of the continental US. Projecting resources at risk involves, at minimum, estimating how real property values could appreciate—their approach links future property value to a projection of US GDP. The results show that the economic cost of SLR is much larger than prior estimates suggest—more than US\$ 63 billion cumulative discounted cost (at 3%) for a 68 cm SLR by 2100, and US\$ 230 billion undiscounted—yet is only one-fourth the total value of low-lying property vulnerable to SLR, illustrating the importance of careful site-specific consideration of adaptation.

By highlighting the limitations of different vulnerability assessment methods Ozyurt and Ergin (2010) proposed an alternative quick but informative vulnerability assessment method based on the Thieler and Hammar-Klose (2000) methodology, which uses both physical and human activity parameters. The study expected that this assessment would focus on identifying those regions where the various effects of sea level rise might be the greatest. More so, by using this concept as a starting point, a coastal vulnerability matrix and a coastal vulnerability index that use indicators of impacts of sea level rise were developed.

Perception towards Climate Change

Sarkar and Padaria (2010) examined the farmers' awareness and risk perception about climate change in the coastal ecosystem of West Bengal. Total six villages were studied from the two blocks of South 24 Pargana district of West Bengal for study. It was observed that nearly 38 percent of the respondents had heard about climate change. Most of the respondents perceived climate change in the form of increase in temperature, reduction in agricultural and livestock production, increase diseases, increase sea level etc. rather than the phenomena like frequent cyclone, occurrence of cold wave, heavy fog and precipitation. They considered rapid industrialization as responsible for these climatic changes. The findings revealed that farmers with more farming experience were more likely to notice climatic changes.

Another study explored households' perception of climate change and related health risks of two villages. A cross-sectional survey was conducted among 450 households randomly selected from two different regions of northern and southern part of Bangladesh. The survey was also supplemented by twelve focus group discussions and fifteen KIIs. The respondents noticed significant climatic shift in their localities such as warmer but erratic winters, experience of catastrophic natural disasters with the prediction of more in future, increased heat during summer, decreased number of season, irregular rainfall and drastically decreased rainfall etc. They also reported that climate variability induced diseases had increased compared to five to ten years ago. Health and hygiene, production loss, working hour losses, extra work, poor crop growth, poor crop yield, over irrigation and increased illness incidence were some other consequences as perceived by the respondents (Haque et al., 2012).

Mahmood et al. (2010) selected south western coastal Bangladesh to assess people's perception about the climate change vulnerability that severely affects their livelihood patterns. For the conceptualization the study depended on few resource persons and extensive literature review. Based on a random sampling survey the study found that people of this area were highly vulnerable due to frequent cyclone, tidal surge, river erosion, heavy rainfall followed by flood, salinity intrusion. The study also focused on the coping strategies and developed a conceptual model for the adaptation with climate change vulnerability.

Apata et al. (2009) examined the arable food crop farmers' perception about climate change and strategies employed to adapt in South Western Nigeria. It was evident in the study that climate change had a strong impact on agricultural production in Nigeria. The study attempted to analyze the perception and adaptation level of climate change by running the Logit model on data. People observed higher temperature, fast water evaporation from the ground, delayed rainfall, spread of agricultural pests and weeds on crop land, violent rain and hailstorms, less clearly defined seasons as the significant climatic variability on their land. Most interesting 95 percent people took these occurrences as a sign of divine anger.

Petrie (2010) provided an analysis and summary of the findings of eight case studies in Africa focusing on impacts of climate change. It aimed to find out various policies, programs and activities that could address these issues. It identified several climate change impacts commonly experienced by the people in all these communities. They are increase in floods, droughts and strong winds, low and erratic rainfall and unpredictability and/or changes (shifting and shortening) in growing seasons, soil erosion and forest or land degradation, etc. It defined different levels for climate change impact: (i) changes in basic meteorological conditions; (ii) consequences for environmental conditions and agricultural resources; (iii) impacts on crop and livestock responses and effects on production; and (iv) impacts on rural economies and livelihoods.

An extensive survey was conducted by Paradise in the Islamic world to know the perception towards earthquake. Study found that perception of Islamic world is totally different than the other parts of the world. Less educated respondents generally tended to attribute earthquakes to divine action and retribution. Participants also indicated that any guess or prediction about future quake was totally forbidden in the Holy Qur'an. In contrast to other studies, the study hypothesized that people of the Islamic world considered climate change as more of a natural phenomenon rather than man-made (Paradise, 2006).

Existing literatures on various climatic conditions of Bangladesh, thus, show that people experience variable climatic conditions such as warmer but erratic winters, increased heat during summer, decreased number of season, irregular rainfall and drastically decreased rainfall, frequent cyclone, tidal surge, river erosion, heavy rainfall followed by flood, salinity intrusion etc. Sometimes these disasters are considered as man-made, however, sometimes as of divine origin.

Based on this literature review, it is distinctly evident that country wise local level assessment of socioeconomic impact of salinity is badly required. Most of the literatures are focused on cyclones, floods, droughts etc. in Bangladesh. A very few number of studies are focused on slow onset climatic changes like salinity. Though few studies are done on this issue, most of them highlighted the cases of those villages which mostly and severely experienced the devastating effects of Sidr and Ayla, like Koyra of Satkhira,

Kamarkhola, Sutorkhali of Dacope etc. Other than these, there are number of villages which were also affected by the high tidal surge of Sidr and Ayla. Due to saline water intrusion into these villages, they totally turned into barren with a yellowish look. Agricultural production is severely affected in these areas which are not focused by NGOs and Media. The current study intends to focus on those villages where GO and NGO interventions are comparatively less. People are undecided about their livelihoods. They are moving to and fro to earn their livelihood.

In the existing literature gender perspective is not addressed. Most of the climate change policies of Bangladesh are not gender friendly. Recently policies have been revised though not sufficient to address the issue.

Most of the studies explored the coping mechanisms. Adaptation mechanism is another recent introduction in climate change issue. Undoubtedly hazards produce vulnerability which are somehow managed by coping mechanisms but can be properly and systematically reduced by adaptation mechanisms. Recent studies intend to explore adaptation mechanisms mostly with rapid on-set climatic changes. A very insignificant number of studies attempted to highlight the adaptation mechanisms with salinity but their gender-based analysis is still missing.

Thus it is still predicted that further research efforts are needed to examine the aspects of coastal livelihood being affected by the saline water intrusion in Bangladesh, to explore adaptation mechanisms those people follow to minimize their vulnerability and to analyze them from a gender perspective which is a new inclusion in climate change issue all over the world.

CHAPTER THREE

CLIMATE CHANGE AND POLICY INITIATIVES: OVERVIEW OF GLOBAL AND BANGLADESH PERSPECTIVES

3.1 Sea Level Rise: Global Perspective

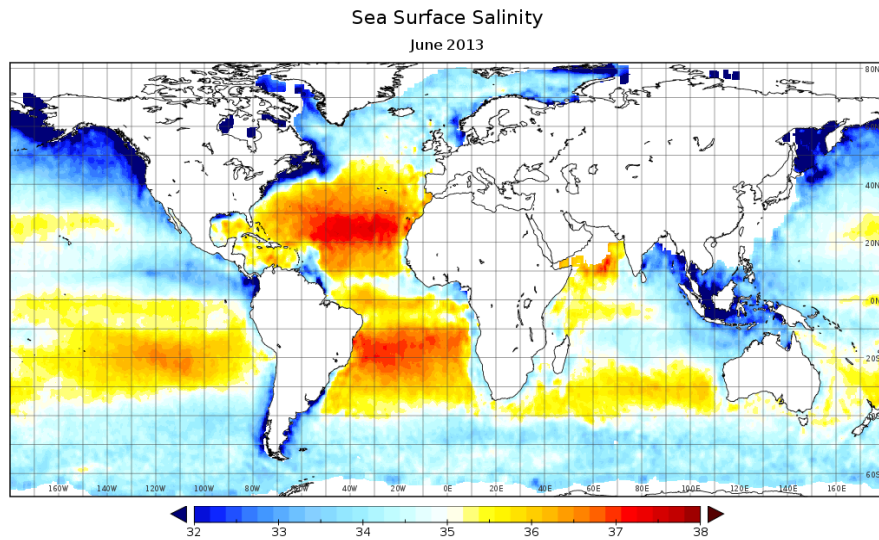
Global mean sea level rise (GMSLR) is basically caused by an increase in the volume of global ocean which in turn is caused by warming the ocean, loss of ice by glaciers and ice sheets and reduction of liquid water storage on land (IPCC, 2014). Since mid-19th century, the rate of sea level rise has been larger than the mean rate during the previous two millennia (high confidence).

Global sea level (GSL) rise of 20 cm during the 20th century caused Sandy to flood an area of 70 km² greater than it would have in 1880, increasing the number of people living on land lower than the storm tide by 38,000 in New Jersey and by 45,000 in New York City (Climate Central, Surging Seas Data Table, 2012 in Miller et al., 2013). Approximately 86 percent of the United States east coast barrier beaches (excluding evolving spit areas) have experienced erosion during the past 100 years (Zhang et al., 2004). Widespread erosion is also well observed in California (Moore, 1999) and the Gulf of Mexico (Morton, 1999 in Cai et al., 2009).

The potential impact of one metre sea level rise is expected to inundate 5,763 km² and 2,339 km² in India and in some big cities of Japan, respectively (TERI, 1996; Mimura and Yokoki, 2004). The maximum inundation area is estimated to be 2,643 km² which is about 1.2 percent of total area of the Korean Peninsula (Matsen and Jakobsen, 2004 in IPCC, 2014). Rising sea levels are already contaminating underground fresh water supplies in Israel and Thailand, in small atolls scattered across the Pacific and Indian oceans and the Caribbean Sea, and in some of the world's most productive deltas such as China's Yangtze Delta and Vietnam's Mekong Delta (UNFCCC Fact Sheet 11, 2014). In China, it is expected that a 30 cm sea level rise would inundate 81,348 km² of coastal lowland (Du and Zhang, 2000 in IPCC, 2014).

The following figure shows sea surface salinity around the globe.

Figure 3.1: Sea Surface Salinity around the Globe



Source: SMOS, 2013

3.2 Sea Level Rise and Salinity in South Asia

Physical extent of climate related impacts will vary depending on regional and local situations (Burtis, 2006). Asia is the largest continent on Earth and spreads over four climatic zones (boreal, arid and semi-arid, tropical and temperate). Asia's coastal areas will become even more prone to increased flooding due to both rising sea levels and river flooding. Because many of the largest cities in Asia are located on the coast and within major river deltas, they are even more susceptible to the impact of climate change (WWF, 2009 in Shaw et al., 2010). The cascading effects of rising temperatures and loss of ice and snow in the region are affecting water availability (amounts, seasonality), biodiversity (endemic species, predator-prey relations), ecosystem boundary shifts (tree-line movements, high-elevation ecosystem changes), and global feedbacks (monsoonal shifts, loss of soil carbon) (IPCC, 2007).

The sea level rise in Asia is geographically variable (ACIA, 2005). Sea level rise varies considerably from 1.5 to 4.4 mm/yr along the East Asia coast, due to regional variation in land surface movement (Mimura and Yokoki, 2004). This would affect the relative sea level rise in the Asian Arctic (ACIA, 2005). The tropical Pacific and Indian Ocean regions have considerable inter-annual and decadal sea level variability associated with the El Niño-Southern Oscillation (ENSO), the Asian–Australian monsoon and phenomena like the North Pacific Decadal Oscillation (Chambers, 2002). Choi et al. (2002) has reported that the regional sea level rise over the north-western Pacific Ocean would be much more significant compared with the global average mainly due to exceptionally large warming near the entrance of the Kuroshio extension.

IPCC (2014) made some projections about climate change issue in South Asia. The warmest daily maximum temperature is projected to increase 47°C, resulting in the highest temperature changes in Turkey, Iran, Iraq, Syria, northern India, Pakistan, China, Nepal, and Bhutan. This may adversely affect rice and other crops growing near their heat stress limits in places such as Pakistan / North India (during October), South India (April, August), East India / Bangladesh (March-June), Myanmar / Thailand / Laos / Cambodia (March-June), Vietnam (April, August), Philippines (April, June), Indonesia (August) and China (July-August).

Sea level rise threatens coastal and deltaic rice production areas in Asia, such as those in Bangladesh, Myanmar, and the Mekong River Delta. For example, about 7 per cent of Vietnam's agricultural land may be submerged due to sea level rise (IPCC, 2014). In many humid regions of Southeast Asia, many ha of lands are technically suitable for rice production but are remaining almost unproductive due to salinity and soil problems. Low water levels in Viet Nam's Mekong River Delta have contributed to inward flow of salt water resulting in an increased level of salinity in river water and thereby endangering rice production. Salinity also affected 3 million ha of rainfed rice fields of Thailand representing about 17 percent of the surface area (Clermont-Dauphin et al., 2010)

In Central and South Asia, crop yields are predicted to fall by up to 30 percent, creating a very high risk of hunger in several countries (IPCC, 2007). In India, changes in cropping pattern and land-use pattern, over-exploitation of water storage and changes in irrigation

and drainage are modifying the hydrological cycle in many climate regions and river basins of India (Mall et al. 2006). The population of the Maldives mainly depends on groundwater and rainwater as a source of freshwater. Both of these sources of water are vulnerable to changes in the climate and sea level rise (National Communication of Maldives to the UNFCCC, 2001). Lack of environmental flows to the deltaic area is likely to expose around 2.26 million people to water scarcity, rising sea levels and food insecurity. The country is extremely short of freshwater resources (MHAHE, 2001). Nepal as a landlocked country experiences wide range of climatic variations. From subtropical in the south to alpine in the north, the elevation changes from 64 to 8,850 m above sea level within a span of about 200 km. It experiences heavy rains from June to September which triggers landslide problems in higher mountainous terrains and floods in lowlands. Thousands of people are affected by landslide and floods which kill 400 people each year (Subedi, 2010).

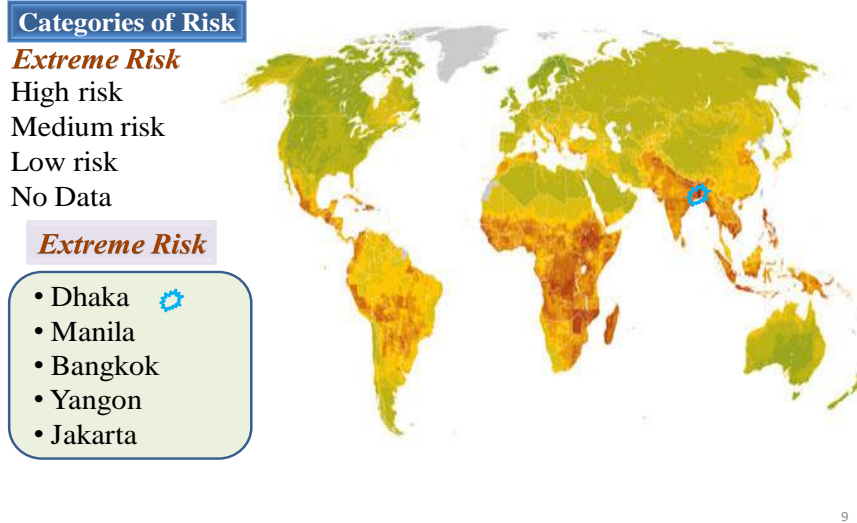
The global burden of climate change-attributable diarrhoea and malnutrition are already the largest in the world in Southeast Asian countries including Bangladesh, Bhutan, India, Maldives, Myanmar and Nepal in 2000 (IPCC, 2007). Notable relations to changes in climate have been seen for dengue and dengue hemorrhagic fever in the Maldives (MHAHE, 2001).

3.3 Climate Change (CC) in Bangladesh

Bangladesh is severely affected by climate change (Nishat et al., 2013; MOEF, 2008; Ahmed, 2006; Islam and Sumon, 2013; Rashid et al., 2013). Increasing surface air temperature is most prominent in Bangladesh. Monsoon is both hot and humid which brings heavy rainfall throughout the season (Nishat et al., 2013). Rainfall is predicted to be increased in the Himalayan catchment areas that results in higher river flows in the monsoon season causing large-scale flooding in Bangladesh. It is also anticipated that 5-10 percent increase in cyclone associated with high tidal surge will increase the vulnerability of the coastal region (Islam and Sumon, 2013). The following figure shows that Bangladesh is at the extreme risk zone of climate change.

Figure 3.2: Climate Change Vulnerability Index

Climate Change Impact: Bangladesh Scenario



Source: Maplecroft’s Climate Change Vulnerability Index (CCVI) Atlas, 2013

3.4 Why Is Bangladesh more Vulnerable due to Climate Change?

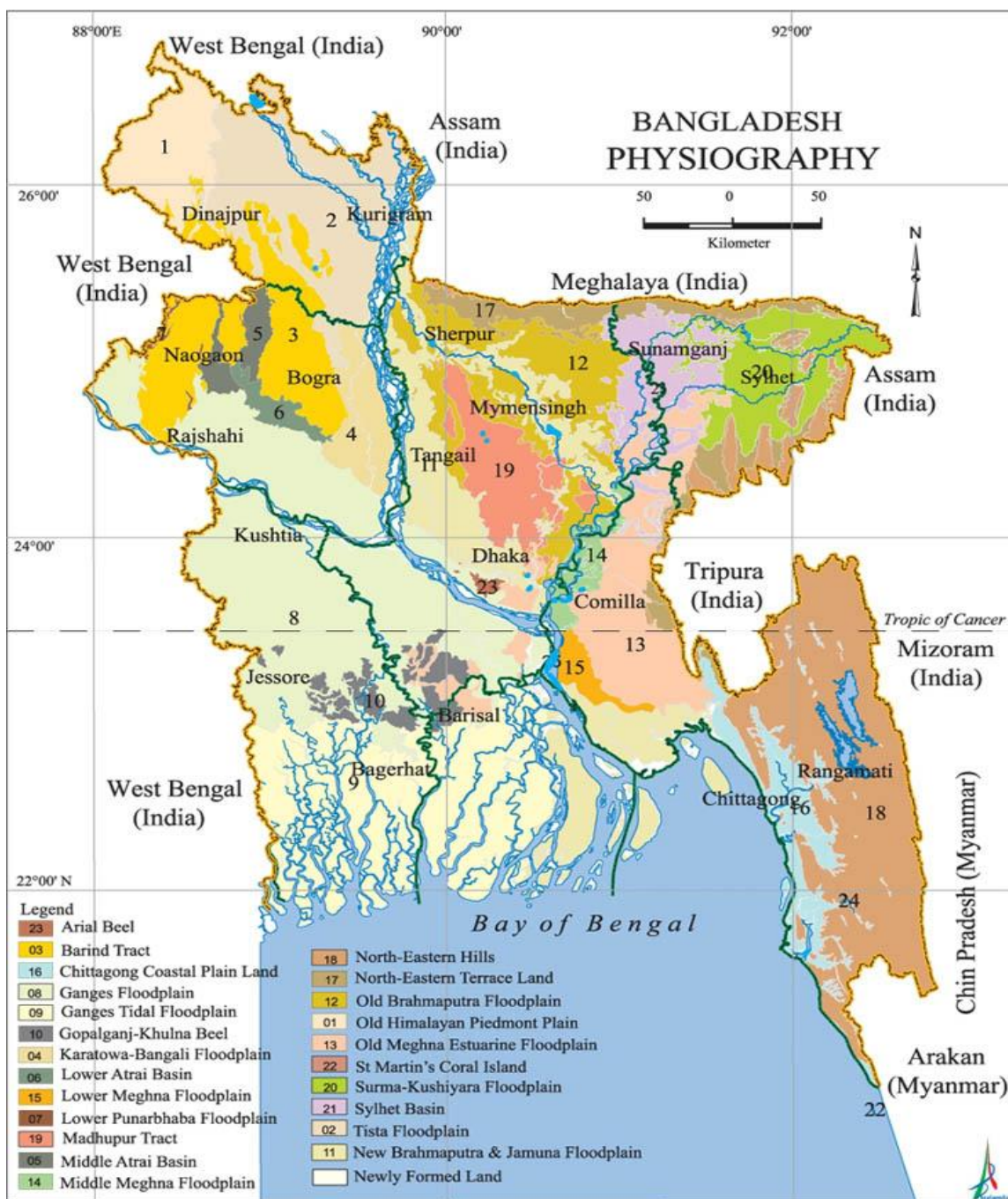
The geographical location and geo-morphological conditions of Bangladesh have made the country highly vulnerable to climate change particularly to sea level rise. For better apprehension of the current study, a very brief description of the geo-morphological conditions of the coastal region of Bangladesh is given below.

Bangladesh is situated at the edge of two different environments, with the Bay of Bengal to the south and the Himalayas to the north (Masum, 2010). This particular geography of Bangladesh provides life-giving monsoons at the one side, catastrophic ravages of natural disasters are common on the other. The coastal morphology of Bangladesh is characterized by a vast network of rivers, an enormous discharge of river water heavily laden with sediments, both suspended, and saltation load, a large numbers of off-shore islands and sand bars, the Swatch of No-Ground (a submarine canyon) running NE-SW partially across the continental shelf about 24 km south of Bangladesh coast, a funnel

shaped, shallow and wide estuary, a gently sloping wide continental shelf, a narrow strip of coastal landforms fronting hill ranges, strong tidal actions, and frequent landfall of tropical cyclones (CDMP, 2009).

The entire coastal plain of Bangladesh can be broadly classified into three distinct zones: the southwest, south central and southeast zone. Southwest and south central zones are low in elevation height and flat in nature. The coastal area of Satkhira, Khulna, Bagerhat and Pirojpur districts belong to southwest zone. The southwestern part of the region is covered by the largest mangrove forest of the world, popularly known as Sundarbans, named after the 'Sundri' trees. The mangrove forests act as deterrents to the furiousness of tropical cyclones and storm surges. The south central coast covers the lower part of the Meghna River extending from the Haringhata River Estuary to Feni River Estuary. Borguna, Potuakhali, Bhola, Lakhshmipur, Noakhali and Feni districts belong to this coast. The central region is the most active one, and continuous processes of accretion and erosion are going on here. The very active Meghna River estuary lies in the region. This estuarial region has seen the most disastrous effects of tropical cyclones and storm surges in the world and is very vulnerable to such calamities. The southeast zone is narrow and dominated by narrow hills and uplands (Sarwar and Islam, 2013). The eastern region, being covered by hilly areas, is more stable, and it has one of the longest beaches in the world.

Figure 3.3: Physiographic Condition of Bangladesh



Source: Banglapedia, 2014

3.5 Observed Sea Level Rise in Bangladesh

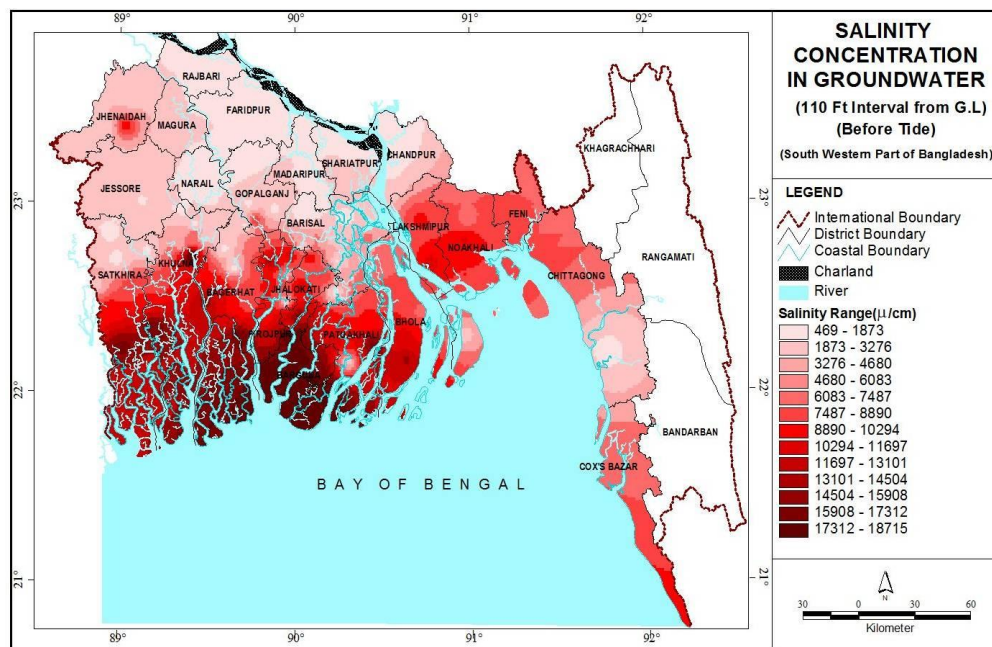
As a low-lying country, Bangladesh is highly vulnerable to SLR (Nishat et al., 2013; Sarwar et al., 2007; Haque, 2006; Ali, 2000). The projected SLR of 1 m in the twenty-first century may affect approximately 1,000 square km of the coastal land of Bangladesh (Cruz et al. 2007). Mean sea level (MSL) along the Bangladesh coast is the highest during the period June-August when river discharge is the greatest due to the heavy rainfall in the country. On the other hand MSL is the lowest in the month of January-March (Khandker, 1997). Singh (2002) analyzed 22 years (1977-1998) tide gauge data from Hiron Point, Char Changa and Cox's Bazar stations on the southwest, central and southeast coast of Bangladesh. The study further highlights highest sea level rise was in Cox's Bazar with a rate of 7.8 mm/year and the second and third highest rates of change at Char Changa at a rate of 6.0 mm/year and in Hiron Point 4.0 mm/year.

3.6 Saline Water Intrusion in Bangladesh

The coastal land of Bangladesh is highly threatened by saltwater intrusion (Sarwar and Islam, 2013; Ahmed, 2006; Nishat and Mukherjee, 2013). Department of Public Health and Engineering treats the coastal zone as the area where salinity intruded into superficial or deep aquifers (Uddin and Kaudstaal, 2003). Salt water from the Bay of Bengal is reported to have intruded 100 km or more inland along tributary channels during the dry season (IPCC, 2007). A 1 m sea level rise is assumed to inundate 17.5 percent of Bangladesh's landmass along the coastal zone, affecting 20 percent of the country's rice fields and threaten the UNESCO-declared world heritage site, the Sundarban (Sarwar and Islam, 2013). Sundarban has already been affected due to reduced flow of fresh water flows through Ganges river system over the last few decades particularly during the dry season. This has led to a definite inward saline water intrusion. A possible 45 cm sea level rise could inundate 75 percent of the Sundarbans by the year 2050 (Qureshi and Hobbie, 1994). Salinity data from Land Reclamation Programme (LRP) and Meghna Estuary Study (MES) indicate an enormous seasonal effect due to the influence of huge fresh water discharge from the Lower Meghna River on the horizontal distribution of

salinity in the estuary. High salinity both in monsoon and dry season in the southwest corner and along the Pussur-Sibsra system of the area is associated with the decreasing upstream fresh water flow as well as silting of major channels (WARPO, 2005 in National Plan for Disaster Management, 2010-2015). Coastal soil will be more affected than coastal water. Soil quality of six different districts has been affected by new salinity intrusion over the 24 year period of 1973-1997. This might cause a loss of US\$ 587 million in agriculture (Sarwar and Islam, 2013).

Figure 3.4: Salinity Concentration in Groundwater



Source: Bangladesh Agricultural Development Corporation (BADC), 2010

3.7 Global, Regional and National Initiatives

3.7.1 Global Initiatives

Climate change has been identified as an immediate pressing global problem that requires governments of every nation to unite their efforts to get prepared for potential climate risks at the First World Climate Conference in 1979. This ultimately led to the formation of Intergovernmental Panel on Climate Change in 1988 which published its First Assessment Report in 1990. This established the basis for negotiations on a climate change conventions under the United Nations General Assembly (Shaw et al., 2013). The

Convention of the Parties under United Nations Framework Convention on Climate Change (UNFCCC) is a result of that negotiation. Since 1995, the Conference of the Parties (COP) under the United Nations Framework Convention on Climate Change (UNFCCC), have been meeting annually to promote the climate change agenda as well as to seek long-term mitigation to take us forward to a climate-resilient future (UNEP, 2014). As a part of this Conference, Kyoto Protocol was adopted in COP 3 (1997) in Kyoto, Japan (Shaw et al., 2013). The last conference was held in Lima, Peru in December 1 to 12, 2014. As an outcome of the climate change convention, National adaptation Programmes of Action (NAPAs) provides a process for Least Developed Countries to identify priority activities that respond to their urgent and immediate needs with regard to adaptation to climate change. In the mean time in 2005, the World Conference on Disaster Reduction was held in Kobe, Japan with an aim of building resilience of nations and communities to substantially reduce the losses in lives and social, economic and environmental assets of communities. The framework of action developed in the conference is known as Hyogo Framework for Action (HFA) 2005-2015 (UNISDR, 2015).

3.7.2 Regional Initiatives

The December 2004 Asia Tsunami and the 2005 Pakistan Earthquake shook the Heads of State or Governments. The South Asian governments underscored the urgency to put in place a regional response mechanism dedicated to disaster preparedness, emergency relief and rehabilitation to ensure immediate response. An (South Asian Association for Regional Cooperation) expert group was formed to formulate a regional comprehensive framework on disaster management for the SAARC region which is known as SAARC Framework for Action (SFA), 2006-2015 (GOB, 2010). The goals of SFA includes

- Developing professionalism in the disaster management system
- Mainstreaming disaster risk-reduction
- Strengthening of community institutional mechanisms
- Empowering community at risk particularly women, the poor and the disadvantaged.
- Strengthening emergency response system

- And developing and strengthening networks as well as coordination of relevant national, regional, and international organizations.

3.7.3 National Initiatives

3.7.3.1 National Adaptation Plan of Action

Bangladesh was among the first few countries to prepare and submit its National Adaptation Plan of Action to the UNFCCC Secretariat in November, 2005. Climate Change Cell (CCC) works as a facilitating wing for the implementation of NAPA (GOB, 2010). Adaptation measures as prioritized in Bangladesh NAPA are as follows:

- Promoting adaptation to coastal crop agriculture to combat salinity intrusion through commercial maize and *Sorjan* production in tidally flooded agro ecosystem.
- Promoting adaptation to coastal fisheries through culture of salt-tolerant fish and diversified fish culture practices.
- Construction of flood shelter and information and assistance centre to cope with enhanced recurrent floods in major floodplains.
- Promoting coastal afforestation
- Increasing community focus for providing drinking water to coastal communities to combat enhanced salinity due to sea level rise. And
- Enhancing resilience of urban infrastructure and industries to impacts of climate change including floods and cyclone.

NAPA Bangladesh works through capacity-building and other emergency preparedness measures for mainstreaming adaptation strategies to climate change policies and program and finally through the inclusion of climate change issues in curriculum of secondary and tertiary educational institutions. Bangladesh NAPA in coordination with Water Resources Planning Organization (WARPO) started its activities under four sub-sectors such as water, coastal areas, natural disaster and health (Nishat et al., 2013). The community based adaptation and climate change through coastal afforestation (CBACC-CF) is the first priority project of APA Bangladesh which has introduced the Triple F livelihood model (Fish, Fruit trees and Forest) for enhancing adaptation capacity of

coastal communities (Alam et al., 2013). The project prioritized the innovating coastal land use pattern for community to reduce the vulnerability and develop adaptation capacity of coastal people (Nandy et al., 2013). Bangladesh NAPA has specifically highlighted the concerns regarding salinity ingress, especially for the southwestern region (GOB, 2010).

3.7.3.2 Bangladesh Climate Change Strategy and Action Plan (BCCSAP)

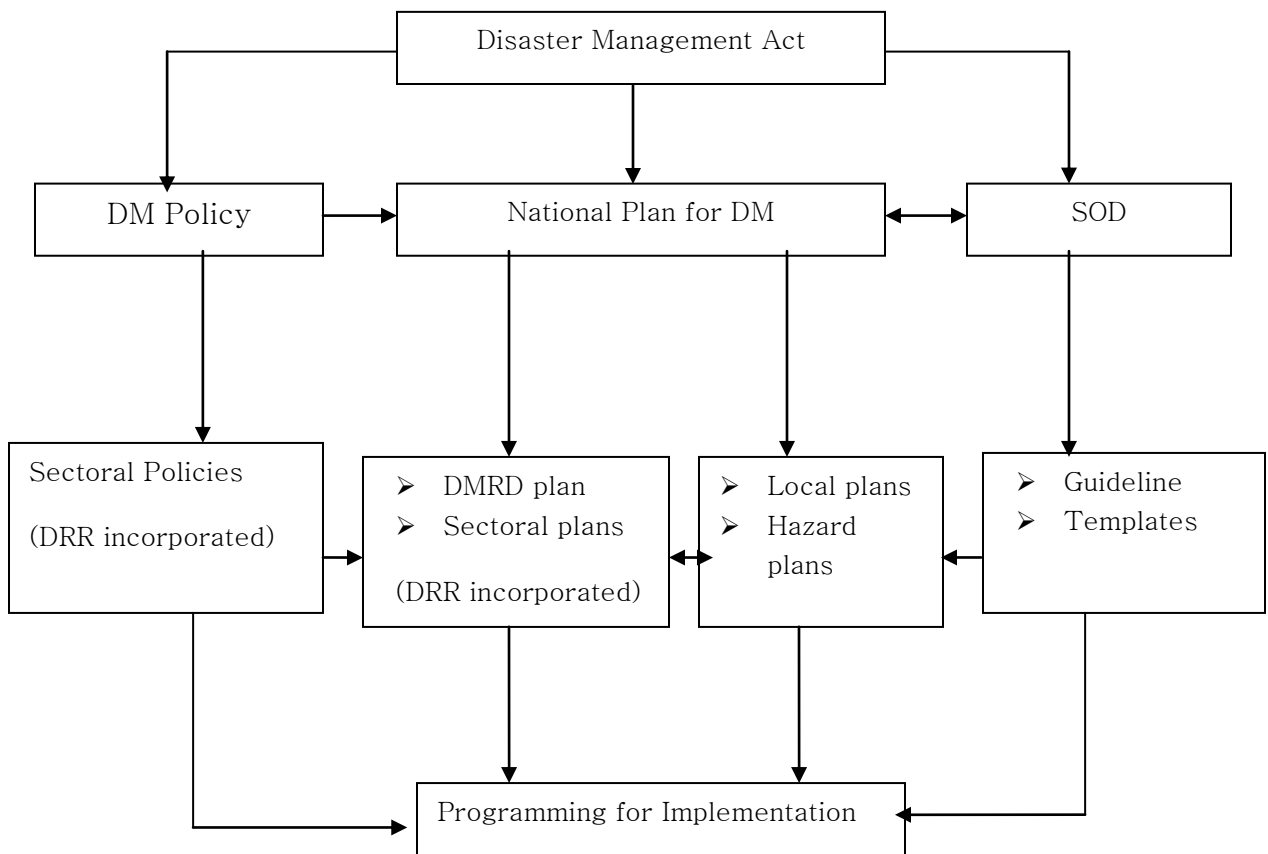
The climate change strategy and action plan of Bangladesh contributes to overall development strategy of the country. BCCSAP is fully committed to take all measures so that climate change is managed in a way that people are fully protected from its adverse impacts. Its major goal is to eradicate poverty and achieve economic and social wellbeing through a strategy which priorities the poor. Adaptation, disaster risk-reduction, low carbon development, mitigation, technology transfer and finance are few of the areas covered by BCCSAP. The strategy planned to achieve its targets through the implementation of six pillars. They are food security, social protection and health, comprehensive disaster management, infrastructure development, research and knowledge management, mitigation and low carbon development, capacity building and institutional development (GOB, 2010).

The strategy has many helping wings. These include—Environment and Forests and its agencies; Food and Disaster Management which include Disaster Management Bureau (DMB) and Comprehensive Disaster Management Programme (CDMP); water resources which includes Bangladesh Water Development Board (BWDB); Local Government, Rural Development and Cooperatives which includes the Local Government Engineering Department (LGED) and the Department of Public Health Engineering (DPHE); Agriculture including the National Agricultural Research System which develops new crops and practices suited to different climatic and salinity conditions in the country; Livestock and Fisheries; Energy; and Health as the main GOB ministries involved in climate change and specifies roles and responsibilities (discussed later) (National Plan for Disaster Management, 2010-1015).

3.7.3.3 National Policy and Coordination: Regulatory Framework

A disaster management regulatory framework has been established in Bangladesh under which the activity of disaster Risk-reduction (DRR) and Emergency Response Management (ERM) in Bangladesh is administered and implemented. The framework includes Disaster Management Act, 2012, National Disaster Management Policy (still in draft), National Plan for Disaster Management (NPDM, 2010-2015), Standing Orders on Disasters (SOD) and Guideline for Government at all Levels (Best Practice Models) (GOB, 2010).

Figure 3.5: Regulatory Framework of Disaster Management in Bangladesh



Source: National Plan for Disaster Management, 2010-1015 (GOB, 2010)

3.7.3.4 National Mechanism for Policy Guidance and Coordination (According to SOD, 2010)

According to Standing Orders on Disaster (SOD) (2010) National mechanism for policy guidance and coordination is gradually moving forward through the roles and responsibilities of some committees. These committees are National Disaster management Council (NDMC), Inter-Ministerial Disaster Management Coordination Committee (IMDMCC), National Disaster Management advisory Committee, Earthquake Preparedness and Awareness Committee (EPAC), National Platform for Disaster Risk-reduction (NPDRR), National Disaster Response Coordination Group (NDRCG), Cyclone Preparedness Program (CCP) Policy Committee, CPP Implementation Board, Committee for Speedy Dissemination and Determination of Strategy of Special weather Bulletin, Committee for Focal Points Operational Coordination Group, Coordination Committee of NGOs Relating Disaster Management and Disaster Management Training and Public awareness Task Force (DMTPATF).

3.7.3.5 Standing Orders on Disaster (SOD)

Disaster Management Bureau (DMB) has published Standing Orders on Disasters (SOD) in 2010 for the concerned officials, ministries, divisions and departments to make them understand their responsibilities regarding disaster management. For the successful accomplishment of these responsibilities, all ministers, divisions and departments are expected to prepare their own action plan under this standing order. The National Disaster management Council (NDMC), Inter-ministerial Disaster Management Coordination Committee (IMDMCC) and Cabinet Committee on Disaster Response (CCDR) will ensure the coordination of disaster related activities at National level.

3.7.3.5.1 Role of Relevant Ministries, Divisions, Departments and Government-Owned Corporations in Disaster Management (According to Standing Order on Disaster, 2010).

SOD has specified the role and responsibilities for different Ministries, Departments, and Divisions. All the thirty six Ministries are directly and indirectly related to disaster

management. Among these which are directly related to fight with the socio-economic impacts of salinity are discussed below.

3.7.3.5.1.1 Ministry of Disaster Management and Relief (MoDMR)

MoFDM works in collaboration with Disaster Management and Relief Division (DM&DR). Its normal time responsibilities include reviewing own action plan, identify disaster prone areas, update the list of NGOs and INGOs interested to work with them, preserving information regarding food, relief materials and transports, arranging meetings with different departments, ensure non-stop telecom link of the Ministry with District and Upazilla Deadquarters and to issue necessary orders immediately related to disaster and response. Responsibilities during rehabilitation stage include arrange for housing building grants, test relief and Food for Work Programs. Under this ministry, Food Division (FD) and Directorate of Food (DG Food) are directly involved in rapid assessment of the loss, damage and needs and take the necessary steps quickly. Construction and reconstruction of store houses, godowns etc. to supply food grains in affected area and to strengthen the distribution program of food are few other responsibilities.

Gaps between Policy and Practice:

- Insufficient supply of food
- Lack of store houses and godowns were realized
- Unfair relief distribution
- Slow on set changes like salinity is not properly addressed. Specifically too much focused on cyclone and earthquake.

3.7.3.5.1.2 Ministry of Water Resources

Bangladesh Water Development Board (BWDB) is working under this ministry. Its normal time activities includes undertaking operation of slwiss gates and other water discharging devices in completed embankment areas, monitoring the conditions of existing embankments and repair the beaches, collecting special weather bulletins etc. during the rehabilitation stage, this department basically determines the extent of loss and damage in details, provides fund for rehabilitation, implement suitable projects for the

stability of newly formed offshore islands and assisting other administrative bodies. BWDB has a special branch which specifically works for flood.

Gap between Policy and Practice

- Many of the southwest coastal embankments are still at vulnerable state.
- The quality of drinking water was not well-ensured in many coastal areas.
- This ministry's primary focus is on flood not on salinity.

3.7.3.5.1.3 Ministry of Agriculture

Department of Agricultural Extension and Bangladesh agricultural Development Corporation are the two major operating wings of this Ministry. Their normal time responsibilities include examine the preparedness every three months, establish the control room to receive the cyclone/flood forecast alert for the safe custody of seeds, fertilizers and other agri-implements, identify high lands for seedling beds, take steps to fight with severe crop failure, identify the areas likely to be affected, take necessary steps for the receipt of seeds/ seedlings by affected people, make availability of spare parts for the repair of deep tube well and shallow tube wells etc. During the rehabilitation stage, major responsibilities are to determine the financial and material necessity for rehabilitation, making available seeds, seedlings, fertilizers etc., educating people through mass media, ensuring fair utilization of aids/loans through training, helping farmers to repair tube wells and water pumps for irrigation etc.

Gaps between Policy and Practice

- DAE and BADC activities are not sufficient in saline prone coastal areas
- Cyclone and floods are more addressed than that of salinity

3.7.3.5.1.4 Ministry of Fisheries and Livestock

Department of Livestock Services (DLS) and Directorate of Fisheries (DoF) are two supporting wings of this Ministry. DLS's normal time responsibilities include preparing shelter of livestock in the high lands before cyclone, arranging emergency stocks of medicines for the protection of poultry and livestock against infectious diseases, shifting

them to the safer places before cyclone, arrange a survey of the number of livestock and poultry in cyclone/flood prone areas. The rehabilitation stage responsibilities include purchasing livestock under loan, assessing the loss and if possible importing livestock, arranging fund for rehabilitation of livestock and supplementary arrangement for lost cattle wealth, distribution of animal feed on an emergency basis, to rescue livestock to IMDMCC during floods etc. The normal time responsibilities of DoF include verifying fishing license, ensuring that all fishing boats are carrying radio, preparing and maintaining a list of government and privately owned fishery assets in cyclone/tidal bore prone areas, undertaking census of fishermen population in cyclone prone areas, ensuring that embankments and slwiss gates are constructed with proper height, coordinating with BADC regarding the availability of power driven pumps for pumping out saline water from coastal ponds and to arrange training for officials etc. Its rehabilitation stage responsibilities include coordination with local administration and BADC regarding the availability of power pump, preparing a list of affected of fishermen etc.

Gaps between Policy and Practice

- Improved management of livestock could not cover all the areas and people.
- Hardly any power pump was seen pumping out saline water from the ponds.
- Coastal people rarely received medicines for livestock.

3.7.3.5.1.5 Ministry of Environment and Forest (MoEF)

Its two major wings are Department of Forest (DoF) and Department of Environment (DoE). Preparation for intensive afforestation program, stop environmental pollution, identification of obstacles to environmental situation in disaster areas are few of the normal time responsibilities of these departments. Assessing loss and damage and assisting local administration are few of the rehabilitation stage responsibilities.

Gaps between Policy and Practice

- Coastal areas are still suffering from large scale deforestation.
- Livestock suffer a lot due to lack of grazing.

3.7.3.5.1.6 Ministry of Local Government, rural Development and Cooperatives

Local Government Division (LGD), Local Government Engineering Department (LGED), Rural Development and Cooperatives Division (Including Bangladesh Rural Development Board), Department of Public Health Engineering (DPHE), Dhaka WASA are the few wings helping the Ministry to accomplish its plans. Its normal time activities include protection of ponds and other sources of water, managing reserve stock of tube wells and spare parts, ensuring maintenance of cyclone shelters, earthen mounds and helipads, encouraging the people of cyclone prone areas to build their houses above flood and storm surge level, raising the pond level also above flood level, planting trees in several rows to save the shore, repair and maintenance of bridges, culverts, roads, providing training, coordination with other administrative councils etc. Its rehabilitation stage activities are assessment of loss and damage, organizing the reconstruction of houses, arranging repair of tube wells, repair or reconstruction of small roads, culverts etc., arranging loan for cyclone affected people, encouraging the farmers for adopting joint programs for agri-production and establishment of nursery for distribution of seedlings among the affected farmers etc.

Gaps between Policy and Practice:

- Less availability of seedlings among the farmers
- Many tube wells are still remaining unusable
- A very limited number of ponds have been raised up to the flood level due to lack of funds
- Houses of poor coastal people are very low lying and often go under water during flooding and high tide.
- Dilapidated roads and street condition observed in the study coastal areas.

3.7.3.5.1.7 Ministry of Women and Children Affairs (MWCA)

Its normal time responsibilities include ensuring newly constructed cyclone shelters with special facilities for women and children, providing disaster preparedness related training, considering risk-reduction and preparedness in the designing of all the income generating schemes being offered. Its rehabilitation stage responsibility includes ensuring

the rehabilitation needs and priorities of women, children and elderly people. Department of Women Affairs is an active wing of this Ministry.

Gaps between Policy and Practice

- Many coastal women are not allowed by their husbands to receive any training. Thereby, training provided by the ministry failed to make many coastal women aware of disaster preparedness.

3.7.3.5.1.8 Ministry of Land

One of the most important responsibilities regarding risk-reduction is to develop and establish the policy for settlements in *Char* and *Khas* lands.

Gaps between Policy and Practice

- Local poor people still have less access to Coastal *Khas* lands.

3.7.3.5.1.9 Ministry of Health

The local wings of this ministry constantly remain vigilant about outbreak of epidemic during as well as disaster. Managing pure drinking water and purifying water by using water purification tablets and bleaching powder is another important activity of this ministry.

Gap between Policy and Practice

- Number of seats in the hospitals is not proportionate to the total population of the locality.
- Many people are still in acute crisis of pure drinking water.

Over the last three decades, Govt. has invested over US\$10 billion (at constant 2007 prices) to make the country more climate resilient and less vulnerable to natural disasters. Bangladesh government has been trying to increase the adaptation capacity of different vulnerable groups through BCCSAP, NAPA, MDG, PRSP and other development projects.

But policies are still weak due to absence of any specific practical guidelines. Salinity is not specifically addressed by many Ministries and Departments. DAE has been found totally inactive in Keyabunia village while in Katabunia few agricultural activities are still going on.

3.8 CDMP as a Supporting Wing of Several Ministries in Bangladesh

The Comprehensive Disaster Management Programme (CDMP) has been working in collaboration with Bangladesh Ministry of Disaster Management and Relief (MD&MR), MoEF, DAE and UNDP. Its core objective is to strengthen national capacity to manage risks related to disasters, as well as the immediate response and recovery efforts. It acts through a comprehensive approach that focuses on all hazards by integrating disaster risk-reduction (DRR) and climate change adaptation (CCA) to make communities more resilient. CDMP has been working in two phases: Phase I and Phase II. The first phase (CDMP I) laid the foundations for institutionalizing a risk-reduction framework and Phase II (CDMP II) is an extension of this. CDMP's activities include knowledge building and policy support with and through the government, as well as community level interventions to reach the most vulnerable section of the population. Livelihood Adaptation to Climate Change (LACC) is completed by Food and Agriculture of United Nations and the DAE under the CDMP of Ministry and Food Disaster Management. They implemented different adaptation practices like mini ponds for rain water harvesting, homestead gardening etc. But LACC I and II projects were only for drought-prone areas. But now CDMP is working with DAE under the Disaster and Climate Risk Management in Agriculture (DCRMA) Project in 52 climate-vulnerable Upazilas like flooding, flash flood, drought and salinity. Its major focus is on improving technology on agriculture and introduction of off-farm livelihood option in coastal areas. The Resilient Habitat has also been launched in the southwestern region by CDMP (CDMP, 2013). This innovative idea suggested raising the whole village rather than raising individual house plinths to make the whole village free from sea water inundation (Rahman and Islam, 2013).

3.9. Few NGO Initiatives

CARE Bangladesh ran Reducing Vulnerability to Climate Change (RVCC) project from 2002 to 2005. It was funded by Canadian International Development Agency (CIDA) and was implemented in six coastal districts of Bangladesh. It worked for food security through agriculture, ensuring access to pure drinking water, health safety, introducing alternative livelihood options and improving safety to housing and other property (Rashid and Khan, 2013).

Worldfish is implementing a 5-year long project under the Feed the Future (FTF) aquaculture program of USAID aiming at increasing fish and shrimp production in the southwestern coastal districts since 1012. UNDP supports coastal adaptation project and USAID supports FTF aquaculture projects. They have been supporting poor households in coastal areas through the introduction of tilapia farming in small homestead ponds especially by engaging women folk (Rahman and Siddique, 2012).

Currently BRAC is running its WASH program to ensure the sanitation facilities to all households of southwest coastal people (BRAC Bangladesh website).

ActionAid Bangladesh works with poor people in over 40 countries across the world including Bangladesh. Its major goal is to end poverty. Currently ActionAid has been working for disaster risk-reduction. The fields that it covers are climate change and population displacement, response to cyclones, flood etc. (ActionAid Bangladesh website).

Save the Children Bangladesh has been working on community based climate change adaptation in coastal areas. It also works for reducing climate change risks and developing resilience in urban children (Save the Children website).

Oxfam's involvement in Bangladesh began in 1970 assisting the then cyclone victims and the poor people of Bangladesh. Other than gender justice, enhancing education, establishing human rights, it is working for securing livelihood of coastal people (Oxfam website).

Concern Worldwide Bangladesh is working to help communities in risk mitigation and to prepare them for facing climate change challenges. Concern Worldwide's initiative to raise a cluster village above the flood line in Char areas, already benefitted 100 families during the recent floods. It has launched a multi country initiative for increasing resilience and reducing risk of coastal communities to climate change and natural hazards on the Bay of Bengal (Concern Worldwide website).

Jagrata Juba Shangha (JJS) are working through capacity building, introducing appropriate & climate adaptive IGAs like: production of high quality mats and handicrafts using locally available mele grass, culture of crabs, cactus etc. and by providing training on skill-building (JJS website). Strengthening resilience and reducing vulnerabilities of disaster vulnerable coastal communities in Bangladesh funded by EU, Enhance Livelihoods of Coastal Community for Adaptation to Climate Change funded by Palli Karma Shahayak Foundation, Community-Based Cyclone Disaster Preparedness Project (CCDP) funded by Shapla Neer and Increasing Resilience and Reducing Risk of Coastal Communities to Climate Change and Natural Hazards in the Bay of Bengal funded by Concern Worldwide are few of the ongoing projects run by JJS.

CHAPTER FOUR

CONCEPTUAL AND THEORETICAL FRAMEWORK

4.1 Concepts of Vulnerability, Adaptation and Resilience

The conceptual framework of the study is based on the following few basic concepts: vulnerability, adaptation and adaptive capacity in terms of gender which is ultimately connected to few other concepts like resilience and coping capability. These concepts are now discussed below from socio-political perspective.

4.1.1 Concept of Vulnerability

The concept of vulnerability is crucial in understanding how a hazard becomes a disaster and for whom. Traditionally the concept of vulnerability has mostly been treated in a simplistic way by focusing on the hazards only and its consequence on biophysical vulnerability (Canon, 2000). Socially produced vulnerabilities were largely ignored due to difficulty in quantifying them. As a result the traditional vulnerability assessment naturally makes the disasters disconnected from some other social forces (social, economic and political) and multiple stressors which ultimately reinforce the vulnerability to a greater extent (Wisner et al., 2004; Eakins and Luers, 2006; Morton, 2007; Kamal and Khaled, 2012). According to Wisner et al. (2002) main elements of vulnerability refer to those conditions that increase and determine the likelihood of injury, death, loss and disruption of livelihood of human beings. An extension to this definition can be observed in Birkmann (2006) which widens the concept of vulnerability from intrinsic internal risk factor to multi-dimensional extrinsic factors encompassing physical, social, economic, environmental and institutional features.

Currently, social vulnerability is assessed in terms of ‘a complex set of characteristics that includes a person’s initial wellbeing, livelihood and resilience, self- protection, social protection and social and political networks and institutions’ (Cannon et al., 2003: 5). Thus, social vulnerability is a multi dimensional concept that helps to identify those characteristics and experiences of communities (and individuals) that enable them to

respond and recover from natural hazards (Cutter et al., 2003). These characteristics are again dynamic in nature that changes over time (Vogel and O'Brien, 2004).

Vulnerability depends on the context where a group or individual is exposed, the extent to which they are dependent on natural resources, the sensitivity of the resources and services that they rely on to climate change and their capacity to adapt (Adger, 1999; Adger et al., 2007). Accordingly, IPCC lays the basis of vulnerability in the system as a whole. Vulnerability is defined here as 'the degree to which a system is susceptible to or unable to cope with adverse effects or damage of a stressor, in this case, climate change' (Omari, 2010: 6). The three components of vulnerability, according to the IPCC definition are: exposure of the community to the natural hazards, sensitivity of the system and its adaptive capacity. FAO (2009) added up another component with them i. e. potential impact.

Among these four components of vulnerability mentioned by IPCC and FAO, Kelly and Adger (2000) emphasized only on adaptation capacity and mentioned that vulnerability depends on the adaptation capacity of individuals and social groups to respond to, that is, to cope with, recover from or adapt to any external stress placed on their livelihoods and well-being (cited in Islam et al., 2010). Based on the entitlement concept of Sen (1981), they mentioned that 'vulnerability or security of any group is determined by resource availability and by the entitlement of individuals and groups to call on these resources' (Kelly and Adger, 2000: 352).

On the other hand, Adger et al. (2005) defined vulnerability in terms of resilience. They claimed that decline of resilience contributes to social and ecological vulnerability of a community. They suggested multilevel governance systems for disaster management to enhance the capacity to cope with uncertainty.

Thus, the analysis of vulnerability is not a single separate phenomenon resulting from the natural hazards only, rather depends on the interaction between hazards and a community's adaptation capacity as well as the resilience of the system.

4.1.2 Concept of Adaptation, Coping Capability and Adaptation Capability

Similarly, climate change adaptation is often perceived by many as depending on the existing socio-political and ecological context. Because of this reason adaptation is often viewed within the broad political ecology field where adaptation management of risks highly depends on the social and political power relations, resource use and global economies (Blaikie and Brookfield, 1987; Sen, 1981; Walker, 2005). Thus, adaptation depends not only on the different kinds of assets, capital or opportunities available within the context (Smit and Wandel, 2006) but also on the wider governance regimes (White et al., 2004). However, its aim is to reduce the harm posed by climate change to people's lives and livelihoods' (DFID, 2006) and to adjust better by exploiting the local benefit opportunities (IPCC, 2007 cited in Venton and Trobe, 2008; Smit and Pilifosova, 2001). These opportunities may range from macro level like sea defenses or flood-proof houses on stilts, to micro level like attitude change at the individual level, such as reducing water use in times of drought and using insecticide-sprayed mosquito nets etc. Other strategies may include better water management and improved risk management, early warning systems for extreme events, various insurance options and biodiversity conservation (UNFCCC, 2007).

Thus, adaptation refers to the 'capability or action of the people to respond well in anticipation to climate variability (Pettengell, 2010:7) by changing the state of a system' (Chapin et al., 2009:23). This includes changes to the things they do, and/or the way they do them. And the potential of individuals, communities, and societies to be actively involved in the processes of change, in order to minimize negative impacts and maximize any benefits from changes in the climate is referred to as adaptation capacity (Pettengell, 2010). Thus, 'adaptation is the manifestations of adaptation capacity and they represent ways of reducing vulnerability' (Smit and Wandel, 2006: 286).

The determinants of adaptive capacity are interdependent (IPCC, 2001). According to Alam et al. (2013), three things determine adaptive capacity: high climate sensitive livelihood characteristics, different socio-economic level and access of households and communities to assets. Again, IPCC (2001) has identified seven determinants of adaptive capacity: wealth, technology, education, institutions, information, infrastructure, social

capital. A community with greater access to all these resources is considered to have the high adaptive capacity to adjust to or to cope with the adverse consequences of extreme climatic conditions and thereby less vulnerable to natural hazard and well prepared to restrict its way towards a disaster.

The term ‘adaptive capacity’ is context-specific which means adaptive strategy varies from country to country, from community to community, among social groups and individuals (Smit and Wandel, 2006; IPCC, 2007). In some literatures, adaptive capacity has been synonymously used with the term ‘coping ranges’ which refers to the conditions that a system can deal with, accommodate, adapt to, and recover from (de Loe and Kreutzwiser, 2000; Jones, 2001; Smit et al., 2000; Smit and Pilifosova, 2001; 2003). But the difference between these two is on the basis of the degree. Where ‘coping ability’ refers to instant short term capacity or the ability to just survive, adaptive capacity on the other hand employs longer term i. e. more sustainable adjustments (Vogel, 1998). Population pressure, resource depletion, unplanned urbanization, deforestation may gradually reduce a system’s coping ability and narrow its coping range, while economic growth or improvements in technology or institutions, training and skill development may lead to an increase in adaptive capacity (deVries, 1985; Smit and Pilifosova, 2003; Folke et al., 2002).

Because of the gender differences in ownership status, access to information, building up social networking and in cultural, social, political and economic roles, the effects of climate change are likely to affect men and women differently (Omari, 2010). Women especially rural women are considered as the vulnerable among the vulnerable and climate change is likely to magnify existing patterns of gender disadvantage (UNDP, 2007b). Like vulnerability, women’s adaptation capacity and coping efforts are challenged by gender relationship perpetuated by patriarchy (CCC, 2009). Thus adaptation options are gender-sensitive too. Men’s opportunities to adapt originate from their limited responsibilities within the household chores. More so, their greater opportunity to receive education, professional and technical abilities helps them to adapt better to climate change (UNDP, 2010).

4.1.3 Concept of Resilience

Walker et al. (2002) defines resilience as the potential of a system to remain in a particular configuration and to maintain its feedbacks and functions, and involves the ability of the system to reorganize the consequent disturbance-driven change.

Resilience refers to the ability to exploit opportunities and resist and recover from negative shocks (Alwang et al., 2001).

Cannon (2000) points out that most usages of the idea of vulnerability accepts that it is part of a continuum or ranking of people, and that vulnerability implies being at the 'negative' end of that scale whereas the positive end represents capabilities and resilience. Thus the term resilience stands as the opposite of vulnerability (Mayunga, 2007).

Like vulnerability and adaptation, the term resilience also depends on some external social and political stressors. Resilience is defined as 'the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change' (Adger, 2000: 347). This definition highlights the connectivity of social resilience and the concept of ecological resilience to maintain themselves in the face of disturbance (Adger, 2000: 348).

Factors which support resilience include shared community values, aspirations and goals, established social infrastructure, a sustainable economic base, established network between agencies, between community groups and between commercial enterprises and greater access of the community people to the resources (Doherty, 2010). Resilience also depends on some external forces like globalization and market liberalization which helps a community's living capacity to be restructured (Eakin, 2005 cited in Islam et al., 2010). Twigg (2001) mentioned that a system's susceptibility depends on pre-existing conditions which includes the geographical location; nature of dwellings; access to physical infrastructure, information and communication systems; patterns of social capital; and the ability of different groups or individuals to secure alternative livelihoods and ensure the flow of resources including financial, social and political to maintain livelihood security.

Although the term adaptive capacity and resilience are sometimes used synonymously, adaptive capacity is an important aspect of resilience (Walker et al., 2002). Where adaptive capacity relates to the ability to influence and respond directly to processes of change (to shape, create or respond to change), resilience is the ability to absorb shocks or ride out changes (Pettengell, 2010). Thus, while adaptation capacity is only reactive, resilience is both proactive and reactive (Adger et al., 2007).

Table 4.1: Summary of the Concepts used in the Study

Concepts	Definitions
<i>Vulnerability</i>	Vulnerability refers to that ecological condition where people are struggling to cope which may arise from their less adaptation capacity and lack of resilience of their community due to complex socio-economic and political forces.
<i>Adaptation</i>	Adaptation refers to the process through which people face disastrous situation and respond well to reduce their vulnerability.
<i>Coping Capability</i>	Coping capability refers to the capability of people to manage the disaster
<i>Adaptation Capacity</i>	Adaptation capacity includes the execution process of response including the resources and other supports required to implement the capability.
<i>Resilience</i>	Resilience refers to the degree of preparedness of a community which implies those means to take necessary action both before and after an extreme event.

4.2 Theoretical Framework

4.2.1 Vulnerability Theories

The concept of social vulnerability emerged most recently in the field of disaster studies. Though multiple theories of social vulnerability exist, no one definition is yet agreed

upon (Weichselgartner, 2001). The conceptual underpinnings are therefore young and perhaps imperfect, and its future development depends on the renewed development of theory (Militzer, 2008). Current social vulnerability research, thus, works as a middle range theory and attempts to understand the disaster within the broader social context.

The recent discussion of disaster attempts to see disaster through the broader lens where disaster is viewed not only as a natural calamity rather as socially constructed (Café, 2012). During the 1970s and 1980s a vulnerability theory emerged as an alternative of classical model which assumes disasters as departures from 'normal' social functioning, and that recovery therefore entails a return to this state of 'normality' (Blaikei et al., 2004). Central to this competing theory is the notion that history prefigures disasters, and that populations are rendered vulnerable by overarching social structures that place certain individuals and groups at greater risk of exposure to natural hazards (Bankoff et al., 2004). Thus, the concept 'social vulnerability' emphasizes two central themes:

First of all, both the causes and the phenomenon of disasters are socially defined (Hewitt, 1983). And secondly, although different groups of a society are equally exposed to a natural hazard, consequences vary for different groups on the basis of age, race, gender, ethnicity etc. as because they have diverging capabilities to face the impact of a hazard.

The *social constructionist theory* is built upon the observation that many of aspects of our everyday experience are the consequence of complex social agreement and institutional practices rather than objective reality. Social constructionism is defined as a perspective which states that a great deal of our life exists as it does due to social and interpersonal influences (Gergen, 1985). Thus, in this study vulnerability due to salinity as people of south-west coastal belt are experiencing is not taken for granted as objective reality about the world, independent of human subjectivity, but instead as the product of human inter-subjectivity.

Another supplementary theory states that if social structure is in a harmony, a natural hazard fails to turn into a disaster. *System theory* states that a system is composed of interdependent parts in interaction that form a whole (Laszno and Krippner, 1998). This means that an investigation of the whole situation is required rather than one or two

aspects of a problem. In the current study, if the input refers to natural hazards as well as complex socio-cultural and political arrangements such as patriarchy, unequal resource distribution etc., the output will be vulnerability. As a result its feedback will come out in different dimensions like low income, low savings, food insecurity, malnutrition, gender violence etc. Thus, according to system theory the people of a society will get the output on the basis of what input they have given to the system. How a wrong input can turn a natural hazard into a disaster for the people can be better explained by the Chaos theory.

A vast number of sciences irrespective of natural or social sciences are now exploring *chaos theory* as a means for conceptual understanding of the systems. This theory as the study of nonlinear dynamic systems (Levy, 1994) has led to an understanding of both the nonlinearity of the world in which we live and its consequent functional instability. In nonlinear systems small changes or small errors can have big effects. Any natural hazard can bring a big disaster for the people if the organizations of a social system and behavior of the people of that society are in constant flux and disproportionate. Thus, any disaster typifies the nonlinearity of human events (Koehler, 1995).

Though different theories identified different social, economic and political reasons for contributing to increase the vulnerability of the community people, among them system theory and chaos theory are too wide-ranging to measure. These two theories focus on the macro social structure i. e. the whole social system and its linearity and non-linearity. On the other hand, social constructionist theory is more able to highlight the micro social factors, such as, patriarchy, inequality, exploitation, oppression, unemployment, lack of marketing system, lack of GO and NGO interventions etc., which can put a community into a more vulnerable condition during a disaster crisis period.

4.2.2 Eco-feminist Approach

Gendered disaster social science considers the social fact of gender as the primary organizing principle of societies. It believes that gender must be addressed in order to have a better understanding about the people living in risky environment. So far gender relation has been examined theoretically in the context of social difference and power structure such as race, ethnicity, nationality and social class. But researchers currently

seek to bring the gender issue to the science of disaster risk-reduction for a richer appreciation of inequalities and differences based on sex and gender during the crisis period which often denies the fundamental human rights of women and girl (Enarson, 2010; Kirk, 1997). The convergence of ecology and feminism into eco-feminist theory makes a big promise in this regards (Lahar, 1991).

In 1974, the term 'ecofeminism' was conceived by d'Eaubonne as a socio-historical association between women and nature (Morgan, 1992). Since then there have been, arguably, major policy shifts in the fields of gender (in)equality and environmental sustainability (Buckingham, 2004). In fact, ecofeminism emerged from the intersections of feminist research and the various movements for social justice and environmental sustainability that revealed the link between the oppressions of gender, ecology, race, species, and nation. This link was nicely depicted through some foundational texts as Susan Griffin's *Woman and Nature* (1978) and Carolyn Merchant's *The Death of Nature* (1980) (Gaard, 2011). But the idea was not yet circulated worldwide until after the meltdown at Three Mile Island when six hundred women attended a conference called 'Women and Life on Earth: A Conference on Eco-Feminism in the Eighties' (Caldecott and Leland, 1983).

Ecofeminism is a joining of environmental, feminist, and women's spirituality concerns (Spretnak, 1990). As the environmental movement along with environmental crises raised the consciousness of women to the decay of the earth, they began to see a parallel between the devaluation of earth and the devaluation of women. Women began to see the link as not a false construction of physical weakness, but as a strong unifying force that clarified the violation of women and the earth as part of the same drama of male control (King, 1990). Thus, eco-feminist argument specifically proposed that, since the same socioeconomic structure produced wide-scale environmental damage, women were therefore better able to argue on nature's behalf (Buckingham, 2004). Ecofeminism, thereby, suggests that women's natural caregiving sensibilities serve as a ground for their special relationship to nature and their special responsibilities to protect nature (Braun, 2009).

By focusing on the daily interactions of women with nature in subsistence economy, Vandana Shiva argued that this connection has not been recognized by the capitalist mode of production which fails to perceive the interconnectedness of nature and women's lives, work and knowledge with the creation of wealth' (Ruether, 1993). Thus, given the widespread and profoundly serious nature of environmental degradation, ecofeminism has a great potential for building a stronger connection between women and environmental justice by bringing people together across lines of gender, race and class which, in turn, will lead a stronger movement for a sustainable future. For such collaboration to work, current study intends to focus specifically on the women to explore their dependency on nature, vulnerability, their coping mechanisms, and preparedness to adjust with the future uncertainty.

4.2.3 Adaptation Theories

Adaptation theories are not that available in the field of salinity related vulnerability. Researchers so far focused on the hazards like cyclone, flood etc. which are comparatively sudden and strike unexpectedly sometimes with a pre-impact warning period of hours or days available. As a result few grounded theories are available on these sudden climate change issues, whereas slow onset issues like salinity were of a bit less focused. More so, assessment of adaptation capacity of people is a recent field of interest of the researchers. Thus, though few grounded theories are available, those are on the coping capacity and not on the adaptation capacity. The current study intends to focus on a grounded theory developed by Nasreen (2012) on the coping mechanisms of people during flood and attempts to ground a theory on adaptation capacity in light of that.

Nasreen (2012) stated that despite the heavy burden of responsibilities, women demonstrated considerable fortitude and ingenuity in their attempts to protect the lives of their family members. This theory contrasts to the *Entitlement theory* of Sen which states that adaptation capacity depends on the entitlement of assets both tangible and intangible (Sen 1981). Consequently men are supposed to cope better than women when any disaster takes place due to their better socio-economic condition.

It is evident in the grounded theory that assets of women which are usually considered as the non-productive assets became more productive when they were disposed of during floods. Women's assets were rather used to meet up their immediate needs whereas men's assets were kept stored for the future. Relief distributed during disaster did not reach the people who were mostly in need of them. With that little or no support from GOs and NGOs, women were more able to seek help from social networks like kin, neighbors etc., than men did from their part. Only women had knowledge about certain medicinal trees those help to cure their family members from different types of diseases. Most of the women reconstructed their houses with their own resources such as used plastic, jute sack and clothes etc. And women had the sole responsibility to ensure food and pure drinking water (Nasreen, 2012).

From these coping strategies, it can be assumed that women have better adaptation capacity than that of men, which is yet to be proved.

Considering all these discussions as central, the current study attempts to evaluate the impact of climate change on the study population in the context of multiple stressors which are sometimes not directly related to climate or climate change. For this, vulnerability assessment is most helpful (Desanker and Justice, 2001). The current study has selected Pressure and Release (PAR) model and few climate change adaptation models to assess vulnerability as well as the adaptation capacity of the study population.

4.3 Few Analytical Frameworks of Vulnerability

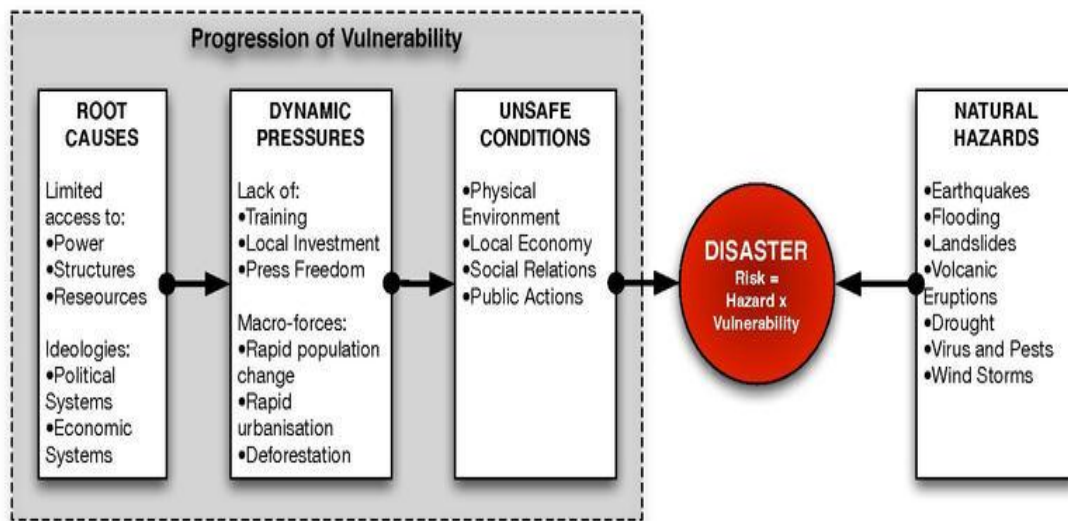
The Pressure and Release model (PAR model) as Analytical Framework

The PAR model understands a disaster as the intersection between socio-economic pressure and physical exposure. Risk is explicitly defined as a function of the perturbation, stressor, or stress and the vulnerability of the exposed unit (Blaikie et al, 1994). The PAR approach is based on the commonly used equation:

$$\text{Risk} = \text{Hazard} \times \text{Vulnerability}$$

It directs attention to the conditions that make exposure unsafe, leading to vulnerability and to the causes creating these conditions. Addressing social groups exposed to unsafe natural conditions, the model emphasizes distinctions in vulnerability in terms of various units like social class and ethnicity. The model distinguishes between three components on the social side: root causes, dynamic pressures and unsafe conditions, and one component on the natural side, the natural hazards itself. The prime root causes include ‘economic, demographic and political processes’ which affect the allocation and distribution of resources between different groups of people. Dynamic Pressures translate economic and political processes in local circumstances (e.g. migration patterns, lack of skill and training, lack of press freedom etc.). Unsafe conditions are the specific natural conditions induced by the physical environment in which vulnerability is expressed in time and space (Blaikie et al. 1994).

Figure 4.1: PAR Model of Vulnerability



Source: Blaikie et al, 1994

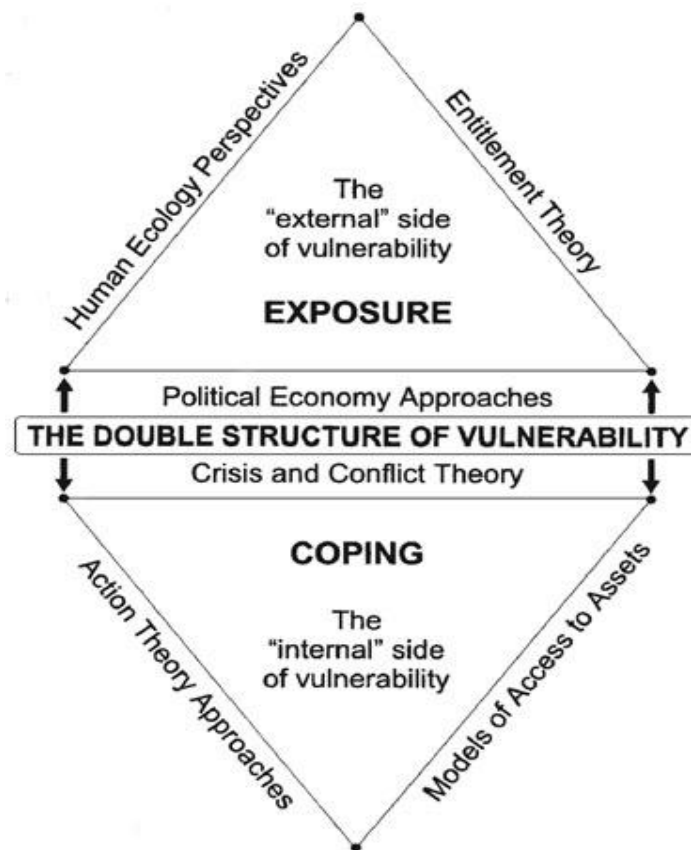
Birkmann (2006) evaluated different analytical framework of disaster risk and represented a comparative analysis of all. Sustainability livelihood framework attempted to connect an individual's or household's capacity to cope with multiple interactions between their ability to get access to and influence over five types of capital: physical,

social, financial, natural and human capital and transforming structures and process. But this connection remains abstract.

Bohle's Double Structure Model of Vulnerability

Bohle (2001) developed a model of the double structure of vulnerability which views vulnerability as the exposure to shocks and stressors and the ability to cope with these shocks.

Figure 4.2: Bohle's Double Structure Model of Vulnerability



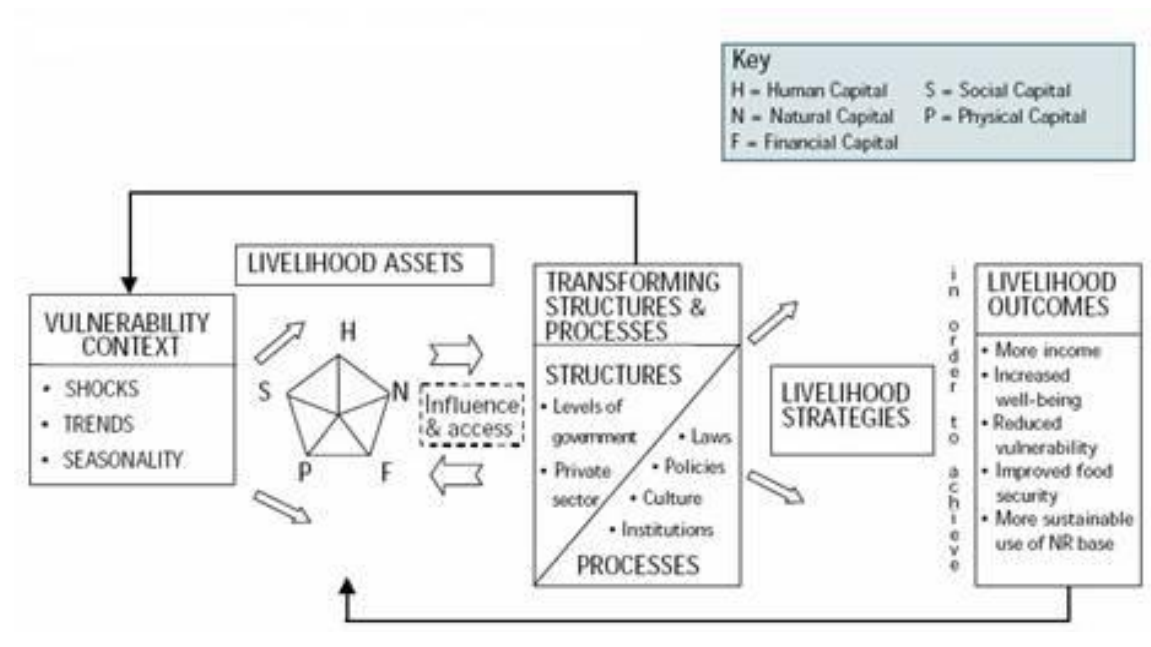
Source: Bohle, 2001

But various dynamic pressures are also associated with vulnerability which is not considered in this model.

Sustainable Livelihood Framework

Sustainable Livelihood Framework considers two major terms. These are sustainability and livelihood. The original concept was developed by Chambers and Conway (1992) who considered livelihood as a combination of all tangible and intangible resources. The framework basically underlines the necessity of empowering marginalized people by providing them five different types of capitals including physical, social, financial, natural and human (Birkmann, 2007).

Figure 4.3: Sustainable Livelihood Framework



Source: Chambers and Conway, 1992

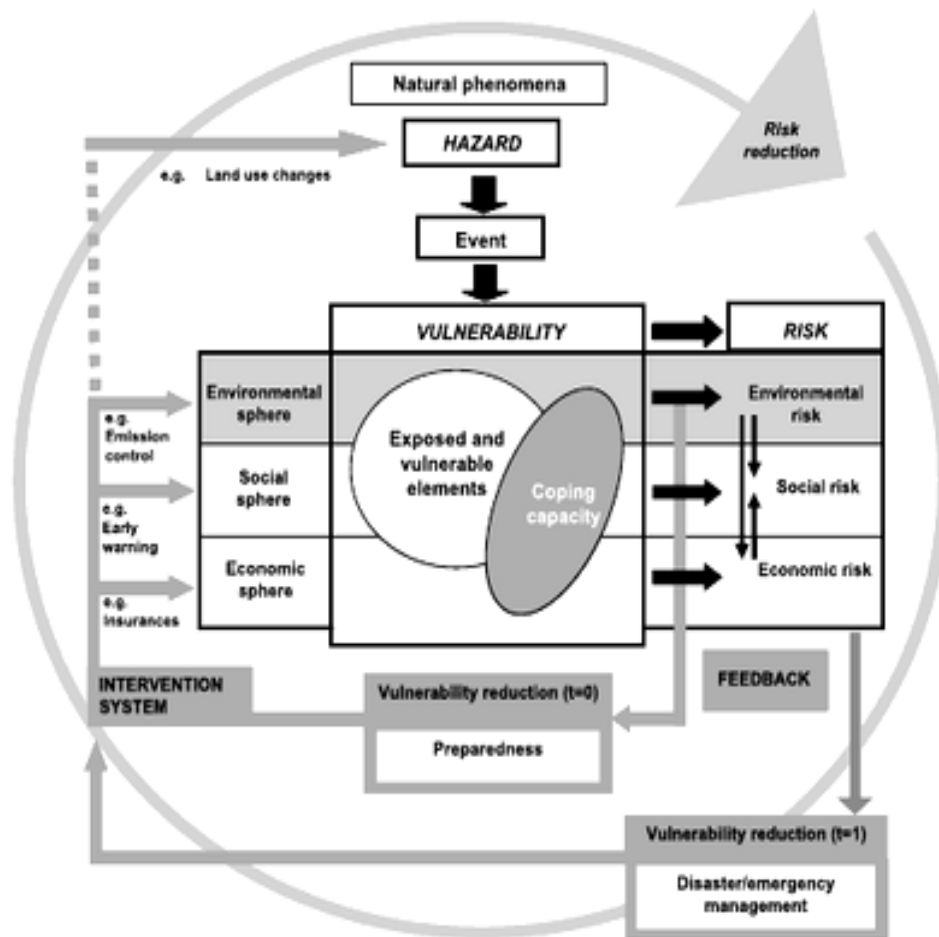
However, the framework is limited for its abstractness. The framework did not recognize the dynamic forces putting obstacles in the way of ensuring equal access of marginalized people to resources (Birkmann, 2007).

Davidson's conceptual framework separates vulnerability from exposure and coping capacity. But vulnerability and coping capability are interrelated. The better people can cope, the less is their vulnerability. This coping capability is again connected to the term exposure. The more people are exposed to unsafe conditions, the less capable are people to cope.

BBC Conceptual Framework

BBC conceptual framework can be considered as a complete framework which properly emphasized on social, economic and environmental risks together. The framework states that these risks can be minimized through improving coping capabilities by appropriate intervention system (Birkmann, 2007).

Figure 4.4: BBC Conceptual Framework



Source: Birkmann (2007)

The BBC conceptual framework and based on Bogardi and Birkmann (2004) and Cardona (1999; 2001), views vulnerability that goes beyond the estimation of damage

and the probability of loss and which is not the goal of the current paper (Birkmann, 2007).

Cutter (1996) developed the hazards-of-place model of vulnerability which focuses on three distinct themes of vulnerability research. They are the degree of loss associated with the hazardous events, social response and exposure of the community (Kumpulainen, 2006). This model is more realistic than others as it attempts to address the social responsibility to cope with hazards and it also has a specific focus on the locality. But this model failed to address few other core causes like political instability, unequal resource distribution, lack of access to information which might otherwise multiply the risk. Later on Cutter et al. (2003) concentrated on measuring social vulnerability that includes both social and economic dimensions of vulnerability but Hazard's project still excludes hazard event frequency and political dimension. More so, damage potential has got smaller attention here (Kumpulainen, 2006).

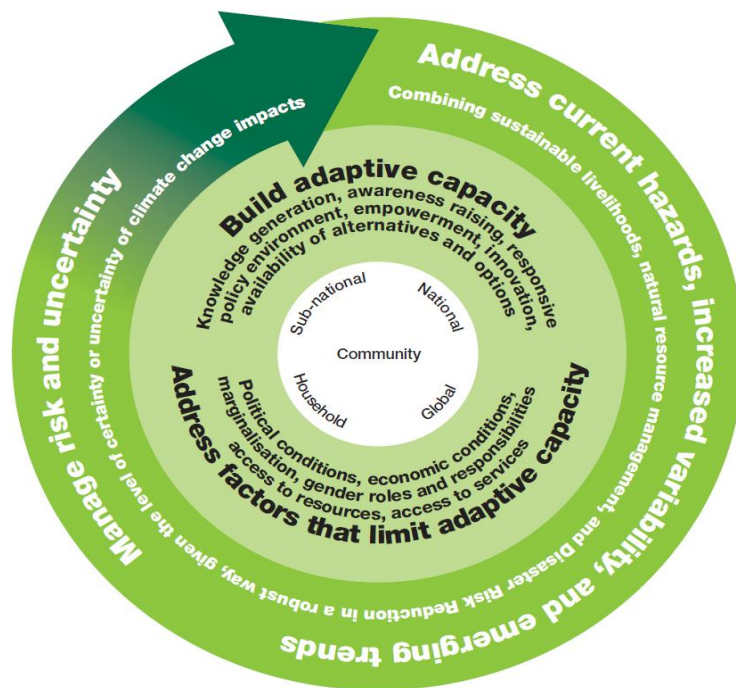
Birkmann (2006) found that **PAR model** is one of the best known frameworks which measures vulnerability not only as a result of natural hazards but in terms of its underlying dynamic forces. It also highlights the fact that the actual effort to reduce vulnerability depends on the existing economic and political system. However this model puts a heavy responsibility on the national level policy makers as well as global to consider the situation more as a social problem and less as an ecological one (Birkmann, 2007). Thereby, the conceptual framework of this study has put much weight on this PAR model.

4.4 Climate Change Adaptation Model

In order to increase the resilience of coastal communities, different studies have developed different adaptation model. Oxfam has developed a model of adaptation that gives community and its adaptation capacity the highest priority. For this, the model attempts to identify all factors including political and economic conditions, marginalization, gender roles and responsibilities, access to resources and services (which factors are important for vulnerability analysis according to PAR model) that may limit the adaptation capacity of a community (Pettengell, 2010).

The current study has developed its conceptual framework on the basis of Oxfam adaptation model as it goes with PAR model. But the study also attempts to incorporate few relevant factors from CDMP's inputs and outputs model and adaptive social protection model of Institute of development studies which are highlighted below.

Figure 4.5: Oxfam's Adaptation Model



Source: Pettengell, 2010.

Comprehensive Disaster Management Program (CDMP) has developed a risk analysis model which consists of hazard analysis and vulnerability analysis together with the analysis of self-protection capabilities from a feminist perspective. This framework of risk assessment has two aspects: first, to identify the possible hazards and vulnerabilities of socially excluded group especially women and to explore the weakness of existing adaptation capacities. Second, to formulate realistic action plans to reduce disaster risk as well as to increase capabilities. This step includes awareness building, concrete risk treatment measures like prevention, preparation, early warning systems, environmental

management, land use and spatial planning, cooperation, alliances, financing influence, poverty alleviation, IGA etc. and capacity building including policy development, community development, human development and reformation of laws (Rashid and Shafie, 2009). Thus, CDMP's disaster risk-reduction plan is a reflection of Hyogo Action Framework which sets the priority on including DRR into the development policy and planning, identifying and assessing hazards and risks, awareness building through education and training, reducing the underlying risk factors through community development and sustainable ecosystem and environmental management and finally on strengthening disaster preparedness by increasing policy, technical and institutional capacities (Hyogo Framework, 2005-2015).

The Institution of Development Studies researchers have developed the concept of 'adaptive social protection'. They explored that climate change adaptation is closely related to disaster risk-reduction and this is the key to social protection. IDS model attempts to promote adaptation through social protection which includes protective and preventive steps indicating coping strategies as well as promotive and transformative steps indicating adaptation strategies. Coping strategies include—social service provision, social transfer, social pension schemes, public works programs, livelihood diversification, weather-index crop insurance etc. On the other hand, adaptation strategies include access to credit, access to common property resources, anti-discrimination campaigns, raising social funds etc. (OECD, 2009).

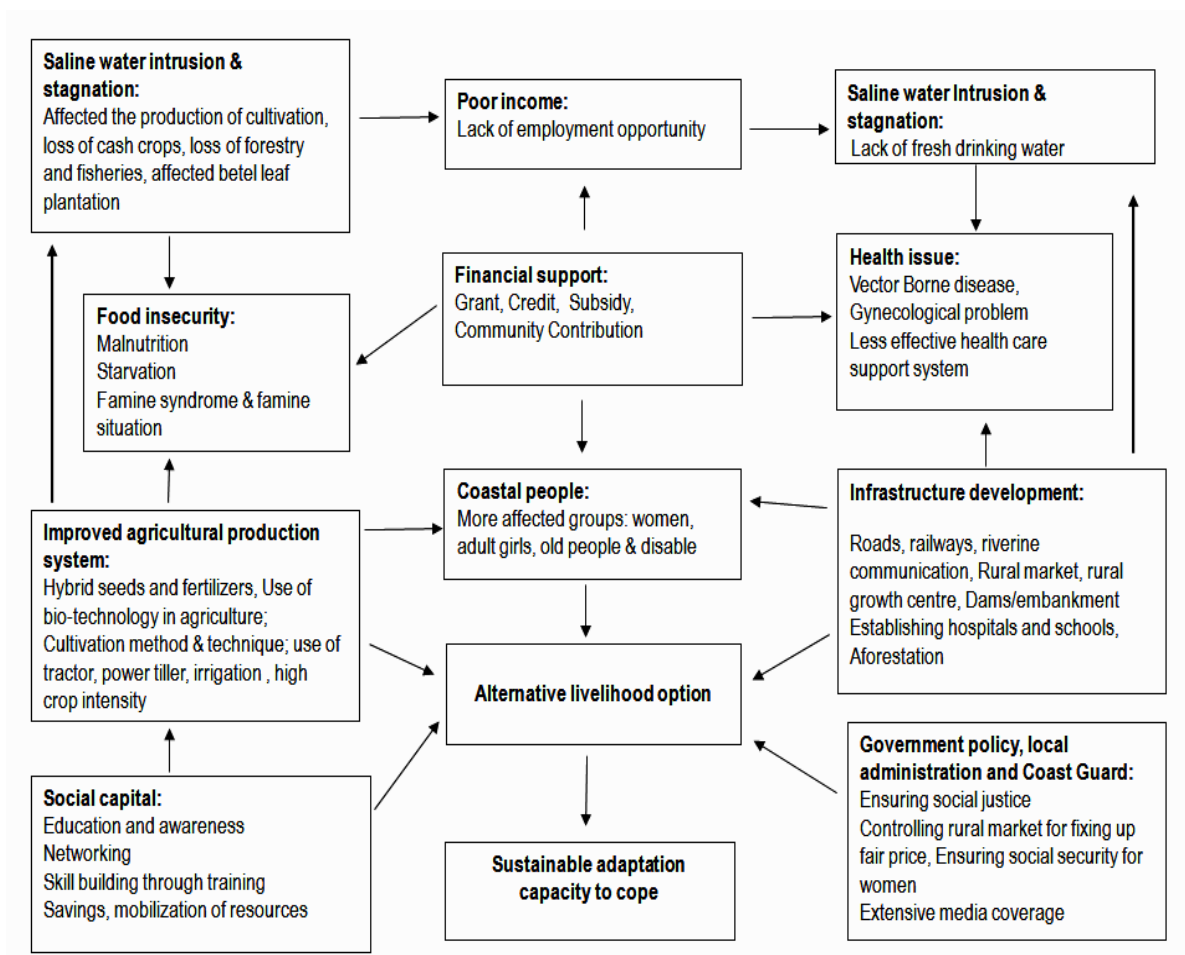
4.5 Conceptual Framework of the Study

In light of the above-mentioned concepts and theories and models, the conceptual framework of the study attempts to explore all socio-economic, cultural and political factors while measuring the nature of vulnerability of both men and women and determines vulnerability by the interaction of natural events with those dynamic pressures. The conventional wisdom of hazard causes and consequences is not sufficient to explain vulnerability. Rather socioeconomic and political causes of natural disaster are needed to be prioritized in natural disaster studies (Rahman, 2009). The study intends to

assess the capacity of the households as well as communities to recover from disaster and also to explore the opportunities to further develop resilience in order to increase the resistance of the households. In the coastal regions of Bangladesh, natural hazards most often turn into disaster due to lack of community' resilience/ well being issues which should be seen as contingent in the security of these areas (WB, 2001).

It is evident in existing literature that post disaster recovery efforts may not always recognize women's capabilities. And their vulnerability can be reduced through environmental, economic and human development (Dasgupta et al., 2010). Thereby, by centering at coastal people especially women and girls, the framework attempts to explore all socio-political dynamic pressures that increased vulnerability of the coastal people of Bangladesh to disasters. They are explosive population growth, lack of awareness, networking and education, poor infrastructural development, loss of livestock and agricultural production and poverty. As the coastal people are exposed to the unsafe natural conditions, their vulnerability becomes multiplied by all these external pressures.

Figure 4.6: Conceptual Framework of the Study



Source: Developed by the Researcher

The impact of natural hazards on cultivable land, fresh drinking water, forestry, fruits, fisheries, cash crops etc. which pave the way to the food insecurity, malnutrition, joblessness, different types of diseases and finally towards famine syndrome and famine situation are well addressed by this framework.

The framework attempts to assess the adaptation capacity on the basis of technological advancement like invention of new seeds and fertilizer, new way of cultivation, exploring indigenous techniques etc. and on the basis of the development of technological skill through training, education, awareness creation and social networking, financial support like subsidy, grant, credit as well as community's own savings etc.

CHAPTER FIVE

METHODOLOGY

The goal of this chapter is to provide a clear and complete description of the specific steps followed which is necessary to help a naïve reader to replicate the study. The chapter both describes and defends the research design chosen for conducting the study. To serve this purpose, the study first of all attempts to conceptualize the problem on which the whole study will be grounded. Next, it particularizes the research type, specifies the research approach, investigates the possible ways of solving the research question, describes the chosen set of methods most relevant to PAR model as selected and justifies for making the choice of this model. Finally the chapter concludes with a brief section identifying the limitations of the study as well as the provisions for further research in the same field. Thus, major areas addressed in this chapter are: the research approach, study location, sampling technique, data collection methods and data analyses techniques/tools, and limitations of the study.

Different research problems imply different research goals which ultimately require varied methods most appropriate to serve the purpose. The general approach of the study is to assess the socio-economic vulnerability and adaptation capacity of the coastal people of southwest region of Bangladesh. Being a pure research, the study attempts to gather in-depth information about the problem under investigation. First of all, the study will follow the appropriate scientific method. Qualitative approaches in addition with quantitative ones also work as very useful tools for understanding people's responses to and the impact of a disaster (Mileti, 1987; Quarantelli, 2002). Because of this reason, a quantitative with the juxtaposition of qualitative research has been conducted.

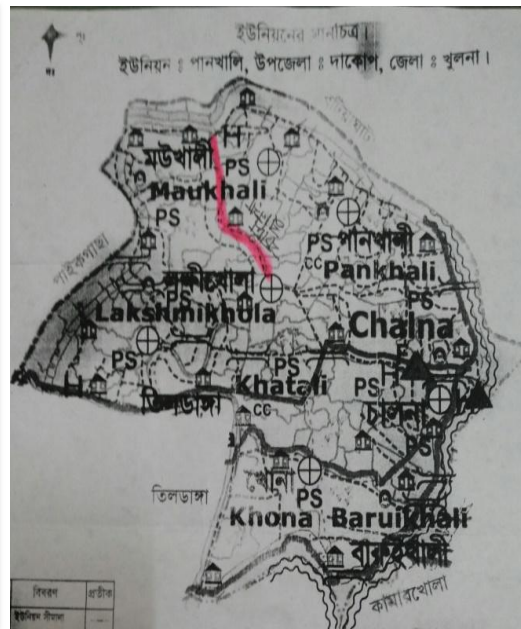
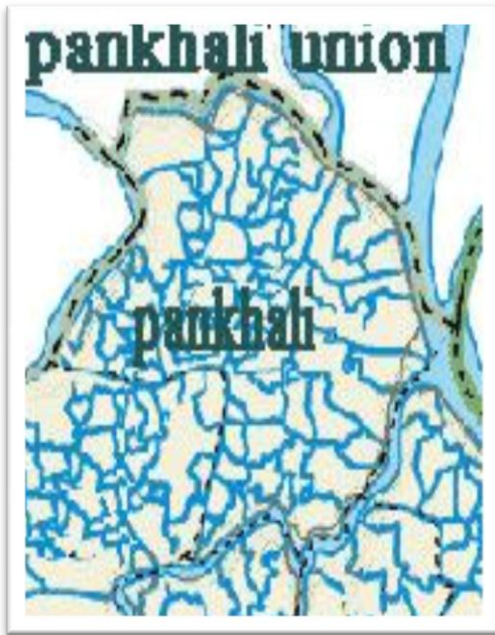
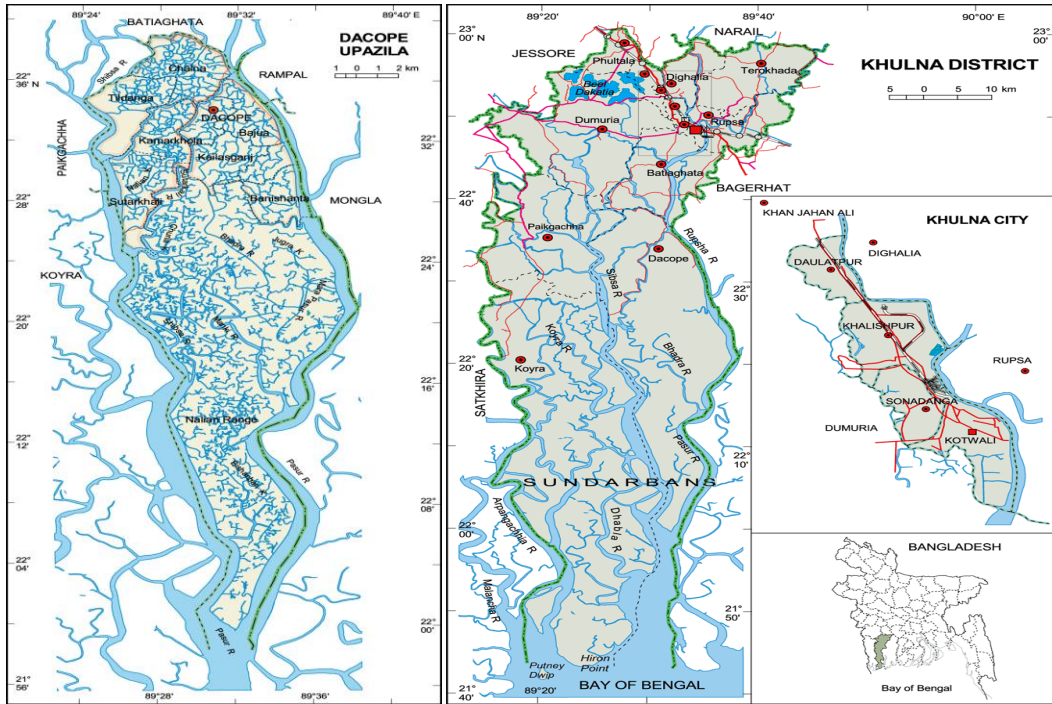
5.1 Description of Study Area

Khulna has an area of 22,285 km² of which 607.80 sq km is riverine and 2028.22 sq km. is under forest (BBS, 2013). It has a population of 15,563,000 at the 2011 Census (Census, 2011). It is situated between 22°12' and 23°59' north latitudes and between 89°14' and 89°45' east longitudes (BBS, 2013). It is on the banks of the Rupsha and Bhairab River. It lies south of Jessore and Narail, East of Satkhira, West of Bagerhat and North of the Bay of Bengal. In the southern part of the delta lies the world's largest mangrove forest, Sundarban. Being located in the south-west coastal zone of the country, the division is highly vulnerable due to the saline water intrusion (Haque, 2006; Adhikari et al., 2012).

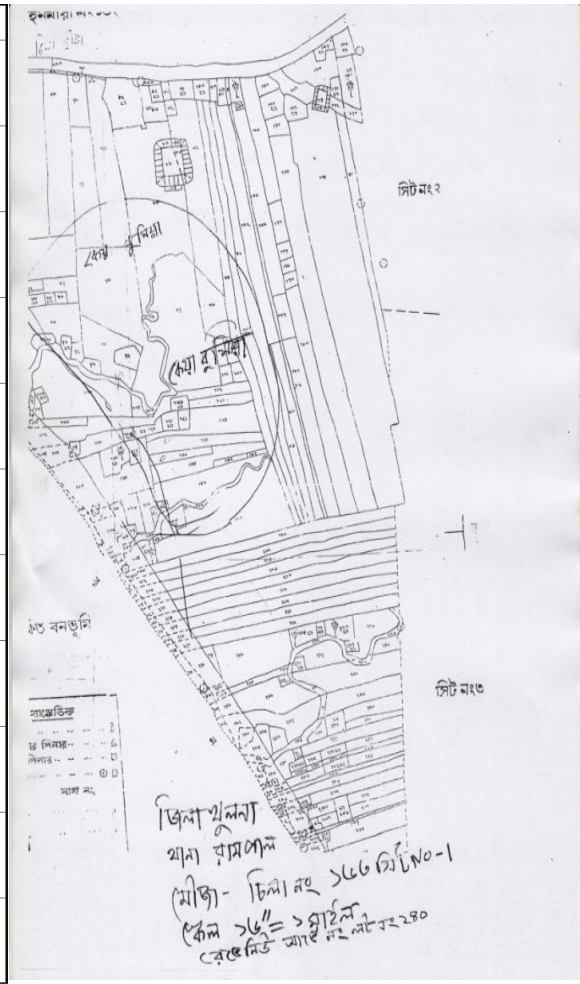
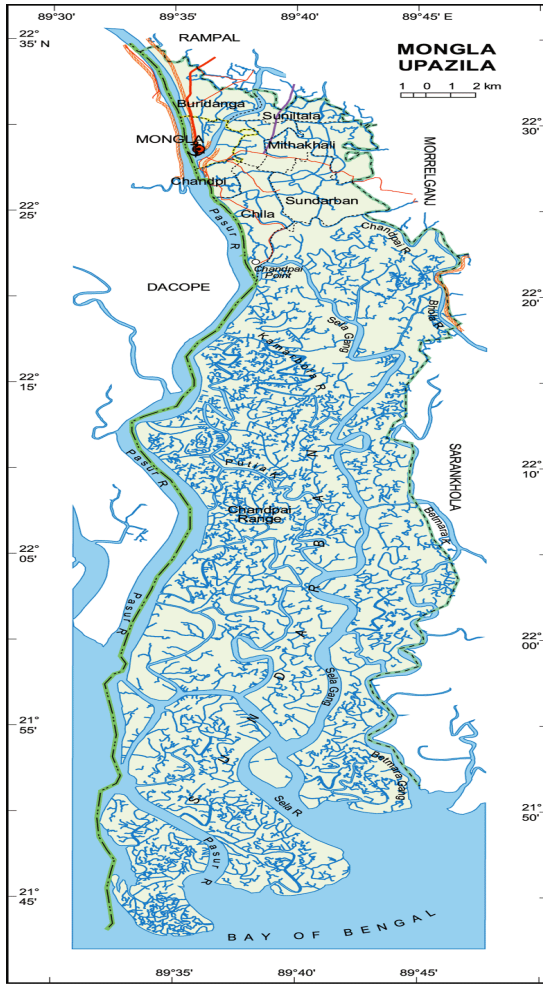
Using multi-stage sampling with the help of simple random sampling the study has selected step by step two districts under this division, Bagerhat and Khulna; two upazillas: Mongla and Dacope; two unions: Chilla and Pankhali; and finally two villages: Keyabunia and Katabunia.

Dacope Upazilla is located at 22.5722°N 89.5111°E. It has 25377 units of house hold and total area 991.58 km² (Population Census Wing, BBS, 2006). Dacope Upazila (Khulna district) with an area of 99158 km², is bounded by batiaghata upazila on the north, pashur river on the south, rampal and mongla upazilas on the east, paikgachha and koyra upazilas on the west. Main rivers are Pasur, Sibsa, Manki, Bhadra. The southern part of this upazila is surrounded by Sundarban (11790.13 hectores) (Banglapedia, 2013). Dacope is one of the mostly affected upazilas of Khulna District. Almost 7 unions of it were inundated during Ayla which was more devastating than Sidr due to high tidal surge. Almost all the agricultural lands were submerged with highly saline water after Ayla whereas about 60 percent population of this Upazilla is dependent on agriculture. (Kumar et al., 2010).

Figure 5.1: Area Map of Study Area (Khulna Division: Dacope and Mongla)



Source: Google earth



Source: Google earth

Pankhali is a union under Dacope upazila of Khulan district. It is the lowest local administrative unit of the GOB. Once upon a time it was the largest mouza of Chalna union. The recent database identified and defined it as an independent union. It has a land area of 9099 acre in which 993 acres of water bodies (10.9%), 802 acres of settlement area (8.8%) and 7,302 acres of agricultural land (80.3%). Total number of HH is 3735. Its total population is 15570 of which all of them are living in households. In this union, 1030 population live per square km (BBS, Population Census, 2011). It has a total of 11 villages. Katabunia is one of them.

Katabunia village is situated at the dead end of Pankhali union. It has 184 households. Total number of population is 739. There is no floating population in this village.

Bagerhat is a district of Bangladesh with an area of 3959 square km. It has 9 upazillas and 75 unions. Mongla is the most famous upazilla among them.

Mongla upazilla is basically famous for Mongla port. Chilla is one of the unions of Mongla.

Chila Union of Mongla Upazila consists of 14 Villages (BBS, 2001). Chila has a land area of 7452 acre consisting of 4373 households with a population of 20,973. Around 1097 people live in per square km in this union. A big crab fattening farm is situated in Chilla funded by European Union (EU).

Poschim Chilla, Locally known as **Keyabunia village**, consists of 354 households with a population of 1411 of which all of them stay in households (BBS, 2001).

Source: District Portal Information of Bagerhat and Khulna

5.2 Community based Vulnerability Assessment (CVA) Approach

For a detailed understanding of the objectives, the study requires a deliberate inquiry into the issue and the experiences of the issue by the coastal people including men and women. Keeping this in mind, Community Vulnerability Assessment Tool (CVAT) has

been selected to identify and understand those driving forces that increase or decrease vulnerabilities of the coastal people. Community based approach not only addresses physical vulnerability, but also social. It ensures the involvement of most vulnerable community people in disaster planning. Steps which are followed are as follows:

1	Getting started
2	Identify the hazards likely to affect the community
3	Identify and map areas of greatest risk
4	Identify and map physically vulnerable people
5	Identify and map socially vulnerable populations
6	Inventory and map employment centers
7	Inventory and map environmental threats
8	Community ground-truthing
9	Putting it all together

Source: Emergency Preparedness Demonstration Project, 2009

Step 1: Most vulnerable people should be identified at first. Current study has selected all landless people assuming them to be most vulnerable in a land holding social structure. The researcher arranged a discussion session with the local NGO activists for selecting the vulnerable group.

Step 2: All sorts of hazards both manmade and natural should be ranked in order. In the current study, the researcher also made a list of hazards that the community people encounter through an active participation and interaction between community people and NGO activists. Salinity has been ranked first due to its major threats on traditional livelihood option.

Step 3: Most vulnerable areas should be marked. Here Keyabunia of Chilla and Katabunia of Pankhali have been selected after a constructive discussion with the local NGO activists.

Step 4: Identification of people and properties who/which are at greater risk. In this study, crops, livestock and water resources are considered. Housing, communication, transportation as well as infrastructure condition were assessed.

Step 5: Identification of population with special consideration like disabled, widow, old people etc.

Step 6: Identification of employers and commercial places vulnerable to natural hazards. The current study has included land owners and farm owners who employ landless farmers. It also included wage labor market within its consideration.

Step 7: Identification of environmental threats. The current study focused on deforestation, water pollution etc.

Step 8: To conduct public forum to validate the information. FGD is a tool which helped a lot to validate the information of survey.

Step 9: Development of strategies to reduce vulnerability. The current study has categorized the role of different departments and put forward a list of suggestions finally.

Thus, community based vulnerability assessment basically focuses on the community level and seeks to connect it with the broader conditions and structures within a framework of social, cultural and political factors (Morgan, 2011). Thus, the study adopted an integrated livelihood and ecosystem approach which included physical, social and attitudinal vulnerabilities and capacities to understand the salinity induced challenges and associated capacities to cope.

5.3 Tools for Data Collection

The methods which were carried out under CVA approach include—Case study, Focus Group Discussion (FGD), Household (HH) survey, In-depth interview and Observation.

Comprehensive structured and unstructured questionnaires were used as means to carry out these methods.

5.3.1 Interviews

Interviews included FGD and in-depth interviews as well as telephone interviews with key actors in the communities. These semi-structured interviews have been used mainly to understand the general perspective of locals about the use of their immediate natural environment and the resources therein.

5.3.1.1 In-depth Interview

In-depth interview is a very important tool of data collection which provides the researcher with detailed information about a topic. Ajibade et al. (2013) used interview as a major tool of data collection to assess the impact of flood in general. It provided the researchers with detailed insights into the information they needed. The current study conducted three in-depth interviews which were again divided into two important categories. The first category focused on the public administration officials and second category focused on the local level NGO activists. Two interviews were taken from TNO of Dacope and TNO of Mongla. Another interview was taken from a BRAC activist of Chilla union.

5.3.2 Focus group discussions (FGD)

FGDs are used mainly to acquire information on a specific subject from specific groups of a particular community. These groups may include people such as men farmers, women farmers, professionals, housewives, widows, female heads, fishermen etc. It requires thorough preparation of a checklist consisting of major topics on specific issues about the problem under study. This allows respondents to talk focusing on those issues which are specifically relevant to the discussion. Omari (2010) used this technique in his study. According to Omari (2010), rich data is possible to acquire through this method as

respondents are open to share and are not guided by the researcher. Ajibade et al. (2013) also conducted 6 FGDs to assess the impact of floods on the lives of women especially. The current study conducted eight FGDs among different groups. Among them four were conducted in Katabunia while four were conducted in Keyabunia. These groups included men, women, female heads, Chairmen and members of union, local land owners and money lenders et al. To quantify the opinion of participants, both structured and unstructured checklists were developed.

5.3.3 Observation

Traditional participant observation is usually undertaken to maintain a holistic approach towards the contents of the study. It usually covers an extended period of time, ranging from several months to many years, and even generations. The purpose is to obtain more detailed and accurate information about the individuals, community, and/or population under study (Omari, 2010). Even though this method requires extended periods of time, it compensates by giving detailed information about the lives of the people and their interaction with each other and the resources and institutions around them. Carothers et al. (2014) used participant observation and semi-directed interviews that provided the conceptual framework for broadening their focus from climate and environmental change to community residents' perception on climate change in the context of their holistic human-environment worldview. The current study took the help of observation of field workers under serious consideration for data analyses and interpretation.

5.3.4 Case Study

A case study is an intensive analysis of an individual unit (e.g., a person, group, or event) stressing developmental factors in relation to context. Nasreen (2012) used case study as one of the major tools to explore the coping mechanisms of women with flood. Three cases studies were used as a mechanism to develop and tools for understanding impacts and vulnerability of biodiversity to climate change in AIACC project no. AF 04 (AIACC, 2006). The current study conducted around 18 case studies including men, women, female heads, and widow etc. with unstructured checklists to sketch the subtle points of

the research. Around 10 cases were conducted in Keyabunia village as it had been a big community while the rest 8 were conducted in Katabunia.

5.3.5 Household Survey

Survey is the most widely used quantitative tool of data collection. It is basically used to list resources, related goods and services, agricultural production, personal consumption pattern and income which are highly susceptible to other few independent variables such as education, training, credit support, natural disaster, possession of land, food price, social awareness etc. The importance of cultural values, child education, women empowerment, gender disparity, different coping strategies of men and women, social and health care services and physical protection provided by the ecosystem can also be recorded. Komba and Muchapondwa (2012) conducted survey on 556 households of smallholder farmers to assess their adaptation capacity in agriculture due to changing temperature in Tanzania. This tool was also used in other climate change studies (Ongoro and Ogara, 2012; Zhang, 2004; Uddin et al., 2011; Ajibade et al., 2013; Nasreen, 2012). The current study conducted a household survey to quantify the respondents' opinion on different climate change issues and their socio-economic impacts on them. It helped the researcher to get an idea about the asset base of a man and a woman in the coastal region. Few other variables which were measured are respondents' educational status, decision making process, their perception towards climate change, their dependency on natural resources, impacts of salinity on food insecurity, income, savings, distance of households from NGOs, their access to resources, number of IGAs, correlation between gender and food insecurity etc.

5.3.6 Secondary Sources

Secondary Source data were also used to strengthen the rationality of the study. The aim of the study was to collect detailed information about the vulnerability and adaptation capacity of the study population. In order to get comprehensive information, a huge number of literatures were reviewed. These basically include recently published scientific

journals, reports of various government and non-governemnt projects, relevant national policies on climate change etc.

5.4 Sampling Technique

5.4.1 Selection of Study Areas

Bangladesh has seven divisions three of which, Khulna, Barishal and Chittagong, are located in the coastal belt. Out of these three divisions, Khulna division has been selected as the study area purposively due to its geographical status. By following multistage sampling technique, gradually two upazillas (Dacope and Mongla), then two unions (Pankhali and Chilla) and finally two villages (Katabunia and Keyabunia) were selected.

5.4.2 Selection of Study Population

In the survey, a total of 318 households were selected from two villages. About 110 households were selected from Katabunia and 208 households were selected from Keyabunia. In Katabunia village the total number of household was 184. Among them 135 were landless poor. The list of landless people was collected from BRAC. Again, in Keyabunia village, the number of poor landless household was 341 out of 1411 among which hardcore poor was 163 and poor was 178. The figure was collected from World Vision. Putting the number in the sampling calculator with 95 per cent confidence level and confidence interval 4, it suggested a sample size of 110 households for Katabunia and a sample of 218 for Keyabunia. In total 328 (110 + 218) households were taken initially. But after collecting data, 10 were excluded due to incomplete information. Thus, a total of 318 ($328 - 10 = 318$) households were finally chosen **purposively** as the sample size of the survey.

For FGD, the study combined probability and non-probability random sampling. The study categorized people by stratified sampling. Each group comprised minimum 4 participants to maximum 6 by using Judgmental Sampling technique. The same

sampling technique was used to select the interviewees for in-depth interview. For case study, 18 cases were selected using purposive sampling technique.

5.5 Preparation of Questionnaire for Data Collection

Consistent with the objectives of the present study, a draft questionnaire was designed for primary data collection. The draft questionnaire was then pre-tested in the study areas. Based on the results of pre-test, necessary corrections were made in the draft questionnaire and it was finalized for data collection. The questionnaire had five sections. Section One contained questions on the socioeconomic and demographic background of the respondents. In this section, information was gathered on the respondents' age, education level, family size, and family members, primary and secondary occupation, household assets, land size etc. Section Two was related to questions on perception towards climate change and respondents' dependency on natural resources. Questions on salinity, agriculture and vulnerability of the villagers were included in section Three. In this section, information on effects of salinity on crops, respondents' vulnerability due to crop failure, sources of agricultural information were collected. Section Four contained questions on the alternative livelihood option as a mode of adaptation. Problems related to alternative livelihood options were also focused in this section. Section Five highlighted the problems related to food insecurity. These problems included the problems of food crisis, lack of pure drinking water and fuel wood crisis as well. Coping and adaptation mechanisms were included with all the sections related to problems. Section Six focused on health related problems of respondents' due to climate change. Section Seven focused on socio-economic impacts of salinity. Section Eight focused on housing and infrastructure of coastal people.

Checklist of FGD and case study highlighted the following topics: socio-demographic information, perception, agricultural vulnerability due to salinity, food insecurity, coping mechanisms, adaptation mechanisms, alternative livelihood options and challenges, gender violence, health problems, services of different organizations and finally on socio-economic impacts of salinity.

Questionnaire for in-depth interviews focused on the current vulnerable situation, challenges of policy implementation and finally steps to be taken.

5.6 Data Analyses and Interpretation

The collected data was given input in SPSS program. For better and comprehensive analyses of the collected data, few statistical analyses including percentage, mean etc. were computed. The study also ran logit model for impact factor analyses. ‘PAR model’ and ‘Oxfam’s Adaptation model’ were used for qualitative data analyses.

5.7 Econometric Techniques of Assessing the Impact of Salinity on Livelihood

Logit model was used by various researchers for impact factor analysis. For instance, Mahmud et al. (2007) used logit model to examine whether the borrowers of Agricultural Diversification and Intensification Project (ADIP) were economically well-off or not. Zaman (2001) used logit model to assess the women empowerment status of BRAC borrowers. Logit model is appropriate technique to use when the dependent variable is dichotomous (Mahmud, 2011b; Mahmud et al., 2007). In this study, the dependent variable of the model was dichotomous having two categories which were: ‘People were food secured’ coded as one and otherwise as zero. Model can be represented as follows:

$$\ln \left[\frac{P_i}{1-P_i} \right] = \beta_0 + \beta_1 \text{ GEN} + \beta_2 \text{ NHH} + \beta_3 \text{ LND} + \beta_4 \text{ RAI} + \beta_5 \text{ SAL} + \beta_6 \text{ CRF} + \beta_7 \text{ GRR} + \beta_8 \text{ INC} + \beta_9 \text{ NGO} + \beta_{10} \text{ MAR} + \beta_{11} \text{ EXT} + \beta_{12} \text{ AGR} + \beta_{13} \text{ ELC} + \beta_{14} \text{ IGA} + \beta_{15} \text{ EDU} + \mu \quad (1)$$

Where, P_i = Probability that the people will be food secured.

$1 - P_i$ = Probability that the people will not be food secured.

β_0 = Constant

GEN = Gender of respondents (dummy; if female=1; otherwise=0)

NHH= Nature of household (dummy; if female headed=1, otherwise=0)

LND = Total amount of land (in decimal)

RAI= Experience of prolonged rain (dummy if experienced=1, otherwise=0)

SAL = Experience of salinity (dummy if experienced=1, otherwise=0)

CRF = Experience of cop failure (dummy if experienced=1, otherwise=0)

GRR= Grants received (dummy if received=1, otherwise=0)

INC= Household income (in taka)

NGO= Distance from NGO (in km)

MAR= Distance from Market (in km)

EXT= Frequency of meeting agricultural extension officer (in number)

ELC= Access to electricity (dummy if yes=1, otherwise=0)

IGA= Number of IGA (in number)

EDU= Educational status (in class)

β_i = Coefficient to be estimated

μ = Error term for the equation one

5.8 Limitations of the Study

In order to get the wholeness of data, the study has applied a number of tools and techniques to gather information. Yet the study failed to gather detail information on some issues.

The study has shown the impact of salinity only on one variable i. e. food security. But there are many other quantitative variables of vulnerability like income, savings etc. which the current study failed to address.

Gender violence is an issue which is not fully reflected in this study due to non-cooperation of the victims. The study can only say about the probability of grants to

increase sustainability. But logit model failed to give the assurance of sustainability in this regards.

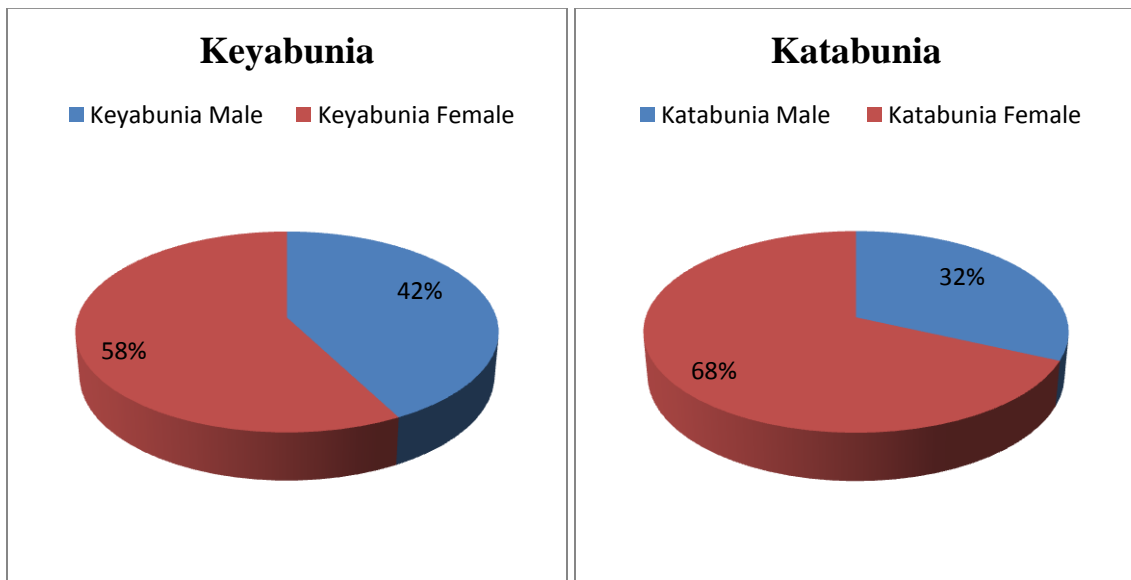
Many respondents made them involved in different other occupations in addition to their traditional livelihood option. People produce crops at a very limited scale. As a result, damage and loss related information regarding agricultural production could not be estimated by the current study due to lack of information and thereby opening up the scopes for the further research.

Chapter Six
Data Analyses and Presentations
Part I
(Quantitative)

6.1.1 Socio-demographic Information

Socio-demographic profile is linked to environmental issues to a large extent. Different backgrounds of people are supposed to have different types of psychology, norms, values and motivational power. Thus, different backgrounds of people have varying needs and desires to enhance the resilience of their communities. This section includes the socio-demographic parameters of respondents like age, educational status, occupation, gender, marital status, family size, nature of household, number of school going children, number of dependent members, and nature of decision making. A total of 318 respondents were interviewed from two study villages. Among them 123 were male and 195 were female. The gender distribution of respondents is shown below:

Figure 6.1.1.1: Gender Distribution of Respondents



Source: Survey, 2014

In Keyabunia village a total of 208 respondents were interviewed among them 120 (58%) were female and (42%) were male. Similarly in Katabunia village number of female respondents was more as they were considered as the most vulnerable group by existing

literature (See chapter 2). A total of 110 respondents were interviewed among which 75 (68%) were female and 35 (32%) were male.

Table 6.1.1.1: Percentage Distribution of Respondents by Age

Age	V ₁		V ₂	
	Male	Female	Male	Female
15-19	2 (2.3%)	8 (6.7%)	2 (5.8%)	1 (1.3%)
20-24	0 (0%)	13 (10.8%)	1 (2.8%)	7 (9.3%)
25-29	14 (15.9%)	23 (19.2%)	2 (5.7%)	20 (26.7%)
30-34	11 (12.5%)	21 (17.5%)	11 (31.4%)	9 (12.0%)
35-39	12 (13.6%)	9 (7.5%)	5 (14.2%)	10 (13.3%)
40-44	10 (11.4%)	13 (10.8%)	7 (20%)	12 (16.0%)
45-49	13 (14.8%)	18 (15.0%)	3 (8.5%)	6 (8.0%)
50-54	13 (14.8%)	9 (7.5%)	1 (2.8%)	7 (9.3%)
55-59	4 (4.5%)	5 (4.2%)	1 (2.8%)	2 (2.7%)
60+	9 (10.2%)	1 (0.8%)	2 (5.8%)	1 (1.3%)
Total	88 (100%)	120 (100%)	35 (100%)	75 (100%)

Source: Field Survey, 2014

Notes: V₁= Keyabunia Village; V₂= Katabunia Village

The table shows the age distribution of respondents of two villages, Keyabunia and Katabunia. Majority of male respondents (15.9%) of Keyabunia village (V₁) belonged to 25-29 age group followed by 14.8 per cent belonging to 45-49 age groups. Another 14.8 percent male respondents belonged to 50-54 age groups as compared to only 7.5 per cent female respondents of the same village. Around 20 per cent female respondents of Keyabunia were from 25-29 age groups followed by 15 percent belonging to 45-49 age groups. A total of 11 per cent respondents of this village were 60 or more than 60 where 10.2 per cent was male and 0.8 per cent i. e. only one respondent was woman.

In Katabunia village (V₂) 14.2 per cent male respondents belonged to 35-39 age groups. Like Keyabunia village, a majority of female respondents (26.7%) belonged to 25-29 age groups followed by 16 per cent in 40-44 age groups. Each 1.3 per cent respondents belonged to two extreme age groups i. e. in the highest age group 60+ and in the lowest age group 15-19. In case of male respondents, 31.4 per cent respondents of this village belonged to 30-34 age groups followed by 14 per cent in 35-39 age groups. Like female respondents, an equal number of male respondents i.e. each 5.8 per cent male respondents belonged to two extreme age groups.

Table 6.1.1.2: Percentage Distribution of the Respondents by Marital Status

Marital Status	V ₁		V ₂	
	Male	Female	Male	Female
Married	81 (92.0%)	90 (75.0%)	32 (91.4%)	64 (85.3%)
Unmarried	6 (6.8%)	3 (2.5%)	3 (8.6%)	1 (1.3%)
Divorce	0 (0%)	13 (10.8%)	0 (0%)	2 (2.7%)
Widow	1 (1.1%)	14 (11.7%)	0 (0%)	8 (10.7%)
Total	88 (100%)	120 (100%)	35 (100%)	75 (100%)

Source: Field Survey, 2014

Notes: V₁= Keyabunia Village; V₂= Katabunia Village

The above table shows the percentage distribution of the marital status of respondents. About 85.3 per cent female respondents of Katabunia followed by 75 per cent female respondents of Keyabunia were married. Accordingly a majority of male respondents (91.5% on an average) of both villages were married. Very few respondents irrespective of male and female were unmarried. There was no divorced male respondent in both villages. The number of widows was very insignificant. On the other hand, a significant number of female respondents (11.2% on an average) of both villages were widows. About 11 per cent female respondents of Keyabunia were divorced compared to none in Katabunia.

Table 6.1.1.3: Percentage Distribution of the Respondents by Educational Status

Level of Education	V ₁		V ₂	
	Male	Female	Male	Female
Class One	18 (20.5%)	13 (10.8%)	12 (34.2%)	16 (21.3%)
Two	5 (5.7%)	7 (5.8%)	0 (0%)	2 (2.7%)
Three	1 (1.1%)	4 (3.3%)	2 (5.7%)	1 (1.3%)
Four	2 (2.3%)	2 (1.7%)	1 (1.2%)	1 (1.3%)
Five	5 (5.7%)	13 (10.8%)	3 (8.5%)	8 (10.7%)
Six	1 (1.1%)	8 (6.7%)	0 (0%)	1 (1.3%)
Seven	2 (2.3%)	5 (4.2%)	0 (0%)	4 (5.3%)
Eight	4 (4.5%)	3 (2.5%)	1 (2.8%)	3 (4.0%)
Nine	3 (3.4%)	4 (3.3%)	1 (2.8%)	1 (1.3%)
Ten	2 (2.3%)	2 (1.7%)	0 (0%)	2 (2.7%)
SSC	8 (9.1%)	3 (2.5%)	1 (2.8%)	1 (1.3%)
HSC	2 (2.3%)	2 (1.7%)	1 (2.8%)	0 (0%)
BA/Diploma	1 (1.1%)	0 (0%)	1 (2.8%)	0 (0%)
Can sign	18 (20.5%)	29 (24.2%)	5 (14.2%)	13 (17.3%)
Illiterate	16 (18.2%)	25 (20.8%)	7 (20.0%)	22 (29.3%)
Total	88 (100%)	120 (100%)	35 (100%)	75 (100%)

Source: Field Survey, 2014

Notes: V₁= Keyabunia Village; V₂= Katabunia Village

The table reflects the percentage distribution of respondents' educational status. It was found that 20.5 per cent male respondents followed by 10.8 per cent female respondents of Keyabunia village (V₁) studied up to class 1. Again another significant number of male respondents, i. e. 34.2 per cent followed by 21.3 per cent female respondents of Katabunia village (V₂) studied up to class 1. A larger number of respondents could only sign their names. About 24.2 per cent male respondents followed by 20.5 per cent male

respondents of Keyabunia village could only sign their names. Similarly, a significant number of male (14.2%) and female respondents (17.3%) of Katabunia village could only sign. Equally significant was the rate of illiteracy. About 18 per cent male respondents and 20.8 per cent female respondents in Keyabunia were illiterates. Again 20 per cent male and 29 per cent female respondents of Katabunia village were illiterates.

Compared to men, it was found that the educational status of women was better up to primary level, i.e. class 5. More than 10 per cent female respondents of both villages studied up to class 5. Gradually literacy rate for women declined. Number of male respondents was more than women in case of SSC, HSC and BA/Diploma. A very insignificant number of male and female respondents of both villages were almost evenly distributed in different classes of high schools.

The table 6.1.1.4 shows the occupational status of the respondents. In Keyabunia village, 61 per cent respondents were primarily fishermen and 34 per cent were involved in crab fattening. In Katabunia, 37 per cent male respondents were primarily agricultural laborers who used to grow paddy in field. Another 28.5 per cent respondents' primary occupation was fishing and 17 per cent respondents were primarily involved in crab fattening. Most of the respondents had more than one occupation. About 43 per cent male respondents of Keyabunia and 28 per cent male respondents of Katabunia used to work in different development projects during lean period. Wage labour has become a primary source of income for 17.5 per cent male respondents of Katabunia. Livestock farming is more suitable as a source of income in Katabunia village rather than in Keyabunia. It is the secondary occupation for 20 per cent male respondents of Katabunia. About 29 per cent female respondents of Katabunia domesticate animals like cows, goats etc. In Katabunia village, most of the women (53%) were basically housewife compared to 40 per cent women of Keyabunia. About 39 per cent women of Keyabunia were primarily fishermen whereas 30 per cent women of the same village took fishing as their secondary occupation. Other than these, respondents were also involved in many other different

Table 6.1.1.4: Percentage Distribution of Respondents by Occupation

Occupation	Gender	V1				V2			
		Primary Occupation		Secondary Occupation		Primary Occupation		Secondary Occupation	
Farmer (Crops)	M	1	1.1%	2	2.3%	13	37.1%	5	14.3%
	F	0	0.0%	6	5.0%	6	8.0%	8	10.7%
Farming (Livestock)	M	2	2.3%	0	0.0%	3	8.6%	7	20.0%
	F	1	0.8%	4	3.3%	15	20.0%	22	29.3%
Collector	M	3	3.4%	4	4.5%	4	11.4%	2	5.7%
	F	4	3.3%	4	3.3%	1	1.3%	5	6.7%
Shrimp farmer	M	8	9.1%	8	9.1%	3	8.6%	3	8.6%
	F	0	0.0%	0	0.0%	0	0%	0	0%
Fisherman	M	54	61.4%	15	17.0%	10	28.5%	6	17.1%
	F	47	39.1%	36	30.0%	1	1.3%	6	8.0%
Dry fish Processor	M	0	0.0%	1	1.1%	0	0%	0	0%
	F	0	0.0%	0	0.0%	0	0%	0	0%
Wage Laborer	M	7	8.0%	38	43.1%	6	17.5%	10	28.6%
	F	8	6.7%	20	16.2%	1	1.3%	14	18.7%
Businessman	M	5	5.7% %	9	10.2%	2	5.7%	0	0%
	F	3	2.5%	2	1.7%	4	5.3%	4	5.3%
Net Makers	M	0	0.0%	0	0.0%	0	0%	0	0%
	F	2	1.7%	0	0.0%	3	4.0%	0	0%
House wife	M	0	0.0%	0	0%	0	0%	0	0%
	F	49	40.8%	41	34.1%	40	53.3%	13	17.3%
Crab Fattening	M	30	34.0%	0	0.0%	3	8.6%	0	0%
	F	1	0.8%	0	0.0%	0	0%	0	0%
Handicrafts	M	0	0.0%	0	0.0%	0	0%	0	0%
	F	0	0.0%	3	2.5%	4	5.3%	2	2.6%
Unemployed	M	6	6.8%	11	12.5%	0	0%	0	0%
	F	0	0.0%	38	31.6%	0	0%	1	1.3%
Boat Builders	M	2	2.3%	0	0.0%	0	0%	0	0%
	F	1	0.8%	0	0.0%	0	0%	0	0%
Total	M	88	100%	88	100%	35	100%	35	100%
	F	120	100%	120	100%	75	100%	75	100%

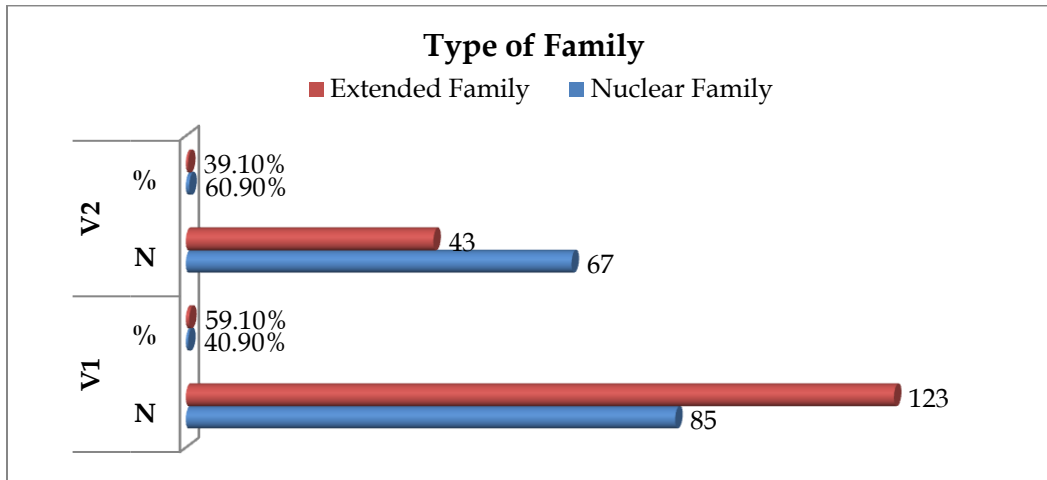
Source: Field Survey, 2014

Notes: 1. V1=Keyabunia Village and V2= Katabunia Village;

2. M=Male and F= Female

occupations, like boat making, muri trading, net making etc., which were not that much profitable and thereby unpopular.

Figure 6.1.1.2: Percentage Distribution of Types of Family



Source: Field Survey, 2014

Notes: V₁= Keyabunia Village; V₂= Katabunia Village

The figure displays the percentage distribution of types of family of study areas. It shows that the number of extended family (59.1%) is more in Keyabunia village than the number of nuclear family as only 40.9 per cent respondents responded. On the other hand the number of nuclear family (60.9%) in Katabunia is more than the number of extended family (39.1%).

Table 6.1.1.6: Percentage Distribution of Respondents by Total Number of Family Members

No of Family Members	V ₁		V ₂	
	N	%	N	%
1	1	0.48%	1	1.3%
2	6	2.8%	2	1.8%
3	30	14.4%	4	4.3%
4	48	23.1%	60	54.5%
5+	123	59.1%	43	39.1%
Total	208	100%	110	100%

Source: Survey, 2014

Notes: V₁= Keyabunia Village; V₂= Katabunia Village

The table 6.1.1.6 shows the percentage distribution of number of family members. As the number of extended family is more in Keyabunia village (V₁), the total number of family members is also more here as 59.1 per cent respondents reported to have more than 5

members in their family. About 23 per cent respondents said to have 4 members and about 14.4 per cent respondents said to have 3 members in their households in this village. On the other hand, around 55per cent respondents said to have 4 members in their household followed by 39.1 per cent who said to have more than 5 members in their households. Only 1 respondent in each village said that they had been the only one member of their households. Among them, one was a widow of Keyabunia and another one was an abandoned woman in Katabunia.

Table 6.1.1.7: Percentage Distribution of Respondents by Number of School Going Son and Daughter

No of School Going Children		V1		V2	
		N	%	N	%
0	Son	89(208)	42.8%	20 (110)	23.9%
	Daughter	111(208)	53.4%	27 (110)	24.5%
1	Son	88(208)	42.3%	52 (110)	47.2%
	Daughter	77 (208)	37.0%	48 (110)	43.6%
2	Son	24(208)	11.5%	21 (110)	19.0%
	Daughter	16 (208)	7.7%	24 (110)	21.8%
3	Son	7 (208)	3.4%	10(110)	9.09%
	Daughter	4 (208)	1.9%	10 (110)	9.1%
4	Son	0 (208)	0 (0%)	4 (110)	3.6%
	Daughter	0 (208)	0 (0%)	1(110)	0.9%

Source: Field Survey, 2014

Notes:

1. V1= Keyabunia Village; V2= Katabunia Village

2. Percentage for both son and daughter has been calculated out of 208 in V1 and out of 110 in V2.

The table 6.1.1.7 shows the percentage distribution of school going children of the respondents of study areas. Around 43per cent respondents said that they did not have any school going son. Around 24 per cent respondents of Katabunia which is almost half of the respondents of Keyabunia Village said that they had no school going son. A significant number of respondents of both villages (42.2% of Keyabunia and 47.3% of

Katabunia) said that they had one school going son. A very insignificant number of respondents of both villages said to have 3 or more number of school going son.

Percentages for daughter have been calculated out of total number of respondents of both villages (See notes below the table). It was found that 53.4 per cent respondents of Keyabunia village and 24.5 per cent respondents of Katabunia village do not have any school going daughter. A significant number of respondents of both villages (37% of Keyabunia and 43.6% of Katabunia village) said to have at least one school going daughter. On an average 20.4 per cent respondents of Katabunia village reported to have 1 or 2 school going children. In Keyabunia village nobody reported to have 4 school going son and daughter. On the contrary a very insignificant number of respondents of Katabunia village responded to have 4 school going son and daughter.

On an average the number of school going son is found 0.75 and daughter is 0.57 for Keyabunia village which is highly insignificant. On the contrary, in Katabunia village the average number of school going children is found 1 irrespective of son and daughter.

Table 6.1.1.8: Percentage Distribution of Respondents by Number of Dependent Members

Dependent Family members		V ₁		V ₂	
1	Dependent male	81(208)	38.9%	61 (110)	55.5%
	Dependent female	66 (208)	31.7%	31 (110)	28.1%
2	Dependent male	55(208)	26.4%	20 (110)	18.2%
	Dependent female	16 (208)	7.7%	32 (110)	29.0%
3	Dependent male	16(208)	7.7%	3 (110)	2.7%
	Dependent female	34 (208)	16.3%	16 (110)	14.5%
0	Dependent male	72(208)	34.6%	26 (110)	23.6%
	Dependent female	53 (208)	25.5%	31 (110)	18.2%

Source: Field Survey, 2014

Notes: V₁= Keyabunia Village; V₂= Katabunia village

The table 6.1.1.8 shows the percentage distribution of the number of dependent members of respondents. Around 39 per cent respondents of Keyabunia village said that they had 1 male dependent member compared to around 56 per cent respondents of Katabunia village. Again 26.4 per cent respondents of Keyabunia village and 18.2 per cent respondents of Katabunia village reported to have 2 male dependent members. A very insignificant number of respondents (7.7% of Keyabunia and 2.7% of Katabunia village) said to have 3 male dependent members on them. On the contrary, a very significant number of respondents of Keyabunia (34.6%) and around 24% respondents of Katabunia village said that they did not have any male dependent member on them.

Similarly a significant number of respondents (25.5% of Keyabunia and 18.2% of Katabunia) said to have no dependent female members on them. Around 32 per cent respondents of Keyabunia village and 28 per cent respondents of Katabunia village said to have 1 female dependent on them. A significant number of respondents of Katabunia village (29%) said to have 2 female dependent members compared to only 8 per cent respondents of Keyabunia village. On an average 15.4 per cent respondent of both villages said to have 3 female dependent members on them.

Table 6.1.1.9: Percentage Distribution of Respondents by their Nature of Decision Making

Nature of Decision Making	V1				V2			
	Male (N)	%	Female (N)	%	Male (N)	%	Female (N)	%
Self	62	0%	26	21.6%	21	60%	17	22.6%
Dependant on husband	0	0%	33	42.5%	0	0%	40	53.3%
Dependent on wife	2	2.2%	0	0%	3	8.5%	0	0%
Both	22	25%	51	27.5%	10	28.5%	13	17.3%
Child	2	2.2%	10	8.3%	1	2.8%	5	6.6%
Total	88	100%	120	100%	35	100%	75	100%

Source: Survey, 2014

Notes: 1. V1= Keyabunia Village; V2= Katabunia village

The table 6.1.1.9 shows percentage distribution of the respondents' nature of decision making. It was found that a significant number of female respondents of both villages, 42.5 per cent of Keyabunia and 53.3 per cent of Katabunia, were dependent on their husbands for taking any important decision. For example, they waited for their husbands,

when they were away from home, to take decisions about training program. Few dilemmas that female respondents usually suffered from were: a) whether or not they would take training from NGOs, whether or not they would work outside, how many eggs to sell and to keep for their children, whether or not their daughter who passed class 5 should continue her education, whether or not she should sell or mortgage her assets in crisis moment etc. These are the situations about which they made decisions by consulting with their husbands. On the other hand, a very few number of male respondents reported to have been dependant on their wives for making any decision.

It was found in the analysis of educational status of the respondents that a good number of respondents had achieved a certain level of education. They made decisions by consulting with each other. Thereby 25 per cent male respondents and 27.5 per cent female respondents of Keyabunia village said that decision-making on any major issue depends on both. Similarly a good number of respondents, 28.5 per cent male respondents and 17.3 per cent female respondents of Katabunia, opined the same. A very insignificant number of people expressed their dependence on their children for making any decisions. They were basically the aged people who had adult earning children.

Table 6.1.1.10: Percentage Distribution of Respondents by Nature of Household

Nature of Household	V ₁		V ₂	
	N	%	N	%
Male-headed	187	89.9%	97	88.2%
Female-headed	21	10.0%	13	11.8%
Total	208	100%	110	100%

Source: Field Survey, 2014

Notes: 1. V₁= Keyabunia Village; V₂= Katabunia village

Table 6.1.1.10 shows the percentage distribution of respondents' nature of households. It was found that majority of the houses were male-headed. Around 90 per cent respondents of Keyabunia village (V₁) said that they belonged to a male-headed household compared to almost equal number of households of Katabunia village (88.2%). Though on an average 10.5 per cent respondents of each village said that they belonged to a female-

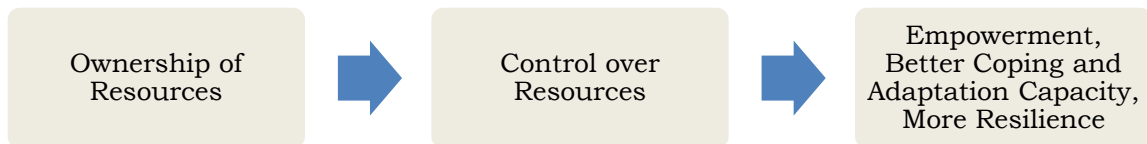
headed household, the number of female-headed households was even more. But many of the male-headed households were basically female-headed (*de facto*) when their husbands remained away from home in a particular season for collecting crabs, wax or honey.¹

Analysis: The socio-demographic profile indicates that a significant number of respondents belonged to reproductive age groups and they were married as well. Most of the families in Katabunia consisted of 4 members and most of the families in Keyabunia consisted of more than 5 members. But respondents' age and marital status indicates the probability that the size might increase further. Educational status of respondents shows that female education rate was higher than that of men in case of primary education while the situation was reverse in high school and later in SSC and HSC stages. But respondents were found very serious about their children's education as most of families had at least two school-going children. Only a few number of respondents said to have no school-going children. In fact, their children were too young to go to school. The occupational status of respondents indicates that men and women were involved in a number of occupations, especially fishing, herding, catching crabs, collecting honey-wax-wood etc., wage labor, farming etc. It was found that men and women were doing almost similar types of occupations though their area of action as well as nature of action was different. For example, like men, women were also involved in fishing. But women caught fishes near sea shore whereas men went to deep sea (details in section 6.2). Most of the households were female-headed (*de jure*) when their husbands remained away from home for a particular period. But decision-making power belonged to male members as women waited for their husbands for making important decisions.

¹ It was difficult to find out the exact number of these female-headed households (*de facto*) due to the incomplete information of the respondents. Again this sort of households could be considered as male-headed households in a sense that these temporary female heads waited for their husbands for making any important decisions.

6.1.2 Gender-based Asset Analysis

Women's fundamental right to asset is violated during disasters and post disaster periods when the policies are not in effect and resource distribution does not focus on women (Enarson and Fordham, 2001:133). Due to their limited access to information, education, occupation and income, women tend to possess fewer assets and depend more on natural resources for their livelihood (Nellemann et al., 2011). Disasters primarily cost these natural resources. In addition, disaster cost women their jewelry and other precious assets (Enarson and Fordham, 2001:134) which ultimately increase women's vulnerability to a greater extent. Assets play a very important role in coping and adaptation as well as disaster risk-reduction. Nandy and Ahammad (2012) stated that limited ownership status affects the adaptation capability of particular poor and marginalized coastal people. According to Sen (1981), the person, who is entitled to more amounts of resources, is better able to cope with the situation. Thus, more entitlement means more coping and adaptation capacity. Thus, assets help the poor people to cope better with the climatic shocks and thereby reducing vulnerability and empowering them (Bebbington, 1999; Sen, 1997; Moser, 2007; Sherraden, 1991).



Source: Developed by the author based on literature

Though women are considered as the key active agents of adaptation due to their better experience of utilizing natural resources (Nellemann et al., 2011), they seem to suffer more negative impacts of climate change due to less access to and control over resources (Goh, 2012; Ariyabandu and Foenseka, 2006; Mitchell, et al., 2007). In south Asian countries, though women have considerable legal rights to inherit the properties, they ultimately do not gain full ownership of them (Agarwal, 1998). Thus, analysis of ownership status of male and female respondents should be a precondition of gender-based vulnerability and adaptation analysis in the upcoming sections.

Table 6.1.2.1: Percentage Distribution of the respondents by the Ownership Status of Resources

Asset	Answer	V1				V2			
		Male		Female		Male		Female	
Land	Yes	42	47.7%	12	10.0%	23	65.7%	18	24.0%
	No	46	52.3%	108	90.0%	12	34.4%	57	76.0%
Radio/TV/CD player	Yes	44	50.0%	0	0%	6	17.1%	0	0%
	No	44	50.0%	120	100%	29	82.9%	75	100%
Fan	Yes	0	0.0%	0	0%	0	0%	5	4.5%
	No	88	100%	120	100%	35	100%	70	93.3%
Mobile Phone	Yes	51	58.0%	42	35.0%	23	65.7%	23	30.7%
	No	37	42.0%	78	65.0%	12	34.3%	52	69.3%
Sewing machine	Yes	0	0%	12	10.0%	0	0%	4	5.3%
	No	88	100%	108	90.0%	35	100%	71	94.7%
Chair-table- Showcase-Wardrobe	Yes	44	50.0%	48	40.0%	20	57.1%	41	54.7%
	No	44	50.0%	72	60.0%	15	42.9%	34	45.3%
Mosquito net	Yes	68	77.3%	73	60.8%	24	68.6%	57	76.0%
	No	20	22.7%	46	38.3%	11	31.4%	18	24.0%
Gold	Yes	49	55.7%	65	54.2%	25	71.4%	54	72.0%
	No	39	44.3%	55	45.8%	10	28.6%	21	28.0%
Livestock	Yes	2	2.3%	65	54.2%	34	97.1%	72	96.0%
	No	86	97.7%	55	45.8%	1	2.9%	3	4.0%
Irrigation pump	Yes	2	2.3%	0	0.0%	6	17.1%	5	6.7%
	No	86	97.7%	120	100.0%	29	82.9%	70	93.3%
Boat	Yes	63	71.6%	7	6.7%	13	37.1%	0	0%
	No	25	28.4%	112	93.3%	22	62.9%	75	100%
Fishing net	Yes	83	94.3%	112	93.3%	13	37.1%	7	9.3%
	No	5	5.7%	8	6.7%	22	62.9%	68	90.7%
Rickshaw/ Van /Bicycle	Yes	4	4.5%	0	0.0%	8	22.8%	0	0%
	No	84	95.5%	120	100%	27	77.2%	75	100%
Timber tree /plants	Yes	4	4.5%	30	25.0%	1	2.9%	5	6.7%

/Vegetables	No	84	95.5%	90	75.0%	34	97.1%	70	93.3%
Cot	Yes	71	80.7%	89	74.2%	30	85.7%	63	84.0%
	No	17	19.3%	31	25.8%	5	14.3%	12	16.0%

Source: Field Survey, 2014

Notes: i) V1= Keyabunia and V2=Katabunia

ii) Total number of male respondents is 88 and female respondents is 120 in Keyabunia

iii) Total number of male respondents is 35 and female respondents is 75 in Katabunia

About 48 per cent male respondents of Keyabunia village reported to own land as compared to only 10 per cent female respondents. Similarly more men of Katabunia village own land than that of women. Around 66 per cent male respondents of this village own land as compared to only 24 per cent female respondents. Though majority of male respondents own land, the amount of land is less than 5 decimal. These people are considered as landless people.

In Keyabunia 50 per cent male respondents said to have radio as compared to 17 per cent male respondents of Katabunia village. On the other hand, many female respondents of both villages said that they had radio in their households but they did not own them. In fact radio belongs to the ownership of men. When men go to Sundarban for catching fish or crab, they take radio with them for listening to weather updates. Almost all the respondents of both villages, except a very few i.e. 4.5 per cent female respondents of Katabunia, said that they did not have any fan in their households. In fact there was no electricity supply in both of these study areas. In Katabunia, a number of few households had solar energy by which they could generate power supply to a single light and a table fan.

Mobile phone plays a very important role in communication. As men of these coastal zones go to Sundarban for earning their livelihood and need to stay away from their home for more than a month, mobile phone is a must for them to maintain contact with their home. The data shows that 58 per cent male respondents of Keyabunia village (V1) owned cell phone as compared to 35 per cent female respondents. Similarly a greater number of male respondents of Katabunia village (65.7%) owned cell phone as compared to only 30 per cent female respondents. Thus, it is clear that male members who remained away from home could not always contact directly with their family. They used to give

information to local shop keepers or any person who had mobile phone and with whom his family members had regular contact.

A very few female respondents reported to have sewing machine. Only 10 per cent respondents of Keyabunia and 5.3 per cent respondents of Katabunia reported that they had a sewing machine. But they did not buy it rather received it from NGOs as part of their training. Among the respondents of Keyabunia, 2 women reported that their machine was not working any more. They were not able to sew anything with that. Thus, it became useless which could no more be considered as an asset for them.

Chair, table, stool etc. are few common assets which were available in many houses of the study areas. About 50 per cent male respondents followed by 40 per cent female respondents of Keyabunia village said to have at least one chair or table in their households. Similarly a large number of male (57.1%) and female (54.7%) respondents of Katabunia said to have these types of assets in their households. An average of 79.5 per cent respondents of both villages said to have at least one cot in their houses. Rest of the respondents said that cyclone Ayla washed away their assets like these. After that they could not manage money to buy them again.

Mosquito net is another common item without which it is very difficult to sleep. Coastal people basically stay in such areas where mosquitoes are huge in number due to dark jungle nearby. Many people suffer from various types of fevers induced by these mosquitoes. NGO workers have made these people aware of this situation. Data shows that majority of the coastal people had at least one mosquito net. About 77.3 per cent male respondents reported to have mosquito net as compared to 60.8 per cent female respondents of Keyabunia village. Again 68.6 per cent male respondents and 76 per cent female respondents of Katabunia reported to have mosquito net in their household.

Gold is an asset which is supposed to belong to women only. Though women use jewelry to ornament themselves, an invisible ownership of male members of their households somehow was reflected on their attitude. Due to this reason, the data shows that almost an equal number of female and male respondents reported to own gold. In Keyabunia village, 55.7 per cent male respondents as compared to 54.2 per cent female respondents

said to own gold. Again in Katabunia (V2), 71.5 per cent male respondents compared to 72 per cent female respondents said to own gold. Gold included one pair of earrings and a nose pin which amounted not more than 5 to 6 grams.

Both of the study areas were prone to cyclones as they are situated in the coastal belt. But between these two, Keyabunia had been more prone to cyclone and salinity as sea is just beside this village. As a result, people had permanently shifted their occupational status from farmers to fishermen. Even due to the lack of grazing land, men of this village did not find domesticating animals profitable in their locality. As a result only 2.3 per cent male respondents said to have livestock as compared to 54.2 per cent women of this village. On the other hand, in Katabunia village, people had started storing sweet water and cultivating paddy twice in a year. They are able to feed their animals based on these agricultural residues. About 97.1 per cent male respondents reported to raise animals as compared to almost an equal number of female respondents (96%) of this village. Again there was a sharp difference between the types of animals. For example, the people of Keyabunia had hens and ducks. A very few of them had goat and cow. On the other hand, people of Katabunia raised cows, goats, sheep, pigs, hens, ducks etc.

Irrigation pump is necessary in that locality where agricultural production is still possible. Between these two study areas, agriculture was no more profitable in Keyabunia. Consequently people had already left this livelihood option. Though many people had irrigation pump previously i. e. in 1990s, many of them sold it by 2014. Only 2.3 per cent male respondents, who said to have irrigation pump, were trying to sell. As they were not getting the expected price, they could not sell it. On the other hand, in Katabunia village 17.1 per cent respondents said to have irrigation pump which was very essential during the month of April-May when drought takes place. A few number of female respondents also said to own irrigation pump as they contributed while buying the pump.

An opposite scenario was seen in Keyabunia village where most of men and women live on fishing. About 94 per cent respondents irrespective of gender said that they had fishing net as compared to only 37 per cent male respondents of Katabunia village. A very insignificant number of female respondents (9.3%) of this village said to have

fishing nets, though the quality of net varied between men and women. Men owned costlier and bigger nets compared to those of women.

Boats were more available in Keyabunia village where people's major source of income was fishing. During maximum time of the year, men of this village stay in Sundarban for catching fishes, crabs etc. and for collecting honey-wax-fuel wood etc. During that time they badly need a boat which serves the purpose of a house. As boat is expensive all the people cannot buy it. The people who did not have personal boat they used to go Sundarban with a group who owned boat. About 71.6 per cent male respondents of Keyabunia village said to own boat compared to only 6.7 per cent female respondents of this village. Again 37.1 per cent male respondents of Katabunia village said to have boats. No woman of this village had boats.

Keyabunia is a village where communication with the main town is not that difficult for those who stay in the front part of the village. But communication is very difficult for those who stay beside the sea. Among those respondents 4.5 per cent said to have a bicycles. On the other hand, Katabunia is 7 km away from Pankhali union. The communication and transportation system was very poor. It was also not possible for people to go to the union on foot. Thus, transport was a must. These people could not go to town until or unless they were getting a van operated by engine or a motorcycle coming back from the town by carrying people. Because of this reason many adult boys had bought bicycle though their number is not too many compared to the whole population of the village. Around 23 per cent male respondents said to have a van or a bicycle compared to none of females.

The number of timber tree is very less in both of the study areas due to high level of salinity. Only 4.5 per cent male respondents said to have a timber tree compared to 25 per cent female respondents of Keyabunia village. On the other hand, around 3 per cent male respondents said to own one or two trees as compared to 6.7 per cent female respondents of Katabunia village. Though apparently female ownership seems more in data, they basically own vegetables and fruit plants. Big trees basically belonged to men.

Nature of Asset and their Approximate Value

The following two tables represent the nature of asset that coastal men and women usually own. The value has been calculated for each of the item based on the statements of the respondents and by analyzing the local market price during the survey period. The asset has been divided into two types: Agricultural asset and Non-agricultural asset. Agricultural asset is again divided into two: Land asset and non-land asset.

Land Asset

Table 6.1.2.2: Percentage Distribution of Respondents by the Amount of Land

Approx. Amount of Land	V1		V2	
	N	%	N	%
1-2 decimal	5	37.0%	4	9.7%
2-4 decimal	37	40.7%	31	77.5%
4-5 decimal	12	22.3%	6	14.6%
Total	54	100%	41	100%

Source: Field Survey, 2014

Notes: i) V1= Keyabunia and V2=Katabunia

ii) Mean amount of land of V1 (X) = 2.6 decimal and of V2 (X) = 2.5 decimal

The table 6.1.2.2 shows the percentage of the respondents based on their possession of land. Out of 208 respondents of Keyabunia village, 54 said to have land. Again out of 110 respondents, 41 per cent respondents said that they owned land. Among them, 37 per cent respondents of Keyabunia village reported to have less than 2 decimal lands as compared to 9.7 per cent respondents of Katabunia village. A very few number of respondents possessed 5 decimal land as only 22.3 per cent respondents of Keyabunia village and 14.6 per cent respondents of Katabunia village reported to have 5 decimal. Again a larger number of the respondents said to have 4 decimal. Around 41 per cent respondents of Keyabunia village and 77 per cent respondents of Katabunia village were owners of lands of 4 decimal.

From the above table, it is found each respondent possesses 2.6 decimal lands in Keyabunia village. Katabunia village reflects almost the same (2.5 decimal).

Table 6.1.2.3: Types of Land and Approximate Value

Nature of Land	V1		V2	
	Amount	Approx. Value	Amount	Approx. Value
Low land	1 bigha	20,000 tk	1 bigha	30,000 tk
Mid level land	1 bigha	25,000 tk	1 bigha	35,000 tk
High Land	1 bigha	30,000 tk	1 bigha	40,000 tk
Total	3 bighas	75,000 tk	3 bighas	1,05,000 tk
Average	1 bigha	25,000 tk	1 bigha	35,000 tk
	1 decimal	757.5 tk	1 decimal	1060.6 tk

Source: Field Survey, 2014

Notes: i) V1= Keyabunia and V2=Katabunia

ii) 1 bigha= 33 decimals

iii) Prices are determined according to the statements of respondents.

This table shows the approximate value of land. Keyabunia village is very close to sea and experiences the flooding and ebbing on a regular basis. Thereby, the value of land of this village is a bit less than that of Katabunia village. In fact people had not been interested to buy low lands which were very close to sea. Only rich farmers, who had planned to cultivate crabs or fishes, bought low lands with an intention to get back the money by making huge profits within a very short time. The mean value of 1 bigha land in Keyabunia village is 25,000 taka and in Katabunia village is 35,000 taka.

Table 6.1.2.4: The Approximate Value Possessed by Individual Respondent

	V1		V2	
	Amount of Land	Approx. Value	Amount of Land	Approx. Value
Possession of each Respondent	2.6 decimal	$2.6 \times 757.5 \text{tk} = 1969.5 \text{tk}$	2.5 decimal	$2.5 \times 1060.6 \text{tk} = 2651.5 \text{tk}$

Source: Field Survey, 2014

Notes: i) V1= Keyabunia and V2=Katabunia

ii) Prices are determined according to statements of respondents.

From this table it is evident that each respondent of Keyabunia village possessed land of around 2000 taka. On the other hand, the value of land was a bit costlier in Katabunia

village where each respondent possessed land of around 2700 taka. Thus, the average price of coastal lands was calculated 2310.5 taka.

Assets other than Land

Non-land assets basically include those things which a farmer or a fisherman or a housewife usually possesses. They include cell phone, sewing machine, gold, timber/plants, livestock, fishing net, boat, mosquito net, chair/table etc.

Table 6.1.2.5: Frequency Distribution of Respondents by the Possession of Chairs/Tables and their Approximate Value

Number of Chair/Table	V1		V2	
	Men (N=64)	Approx. Value	Women (N=89)	Approx. Value
1	20×1=20	20×200=4000 tk	40×1=40	40×200=8000 tk
2	19×2=38	38×200=7,600 tk	34×2=68	68×200=13600 tk
3	25×3=75	75×200=15,000 tk	15×3=45	45×200=9000 tk
Total	64	26,600 tk	89	30,600 tk
Each respondent possessed		415.6 tk	Each respondent possessed	343.8 tk

Source: Field Survey, 2014

Note: i) Each chair/table costs 200 taka according to respondents

ii) Total number of male respondents of both villages is 123 and female respondents is 195

This table reflects the number of chairs/tables that both male and female respondents possessed. Out of 123 male respondents, 64 said to have furniture like chairs/tables. Among these 64 respondents, 20 had one chair and table that cost 4000 taka, 19 men had 2 chair/table worth 7,600 taka and 25 men had 3 chair/table worth 15,000 taka. On an average each man possessed furniture of 415.6 taka. Again each woman possessed furniture of 343.8 taka.

Table 6.1.2.6: Frequency Distribution of Respondents by the Possession of Mosquito Net and Its Approximate Value

No. of Mosquito net	Men (N=92)	Approx. Value	Women (N=130)	Approx. Value
1	57×1=57	57×300=17,100 tk	92×1	92×300=27,600 tk
2	35×2=70	70×300=21,000 tk	38×2=76	76×300= 22,800 tk
Total	92	38,100 tk	130	50,400 tk
Average of Each Respondent		414.1 tk	Average of Each Respondent	387.6 tk

Source: Field Survey, 2014

Note: On an average each mosquito net costs 300 taka according to Respondents

ii) Total number of male respondents of both villages in 123 and female respondents is 195

This table shows the number of mosquito net that each respondent possessed. Out of 123 male respondents, 92 said that they had mosquito net. Among them, 57 male respondents said to have a single mosquito net and 70 men said to have two mosquito nets. On an average, each male respondent possessed mosquito net worth 414 taka. Again out of total 195 female respondents, 92 said to have one mosquito net and 38 female respondents said to have two. On an average each female respondent possesses mosquito net of 387.6 taka.

Table 6.1.2.7: Frequency Distribution of Respondents by the Possession of Number of Timber/Fruit Plants

Number of Timber Tree/Fruit Plants	Men (N=5)	Women (N=35)
1-2	0	35
2-3	3	0
3-4	2	0
Total	5	35
Average (X̄)	2.9	1.5

Source: Field Survey, 2014

ii) Total number of male respondents of both villages in 123 and female respondents is 195

The above table displays the number of timber tree that men and women possessed. Out of 123, only 5 said to have timber tree as compared to 35 women out of 195 respondents. Among these 5 respondents, each possessed 2.9 timber trees. On the other hand, women possessed 1.5 timber trees. According to respondents, these timber trees include coconut tree, sundori tree etc. which cost no more than 2000 taka. Thus, men possessed timber

trees worth (2.9×2000) 5800 taka. On the other hand, women possessed timber trees worth (1.5×2000) 3000 taka.

Table 6.1.2.8: Number of Livestock Men Possess and Approximate Value

Livestock	Men (N=36)	Total Amount	Value	Taka
Cows	15 (41.6%)	1×15=15	15×10,000 tk=	150000 tk
Goats	12 (33.3%)	7×1=7 5×2=10	17×3000 tk=	51,000 tk
Hens & Ducks	0	0	0	0
Sheep	5 (13.8%)	3×3=6 2×2=6	12×4000=	48,000 tk
Pigs	4 (11.1%)	3×2=6 1×4=4	10×4000 tk=	40,000 tk
Total	36 (100%)			2,89,000 tk
Each man possessed				8027.7 tk

Source: Field Survey, 2014

Notes:

- i) Prices are determined according to the statements of respondents.
- ii) Total number of male respondents of both villages in 123 and female respondents is 195

The table 6.1.2.8 displays number of livestock that men possessed. Out of 123 male respondents, 29.3 per cent (36) men said to raise livestock. Among them, 41.6 per cent said to domesticate cows and 33.3 per cent said to tame goats. A very few number of respondents said to raise sheep and pigs. On the basis of their local prices as mentioned by the respondents, it was found that each man possessed livestock of about 8028 taka equivalent to US\$ 104.

Table 6.1.2.9: Number of Livestock Possessed by Female Respondents and their Approximate Value

Livestock	Women (N=137)	Total Amount	Value	Taka
Cows	33 (24.0%)	1×33=33	15×10,000 tk=	150000 tk
Goats	29 (21.2%)	17×1=17 12×2=24	17×3000 tk=	51,000 tk
Hens & Ducks	75 (54.7%)	28×2=56 24×3= 72 23×4=92	220×150=	33,000 tk
Sheep	0	0	0	0
Pigs	0	0	0	0
Total	137 (100%)			2,34,000 tk
Each woman possessed				1708.0 tk

Source: Survey, 2014

Notes: i) Prices are determined according to the statements of respondents.

ii) Total number of male respondents of both villages in 123 and female respondents is 195

This table shows the possession of livestock by female respondents of the study. Out of 195 female respondents 137 respondents said to have raised livestock. Among them, a significant number of women (54.7%) said to have hens/ducks. Rest of them possessed cows and goats given by NGOs. According to prices stated by respondents, it is found that each woman possessed livestock of approximate 1700 taka equivalent to US\$ 22.

Table 6.1.2.10: Possession of Gold by Women

Gold	Women	
	N (119)	%
Less than 1.5 gram	0	0%
1.5-3 grams	20	16.8%
3-4.5 grams	87	73.2%
4.5-6 grams	12	10.0%
Total	119	100%

Source: Field Survey, 2014

The table 6.1.2.10 reflects data on the possession of gold by female respondents. Out of total 195 female respondents, 119 said to possess gold. These women had been basically the owner of one pair ear rings and one nose pin. A significant number of respondents

(73.2%) said to have gold not more than 4.5 grams. On an average each woman possessed 3.5 grams of gold which costs 7,937.685 taka (US\$ 102.025) according to International gold market price. But its resell value will be just half of that i.e. approximately 4000 taka only.

Table 6.1.2.11: Total Value of Asset that a Coastal Man and a Coastal Woman possessed (Both Land and Non-Land Asset)

Nature of asset	Man	Woman
Land	2310.5 taka	2310.5 taka
Mobile phone	2000 taka	2000 taka
Sewing Machine	0 taka	4000 taka
Chair-table	415.6 taka	343.8 taka
Mosquito net	414.1 taka	387.6 taka
Gold	0	4000 taka
Livestock	8028 taka	1700 taka
Fishing net	4000 taka	300 taka
Timber/Plants	5800 taka	3000 taka
Boat	16,000 taka	0 taka
Total	38,968.1 taka	18,041.9 taka

Source: Survey, 2014

Note: i) A farmer with less than 5 decimal lands is considered as landless.

The 6.1.2.11 table attempts to calculate the total amount of asset that a landless coastal man or a coastal woman possesses. This table includes only those items which a coastal man or a coastal woman usually possessed. Gold and sewing machine were naturally possessed by women only though men felt an invisible ownership over gold too. On the other hand, boats were possessed by men only.

Land is an asset over which men had definitely greater access. Though a very insignificant number of women inherited lands from their parents due to patriarchal nature of inheritance (Nasreen, 2012), even then land has been considered both for men and women.

Both men and women possessed fishing net. But women caught fishes in the sea shore with nets worth only 300 taka each. Sometimes they made it by themselves. On the other

hand, men caught fishes in the deep sea by sailing with heavy nets which were very costly.

By considering all these things, the total value of asset possessed by a man has been calculated approx. 38,968 taka. Again total value of asset possessed by a woman has been calculated approx. 18,041.9 taka which is almost half of the value of men's asset.

Gap between Men and Women's Ownership of Resources

It is found that the amount of asset that a coastal man possessed is 38,968 taka which is even less, i.e. 36,658 taka (38,968 – 2310 taka) if the farmer/ coastal man was totally landless. The amount of asset for coastal woman was 18,041.9 taka which was just half of that of a man. Thus, significant gap has been reflected between the ownership status of men and women of coastal areas.

Table 6.1.2.12: Gender Gap in Ownership Status

Asset of a Coastal Man	Asset of a Coastal Woman
Approx. 38,968 taka (including land) (About 506 US\$)	Approx. 18,042 taka (including land) (About 234 US\$)
Approx. 36,658 taka (without land)	Approx. 15,731 taka (without land)

Source: Field Survey, 2014

Though women own properties, they cannot gain their full rights over it due to their subordinate status in the households. Gold is an asset which belongs to women though men feel an invisible ownership over it. This is highly supported by Agarwal (1998). One respondent said, 'I can sell vegetables from my homestead to buy daily essentials but I could not sell my apricot tree even for my treatment without the permission of my husband'. Anything profitable belonged to men by any means, and anything less profitable belonged to women.

Analysis: The findings naturally proved that women owned fewer amount of resources than those of men. The resources like mosquito net, handmade fishing net, chair table, small plants etc. which female respondents owned are not valuable enough as compared to resources like land, boat, big fishing net, timber tree etc. which men usually owned. Few valuable resources that women owned were basically received either from parents as a result of inheritance or from the NGOs. Such resources included land, gold, livestock etc. Women traditionally had no control over these resources due to patriarchal nature of society. On the other hand, these were the assets over which men felt invisible ownership and thereby, were usually kept mortgaged by men. Thus, the question of who owns and who claims is still a matter of ambiguity.² But resources are the capitals which are required to increase the adaptation capacity of an individual (please see chapter 4: Conceptual and Theoretical Framework). This is also supported by Sen (1981).³ Thus, though these coastal women were now capable enough to face the future challenges of salinity due to various types of training and NGO support (Details are in case analysis, table no. 6.2.1.3.2), they lacked the capacity to implement those training in reality.

² See Agarwal (1998), “Whose share? Who claims?”, p. 245.

³ For detail, see Chapter 4: Conceptual and Theoretical Framework, Sen (1981).

6.1.3 Perception towards Climate Change

The uplands of the eastern, northern and western parts of Bangladesh and the Bay of Bengal in the southern part determine the characteristics of the climate of the country. The low-lying floodplain with fertile soil and large number of rivers and canals regulate the primary economic mode of production (Islam et al., 2010). As a result a large number of people are dependent on natural resources for their livelihood. But these natural resources are highly threatened by the adverse climatic condition which occasionally appears to us as various forms of hazards and thereby putting us into high risk of vulnerability. This section will focus on this climate change-induced threats and uncertainties that the local people perceive in various ways.

Table 6.1.3.1: Perception of Respondents towards Climate Change Impacts

Climatic Shocks	V ₁			V ₂		
	Female (\bar{x})	Male (\bar{x})	Total (\bar{x})	Female (\bar{x})	Male (\bar{x})	Total (\bar{x})
Prolonged rainy season	4.88	4.54	4.71	4.39	4.80	4.60
Increased number of cyclone	4.83	4.83	4.83	4.93	4.71	4.82
Increased number of Flood	3.83	3.89	3.86	3.87	3.57	3.72
Drought	3.1	3.09	3.09	3.64	3.43	3.54
Loss of bio-diversity	2.88	3.89	3.38	3.35	3.37	3.36
Soil erosion	4.86	4.98	4.92	4.77	4.60	4.69
Saline water intrusion	5.0	5.0	5.00	4.83	4.71	4.77

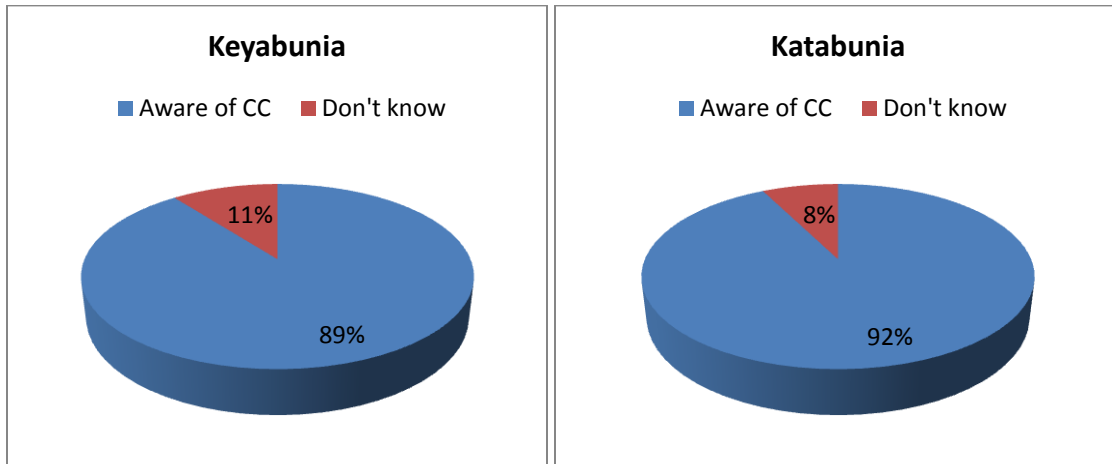
Source: Field Survey, 2014

Notes:

1. V₁=Keyabunia Village, V₂= Katabunia Village
2. It is a multiple response table where total no. of respondents of village1 was 208 and village2 was 110.
3. Mean score has been calculated out of a 5 point ordinal scale where 1=very low, 2= low, 3= average, 4= high and 5= very high.

About 89 to 92 per cent respondents of both villages said that they had heard about climate change.

Figure 6.1.3.1: Percentage Distribution of Respondent by Perception about Climate Change



Source: Field Survey, 2014

They used to perceive different climatic changes not as a human-induced hazard—rather as natural hazard. They did not consider human beings responsible for climatic changes. This fact contrasts with the findings of another study conducted in Indian coastal belt. Most of the respondents of that study perceived climate change due to rapid industrialization by human beings. Not only that, they were more aware of increased temperature, increased diseases, increased sea level rise rather than cyclone, flood, drought, rain etc. (Sarkar and Padaria, 2010). On the other hand, respondents of this study were more concerned about cyclone, flood, drought, soil erosion, soil salinity etc. rather than increased temperature, sea level rise etc. The following table presents mean score of the perception of the respondents of the current study.

Respondents of study areas were asked about their perception towards climate change. It was found that almost 90.5 per cent respondents of both villages were aware of the impact of climate change. They have perceived multidimensional aspects of climatic change. In the table no. 6.1.3.1, it is distinctly evident that both of the villages were confronted with a number of climatic stressors and these stressors were prevalent to a large extent. The table further shows that the mean score for all these climatic stressors is above 4 indicating very high level of the measurement scale except flood and loss of bio-diversity. The mean score for saline water intrusion is 5 in Keyabunia and 4.77 in

In Keyabunia village, cultivation of paddy was almost impossible due to extreme level of salinity whereas in Katabunia paddy had become a one-season crop. Though people are trying to plant some fruit plants by preparing artificial crop bed, it keeps a little contribution to their livelihood. Though the artificial inundation⁴ of water was stopped in Katabunia by the protest of local people, the effect of natural inundation had made all the lands almost unproductive.

In addition to the salinity, people of both villages perceived cyclone as a greater threat as scored 4.93 and 4.71 by female and male respectively in Katabunia (please see table 6.1.3.1). The mean score for cyclone in Keyabunia village is 4.83 for both male and female. Observation says that people were more scared about cyclone than salinity, though salinity had been a great threat to their livelihood. Though people did not consider salinity as a disaster, they acknowledged the fact that agricultural production was no more productive in their locality due to the experience of crop failure years after years.

Flood is another major stressor of both areas as mean score is 3.72 in Katabunia and 3.86 in Keyabunia. People referred flood as a result of precipitation, high tide, storm surge and its consequent sea level rise. In Keyabunia village, sea water entered into their yard once or twice in a day and it went off again due to regular flooding and ebbing. In the Katabunia village, once saline water entered into the lands, it became trapped in some low lands. It stayed over there for a longer period of time until the sun dried it out.

River erosion is a common feature of the Bengal Basin. Tidal force and wave action cause erosion that keeps the coast dynamic (Sarwar and Islam, 2013). Soil erosion is very highly perceived by the people of both villages. But its effect is more acute in Keyabunia (mean score 4.92) than that of Katabunia (mean score 4.69). People of Keyabunia had been the direct victims of soil erosion. Many people have lost their lands, dwelling place etc. due to this. But in Katabunia, soil erosion is highly perceptible beside the sea.

Drought is mostly perceived in dry land regions like Sahel, Africa especially North Africa (Anderson et al., 2012). Droughts are also very frequent in Bangladesh due to its

⁴ Local elite people are the owner of maximum lands of coastal areas. In order to make profit from shrimp farming, they allow saline water to intrude into their non-saline lands through canalizing artificially.

geo-physical position and varying rainfall pattern (Habiba et al., 2013). It is also perceptible in both study areas though the extent is average according to the measurement scale; 3.54 in Katabunia and 3.09 in Keyabunia village. Drought exists in both villages other than the season of monsoon.

On an average 87 per cent respondent of both villages said that they no more observe six seasons in Bangladesh. Three dominating seasons they identified are summer, winter and monsoon. Thus, loss of bio-diversity is another climate change impact that people scored 3.38 in Keyabunia and 3.36 in Katabunia.

Nature of Dependency on Natural Resources

Coastal people are highly dependent on different types of natural resources for their livelihood. People are especially dependent on four types of natural resources. These are agriculture, forestry, water resources and livestock. It is found that people of Keyabunia has a very less dependency on agriculture. Only 4.8 per cent respondents expressed high dependency on it. Due to regular inundation of sea water into the area has made most of the lands unproductive. As a result a very significant number of respondents, almost 65 per cent, reported that they are unable to rely on agricultural productive system. On the other hand, 57 per cent respondents in Katabunia were still dependent on agriculture. In fact, people used to produce paddy in Katabunia during monsoon when sweet water is available on land. They preserve this rain water by raising isles surrounding their lands. They produce paddy in that sweet water. In such way, agriculture contributes to their livelihood a bit.

Table 6.1.3.2: Nature of Dependency on Different Natural Resources

Nature of Dependence	Agriculture		Forestry		Water resources		Livestock	
	V ₁	V ₂	V ₁	V ₂	V ₁	V ₂	V ₁	V ₂
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Heavy dependence	10 (4.80)	63 (57.27)	19 (9.13)	48 (43.63)	176 (84.62)	83 (75.45)	27 (12.98)	68 (61.82)
Partial dependence	61 (29.33)	41 (37.28)	101 (48.56)	46 (41.82)	30 (14.42)	27 (24.55)	163 (78.37)	34 (30.91)
No dependence	137 (65.87)	6 (5.45)	88 (42.31)	16 (14.55)	2 (0.96)	0 (0)	18 (8.65)	8 (7.27)
Total	208 (100)	110 (100)	208 (100)	110 (100)	208 (100)	110 (100)	208 (100)	110 (100)

Source: Survey, 2014

Notes: 1. Village 1=Keyabunia, Village 2= Katabunia

2. Total number of respondents of village 1 is 208 and village 2 is 110.

Respondents of both villages showed high dependence on water resources (fishes, crabs etc.) as almost 85 per cent respondents of Keyabunia and 75 per cent people of Katabunia reported heavy dependence on it. In Keyabunia village, most of the people live on fishing. Thus, these people especially mean different types of fishes by water resources. Among water resources, crabs are very important to people. Two respondents said that they earned even more than one lac taka annually by selling crabs. Most of the respondents of Katabunia (75.45%) also showed high dependence on crabs, fishes etc.

Respondents of Katabunia showed heavy dependence on livestock as 61 per cent respondents reported this as compared to only 12 per cent respondents of Keyabunia. The nature of livestock also varied between two villages. People of Keyabunia had hens, ducks, goats etc. but the people of Katabunia herded animals like cows, goats, pigs, sheep, hens, ducks etc. As most of the people receive such support from NGOs, a very insignificant number of respondents (7.27%) reported 'no dependence' on livestock. Only 7 per cent respondents of Katabunia and 8 per cent respondents of Keyabunia reported 'no dependence'. They said that they were no more dependent on livestock as their animals died for various reasons including diseases, lack of animal fodder, attack of wild animals etc. Many of them sold their animals as their animals were unproductive.

About 49 per cent respondents of Keyabunia said that they were partially dependent on forestry including Sundarban, community forest, agro-forest, homestead forest etc. Due

to lack of homestead forest for soil salinity, they get very less amount of food from it. Almost a closer number i. e. 42 per cent respondent of the same village reported no dependence on it for the same reason. But Sundarban still contributes to their livelihood as a major source of fuel wood. Their husbands cut *golpata* from Sundarban which is a very important source of energy resources for these people.

In Katabunia village almost equal number of people showed high dependence and partial dependence on forestry. Around 44 per cent respondents of this village showed heavy dependence on forestry⁵ followed by another 42 per cent people reporting partial dependence on forestry.

A significant number of respondents, 85 per cent of Keyabunia and 75 per cent of Katabunia, showed heavy dependence on various natural sources of water such as ponds, rivers, rain water etc.

Analysis: From the above-mentioned descriptive data, it is evident that respondents are facing the challenges of a number of climatic stressors including prolonged rainy season, flood, drought, salinity, cyclone, loss of bio-diversity etc. Many of these stressors were also perceived by the study Haque et al. (2012) who also conducted a study in the southern part of Bangladesh. Among these stressors, respondents are more concerned about cyclone which is a rapid onset climatic change. Though the respondents identified salinity as highly perceived in their locality, they are not that much concerned about it as they are about cyclone considering its immediate loss. Thus, rapid onset climate changes create a traumatic feeling among people which does not happen in case of slow on set climatic changes.

As people of these localities are facing a number of climatic stressors; their adaptation capacity is supposed to be complex. They may grow more saline tolerant plants to reduce their vulnerability which may be destroyed by cyclone. Thus, their increasing capacity to respond to a particular stressor might be minimized by another stressor. Thereby, they are always at risk. Pressure and Release model stated that natural hazard is one of the major indicators producing risk. These hazards being multiplied with a number of other social

⁵ Forestry here includes natural forest, community forest, agro-forest and homestead forest.

and political factors, produces risk (for details, please see PAR model in Chapter 4: Conceptual and Theoretical Framework).

Though respondents have been living in an unsafe natural condition confronting with a number of climatic stressors, their dependence on natural resources for their livelihood is very high. People have reduced their dependence on agriculture. People of Keyabunia are more dependent on water resources like catching crabs or fishes, whereas people of Katabunia on forestry and also on livestock. But respondents of both villages informed that they face much difficulty with their livestock due to lack of animal fodder in the locality (For detail, see the Case no. 6.2.1.1.3 of Tripti Mondol in qualitative section 6.2). Few statements of Tripti Mondol are cited here:

She said, 'It was not possible for me to take it to distant grazing fields every day. The goat was probably just stunted and could not live up to its full production potentials. Finally it died due to lack of fodder'.

Despite having much difficulty, herding animals is one of the most important livelihood options especially in Katabunia.

6.1.4 Salinity, Agriculture and Vulnerability

The economy of Bangladesh is largely dependent on agriculture and most of the rural people still make up their livelihood from agriculture related activities (Rahman and Islam, 2013). Assessment of many studies covering a wide range of regions and crops shows that climate change is negatively correlated to crop yields rather than positively (high confidence) (IPCC, 2014). The current study supplements data to all these preceding studies as significant impacts on agriculture have been observed in both study areas due to salinity.

Table 6.1.4.1: Mean Score of the Respondents’ Opinion on Crops/Plants/Trees Affected due to Salinity

Types of crops/plants/trees	V ₁		V ₂	
	N	(\bar{x})	N	(\bar{x})
Paddy	208	4.67	108	4.45
Fruits	206	4.77	104	4.22
Vegetables	208	4.65	108	4.42
Timber	205	3.89	106	3.99

Source: Survey, 2014

Notes:

1. V₁=Keyabunia Village, V₂= Katabunia Village
2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.
3. Mean score has been calculated out of a 5 point ordinal scale where 1=very low, 2= low, 3= average, 4= high and 5= very high.
4. N=Number of respondents responded

Almost all the respondents reported that salinity created severe impact on all sorts of plantation. Among these plantations, paddy, fruits, vegetables and timber trees were mostly affected. Agricultural production especially paddy was highly affected in both areas. The mean score for paddy in Keyabunia is 4.67 and in Katabunia 4.45. Equally affected are vegetables and fruits. The mean score for vegetable is 4.65 in Keyabunia and 4.42 in Katabunia indicating very highly affected in a five point measurement scale. The mean score for fruits is also above 4 meaning very highly affected.

One noticeable thing is that timber trees were less affected both in Katabunia ((\bar{x})=3.99) and in Keyabunia ((\bar{x})=3.89). A very few number of timer trees were still surviving in

those villages as because these trees are saline tolerant by nature. In most of the coastal areas these saline tolerant trees are prevalent.

Table 6.1.4.2: Percentage Distribution and the Mean Score of Respondents' Opinion on the Effects of Salinity on Agricultural Products

Types	Effects	V1			V2		
		N	%	(\bar{x})	N	%	(\bar{x})
Crops/ Plants/ Timber	Reduced cultivable land	195	93.75	5.00	106	96.36	4.84
	Reduced soil quality	197	94.71	4.84	105	95.45	4.70
	Cause the root rotten	186	89.43	4.34	88	80.00	4.38
	Spread of various diseases and retardation of growth	113	54.33	4.31	91	82.73	4.29
	Top dying of paddy	91	43.75	4.38	62	56.36	4.24
	Dropping of premature fruits	91	43.75	3.36	74	67.27	4.18
	Death of all kinds of vegetation	202	97.10	4.67	100	90.90	4.51
	Others	37	17.79	4.81	17	15.45	4.88
Livestock	Less availability of plants /trees for supporting the animal fodder	188	90.38	4.78	91	82.73	4.62
	Less availability of grazing land	180	86.54	4.74	90	81.82	4.56
	Suffering from water-borne diseases	145	69.71	3.52	83	75.45	4.06
Water Resources	Shifting fishing zone	122	58.65	3.61	61	55.45	2.74
	Rapid decline of species grown in water and fish stocks	81	38.94	3.59	69	62.73	2.17
	Others	10	4.81	4.00	2	1.82	2.50

Source: Field Survey, 2014

Notes: 1. V1=Keyabunia Village, V2= Katabunia Village

2. It is a multiple response table where the total number of respondents of Village 1 is 208 and village 2 is 110.

3. Mean score has been calculated out of a 5 point ordinal scale where 1=very low, 2= low, 3= average, 4= high and 5= very high.

4. N=Total number of respondents responded.

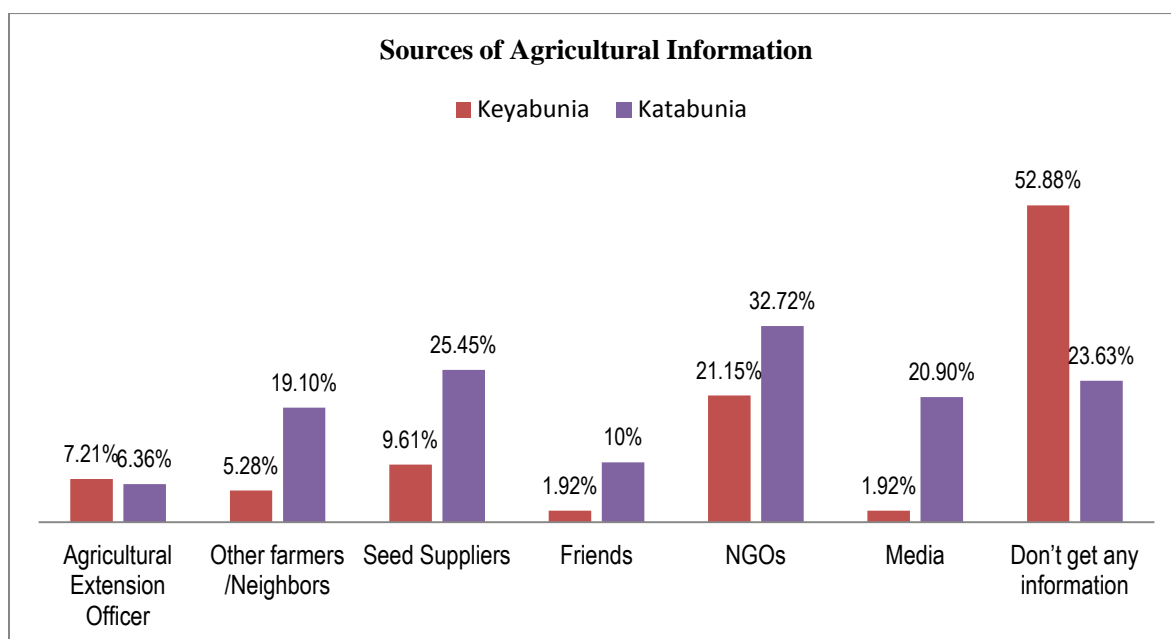
It is evident in the table 6.1.4.2 that salinity had been creating adverse effect on different types of agricultural products. The most remarkable issues are 'reduced cultivable land' and 'reduced top soil fertility'. On an average 95 per cent respondents of both villages highlighted these problems. Soil salinity was not only a result of sea water intrusion, it also happened due to drought as well. During dry season, salt comes up to the top layer of the soil from underground and cause plants to die. About 97 per cent respondents of Keyabunia village followed by 90 per cent in Katabunia reported this. About 83 per cent respondents in Katabunia reported that salt slows down the growth of plants by causing the root rotten. About 89 per cent respondents in Keyabunia followed by 80 per cent respondents in Katabunia reported this problem. In addition, almost 45 per cent respondents in Keyabunia and 56 per cent respondents in Katabunia said that sometimes the top of plants grew reddish and ultimately died out. Among few other problems, around 17 per cent respondents reported that they did not try to grow anything in their locality. A very insignificant number of respondents said that they could not work on salty muds for a long period of time due to skin diseases.

Less availability of plants and trees and less availability of grazing lands are another two major problems identified by the respondents. About 90 per cent respondents of Keyabunia followed by 82 per cent respondents of Katabunia mentioned about unavailability of plants and trees in their locality. Salinity of soil turned the whole areas almost barren. About 86 per cent respondents of Keyabunia followed by 81 per cent of Katabunia reported that they were in the face of great challenges in managing animal fodder due to lack of grazing lands.

Salinity had been a big challenge for water resources. Basically for coastal people, different types of fishes were considered as water resources. They reported that they did not get the amount of fishes that they used to get previously. They predicted that fish stocks either left the place from the shore (on an average 56.5 per cent respondents responded in both areas) or they might be dying out due to construction of embankments or both. Only 4 per cent respondents in Keyabunia and 2.5 per cent respondents in Katabunia reported that they do not find any aquatic resources beside the shore other than fishes and small crabs. It is distinctly evident that mean score for most of these problems

is above 4—indicating the rampant problems in both areas. But people are less aware about shifting fishing zone. The mean score is 3.65 for Keyabunia and 2.74 for Katabunia. They said that they did not find huge number of fishes and crabs near the seashore as before. Due to extreme climate variability, many species of fishes declined from the locality. It is also evident that they have lost their natural habitats due to extreme climate variability.

Figure 6.1.4.1: Percentage Distribution of the Respondents based on their Opinion on Sources of Agricultural Information



Source: Field Survey, 2014

A very insignificant number of respondents (7.2% in Keyabunia and 15.5% in Katabunia) mentioned about GO support and cooperation. About 33 per cent respondents of Katabunia said that they received all sorts of information from NGOs followed by 25 per cent respondents who mentioned about seed suppliers.

In fact, people of Katabunia are still concerned about agricultural production as compared to that of Keyabunia. Agricultural production is still possible in Katabunia whereas in Keyabunia agricultural production became almost unprofitable. Most of the farmers of this village turned into fishermen. That is why about 52 per cent respondents of

Keyabunia village reported that they did not get any information about cultivation as compared to only 24 per cent respondents of Katabunia village.

Analysis: This is clearly evident that crops are highly affected by salinity especially paddy. This is also observed by few other studies (Shamsuddoha and Chowdhury, 2007; Mahmood et al., 2010; Akanda, 2009) also observed the same. Equally affected are vegetable plants and fruit plants. But coconut tree can grow well and can sustain in salty soil. Paddy has become a one seasonal crop now. During the dry season of the year, people need to explore few other livelihood options (See FGD 6.2.2.2.1 of Keyabunia in Qualitative section 6.2). All the participants agreed upon the fact that salinity has destroyed the traditional livelihood option of the coastal people. Most of the lands of these areas are used for commercial Shrimp cultivation which is highly profitable.

Due to the soil salinity, most plants die other than the timber trees. Even timber trees also do not get full nourishment from the salty ground. In the case of Saleha it is distinctly evident.

Saleha wants to contribute her family in other ways. She said, ‘I wanted to grow cucumber on the homestead of my neighbor but failed. The plant grew yellow with the root rotten. Within a very few days they died. I also have a coconut tree beside my house. But the tree is not tall enough and looks very thin and weak. It does not give me any fruit.’

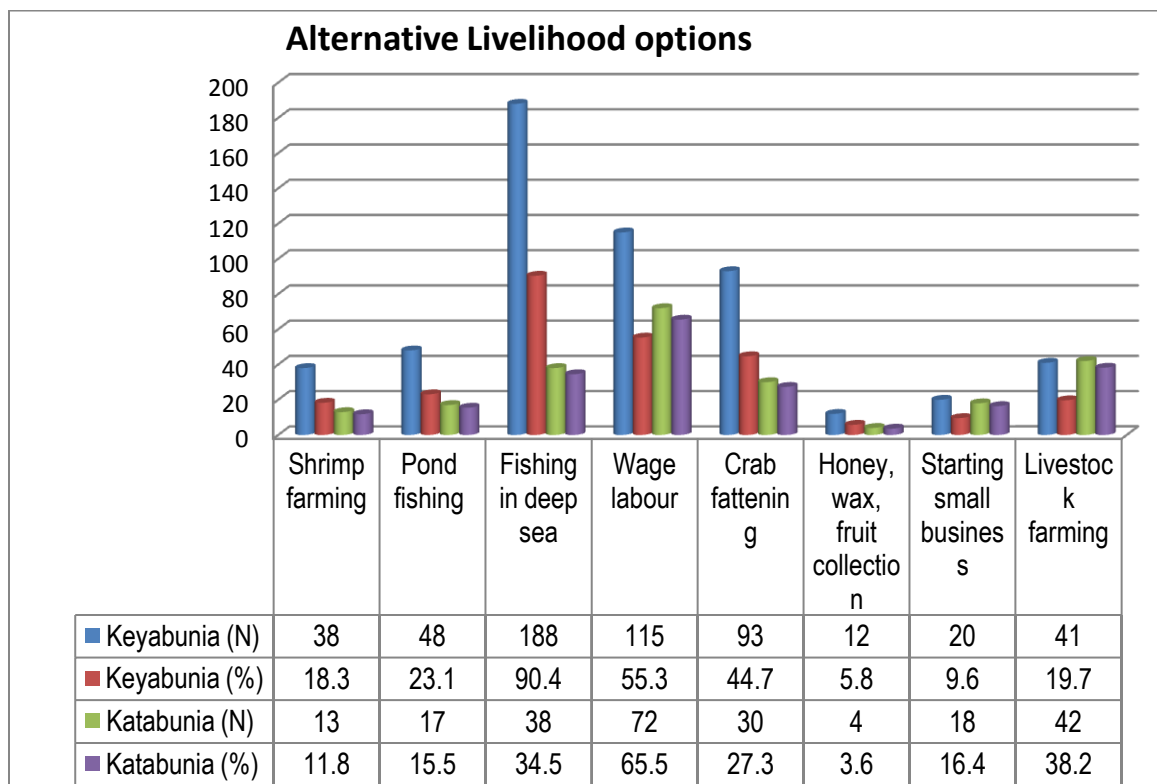
Salinity is also destroying other types of agricultural products like livestock, fisheries etc. But monsoon season is very good for all sorts of production. Plants grow well during this season when sweet water covers the top layer of the soil. Crops/plants get enough nutrients from soil during monsoon.⁶ But to grow crops more scientifically, people need more agricultural information. The support from Agricultural Extension Office is needed more.

⁶ See the case Parvin has planted some potatoes in her very small homestead during last monsoon and became successful.

6.1.5 Alternative Livelihood Options as Means of Adaptation

Coastal people are at the frontline of facing climate change in various forms as already discussed in the preceding chapter. Therefore, they have developed a wide range of coping and adaptation strategies to survive with these climatic shocks. Agriculture, being a means of livelihood in southwest coastal zone of Bangladesh, is highly affected by the recent progression of salinity level in soil. Salinity has caused substantial reduction in food production and affecting coastal rural livelihood adversely. Diversifying livelihood option is a key adaptation measure that helps these rural people to stay alive. This section focuses on various alternative livelihood options that coastal people are involved in and their subsequent problems.

Figure 6.1.5.1: Percentage Distribution of the Respondents based on their Involvement in Various Alternative Livelihood Options



Source: Field Survey, 2014

Note: Total number of respondents of Village 1 is 208 and village 2 is 110.

People of both villages are involved in multiple occupations due to limitations of agricultural production caused by the salinity. There is a significant difference between two villages. In Keyabunia fishing in deep sea is a very common alternative occupation as more than 90 per cent respondents reported. People who are used to go for fishing in deep sea, many of them were also involved in crab fattening (44.7%). This village is not that much far away from the upazilla. Thus, many of them (55%) do work in different development projects run by GOs and NGOs.

On the other hand, people of Katabunia are basically wage earner as around 66 per cent respondents reported this. They work in various development projects. Especially they work in embankment development or repair. They are also involved in earthwork. Rest of the respondents, i. e. 34 per cent, goes for fishing into the deep sea. Almost an equal number of respondents (41 in Keyabunia and 42 in Katabunia) reported that they are to large extent dependent on livestock farming. But the percentage is very high in case of Katabunia (38%) as compared to Keyabunia (only 19.7%).

A very insignificant number of people are collectors as only 5 per cent respondents reported in Keyabunia and 4 per cent in Katabunia. In fact those who go for fishing in sea, are all directly or indirectly collectors. At least they collect leaves, branches of trees etc. to use them as fuel wood. But respondents did not consider it as their main livelihood option rather it was a sort of supplementary income to their household.

Shrimp cultivation is relatively prominent in Keyabunia village than that of Katabunia village. As a result only 11 per cent respondents in Katabunia reported to remain involved in Shrimp cultivation as compared to 18 per cent in Keyabunia. Though Shrimp cultivation was still dominant in Keyabunia, very less number of respondents reported to remain involved in it—as this sort of farming required only one farmer for one or two bihgas of lands.

Table 6.1.5.1: Percentage Distribution of the Respondents' Opinion on the Problems Related to Alternative Livelihood Options

Problems related to	Problems	V1		V2	
		N	%	N	%
Shrimp cultivation	Destruction of cultivable land	126	60.6	71	64.5
	Pollution of pond water	140	67.3	28	25.5
	A few number of farmers needed	169	81.3	15	13.6
	Land use conflicts	34	16.3	22	20
	Exploitation by large land holders	18	8.7	16	14.5
Livestock	Decline of grazing lands	196	94.2	63	57.3
	Inadequate space in livestock shed	147	70.7	50	45.5
	Less availability of grazing lands and animal fodder	141	67.8	57	51.8
	Attacked by wild animals	13	6.3	13	11.8
	Death of livestock due to various diseases	44	21.2	36	32.7
Labor market	Lack of job opportunity	132	63.5	76	69.1
	Poor wage and salary	116	55.8	71	64.5
	Long distance	107	51.4	100	90.9
	Not getting wage on time	91	43.8	54	59.1
	Sexual Harassment by the employer	9	4.3	12	10.9
Problem as a collector	Less availability of plants, herbs, shrub and trees near the shore	146	70.2	76	69.1
	Attack of wild animals	49	23.6	98	89.0

Source: Field Survey, 2014

Notes: 1. V1=Keyabunia Village, V2= Katabunia Village

2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.

3. N=Number of respondents responded

The table 6.1.5.1 shows that cultivable lands of both villages are highly affected by Shrimp cultivation as more than 60 per cent respondents reported this. This Shrimp cultivation also affected local ponds in Keyabunia village. Sometimes land owners channelize salt water through ponds to their farm lands which makes pond water unusable. Shrimp cultivation is also responsible for unemployment in Keyabunia. As this sort of farming requires a single farmer for a big farm consisting of 2 bighas (1 bigha=33 decimals) of lands, most farmers regret for not being hired by land owners. On the

contrary, in Katabunia village people recently stopped doing shrimp cultivation though it destroyed most of their lands by that time.

Farmers of both villages are less concerned about land use conflicts that happen between land owners. Only 16.2 per cent respondents in Keyabunia and 20 per cent people in Katabunia were concerned about this. Even farmers were also less concerned about the exploitation by the land owners as only 8.7 per cent respondents of Keyabunia and 14.5 per cent respondents of Katabunia reported this.

Respondents of Keyabunia and Katabunia village faced lots of trouble regarding their livestock. Lack of grazing land was one of the major problems reported by almost 95 per cent respondents of Keyabunia village. The same problem, reported by around 58 per cent, existed in Katabunia village but not to that extent. Again problem related to the dwelling place of cows, goats, sheep etc. was also very distinct in Keyabunia village reported by more than 70 per cent respondents than that of Katabunia only 45.5 per cent respondents responded this. The respondents informed that animals usually died out due to lack of fodder or malnutrition. They could not afford sufficient amount of food for them due to lack of homestead plantation as 68 per cent respondents reported in Keyabunia followed by 52 per cent in Katabunia. They also lose their livestock due to spread of various diseases or by the attack of wild animals. About 6.3 per cent respondents of Keyabunia and around 12 per cent respondents in Katabunia showed their concerns about the attack of wild animals on their livestock. But it was observed that people of Keyabunia were undoubtedly facing more troubles related to their livestock than that of Katabunia.

Respondents said that they face many problems in the labor market. The most importantly is lack of job opportunities. People of both villages are involved in multiple occupations. They remain attached to labor market for a particular season only. About 70% respondents in Katabunia reported that they did not have the guarantee of getting any work regularly. In every month on an average 5-7 days they go without any work. Same problem is seen in Keyabunia village. They had been also dissatisfied with the wage. They said that it was very tough for them to save anything from the wage. They live from hand to mouth. They earn 100-150 taka per day which is not enough to meet

their daily demands as 66 per cent respondents in Katabunia and 58 per cent respondents in Keyabunia reported this. In addition to these problems, poor communication system has made the area far away from the main land. Katabunia village is 7-8 miles away from pankhali union but it takes almost 3 hours to reach there. Thus, a laborer needs to keep much time in his hand to be the first person in the labor market. As a result long distance has been identified as one of the major problems by more than 90 per cent respondents in Katabunia. Keyabunia village is 6 miles away from the town. The roads are so narrow that only bi-cycle or motor cycle can run rover there. As a result the same problem was also identified by the 50 per cent respondents of Keyabunia village. Rest of the people stays in the mouth of the village which is 3-4 miles away, thereby, producing fewer communication problems for them.

A very insignificant number of women are involved in labor market in both villages. Therefore, sexual harassment is less prevalent there. Only 4.3 per cent respondents in Keyabunia followed by around 12 per cent in Katabunia reported this.

The problems for the collectors are also obvious in Sundarban. Almost 90 per cent respondents reported the attack of wild animals. People mentioned that one person lost his life during the survey period by the attack of tigers in Sundarban. People of Katabunia therefore are more concerned about this issue irrespective of male and female. Those who go to Sundarban are worried about their own lives and their wives remain worried back at home. On the other hand people of Keyabunia were less concerned about it as only 23 per cent respondents reported this. But respondents of both areas admitted that the collecting as an occupation is very risky at present due to less availability of tress near the shore. Thereby they need to go to deep into the jungle for collecting honey, wax etc. which is very risky for them. Almost 70 per cent respondents of both villages reported this problem.

Analysis: Salinity problem has become so prevalent in both the study areas that people are now leaving their traditional livelihood option, agricultural farming and rather becoming involved in a number of other challenging occupations. Few other studies also found this (Ahmed, 2008; Olmos, 2001). In Keyabunia, most of the male respondents are involved in fishing in deep sea, catching crabs from sundarban, collecting honey, wax, wood from nearest mangrove forest. Herding animals is not popular in this village due to acute crisis of fodder. Rabbani (2009) found zero rice production the four villages of south west coastal zone.⁷ Consequently animals also suffer due to lack of plants and leaves in the area. On the other hand, many respondents received livestock after Ayla from different NGOs. Therefore, herding animal is found there as more common among the respondents. Other than this, most of the male respondents go to nearby mangrove forests for collecting different forestry products. But this is very risky due to the attack of wild animals as one participant of FGD said that one of his neighbors was killed by tiger in Sundarban (see FGD no. 6.2.2.1.2).

Female respondents are also involved in a number of activities. In Keyabunia village women are also involved in fishing. But in Katabunia, women are involved in making few useful products such as making charo, a tool for catching fish. They also need to work as collectors which ultimately force them to give up their traditional Purdah (Nasreen, 2012).

Thus, the study showed in its conceptual framework that more number of IGAs should be created for both men and women so that they can get a sustainable livelihood option and can stay safe.⁸

⁷ Rabbani (2009) found zero rice production the four villages of Shymnagar Upazilla where rice crops (Aman) declined from average 2.9 tons/ha in 2008 to “0” ton/ha in 2009 due to high salinity in the rice fields.

⁸ Conceptual framework of the study is given in chapter 4.

6.1.6 Salinity, Food Insecurity and Vulnerability

Several studies have identified several causes of food insecurity of people. FAO (2010) mentioned that when people do not have adequate physical, social or economic access to food, food insecurity exists. Lack of purchasing power, lack of cultivated land, inadequate asset-base, and lack of access to credit facilities for consumption were considered as the major obstacles to food security by Mallick and Rafi (2010). Ala and Bello (2010) also mentioned about lack of credit facilities. But all these causes are justifiable when food is available in the market. The current study finds that salinity has affected the food production process in the coastal belt so adversely that farmers have switched to different alternative livelihood options. Thus, foods which are available in market, a larger share of that are not locally produced. As a result, the price goes higher and beyond the purchasing capability of people. This section highlights the major causes of food insecurity and food consumption pattern of south-west coastal people of Mongla and Dacope.

Table 6.1.6.1: Percentage Distribution of Respondents' Experience of Nature of Food Insecurity

Nature of Food Insecurity	V1	V2
Less availability of food	42 (22.6%)	43 (39.1%)
Lack of purchasing capability	196 (94.2%)	69 (62.7%)
Future uncertainty	155 (74.5%)	94 (85.5%)

Source: Field Survey, 2014

Notes:

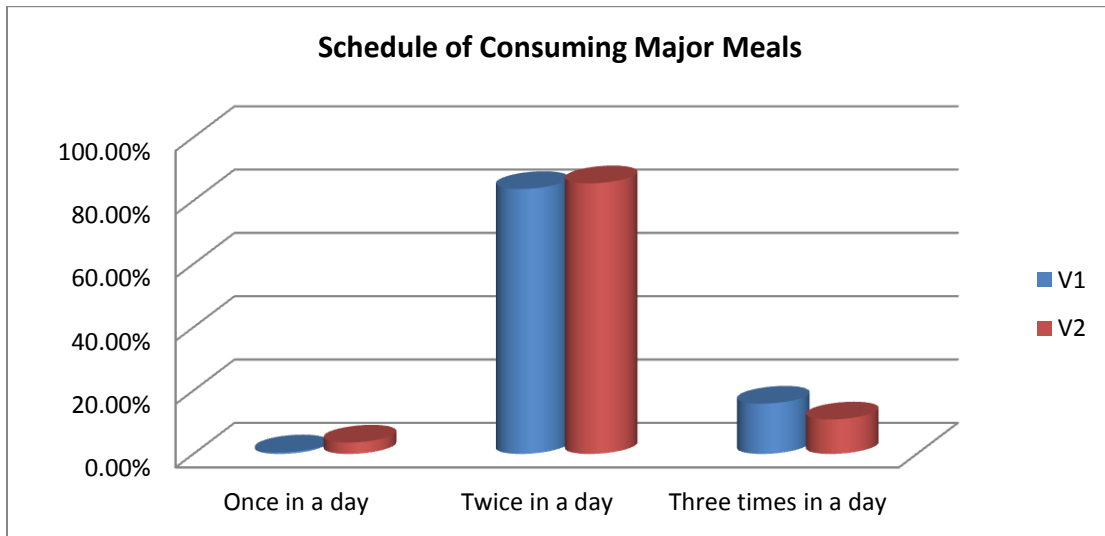
1. V1=Keyabunia Village, V2= Katabunia Village

2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.

All the respondents of Keyabunia and Katabunia villages reported that they did not have food security. They lived from hand to mouth. They did not have any assurance of getting food next day. Almost 75 per cent respondents of Keyabunia and around 86 per cent respondents of Katabunia said that they remained worried all the time for the next day. About 94 per cent respondents of Keyabunia reported that they did not have purchasing capability. The same was reported by 63 per cent respondents of Katabunia. Though 23 per cent respondents of Keyabunia followed by 39 per cent respondents believed that less

availability of food was there in the market due to less production for the salinity; the rest of them opined differently. They said that food had been available in the market but they did not have purchasing capability.

Figure 6.1.6.1: Percentage Distribution of Respondents’ Schedules of Consuming Major Meals

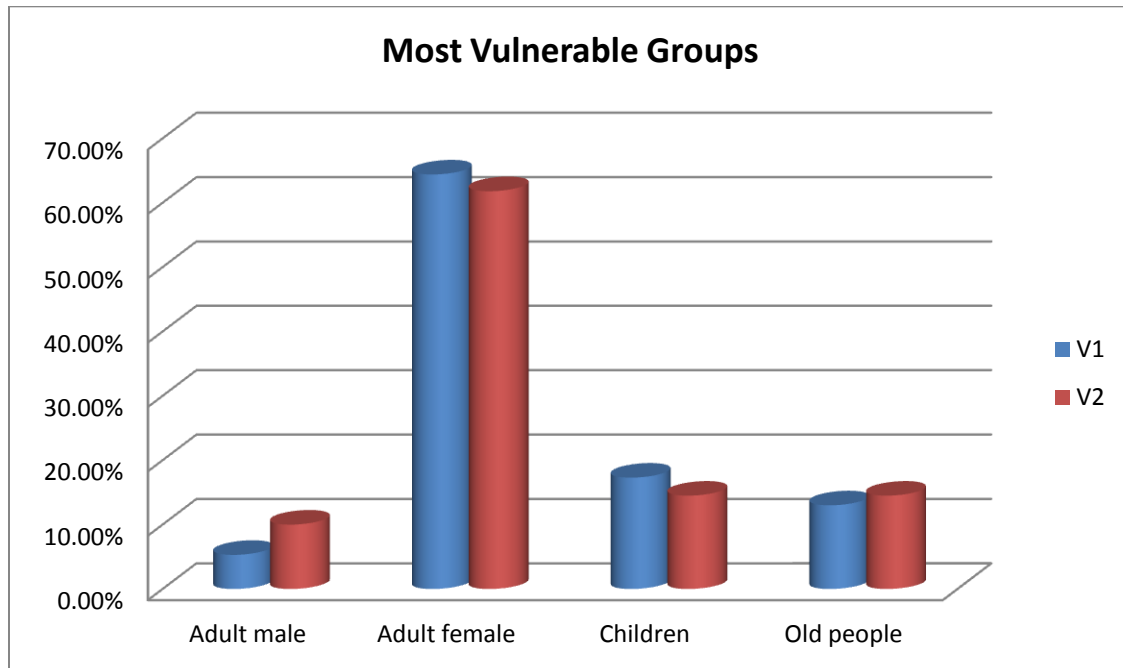


Source: Survey, 2014

Notes: 1. V1=Keyabunia Village, V2= Katabunia Village

More than 80 per cent respondents of both areas took their major meals twice in a day. Around 20 per cent respondents of Keyabunia followed by 11 per cent respondents of Katabunia ate three times a day. They said that though they took meal three times a day, they did not get balanced diet. A very insignificant amount reported that they took food only once in a day. Widow and abandoned women basically belonged to this group.

Figure 6.1.6.2: Percentage Distribution of Respondents' Opinion about Most Vulnerable Group in terms of Food Insecurity



Source: Survey, 2014

Notes: V1= Keyabunia and V2= Katabunia

It is an established fact that women and children most badly affected by disasters (Dasgupta et al., 2010). In the current study respondents were asked to identify the most vulnerable groups in terms of food insecurity because of salinity. It was found that more than 60 per cent respondents of both villages reported that adult females were highly insecure in terms of food. Female members of the households were in charge of food distribution. They gave priority to other members while distributing foods. Females were the last food consumers of a household. If the amount of food was less, they sometimes needed to starve even. On the other hand, only 5 per cent respondents of Keyabunia and 10 per cent respondents of Katabunia said that adult males were food insecure. It means that adult males got the priority in food distribution as their wives gave highest priority to them in food distribution because they worked hard and earned money. If they became sick, the whole family would have to starve. The data shows that children and old members of the household got almost equal priority in Katabunia village. In Keyabunia village, the disparity between children and old people is very insignificant.

Table 6.1.6.2: Percentage Distribution of Respondents' Opinion on Causes of Food Insecurity

	Causes of Food Insecurity	V1	V2
Unsafe climatic condition	Crop failure due to salinity of water	168 (80.8%)	89 (80.9%)
	Loss of livestock due to extreme weather events	86 (41.3%)	47 (42.7%)
	Saline Water stagnation	124 (59.6%)	60 (54.5%)
	Unpredictable/ erratic rainfall	89 (42.8%)	56 (50.9%)
Dynamic pressure	Lack of skill	77 (37.0%)	40 (36.4%)
	Unemployment	121 (58.2%)	69 (62.7%)
	Gender discrimination in wage in local labor market	17 (8.2%)	30 (27.3%)
	Large size of the family	40 (19.2%)	28 (25.5%)
	Lack of grants, loans etc.	119 (57.2%)	55 (50.0%)
	More busy in the household chores	25 (12.0%)	24 (21.8%)
	Traditional Purdah system	8 (3.8%)	12 (10.9%)
Root causes	High price of food	191 (91.8%)	96 (87.3%)
	Exploitation by large land owners	20 (9.6%)	22 (20.0%)
	Landlessness	189 (90.8%)	96 (87.3%)

Source: Survey, 2014

Notes: 1. V1=Keyabunia Village, V2= Katabunia Village

2. It is a multiple response table where the total number of respondents of Village 1 is 208 and village 2 is 110.

Respondents identified major causes of their food insecurity. They said that they were vulnerable due to their unsafe natural conditions. They said that they stayed in such a location which was highly susceptible to any sort of natural calamity. They also said that they were basically the first victims of any sort of natural calamity because of their unsafe geographical location. They lost their assets and crops insatantly by cyclones and storms. But they reported that salinity had indirectly affected their agricultural production and put them into the starvation. More than 80 per cent respondents of both villages reported salinity as one of the major causes of their food insecurity. Saline water entered the village during regular flooding and ebbing. There were few places where water could

not go away once it entered. Thus water remained stagnant over there and made the land unproductive. Water stagnation was another common problem of both areas as 60 per cent respondents of Keyabunia and 55 per cent respondents of Katabunia reported this. Respondents were to some extent dependent on their livestock for food. People who were dependent on livestock become food insecure if they lost their livestock for any reason as on an average, 41 per cent respondents of both areas reported this. People of Katabunia were still dependent on agriculture. This agricultural production had been again dependent on rainfall. Thus when rainfall became unpredictable, their production delayed and thereby, increased food insecurity. Almost 50 per cent respondents of Katabunia reported unpredictable rainfall as another important cause of their food insecurity.

These climatic events being multiplied by few other dynamic forces put them into severe crisis. Respondents said that they needed work as they had lost their traditional livelihood option. But there is a crisis of jobs in the job market as 63 per cent respondents of Katabunia and 58 per cent respondents of Keyabunia reported. On an average, 36.7 per cent respondents of both villages said that they were not taken in all sorts of works due to their lack of skills. Gender discrimination in the labor market was not significantly reported by the respondents (only 8%) of Keyabunia. Though almost 28 per cent respondents reported this, they reported based on their experience. In fact, women of both villages did not have experience of working in the wage labor market. Thereby, they were not aware of gender discrimination in this sector. Few other factors were identified by the respondents contributing to a little extent to their food insecurity. These were—large family size, remaining busy with the household activities etc. Respondents complained that they became the victims of Sidr, Ayla etc. but they had not received any grants from any organization. About 57 per cent respondents of Keyabunia and 55 per cent respondents of Katabunia said that they could compensate their damage and loss if they would get some sort of grants or loans from any organization.

Respondents said that they had very limited income. The price of the food was too high to buy. Almost 91 per cent respondents of Keyabunia followed by 87 per cent respondents of Katabunia reported this. Almost a similar percentage reported that their landlessness was highly responsible for their food insecurity. Exploitation of land owners was not significant as only 10 per cent respondents of Keyabunia and 20 per cent

respondents in Katabunia reported this. In fact, people were not conscious of their rights. Thereby they could not understand when their rights were unprotected.

Table 6.1.6.3: Percentage Distribution of Respondents by their Involvement in Food Processing, Cooking and Distribution

Involvement in Food Processing, Cooking and Distribution		V ₁		V ₂	
		Male	Female	Male	Female
Food Processing	Collection of forest products	39 (44.3%)	30 (25.5%)	30 (85.7%)	17 (22.7%)
	Producing food	39 (44.43%)	29 (24.2%)	19 (54.3%)	33 (44.0%)
	Purchasing food	88 (100%)	48 (40.0%)	30 (85.7%)	28 (37.3%)
Food Cooking	Cooking food	10 (11.4%)	120 (100%)	5 (14.3%)	75 (100%)
	Collection of pure drinking water	44 (50.0%)	120 (100%)	5 (14.3%)	75 (100%)
	Collection of fire wood	55 (62.5%)	120 (100%)	19 (54.3%)	75 (100%)
	Chopping tree	70 (79.5%)	16 (13.3%)	9 (25.7%)	9 (12.0%)
Food Distribution	Ensuring food for all	70 (79.5%)	98 (81.6%)	28 (80.0%)	35 (46.7%)
	Ensuring pure drinking water	19 (21.6%)	120 (100%)	10 (28.6%)	75 (100%)

Source: Survey, 2014

Notes:

1. V₁=Keyabunia Village, V₂= Katabunia Village
2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.

Men and women were differently involved in food processing, cooking and distribution process. Around 85 per cent men of Katabunia village were involved in collection of forest products followed by 45 per cent men of Keyabunia. In fact, most of the men of Keyabunia were fishermen. Thus collecting forest product was not their main concern. Few numbers of women went to Jongla (a small jungle near their village) as they called it for collecting fruits, leaves, wood etc. Men were not involved in food production as agriculture no more dominated in these areas. About 54 per cent respondents were involved in food production in Katabunia village followed by 44 per cent men of Keyabunia village. Men and women of Katabunia were comparatively a little bit more involved in food production as compared to men and women of Keyabunia. About 44 per cent women of Katabunia, compared to only 24 per cent women of Keyabunia, were involved in food production. Women were basically involved in homestead plantation.

Men still produced paddy commercially in Katabunia. But like women, men in Keyabunia were involved in homestead plantation by producing artificial beds for production.

Men were not at all involved in food cooking as 100 per cent women of both villages reported this. On the other hand, chopping tree log had been a work of men as 80 per cent men of Keyabunia reported this. In fact, men of Keyabunia cut *golpata* and leaves of *baula* trees in the Sundarbans. They carried it to their village by boats. Men of Katabunia were less involved in it. Women of Katabunia managed firewood by themselves. They cut thin and narrow tree branches and processed it to fire wood. They used *nara* (agricultural residues) as energy resources. As 50 per cent people of Katabunia had livestock, they processed cow dung and used them as energy resources. Though men cooperated with women, 100 per cent women in both villages were involved in the collection of fire wood as they believed that managing fuel wood, ensuring pure drinking water and food for all the members of the household were their sole responsibilities. About 80 per cent men of Katabunia followed by 79 per cent men of Keyabunia believed that ensuring food for family members was their lone responsibility. But a very few number of men were involved in collection of pure drinking water. In Keyabunia 22 per cent men were involved in collection of drinking water. They brought pure water from the town by boats.

Table 6.1.6.4: percentage Distribution of Respondents based on Their Food Consumption Pattern

Types of Food	Village	Gender	Before Salinity (times per week)									After Salinity (times per week)										
			0	1	2	3	4	5	6	14	21	0	1	2	3	4	5	6	14	21		
Rice	V ₁	M										100%										100%
		F										100%										100%
	V ₂	M										100%										100%
		F										100%										100%
Wheat	V ₁	M	100%										98%	2%								
		F	100%										100%									
	V ₂	M	100%										100%									
		F	100%										100%									
Meat	V ₁	M			64.8%	35.2%							96.5%	3.5%								
		F		47.5%	52.5%								100%									
	V ₂	M			80%	20%							100%									
		F		82.6%	17.4%								100%									
Vegetables	V ₁	M										100%										100%
		F										100%										100%
	V ₂	M										100%										100%
		F										100%										100%

Egg	V ₁	M				27.3%	25.0%	47.7%				6.8%	44.3%	48.9%							
		F					29.2%	33.3%	37.5%				3.3%	50.8%	45.8%						
	V ₂	M				11.4%	40%	14.2%	34%					5.8%		94.2%					
		F				12%	22.6%	46.6%	20%					4%	46.6%	49.3%					
Milk	V ₁	M				6.8%	45.5%	13.6%	34.1%		1.1%	64.8%	35.2%								
		F				4.2%	35.0%	8.3%	52.5%			63.3%	0.8%	4.2%							
	V ₂	M			5.8%	25.7%	14.2%	54.2%				34.2%	42.8%	22.8%							
		F				4%	50.6%	10.6%	34.6%			24%	48%	28%							
Fruits	V ₁	M			3.4%	94.3%	2.2%					51.1%	54.5%	14.7%							
		F		97.4%	2.6%							100%									
	V ₂	M			68.5%	31.4%							100%								
		F			100%								100%								
Fish	V ₁	M				3.4%	94.3%	1.1%	1.1%					97.7%	2.3%						
		F					3.3%	95.8%	0.8%					99.2%	0.8%						
	V ₂	M			53%	54.2%							42.8%	57%							
		F		45	40%									100%							

Source: Survey, 2014

Notes: 1. V1=Keyabunia Village, V2= Katabunia Village

2. It is a multiple response table where the total number of respondents of Village 1 is 208 and village 2 is 110.

Respondents were asked about their weekly food intake status.⁹ Almost all the respondents of both villages said that before salinity in 1990 they had no crisis of food. They would take their major meals three times in a day. As a major meal, they used to take rice, not wheat. After salinity, they take their major meals twice in a day. Thus, they were now consuming rice 14 times rather than 21 times weekly.

About 80 per cent male respondents of Keyabunia village and 64 per cent male respondents of Katabunia reported that before salinity, they could afford meat at least twice a week. A significant number of female respondents (82%) of Katabunia village said that they could manage meat at least once in a week. But most noticeable thing is that, respondents of both villages irrespective of men and women could not afford meat at all due to high price.

As Keyabunia is a fishing community, more than 95 per cent respondents said that they took fish at least twice in a week—though before salinity they used to take 3 times or 4 times in a week. On the contrary, people of Katabunia, the herding community, could afford milk for their children more than that of Keyabunia people. About 28 per cent female respondents of Katabunia reported that they could afford milk twice in a week for their children as compared to only 4 per cent female respondents of Keyabunia.

Vegetable had been a common food item to all the respondents of both villages. As 100 per cent respondents of both villages said that they took vegetables 14 times weekly. In their every major meal, gourd, potato, different types of leaves called *shak*, ladies finger (dherosh), chilli *vorta*, stem of water lily, leaves of cucumber etc. were common. Egg had also been a very common item in almost every day food menu. Egg still played a dominating role in food menu.

About 94 per cent male respondents of Katabunia village said that if they could not manage any other food item, they take egg fry. Though 49 per cent female respondents of this village reported that they took egg twice a week, they basically referred to their kids. In fact they afforded eggs for their children.

⁹ It is to be noted that the information that women gave is about their household, not solely about themselves.

Few common fruits of coastal areas were coconut, guava, banana, apricot etc. About 94 per cent respondents of Keyabunia village said that they used to take such sort of fruits at least twice in a week. About 54 per cent male respondents said that they took fruits like coconut. People, who had coconut trees, picked coconuts. But women did not consume fruits at all. If women found any ripe guava or apricot, they kept it for their children.

Table 6.1.6.5: Daily Calorie Intake Status of the Respondents

Staple Food	Amount in gram/ml	Energy in Kilocalorie
Rice	320g	416
Potato	100g	93
Gourd	100g	20
Spinach	100g	23
Palm Oil	100ml	862
Total		1,414

Source: Sources: Developed by the Researcher based on primary sources of data and with the help of a nutritionist.

The results from the interviews and focus group discussion show that rice was the main staple food of the livelihood zone. Fruits, milk, egg were not daily taken by the respondents as they could not afford these foods regularly. Vegetables were far more popular and more available in the markets. Vegetables like unripened banana, different types of leaves like spinach, *kolmi shak*, *lal shak* etc. and gourd were the main vegetables consumed by the respondents. Animal products such as chicken eggs and small, fresh fishes were also reported to be consumed, though not daily. Respondents reported that they took fishes like tilapia, small hilsha, curru etc. once or twice in a week. But they reported that they could not afford meat even once in a month. The above table is developed on the basis of their daily staple food intake. Recommended daily calorie intakes vary across the world. According Statistical Yearbook of Bangladesh, each poor person must ensure a minimum of 2122 kilo calories of food (BBS, 2012). But it is found that the average calorie intake by a coastal man or a woman is only 1414 kilocalorie

which is much less than the average bodily requirement. If the food intake status includes 50g fishes like tilapia (48 kilocalorie) and one egg (74 kilocalorie), average calorie intake per capita would be 1,541 kilocalorie, though that still does not meet the average requirement of human body.

Table 6.1.6.6: Sources of Water Before and After Salinity

Sources of Water Resources	V ₁		V ₂	
	Before Salinity (1990)	After Salinity (2014)	Before Salinity (1990)	After Salinity (2014)
River	88 (42.3%)	22 (10.6%)	25 (22.7%)	13 (11.8%)
Pond	133 (63.9%)	49 (23.6%)	74 (67.3%)	61 (55.5%)
Tube well	38 (18.3%)	147 (70.7%)	74 (67.3%)	103 (93.6%)
Rain	120 (57.7%)	162 (77.9%)	22 (20.0%)	61 (55.5%)
Pipe line	5 (2.4%)	145 (69.7%)	0 (0%)	0 (0%)

Source: Survey, 2014

Notes:

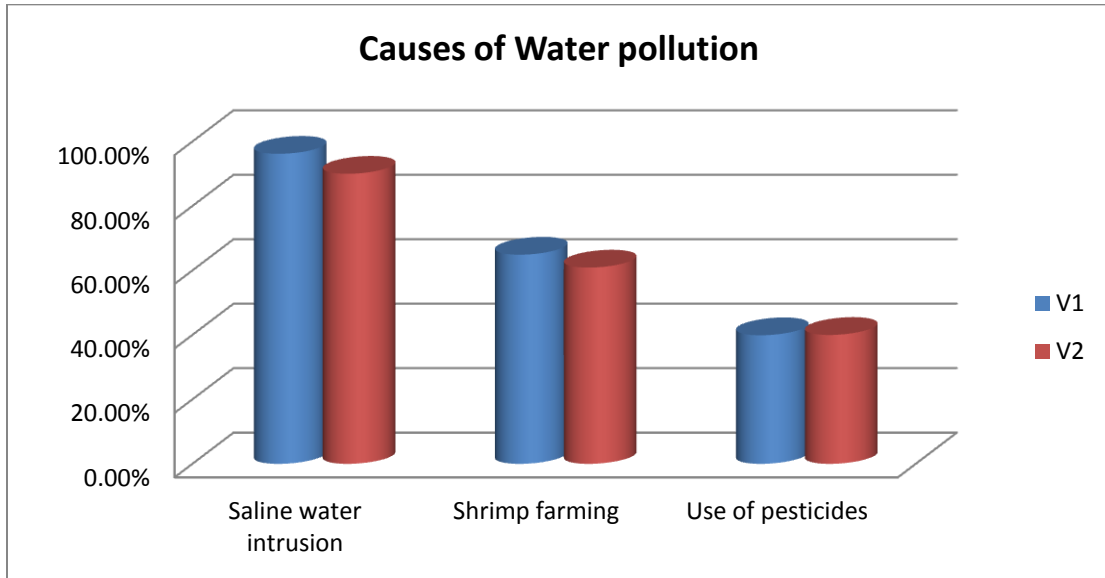
1. V₁=Keyabunia Village, V₂= Katabunia Village
2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.

The table 6.1.6.6 describes the sources of water of Village 1 and Village 2 both before and after the salinity. In Keyabunia, it was found that the people used to use river (42.3%) and pond water (63.9%) in 1990s as these sources were not that much affected by the salinity at that time. Gradually ponds and rivers became affected by salinity. The extent of salinity is so high that the use of these sources of water has drastically declined. People are now highly dependent on tube well water, rain water and pipe line water. Rain as a source of water is important in every period of time. But about 70 per cent people currently use pipe line water which was only 2.4 per cent in 1990s.

In Katabunia almost same scenario was found. Pond used to serve as a major source of pure drinking water in this village 2 in 1990s as 67.3 per cent people reported this. River also served as another important source of water. But now almost 94 per cent respondents used tube well water for drinking. Rain water harvesting had been a common practice in this village too. More than 50 per cent people considered rain water as a very important source of water. However, in this village, pipe line water supply was not available. As

this village was almost 7 km away from the Upazilla, these people were highly dependent on different natural sources of water and on tube wells established by their own fund.

Figure 6.1.6.3: Percentage Distribution of Respondents’ Opinion on Causes of Water Pollution



Source: Survey, 2014

Notes: 1. V1=Keyabunia Village, V2= Katabunia Village

Due to sea level rise, sea water started entering all coastal zones of Bangladesh. This sea water had been gradually affecting all natural sources of water. Water of natural sources like pond, river, and canal became unusable due to salinity as more than 90 per cent people reported in both villages. Local elites started shrimp cultivation in saline water. Around 40 per cent people said that different types of pesticides were used on land for better production. These pesticides, being washed away into nearest water sources, polluted them.

Table 6.1.6.7: Percentage Distribution of Respondents' by Sources of Energy Resources

Sources of Energy Resources	V ₁		V ₂	
	Before Salinity	After Salinity	Before Salinity	After Salinity
Using homestead plantation	106 (51.0%)	55 (26.4%)	55 (50%)	25 (22.7%)
Forestry	77 (37%)	142 (68.3%)	45 (40.9%)	70 (63.6%)
Cutting down trees and branches	64 (30.8%)	48 (23.1%)	20 (18.2%)	25 (22.7%)
Collecting Golpata	26 (12.5%)	188 (90.4%)	17 (15.5%)	93 (84.5%)
Using cow-dung	78 (37.5%)	60 (28.8%)	69 (62.7%)	82 (74.5%)
Agricultural residue	36 (17.3%)	19 (9.1%)	73 (66.4%)	39 (35.5%)
Buying fuel wood	0 (0%)	141 (67.8%)	0 (0%)	11 (10.0%)

Source: Survey, 2014

Notes:

1. V₁=Keyabunia Village, V₂= Katabunia Village

2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.

The table 6.1.6.7 displays a comparative analysis of fuel wood consumption pattern in different time periods. The table shows that there was a significant difference between the energy consumption pattern of 1990 and 2014. In 1990, more than 50 per cent people used to use homestead plantation which had significantly declined at present due to less production of plants and trees. The usage of *golpata* as fuel wood was very less in 1990 as only 12.5 per cent people of Keyabunia village and 15.5 per cent people of Katabunia village reported this. Currently 90.4 per cent respondents in Keyabunia and 84.5 per cent in Katabunia used *golpata* as one of the major energy resources. As people of Katabunia still produced paddy once in a year, 35.5 per cent respondents mentioned about agricultural residue as a source of energy resources. More so, many people in Katabunia had cows which they got from NGOs. Thus cow-dung contributed a lot to them as a source of energy resources. About 75 per cent respondents of Katabunia used cow-dung as compared to only 29 per cent respondents of Keyabunia. One noticeable thing is that, a significant number of people (67.8%) needed to buy fuel wood in Keyabunia village though people of Katabunia still depended on nature.

Table 6.1.6.8: Percentage Distribution of Respondents' Opinion on Total Amount of time in Collecting Pure Drinking Water

Total Time	V ₁		V ₂	
	Before Salinity	After Salinity	Before Salinity	After Salinity
Less than 1 hour	128 (61.5%)	9 (4.3%)	85 (77.3%)	6 (5.4%)
1 hour	78 (37.5%)	41 (19.7%)	24 (21.8%)	24 (21.8%)
2 hours	2 (0.9%)	1 (0.5%)	1 (0.9%)	80 (72.7%)
3 hours	0 (0%)	156 (75%)	0 (0%)	0 (0%)
More than 3 hours	0 (0%)	1 (0.5%)	0 (0%)	0 (0%)

Source: Survey, 2014

Notes:

1. V₁=Keyabunia Village, V₂= Katabunia Village

2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.

The table 6.1.6.8 shows the total amount of time required to collect drinking water. It is found that before salinity in 1990, a significant number of people used to collect water from nearest sources that would take even less than one hour. About 62 per cent respondents of Keyabunia village and 77 per cent respondents of Katabunia village reported this. But after salinity in 2014, the situation had worsened a lot. Now about 73 per cent respondents of Katabunia village said that it took almost two hours in collecting pure drinking water. Almost a similar number of people (75%) of Keyabunia village reported that it took 3 hours to collect water because they needed to go to main town by covering a total distance of 6 km. About 22 per cent in Katabunia village reported that it took just one hour both before and after salinity. This number of people lived in a place close to a pond which was recently re-excavated.

Analysis: The negative impact of climate change and food insecurity has been proven in many literatures (Hanjra and Qureshi 2010; Shaffril et al., 2011; Apata et al., 2009). Almost all the respondents were suffering from food insecurity in one way or another. Respondents said that they had reduced their number of major meal. Instead of three times, they now took their major meals twice a day. More so, they had brought huge changes in their food consumption pattern (please see chapter 6.2, figure no. 6.2.1.3.4). Vegetable was their common food item. They could not afford meat even in a month. The weekly food calendar of the respondents indicated their daily calorie intake. Their calorie intake status shows that they had significant calorie deficiency. The malnourished mother will give birth to malnourished child. Few statements from the case of Tripti Mondol is cited here:

When asked about the food menu, she replied, ‘I cannot afford rice for my children let alone other food menu (*khabar e nai tar abar dhoron*). I very often offer dry foods like muri, chira, biscuits etc. to my children. These foods destroy their appetite for rice. Vegetables like potol, kolmi shak, potato etc. are common in my food menu.’ It means that her food menu is not a balanced menu consisting of five categories of food needed for the balanced growth of the body.

Respondents were also suffering from lack of pure drinking water and also lack of fuel wood. In 1990s, their main source of pure drinking water was pond, but now women of both villages needed to come across a long distance to collect water from recently excavated ponds. This was very time consuming. When women left home for collecting drinking water, their home remained unattended and thereby insecured.

Respondents of Keyabunia needed to buy *golpata*. Sometimes they collected it from the Sundarbans. On the other hand, respondents of Katabunia still depended on cow-dung, leaves and branches of trees and also on *golpata*. As people of Katabunia herded animals, they could manage cow-dung which was not possible for the people of Keyabunia. In order to save fuel wood, respondents sometimes exchanged food items with each other.

The next two sections will discuss about their coping and adaptation mechanisms with food insecurity and the scarcity of drinking water.

6.1.7 Gender-based Coping Strategies

People living in disaster prone areas of Bangladesh employ an array of measures to safeguard their lives and assets. These measures are deployed not to improve their living standard rather somehow to survive with multidimensional challenges of their unsafe natural conditions. Millennia old traditional knowledge plays a significant role in developing these practices (Abedin et al., 2014). Few determinants of coping mechanisms are family solidarity patterns, age, sex, cultural backgrounds and social status (Dasgupta et al., 2010). Thus, coping mechanisms vary between men and women based on the experience of above mentioned factors. The existing literature indicates that women are more vulnerable to climate change due to their more dependence on natural resources. Their less access to resources also put significant hindrances in their way to cope (Agarwal, 1998).¹⁰ Nasreen (2012) is the pioneer study on coping mechanism in Bangladesh. In exploring women's responses to floods, she focused on distinctive features of social structure of Bangladesh villages. However, this section highlights gender-based coping strategies of southwest coastal people with various challenges imposed by salinity.

Table 6.1.7.1: Percentage Distribution of Respondents' Coping Mechanisms with Adverse Effects of Salinity on Agricultural Products

Coping Mechanisms with adverse effects of salinity	V ₁			V ₂		
	Male	Female	Total	Male	Female	Total
Selling asset	41 (46.6%)	31 (25.8%)	72 (34.62%)	25 (71.5%)	19 (25.3%)	44 (40.0%)
Taking grants, subsidy, loan	76 (86.4%)	97 (80.0%)	173 (83.17%)	30 (85.7%)	54 (72.0%)	84 (76.3%)
Mortgaging assets	11 (12.5%)	10 (8.3%)	21 (10.10%)	5 (14.3%)	14 (18.7%)	19 (17.2%)
Switching between farming and fishing	67 (76.1%)	41 (34.2%)	108 (51.92%)	25 (71.4%)	4 (5.3%)	29 (26.3%)
Exploring alternative livelihood options	86 (97.7%)	84 (70.0%)	170 (81.73%)	30 (85.7%)	51 (68.0%)	81 (73.6%)
Out migration	46 (52.3%)	11 (9.2%)	57 (27.40%)	18 (51.4%)	4 (5.3%)	22 (20.0%)

Source: Field Survey, 2014

Notes: 1. V₁=Keyabunia Village, V₂= Katabunia Village

2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.

¹⁰ Agarwal (1998) highlighted four factors on which an individual's bargaining strength depends. These are: access to land, access to employment, access to communal resources and finally access to external social support. P. 183.

Table 6.1.7.1 focuses on gender-based coping mechanisms of Keyabunia and Katabunia village. In both villages, people invested a lot of money to produce agricultural products but failed. Salinity has affected these areas so intensively that agricultural production has become less profitable to them. These people somehow coped with that poor harvest by selling their asset, taking grants, mortgaging assets, doing multiple jobs and migrating.

Men usually sold assets more as about 47 per cent men in Keyabunia village sold asset to cope with the loss compared to 26 per cent women only. Similarly in Katabunia, 71 per cent male respondents sold assets as compared to 25 per cent women only. This is due to the fact that men owned the property and they could easily make decisions about selling asset.

Grants, loan etc. played important role in coping mechanisms and displays no difference between men and women. Around 83 per cent respondents of Keyabunia and 76 per cent respondents of Katabunia irrespective of men and women depended on grants, loan, subsidy etc.

A very insignificant number of respondents mentioned about mortgaging assets. They said that they did not own the type of asset like gold, land which can be mortgaged. As a result only 10 per cent people of Keyabunia and 17 per cent people of Katabunia reported that during their crisis period they mortgaged asset. Among them, one failed to withdraw his land which he kept mortgaged.

Due to the damage and loss in agricultural production, people especially men of both villages were always in search of alternative livelihood options. About 98 per cent men and 70 per cent women of Keyabunia village were involved in alternative livelihood options. Again in Katabunia village, 86 per cent men and 68 per cent women are involved in multiple occupations. In Keyabunia village, almost all people irrespective of men and women were involved in fishing. But in Katabunia, women were involved in homestead plantation and herding animals.

When people fail to earn their livelihood within their locality, they ultimately migrate. On an average 51 per cent men of both villages were involved in temporary migration. These people lived at deep sea or in the Sundarbans at a particular time period for catching

fishes, crabs etc. and collecting honey-wax-*golpata*. They left their family back home. Consequently, female migration rate was very low in both villages.

Table 6.1.7.2: Mean Score of Respondents' Coping Mechanisms with Food Insecurity

Coping Strategies with Food-Insecurity	V ₁		V ₂	
	Male (X̄)	Female (X̄)	Male (X̄)	Female (X̄)
Reducing expenditure on non-food items	5	5	4.03	4.05
Substitution between foods	4.36	4.35	4.11	4.13
Smaller meals	3.75	4.46	3.69	4.23
No rich diet	4.76	4.87	4.49	4.68
Fewer mealtimes per day	4.67	4.69	4.66	4.24
Payment in food for casual labor	4.94	3.44	4.37	2.40
Bartering for food	3.75	4.98	3.80	4.75
Collection and consumption of wild food	4.36	4.51	4.74	4.83
Drawing down on social networks	4	3.39	4.09	4.75
Withdrawing children from school	2.35	2.38	2.90	3.0
Borrowing from moneylenders	5	5	5	4.95
Selling asset/livestock	5	3.35	4.86	2.4
Begging from rich neighbors	0	2.5	0.0	3.60
Taking grants (Govt. & non Govt.)	2.39	2.38	2.90	2.4
Mortgaging own things	3.54	2.38	3.69	3.60
Migration	3.54	2.28	3.69	2.40

Source: Field Survey, 2014

Notes:

1. V₁=Keyabunia Village, V₂= Katabunia Village
2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.
3. Mean score has been calculated out of a 5 point ordinal scale where 1=very low, 2= low, 3= average, 4= high and 5= very high.

Table 6.1.7.2 reflects gender-based coping mechanisms with food insecurity. Data of this table has been collected based on likert scale. Thus, only mean score has been calculated only.

Almost 100 per cent respondents of Keyabunia reduced expenditure on non-food items as the mean score 5 indicating 'very high' practice of this. About 87.5 per cent respondents of Keyabunia also cope with food insecurity by buying less non-food items. The mean score is 4.03 and 4.05 indicating very high practice. These non-food items include clothings, health treatment etc.

Almost all the respondents of both villages had brought massive changes in their food consumption pattern. They took vegetables in all the meals. Fish is also common especially *telapia* and *curfu*. But 95.5 per cent respondents of Keyabunia and 97 per cent respondents of Katabunia said that they hardly could afford meat. Again smaller meal is a mechanism that basically women follow more than men. The score for women is 4.46 (90.5%) and 4.23 (92.5%) in Keyabunia and Katabunia respectively. It means that women sacrificed their meal to a 'very high' extent than that of men because the score for men is 3.75 (56.7%) and 3.69 (67%) (high practice) in Keyabunia and Katabunia respectively.

In fact all respondents irrespective of gender took their major meals twice in a day. In addition women took less food while taking their meal by keeping their stomach half empty. Though men took meal twice in a day rather than three times, they took full meal.

Few more strategies which are highly practiced were borrowing money from local money lenders, avoiding rich diet, collection and consumption of wild foods etc. All these mechanisms scored more than 4 irrespective of gender indicating 'very high practice' of them.

Bartering food is a mechanism more practiced by female respondents scoring 4.98 and 4.75 for Keyabunia and Katabunia. About 90.5 per cent female respondents of Keyabunia and 92.5 per cent female respondents reported this. It is a practice that women did informally based on good relationship and mutual understanding.

Selling assets was another way to survive which was very highly practiced by men only as they are the owner of asset. On the other hand mean score of selling asset is 3.35 and 2.4 for Keyabunia and Katabunia female respondents respectively due to the less entitlement of asset. But in acute crisis many of them reported to have sold their livestock that they got from NGOs.

Whatever may be the crisis, the rate of withdrawing children from school (mean score below 3 meaning average according to the scale prepared by the researcher) was bit less practiced as schooling of children was beneficial to them. They received different types of supports from NGOs against the enrollment of their children in school. Due to this fact, they did not withdraw their children when they were incapable of earning. But when the children became capable of earning, parents withdrew them from school and sent them to work outside. In case of daughters, they married them off.

Though most of the people lived on loan, the mean scores (below 3) show that the practice is average according to the scale prepared by the researcher. The reason behind this is that they did not want to express that they already took loan from some NGOs with an expectation of further loan.

In order to cope, respondents used to maintain less social network. They neither invite anybody at their home nor do they visit any relative's house. Maintaining good social network means more expenditure for entertainment. The mean scores are 4 (high practice) and 4.09 (high practice) for male respondents of Keyabunia and Katabunia village respectively. The score varies between Keyabunia female respondents (\bar{X} =3.39; average practice) and Katabunia female respondents (\bar{X} =4.75; high practice).

Begging is another way which was practiced as a means of livelihood by female respondents only. About 54.2 per cent female respondents of Katabunia reported to beg food from their rich neighbors. Comparatively, men worked more outside than women. In both villages, few developmental activities were going on where more male members were hired scoring 4.94 and 4.37 for Keyabunia and Katabunia male respondents respectively. On the other hand, the mean scores 3.44 for Keyabunia female respondents

and 2.40 for Katabunia female respondents out of a 5 point measurement scale indicate that women were less employed in these developmental activities.

Migration was another coping strategy followed by male respondents mostly. Data show that the mean scores for men are 3.54 (90% respondents) and 3.69 (86.5% respondents) for Keyabunia and Katabunia respectively. Again, the scores for women are 2.28 for Keyabunia and 2.40 for Katabunia out of a 5 point measurement scale. In fact women gave information about their households not about themselves. The adult male members of their households either migrated permanently in nearby towns or cities or stayed in the Sundarbans temporarily. But women hardly migrated themselves.

Table 6.1.7.3: Percentage Distribution of Respondents' Coping Mechanisms with Saline Water

Coping Strategies with Lack of Pure Drinking Water	V1		V2	
	Male	Female	Male	Female
Storing rain water in bucket	70 (79.5%)	92 (76.7%)	29 (82.9%)	56 (74.7%)
Conservation of Pond water	12 (13.6%)	12 (10.0%)	29 (82.9%)	56 (74.7%)
Using potassium to purify water	18 (20.5%)	24 (20%)	2 (5.7%)	12 (16.0%)
Crossing long distances to collect tube well water	27 (30.7%)	69 (57.5%)	12 (34.3%)	54 (72%)
By filtering salt	0 (0%)	12 (10.0%)	3 (8.6%)	13 (17.3%)
By boiling	12 (13.6%)	22 (18.3%)	7 (20%)	29 (38.7%)

Source: Field Survey, 2014

Notes:

1. V1=Keyabunia Village, V2= Katabunia Village
2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.
3. Mean score has been calculated out of a 5 point ordinal scale where 1=very low, 2= low, 3= average, 4= high and 5= very high.

The table 6.1.7.3 reflects gender-based coping strategies with pure drinking water. After 1990s almost all the sources of water of two localities became unusable due to saline water intrusion. People tried to make their water salt free by boiling, filtering, using potassium etc. A significant number of female respondents, 57 per cent in Keyabunia and 72 per cent in Katabunia, reported to cover a long distance for collecting tube well water.

Rain water served as a very important source of pure drinking water. Around 80 per cent male respondents of Keyabunia and 82 per cent male respondents of Katabunia mentioned about storing rain water. On an average of 75 per cent female respondents of both villages also reported about storing rain water. However, men's involvement in managing drinking water for the household is reflected less than that of women.

Analysis: The findings explored few coping mechanisms that the people of these villages follow to cope with the challenges of salinity. These were reducing expenditure on non-food items, substitution between foods, smaller meals, no rich diet, fewer mealtimes per day, payment in food for casual labor, bartering for food, collection and consumption of wild food, drawing down on social networks, withdrawing children from school, borrowing from moneylenders, selling asset/livestock, begging from rich neighbors, taking grants (Govt. & non Govt.), mortgaging own things, migration etc. Among these mechanisms, migration, payment in food for casual labor, borrowing from money lenders, mortgaging assets were basically followed by men. On the other hand, bartering for food, sacrificing own food, smaller meals, drawing down social network, begging were usually followed by women.

Respondents had brought changes in their food consumption pattern (please see chapter 6.2, figure 6.2.1.3.4). Nasreen (2012) showed that though the position of women and their access to resources was weaker than that of men, their limited assets play crucial role acute crisis. In such a crisis moment men either mortgage or sell their wives' assets like gold, livestock, land (if she owns a little) etc.

It is found in the study that women usually cut down their social network from relatives for not being able to entertain them during their crisis moment. Due to the soil salinity they are almost in constant crisis of food. For their food insecurity, respondents maintained distance from their relatives. This result contrasts Nasreen (2012) which found that during flood women usually receive help from their relatives.¹¹

¹¹ See Nasreen (2012), *Vulnerable or Resilience*, p. 69

In order to cope with the salinity water, women came across a long distance to carry non-saline water from the town. This water they used only for cooking and drinking purposes. Otherwise, they used normal saline water from the local ponds. A few of them tried to dig shallow tube well by combining their small capitals, but that did not work out. But storing rain water in the bucket was a very effective coping mechanism, though rain is uncertain there. In case of collecting water, men of Keyabunia help their wives to some extent. On the other hand it was found in Katabunia that collecting pure drinking water is solely women's responsibility.

6.1.8 Gender-based Adaptation Strategies with Salinity

Coastal communities face greater extent of vulnerability due to various climatic stressors (Shaw and Krishnamurty, 2012). Some of these stressors are fast in nature keeping sudden effects on coastal livelihood. But others are slow like saline water intrusion though keeping long term effects on the social economic life of landless coastal people (Alam et al., 2013). These coastal communities mobilize natural resources in various ways to adapt with the adverse climatic conditions. But these marginalized and landless coastal people who have limited access to natural resources as well as social and institutional services are losing adaptive capacity in the long run (Alam et al., 2013). The findings of this section attempts to explore various scientific and indigenous techniques that the coastal people of two study areas follow to adapt.

Adaptation strategies with lack of pure drinking water

All the respondents of study areas were following a number of strategies to adapt with lack of pure drinking water. these are rain water harvesting, establishing deep tube wells, digging wells, pond re-excavation by GO and NGO, collecting water supplied by pipe line etc. the following table shows data on these coping strategies.

Table 6.1.8.1: Percentage Distribution of the Respondents' Various Adaptation Strategies with lack of pure Drinking Water

Adaptation Strategies	V ₁			V ₂		
	Male	Female	Total	Male	Female	Total
Rain water harvesting	40 (45.5%)	39 (32.5%)	72 (34.62%)	35 (100%)	75 (100%)	110 (100%)
Establishing deep tube well	10 (11.3%)	22 (18.3%)	32 (15.3%)	10 (28.5%)	21 (28.0%)	31 (28.1%)
Digging well	9 (10.2%)	13 (10.8%)	21 (10.10%)	5 (14.2%)	23 (30.7%)	28 (25.4%)
Pond re-excavation/PSF by GO and NGO	12 (13.6%)	28 (23.3%)	108 (51.92%)	28 (80.0%)	70 (93.3%)	98 (89.0%)
Collecting pipe line water supply	56 (63.6%)	87 (72.5%)	143 (68.7%)	0 (0%)	0 (0%)	0 (0%)

Source: Survey, 2014

Notes:

1. V₁=Keyabunia Village, V₂= Katabunia Village
2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.

The table 6.1.8.1 displays data on gender-based adaptation strategies with pure drinking water. Few strategies are taken from personal level and few are taken by the Govt. and NGOs. It is evident from the survey findings that all the respondents of Katabunia village stored rain water in big drums through a pipe set on their roof top of their houses. But the people of Keyabunia are not that much dependent on rain water rather they used to collect supply water through pipe line. In Chilla union a number of ponds had been re-excavated by the initiatives of NGOs in collaboration with GOs. Water had been supplied in different densely populated areas of this union through the connections of pipes. About 72.5 per cent female respondents of Keyabunia come across a long distance of about 6-7 km everyday for collecting water from this source. Male respondents are also involved in this process as 63.6 per cent male respondents reported this. A number of men of several households came across this distance by boats in a shortcut ways. They carried different types of containers or drums on their boats and collected water from pipe lines. These households normally stored that water in plastic tanks provided by NGOs.

It was further evident that the village people of Katabunia collected water from a pond which was recently re-excavated. About 94 per cent female respondents said that this pond had saved their time a lot otherwise they would need to collect water from a very distant place. But women from nearest village, Moukhali, also came to Katabunia by crossing a long distance to fetch water from this pond. While coming for collecting water they usually faced a number of challenges including sexual harassment. A woman who came from Moukhali to Katabunia to collect water informed that she became the victims of eve teasing, especially on her way back to the village with wet saree.

In Katabunia, 28 per cent male respondents established tube wells. Among these respondents few of them got loan from NGOs. But most of them combined their little savings and collectively took the initiatives to establish tube wells.

Salinity is so much prevalent in Keyabunia that very insignificant number of people, only 15 per cent, took this initiative. But they said that it did not work out.

Adaptation strategies with food-insecurity

Food-insecurity was significantly prevalent in both study areas. Respondents of both villages took a number of strategies to combat food insecurity such as building up stores of grains, making savings, using modern technology in agriculture, growing crops suitable for the climate, building up livestock herds, diversifying crops, diversifying income sources, taking grants/ credit, changes in land use pattern and cultivating fish fry in a reservoir etc.

Table 6.1.8.2: Mean Score of Gender-based Adaptation Strategies with Food Insecurity

Adaptation Strategies	Gender	V1				V2			
		L	M	H	(\bar{X})	L	M	H	(\bar{X})
Building up stores of grains	M	75 (85.2%)	3(3.4%)	9(10.2%)	0.73	30(85.7%)	0(0%)	5(14.3%)	1.63
	F	105(87.5%)	8 (6.6%)	7 (5.8%)	1.49	65 (86.6%)	3 (4.0%)	7 (9.4%)	1.52
Making savings	M	53 (60.2%)	31 (35.2%)	4 (4.5%)	2.08	15 (42.9%)	16 (45.7%)	4 (11.4%)	2.54
	F	106 (88.3%)	6 (5%)	8 (6.6%)	1.56	53 (70.6%)	7 (9.4%)	15 (20.0%)	2.53
Using modern technology in agriculture	M	75 (85.2%)	3(3.4%)	9 (10.2%)	0.73	10 (28.6%)	17 (48.6%)	8 (22.8%)	2.89
	F	111 (92.5%)	5 (4.2%)	4 (3.3%)	1.29	61 (81.4%)	0 (0%)	14 (18.6%)	1.76
Growing crops suitable for the climate	M	75 (85.2%)	3(3.4%)	9 (10.2%)	0.73	10 (28.4%)	3 (8.6%)	22 (62.8%)	3.29
	F	109 (90.8%)	5 (4.2%)	6 (5%)	1.34	62 (82.6%)	2 (2.7%)	11 (14.7%)	1.77
Building up livestock herds	M	82 (93.2%)	3 (3.4%)	2 (2.4%)	1.24	10(28.6%)	12 (34.3%)	13 (37.1%)	3.00
	F	113 (94.1%)	5 (4.2%)	2 (1.6%)	1.35	21 (28.0%)	4 (5.4%)	50 (66.6%)	3.22

Diversifying crops	M	75 (85.2%)	3 (3.4%)	9 (10.2%)	0.73	8 (22.9%)	26 (74.3%)	1((2.9%)	2.83
	F	77 (64.2%)	40 (33.3%)	3 (2.5%)	1.84	60 (80%)	6 (8.0%)	9 (12.0%)	2.29
Diversifying income sources	M	12 (13.6%)	6 (6.8%)	70 (79.6%)	4.33	5 (14.3%)	2 (15.7%)	28 (80%)	4.26
	F	0 (0%)	79 (65.8%)	41 (34.2%)	3.50	42 (56%)	4 (5.4%)	29 (38.6%)	3.11
Taking grants/ credit	M	82 (93.2%)	0 (0%)	6 (6.8%)	1.29	35 (100%)	0 (0%)	0 (0%)	1.06
	F	69 (57.5%)	49 (40.8%)	2 (1.7%)	1.91	74 (98.7%)	1 (1.3%)	0 (0%)	1.08
Changes in Land use pattern	M	0 (0.0%)	0 (0.0%)	0 (0.0%)	0	35 (100%)	0 (0%)	0 (0%)	1.06
	F	5 (4.2%)	6 (5.0%)	0 (0.0%)	0.83	74 (98.7%)	1 (1.3%)	0 (0%)	1.01
Cultivating fish fry in a house	M	2 (2.3%)	0 (0.0%)	0 (0.0%)	0.50	0 (0%)	0 (0%)	0 (0%)	0
	F	4 (3.3%)	0 (0.0%)	0 (0.0%)	0.83	0 (0.0%)	0 (0%)	0 (0%)	0

Source: Survey, 2014

Notes:

1. V1=Keyabunia Village, V2= Katabunia Village
2. It is a multiple response table where the total number of respondents of Village 1 is 208 and village 2 is 110.
3. L=less practice, M=medium practice, H=high practice
4. X= Mean score of Respondents' opinion

The table 6.1.8.2 shows data on gender-based adaptation strategies of Keyabunia and Katabunia village. About 85 per cent male respondents and 87 per cent female respondents said that they stored food only in case of disaster like, flood, cyclone etc. In order to adapt with salinity, they usually did not store food but they kept some biscuits at home. They stated that biscuits destroyed their appetite for rice. Thereby, the mean score for Keyabunia male is 0.73 and for Katabunia male is 1.63 which indicates 'very low' and 'low practice' respectively according to the score of Likert scale developed by the researcher. The mean score for female respondents of both villages showed almost the similar results. About 88 per cent female respondents of Keyabunia and 86.6 per cent female respondents of Katabunia village stated that they usually did not store food for the disaster like salinity. Thereby, the mean score for Keyabunia female, 1.49 and Katabunia female, 1.52, indicate the 'low practice' of the scale.

Savings is another adaptation strategy that all the respondents of both study areas irrespective of male and female followed. During the lean period this savings helped them a lot. Respondents who were wage laborer use savings in the day did not get work. As their income is limited, their savings were also limited. The mean score for male in Keyabunia and Katabunia is 2.08 and 2.54 respectively and thereby indicating medium level of the scale.

Savings as an adaptation strategy was also practiced by female respondents of both study areas. Women of both study areas were involved in some occupations like net making, catching fish fries, selling vegetables etc. The mean score for female respondents of Katabunia village is 2.53 which indicated the medium level of the Likert scale. But the mean score for female respondents in Keyabunia is 1.56 indicating the low level of the scale. It means that savings of female respondents of Keyabunia village was less than that of Katabunia.

In order to adapt with food insecurity, respondents of Katabunia applied various types of modern technology¹² in agriculture. On the other hand, the use of modern scientific

¹²Modern technology include using saline tolerant seeds, bringing change in cultivation season, pumping out saline water from the lands, channelizing two or more lands to allow sweet water to enter, plantation on floating mats, preparing artificial seed beds etc.

technology in agriculture was very less in Keyabunia village as lands were almost unproductive here. Thereby, the mean score for male respondents in Katabunia is 2.89 indicating 'medium practice' as compared to only 0.73 for male respondents of Keyabunia indicating 'very low practice' of applying modern technology in agriculture. On the other hand, the mean score for female respondents in Keyabunia and Katabunia village was 1.29 and 1.76 indicating 'low practice' of the Liker scale. In fact, females are not directly involved in commercial paddy cultivation. But they got involved during harvest. They usually helped men in boiling paddy. Mostly women were involved in homestead plantations where use of modern technology was very less.

Landless female respondents of both villages grew some vegetables especially various types of leaves (lal shak, palong shak etc.), potatoes etc. They also grow fruits like banana, coconut etc. on their limited homestead lands. Sometimes they grew plants in drums, sometimes by preparing seed bed artificially¹³ etc. Male respondents of Katabunia grow crops which are suitable for the climate such as they produce *boro* rice once in a year. They also produce high yielding salt tolerant varieties BRRIdhan47 and 55. The mean score for men is 3.29 indicating 'high practice' of growing these particular crops. They were now able to grow paddy twice in a year.

Katabunia can be considered as a herding community¹⁴ as about 37 per cent male respondents and 66.6 per cent female respondents of this village reported to herd animals like cows, goat, sheep, pigs etc. which they received from NGOs after Ayla. The mean score for men and women of Katabunia is 3.00 and 3.22 respectively indicating high practice of this. On the other hand, herding animals as a means of livelihood was not that much practiced in Keyabunia village. About 2.4 per cent male respondents and 1.6 per cent female respondents of Keyabunia reported that they faced lots of difficulties with their cows and goats when their shelters would get inundated during natural flooding and ebbing. More so, they sold them out due to lack of fodder.

¹³ People raise the height of a particular place of their homestead lands above the level of saline water inundation and grow various types of vegetables over there.

¹⁴ After the cyclone Ayla, a number of NGOs provided livestock like cows, goats, sheep, pigs etc. as a means of livelihood to the people of Katabunia. As a result most of the respondents were found taming animals of one kind or another. Thereby, they are referred here as a herding community though their social structure is still agro-based.

The most important adaptation strategy was diversifying income sources. On an average 80% male respondents of both villages were forced to get involved in a number of occupations such as fishing, crab fattening, herding, collecting golpata, wax, honey etc., earth work, rickshaw pulling etc. The Keyabunia village is a fishing community¹⁵ where everyone irrespective of gender went for fishing. On the other hand, Katabunia was a herding community where most of the people herded animals. More so, people of both villages were involved in various developmental activities as wage laborers. The mean score for men of both villages was more than 4 indicating ‘very high’ practice and for female is more than 3 indicating ‘high’ practice of Likert scale.

About 93 per cent male respondents of Keyabunia and almost all the male respondents of Katabunia reported that grants in aid played a very important role in their life though their experience of receiving grants is very less. Similarly 57 per cent female respondents of Keyabunia and almost 99 per cent female respondents of Katabunia also reported that their experience of receiving grants was very less. The score for men and women of both villages is between 1 and 2 indicating that grants as an adaptation strategy is less practiced by the respondents. Most of the respondents said that they will be better able to survive if they get some grants from government. Though it was evident that many respondents got sustainability after receiving livestock from NGOs as grants, they denied the fact for the hope of receiving more grants in future.

Changes in land use pattern as an adaptation strategy was popular among the respondents of Katabunia where agricultural production is to some extent possible. Almost all the male respondents of Katabunia village said that they grew *boro* during monsoon. During dry seasons of the year, they cultivated shrimps on sweet water which they stored in ponds during monsoon. About 98 per cent female respondents of this village also reported to follow the same strategy. During rainy season, they grew some vegetables on their homestead. During other seasons, they concentrate on making nets. Thereby, the mean score for both male and female respondents of Katabunia village is 1.06 and 1.01

¹⁵ Keyabunia had been referred as a fishing community as almost sane per cent people of this village irrespective of male and female are in one way or another involved in fishing.

respectively which are pointing to the 'low' level of the Likert scale. It means that they did not follow this strategy at a large scale.

Cultivating fish fry in a reservoir is the least practiced adaptation strategy followed by a very few female respondents of Keyabunia village. Thereby the mean score for female respondents of Keyabunia village is 0.83 which indicates 'very low' level of measurement scale used by the researcher.

Analysis: Respondents followed a number of adaptation strategies. Using modern technology in agriculture is an adaptation strategy which plays an important role to adjust with negative effects of salinity on land. Respondents said that they were now using different salt tolerant varieties like *BRRIdhan47* and 55. They had also brought changes in land use pattern. Respondents of Katabunia produced boro during monsoon. In other season they used the land for multiple purposes like sweet water shrimp cultivation and growing vegetables in the same land. Respondents of Keyabunia did not grow paddy. But women still grew plants in their homestead by preparing the seed beds artificially. Making local people with the new advanced technology was one of the indicators to address salinity as it is suggested in the conceptual framework (please see chapter 4: Conceptual and Theoretical Framework).

People of Katabunia raised different types of livestock as they received them from NGOs. Thus different NGO interventions are on-going in coastal areas for the climate victims. In addition to these supports, they also provided training on different issues like cultivating fish fry in an artificial water-house, rain water harvesting etc. (please see Chapter 6.2: Case studies, table no. 6.2.1.3.2).

Diversifying income sources and temporary migration were two strategies basically followed by men. Women were also involved in a number of activities though the monetary rewards of those activities are very less. Thereby, making savings is not possible for women. Again women were not allowed to migrate due to their close tie to their families. Nishat et al., (2013) also mentioned migration as a very important adaptation mechanism.

6.1.9 Salinity, Health and Vulnerability

Disasters cause various types of diseases, injuries and even deaths. For instance, floods contaminate drinking water and provide sites for disease vectors (WB and NDCC, 2004 in Pulhin et al., 2010). Salinity also affects pure drinking water leading to diseases such as diarrhea, cholera, skin problems etc. At present the worldwide burden of human ill-health from climate change is relatively small compared with effects of other stressors and is not well quantified (IPCC, 2014). However, the current study attempts to focus on most vulnerable group in terms of health and some climate change induced diseases.

Table 6.1.9.1: Percentage Distribution of Respondents' opinion on Most Vulnerable Group in terms of Health

Health related Vulnerability	V ₁		V ₂	
	Male	Female	Male	Female
Men	20 (22.7%)	13 (10.8%)	12 (34.3%)	13 (17.3%)
Women	64 (72.7%)	76 (63.3%)	22 (62.9%)	59 (78.7%)
Adult boys	4 (4.5%)	5 (4.2%)	1 (2.9%)	3 (4%)
Adult girls	4 (4.5%)	6 (5.0%)	1 (2.9%)	8 (10.7%)
Children	65 (73.9%)	81 (67.5%)	30 (85.7%)	61 (81.3%)
Old people	39 (32.5%)	39 (32.5%)	6 (17.1%)	25 (33.3%)

Source: Field Survey, 2014

Notes:

1. V₁=Keyabunia Village, V₂= Katabunia Village
2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.

The table 6.1.9.1 reveals data on most vulnerable groups due to health problem. Among different groups, women and children are considered as the most vulnerable groups. About 72 per cent men and 63 per cent women of Keyabunia village reported that women suffer more from various types of health problems. The same situation was reflected in Katabunia village where 63 per cent men and 78 per cent women identified women suffering more for health problems. Islam (2011) also said that women are more vulnerable group in disastrous situation. Thereby, they need to be well taken care of.

They will not be able to cope better with the situation unless proper steps are taken for them.

More than 80 per cent respondents of Katabunia village reported that like women children were also more prone to health related problems due to salinity. About 74 per cent men and 68 per cent women of Keyabunia village identified children who suffer more from different diseases like diarrhea, cholera etc.

Table 6.1.9.2: Percentage Distribution of Respondents' experience of Various Types of Disaster (Salinity) Induced Diseases

Types of Diseases	V ₁						V ₂					
	Before			After			Before			After		
	M	F	T	M	F	T	M	F	T	M	F	T
Diarrhea, dehydration	38 (43.2%)	51 (42.5%)	89 (42.7%)	68 (77.3%)	92 (76.7%)	160 (76.9%)	27 (77.1%)	19 (25.3%)	46 (41.8%)	15 (42.9%)	32 (42.7%)	47 (85.6%)
Gynecological problem, skin diseases etc.	38 (43.2%)	27 (22.5%)	65 (31.2%)	51 (58.0%)	65 (54.2%)	116 (55.7%)	8 (22.9%)	23 (30.7%)	31 (53.6%)	25 (71.4%)	54 (72.0%)	79 (71.8%)
Cough and cold, chest pain, asthma etc.	37 (42.0%)	34 (28.3%)	71 (34.1%)	50 (56.8%)	55 (45.8%)	105 (50.4%)	20 (57.1%)	14 (18.7%)	34 (30.9%)	20 (57.1%)	32 (42.7%)	52 (99.8%)
Malaria, dengue, skin and eye diseases	21 (23.9%)	38 (31.7%)	59 (28.3%)	33 (37.5%)	56 (46.7%)	89 (42.7%)	14 (40%)	4 (5.3%)	18 (16.3%)	8 (22.9%)	31 (41.3%)	39 (64.2%)
Death, , heat stroke	1 (1.1%)	2 (1.7%)	3 (1.4%)	3 (3.4%)	3 (2.5%)	6 (2.8%)	2 (5.7%)	1 (1.3%)	3 (7.0%)	10 (28.5%)	5 (6.7%)	15 (13.6%)

Source: Survey, 2014

Notes:

1. V₁=Keyabunia Village, V₂= Katabunia Village

2. M=Male and F= Female

3. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.

Coastal people suffer from various types of diseases due to climate change. Borroto (1998) mentioned that sea level rise may increase the risk of health hazards like diarrhoea, cholera, etc. *Vibrio cholera* is the causing microbe of cholera that survive longer with salinity level ranging from 2.5 ppt to 30 ppt and need Sodium ion (Na⁺) for growth. Around 76 per cent respondents of Keyabunia village and 85 per cent respondents of Katabunia village said that people especially children suffered from diarrhea, dehydration etc. due to extreme heat and lack of pure drinking water.

About 72 per cent female respondents of Katabunia and 54.2 per cent respondents of Keyabunia said that the intensity of gynecological problem and skin diseases had become more prevalent than before. CCC (2009) also supported that women and adolescent girls are affected by gynecological problems by using saline water during menstruation. In this study, women explained their bitter experiences about menstrual hygiene management. Respondents reported that saline water creates pain during menstruation. The used clothes become hard after drying (due to the water salinity), which creates discomfort when next used. Further use of the same hard clothes can create genital injury, including bleeding, infection and other complications.

About 34 per cent respondents of Keyabunia village said that they used to suffer from cough and cold in 1990s as compared to 50 per cent respondents of 2014. Almost 100 per cent respondents of Katabunia village reported that currently cough and cold was a common phenomenon to them whereas the problem was not that much acute in 1990 as only 30 per cent respondents reported this.

The prevalence of dengue, malaria has also been increased in both villages. Percentage of respondents suffered from different types of fevers in 1990s is only 16 per cent in Katabunia and 28 per cent in Keyabunia whereas the percentage is now 64 per cent in Katabunia and 47 per cent in Keyabunia.

Only 13.6 per cent respondents of Katabunia and 2.8 per cent respondents of Keyabunia reported that people also died due to heat stroke though the case was very rare. In 2003 around 62 people died due to heat wave across the country (Rajib et al., 2011). This heat related mortality is also supported by IPCC 5th assessment report. The report said that

there has been increased heat-related mortality and decreased cold-related mortality in some regions as a result of warming (medium confidence) (IPCC, 2014).

Table 6.1.9.3: Percentage Distribution of Respondents' experience of Seeking Treatment from Different Organizations

Organization for Treatment	V ₁		V ₁	
	N (%)	Total	N (%)	Total
Upazilla hospital	148 (71.2%)	208	78 (70.9%)	110
Local clinic	38 (18.3%)	208	9 (8.2%)	110
Unspecialized doctor	166 (79.8%)	208	83 (75.5%)	110
No proper health care centre	19 (1.9%)	208	17 (15.5%)	110
Kabiraj	5 (2.5%)	208	7 (6.4%)	110

Source: Survey, 2014

Notes: 1. V₁=Keyabunia Village, V₂= Katabunia Village

The table 6.1.9.3 exhibits that almost 70 per cent people of both villages went to Upazilla hospital for treatment. Unspecialized doctors also were very popular among the villagers as almost 80 per cent people of Keyabunia and 75 per cent people of Katabunia also visited them for quick response. They said that the number of seats in Govt. hospital was not sufficient enough to accomodate so many pateints of the Upazilla. For this reason, some 18.3 per cent people of Keyabunia and 8.2 per cent people of Katabunia sometimes went to local clinic. Only 1.9 per cent respondents in Keyabunia and 15.5 per cent respondents in Katabunia stated that there was no proper health care facility. Because of this reason, they specifically mentioned about Herbal (kabiraji) treatment which they usually take for primary health care purposes.

Analysis: It is found that saline water was responsible for various types of health problems which are also observed by few other studies (Basar, 2012; Khan, 2010). Most of the respondents were suffering from various types of skin diseases. Salinity was more harmful for women's health. Especially pregnant women were suffering from gynecological problems due to the use of sea water. People usually went to health complex situated in the union. But a single health complex, consisting of only 50 seats, could not accommodate so many people. As a result many of them would go to unspecialized doctors. Again a few of them visited kabiraj too. Few statements from the case of Nurunnesa Begum (See in detail case no. 6.2.1.2.3) are cited in the following box:

Nesa said she has been suffering from skin diseases for the last two years. Few areas of her hands and legs are dry and swollen due to extreme roughness of the skin. Skin between her fingers looks white. She said, 'When itching starts, it becomes unbearable. My pink flesh comes out of it. I met a kabiraj who said that this is because of the salt of water.'

6.1.10 Housing and Infrastructure

Bangladesh is highly vulnerable to climate change. Scientists affirm that Bangladesh has already experienced noticeable impacts of sea level rise (SLR) including saline water intrusion, inundation and erosion etc. (Hossain, 2010). SLR is anticipated to inundate the southwest coastal zone of Bangladesh permanently (Nishat and Mukherjee, 2013). This will ultimately create pressure on people to migrate in the upstream from these low lying vulnerable areas (Hossain, 2010; Nishat and Mukherjee, 2013). But natural habitat and infrastructure is central to all aspects of human living (Mallick, 2013). Mallick (2013) said that undoubtedly if habitat and infrastructure adaptive to climate change could be developed, multifarious aspects of climate change would not be able to make us worried about it. Thus, it is imperative to describe the housing and infrastructural condition of two study areas situated beside the shoreline.

Table 6.1.10.1: Percentage Distribution of Houses by Materials Used

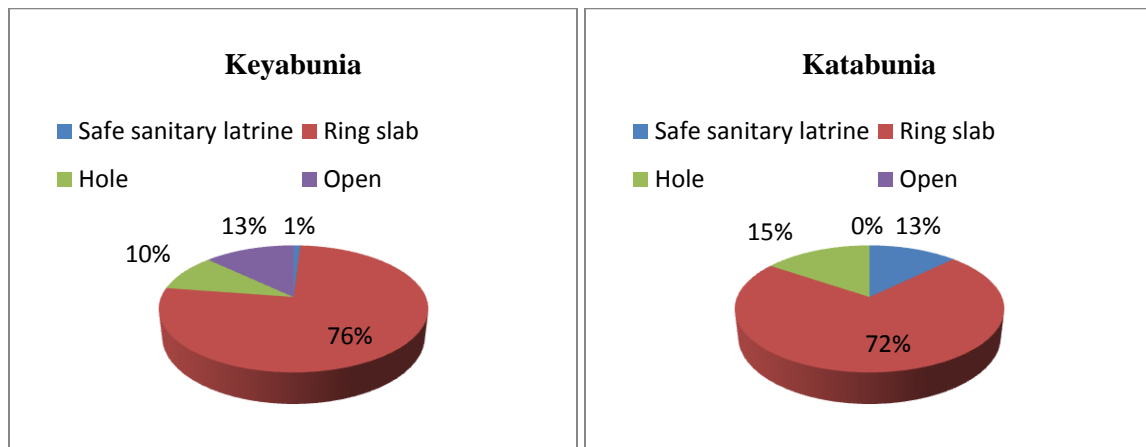
Houses made by	V ₁		V ₂	
	N (%)	Total	N (%)	Total
Pakka	4 (1.9%)	208	7 (6.4%)	110
Bamboo	15 (7.2%)	208	18 (16.4%)	110
Mud	75 (36.1%)	208	52 (47.3%)	110
Tin shed	95 (45.7%)	208	29 (29.4%)	110
Golpata	19 (9.1%)	208	4 (3.9%)	110

Source: Field Survey, 2014

Notes: 1. V₁=Keyabunia Village, V₂= Katabunia Village

Most of the houses of Keyabunia and Katabunia village are made up of mud (36.1% and 47.3% respectively). Many of them are with tin shed (45.7%). Similarly in Katabunia village 29.4% houses are with tin shed. The number of Pakka houses is very insignificant.

Figure 6.1.10.1: Percentage Distribution of Respondents based on having Toilet Facilities



Source: Field Survey, 2014

Around 76 per cent respondents of Keyabunia village followed by 70 per cent respondents of Katabunia village had ring slab latrines which were developed by the Wash program of BRAC. A very few respondents said about safe sanitary latrine (13% respondents of both Keyabunia and Katabunia) and hole system (15% respondents of Katabunia followed by 10% respondents of Keyabunia).

Table 6.1.10.2: Percentage Distribution of Respondents based on having Kitchen Facilities

Kitchen Facilities	V ₁		V ₂	
	N (%)	Total	N (%)	Total
Yes	162 (77.9%)	208	101 (91.8%)	110
No	46 (22.1%)	208	9 (8.2%)	110

Source: Field Survey, 2014

Notes: 1. V₁=Keyabunia Village, V₂= Katabunia Village

Most of the households had separate place for cooking. Few cooking places were surrounded by golpata which were at high risk. Two or three households had common cooking place. Because of this reason, the data shows that most of the households, 78 per cent households of Keyabunia and 91 per cent households of Katabunia, had kitchen.

Table 6.1.10.3: Percentage Distribution of Respondents by the Distance from Local Offices of NGOs

Distance (Km)	V ₁		V ₂	
	N (%)	Total	N (%)	Total
1-2 km	47 (22.6%)	208	0 (0.0%)	110
3-4 km	131 (63.0%)	208	5 (2.5%)	110
5-6 km	30 (14.4%)	208	99 (90.0%)	110
6+ km	0 (0.0%)	208	6 (5.5%)	110

Source: Field Survey, 2014

Notes: 1. V₁=Keyabunia Village, V₂= Katabunia Village

The table 6.1.10.3 represents data on the distance of villages from their respective unions. Katabunia village is about 6 km away from Pankhali union. Thereby, about 90 per cent respondents of this village said that the nearest NGO was 5-6 km away from their village because most of the NGOs were situated in the union. People, who stayed in the front side of this village, reported that the nearest NGO was about 3-4 km away. On the other hand respondents who stayed at the end of the village reported about 7 km. Similarly NGOs were situated in the main town of Chilla Union. As Chilla is 3-4 km away from the village, majority of the respondents (63%) said that the nearest NGO was 3-4 km away from their village.

Analysis: The housing condition of the respondents of Katabunia was a bit better than those of Keyabunia as few NGOs had repaired the houses of most vulnerable people of Katabunia village after Ayla. On the contrary, housing condition of few of the respondents of Katabunia village was very poor. These houses were made up of *golpata* and bamboo which were highly vulnerable to any strong wind. The house of Bimola did not look like a house of humans rather it looked like a house of hens and ducks. It consisted of a single room made up of leaves and branches. The roof of the house was also made up of same material. The roof was so low that it was not possible to stand up inside the house. The room was full of different types of insects including ants, mosquitoes and flies etc. (For details, please see the case 6.2.1.1.9). BRAC's WASH program ensured ring slab latrines in almost all the households of Katabunia whereas the sanitary condition of Keyabunia was very poor. Saline water stagnation had made both the study areas muddy and wet which was highly unhygienic for the people.

6.1.11 Socio-economic Impact of Salinity on Livelihood

Coastal areas of Bangladesh are highly affected by saline water intrusion because of its low elevation. Areas closer to the seashore are more saline prone than those of distant lands. Miah et al. (2007) indicates that saline soil of 52,000 ha in 1983-1984 has attained to 203,000 ha in 2005-2006, pointing to a salinity increase of four times in the area during a time period of only 21 years. This rising saline soil is also observed by the Soil Resources Development Institute (SRDI). NAPA of Bangladesh has also much concerns regarding salinity ingress especially for the southwestern region (National Plan for Disaster Management, 2010-2015).

Due to salinity, availability of fresh water has become highly seasonal (Nishat and Mukherjee, 2013). Abedin et al. (2014) stated that one of the most serious resource and health issues of coastal communities is the scarcity of pure drinking water triggered by salinity. More so, increased salinity not only causes a net reduction of about 0.2 Mmt of rice production on an average year, but also diminishes potentials of Boro and wheat cultivation in saline water affected coastal areas (Nishat and Mukherjee, 2013).

Thus, salinity has kept severe impact on household's food security especially on pure drinking water in both of the study areas. Thereby, it is imperative to assess the socio-economic impacts of salinity to identify the gaps between policy and practice in order to improve the coping and adaptation capability of southwest coastal people of Bangladesh.

Table 6.1.11.1: Percentage Distribution of Respondents' Experiences of Socio-economic Impacts of Salinity

	Impacts	V ₁			V ₂		
		Male	Female	Total	Male	Female	Total
Salinity and Food Insecurity	Decreased income	76 (86.4%)	99 (82.5%)	175 (84.1%)	33 (94.3%)	63 (84.0%)	96 (87.2%)
	Decreased savings	80 (90.9%)	99 (82.5%)	179 (86.0%)	30 (85.7%)	58 (77.3%)	88 (80.0%)
	Joblessness	55 (62.5%)	54 (45.0%)	109 (52.4%)	23 (65.7%)	54 (72.0%)	77 (70.0%)
	Out migration and increasing the number of female headed households	35 (39.8%)	31 (25.8%)	66 (31.7%)	9 (25.7%)	19 (25.3%)	28 (25.4%)
	Increased malnutrition and illness especially among the females	54 (61.4%)	71 (59.2%)	125 (60.0%)	20 (57.1%)	59 (78.7%)	79 (71.8%)
	Increased disruption of communication (roads and communication)	30 (34.1%)	56 (46.7%)	86 (41.3%)	10 (28.6%)	34 (45.3%)	44 (40.0%)
	Withdrawal of the children from school	12 (13.6%)	20 (16.7%)	32 (15.3%)	5 (14.3%)	12 (16.0%)	17 (15.4%)
	Cutting down social network	17 (19.3%)	71 (59.2%)	88 (42.3%)	10 (28.6%)	59 (78.7%)	69 (62.7%)
Salinity and Pure Drinking Water	Forcing girl child to collect fresh water rather than sending her to school	6 (6.8%)	16 (13.3%)	22 (10.5%)	7 (20.0%)	12 (16.0%)	19 (17.2%)
	Mothers often get tired for collecting water and can't spare time for playing other roles at home properly	25 (28.4%)	80 (66.7%)	105 (50.4%)	14 (40.0%)	50 (66.7%)	64 (58.1%)
	Women and adult girls are subject to occasional eve teasing and sexual harassment while collecting water	0 (0%)	30 (25.0%)	30 (14.4%)	7 (20.0%)	12 (16.0%)	19 (17.2%)
	Investment of extra time for collecting drinking water	45 (51.1%)	62 (51.7%)	107 (51.4%)	21 (60.0%)	47 (62.7%)	68 (61.8%)
	Children remaining unattended as their mothers go for collecting water	13 (14.8%)	100 (83.3%)	113 (54.3%)	5 (14.3%)	51 (68.0%)	56 (50.9%)
	Suffering from various diseases due to lack of fresh drinking water	43 (48.9%)	67 (55.8%)	110 (52.8%)	18 (51.4%)	45 (60.0%)	63 (57.2%)
	Additional burden for bearing the cost of increased expenditure on treatment of different diseases induced by climate variability	67 (76.1%)	78 (65.0%)	145 (69.7%)	20 (57.1%)	55 (73.3%)	75 (68.1%)

Source: Survey, 2014

Notes:

1. V₁=Keyabunia Village, V₂= Katabunia Village

2. It is a multiple response table where total number of respondents of Village 1 is 208 and village 2 is 110.

The table 6.1.11.1 reveals data on the impacts of salinity on the socio-economic condition of the people. It is found that salinity has negative impact on income and savings. More than 80 per cent respondents of both areas admitted the fact that their income and savings decreased at a noticeable rate due to the adverse effects of saline water intrusion in their village. Consequently they became forced to shift themselves in other sorts of occupation such as fishing in deep sea, catching crabs, wage laborer, Shrimp cultivation etc. which were also challenging and unsecured. In 1990s, they would earn 3 to 3.5 thousand taka monthly. Their monthly income remains almost same like 2.5 to 3 thousand taka in 2014. Although the difference of income is very less, but the international value of taka has been decreased a lot. In 1990s, US\$ 1 was equal to approximately 36 taka. Thus, respondents' income (taking 3000 as an average) was equivalent to approximately US\$ 83. If their present income is converted to US\$, it becomes approximately US\$ 38. Thus, their income decreased significantly. As a consequence they are forced to take loan. Either they make loan from local money lenders or from shop keepers who charge a very high interest rate. Borrowing money is therefore a big challenge for the vulnerable people though it is a reality for most of the respondents.

In the study many respondents were rather forced to change their occupation to survive though lack of employment in the locality has multiplied their sufferings a lot. About 52 per cent respondents of Keyabunia and 70 per cent respondents of Katabunia reported that they did not have the guarantee of getting work every day.

Salinity and its consequent food insecurity kept differential impact on men and women. Most of the men were busy with earning livelihood and in many instances they were unable to maintain tie with relatives, neighbors etc. This kind of relations affects men less whereas women were more concerned about emotional bonding. Women felt sad as because they did not have the ability to invite their relatives, parents etc. That is why comparatively more number of women reported that they needed to cut down social network due to lack of food, awkward communication system etc. About 59 per cent women as compared to 19 per cent men reported that they could not entertain their relatives even occasionally with rich food. They could not even afford meat even in social and religious festivals unless they visited affluent neighbor's house. The same fact

was reported in Katabunia village by 79 per cent female respondents and 29 per cent male respondents.

Due to food insecurity children were suffering from malnutrition (see for detail in section 6.1.6). More salinity kept diversifying effects on the health of people (please see details in section 6.1.9). About 53 per cent respondents of Keyabunia village and 57 per cent respondents in Katabunia village said that different types of skin diseases were common to all people irrespective of age and sex. As a result expenditure on treatment had been increased than before as responded by 70 per cent respondents of Keyabunia village and 68 per cent respondents of Katabunia village.

An average of 40.5 per cent respondents of both areas reported that their communication got disrupted for the inundation of sea water, frequent number of storms or high tide.

An equal number of women (66%) of both villages said that they become tired by collecting drinking water and managing everyday food. Consequently they could not spare time to take care of their children properly.

Eve teasing and sexual harassment were prevalent in these localities as community people mentioned. But most of the female respondents denied of having such experiences due to avoid further harassment. Only 25 per cent female respondents of Keyabunia and 16 per cent female respondents of Katabunia reported this. They said that when they went for collecting water, local mastans used to comment negative on them. Sometimes these boys would sing bangla movie songs. Many of them also proposed their adult daughters to marry them.

About 20 per cent male respondents of Katabunia village also reported harassment as a problem of their wives or daughters. The head master of Pankhali Momtaj Begum School said that many women and girls also became the victims of rape which remains unreported for the further harassment. This usually happens in the evening when they come back home after collecting pure drinking water from different distant places.

Results of Logit Model

It was earlier mentioned that households under salinity had little income, little education, limited asset base and low level of investment ability. They had also low level of agricultural production due to less productivity of lands. Because of this salinity problem, majority of the households under study were facing food insecurity which forced them to lead a low quality of life. Thus, an effort was taken to examine the influence of socioeconomic variables on the dichotomous dependent variable 'people will be food secured'. Socioeconomic variables like gender, nature of household, total amount of land, grants received by the respondents, household income, number of IGA, educational status, access to energy, distance from NGO, distance from local market, distance from agricultural office, frequency of meeting with agricultural extension officer were considered in the logit model as independent variables. Few other ecological variables like intensity of salinity, prolonged rainy season and crop failure were also taken into account as independent variables. Results of the logit model are presented in Table 6.1.11.2.

As it can be seen from Table 6.1.11.2, among the fifteen variables, seven variables had created a significant influence on the dependent variable. These are gender, total amount of land, intensity of salinity, experience of crop failure, grants received by respondents, distance from NGO and access to energy resources like electricity. It is important to examine whether the data fit the model adequately or not. For this purpose, Hosmer and Lemeshow test of goodness for fitting was conducted. The test results show that the chi-square value was 10.288 with 8 df and the chi-square value was found non-significant (p-value 0.245). It indicates that data fitted the model adequately. Nagelkerke R-square of the model was .316 indicating that model's predictors explain about 32 per cent of the total variation of the dependent variable. Overall accuracy of the model was 72 per cent (Table 6.1.11.2).

Table 6.1.11.2: Estimated Results of Logit Model

Variables	Coefficient	Wald	Level of Significance	Odd ratio
Constant	-.895	0.212	0.645	0.409
Gender	-.748	6.954	0.008	.473
Nature of Household	0.101	0.105	0.745	1.107
Total amount of Land	0.366	4.775	0.029	1.442
Prolonged Rain	0.319	1.193	0.275	1.376
Intensity of Salinity	-.796	6.900	0.009	0.451
Experience of Crop failure	-.997	6.659	0.010	0.369
Grants received	1.220	13.391	.000	3.386
Household Income	0.000	1.903	0.168	1.000
Distance from NGO	-.406	5.203	0.023	.666
Distance from Market	0.068	1.803	0.179	1.070
Distance from Agricultural office	0.347	12.360	0.000	1.414
Frequency of Meeting with Agricultural Extension officer	0.239	0.661	0.416	1.270
Access to Electricity	1.857	11.416	0.001	6.406
Number of IGA	0.084	0.233	0.629	1.088
Educational Status	0.021	0.709	0.400	1.021
Cos and Snell R Square : 0.23				
Nagelkarke R Square : 0.32				
H-L Chi-square : 10.288 with 8 df				
Overall accuracy : 72%				

Source: Survey, 2014

Note: Probability= [Odd/ (1+Odd)]

Though it is proved by Nasreen (2012) that women cope better than man, their less entitlement to property is the biggest challenge towards coping and adaptation. Due to the subordinate status of women in the household (Ritzer, 1993), they are highly food insecure. Scanlan (2004) observed that a severe gender gap exists between male and female in terms of nutritional status, education, and inequality in the less industrial countries. The study also found that female would more likely to experience malnutrition as compared to their male counterparts. This gender parity was also proved by Mallick

and Rafi (2010). Similarly the current study confirms that women are more vulnerable than men in terms of food security. The result shows that the variable 'gender' is negatively and significantly correlated to dependent variable 'food security'. It means that if the respondent is a female, the probability of her being food insecure is 29 per cent.

Land is a very valued form of property for an individual for its political and symbolic importance especially in the agrarian economies of South Asia. Traditionally it is considered as the source of political power and social status. It also provides a sense of identity and feeling of rootedness in one's own village (Agarwal, 1998). Besides these, land has a resale value. Women in coastal areas are involved in various types of homestead plantation which contributes a lot to their food management process. Thus, possession of land is significantly correlated to food security. The study supports the fact that property entitlement like possession of land is positively and significantly related to the dependent variable as expected. According to the result of this model, if 1 decimal land is increased for an individual, the probability that the person will be food secured is 59 per cent.

Undoubtedly salinity is core of majority of the problems of coastal areas. The traditional social structure has been broken down due to unproductive nature of lands. People are now diversifying their occupation to meet up households demands of food. Each coastal man and woman is involved in more than one income generating activity. Despite that salinity and its consequent crop failure contribute to food insecurity a lot. In the current study these two variables are found significantly and negatively correlated to food security. The table 6.1.11.2 shows that if one unit of salinity increases, the probability that coastal people will be food insecure is 31 per cent. It is also proved that if people experience crop failure one time more, their probability of being food insecure is 27 per cent.

Grants play a very important role in reducing poverty and ensuring food security. Poor people do not have the investment capability due to lack of loans/credits/grants. They also do not get loans from bank. As result, they sometimes become bound to mortgage their assets to local money lenders to get loan at a very high interest. Sarker et al., (2006)

found that unavailability of credit was the major problem in Bangladesh for the fishermen for the pond fish culture entrepreneurship. BRAC's 'Challenging the Frontiers of Poverty Reduction Targeting the Ultra Poor' (CFPR-TUP) program could significantly increase the household's ownership of livestock (Das et al., 2014). Thereby it was expected that if these rural poor receives grants from any NGOs and GOs in the form of credit, livestock or grocery shop, they would be better able to cope and adapt with the uncertainty. In this model, grant is found positively and significantly correlated to food security. Grant was taken as a dummy variable here. Thereby, it is found that if a person receives any grant, the probability that the person will be food secured is 77 per cent.

The NGOs play important role in proving financial support, adoption of technology, resource management, and access to information. Jagger and Pender (2002) said that a household which receives credit from an NGO is better able to address some immediate needs. The household even may be able to adopt a longer-term perspective on investments such as tree planting that lead to improved land management (Jagger and Pender, 2002) and thereby to ensure household's food security. Thus, if the distance increases it will not be possible to get easy and frequent services from the NGOs for the rural poor especially for the women whose movement is far more restricted (Mahmud et al., 2010b). Therefore it was expected that distance of villages from NGO would affect food security. Result shows that distance from NGO local offices is negatively and significantly correlated to food security. It means that if one km distance increases, the probability that this will affect food security is about 40 per cent.

Access to energy resources means more networks and thereby opening more opportunities for the people. In both study areas, access to electricity was very limited. About 18.8 per cent respondents of Katabunia village were found using solar panel which they received from an NGO. The table shows that access to energy resources is positively and significantly correlated to food security. The study indicates that if people get access to electricity, their probability of being food secured is 86 per cent.

Though Mahmud et al., (2010b) proved significant implication of educational status of rural poor to improve their overall living standard, the current study found it

insignificant. The sort of occupations that coastal people are involved in requires special type of skill/training more rather than that of traditional education.

According to Mahmud et al. (2007) emphasis should be given to the need and nature of IGA pursued by the households. In the current study, number of IGA is found insignificant. In fact, the number is not as important as the total amount of income coming from each activity is. It is found in both study areas that each individual is involved in more than one occupation. Many of them are even involved in three. But almost 100 per cent respondents reported to have food insecurity. It means that they were not getting the expected income from each occupation. More so, their labor and effort to each occupation was not proportionate to their income. Thus, 'household's asset base', 'access to grants', 'access to energy resources', and 'distance from NGO local offices' are found in the model as the significant determinants of household's food security.

CHAPTER SIX

Part II

Qualitative Data Analysis and Presentation:

Case Studies

6.2.1 Introduction

In the preceding chapters, the vulnerability, coping mechanism and adaptation techniques of the study people were presented based on statistical data. Survey data, tools and techniques are very effective in providing facts about the reality more scientifically. But it often fails to depict the underlying facts in a very comprehensive way. It also fails to bring out psychological trauma, day to day challenges—as well as the stress behind the ruthless realities that the respondents face during and after disasters and hazards. Therefore, in order to overcome the shortcomings of survey data as well as to supplement and complement those findings, this study has followed the case study method. With the help of this particular method, the researcher has assessed the vulnerability of poor men and women from different dimensions. This chapter is divided into two sections: the first section describes the cases of two villages and the second section includes analyses of these cases.

6.2.1.1: Cases of Keyabunia

6.2.1.1.1: Renuka Mondol

Village: Keyabunia

Renuka is 32. Being an inhabitant of Keyabunia, she is one of the victims to the adverse climatic condition. She lives at the remotest south end of the village which is very close to the seashore. Her house is subject to severe river erosion. In case of any further erosion, her homestead will be affected first. In the meantime she lost 2 decimals of her homestead lands and that had been taken by the river Pashur. She now does not have any cultivable land to subsist. She might be in further uncertainty due to any unpredictable morphological confluence of this river.

Renuka is the mother of one son (7) and one daughter (5). As she was unable to maintain the expenditure of her family, she forced her daughter to stay with her maternal uncle. While staying in the uncle's house, her daughter became the victim of trafficking of an organized gang. Now she has only one son who is a student of class two. It is quite challenging for her to bear the expenditure of her son's education with her limited

income. She got a little support from NGOs in lieu of her son's enrollment in school. She received a drum containing 30 litres of water from an NGO.

Renuka is a typical housewife. Besides, that she has some involvement in catching fishes. She catches fishes with a simple square-shaped net framed with wood. With that simple net she used to catch fish fries and sell them in the local market.

As she lives at the dead end of the village, local market is far away from her home. Thereby, she needs to come across a long distance every day. But fishes are not available near the shore every day. In such a bad day, she fails to earn money for her family.

Her husband is a landless farmer. He used to cultivate paddy three times a year. During the period of cyclone Ayla in 2010, the whole area went under sea water by the high tidal surge. This water remained stagnant due to lack of canals to release. Saline water made maximum lands of the locality incompatible for production. Before Ayla her husband would work in the land of rich a farmer and used to get 12-15 mound paddy in each harvest. This was sufficient to meet up the demands of rice of her households. But after Ayla, her husband became bound to switch his occupation. Her husband became a fisherman and a collector as well. He used to go to deep sea and in the mangrove forest for catching fishes and collecting *golpata*, honey, wax etc.

Despite Renuka and her husband have been working so hard, her family is in acute food crisis. Renuka could not afford major meal for her family three times in a day. Though their family lived on fishing, they sell all the fishes in the market without keeping a single to eat for her family. She usually cooks a single vegetable curry with potatoes and different types of leaves like *kolmi shak*, *kochu shak*, etc.. Sometimes her also shows anger to his parents for the monotonous food item and demands some rich food. This creates a psychological pressure on them. She mixes up *pona machh* (small fishes) with vegetables to bring variation in food menu.

On an average their daily income is 100 to 150 taka. When her husband comes from sea by catching fishes and crabs once in a year, they would get 20,000 to 30,000 taka at a time. This was the only money they usually save. They lead their everyday life with their

regular income. If they fail to earn money for any sickness or for any other climatic stressor like cyclone, flood etc., they use this savings for their survival.

Renuka has a cot called *chouki* in her house. There was no other furniture in her house. As they might need to move now and again due to river erosion or cyclone, they lived with very less number of furniture. She had a mobile phone to maintain communication with her husband when he is away. Last year, she got a call from her husband's mobile. She picked up the call and came to know that her husband was kidnapped by the pirates. They demanded Tk. 30,000 as ransom. She had to borrow that money from rich farmers to give that taka and finally could make her husband free from them. They are still indebted to those money lenders and struggling hard to repay the loan. Every month she needs to pay Tk. 100 as interest with the capital amount. She was also forced to mortgage her ear rings to repay the loan.

Other than this purpose, she had to borrow money for several purposes such as to repair her house, to buy some seeds, for treatment of her son etc.. Still she is indebted of Tk. 50,000 in total. She needs to pay 400 taka every month. Therefore she is already in trap of vicious cycle. And she does not have any back up resources to manage that. She is now in a challenging and vulnerable situation.

All the ponds of the locality are inundated by sea water. Thus, there was not a single drop of water anywhere to drink. The only road that connects the village with the town was very narrow where motor bike can run only. Thus, Renuka had to cover 6 miles every day on foot to fetch pure drinking water. It took almost 2 to 3 hours per day. She used to get tired and does not get energy to engage her in other activities of the house.

Saline water stagnation made the soil salty and thereby unproductive. Once upon a time trees and plants were available in the area. She could easily collect branches, dry leaves fallen on grounds as fuel wood. She needs to buy fuel wood if her husband fails to collect *golpata* from jungle. Sometimes she hires fuel wood from her neighbors. In exchange of that she gives her fuel wood when her husband collects from forests.

Different NGOs were at their services to reduce their vulnerability. NGO workers offer training on different adaptation techniques. But she had not received any support like

livestock, poultry etc. from any NGO. She just got to learn rain water harvesting. During her leisure time, she sits with her neighbors together and gossip; she maintains good ties with all of them. She said that their life is so much uncertain that they are all highly interdependent on each other. In fact, they have no other alternative but to stay close and united.

Case 6.2.1.1.2: Sundori

Village: Keyabunia

Sundori is 25. She is the mother of 8 years old son. She also lives at the dead end of the village towards the southernmost place. Soil erosion appears as a disaster here every now and then though it was not a serious problem just few years back. Recently it had taken away her homestead. In addition to this erosion, the frequent number of storms and cyclones made her life more vulnerable. Her house is made up of mud with tin shed which is highly vulnerable to a strong wind. In case of cyclones, they need to leave their place and take shelter in local schools. Sundori said that she is always mentally prepared to move to the shelter place due to increasing frequency of cyclones. Thereby, she has a very less number of furniture like a *chouki*, a stool, a mosquito net and fishing net. These were the few things that she took with her while shifting from her house during the last cyclone. She needs to repair her house after each cyclone, she said.

Salinity of soil is a common problem though Sundori is not that much concerned about it as she is concerned about cyclone. Now her husband has become a fisherman from a farmer. He also works as a day laborer in the Chilla union. Sundori herself is also involved in fishing. She catches fish fries from the shore and sells them at a rate of 10 taka each. Sometimes she can earn 120 taka by selling 12 fries in the market. Thus Sundori can contribute monetarily to her household.

Sundori's household consists of three members including Sundori, her husband and her only son of 4 years old. Most of the time her husband remains away from home for fishing, she then stays alone with her very young son, Hassan. Sundori cannot manage food three times a day for her household. She was found very much concerned about her

beauty. She said that if she could manage more nutritious food to eat, she would look more beautiful.

Sundori cooked vegetable curry and *dal* in the day she was interviewed. *Dal* is a common item that she usually shares with two of her neighbors. She said that to cook *dal* for only two members is not cost effective. Thereby she contributes little amount of *dal* to her neighbor, Renuka. They cook for two or three households together. It saves her fuel as well as prevents the wastage. Sundori sometimes cooks fish fries with *Palong shak* (spinach) which is also very rare. She occasionally buys big fishes like Tilapia. The day she fails to catch fish fries and is not able to earn, she cannot afford food on that day. Her son takes food with her neighbors and she usually starves on those days. She does not take any breakfast. She intentionally cooks a bit extra rice and mixes *dal* and vegetables with it to make it *khichuri* for her son. Most often she puts water in it and in the morning she offers *panta vat* to her son. Each day is a challenge for her to manage food for her son.

Sundori used to collect drinking water from a nearby pond just ten years back. At that time salinity was not that severe in the pond water. But within a very short period of time, the water became too salty to drink. Now she manages pure drinking water from a distant pond which is recently re-excavated by an NGO inside the main town. But it is very time consuming as she lived at the last end of the village. Because of this reason, sometimes two or three neighbors hire a boat. Two or three men go to the town with a number of big drums by that boat in a short-cut way to collect pure drinking water from a pipe line set by the government. This pipe line is connected to a pond which is recently re-excavated though the water of that pond is not fully salt free. Her family can go for a week with that reserved water. Sundori said that her son does not want to drink water unless it is of extreme necessity.

For taking shower she used to go to a nearby pond where salinity is to its highest level. She suffers from skin diseases due to using this saline water. As a very young woman, she has also been suffering from gynecological problems. During menstruation, problem becomes unbearable. Itching is another health problem of her husband and son. She has visited unspecialized local doctors for her son's skin problems. That doctor gave him an

ointment but it did not work out. The clothes which they put on have become too rough to wear.

Sundori's family is a nuclear family. It's patriarchal in nature. She is fully dependent on her husband for making any decision. Sundori's husband had been a farmer. But after *Ayla*, whole area had gone under commercial shrimp cultivation. Salinity has destroyed most of the fertile lands of the locality. Now, Sundori's husband is involved in multiple occupations. He is a fisherman as well as a crab collector. By selling crabs he earns about Taka 25-30 thousand per year. When season does not permit to go to the deep sea, he works as a day laborer in different development projects inside the town. He earns Tk. 150 per day as a day laborer. Men are more preferred in these activities than that of women. Despite having diversified occupations, they are in the face of greatest threat to survival.

Borrowing money is a common coping mechanism that Sundori follows like all her neighbors. Sundori said that hardly anybody could be found without loan in her village. It is very normal for all to borrow money to overcome any crisis moment, as Sundori said.

Sundori said that NGO activists very often come to them to motivate local women to receive training on different techniques to cope and adapt better with adverse climatic condition. She learnt rain water harvesting from them. But Sundori's husband does not allow her to go with them. Traditional purdah system and lack of social security worked as a main barrier in receiving these trainings. Sundori has become habituated with all the threats and challenges imposed by salinity. She does not have any expectation from government and non government organizations as she firmly believes that they will not be able to change their fate.

Case 6.2.1.1.3: Tripti Mondol

Village: Keyabunia

Tripti Mondol is 26. She studied up to class four. However, she had to drop her education due to acute financial crisis of her family. Her family got her married off at the age of 15.

Her family is a nuclear family. She has a daughter (5) and a son (3). She lost her husband 4 years ago in Ayla, 2009. She is the head of her family. Being the head of the household, it is her bare responsibility to manage their basic needs.

She had a homestead of about 12 decimals. But she has lost two third of that during last Ayla. Rest of the land has become unfertile due to salinity. She tried several times to grow vegetables but failed. In the last year, she planted *lalskak* but all the plants died. Consequently, she lost 400 taka. Since then she has stopped planting anything. She now lives on fishing. But every day fishes are not available on the shore. She stays at home. Her monthly income is very less and highly irregular. The day she fails to earn, she has to starve. She then sends her children to her neighbor's house to eat.

Tripti is already under pressure from various climatic stresses. She has been experiencing regular salinity in her locality. She said that 'salinity is a long-term devastating climatic event which has brought a lot of miseries for us and we will never be able to make us free from it.'

Salinity is responsible for widespread disruption of her socio-economic well-beings. She said, 'I might need to leave this village due to salinity. I go to the sea shore to catch fishes, but I cannot afford food for my children by this.' Fishes are not that much available due to over exploitation of resources by the villagers. Thereby, sometimes she has to face acute food crisis.

When asked about the food menu, she replied, 'I cannot afford rice for my children let alone other food menu (*khabar e nai tar abar dhoron*). I very often offer dry foods like *muri, chira*, biscuits etc. to my children. These foods destroy their appetite for rice. Vegetables like *potol, kolmi shak*, potato etc. are common in my food menu.' It means that her food menu is not a balanced menu consisting of five categories of food needed for the balanced growth of the body.

She has to collect fuel wood, potable drinking water for her family from distant places. It causes much harm to her health. She suffers from bodily pain as she needs to cover a distance of about 6 km everyday for collecting pure drinking water. She has two small pitchers with a very limited capacity. These pitchers can support for a day only if she

utilizes that water very carefully. More so, she remains anxious about her little child back at home while collecting fuel and water. Sometimes she became the victim of the sexual harassment by the local *mastans*. Tripti said that very known people of her community offer her indecent proposals as because she is a widow.

She informed that she borrowed Taka 3000 from a money lender at 40% interest rate after the Ayla. She thought that she would be able to repay the loan. But her amount of loan is increasing gradually with interest. To repay that loan she has recently mortgaged her small homestead which has become unproductive due to saline water intrusion. Thereby, her all the sources of income and savings are in the face of threats which put her into great mental pressure. She most often panics about future uncertainty.

When asked about diseases she showed her hands. Her skin is very dry and rough. The same skin condition is of her children. She also told that one of her children had been suffering from fever for more than ten days. Usually she visits *Kabiraj* (rural herbal doctor) for treatment. But everybody suggested her to visit a doctor that time. She then borrowed Taka 50 from her neighbor and went to a local unspecialized doctor. The doctor prescribed to buy some medicines which were very expensive. She said '*paina vat, khabo oushod*' meaning 'we do not get food to eat, let alone medicine'.

Tripti got a goat from BRAC. She said that hardly any tree (crops, vegetables, fruits trees, wood trees etc.) was found in the locality to feed it. She had to take it to a very distant place beside the main street to feed it. But it was very time consuming. She said, 'It was not possible for me to take it to distant grazing fields every day. The goat was probably just stunted and could not live up to its full production potentials. Finally it died due to lack of fodder'. She also received tin from NGO with which she repaired the roof of her house. She also received a water tank from JJS. She took training on rain water harvesting. But the GO and NGO activists are doing nothing to combat salinity, she complained. If the saline water could be prevented by building barricade or embankment, this locality would turn into green and full of crops. But Tripti is not that much concerned about salinity and agricultural production as her husband is not alive. There would be no end of her miseries as Tripti said with a long breath.

Case 6.2.1.1.4: Achhiya

Village: Keyabunia

Achhiya is 29. She is a housewife. She didn't have any secondary occupation. She has a son (4) and a daughter (6). She remains busy with taking care of her children. She lives in a joint family. Her other female family members go for fishing. But she stays at home as because she is carrying once again. Her husband does not allow her to go for fishing because of her pregnancy and the consequent ill physical condition. Her husband and brother-in-law go to deep sea for catching crabs and come after every three or four months. Achhiya was self-dependent in making everyday decisions. But she waits for her husband's arrival for taking any serious decision like what type of seed to buy, which vegetables to grow, what type of fish to cultivate etc.

Achhiya's family had 6 kathas of land. All these lands were eroded by the river as she lives just beside the river bank. Now they only have the dwelling place and a very small pond inside the house. But her house is inundated twice daily. The pond overflows during flooding and turns back to the normal condition during ebbing.

She got two pregnant goats from BRAC. They reproduce twice a year and now she is the owner of eight goats. But she faces much difficulty with them due to lack of fodder in the locality. She needs to take them to the field which is 4 km away from her house. Now her physical condition does not permit her to cover such a long distance. As a result goats have become malnourished and one of them died in the last month.

Acchiya is also facing much trouble with pure drinking water. she said that she did not have any problem regarding drinking water before the salinity. But currently the intensity of salinity became so high that all the sources of water became unusable. Now she needs to collect pure drinking water from a pond which has been recently re-excavated inside the town. But most of the time her sister-in-law goes for collecting water considering the poor physical condition of Achhiya. Her house was very far away from the town and thus it takes more than 4 hours to collect water every day. Compared with her brother-in-law, Acchiya's husband's income was a bit more. Consequently she has an invisible domination over her sister-in-law.

In 1990s Achhiya used to collect leaves and wood from different places of the village. Within a very short period of time, most of the trees and plants died out. Due to the lack of trees and branches, she needs to buy 1 pound *golpata* with Taka 150 for a week. Beside the pond Achhiya has six coconut trees. She gets coconut from two only. But she can use the dry coconut branches as fuel wood.

Achhiya owns fishing nets. It is a very simple net usually made by the villagers themselves. A piece of net framed by wood placed in the sea shore to trap small fishes. Achhiya's sister-in-law goes for fishing with Achhiya's fishing net. Thereby, she is also grateful to Acchiya. Achhiya is also the owner of two stools and a chair. Acchiya had a mobile phone by which she maintains communication with her husband when he is in the Sundarbans.

In 1990s, Acchiya's husband used to cultivate lands and grow paddy. But now her husband needs to go to sea for catching crabs and fishes. It is a very challenging job. In the last month he became the victim of *Kalboishakhi* and somehow he saved his life. Local areas are all under shrimp cultivation, Acchiya stated. As the village is near the sea, local elite people allow sea water to enter into lands so that they can use it for shrimp cultivation. As a result they cannot produce paddy or other vegetables on those lands. Acchiya said, during rainy season it is possible to grow paddy and other vegetables. But due to commercial shrimp cultivation, this is not possible any more. Thus, the only way to earn livelihood is to diversify the occupation.

Acchiya was not allowed to go to any NGO for receiving any training. Few local NGOs were there like Prodiyon, JJS etc. provided incentives to school going children's family. As Acchiya had a school going son, NGO people came to teach them adaptation techniques on homestead gardening. World vision taught them fish cultivation in their pond. Accordingly she threw some small fishes in the pond during the spawning period. But all fishes were lost when the pond was inundated and overflowed. She lost 1800/- taka as a consequence of that.

Acchiya also learned to grow trees in preparing artificial seed beds in drums. On an experiment basis, they planted a guava tree in a drum. The tree is growing up gradually.

She tried to grow vegetables beside the pond. But the plants turn into red in color and die out due to soil salinity.

Acchiya and her family had a very good family tradition. In 1990s, her family was financially very well-off. During each harvest her family used to get 10-15 maunds of rice that would serve them for 4 months. They never had to think of food then. But recently they were put into acute food crisis. She feeds her child first. Household's male members take meal after children. She and her sister-in-law eat last of all. She does get priority in food intake even being pregnant. Traditional customs thus get priority in food distribution system of her household. Sometimes she skips her meal or takes small meal though she does not tell it to her husband. The food she takes does not fulfill the requirement of her body especially during this pregnancy. Acchiya is very worried about her upcoming baby as she had to suffer a lot after the delivery of her second child who was a LBW baby¹⁶.

Acchiya lives in a house made up of wood, leaves and mud with tin shed which was highly vulnerable to cyclones. Two rooms were attached together and they had a common yard on which they used to cook.

Acchiya did not have any expectation from NGOs. They gave her training on tree plantation. But these trainings failed to meet up her household's basic needs. That is why she stopped cooperating with NGO workers further.

Case 6.2.1.1.5: Kulsum

Village: Keyabunia

Kulsum is 36. She is primarily a housewife. Her secondary occupation is fishing. She has two sons and three daughters. Thus she needs to maintain a family of 7 members. Her elder son had completed class 7 and elder daughter studied up to class 5. They left school

¹⁶ LBW (low birth weight) baby is a newborn baby weighing less than 5 pounds 8 ounces. According to WHO (2015), LBW contributes to 60% to 80% of all neonatal deaths. The global prevalence of LBW is 15.5%, which amounts to about 20 million LBW infants born each year, 96.5% of them in developing countries.

and started helping their mother in household activities. Rest of her children goes to school regularly. She received some supports from NGOs against their enrollment in school.

Her husband is involved in different types of occupations. Primarily her husband is a fisherman. He also works as a collector, wage laborer etc. Her husband usually collects crab and catches fish. He sells them out in the market. He earns an amount of Taka 20,000 by selling crabs and fishes. In order to earn livelihood her husband remains away from home for a period of three to four months in a year. During that time she makes all the decisions. Otherwise she depends on her husband for decision making.

Kulsum's husband has a land of about 5 decimals on which her small house existed. Her very small homestead is left unproductive due to soil salinity. She tried to plant few vegetable plants but failed. Potato plants grew yellow initially and finally died. Now she has a coconut tree and a banana tree on her homestead. She is suspecting that this banana tree will not be able to survive due to salinity problem. She gets coconuts from the tree. Most often she sells coconut though sometimes she cooks food with the coconut milk.

She also has four hens and two ducks. She faces much trouble in managing food for them.

Kulsum is in charge of food management and food distribution at home. She needs to struggle a lot for managing food for a family of 7 members. She cannot think of buying meat at all. She said that beef in food menu is a dream for them as it costs more than Taka 300 per kg. But she cooks fishes twice in a month. She sells young shrimps that she catches from the seashore and buys *curfu*, *hilsha*, *mola* etc. for her household. Vegetable is common in every major meal. Dry fish called *shutki machh*, *aloo bhorta*, potato curry etc. are also common. A piece of dry fish can go for a week. She takes a part of that fish and makes a *bhorta* with red chilies.

Catching fish in sea shore is another great challenge for her. Officials of the Coast Guard do not allow them to catch fish fries. If Coast Guard sees their fishing net, they destroy immediately. Thus, villagers are not legally permitted to catch fishes. Since, each net costs Taka 5000, it is a great loss for them. Thus, local people keep informers who inform

the villagers over the phone whenever coast guard come to inspect. Kulsum also gets informed earlier, thanks to her mobile phone, and accordingly takes her net away from the sea. But when the information comes late, net gets destroyed.

She manages pure drinking water like others. She goes inside the town to collect water from a pipeline water supply. It takes more than three hours. She stores rain water in a tank that she has got from an NGO, World Vision. For fuel wood, she is totally dependent on the local market due to lack of trees and plants in the locality. If she buys *golpata* of about 150 taka, it goes for 7 days. Sometimes she buys one mound of wood which gives her support for 15 days.

She and her children take shower in a nearby pond which is full of salt water. Though she does not have any health problem but her children have itching problem. She has become used to with that saline water but her children's soft skin is highly affected by salinity. When her husband comes from sea, she massages oil on his body as the skin gets very dry and rough which is at risk of various types of skin diseases.

Kulsum recalled the past memories and shared her sufferings. She said that once upon a time, she used to get 7-10 mounds paddy during each harvest that would go 4-5 months easily without any tension. But now she needs to buy every item she eats. Each day is a challenge for her. She is already indebted of Taka 5000 to a local money lender. The amount of loan is increasing day by day due to increasing uncertainty of work.

Kulsum's house is at the middle of the village which is connected to sea through a channel dug by an influential person to allow saline water in his lands. She now faces huge problems because of this artificially dug channel through which sea water inundates her homestead daily twice during flooding and ebbing. Sometimes sea water enters into her house. Then she puts fence with mud near the house though she is always in fear that any time the fence might be broken down due to the force of water.

Government *khash* land is less in her community. All the lands are privately owned by local political leaders or by the local elite. Commercial shrimp cultivation has occupied all productive lands of her area. She herself is almost landless other than her dwelling place. She expects local elites to make lands free so that they can produce paddy again in

a more scientific way with the help of NGO. She has not received any training from NGO yet but she has taken many supports from them. She wants to get training on several livelihood options so that she can get a sustainable livelihood option.

Case 6.2.1.1.6: Shuchitra Bachhar

Village: Keyabunia

Shuchitra Bachhar is 28. She is the mother of a son and a daughter. Her daughter is studying in class three and son is too young to go to school. She received her education up to class three. Her primary occupation is housewife and secondary occupation is fishing. She also works as a day laborer in different development projects of the Government. Though she earns money and contributes to the total household's income, she plays the secondary role in decision making. Her husband makes all the important decisions regarding occupation, training from NGO, tree plantation, fish cultivation etc.

Suchitra got married in the same village. Since her childhood, she had been observing significant changes in her village. The village was very much extended up to sea 10-15 years ago. But later on, most of the areas near the sea became inundated by sea water. Lands of southern part of the village were eroded by the river. As a result, the total land area of the village had been reduced. Saline water started intruding since 1980s. She said that she saw her parents producing vegetables, planting trees like guava, banana, coconut etc. which is no more possible to grow to that extent. Once upon a time homestead plantation played important role in meeting up the demands of food of the household. Even rearing cattle and other animals also became very tough there for the shortages of leaves and trees. No grazing land is available there because of sea water inundation. She has received a cow from an NGO after cyclone Ayla. But she failed to take care of it properly. For the lack of adequate fodder, it was gradually becoming malnourished. At last she became bound to sell it at the cost of only Taka 12 thousand.

Though Shuchitra said that she did not have any food insecurity, she used to starve when there is food shortage. She always eats in the end because she gives the highest priority to her husband and children in food distribution. Her sacrifice carries the symbol of

traditional patriarchy where male members of the household hold the maximum authority. She is involved in food management and food distribution of her household. Her husband works as a day laborer. He earns 120 taka only per day. It is not possible for her husband to maintain all the expenditure of the household. She cooks vegetables like gourd, *lal shak*, *kochu shak*, *kolmi shak*, *potato*, *morich bhorta* etc. Weekly once or twice she cooks small fishes like *telapia*. She cooks eggs too. But she cannot manage meat because of its high price. She also cannot afford milk for her children as she already sold her cow.

Shuchitra manages drinking water as like other neighbors of her community. She goes inside the union and collects water from a supply pipe. But there is always a long queue. So she needs to wait there one to two hours. In total, it takes 2 to 3 hours per day. While coming back home, she collects leaves beside the ponds and cooks them as *shak*.

Salinity has brought significant changes in Shuchitra's life. She is somehow coping with the situation but has not taken any adaptation strategy so far. The major problems that she is facing are food insecurity, lack of pure drinking water, poor income, lack of employment opportunities etc. She puts blame on local elite people who have occupied most of the lands of the locality for shrimp cultivation. Only one adult man is enough for one or two *ghers*. Sometimes the owners employ children. As a result maximum people are jobless here.

She took training on homestead plantation but she doesn't have land to plant trees. People of this locality either go to deep sea or they need to work in different development projects like embankment construction and reconstruction, earthwork for re-excavation etc. When developmental projects are not available, their hardship goes to the highest. Shuchitra is more dependent on the market rather than natural resources. She needs to buy maximum things from the market including fuel wood. She also collects branches, leaves etc. to use them as fuel wood.

Shuchitra suffers from headache, body pain most of the time. She does not know the causes of these sicknesses. She is over burdened with her responsibilities. It can be one of the reasons, she guesses. Saline water also creates problems in her stomach. She drinks water only when her thirst goes to the extreme.

Suchitra's house is made up of mud with tin shed and wood. It is highly vulnerable to cyclones. She is more concerned about cyclone rather than saline water intrusion. Salinity is a normal phenomenon to her as because it changed her livelihood gradually. She is rather more concerned about cyclone which brings an immediate change in her life. She does not believe that they can reduce salinity by their effort because it's a natural phenomenon. Thereby, it happens naturally and nobody can stop this saline water intrusion. Thus a blind faith on Almighty about any natural calamity can be noticed from her above-mentioned opinion.

Being a Hindu minority, she and her husband hardly get support from NGOs. She said that one of her neighbors who lives just opposite to her received a grocery shop from an NGO which changed her life. But she never received any significant support from them, she complained. Sometimes she decides to migrate to Dhaka. But considering further challenges and uncertainty, she changes her mind and stays back at her place of origin though she is determined to send her children to Dhaka for doing jobs when they will grow up.

Case 6.2.1.1.7: Peyara

Village: Keyabunia

Peyara is 40. She is a malnourished woman. She cannot work properly. Somehow she manages household activities though unable to work outside. Her husband's left hand is paralyzed. He does not get work every day due to this reason. The day he gets work, he earns 100 taka. Otherwise his family needs to starve. Though her husband cannot earn a lot, she respects him a lot. She never takes any decision without his consent. She has two daughters and a son. She married her elder daughter off to a man who is addicted. Though her daughter stays in a house beside her house, most often she (daughter) comes to mother's house and takes food as well.

Peyara has a very small yard of one katha in front of her house. She planted vegetables and a banana tree over there. All the vegetable plants died due to the salinity of water. Only the banana tree is surviving. But the tree has not given any fruit yet. There is a pond very close to her yard. When sea water rises, this pond overflows and her house gets

flooded. It is a regular phenomenon to her during flooding and ebbing. She has put fence in front of her yard so that water cannot get into her house even though she is in continuous fear of inundation. She is also concerned about frequent number of cyclones.

Peyara has identified poverty as one of her major problems. She cannot afford food two times a day. She is more worried about her son. He cannot tolerate hunger but her daughters can. She sacrifices her meal at night to ensure food for others. Her husband also sometimes sacrifices his meal and takes meals only once in a day. Vegetables and potatoes are the main food of her family. Potato *bhorta*, *shutki bhorta* etc. are some other food items. She manages to cook tilapia fish when her son gets crazy. She has to buy fuel wood due to lack of trees in the area. Peyara finds food prices very high. Every day she spends Taka 50 to 60 for food. She needs to buy each and every item of her meal as her homestead cannot help in any way. Peyara's elder daughter, Sumi, comes to father's house almost every day for getting support as because Sumi's husband is a vagabond. This creates extra burden on Peyara's family. When she comes, they share whatever the food they have.

Peyara manages pure drinking water by boat. She gives two or three drums to her neighbors who go by boat to collect water. She stores water in a plastic water reservoir that she has got from the NGO, World Vision. Peyara mentioned that collecting water by boat is expensive. It would be better if she could go physically to the town to collect water. But her physical incapability does not permit her to go. Her younger daughter is only 5 years old and too young to collect water. Sumi helps her by collecting water very rarely as she needs to manage water for her own household.

Peyara and her husband, both are sick. They go to the nearest upazilla clinic, 3 km away from her house. Every month she needs to spend approximately Taka 100-200 for medicine. Peyara's house is made up of mud with a shed of leaves and branches of the tree.

Peyara is unable to utilize the natural resources in a sustainable way. Staying in a village near the sea, she cannot exploit water resources. She lives from hands to mouth. She is indebted of 8 thousand taka to a local money lender at an interest rate of 40%. She had to make that loan when her husband was sick. Now she needs to pay 4% monthly interest

for that. She does not dare to take any loan further because the amount of interest is too high to pay back.

Peyara does not have assets like land, savings etc. which are required to implement training skills into practice. She does not have the capability to experiment once again by buying more saline tolerant seeds. Thus, she finds no end of her miseries and vulnerabilities.

Case 6.2.1.1.8: Momtaj

Village: Keyabunia

Momtaj is 32. She is the mother of one son and one daughter. Momtaj's husband is a fisherman. Her son is disabled. He cannot walk properly. Momtaj lives in a nuclear family. Her husband does not stay with her whole year. He used to go to sea by his own boat for fishing. But few months back, his boat was hijacked. Since then he goes to sea with other fisherman by renting boat. Momtaj is working hard to save money for making a boat for her husband.

Momtaj lost her everything for the cyclone Ayla. She was then selected as one of the most vulnerable women of the village. More so, she had a disabled son of 12 years. Considering her situation, an NGO, Kodek, build a grocery shop for her. Now Momtaj runs a grocery shop in the village.

Momtaj has extra expenditure for food and medicine of her son. She manages to fulfill the requirement of her son from her shop. The vegetables like potatoes, *kochur mukhi*, onion, ginger and other spices etc. are the items that she usually sells in her shop with a profit of one to two taka per item. She gets Taka 50 to 100 profit on an average every day. Though the profit is not enough, it helps them to survive.

She does not have food insecurity in a sense that she can eat three times a day. But shorter meal is a common phenomenon. She eats less every night. She keeps her food for her son. Her relatives occasionally come to visit her house. She then cooks food by taking from her shop. Her son is a big burden on her. He needs milk everyday as per doctor's advice. She buys milk from the market when she goes to collect water inside the town.

Momtaj faces a challenge for collecting pure drinking water. When she goes to collect water, her shop remains unattended. Initially she left her son in the shop. But as local people know about his disability, they pick up whatever they need in his presence. Though most of them pay later to her, a few of them do not pay at all. Now she keeps her shop closed when she goes for collecting water. But it is a great loss for her as Momtaj mentioned that it takes more than three hours to collect drinking water. She takes her bath in a nearby pond. The water of the pond is full of salt. As a result she has the allergy problem. She does not take any medicine for it. It goes off automatically.

Momtaj said that she wanted to grow vegetables in a nearby land owned by a rich neighbor, but the plants grew yellow and died out. Thus, she lost 500 taka which she took from the land owner. She could not repay that loan fully yet though she partially repaid from the profit of her shop.

Cyclone is like a phobia to her. She is more worried about her shop rather than house. If cyclone destroys her shop, she will be in vulnerable position again.

When her husband goes to sea, she becomes very worried. She gets worried about stormy weather. More so, hijacking, kidnapping etc. are very common at sea. Momtaj's husband comes home every after 5 or 6 months. The fishes, he catches, are sold in the market. By selling those fishes in the market, he gets 15-20 thousand taka. This is the main source of savings with which her husband goes rest of the year. Almost in every month he needs to repair his net as because it has become very old. So she is trying to save a little amount of money every month from the profit of her shop to buy a new net for her husband.

Momtaj is an empowered lady. She takes her son to the hospital, communicates with doctors and does everything according to the doctor's advice. She has studied up to primary school. So she understands what doctors say. Her daughter (4) goes to school regularly. She wants to see her daughter empowered and established. When Momtaj goes to collect drinking water, her daughter stays at school then. She believes that one day her daughter will discharge all the responsibilities towards them and will serve the purpose of a son.

Momtaj's house is made up of mud with tin shed. During summer it is good, but during monsoon, water enters into the house. Her shop is made up of wood with tin shed. Momtaj is grateful to NGO workers for the shop and other support which she got during a period of acute crisis.

Case 6.2.1.1.9: Bimola Mitro

Village: Keyabunia

Bimola is 40 though she looks like a woman of 60 due to hunger and malnutrition. Being a minority in terms of religion, Bimola is one of the most vulnerable women of the village. She is a widow. She has a son of 22. He left the village many years ago. She lives in this village alone as an abandoned woman. Thus, she makes all the decisions alone.

The house she lives in does not look like a house. It consists of a single room made up of leaves and branches. The roof of the house is also made up of same material. The roof is so low that it is not possible to stand up inside the house. The room is full of different types of insects including ants, mosquitoes and flies etc.

Bimola's primary occupation is fishing. But she cannot go maximum time due to sickness. The day she is unable to go, she has to starve. She lives from hands to mouth. She sells fish fries in the market and gets 50 tk per day on an average. Bimola is not expert in catching fish. She does not have any asset. Even she does not have any fishing net. She catches fishes by hiring net from her neighbors. She lives just at the opposite of Momtaj's shop. She buys her necessary things from there.

Starvation is very common to Bimola. She eats only once in a day. She does not take breakfast and lunch. She somehow passes the morning and the noon. In the afternoon, she takes food and waits for the next afternoon. The day, interview was taken, she was found starving. No food was available at her home. At 3pm, she was going to a nearby pond for taking shower. She did not cook anything that day. Her neighbors did not go for fishing on that day due to roughness of the sea. So Bimola had no money in her hand in that day.

Bimola has been suffering from acute food insecurity. She eats vegetables most of the time. She sometimes buys potatoes from Momtaj's shop which is close to her house.

Morich bhorta is one of her main meals. She does not have her own *chula* (cooker). She cooks in her neighbor's cooker. Sometimes she gives two/three potatoes to her neighbors. They boil them while cooking other things. She then eats rice with that smashed potatoes. In this way, she manages cooking to avoid the cost of fuel wood. She goes to the town for collecting water from 'supply pipe'¹⁷. She collects water with a small vessel that goes two to three days.

Being a minority, she does not get any help from any organization. She complained that NGOs never identified her as vulnerable. She has withdrawn all her expectations from government organizations and NGOs. Bimola lost her house in simple storm. Her house also does not permit her to stay if it rains in torrent. She takes shelter in her neighbor's house. Her neighbors are very helpful. If her neighbors come to know that she has not cooked anything, they share their foods with her.

Bimola does not have the minimum amount of assets which is required to survive. For example, planting tree in a drum requires a place where the drum has to be placed. But she herself lives in a drum like house. Buying seeds and planting them requires a land or a yard which Bimola does not have.

Bimola is not a beggar. But she is highly dependent on others. The only one difference between a beggar and Bimola is that a beggar begs, but Bimola is helped by others when other people see her miserable condition. She never demands anything from anybody. Being a widow, Bimola can be considered as the most vulnerable among the vulnerable.

Case 6.2.1.1.10: Saleha

Village: Keyabunia

Saleha is 47. She lives at the end of the village in a tin shed house. The walls of the house are made up of wood and mud. Her house consists of two rooms. There is just a bed inside the room. She has no other furniture. She is always ready to shift in case of further river erosion or of unpredictable cyclones. She was the owner of 10 katha land. She has

¹⁷ Local government has placed a number of pipe lines which are connected to the nearest ponds which are re-excavated recently. These pipe lines supply saline free water for the local people.

lost almost her total land except her dwelling place. She is also in fear of losing her home too.

Saleha is the mother of two sons and one daughter. Her elder son studied up to class 7. He has stopped going to school now. Her second son is a student of class 5. He is still continuing his education. Her daughter is a student of class 2. She thinks that her condition is more vulnerable than any other due to her big family size.

Her husband is a fisherman. For fishing, he needs boat and fishing net. He took loan from a rich neighbor at an interest rate of 40% during an acute crisis period. Now she needs to pay 500 taka per month which creates much mental pressure on her. Monthly income of her household is 3000 to 4000 taka. She keeps 500 taka separated for repaying that loan. She does not use that money even when she is in acute crisis.

Saleha cannot work in the labor market due to her back pain. As she is almost 50, she does not get any work. She cannot catch fish also. Thus, she does not have any monetary contribution to the total income of the household. She is busy with household activities. Saleha wants to contribute her family in other ways. She said, 'I wanted to grow cucumber on the homestead of my neighbor but failed. The plant grew yellow with the root rotten. Within a very few days they died. I also have a coconut tree beside my house. But the tree is not tall enough and looks very thin and weak. It does not give me any fruit.'

Vegetables like *lalshak*, *pui shak*, *potatoes*, *gourd*, *ladies finger* etc. are few common food items of her household. She cooks *shak* with small fishes. If she buys any big fishes like sorputi, tilapia or hilsha etc. in any month, she separates the bones of fishes called *kanta*, *tail* etc. She cooks them with *shak* in other days. She buys fuel wood from the market. She buys *golpata* with 150 taka. It goes for a week.

Saleha collects pure drinking water by boat. As she lives at the end of the village, it is not possible for her to go inside the city on foot by crossing 6 miles of broken muddy uneven road. More there is always a long queue in front of the piped line supply water. If she would go on foot, it would take minimum 3 to 4 hours. Thus, she hires a boat with others

and goes to the main land with lots of drums. Each drum of water costs 10 taka. Two drums of water go for two weeks.

She has a water filter. Still the water tastes salty. Her children don't want to drink that water but no way. Their clothes become very rough. Few years back, salinity was not that much acute in her locality. She used to work at her homestead. She had few homestead plantations like cucumber, *lau*, *lal shak* etc. But she cannot grow anything else now. Soil salinity has reached up to such a level that plants die within a month. She said that government has not taken any initiatives to stop salinity. New cultivation techniques have not yet reached to them. She expects authority to stop shrimp cultivation and to help them to produce something. If it is possible, it will help them to meet up their needs of rice and thereby reduce their food insecurity.

Analysis of the Cases of Keyabunia

From the cases, it is clearly evident that people of Keyabunia are surviving amid the greatest challenge concerning their livelihood. Other than the salinity, it is due to the gradual sea level rise that the cases of Keyabunia perceived frequent number of cyclone, river erosion etc.

They said that salinity kept significant impact on their life. It destroyed their traditional livelihood option. Sea water has inundated most of the lands of their community which kept significant negative impact on agriculture. They mentioned that it is very difficult for them to grow any crops in their locality due to high intensity of salinity. Consequently, they all have diversified their livelihood options irrespective of male and female. Men have become fishermen, collectors, and wage laborers instead of agricultural laborer. All of their main occupation is fishing. The village structure has been gradually shrinking due to continuous effect of river erosion. Due to sea level rise, saline water inundates the village twice in a day during flooding and ebbing. Commercial Shrimp cultivation has covered almost all the lands of the area.

Due to the devastating effect of salinity on agriculture, almost 99% cases reported that they are in acute food crisis. Vegetables are the common food items for their everyday

meals. Cases of this village eat fishes more compared to the cases of Katabunia. They eat tilapia fish most frequently. Many of them tried to grow different kinds of vegetables like *lalshak*, *cucumber*, *pumpkin*, *pui shak*, potatoes etc. They sowed more saline tolerant seeds but failed as plants died out due to soil salinity which took its extreme form after Ayla. One case reported that she tried to cultivate fish in a reservoir but she lost them all due to overflow of the tank. Again one case said that she planted a guava tree in an artificially raised seed beds. The plant is not yet matured. If she succeeds, it can be a very unique adaptation strategy. In addition due to lack of *ejmali shompotti* or government *khash land*, women cannot herd animals. These animals suffer a lot due to lack of fodder in the locality. Thereby, their dependence on natural resources turned down gradually. They have become more dependent on local market system.

Lack of pure drinking water is a common problem of that coastal zone. Rain water harvesting is a technique they all apply to store pure drinking water in tank. Otherwise they are bound to collect water from the town. Either they go on foot or they hire a boat to go to the town in a short-cut way for collecting water from pipeline supply but this is very time consuming.

Most of the people are suffering from various types of stomach diseases. More so, many of them are dying due to high blood pressure caused by the extreme intake of salt through water. Most of the households of this area are female-headed households due to seasonal migration. Though households are female-headed (*de jure*), women are not the main decision makers of the household. Rather they all are dependent on their husbands for decision-making.

Only a very few cases became benefitted from the services of the government and non-government organizations. Momtaj is one of them. She was found successfully running her grocery shop. Only Momtaj has got a sustainable livelihood option from NGO while others received much temporary support from them. Not a single case mentioned about micro credit program. All the cases were found borrowed money from local money lenders at a very high interest rates.

Most of the cases want to get relieved from the curse of salinity. They expect government and non-government organizations to construct embankment so that sea water cannot

enter into the locality. Few others just want support, relief, help from NGOs so that they can survive for a moment.

6.2.1.2 Cases of Katabunia Village

Case 6.2.1.2.1: Khadija

Village: Katabunia

Khadija is 24. She lives in an extended family. Khadija's family consists of her husband, one son, her father-in-law and mother-in-law. All the decisions of her family are taken by her father in law. In absence of her father-in-law, her husband makes the decisions. Thereby, she is just a dependent entity in a household dominated by male members.

Though Khadija is illiterate herself, she wants her son to be educated. Her son is a student of class 2. Although there is no school in Katabunia village, she sends her son to a school which is situated in a nearby village. There is another underlying reason behind her seriousness about son's education. She receives supports from an NGO against her son's enrollment in school. By this time, she has received a solar panel provided by that NGO to facilitate her son's education.

Khadija's husband is basically a farmer. Frequent number of cyclones especially Ayla and Sidr damaged his crops severely. He lost crops of about 15 thousand taka in each cyclone. In addition to this cyclone, increasing saline water intrusion due to gradual sea level rise has made agricultural production more difficult.

Khadija's husband is now a seasonal farmer. He produces paddy when sweet water comes during rainy season. He often leased in agricultural land from village farmers on contract basis. He needs to give 50-60 per cent crops of total production to the land owner and the rest he used to keep for himself. He produces about 20-25 mounds paddy out of which he gets about 10 mounds the sell value of which is around 10,000 taka. After deducting all the production cost, only around 2,000 taka remains as savings. Once the rainy season is over, the lands become more unproductive due to intrusion of saline water. He works as a day laborer year round but during the lean period he gets on an average 100 taka per day. But works are not available everyday. The day Khadija's

husband does not get work, she somehow manages food for her family members or they might need to starve. Such a situation puts her in an unbearable stress and anxiety.

Khadija is primarily a housewife. She often plays a secondary role which does not contribute monetarily to her household. But she contributes otherwise. She collects leaves like *kochu shak* from nearby lands. She also collects fuel wood like dry branches from street side trees. She is in charge of cooking and distribution of food in her household. But her husband is in charge of food management. But her husband, being a seasonal agricultural laborer, cannot afford to manage meat, fish, milk or fruits even once in a month for the members of his household. Khadija cooked curry of eggs and potatoes on the day the interview was taken. She told her children to take rice from neighbor's house. In exchange of that rice she gave them curry. This is a coping strategy which they follow to minimize the cost of fuel. Khadija cooks only one curry every day. Her monotonous food menu is some vegetables which sometimes seem to affluent farmers as nominal side dish. Sometimes her son refuses to take this monotonous food menu and also demands for meat and fish. Being failure to satisfy her son's needs, she feels helpless then. Getting no other alternative she often asks her husband to bring fish or meat from the market. her husband becomes angry. Sometimes her husband bits her son for not eating the food available at home. In fact she is severely mentally challenged for this situation. Being the female member of the household, she eats at the end of all. In extreme food crisis, she sacrifices her own meal for other male members of her household.

Khadija used to collect water from a nearest pond in 1990s. Gradually all the ponds of the area went under saline water. Consequently water of all these ponds became contaminated and unusable. By drinking that water, her mother-in-law started suffering from severe stomach pain. Being worried about mother's health, Khadija's husband dug a shallow tube well at the cost of Taka 10,000. He borrowed Taka 5000 from a local money lender at a very high interest rate (ranging from 50% to 100%). He had to pay Taka 25 weekly to that lender as an interest. This tube well initially could provide salt free water, but has gradually become more salty. Consequently it has become useless for the extreme level of salinity. Recently an NGO has re-excavated a pond of this village. This is the only source of pure drinking water for the villagers. The pond is situated at the middle of the village. It takes at least one hour travelling time for her to collect water from the

pond. She collects water from that pond only for drinking and cooking purposes. On the other hand she uses the water of tube wells for bathing and washing clothes and utensils. She got training on rain water harvesting from an NGO. During rainy season, she stores some rain water in the bucket. But in other season, that pond is the only source of drinking water.

Cyclone Ayla completely damaged her house. Due to strong wind velocity of Ayla, the roof of her mud house was taken away to the unknown destination. When she came home back from the cyclone shelter, she was unable to identify her dwelling place. She with her family members was forced to stay on street side for couple of days which made her more insecure and vulnerable. In the meantime, one of the NGOs came and made a list of most vulnerable households. That NGO built houses for each vulnerable family. The newly built house is made up of wood with tin shed. It consists of two living rooms and a kitchen. She has a single bed in one room where her mother-in-law stays.

Khadija's mother-in-law is still sick. Khadija needs to spend 500 tk per month for her (mother-in-law) treatment including the transport fair and medicine cost. Communication system is also very backward here. Katabunia village is 8 km away from Pankhali union. So she needs to cover a long distance to visit Pankhali health complex to seek treatment.

River erosion has shrunk the total land area of the village including her homestead land, Khadija grieved. Thus, it is not possible for Khadija to grow plants and vegetables within the small homestead plot. She is looking forward to some grants and reliefs from government and non-government organizations so that she can run a small business to make her livelihood better.

Case 6.2.1.2.2: Halima

Village: Katabunia

Halima (60), a poor illiterate woman and a mother of a mentally disordered son (17) and three married daughters, stays with one of her daughters. A vagabond due to his psychological and mental disorder, the son doesn't know where to stay. This has created

tremendous mental pressure on his mother Halima. Halima's husband (70) is no longer able to earn. The main earning member is the son-in-law who makes all the decisions of the household. Halima and her husband are two dependent members of this household. Sometimes Halima's son comes to meet her but her son-in-law does not allow him to stay because of his abnormality.

Halima's son-in-law often stays away from home since he does various jobs like day laboring, assisting in NGO development projects, collecting off-season crabs & honey in the Sundarbans etc. In absence of Halima's son-in-law, Halima's husband takes most decisions for the patriarchal nature of society.

Halima cannot contribute to the family monetarily but she contributes in many ways. For example, she helps her daughter in household activities—such as cooking, managing households, while her daughter remains busy in making clothes and selling them among the local women. (Halima's daughter has a sewing machine and completed sewing training from an NGO. She collects orders mostly from the neighbors.) Besides, she also helps her daughter by collecting water from a nearby pond which has become quite a challenging task for a recent re-excavation done by an NGO. She feels that she and her husband are the extra burden to her daughter's house. Though Halima cooks, her daughter is in charge of food distribution. Her daughter gives the highest priority to her husband and then to her father in distributing food. Halima and her daughter are the last persons to eat, who get obviously the leftover portion of the food, in most cases a very little amount of food. This is a traditional patriarchy where men get the priority even in taking food. Halima cooks vegetables like *kolmi shak*, *pui shak*, *shapla* etc. in most of the time. She also manages to cook some eggs sometimes. Halima's daughter bought two ducks which lay eggs though not regularly. Therefore she can manage to cook curry of eggs at least once in a week. Sometimes she cooks *pui shak* with very small fishes. But they eat fish very rarely. They do not afford to eat meat even in a month. Halima sometimes eats rice with the soup of the curry only and does not disclose the fact to others.

Halima was one of the most vulnerable women after the Ayla as listed by an NGO. She received a cow from that NGO. That cow had put her into more troubles. Halima said that

most of lands of her village are almost infertile due to soil salinity. As people grow paddy only once in a year, Halima had to face lots of challenges for collecting fodder called *nara* for her cow. More so, she had none to take the cow for grazing. Once her son-in-law became sick and they were badly in need of money for his treatment then. Halima then decided to sell that cow during that crisis period. Halima contributed a lot to manage that crisis by selling her cow at the cost of 10,000 taka.

Halima has a very small homestead land which is basically owned by her son-in-law. During Ayla and Sidr, this homestead became inundated by the sea water which came through a canal behind her house. They now cannot grow anything on that land due to extreme intensity of salinity in the soil. Her daughter took initiatives several times to grow some potatoes but failed. Plants grow yellow within a very few days and finally die out. They have a coconut tree in that homestead. They get coconuts from that tree and sell each at 10 taka.

Halima regrets that most of her income sources are uncertain. Halima remembers the 1980s while her husband grew 15-20 mounds paddy to meet up the demands of family for the entire year. Even then they would have surplus production. By selling rice in the market her husband could earn about 10 to 15 thousand taka during the harvesting season. But now Halima and her husband have no income of their own since 1990s. She buys things like soap, needle etc. from a local shop on loan in case of dire necessity. Sometimes her daughter becomes angry and dissatisfied with her mother when the shop keepers do not want to sell on due. This situation puts Halima into sheer embarrassment.

Very often Halima and her husband remain sick due to their age. They are also subject to various types of physical vulnerabilities including skin diseases. When they fall sick, they go to Chalna Health Complex 7 km away from the village. Doctor prescribed them to take some essential medicines which cost 700 taka per month. They do not take these medicines regularly due to high price. They take medicine only when they fall seriously ill. More so, communication system with the Port city Chalna is very challenging due to dilapidated condition of roads. The patient even becomes sicker before reaching the hospital due to the poor condition of the street, Halima mentioned.

Sometimes Halima recalls her sweet memories of the past especially before salinity. At that time her husband could grow 15 to 20 mounds paddy for the household. She had no worry about food insecurity. She said that if her son would be a normal person and be able to earn money, she would probably not be a burden on her daughter. This old couple expects that government should provide grants to old vulnerable people like them so that they can live with pride.

Case 6.2.1.2.3: Nurunnesa Begum

Village: Katabunia

Nurunnesa Begum looks like a woman of 30 to 35 years old though she herself does not know her actual age. She is illiterate. Being a daughter of a conservative Muslim family, she was not allowed to receive education. She is the mother of two sons and one daughter. She wants her daughter (13) to be educated though her daughter does not want to go to school. Her sons are too young to go to school. One of them is 5 and another one is 7 years old.

Nurunnesa's husband is a farmer. He grows paddy during monsoon when top layer of the soil remains under sweet rain water. He takes land lease from a rich farmer who takes 50% crops of the total production. He receives 10 to 15 maunds of paddy in each harvest. He has to maintain his family with much stress when he gets a poor harvest. In case of crop failure, his sorrows know no bounds. He remains unemployed during the dry seasons of the year when he fails to grow crops due to soil salinity. Then he switches his occupation and turns into a collector. He goes to forest with other collectors for collecting honey, wax, fuel wood etc. He earns Taka 5 to 10 thousand by selling these products in the market. He occasionally works as a day laborer too. His average monthly income is Taka 2000. He has to face severe challenges when any family member falls sick.

Nurunnesa, also addressed as Nesa, has to manage her household when her husband remains away from home. She specifically needs to do three activities including household work, homestead farming and fishing. Nesa's house is situated beside a narrow canal through which sea water enters into her yard. Most often Nesa makes an aisle with mud so that sea water cannot inundate her homestead where she has grown some

potatoes. When asked about the effects of salinity, Nesa said that she could produce varieties of vegetables like cucumber, tomato, papaya, banana etc. during 1990s. She now rarely plants few vegetables though she is always in fear of the death of these plants. Her husband brings seeds which are more saline tolerant from Chalna. She plants them. When plants grow well, Nesa becomes happy and proud as well. But most of the time plants die, Nesa shed tears in sorrows.

Nesa's pot remains dry and empty when her husband does not have any income. She sometimes catches fish fries from that canal. She typically feeds her children with vegetables. Often she mixes up *pona chingri* with those vegetables. She faces many problems with collecting fuel wood. She and her daughter collect residues of paddy from paddy fields and cow dung from the street. As all the people of the village collect these stuffs for cooking, it is, therefore, a big challenge for her to get them available.

Nesa also faces problems regarding pure drinking water. Before Ayla, scarcity of pure drinking water was not that much acute. But after Ayla her husband managed to dig a tube well by combining the capitals of three other neighbors. The misery is that the tube well water is so saline that is not drinkable currently. Though one pond has been re-excavated, water of that pond is not fully salt free. Most of the time she sends her daughter to collect water from that pond which is 2 km away from her house. It takes almost two hours to collect water. Sometimes she faces harassment. Young adult boys of the village tease on her way. Her daughter does not want to go for collecting water because of these mastans. Instead, Nesa herself goes to collect water sometimes. Nesa usually wears a *borka* (veil) while going outside. But she cannot maintain 'cover' in that time which put her into further embarrassment.

Nesa has five hens which support them monetarily to some extent. Three of them lay eggs. Money that she gets by selling eggs is more vital to buy some other non-food items like cloths, medicine etc. She said that it is easier to raise hens rather than herding cows or goats because there is huge scarcity of animal fodder in her locality. Before Ayla, she had a cow and a goat. She used to get 3-5 litres of milk from them. But the devastating Ayla washed them away.

Nesa lives in a hut made by mud, wood & straw. 'BRAC Wash Program' made a ring slab latrine for each household but her latrine's cement rings has been somehow broken down. Now she and her daughter are facing huge problems. They use neighbor's toilet in the day, but at night they become bound to use open space.

Nesa said she has been suffering from skin diseases for the last two years. Few areas of her hands and legs are dry and swollen due to extreme roughness of the skin. Skin between her fingers looks white. Nesa said, 'When itching starts, it becomes unbearable. My pink flesh comes out of it. I met a kabiraj who said that this is because of the salt of water.' Kabiraj also said that the plants which are needed to make herbal medicines are no more available in that locality. Frequent number of cyclones, tidal surge and its consequent saline water intrusion has damaged all the plants which were basically used to prepare medicine, Kabiraj mentioned. Thereby, he is also in face of challenges to earn his livelihood.

Nesa offers her prayers every day. After completing her morning prayer, she prays to Allah for her husband's safe return when he stays away from home. During that time she sometimes keeps fast. She prays for a safe return of her husband. She expects a sustainable livelihood option for them.

Case 6.2.1.2.4: Parvin

Village: Katabunia

Parvin (34) lives in an extended family. She is the mother of a son (4) and a daughter (9). Her daughter studies in class IV in a school situated in the next village as there is no school for children in Katabunia. Her son is too young to go to school. Parvin's mother-in-law stays with her.

Parvin's family is typically dominated by male members. Her husband makes all the important decisions regarding expenditure and savings. He switches between two or three jobs although primarily he is a Mouali, i.e. a Honey Collector. He leaves the home with other neighbors during the first week of April every year. He meets his neighbors and

bids 'good bye' to everyone he knows. This formal departure is known as 'Chata dewa'. Parvin's husband and his co-workers stay over there in a boat for two or three months once they leave their homes. Their job is very risky. Most often tigers attack them. For protecting themselves from the attacks of tigers, they use *karu*. A team of about 5-10 collectors go for collecting honey and wax. While they return, they also cut golpata and bring them for using as fuel wood. Parvin's husband is also works for wages. Sometimes he would work as a day laborer in various development projects such as embankment construction, repair etc. To add to these, he is also a seasonal farmer, working for owners of the field.

Parvin's husband is not an expert *Moual*. By selling honey he earns only 15-20 thousand taka which is just half of that of an expert *Moual*, Parvin stated. Rest of the year, her husband earns very little. Thus, on an average they don't get even 2000 taka monthly. It is very difficult for them to manage their household expenditure with that limited income. Parvin is primarily a housewife though she runs a small business side by side. Her husband helps her a lot in her business. She buys vegetables from Chalna local market and sells them out to their neighbors. Basically she buys potatoes, onions, different types of spices, gingers etc. She makes a profit of 10 to 20 taka per day. Her husband brings all these items while coming back from Chalna. When her husband goes for collecting honey, she goes to Chalna by herself.

Parvin has planted some potatoes in her very small homestead of about 1 decimal which is a low lying land. During last rainy season, rain water remained stagnant over there. She utilized that rain water properly. Thereby smashed potato is another common item in her food menu other than vegetables like *lal shak* (locally called *shag*), brinjals etc. Sometimes she cooks eggs as she has two hens. Though Parvin is self-employed, her household often faces insecurity of food. They take food twice in a day. Usually they skip their breakfast. They take food at 11 am and again they eat in the evening. In between sometimes her son demands food. Then she offers him boiled potato. She also offers dry food like biscuits, *chira*, *muri* etc. to her son instead of rice. She is the last eater of her household. She gives meals to other members of the family. She gives priority to her mother-in-law who has been suffering from stomach pain since 1998. She had to go for a surgery that cost 10,000 taka. Parvin had to borrow money from a rich neighbor. Now she

has to pay 25 taka weekly as interest. Parvin is also worried about her daughter who also has stomach pain. Her daughter needs to remove her appendix as soon as possible. A doctor of Chalna Health Complex said that any time her appendix might burst. Parvin cried out, 'Where can I get such a large amount of money? Already I am indebted to a money lender. Again I need to borrow money from him.' Parvin's father-in-law also has the stomach problem. Parvin does not have any savings due to these unexpected expenditures on health. Last year when her husband came from sea, they made profit of about 16,000 taka by selling honey. But all her savings were spent against these treatment purposes. Parvin realized that salty drinking water is responsible for all these stomach problems.

Parvin said that we did not have water for ablution too. They often swallowed Saline water while gurgling, which made them feel very uneasy. Considering all these, her husband took initiative to make a tube well by spending 6000 taka. They got this money by selling honey and golpata. Water of this tube well is comparatively less salty. In addition, during rainy season, she stores water in drums.

Parvin's house consists of two rooms made up of wood, mud and tin shed. She has a mosquito net and two beds. Parvin is the owner of this mosquito net because she bought it with her own money that she earned by selling vegetables. She is also the owner of one bed which her father gave her as dowry. Parvin expects some grants from NGO to buy a cow which, she believes, would increase her income a lot.

Case 6.2.1.2.5: Safia

Village: Katabunia

Safia is 30. She is a widow. Now she is the mother of two sons and two daughters. She studied up to class 5. Her father married her off to a small farmer of Katabuni village at her age of 13. Due to increasing salinity Safia's father's income was shrinking gradually. It became difficult for him to maintain a family of 8 members.

Considering father's situation Safia became bound to leave her education and to get married to a person who was 17 years older than her. His income was good in 1990s. He had a land of about 1.5 acres beside the river. During the last 10 years, he lost all his lands gradually due to river erosion. Safia grieved that if the embankment would have been developed earlier, she could have saved her land.

Safia was financially well off initially. She used to get paddy of about 20-25 mounds after each harvest. Since 2002, the size of her land started shrinking due to river erosion. In addition, increased intensity of salinity was affecting the production of her land. By 2010, her husband lost all his lands due to river erosion and turned into a landless farmer. He became highly frustrated. He was bound to switch his occupation. He became involved in multiple occupations like fishing, catching crabs etc. But he was not used to with those occupations. He could not take that stress anymore and finally died in 2011 by heart attack, as Safia said. After the death of her husband Safia's vulnerability found its peak.

She is in the face of greatest challenges regarding her livelihood. She does not get work as a day laborer or a farmer. She earns her livelihood by working in rich farmer's house. She sews clothes (Nakshi katha) and sells them out. She also makes *shitol pati*. But her income is very uncertain. By selling a nakshi katha she gets 70-80 taka. If she sells it to someone outside the village she gets 100-250 taka. Safia's elder son stopped going to school. He is a van puller. He takes a van from a garage and earns 100 taka daily on an average. He needs to pay 30-40 taka to the van owner. With rest of the money, Safia manages her livelihood. Safia's elder daughter is 12 years old. She helps her mother in household activities.

Safia is involved in food management and food distribution as well. She buys things from a local grocery shop where already she has due payment of 5000 takas. She most often collects shak from a nearby jungle and cooks them. Vegetable is her constant food menu that she can manage twice in a day for her children. On the day of interview, she did not have any income and she was totally empty handed. She borrowed 1 kg rice from her neighbor.

Safia had 2 hens and a goose. She could manage eggs to eat. But recently she had to sell them all to repay her loans. Her husband made a loan of about 500 taka from a local money lender in 2011. That money has become 2500 taka in 2014 with interest. That money lender used to remind her almost every day. She requested him to consider her situation. She told him about her husband's death and also requested to reduce the rate of interest. The money lender then told her to give 1500 taka. Safia then decided to sell her hens and goose. With that money, she somehow managed to repay that loan.

Thus, collection of food from street side jungle, buying food from a local shop on loan, borrowing food from neighbors, selling asset, taking loan from local money lenders are few of the coping mechanisms that Safia follows to manage her livelihood.

She received a solar panel from an NGO at the cost of 500 taka. Her younger son, who is 7, can study at night. She has also taken training on rain water harvesting. She stores pure drinking water during rainy season or she collects pure drinking water from a nearby pond which is recently re-excavated. Once upon a time, she had no worry about drinking water. But now it is one of her major concerns, she mentioned. She and her daughter alternately go for collecting water. The pond is not that far from her house. It takes almost an hour.

Salinity has destroyed her homestead gardening too. Few days back, few people came and said to Safia that the seeds they distributed were more saline tolerant. She then bought seeds of *khira* and sweet potato for about 300 taka. She tried to grow them on her homestead. After few days she saw that only few plants were growing. Most of the seeds could not sprout. 'I lost that money too', Safia took a long breath. She said that every day is a great challenge for her.

Safia's house is made up of wood and mud with tin shed. Her house's condition was good. But Ayla has broken a part of her house, especially kitchen and toilet. She has a common kitchen and a common toilet that she shares with her neighbors. Many of her neighbors received houses after the cyclone Ayla. She demands a house from NGOs. She also demands a good communication system with Chalna so that she can easily communicate with the local market for selling her products.

Case 6.2.1.2.6: Shudhir Howli

Village: Katabunia

Shudhir Howli is 55. He studied up to class VI. He is a landless farmer. He used to earn his livelihood on agriculture. He is the father of three sons and a daughter. All his sons are day labourers working in Chalna. Once upon a time they used to help him in agriculture. But during last 10 years, salinity has affected most of the cultivable lands which are no more productive at a particular season of the year. Finding no other way, his sons have left agricultural activities and migrated from the village to Chalna union. They are settled over there with their family. Shudhir Howli stays with his only daughter and son-in-law. His son-in-law is a collector as well as a fisherman. He (son-in-law) goes to sea for 4-5 months for fishing and catching crabs. By selling these crabs and fishes, he gets 25-30 thousand taka. He keeps five thousand taka as repair cost of nets and boats. With rest of the money he runs his family of 5 members.

Shudhir Howli feels that he is a burden to his daughter. He does not get job because of his age. More so, jobs are not available there. He said that almost all the lands of the area went under the control of rich farmers five to six years ago. Rich farmers who are the owner of 10-15 acres of land started commercial Shrimp cultivation in the saline water. They even allowed saline water to enter into the non-saline lands for profitable Shrimp cultivation. This sort of farming requires only a very small number of farmers such as only one farmer is required for 2 bighas of land. Sudhir said that most of the farmers became unemployed due to this reason. Once upon a time, Shudhir Howli used to produce 30-35 mounds paddy. He had to give around 50 per cent of that paddy to the land owner and rest of the paddy he would get. During 1990s 15-20 mounds paddy did cost around 15 thousand taka. He could run his family with much comfort with that money.

Shudhir Howli said that salinity was the most acute problem of his village. Saline water intrusion destroyed his life by making most of the lands unfertile. His house is near to the sea. Due to the natural course of water, saline water often enters into his house during flooding and automatically gets down from his homestead during ebbing. As a result his homestead land of about 4 decimal has become unproductive too.

Sudhir is dependent on his daughter now. He needs to take money from her daughter to buy anything for the household. He feels shy to take money. But he has no other alternative as because he has no income of his own now. But he helps her daughter by rearing her cattle. Sudhir takes her daughter's cow to the field for feeding. He himself milks the cow. His son-in-law takes that milk to the market and sells it. This cow helps them a lot. His daughter makes sort of cakes with the cow dung and dries them in the sun. These cow dung cake is a major source of fuel of his household.

All his family members eat twice in a day. They cannot manage fish or meat once in a month. Most often they take vegetables like potato, Kacha kola, kochu etc. The cow gives milk regularly. But they do not drink themselves though his daughter has significant calcium deficiency. This is responsible for her pain of arthritis for what she takes medicine of calcium regularly. She faces a lot of problems for collecting drinking water. The pond which is re-excavated is far away from her home. It takes almost two hours to fetch water from that pond. The day, she feels severely sick, does not go to collect water. Then she uses the water of a nearby pond for cooking purposes. She also uses this saline water for washing clothes and utensils, bathing and cleaning purposes. Sudhir Howli also faces stomach problems for this saline water. In addition, he has skin problems. His skin has become dry and whitish. Sudhir said that they get relief from this salty water during rainy season. The problem of drinking water persists in other season of the year which has become a reality to them.

After the death of his wife, he became very lonely. All the NGOs work for women, he said. They provide training to women. Shudhir Howli wants to get training on agriculture. He wants modern varieties of seeds which are more saline tolerant. He does not get any information from any agency, he complained. Sudhir said that NGOs provide grocery shop to women who do not understand anything of business. Shudhir wishes that if he would get a shop like that, he could be better able to manage. He expects more supports from GO and NGO so that they can survive in a sustainable way in such an adverse climatic condition.

Case 6.2.1.2.7: Shubir Nandi

Village: Katabunia

Shubir Nandi is 55. He stays in the western side of the village of Katabunia. His family consists of two sons and one daughter. His elder son (24) earns his livelihood by fishing and catching crabs. His younger son reads in class seven. His daughter is a divorcee who stays with them. The groom demanded dowry of about 2 lac taka. Subir Nandi could not give that money. Groom's family then sent his daughter back.

Shubir Nandi had a homestead land of about 1.5 decimal where he used to grow different types of vegetables. After Ayla, he wanted to grow brinjal and ladies finger. But plants died within a very few days. Subir said that the intensity of salinity increased a lot due to high tidal surge during Ayla. It was very difficult then to produce any crops or vegetables in any land in his locality. Subir Nandi also had a land of about 4 decimals beside the embankment which he had to sell to a rich farmer. At that time, rich farmers of the village started commercial shrimp cultivation at a massive scale inside the village. For profitable Shrimp cultivation, rich farmers often forced the poor farmer to sell their small land to them.

Subir initially worked in a farm. But currently Shrimp cultivation has been stopped in the locality as local people protested. Shubir Nandi said that shrimp cultivation has destroyed all the lands of the village. During monsoon, he works in the land of a rich farmer. He gets almost 7-8 maunds of paddy by which he can run 3-4 months. But during the lean period, he has to suffer a lot. Last year NGO Shushilon started a project of reconstructing the road from Katabunia to Chalna. He got work in that project and could earn some money as a day laborer. But now the project is finished and he became unemployed again. Many new projects are running but they do not want to recruit aged person like him, Subir said. Subir's elder son went to sea for catching crabs during the period of interview. Subir said that his elder son gets 30 to 50 thousand taka by selling crabs. But rest of the year, he remains unemployed.

Shubir recalled the past memories and said that once upon a time there was huge amount of fishes in a nearby canal which is connected to sea. He used to catch a lot of fishes over

there. Sometimes he had to give some of extra fishes to his neighbors. But currently he is in acute crisis of food. They eat twice in a day. He eats less most of the time by considering other members of the household. ‘Is it possible to work with an empty stomach?’ Subir asked.

His daughter is a burden for him, he said. She contributes to the household by collecting pure drinking water which usually takes 2 hours. On her way local people used to comment negative on her. Many people give her dirty proposals as because she is a divorcee.

Shubir feels that he has become aged much. Most often he remains sick. He does not think that he can contribute any more to his family. He buys necessary things from a grocery shop. But most often he keeps the payment due. He requests the shop keeper to keep records in notebook. He already made a loan of 20 thousand taka over there. Shop keeper does not want to sell anything else to him. He is now waiting for his son to come home and to repay the loan at least partially.

Shubir Nandi said that he has not got any support from any NGO. NGO workers include him also as an earning member though his physical condition does not allow him to work. As there is more than one male earning member in the household, they had never been enlisted as a vulnerable household. Thereby, they never got any benefit from any NGO.

He expects GO and NGO to distribute saline tolerant seeds among farmers. In few places of eastern Katabunia, sunflower cultivation has been started on an experimental basis. He expects NGOs to start the same in the western part of the village locally known as Malopara. He finally suggested to reconstruct embankment in the areas where it is already broken due to the force of sea water.

Case 6.2.1.2.8: Nasrin Akter

Village: Katabunia

Nasrin is a woman of about 40. She lives at the mouth of Katabunia village. She has two sons and one daughter. Nasrin’s husband is a collector. He goes to jungle for catching

crab and collecting golpata. Her husband stays away from home for a particular period of time from April to June. Her elder son is a van puller. He earns 100 taka on an average per day. In absence of her husband, her son makes all the decisions due to patriarchal nature of the society. Nasrin's daughter is 7 and younger son is 5. Her daughter goes to a nearby school situated in the mouth of the next village.

Nasrin's husband was a farmer in 1990s. He changed his profession 10-12 years ago when saline water started entering into the village at a massive scale. Now he cultivates the land of others and produce paddy during rainy season when sweet water stays on ground. Rest of the time he stays in Sundarban for multiple purposes. Sometimes he catches crabs. Again sometimes he collects golpata. Nasrin said that her husband has to sell all the crabs he catches. He himself cannot be involved in crab fattening because it requires a small pond which he does not own.

Nasrin lost her everything in last cyclone Ayla. They had to leave their dwelling place during cyclone and took shelter in a school in Chalna. After coming back she could not identify her dwelling place. Her house got destroyed fully by Ayla. NGO workers identified her as one of the most vulnerable and made a new house for them. That house consists of two rooms made up of mud, wood, straws and golpata. She somehow recovered that damage with the support of NGOs. But she personally made loans of about 15 thousand taka from two of her rich neighbors which she could not repay yet. In the mean time, one money lender was giving her pressure to repay the loan. Getting no other way she had to give her ear rings that her father gave her in her marriage. Parvin seemed very sad that she had to sacrifice the last sign of her father who is no more in this world.

Nasrin also got a cow from an NGO after Ayla. Now she is in great trouble with the cow due to lack of leaves, grasses in the area. She collects wastage of paddy called *nara* from the field. As paddy is a one seasonal crop, *nara* is not available throughout the year. Nasrin has to spend 4 to 5 hours a day in collecting *nara* and fetching pure drinking water.

A pond has been re-excavated by an NGO the water of which is less salty. Nasrin collects water from that pond. Sometimes she sends her daughter with a small pitcher to fetch water. Her daughter is too young to collect water. For that reason, most of the time she

herself needs to go. It takes one and half hour to fetch water. But she complained that this water is also not fully saline free. Besides, sometimes she needs to go twice. She alone can carry one pitcher and a bucket which is not sufficient for her household. In that case it takes three hours of a day. But during rainy season, she gets relief. She took training on rain water harvesting which is an important adaptation strategy with saline water.

Nasrin's daughter also helps her by collecting fuel wood such as straws, branches of trees etc. Nasrin collects cow dung from fields and makes them dry in the sun to use them as fuel wood. Thus dried cattle dung is one their important sources of fuel wood. Nasrin often shares food with her neighbors to save fuel wood. She takes rice from her neighbor and gives curry in exchange of that. Sometimes she gives potatoes to her neighbor to boil them while they cook rice. Potato curry, aloo vorta, morich-peyaj vorta etc. are their main foods. Nasrin has a coconut tree. She gets coconuts from this tree. She occasionally cooks semai with coconut. Most often she sells them. She also entertains guests with coconut water.

Nasrin was highly worried in the day interview was taken. Her husband was at sea. By this time, her elder son was arrested by the police. At that time her household had no regular income. She accused the police for arresting her innocent son. She firmly believes that her son cannot be involved in any criminal activity. Nasrin had been starving for two days. She was trying to communicate with her son over the mobile phone. She said that she will not take food until her son comes back. She did not cook anything in that day. Rest of her children was very hungry. She sent them to her neighbor's house to take food.

Nasrin said that salinity has made their livelihood vulnerable. Her household's income has become uncertain. Her son had to go to Chalna for the search of work otherwise he would not be arrested, she felt sad. Nasrin said that her husband and son are trying a lot to cope with the situation by diversifying their income sources. In that sense she is helpless as she cannot contribute monetarily. NGOs have supported a lot, Nasrin acknowledged. But she needs a permanent solution. She said that NGOs should provide training to the women of Katabunia so that they can also earn and contribute to their family monetarily.

Analysis of the Cases of Katabunia

Katabunia, like Keyabunia, is equally affected by salinity, cyclone and river erosion. Among these, salinity is directly related to loss of agricultural production and thereby producing food insecurity.

Most of the women in Katabunia are primarily homemaker. They cannot contribute monetarily to their households. But their non-monetary contribution is very significant. Collecting food is one of the important coping mechanisms for women of Katabunia village. They collect different kinds of shak from the side of embankment, water from ponds and tube wells, fuel wood from street and fields etc. In addition, selling assets or mortgaging gold, borrowing money from local money lenders at a very high rate of interest, exchange of food items, reducing meal time, changing food consumption pattern are few other significant coping mechanisms that they follow. Few of them are involved in small business. They make net, sew cloths, grow vegetables on homestead and sell all these products to neighbors. They cannot go to Chalna for selling their products due to backward communication system. It takes more than to 4 hours to go to Chalna and to come back.

Men in Katabunia are involved in various types of occupations. Their occupation changes with season. During monsoon, they grow paddy. In other seasons of the year, they either go for fishing or work as day laborer. In addition, men of this village are also involved in herding animals, crab fattening, collecting honey etc. Thus, diversifying income source works as an important coping mechanism for men in this locality. In addition, coping mechanisms like selling asset like gold, livestock etc., borrowing money from local money lenders, mortgaging wife's gold etc. are also common practices among the men of this village.

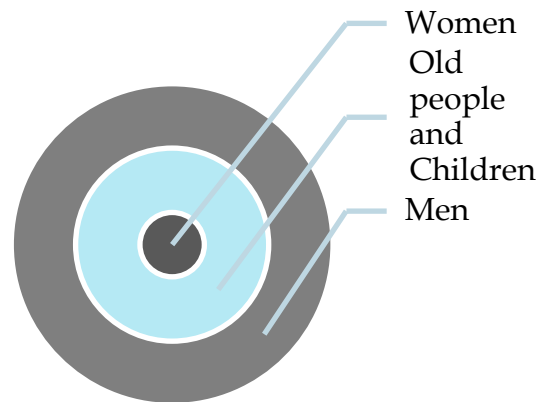
They also follow a number of adaptation strategies. These include change in crop production season, growing crops which are more saline tolerant, channelizing rain water to dry lands and to cultivate those lands, cultivating shrimps in sweet water etc. Women have taken training on rain water harvesting. In addition they have got various types of supports from different NGOs. Many of them have got houses, cows, solar panel, sewing machine, sanitary latrine etc.

Saline water is responsible for many of their health problems including skin diseases, stomach pain, diarrhea etc. Due to backward communication system, they rarely go to Chalna Health Complex. They usually visit Kabiraj.

6.2.1.3 A Comparative Analysis of Keyabunia and Katabunia Cases

6.2.1.3.1 Who is mostly affected?

The case studies presented in this chapter reveals that salinity as a slow on-set climatic change is affecting the livelihood of coastal people in general. But women, though not directly, are the most victim of it. As salinity is directly affecting agricultural production, men's income is squeezed down immediately. But its indirect impact falls on women maliciously. Though women were not involved in profitable rice production, they were involved in homestead production like different types of *shak*, potatoes, chili, fruits like guava, coconut, banana etc. As women are solely responsible for food management and food distribution of the household, they are in constant worry regarding that. After women, most affected are children and old people who remain malnourished due to lack of proper diet. Though men eat twice a day, being the head of the household and chief bread winner, they eat first. If they get sick, the whole family will be in threat. Thereby, a handsome amount of meal is always kept for them.



Three Tire Vulnerability Circle

In the above vulnerability circle, women are at the centre of the vulnerability. Old people and children come next. Men are in the outer circle meaning the least vulnerable group. It is to mention here that if disability is added up to any of these groups, it will exaggerate his/her vulnerability and put him/her into the centre of the vulnerability circle.

6.2.1.3.2 Unprotected Rights

If the above-mentioned cases are analyzed from a right based approach, various dimensions of vulnerability can be sorted out. Each aspect of vulnerability gives us the reminder of a particular human right being dishonored. The first and foremost important human right is right to food which is violated largely. It is distinctly evident that people of study areas are extremely food insecure. There are four criteria to define food insecurity already mentioned in survey section. Few of them or almost all of them are hampered in one way or another for each case.

Another important right violated is right to good health. Due to water salinity, they do not get pure drinking water. As a result, they all have been suffering from itching. Few cases mentioned that they have gynecological problem.

Due to salinity of soil, male members of the household, who had been farmer once upon a time, have become jobless. Shrimp cultivation has occupied almost all the lands of the community. Lack of employment opportunity has made their husbands bound to go to deep sea for fishing or catching crabs and thereby encouraging temporary migration. Being the minority women do not have the access in the labor market. As a result, their right to safe work remains unprotected.

Almost all the cases mentioned that they do not have any contact with the agricultural extension officer. NGO workers also did not come up with modern scientific techniques and high breed seeds so that they could maintain their traditional livelihood option. Their right to information, thus, is also unprotected.

Figure 6.2.1.3.1: Vulnerability Analysis of Salinity based on Cases

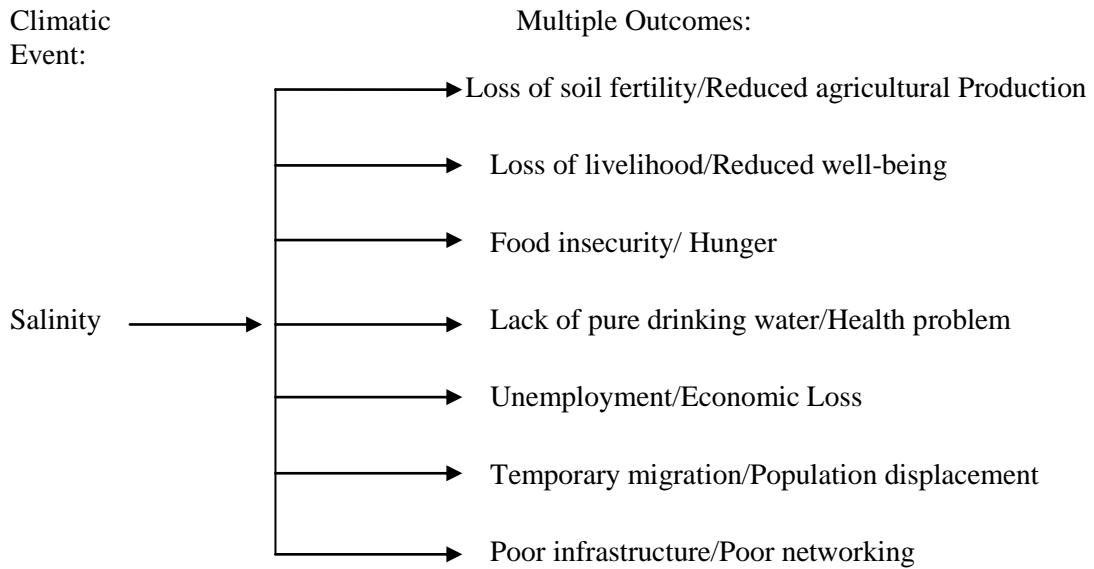
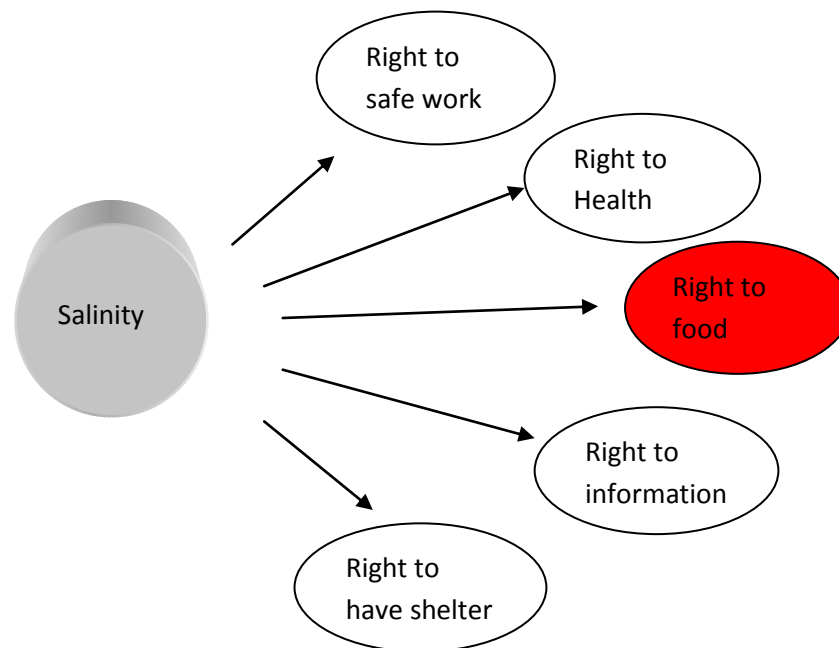


Figure 6.2.1.3.2: Rights Remaining Unprotected due to Salinity



Source: Author's Illustration from a Right based Approach

6.2.1.3.3 Coping Mechanisms

From the cases it was evident that women of both villages are highly dependent on natural resources. Due to salinity agricultural production was to a great extent affected. In Keyabunia village, agricultural production was almost impossible. But in Katabunia paddy production had become a one seasonal crop. As a result, they were diversifying their occupation. Sometimes women would work as a day laborer in different development projects. On the other hand, women in Keyabunia used to go for fishing in the seashore.

Salinity directly affected agricultural production which ultimately led towards food insecurity. From the cases it is evident that women had better coping capabilities than that of men. Women of both villages were collectors. They did not go to deep jungle for collecting. Rather they would collect wild vegetables from their nearby jungle and fields. They would also collect leaves and branches of trees to use them as fuel wood. They had brought huge changes in their food consumption pattern. They did not eat meat at all. Vegetables, different types of *vortas* like *kochu vorta*, *aloo vorta*, *shukno morich vorta*, *begun vorta*, *shutki vorta* etc. were their main food menu. In order to maintain the nutritional value of food for their children, they added milk and egg occasionally for the children only with their daily food menu.

Cases mentioned that fetching pure drinking water was another challenge for them. In order to fetch drinking water, they needed to cross a long distance which takes 2-3 hours on an average. They used to discourage their children to drink too much water. They customarily finished off their cooking without boiling the water and vegetables properly. Such practice would save both energy consumption and water.

Almost all the cases lived on loan. There is not a single case in the community who did not make loan. During monsoon, people of Katabunia used to get harvest. But in other season of the year, hardship carries over. Then they would borrow money from rich farmer or mortgage assets to them. They bought things from shop on loan. Few of them might need to beg. They did not maintain any communication with their relatives so that they needed not to maintain any formality by inviting them.

Figure 6.2.1.3.3 Coping Strategies Followed by Cases

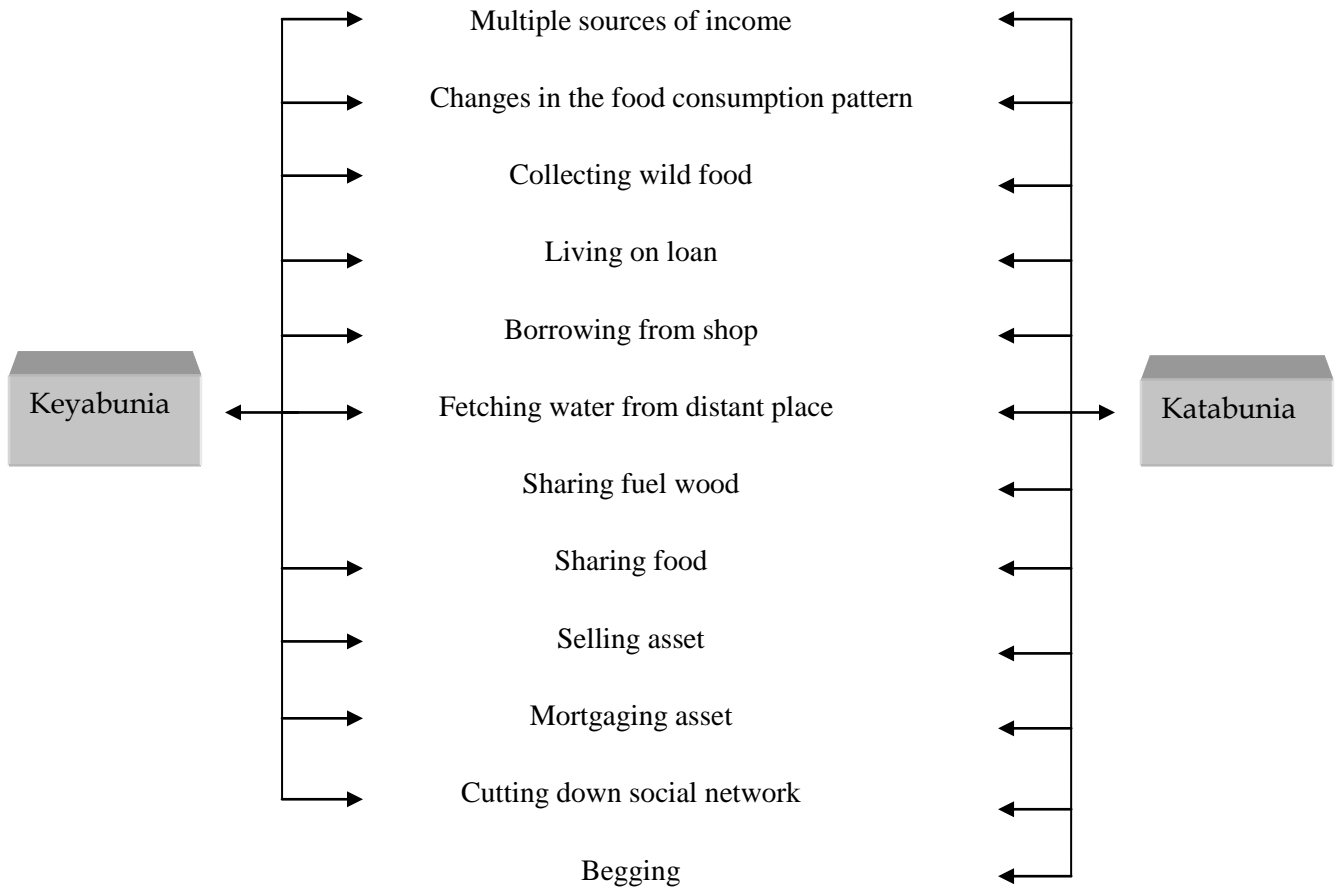
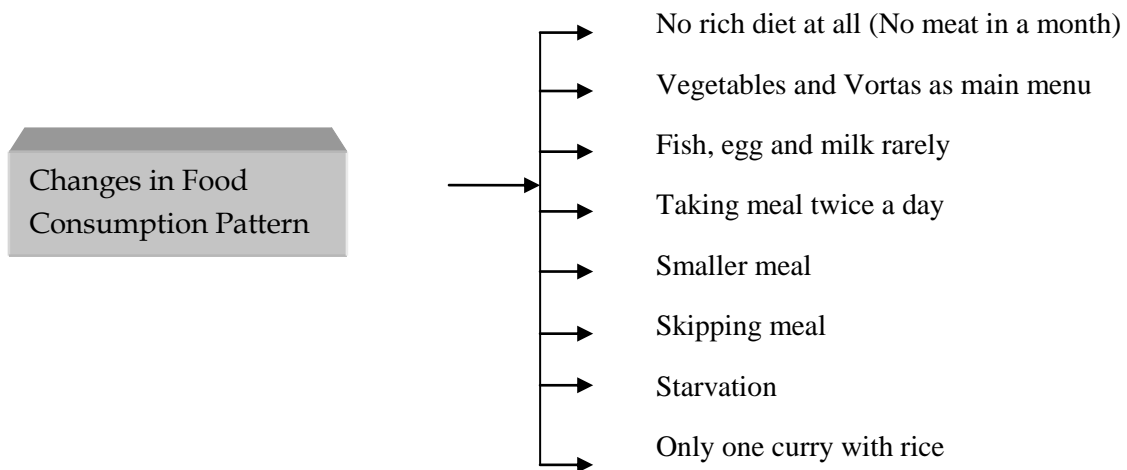


Figure 6.2.1.3.4: Changes in Food Consumption Pattern



6.2.1.3.4 Adaptation Strategies

Adaptation refers to the preparedness of people to face a disaster. In that sense, cases are not that prepared to face the salinity induced challenges. Gradually lands were becoming unfertile. They were trying their best to produce but failed. After few repeated failure in harvest, they started diversifying their income sources. Almost all the cases of Keyabunia village were fisherman. On the other hand, few cases of Katabunia were involved in small business. But maximum household of Katabunia had received livestock from NGO. So herding animals is another important source of income of these women. Cases said that male members of their household are involved in risky occupation as they went deep into the sea for fishing and collecting.

To combat food insecurity women and their husbands were trying to increase their income from multiple sources. Few women in Keyabunia planted plants in drum. They collected salt free mud and poured it in the drum. But they had learned the technique recently from NGO workers. They did not know what would happen with these plants when they would mature. Women in Katabunia planted few vegetables during monsoon in their homestead. In other season of the year they made *charo*, a sort of fishing net and sold them. Few women bought a bulk amount of vegetables from the market and sold them to their neighbor at minimum profit.

Rain water harvesting is another technique they had learned from NGO workers. In addition few ponds are re-excavated by the initiative of GOs and NGOs. People fetched water from there though it is time consuming. Few women used *fitkiri* to purify water. Again few of them received water filter from NGOs and filtered water. Boiling water was not possible for them as it consumed much energy resources.

Figure 6.2.1.3.5 Adaptation Strategies followed by Cases

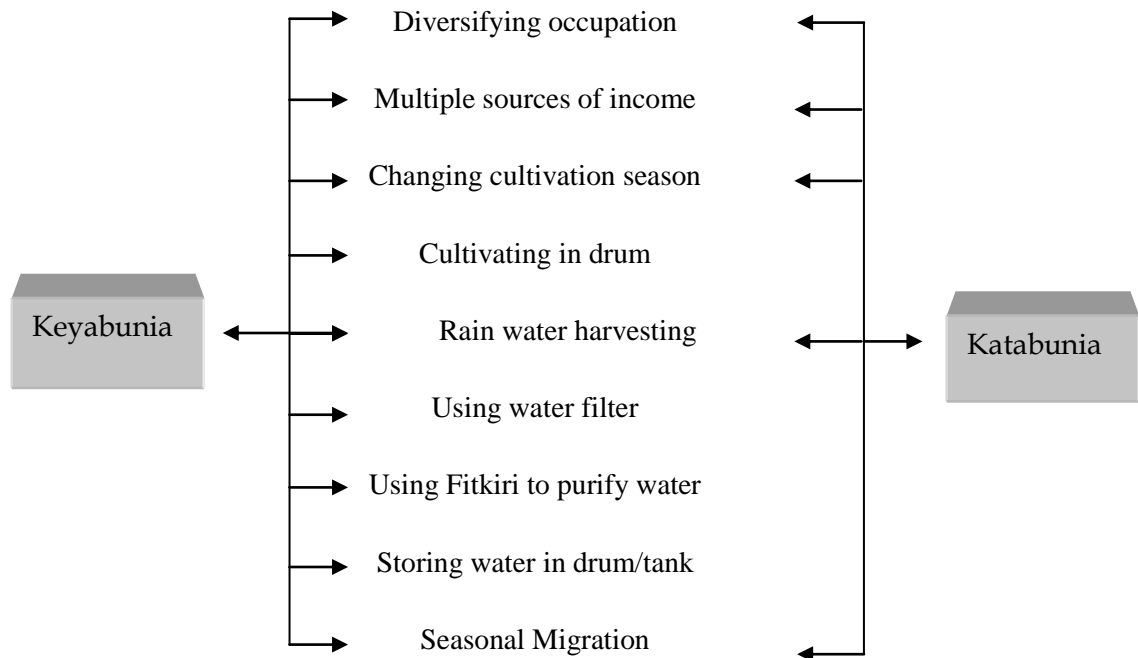


Table 6.2.1.3.1 Diversified Occupations based on Gender

Diversified Occupations	Men	Women
Farming	Paddy, Shrimp cultivation	Homestead plantation
Fishing	Big fishes, catching crabs	Young fishes
Collecting	Honey, wax, <i>golpata</i>	Street side leaves called <i>shak</i> , branches of trees etc.
Small Business	Grocery shop	Making fishing net, selling vegetables etc.
Raising Livestock	Herding pigs, sheep, cows	Herding cows, goats, hens, ducks etc.
Wage labor	In development projects	At the house of rich farmers
Source: Case Study, 2014		

6.2.1.3.5 Services Received from GOs and NGOs

The cases revealed that GOs and NGOs are not that vigilant in these villages. The services provided by the NGO could not serve them successfully. Women in Keyabunia had received Gazi tank, water filter, goats, duck, hens etc. A few numbers of ponds was re-excavated inside the main town. They had received training on homestead plantation and on rain water harvesting.

On the other hand, women in Katabunia had received cows, goats, pigs, sheep etc. from NGOs. Few of them received sewing machine. NGO workers also re-excavated one pond inside the village. They had received training on rain water harvesting. Now all the people know how to store rain water through a pipe from the roof to the bucket. NGO workers have started commercial sunflower plantation by channelizing rain water from land to land in a nearby village. But no such activity had started yet in the study areas. Almost all the households had got solar panels that serve them at night to their school going children. But solar panel was in no way related to combating salinity.

Cases mentioned that they had never met with workers of Salinity Management Centre or agricultural extension officer. Thus, they had not received any service from GOs to combat salinity. A list of NGO services is given below:

Table 6.2.1.3.2: Name of NGOs and Services Provided

Name of NGOs	Keyabunia List of Services Received	Name of NGOs	Katabunia List of Services Received
Kodek, JJS, Prodipon, World Vision, Brac	Water tank/reservoir	World Vision, BRAC Shushilon	Pond re-excavation
	Water filter		Rain water harvesting
	Pond re-excavation		Livestock
	Rain water harvesting		Sewing machine
	Livestock		Solar panel
	Homestead plantation		Tin, House
	Tin		Sanitation
	Grocery shop		Road construction

CHAPTER SIX

Qualitative Data Analysis and Presentation

Focused Group Discussion (FGD)

6.2.2 Description of FGD

6.2.2.1 FGD of Katabunia

6.2.2.1.1 Pankhali Momtaj Begum High School

Focus group discussion started with five teachers of Pankhali Momtaj Begum High School. They were Mohibur Rahman Sheikh, S. M. Motiur Rahman, Md. Ali Hossain, Arun Kumar Mondol and Tribedi Mondol. This school is situated 7 km away from Pankhali Union. Students from different villages come to this school. There is no school in Katabunia village. So the children of Katabunia come across a long distance of about 5 km to attend this school. The teachers were highly aware of the climate change impacts and many of them were personally involved, sometimes collectively, to fight with these climatic shocks.

Other than cyclone, flood and soil erosion, the livelihood of the people became seriously affected by the salinity as participants mentioned. They agreed upon the fact that people of this union were more concerned about the rapid and extreme forms of climatic changes rather than slow on set changes like salinity. But salinity has destroyed their traditional livelihood option. It has destroyed various sources of water as well. There had been variety of fishes once upon a time. But now this saline water is suitable for only shrimp cultivation and crab fattening. The growth of different water-born plants, which had been edible, significantly declined in saline water. Situation has been acute since 1990s. Before 1980, people used to grow paddy three times a year. In every harvest, a farmer would get 10-15 mounds paddy after giving the share of land owner. By selling 50 per cent of that paddy, they would get 7000 to 7500 taka. With that rest of the paddy they could easily go 3-4 months in a year. In such way, they used to get harvest three times in a year. They said that rice has become a one seasonal crop now. Rest of the year people involve themselves in other activities.

After 1980, when saline water started intruding due to sea level rise, many rich land owner captured maximum land of the area and started commercial shrimp cultivation, said Motiur Rahman. Shrimps grow well in saline water. Rich farmers tried to combine several fields together for cultivating shrimp at a massive scale. For this reason, they

forced many middle range farmers and small scale farmers to sell their lands to them. Sometimes rich farmers made invalid documents of the ownership of land and started using the lands of others as their own. This shrimp cultivation made large scale local farmers unemployed as because Shrimp cultivation on an area of one acre requires a single farmer only. So according participants, effect of salinity, though not that visible, is gradually destroying the local economic structure.

Mr. Mohibur said, in 1990, the local people protested against the land owners. Most of the land owners lived in Dhaka or in some other urban places, Md. Ali Hossain added up. Under the leadership of Managing Director of BELA, Miss Reswana Hassan, all the school teachers—especially Mohibur Rahman Sheikh with the support of local people—stopped commercial Shrimp cultivation in the whole Pankhali Union. But by that time saline water already destroyed the fertility of most all the lands of the area. Now rice production is possible only in rainy season when rain water remains stagnant in those lands.

One female participant, Miss Tribedi, said that the most important impact of salinity is on food. People of this union are highly food insecure especially they face the problem of fuel wood. Women of the village go to nearby jungle and also cut down the branches of street side trees, she mentioned. They also use the agricultural residues as fuel. But these cannot give them support for the whole year. When men go to the Sundarbans for fishing, they bring a kind of leaves called *golpata*, branches of many other trees like *Keura*, *Sundori*, *Bain* etc. to use them as fuel wood. Tribedi mentioned that the problem of fuel wood and pure drinking water affected not only the poor people but also the people of all classes. Miss Tribedi herself collects water from the school's water tank.

Mr. Mohibur informed that with the help of an NGO, they have made an underground water tank which is connected to the roof of the school through a pipe for rain water harvesting. This tank is again connected to a tube well. Teachers as well as students, they all consume water from this tube well. But students are not allowed to carry water to their home. Thus, during school time children are getting pure drinking water, but rest of the time, they need to drink saline water.

Mr. Matiur said that food that the local people consume is not balanced. Children were suffering from various types of diseases due to lack of balanced diet. The main occupation of men of this village was wage working. Women used to make small net for fishing called *Charo* and earn a very little amount of money, like 10 or 20 takas per *charo*, he said. Seasonally men of this village migrate to Sundarban and catch crabs. By selling this crab, they get 20-25 thousand takas on an average per year. But their savings was ultimately zero by returning the loan that they took from different local money lenders.

Few institutional problems that they identified were lack of funds, lack of GO and NGO initiatives, lack of community people's awareness, less access to resources, rural politics etc. They said that NGO workers used to come and to give trying on different adaptation mechanisms to make the community resilient. But they do not take the follow up report. Salinity Research Institute is a dummy institution doing nothing—they mentioned. This institution failed to come up with new agricultural inventions. All the participants admitted that if they could stop saline water intrusion in the locality by making a dam or bridge beside the street side, maximum problem of the area would be solved. They all sought the help of authority to take a big project and to implement it immediately for the sake of the survival of the people. At the end of the discussions, all participants were asked to rank all the climatic challenges out of 10. The result is shown in appendix B.

6.2.2.1.2 Katabunia, Dacope (Male)

This focus group discussion is with male participants of Katabunia village. Five male members were taken as participants. They are Moyeen Uddin (40), Abdur Rouf (45), Abul Kashem (35), Kalam Mia (25) and Abdur Rashid (38). Questions were asked focusing on the topics like perception towards climate change, impacts of climate change, coping mechanisms, adaptation strategies and the initiatives of GOs and NGOs.

They all said that climate change is extremely perceptible in their locality and their village is deadly affected by it. Climate change and its after effects have broken down their whole economic structure of the union. The participants were more concerned about salinity rather than cyclone because they lost their traditional livelihood option due to

salinity. Traditionally they all had been farmers, Kalam Mia said. Their main production was paddy which was highly affected by the saline water intrusion into the cultivable lands. Once upon a time their annual income was 40 to 50 thousand takas if the harvest was too good yearly. But now paddy has become a one seasonal crop which ultimately made their annual income three times less than their previous income. Kalam Mia also said, before 1990 in each harvest they used to get 25-30 maund paddy—50% of which they had to give to the land owner. They would get rest of the 50 per cent, the cost of which was about 10 thousand to 15 thousand takas.

Abdur Rashid said, saline water started entering due to sea level rise in 1990s and it inundated almost all the lands of the village. Production reduced drastically and put them into real hardship. Common symptoms found in the crops were rotten root, dry leaves, reddish paddy plants etc.

Mr. Moyeen was a bit more concerned about cyclone. He stated that in addition to saline water, cyclone affects them almost every year causing significant damage to crops. People lose nearly 10,000 takas on an average every year due to cyclone or *Kalboishakhi*. They now wait for the rainy season to cultivate crops on sweet water. Sometimes rain comes on time. But sometimes they suffer from prolonged drought. Moyeen Uddin said with grief that whatever happens to them happens to its extreme.

Kalam Mia agreed with Mr. Abdur Rouf that their source of income is multiple. Many of them used to go to sea for fishing. But for catching a good number of fish they needed to go deep into the sea which was risky. Many of them were collectors as well.

Abul Kashem is a collector. He used to collect *golpata*, honey and wax. He also collects fuel wood from Sundarban. Five to six men go to Sundarban together by boat. They stay there for more than a month which is locally known as 'Chhata Dewa'. But this period has been decreased gradually due to the fear of Pirates. Now they alternately come back home every after 2/3 weeks with all their products. Rest of the members stays in Sundarban for further collection. When he joins them, another member comes home back. This is the way they save their products from the attack of Pirates, Kashem said. Sometimes wild animals especially tiger attacks them. Many of them lost their lives by

the attack of tiger. Recently tiger killed one of their neighbors. That person died leaving his wife and four daughters. They were leading a miserable life losing their main earning member.

Many of them catch crabs and sell them out in the market, Abrud Rashid mentioned. Crab fattening is very profitable there, he said. Landless poor farmer have to sell them. Crab fattening is a sort of cultivation which requires land like Shrimp cultivation. Thus, landless farmers just catch them and sell them to other rich farmers who nourish them by keeping them in a pond full of saline water. Many of them of the village are wage earners. For getting jobs, many of them left village and migrated to different urban places. Few others domesticate animals that they got from different NGOs after being affected by Ayla. But they are in the face of greatest challenges due to lack of grazing lands as well.

Participants said that their poor income had put them into far more problems. Their main problem was food insecurity. They were in constant challenges in managing food for their family members. Moyeen Uddin said that being the main bread earner, food management is one of the major challenges that he faces in his everyday way of life. Their main food is rice and vegetables. They cannot afford meat once in a month even. Sometimes saline water inundates their homestead land. With that water very small fishes also come. Then they catch those fishes and cook them with vegetables. Cooking food and collecting pure drinking water are the responsibilities which belong to Kashem's wife. Participants said that they got relief of having a pond re-excavated by an NGO. The water of this pond is less salty and suitable for cooking and drinking. They skip meal and take food twice in a day.

The participants were available on the day discussion took place. Few were sitting idle in their home and few were playing carom in a public place for not getting any work on that particular day. In such situation either they spend their savings or buy things on loan from their rich neighbors. They do not have any savings as all the participants agreed upon. Taking loan is a very common coping mechanism for all. When hardship is acute, they become compelled to sell their assets, especially domestic animals. These are ways they are somehow coping with the situation. Every year they plan to save some money

but fail. Whatever they earn finishes immediately by reimbursing their previous loan and getting back their mortgaged assets.

NGO activities are not that much visible in their village as participants mentioned. They have seen in other villages that people were commercially cultivating sunflower by storing rain water in small pieces of land by making channel and connecting one land with another. They did not see any initiative like this in their own village. Participants did not know about Salinity Research Institute situated in Dacope. They expected GO and NGO to be more active in their village. They want to go back to their traditional livelihood option. New livelihood options are risky and challenging as Kalam Mia said. He was a day labourer but everyday he did not get work. In addition they desire to have better communication system with the Pankhali union, a primary school in their village, a community clinic nearby and access to electricity. Few solar panels were placed on the roof of some houses funded by NGOs which was not sufficient for them. At the end of the discussion, they were asked to rank the major climatic shifts of their locality out of ten. Their score is shown in appendix B.

6.2.2.1.3 Pankhali, Dacope (Female)

This focus group discussion was with all the female respondents of Katabunia. They were Lutfunnahar Begum (40), Sufia (50), Merina Parvin (35), Lotifa Begum (35), Azifa Begum (40) and Rojina Begum (30). Discussion started with the problems they were facing due to soil salinity and other climatic shocks. The major climatic shocks that they have observed in their village were cyclones, flood, saline water intrusion, soil erosion etc. Lutfunnahar said that Ayla destroyed her house. Coming back from shelter centre, she could not identify her dwelling place initially. Unlike male participants, female participants were more cyclone rather than saline water intrusion. Though they were not directly involved in rice cultivation, their homestead plantation was directly affected by soil salinity. Sufia produces few vegetables especially potato during rainy season. Latifa planted one coconut tree 10 years back which had grown up fully. Other than the coconut tree, no other plants could grow well on that saline-affected soil, Latifa mentioned.

Due to soil salinity, their husbands failed to grow paddy three times in a year, participants mentioned. They said that though they had diverse sources of income, they were not food secured. They had never been food secured, one participant said. The problem started since 1980. At that time, problem was not that much acute. At least they could afford food for three times. But now they take food only twice in a day, sometimes only once. Sometimes they need to squeeze their meal. Children demand food in unusual time. For that they sacrifice their own meal or keep a part of that for their children. Being women they are involved in food collection, food cooking and food distribution as well.

Merina said that each day is a challenge for her. Most of the time, they cook vegetables. Sometimes they cook small fish with vegetables. They cook a single curry and rice every day. They put potatoes sometimes to make the amount big. They keep much soup in the curry. Sometimes they eat only with the soup of the curry.

On days when their husbands do not get work, they cannot buy food, Latifa mentioned. As their husbands do not get work regularly, they often need to go without food. Then they collect vegetables from nearby fields or jungle. Maximum of them are wild leaves which do not seem edible to rich people.

They collect pure drinking water from a pond. In 2012, a pond of that village has been re-excavated by an NGO with the supervision of Government Officials. Since then, they have got much relief about drinking water. As the pond is situated within their village, it does not take much time for them to collect pure drinking water.

Almost all the participants have domestic animals. Merina has four goats. Sufia has two hens and a duck. Lutfunnahar has a duck and Azifa had a cow. They got them from different NGOs after the Ayla. Merina and Azifa faced great difficulty with their goats and cows due to lack of grazing lands. Azifa gets milk from her cow. Merina had to sell a goat at the cost of 1300 due to the treatment of her son who had been suffering from chronic cold and cough.

During their childhood, they saw their relatives visit their houses and stay for a week while their mothers cooked delicious foods. But in their adult lives they find that they do

not have the capability to entertain their relatives. Merina said, ‘We cannot celebrate different social occasions or festivals with our relatives.’

Sufia’s husband is a crab collector. He earns 20-25 thousand takas by selling crabs. With that money they survive rest of the year. In case of acute crisis, they use their little savings. But they do not want to spend savings for food.

Participants were found very much concerned about their health problems. Among the health problems, participants agreed upon that itching is a common problem to all of them. Rojina, a woman of 30 only, has been suffering from uterus infection. She had to mortgage her earrings to a rich neighbor at an amount of 500 takas for her treatment. She could not pay back that money yet.

They have received training only on a single issue from NGOs—rain water harvesting. They connect pipes from their roofs and set the other side of the pipes in buckets. The rain water gets into the buckets through that channel from the roofs of their houses. Other than this, they have got solar energy panels which give them light in single rooms at night. Only the families with school-going children have got solar panel. BRAC has WASH Program in that village which provides sanitary latrine. So they all have ring slab sanitary toilet.

However, NGOs do not or could not give them training on income-generating activities as all participants informed. They also want proper communication system with Chalna so that they can be connected to local markets. Many of them make *charo* for catching fishes but they have to sell them to their neighbours at a very low cost of 100 takas. Thus, they want proper communication system so that the products that they produce can be sold in the markets.

6.2.2.1.4 Chairman, Members and Rural Elites

Another FGD took place with the Union Parishad Chairman, members and with the respected people of the village, Katabunia. Discussants are Shikder Shohrab Hossain, Chairman, Edris Shikder, member of ward no. 3, Md. Zaman Sheikh, Ex. UP member, Md. Gazi Abdul Hannan, Secretary, Ward no. 4 and Abdur Rahman, Businessman (fish).

They all are very much aware of climatic shifts and are involved directly or indirectly in the mitigation of climate change.

The shocks which they have been experiencing over the last few decades are frequent cyclones, storms, sea water stagnation, river erosion etc. The extreme situation as Mr. Hannan mentioned is that, it rains heavily and continuously during rainy seasons. Sometimes lands get overflowed and floods occur. In other seasons of the year, drought occurs and continues to stay for several months. In both cases, the situation is not favorable for cultivation. Amid such unfavorable conditions, farmers try their best to produce, but frequent occurrences of cyclones diminish their hope, Mr. Hannan said. Siltation is another important problem of the area. A large number of canals are filled up due to siltation. It is destroying the normal flow of water responsible for causing drought to large extent.

The Chairman Shikder Shohrab Hossain said that salinity is one of the major problems of the village. It severely affected agriculture, water resources, especially fish, livestock and forestry. The barricade that protects the village from sea water is also at risk and has already made the village defenseless. Due to rising sea level, sea water is entering the village and has already covered most of the lands. Agricultural production is extremely affected. Now paddy *Aman* has become a one-season crop. Local economy is no more based on agriculture. Now the local economy of the village is founded on fish business to some extent, Abdur Rahman mentioned. He further added that fish business is highly profitable in that area. Other than shrimp, sweet water fishes are very expensive.

Mr. Shikder said that people are now involved in multiple occupations. So, it is difficult to mention any one as the soul of the local economy. Few people of the village are fishermen, few are wage workers, few are collectors and few are farmers, the participants informed. Fishes are dying at a large number due to extensive use of pesticides in lands. This medicine is being washed away to the sea. As a result, fishing zone has been shifted. Consequently people need to go to deep sea for fishing and catching crabs. Honey- and wax-collectors stay near the Sundarbans in the boat for several months. Sometimes they become victims of the wild animals. A week before this interview, one man was killed by the attack of tiger, one participant mentioned. Due to crisis of job, few people go to

Northern part of Bangladesh during harvest. People of this village also raise the herd of cattle. But they face immense problems in raising cattle. As paddy is a one-season crop, straws are not available over the year for cattle. These straws are also used as fuel wood. Thus people don't allow their cattle to eat them. More so, trees and plants are not available there. Lack of grazing land is another cause for the death of cattle. Not only food crisis, cattle are also suffering from different diseases due to drinking saline water from ponds, Mr. Zaman added.

Participants identified few other major problems of the locality. They said that before 2010, the whole area went under the control of few rich and elite people. They started commercial Shrimp cultivation over there. Villagers finally managed to stop it. But irreparable loss had already been done by then. The union is badly in need of few number community clinics. People of this village usually suffer from itching, cholera, etc. Due to lack of proper communication system, it takes almost 3 hours to go to Chalna clinic. Transports are not available always. One sort of van and motor cycle are the main transports there. These are very few in number.

Being the representative of the people, Mr. Shikder said that the very narrow brick made road has been constructed recently by his enthusiastic initiative only. He also said that otherwise it would have been impossible for the researcher to get into the village. The communication would become totally stuck during rainy season due to the roads broken by mud. Though the communication has improved much, this is not enough. Mr. Shikder is also very sincere about the distribution of VGD and VGF cards. He tries to ensure that each and every vulnerable family gets these. But he admitted that the shortage of VGD and VGF cards is a crude reality.

The participants put blame on the Government and said that Government is not aware of the problems of this village. All projects are running in Kamarkhola and Sutorkhali union. They are vulnerable, no doubt, they said. But the people of Katabunia are vulnerable too. Few projects can run over Katabunia as well, the participants demanded. The major hindrance is the lack of fund. The members said that if they get enough fund, they can bring a significant change in the village. Sluice gates are needed to be reconstructed in a scientific way to control the saline water. More number of canals

should be dug for channelizing rain water from one land to another. An NGO named GIZ is distributing solar panel to the household having school-going children so that they can study at night. But to give the coverage of electricity to the entire village, they need the support of Government. A number of cement-made big water-storage houses should be built so that water can be supplied through pipes at several public points of the village. More number of ponds should be re-excavated. Participants said that Salinity Research Institute is an inactive institute. This institute is not doing any research for inventing scientific seeds that could grow well on salty soil. They never met the agricultural extension officer of the union. The whole village is gradually becoming barren other than few wild and coconut trees. To make the area green again, all the participants sought help from GOs and NGOs to come up with new technology, suggestions and training.

Table 6.2.2.1.4.1: Social Construction of Disaster (Salinity)

Root Causes	Lack of Government Initiative, corruption
	Exploitation of elite people/rich farmer
	Lack of fund
	Artificial Inundation of saline water on fresh lands
Dynamic Forces	Lack of skill, training
	Illiteracy, Lack of school, community hospital
	Very Poor Infrastructure
	Poor condition of Slwiss gates, barricade
	Unemployment
	Commercial shrimp cultivation
Unsafe Natural Conditions	Deforestation
	Shifting fishing zone
	Soil salinity

Source: FGD, 2014

6.2.2.2 FGDs of Keyabunia

6.2.2.2.1 Union Parishad Members and Rural Elites

The total number of participants of this FGD was 5. They were Babu Komollesh Mondol, freedom fighter; Halim Howlader, member; Shikha, a woman political representative; Sheikh Mujibur Rahman, a rich farmer and businessman; and Md. Kamrul Ahsan, Imam of a local mosque.

They identified salinity as the number one problem of the locality. Due to salinity, agricultural production had become totally impossible. Once upon a time the area looked green and beautiful. But since 1980 and especially after 1990, the saline water entered the whole area and destroyed the fertility of lands forever. After that, the entire area went under the control of rich farmers. They started commercial shrimp cultivation which is possible only in saline water. People gradually started diversifying their occupations. They became fishermen, crab collectors, honey- and wax-collectors, wage laborers and so on.

The local economy ran on fishes, especially shrimps and crabs. The landless farmers caught crabs from the sea and sold them to the rich farmers who had lands. They stored saline water on their land and kept crabs over there for fattening them. Thus, catching crabs was a job of poor landless farmer whereas crab fattening was possible only by rich farmers. A poor landless farmer could be just an employee, as rich farmer Sheikh Mujibur Rahman mentioned. He had more than 75 acre lands where he had been cultivating shrimps and crabs. He employed only four landless farmers over those 75 acres of land. By making profits from this shrimp cultivation, he had sent his one son and one daughter to Dhaka city for higher education. His children had been studying in private universities and the cost was coming from this Shrimp cultivation. Sheikh Mujib also cultivated different varieties of sea fishes which were highly profitable. Md. Kamrul Hasan said that rich farmers like Sheikh Mujib had taken the control of all lands of the area. This elite group had good network with local administration. As a result, it had become very difficult for them to stop Shrimp cultivation. Sheikh Mujib admitted that they had been doing harm to the lands of the area. But he said that, if Government did not

construct barricade beside the river, saline water would intrude and lands would naturally lose its fertility.

Due to salinity people could not herd animals. They could not feed their animals properly due to lack of grazing land. More animals suffered from different types of diseases due to drinking pond-water. Not just animals, people also suffered from different types of stomach diseases because of drinking saline water. Though they tried to purify water through filtration, they could not remove salt fully, as participants said. Children suffer more from cholera and diarrhea. The community clinic was 7 miles away from this village which is another major problem of this locality, Miss Shikha added. More so, the number of seats in the clinic was only 50 which in no way could fulfill the demand of people. She also said that women of this village needed to cover a distance of about 4 km to fetch pure drinking water. On the one hand, poor women in Bangladesh were suffering from malnutrition; they are in continuous struggle for their survival on the other. They lose their health and sacrifice their lives for their husbands and children. Stereotyped gender role kept them away from receiving any sort of skill and training. Ultimately they became detached from the paid labor market, according to Miss Shikha.

People of Keyabunia were highly insecure in terms of food. Md. Kamrul Ahsan mentioned how once upon a time they used to produce 30-35 mound paddies in each season and had a superfluous amount of rice and fishes. That glorious history had gone forever, lamented freedom fighter Komollesh Mondol. Now people went to deep sea for catching fishes and crabs. They also worked in different government projects as wage laborers. Even being involved in multiple works, people failed to meet their demands for food. More so, due to uncertainty of jobs, many people had been leaving their villages and moving towards Dhaka city for jobs.

Member Halim Howlader and Shikha said that their major responsibility was to distribute VGD and VGF cards among the vulnerable people. They also distributed 400 blankets last winter. To adapt with salinity, they brought two km areas under the supply water. But this village was not under that, as they said. In order to bring large number of area under pipe water coverage, they needed huge fund. But they had helped NGOs for the re-excavation of number of ponds within the city. To re-excavate a pond in each village, huge fund was

required. Finally, participants recommended that a number of canals should be dug to allow siltation. This would really be helpful for the agricultural production in the village. Shrimp cultivation has to be stopped. They did form a committee to stop shrimp cultivation. But due to the influence of political people, they could not stop it. Sheikh Mujib said that he does not have any problem if Government puts restriction on shrimp cultivation. Shrimp cultivation is rather comparatively less profitable, he said. If GOs and NGOs could produce crops on these lands, he would produce varieties of crops which could meet the demands for food of the community as well as this would be much profitable.

6.2.2.2.2 Mongla, Chilla, Keyabunia, (Female)

The number of participants of this FGD was 4. They were Fatema Begum (35), Nasima Begum (35), Taslima Begum (30) and Rokhsana (30). The first three were the heads of their households. Their husbands were basically rickshaw pullers. They were wage workers too. On days they did not get rickshaw, they looked for work as day laborers. They said that they did not have any idea about climate change. But they observed significant impacts of it. They said that during the last ten years, flow of sea water had changed. Saline water intruded their mainland. Most of the lands lost their fertility. Crop production decreased significantly. As a result, their husbands left agricultural activity as because it was no more profitable now. Now they pulled rickshaws in Khulna city, Fatema and Nasima said. Another challenge that they faced was the frequent occurrences of cyclones. But they got early warning now. As a result they could take shelter in the shelter centre on time.

All the participants agreed that they were highly food-insecure. They brought huge changes in their food consumption pattern. Nasima mentioned that she was not able to afford balanced diet for her family members. Different kinds of vegetables like *shak*, gourd, potato etc. were the food she cooked every day.

Taslima had a breast-feeding child. She said that she could not feed her baby properly due to her poor nutritional status. She could afford meat only in festivals, for example, Eid-ul-Fitr, Eid-ul-Azha etc. She used to collect meat from different affluent houses

during any occasions and cooked it. Fatema added that she could not manage milk and eggs for her children. Vegetable was a common food menu in Fatema's house too.

Participants agreed that collection of pure drinking water was the greatest challenge to them due to salinity problem. It took three hours to collect one bucket of water. They did not allow their children to drink much water due to the scarcity of pure drinking water. Rain water harvesting was one of the major sources of pure drinking water, Fatema mentioned.

They are no more attached to cultivation. They have shifted themselves from traditional livelihood option. Especially, they depended on their husbands' income who earned wage from the labor market. Fatema sometimes went to shore for catching fishes. But the Coast Guard had destroyed her fishing nets several times. As a result, she failed to make any profit from fishing. More, fishes were not available all the time according to Taslima. Due to all these uncertainties, they did not consider the income from fishing as a regular income and thereby, could not depend on it. They never met the Agricultural Extension Officer. Rokhsana said that he never came up with any scientific inventions to promote agriculture in their locality. But she had got a water tank from a voluntary organization named Prodipon. She stored rain water in that tank. This tank consisted of 5000 liters of water. This was the only one help that she received from an NGO. Another participant got two hens but she had to cook them to meet the demands of their children. Others said that they never received any support from any NGO.

Their housing patterns were almost identical. Those were made up of mud with tin, broken woods, leaves named *golpata* and plastic shed. Water entered their houses if it rained a bit. If it rained continuously, their houses become unable to live. They somehow passed their nights sitting at the corners of their rooms as rain water leaked into their houses.

They suggested that shrimp cultivation should be stopped. This farming had made them unemployed because it required only a very small number of farmers. Sometimes, owners of shrimp cultivation recruited children—promoting child labor in their locality. They

want job opportunity to increase in their union to ensure that they were getting work on a regular basis.

6.2.2.2.3 Female Headed Household, Chilla, Keyabunia

This group discussion was held with four female headed households. They were Bimola Mitro (40), Rongo Mondol (30), Bithika Mondol (30) and Promila Bain (45). Among them Bimola was a widow. Promila's husband had been missing for four years. He went to cut wood in the jungle and had never come back. It was assumed that he had been killed by a tiger. Rongo Mondol was a divorcee and Bithika's husband had got married again and stayed in Dhaka. The other two women, Rongo Mondol and Bithikia, did not have any children. Promila had a son. He got married and stayed away from her. Bimola was an abandoned woman. They were all Hindu by religion. Not only as women but also as being minority, their day to day challenges were greater than any other people of the community. The reality that these women faced was totally different than that of others.

The house that they lived in was like houses where hens and ducks usually stayed. The roof top was too low to stand inside the house. Each of their houses consisted of one room only. It was not even possible to sleep by spreading out the body fully. They needed to bend themselves to be accommodated within that tiny space. The house was made up of leaves. These leaves were full of insects like ants, flies, mosquitoes etc. Definitely, such a house was highly susceptible to strong wind. In case of cyclones, their houses got totally destroyed. Promila and Bithika said that during the last few years they had been attacked by number of cyclones. Now they had got phobia about cyclones. Cyclones had destroyed their houses and salinity took away their food, Bithika said.

They were basically fisherwomen. But they did not go for fishing every day. Rongo Mondol and Bithika had fishing nets, but Promila and Bimola did not. They could not go for fishing unless they hired a net from others. Rongo Mondol and Bithika lent them nets when they came home back after fishing. Rongo and Bithika went for fishing early in the morning. On the other hand, Promila and Bithika went to catch fish in the late morning. They sold each fish fry at a price of 10 takas. Almost every day they could sell about 10 fish fries and thereby earn 100 taka. On days they did not get fish, they starved. They did

not have any other alternative sources of income for not having any male member in their households. Rice and vegetables were their only meals. Sometimes they cooked vegetables with small fishes but this was very rare.

Not only food insecurity, lack of pure drinking water was one of the most important challenges for them as all the participants mentioned together. They needed to go to Chilla union for collecting water from pipe lines which took minimum three hours per day. Sometimes they found long queues there. The young girl, Bithika, said that it takes even evening to come back if she went to collect water in the late noon after finishing all household activities. Sometimes, she became victims of eve teasing. Many men also gave illegal proposals to her. If she denied, many of them gave her threats of throwing acid on her face. Bithika had been remaining seriously anxious and socially insecure.

Promila took training on homestead plantation from an NGO. But she could not apply that training in her practical life due to lack of homestead land. Participants said that trainings are for those who had small amount of land or a homestead or a little savings. They lived from hand to mouth. They could not buy seeds to cultivate on an experimental basis. For these reasons they did not receive any training. If NGO workers came to meet them, they refused. However, if any NGO provided them grants, they just took it. They had now become dependent on grants. They did not get VGD or VGF cards, Promila complained. They said that being Hindus, they got the least priority from the authority and were discriminated.

Participants said that they did not have any savings. Thus, starvation was the only way to cope. They did not have any assets to sell or mortgage. Rongo Mondol had a pair of gold earrings but she would never sell it, she said. This was the only memory she had of her husband.

If they got sick, they went to nearby hospital which was five miles away from their houses. They went there on foot. The very narrow and dilapidated street did not allow any transport to get into the village except motorcycle. They wanted help from Government to make them free from this uncertain life. But the participants did not mention anything specifically.

6.2.2.2.4 Mongla, Chilla, Keyabunia (Male)

The total number of participants was 5. They were Kaosar Ali, Mir Kashem, Bulbul, Kashim and Shah Alam. They were found sitting idle at home. They did not get any work on that day. Primarily they all are fishermen and collectors. They caught fishes at a particular period of the year. Rest of the year, they worked in different development projects as day laborers.

On days they could not earn, they faced acute food crisis. They utilized their savings to survive though they did not want to do so. They then took food only once a day. Vegetables and different types of *vorta* are their main food. Otherwise, they just simply took *panta vaat* (rotten rice) with chili, onion and salt, Bulbul said. They tried to manage egg, milk occasionally for their children. Participants said that once upon a time they had no worries at least about rice. But now they needed to buy each and every item, including rice. The area was unsuitable for any sort of production. Kaosar said that saline water started intruding at a massive scale since 1990. If a strong embankment could have been built, they might not have experienced these sufferings.

As the main bread-winner of the household, male members of the households were under huge mental stress, participants agreed. They needed to leave their home for a particular season of the year. They stayed in the Sundarbans from August to December. During this time, they collected *golpata*, honey, wax etc. During that time of ‘Chhata Dewa’, they remained very much worried about their families back at home. They were struggling for their survival by taking life risk deep into the jungle. People had cut down the trees beside the shore. In order to collect fuel wood, they now needed to get into the deep jungle where the attack of wild animals, especially tiger, was very common.

Mir Kashem caught crabs and sold them to local hatchery if crabs were big. If crabs were too small, he kept them in a pond for fattening them and after that he sold them in the market for getting proper price. Shah Alam added that crab fattening had been a very profitable business here. They just caught crabs and sold them in the market. Land owners bought crabs from them and kept them in land full of saline water in which crabs grow well. By selling crabs and fish, they earned 15,000 to 20,000 taka at a time. This

was their savings of the year. They used this money to manage the acute crisis period—else they would live from hand to mouth. They also took loan from local money lenders very frequently. Mir Kashem said that local money lenders lent money at very high interest rates of about 40 per cent to 50 per cent. Kaoser Ali said that he mortgaged his land of about 5 decimal a rich farmer which he could not get back for not being able to repay the money.

All the participants wish to have a guaranteed livelihood option. They were always in the face of great challenges due to the uncertainty of their life. They believed that they were not suitable for doing any job due to their illiteracy and lack of skill and training. They complained that NGO worker arrange training only for women. One participant said that women stayed in the household chores and had nothing to do with training. Rather training should be given to them who were the head of the household and main bread-earner. Finally, participants said that NGO workers should think of men too, not only of women.

6.2.2.3 Analysis of FGD

To supplement the data of survey, the researcher also conducted 8 FGDs in two different study areas. Four FGDs were conducted in Katabunia Village and another four FGDs were conducted in Keyabunia village. Discussion was based on a structured and unstructured checklist. Participants were free to opine on different issues concerning the checklist. They were also asked to rank out of 10 on different aspects of climate change issue where 0-2 points indicate low, 3-4 points medium, 5-7 points high and 8-10 points indicating critical level. The tables of raw data are all attached in appendix B. The mean scores of all the tables belonging to each study area are presented in this section under different headings.

6.2.2.3.1 Perception towards Climate Change

Climate change had kept significant impact on two villages. Two study areas became manifested to us with two different scenarios. Climate change had been a very common phenomenon to both of these areas. People had been the continuous victims of various climatic situations and its direct and indirect impacts. Among these changes, participants reported about prolonged rainy season, increased number of cyclone, water stagnation, drought, loss of bio-diversity, soil erosion and most importantly saline water intrusion. Soil erosion is a very common problem in these study areas as they both were located very close to the rivers. Another major problem was saline water intrusion ranked 10, indicating critical level as like as soil erosion. But the difference between Katabunia and Keyabunia was that, Katabunia had the most highly affected areas due to salinity which affected lands at a massive scale. On the other hand, Keyabunia was still sluggish with water salinity at a larger scale. Large amount of land was still under saline water in Keyabunia village. Though study areas were going through an experience of significant number of climatic issues, their total economic structure has been changed due to the salinity of water which affected these areas dreadfully.

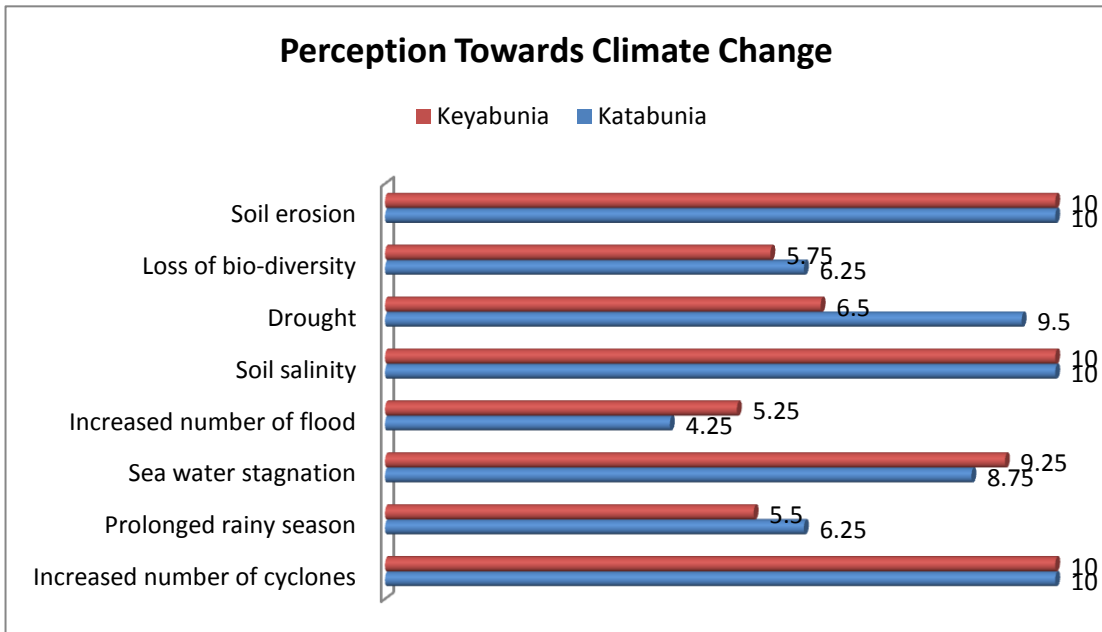
According to the participants, saline water stagnation, sometimes considered as flood to the local people, is another common problem to these localities. Participants of Katabunia ranked 4.25 and participants of Keyabunia ranked 5.25, showing below average and

average level of measurement scale respectively. Though this problem was not evident in Katabunia village when study was conducted, participants complained that sea water entered the land seasonally and stayed over there for a certain period of time. On the other hand, in Keyabunia, saline water was stagnant in many places which were being used commercially.

As water stagnation attacks seasonally only in Katabunia, the area was attacked by drought (ranked 9.5 i.e. critical level) during other seasons of the year except monsoon. But as Keyabunia experienced longer rainy season, drought came occasionally (ranked 6.5 only compared to that of Katabunia).

Participants said that they are no more afraid of cyclones which have become regular phenomena to them. Both areas showed very critical level in experiencing cyclones ranked 10. Participants also reported about loss of bio-diversity. The mean score for Katabunia is 6.25 and for Keyabunia is 5.75, indicating high level of the scale.

Figure 6.2.2.3.1: Perception of Coastal People towards Climate Change



Source: FGD, 2014

6.2.2.3.2 Impact of Salinity on Agriculture, Livestock and Local Economy

Salinity affects agriculture terribly. Sometimes participants took challenge to grow vegetables in their salinity-affected land but failed. They stored rain water on lands and grow paddy on that sweet water though only once in a year. Participants said that once upon a time, they used to produce paddy three times a year. But now paddy had become a one-season crop which could not meet the demand of rice for the whole year. A successful harvest was not even ensured during rainy season. Salinity has affected lands so ghastly that sometimes they receive very poor harvest in sweet water also. They still grew few vegetables in their home yards where saline water went off. Major problems which were seen among plants were the dead tops and the rotten roots. Salt of the land created obstacle in the nourishment of plants and made plants dry. After few days these symptoms caused plants to die. As a result, they became disheartened and gave up hope of growing any kind of crop in future. Participants of Katabunia said that maximum lands went under the commercial use of shrimp cultivation due to the crop failure. As a result, total amount of cultivable land became reduced in that village. Rich farmers started exploiting small farmers. Consequently, local people gradually shifted themselves in alternative livelihood options. Though shrimp cultivation was no more available in this village due to few policy initiatives by GOs and NGOs, lands already affected by salinity lost their fertility forever. Now the maximum people of Katabunia village were part-time day laborers.

Katabunia can be considered as a pastoral society, where people also lived on the domestication of animals. Cows, goats, pigs, chicken and sheep were the animals they domesticated. But villagers were also facing problems regarding animals which most often were attacked by various viruses and bacterial infection. Other than this, animals were malnourished due to lack of grazing lands, plants and trees. These animals also did not have proper place to stay at night. They sometimes died by the bite of snakes and other poisonous insects. When an animal died, this put a great threat to the survival of that household.

Keyabunia village reflected almost the same scenario. Here people could not think of cultivation. Almost all the lands of this village were salinity-affected and under the

commercial utilization. Rich farmers cultivated shrimps and made huge profits. Maximum rich farmers sent their children to Dhaka for higher education. They bore all their expenses based on this profit. Local people domesticated animals too. Duck, chickens, goats and cows were the kinds of animals they kept. They met the nutritional needs of their children from milk and eggs. They were exploited by the rich shrimp farmers. Local people took the initiatives several times to stop shrimp cultivation, but failed due to political reasons. Shrimp farmers were somehow connected to the local political leaders and administration. As a result, economy of Keyabunia no longer depended on agriculture. The wheel of the local economy turned towards the wage labor market and fishing.

Men were especially involved in wage labor market and maximum women go for fishing with net. Due to the soil erosion, fishing zone had been shifted and moved on deeper into the sea where women did not dare to go. Fishing was profitable when their husbands went deep into the sea by boat for catching big fishes. But this was highly challenging and life threatening too. Many lost their life by the attack of wild animals.

6.2.2.3.3 Salinity, Food Insecurity and Vulnerability

Impact of salinity on agriculture and on livestock made local people intolerably food insecure. Participants said that three times food in a day was a dream to them. Landlessness, experience of crop failure, lack of skill and unemployment, shifting fishing zone, poor networking with the main land due to worst infrastructural conditions and lack of NGO interventions were the major causes of food insecurity.

People of both study areas ate maximum twice a day. They took late breakfast around 11 to 12 o'clock. Then they took their second meal in the evening immediate before they went to sleep. As food, they took rice and vegetables, potato etc. throughout the year. They did not have any variation in their meal. Sometimes they cooked potato curry; smashed potato known as *aloo vorta* is a common food to them. They collected vegetables from their homesteads. They needed to buy maximum items. People, having hens and ducks, kept eggs for children and for the elderly people. Meat, beef, and other

rich diets were beyond their imagination. Fish was rarely taken as the participants of Katabunia reported. On the other hand, people of Keyabunia took fish twice a week. If women could catch more fish fries, they kept few for their family after selling. Bread, fruits, pulse, meat, beef etc., containing different nutritional components, were totally absent in the food menu of the people of both villages (please see section 6.1.6 for details).

Barter system on food still existed in both the localities—though practiced comparatively more in Katabunia rather than in Keyabunia. Participants told that they would not cook both rice and curry regularly. If a person's neighbor cooked rice, she would cook a curry. Then they exchanged food items with each other. Hardcore poor would not cook at all. They used to beg from rich farmers.

Pure drinking water crisis was most acute in two villages. As saline water intruded almost in all areas, water of all sources was affected. They would discourage their children to drink much water. They themselves also tried to drink less. Few people had filter in Keyabunia village as participants mentioned. But in Katabunia, people used to drink particular pond water which is excavated by an NGO. It cannot be said that this water was salt free, rather seemed to be less saline. People who lived close to that pond got drinking water without wasting any time. But those who live far away from that pond, it would take 2-3 hours for them to fetch a pail of water.

6.2.2.3.4 Coping Strategies

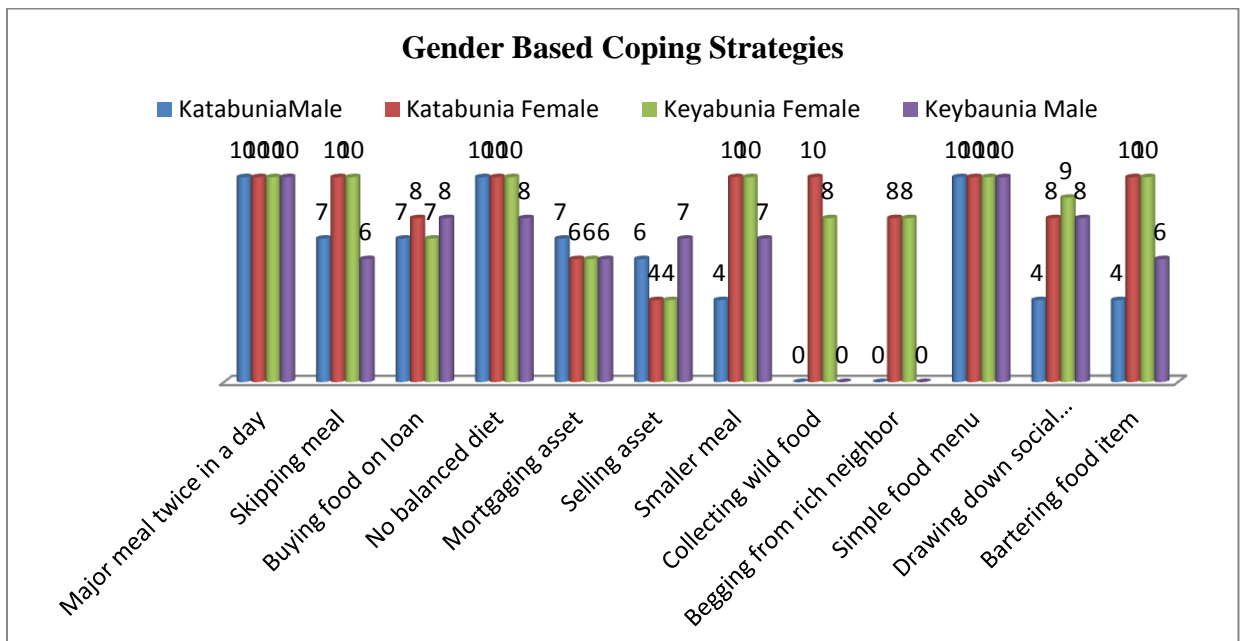
In order to distinguish gender-based coping strategies, two FGDs were conducted in Katabunia; one with only female participants and one with male. Similarly, another two FGDs have been taken from Keyabunia village. Like perception, participants were asked again to rank out of 10 where 0-2 indicates less practice, 3-4 indicates medium practice, 5-7 highly practiced and 8-10 very highly practiced.

In both villages, people had brought significant changes in their food consumption pattern. Usually they ate vegetables in every meal that they would collect from jungles beside the street. They took potatoes more than any other vegetables. Women participants reported that they passed over meal time and used to take smaller meal (ranked 10) than

their requirement. On the other hand, men experienced this reality comparatively less than women.

NGOs picked up the most vulnerable women of these areas and help them by giving domestic animals. Women, who could raise them properly, became benefitted by them. These women could afford egg, milk etc. in the meal but others could not. They sold milk and sometimes they wished to buy rich foods like beef, big fish etc. though it happened hardly. Few women in Keyabunia sometimes went to the Upazilla to participate in ‘Food for Work’ program. Again many women would go for fishing in the riverside. They could afford fish at least once in a week. But people of Katabunia rarely could afford fish in their meal.

Figure 6.2.3.2: Gender-based Coping Strategies



Source: FGD, 2014

All the participants said that they became used to with food-insecurity. Sometimes they ate only once in a day. They were just surviving with a very simple and boring food menu (ranked 10 for all indicating very high level of the scale). Women of Keyabunia reported that they sacrificed food for their children and male members of the household. Sometimes women exchanged food with their neighbors to manage food for their

children and husbands (very high level) though men were not as much concerned about that as women were (medium level for Katabunia and high level for Keyabunia).

Women had cut off their social network. They maintained no regular contact with their relatives so that they needed not to spend money against entertainment (ranked 8 for Katabunia female and 9 for Keyabunia Female indicating high level of the scale). Men also cut off social network but not to that extent (ranked 8 for male Keyabunia and 4 for male Katabunia). Though men of Katabunia did not have any contact with them for a long period of time, they did not feel to that extent that they were remaining isolated from their relatives

Women would manage fuel wood from *jongla* (little jungle situated beside the street or behind the house or beside the pond etc.). In this case their male partners helped them a lot. Men in Katabunia village used to go to jungle and collect *golpata* and leaves of Baula tree. Men in Keyabunia also contributed to cooking by collecting fuel wood. But these could not meet their daily needs. Most often, they needed to buy *golpata* from local market.

Collecting *shak* from pond side is a task for women (very high level of scale). On the other hand, men never became involved in this work (very low level of the scale).

Participants said that they had become used to with saline water. They boiled water or filtered them very rarely. Rather they would try to find out a tube well or a pond whose water was less salty and collected water from there.

Participants said that they seldom mortgaged things because they did not have any valuable thing to mortgage (high practice). As women were not the owner of properties, they did not take decision about selling goods (indicating medium level for women and high practice for men). Thus, it was mostly male who sometimes sold goods or assets for the sake of survival.

6.3.3.5 Adaptation Strategies

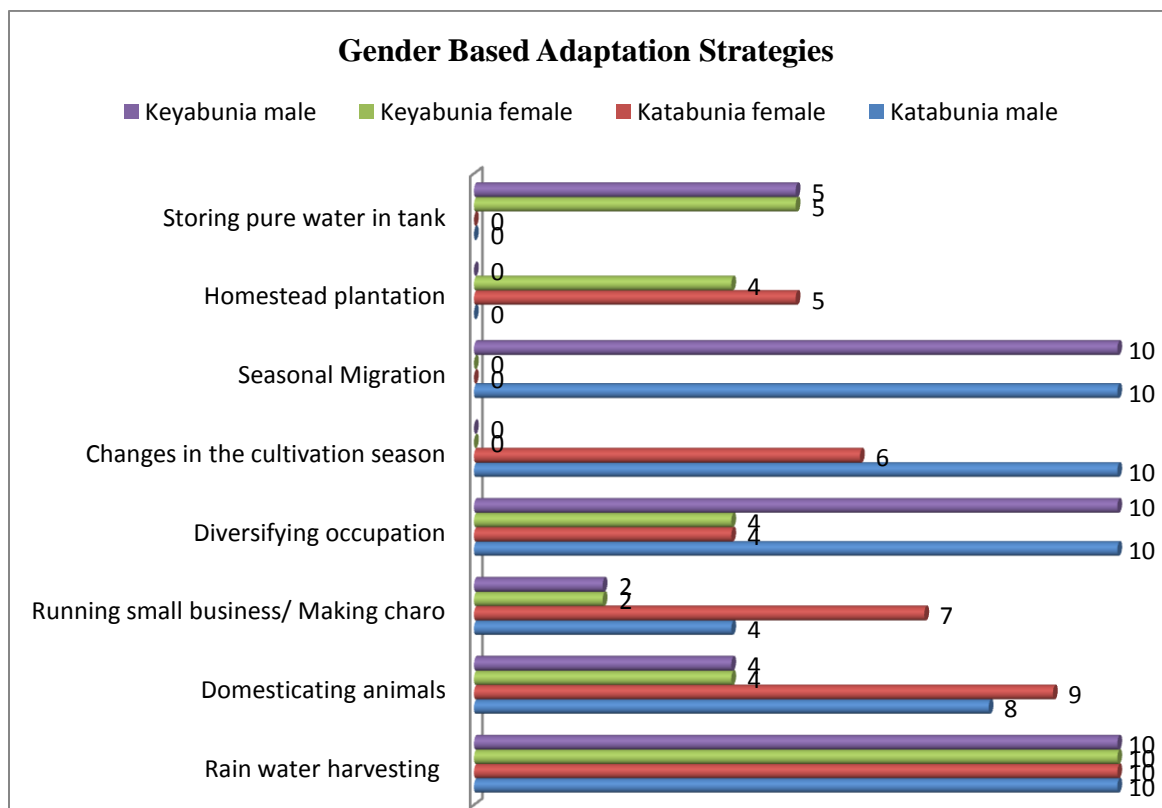
People's income decreased significantly due to salinity of water. Due to crop failure year after year participants did not find agriculture profitable any more. Even though people of Katabunia especially men were trying to grow crops by changing the cultivation season (very high practice) compared to that of men of Keyabunia (very low practice). Diversifying income source was another important adaptation mechanism as mentioned by the male participants (ranked 10).

Women of Katabunia village involved in homestead plantation, domesticating cows, goats, duck, hen etc. many men of this village would regularly go to the main land for the hope of a job. Sometimes they got work, sometimes not. These people used to go without any work for 5-7 days on an average in every month. Almost all the people of this village were directly or indirectly involved in herding animals (very high practice) as compared to that of Keyabunia people (medium practice). But even then, people of both areas needed to live on loan. They took loan from their neighbors, who were comparatively in a bit better situation than them. They also placed request to the shopkeepers to sell product to them and to keep the payment due. In fact, participants mentioned that they were indebted to local money lenders or rich neighbors or to the local shopkeepers throughout the year.

Almost all the men of Katabunia gradually were trying to adapt with the existing situation by diversifying their sources of income. Only very few women were trying to grow vegetable plants on their homestead though the rate of success was very less (medium practice by Keyabunia female and high practice for Katabunia female). Women would go to jungle for collecting *buno shak* which seem to us unpalatable. More, pastoralist villagers try to meet up their nutritional demands from animals. On the other hand, few women of fishing community i.e. Keyabunia were trying to grow fruit plants on big drums. By stockpiling mud they also prepared a raised seed bed on their homestead which saline water could not submerge. They were trained up in this special type of plantation by NGOs especially by World Vision. Men were busy with outside activities and less involved in homestead plantation (very low practice).

Keyabunia villagers could easily switch to alternative livelihood options because it was close to the Chilla union. By switching between fishing (very highly practiced as an alternative occupation) and farming, these people attempted to minimize their vulnerability. Women would catch fish near to the shore, but men went to deep into the sea which was highly challenging. Catching Crab was another seasonal occupation as male participants mentioned (very highly practiced). To catch crab, people of both areas would go to the Sundarbans. Crab fattening and selling played a very important role in household income and expenditure. But sometimes they would become the prey of many ferocious animals inside the jungle. This seasonal migration, locally known as ‘*chhata dewa*’, of male members (ranked 10) led to increase female headed household in the locality for the time being. On the other hand, alternative livelihood options were limited for women (Medium level of the scale).

Figure 6.2.2.3.3: Gender-based Adaptation Strategies



Source: FGD, 2014

It is already mentioned that after identifying the most vulnerable women, NGOs provided livestock to them as grants and trained them up how to make profit from these animals. Few of them became successful in cattle rearing and reproducing animals. Their household expenditure depended on their livestock a lot. Women of both localities used to make one sort of basket/net for catching fish. By selling these products, they would earn money. But such sort of activities were not that much prevalent in Keyabunia (very low practice) compared to Katabunia (medium practice by men and highly practiced by women).

For pure drinking water, one NGO had re-excavated a pond whose water was comparatively salt free. People from distant places used to go here to collect water. People of Katabunia felt lucky for having this pond in their locality. People of Moukhali village went there to collect water and it would take 2-3 hours for them. People who were a little bit solvent dug deep tube well. Other than this, NGOs had taught these people how to store rain water through a pipe connected to the roof top of their house (very highly practiced in both areas). Few female participants of Keyabunia reported that sometimes they needed to buy drinking water. For cooking they used to collect water from nearby pond or go to the city to collect supply water (highly practiced).

6.2.2.3.6 Perception of Local People towards NGO Initiatives

Participants were asked to comment on the interventions of NGOs in their localities. Participants could not tell the name of NGOs. But from the discussions, it was evident that NGO intervention was very limited in Katabunia Village whereas few NGOs like World Vision, BRAC, Prodipon, Jagrata Juba Sangstha (JJS), Ahsania Mission, Nazrin Mission etc. were working in Keyabunia. BRAC was working on ensuring the proper sanitation facilities but not on salinity in these two villages. The 'Wash Program' of BRAC provided them pacca toilets. World vision funded by European Union provided water tank to 50 per cent of total household to store rain water. But this facility was given to those families whose children had enrolled under the World Vision education program. This NGO had also provided 20 tins to each vulnerable person affected by cyclone. Besides these, World Vision also helped local people by providing them livestock like hen, goat etc. JJS and Caritas also provided water tanks/reservoir to the vulnerable

people. Nazrin Mission helped by building water storing brick reservoir consisting of 5000 liter water. Ahsania Mission provided the solar energy system which was a great help for the children to study at night.

On the other hand, NGO intervention was very insignificant in Katabunia village. Only BRAC's sanitation program was on-going there. One NGO, which people failed to name, re-excavated a pond in Katabunia which was a great help for the local people. People from distant places used to come to collect water from that pond. BRAC has started adaptation program related to agriculture in a nearby village. Sunflower cultivation had been started on an experimental basis over there.

It is very difficult to know about NGO interventions in the study areas from the participants. These people think that if they share about the interventions of NGOs, they will be deprived of any future grants. Thus, though few people in Katabunia got some supports from NGOs, they tried to hide the information to the researcher.

CHAPTER SIX

Data Analyses and Presentation

Qualitative: In-depth Interview

6.2.3 In-depth Interviews

6.2.3.1 TNO (Pankhali, Dacope)

Md. Nurul Hafiz was the TNO of Dacope Upazila during the time of interview. The researcher took an in-depth interview to know the Government initiatives on climate change issue in that Upazila. Mr. Hafiz said that administration was highly concerned about the problems of the locality. He identified the salinity as one of the most acute problems of Dacope Upazila. ‘Salinity affected agriculture and pure drinking water grisly’, he said. To combat the issue, the local administration was always alarmed. By that time, his administration took several policies which are discussed below:

Administration had re-excavated number of ponds in different vulnerable villages. They were also working to purify the pond water through the PSF (Pond Sand Filtration) system. But these were not absolutely done by the Government alone due to lack of fund. Rather with the collaboration of different NGOs they were executing all these activities. Mainly fund was provided by the NGOs and all administrative supports were given by the Government. All these activities were monitored by the local administration. By the re-excavation of these ponds, they would harvest rain water over there. Then they would supply this water through pipeline to distant places. Each pond could cover up an area up to five miles.

To battle with food insecurity, many areas of Dacope Upazila were brought under green vegetation. Commercial cultivation of watermelon was very common in 32 no. polder of Dacope Upazila, Mr. Hafiz mentioned. Local people grew watermelon at a bulk amount in 5 unions including Kamarkhola and Sutarkhali union, severely affected unions by Sidr and Ayla. These watermelons were not only quenching the thirst of local people but also were being exported. Thus, salinity affected areas were also contributing to the national economy through agriculture which was a sign of massive development in these areas, Mr. Hafiz mentioned. By the by he mentioned about a model village, Kanabogi, which was noticeably made significant improvement within a very short period of time after Ayla.

One most interesting thing was that Mr. Hafiz totally denied the fact that food-insecurity existed in his Upazila. ‘No Food Crisis Here’—he stated boldly. Local people were continuously switching to different occupations like agriculture, labor market and/or sometimes fishing. Thus their source of earning was multiple and somehow people would meet up their need for food. Foods were available in the market and prices were reasonable, Mr. Hafiz claimed. Prices of products in the market were strictly maintained by the local administration so that they could not go beyond the capability of poor people. More poor people were getting involved in ‘Kabikha’ i.e. *Kajer Binimoye Khaddo* (Food for Work) projects and earning money. These areas were so vulnerable that these projects were always ongoing. So lots of employment opportunities were available there as well.

About the hindrances of implementing the policies, Mr. Hafiz mentioned the fund crisis as the number one problem. The infrastructure of the Upazila was very poor. So he needed huge fund to develop roads to enhance the communication with the greater Khulna division. Local economy and market system would be highly benefitted by the smooth communication and transportation system. He also felt the necessity of bringing the whole upazila under solar energy system. Embankment must be built immediately in Sutarkhali which was under the threat of huge soil erosion. He required more number of VGD and VGF cards to cover more number of vulnerable households.

From the interview, what is clearly evident that administration was more busy about the development of those villages which were highly affected by the disaster like cyclones, tornados etc. But slow changes are not the concern of authority. From the GOs and NGOs, lots of initiatives had been taken for the commercial plantation of watermelon in the cyclone affected villages. Local people were producing them at a massive scale and even exporting them abroad. Such sorts of projects were needed to be taken in the villages which were the victims of slow-on-set climatic changes like Katabunia, as the TNO realized. He said that administration was always ready to work with NGOs. As it was not possible to fund lots of projects at a time in different villages for GOs, they were always in hand to cooperate, monitor and evaluate the projects funded and run by the NGOs.

6.2.3.2 TNO (Chilla, Mongla)

Dr. Mizanur Rahman is the TNO of Mongla Upazilla. He is a bio-diversity specialist from Vienna. Among the climatic changes of his area, he identified cyclone as one of the major disasters. Saline water inundation from deep sea is another slow onset change happening in his locality. Dr. Mizan said that climate change mitigation is more important than the climate change adaptation.

Dr. Mizan said that salinity was putting its greatest impact on the Sundarbans. Sundori tree, the pioneer species of the Sundarbans was declining in huge number and now being replaced by the Keura. Floral life of the Sundarbans was also mostly affected. Worldwide famous Royal Bengal tigers were suffering from kidney problem and gradually dying out. Thus, salinity was destroying the total ecological balance. In addition, human relationship with anthropogenic resources was highly affected by this salinity.

Anthropogenic disturbance is one of the major impacts of salinity, as Dr. Mizan mentioned. Due to salinity, water and soil had lost their quality. Water layer was getting down. Seasonal flow of water was also changing gradually. Biological Oxygen demand changed in water. Salinity had increased the temperature in water. The increase of Sodium Chloride of water increased the blood pressure of water species. As a result fishes and other water resources were suffering from oxygen crisis and breathing problem and were dying out in large number.

As a result people's dependence on water resources was gradually dropping down. These all were affecting the livelihood options of the local people. People were diversifying their occupation then. They had become collectors and fisherman rather than farmers. They used to collect honey, wax, *golpata* etc. from mangrove forest.

Once upon a time, the local economy of the area was dependent on agricultural activities. But now the economy depended on fishing only, Dr. Mizan said. Shrimp cultivation became currently highly profitable. Rich people were trying to make more profit from this farming. But Dr. Mizan said that these elite people did not know that they were doing harm to themselves by channeling artificial inundation of saline water into lands. This Shrimp cultivation would no more remain as profitable as it was then due to increasing

salinity. Homestead gardening, flowery culture, forests, trees were affected. Consequently, poultry and livestock were dying out due to adequate leaves, grasses etc.

People were suffering from different diseases due to lack of pure drinking water. Dr. Mizan said that the reason of maximum unexpected death was unknown to the local people. But it was happening due to high blood pressure caused by saline water.

As the TNO of the Upazilla, he took the step first to stop Shrimp cultivation. But he could not be successful due to the influence local political people. By this time he helped NGOs to re-excavate almost 50 to 60 ponds of the locality. But only this was not enough for stabilizing the livelihood pattern of the local people. 'The first thing needed is to stop the further inundation of lands by raising the height of the existing embankments. In addition we need new areas to be protected by constructing embankments', Dr. Mizan said. Shrimp cultivation is a profitable farming and it contributes to our national economy a lot. Thus, rural elites might continue Shrimp cultivation only on those lands which were naturally inundated. But artificial inundation of saline water for Shrimp cultivation and crab fattening must be stopped. Water bodies should be prepared by canalizing into different directions so that the natural flow of water can be maintained. Saline water then would not be able to get into the locality. Surface water treatment was also a must, Dr. Mizan said finally.

Analysis of In-depth Interviews 6.2.3.1& 6.2.3.2

From the interviews of TNOs of two Upazillas, Dacope and Mongla, it is noticeable that public administration is busy with disaster like cyclone, flood etc. They are less concerned about slow on-set changes like salinity. People have lost their traditional livelihood option due to salinity. Agricultural production is highly affected. People are getting involved in risky occupations like going deep into the sea for fishing or collecting crabs. More, the whole area is under the control of a few numbers of elite people who have started commercial shrimp cultivation in the lands which are inundated by the saline water. These rich people also channelize saline water in the lands which are still fresh and fertile. Public administration tried to prevent this artificial inundation of saline water several times but failed due to the influence of these rich people. In case of Katabunia, shrimp cultivation has been totally stopped due to the protest of local people and teachers under the leadership of BELA.

To address salinity, public administration of both Upazillas has re-excavated number of ponds to ensure fresh water for the local people. But they feel that more number of ponds should be re-excavated to cover the people of whole area.

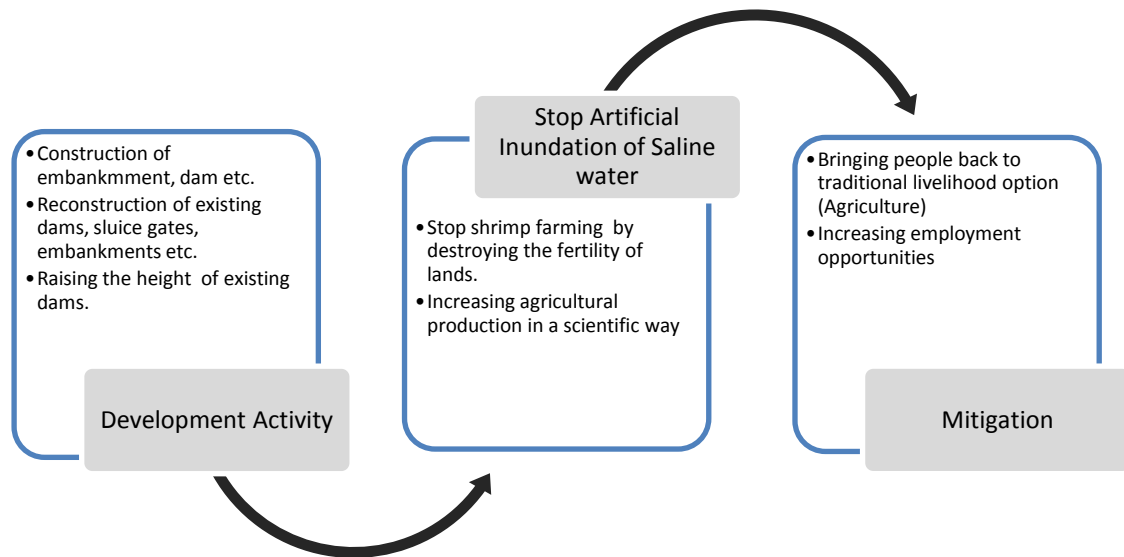
Unemployment is a major problem in both areas as because people have lost their livelihood options. Public administration is executing different development projects where a large number of people are working in exchange of food. These projects are known as KABIKA i.e. *Kajer Binimoye Khaddo Kormoshuchi* (Food for Work Program).

The TNO of both Upazillas feel mitigation is more important than prevention. They must stop saline water intrusion by construction and reconstructing barricade, Sluice gate or embankment etc. But it requires huge amount of funds which is one of the greatest challenges that they face. But they always co-operate NGOs to implement their projects. They promised that they are always ready to offer their services to NGOs for implementing any project to combat salinity.

Table 6.2.3.1: Summary of the Interviews 6.2.3.1& 6.2.3.2

	Steps taken	Steps that should be taken	Major Challenges
Keyabunia (TNO)	Pond re-excavation	More number of Ponds should be re-excavated	Lack of fund
	Kabikha	Construction and reconstruction of embankment, Raising the height of existing embankments	
		To stop commercial shrimp cultivation by artificial inundation of saline water	Influence of local politics
Katabunia (TNO)	Pond re-excavation	Creating Employment opportunities	Lack of fund
	Pond Sand Filtration (PSF)	Construction and re-construction of Slwiss gate and Raising height of Embankment	
	Kabikha		

Figure 6.2.3.1: Process of Mitigation based on In-depth Interviews



Source: Survey, 2014

6.2.3.3 Mr. Bayejid, a BRAC Activist of Keyabunia

Mr. Bayejid was the project implementation officer of BRAC in Chilla, Mongla. He said that the area was the victim of a number of climatic shocks. These were cyclone, tidal surge, flood, river erosion and salinity. Mr. Bayejid said that any project to adapt with salinity failed due to the counter adverse effects of other shocks. Universal social inequality being multiplied by these stressors put a detrimental pressure on the whole community.

People of this village were so poor due to the multiple stressors that they were in the face of greatest challenge to their survival. BRAC had offered livestock like cows, goats etc. to the people as grants, Mr Bayejid said. But people faced lots of trouble with livestock. They could not feed them properly due to lack of leaves, grazing lands and fodder. Many of them died for the lack of proper care. Again, when people were in acute crisis, they sold them out to survive for the moment. These all contributed a lot to the failure of whole project.

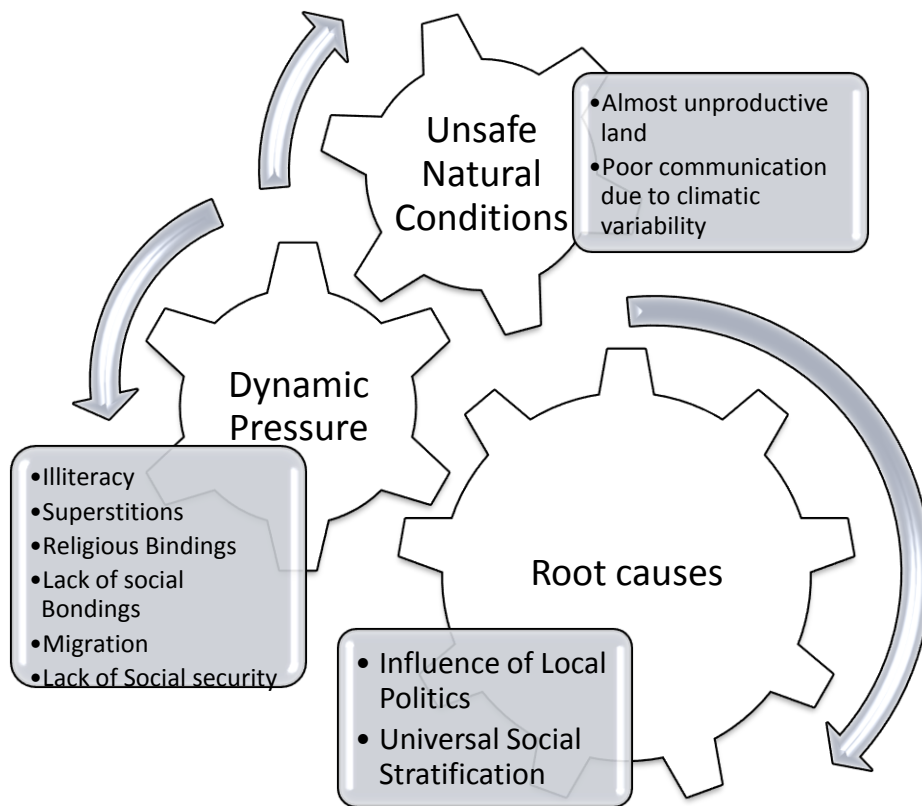
Bayejid said that they wanted to provide training on different adaptation techniques like rain water harvesting, homestead plantation etc. But men did not allow their wives to come to NGO to take training for the traditional *purdah* system, lack of social security etc.

People had a wrong perception about NGO worker, Bayejid said. Local people believed that NGO people intended to convert the religion of local people in exchange of their services. Another reason of project failure was that after receiving training many people left the village and migrated in better place. Consequently they did not ultimately get the output of their training.

Mr. Bayejid said that in order to make any project successful, the unity and cooperation of the local people was a must. Influence of the powerful people and their control over lands had made the community more vulnerable. They had brought almost all the land area under profitable shrimp cultivation which kept a devastating effect on lands by making them unfertile forever. In case of Dacope, BRAC was running a project in Katabunia which was known as BRAC WASH Program. This project worked to ensure to

sanitary facilities to the people. But BRAC had not yet initiated any project in Katabunia village to increase the adaptation capacity of people to face salinity.

Figure 6.2.3.2: Factors behind Project Failure



Source: In-depth Interview 6.2.3.3

CHAPTER SEVEN

RESULT AND DISCUSSIONS

7.1 Socio-demographic Profile of the Respondents

Socio-demographic profile of an individual depends on the geographical location of the area he/she lives in. As both the study areas are situated on the shoreline, their life is full of struggle and uncertainty due to frequent experiences of cyclone, tidal surges, soil erosion, salinity etc. The age distribution of male respondents reflects that majority of the respondents of Keyabunia village are between 25-50 years and Katabunia village between 25-44 years. People of these villages go to the Sundarbans to earn their livelihood which requires a lot of energy and effort. Thus, age distribution shows that most of the respondents of both villages are able to cope with the challenges posed by the climate change. In case of female respondents, a greater number belongs to reproductive age group i.e. group of 25-29 years. Though the average life span expectancy is 70.65 years according to World Fact Book (2014), a very insignificant number of respondents were found belonging to age group of 60+. This matches with the study result of Mallick (2011) who found that average number of old persons belonging to this age group was only 0.58. It indicates that various climate driven stressors and strains do not allow people to survive up to 70. Moreover, few stressors are responsible for various life threatening diseases as well.

Most of the respondents of both villages are married. The age distribution of the respondents also indicates the same. As majority of the respondents are young enough, they are supposed to be married rather than widow. This is also connected to the nature of household. Most of the households of both villages are male headed as 90 per cent respondents of Keyabunia and 88 per cent respondents of Katabunia reported this. As the number of old people is very less, number of widow is also less in both study areas.

As most of the households are male-headed, decision making process of the households reflects patriarchy. Though a few number of households was found female headed (*de*

facto), women were found to be the temporary head of their households and they were found dependent on their husbands to make important decisions.

Most of the people of both villages are illiterate. Many of them studied up to class 1. Again many of them can sign only. After combining two categories 'illiterate' and 'can sign only', percentage is 41.5 for Keyabunia village and 40 for Katabunia. This result coincides with Mallick (2011) who studied the Ayla-affected people. He took interview of 280 people and found that 40 per cent of them were illiterate. The percentage of female education in the current study is higher up to primary level. But in case of higher education, percentage of female education is less. Due to the salinity and stagnation of saline water the mode of production has been changed and shifted occupation of the respondents from agriculture to other sort of occupations like wage laboring, Shrimp cultivation, fishing, collecting honey, wax, etc. These occupations require training and skill more rather than academic qualifications.

In Keyabunia village, most of the people became fisherman irrespective of gender. Men catch fish in the deep sea whereas women catch fish near the shore line. About 61 per cent male respondents and 39 per cent female respondents of this village were found living on fishing. Among the male respondents 34 per cent are involved in crab fattening. Nokrek and Alam (2011) in their study in southwest coastal zone of Bangladesh also found that 37 per cent respondents were involved in crab fattening. Thus, the result of Nokrek and Alam (2011) is much similar with the current study. In the same village, people herd animals but in limited scale. On the other hand, many male respondents of Katabunia are still farmers though agriculture is a one-season crop now. A good number of male respondents (20%) were found to herd animals and 28 per cent respondents were found day laborers. In addition to their agricultural activities, many respondents took wage labor and herding animals as their secondary occupation. About 53 per cent female respondents of this village were found housewives. But a significant number of them were found herding animals which they received from different NGOs after Ayla. Around 29 per cent respondents reported to take herding as their secondary occupation. Other than these, respondents of both villages were found being involved in many other occupations like, boat building, *muri* trading, running small business, net making, handicrafts etc. If the occupational status of the respondents is compared with the same of

Mallick (2011), it is found that he also interviewed most of the fishermen and farmer though many of them claimed them as day laborer. But it is evident in Mallick (2011) that 60 per cent of the rural population is full-time farmer or fishermen.

It is significantly evident that the total number of family members of 59 per cent respondents of Keyabunia village and 39per cent respondents of Katabunia is limited up to 4 indicating small family size norms. Rest of the respondents reported to have more than 5 family members and thereby indicating large family norms size as well. Mallick (2011) found that average family size of Ayla-affected people was 6.2 which also indicated large family size. As most of the women of the current study belong to the reproductive age group and many of them do not use contraceptives due to religious bindings, the family size is supposed to increase in future.

It is found that almost half of the respondents of both villages have at least one school going son and daughter. Few have more than one. What was observed is that people sent their children to school due to the stipend, grants or incentives they receive from NGOs against each enrollment.

It was evident that there was at least one dependent member in each family. In Keyabunia village, the average number of dependent male member was found 1.1 and female member was 0.96. On the contrary, average number of dependent female member is more than dependent male member in Katabunia village. Here, average the number of dependent male member was found 1 and dependent female member was found 1.3.

Table 7.1: Summary of the Socio-demographic Profile of the Respondents of both Villages

<ul style="list-style-type: none"> ▪ Most of the men are young and can be considered as working group (between 25-50 years)
<ul style="list-style-type: none"> ▪ Most of females belong to reproductive age group (25-29 years)
<ul style="list-style-type: none"> ▪ A very insignificant number of respondents were found belonging to age group of 60+
<ul style="list-style-type: none"> ▪ The ratio of nuclear and extended family is 50: 50
<ul style="list-style-type: none"> ▪ Family size is relatively large as more than 50 per cent respondents had more than 5 family members.

<ul style="list-style-type: none"> ▪ Most of the people of both villages are illiterate as each 40.75 per cent respondents of both villages were found illiterate and can sign only.
<ul style="list-style-type: none"> ▪ Most of the respondents are married.
<ul style="list-style-type: none"> ▪ Half of the respondents of both villages have at least one school going son and daughter.
<ul style="list-style-type: none"> ▪ Most of the households are male-headed. Many of them are by name female-headed (<i>de facto</i>) but the decision making process is fully dependent on male.
<ul style="list-style-type: none"> ▪ The average number of dependent male member was found 1.05 and female member was 1.13. But in case of Keyabunia, number of female dependent member was less than that of Katabunia compared with the number of male dependent members.
<ul style="list-style-type: none"> ▪ Most of the people were basically farmers. Many of them live on fishing, crab fattening and herding. Wage labor works as another important alternative livelihood option.

Source: Field Survey, 2014

7.2 Perception towards Climate Change

Climate driven stressors which strike both the study areas a lot are many in number. People of both study areas said that cyclone, saline water intrusion, prolonged rainy season, flood, drought, loss of bio-diversity and soil erosion were very highly perceptible. The mean scores for all of them were found more than 4 which means very highly perceptible except flood and loss of bio-diversity. As compared to others these last two were less perceptible in the areas.

Respondents of this southwest coastal zone reported that their areas are highly vulnerable to tropical cyclones. Mahmood et al. (2010) also said that in Chilla union of Bagerhat, cyclone is a very common phenomenon which got the highest rank in this study. The cyclones occurred in 1970, 1985, 1991, 1997, 2007 and 2009 caused huge losses and were responsible for the displacement of millions of people in the coastal areas (Akter, 2009). These two areas being located in southwest coastal zone also experienced all these cyclones very frequently.

Respondents of Katabunia said that they wait for the monsoon when cultivation in sweet rain water becomes possible. But sometimes, rain becomes responsible for the destruction of their agricultural production when it continues for several months. Like Mahmood et al. (2010), heavy rainfall is also perceived highly Keyabunia village of Chilla union.

Respondents of this village said that when rain continues for several days, water enters into their homestead compounds and sometimes inundates their houses.

IPCC (2014) found that there is low confidence that anthropogenic climate change has affected the frequency and magnitude of fluvial floods on a global scale. Respondents of Keyabunia said that they experienced flood due to tidal surge. The same was reported by the respondents of Katabunia village. The mean score of both study areas was 3+ indicating average level of the measurement scale. The sea water that enters into the locality during the tidal surge become trapped into their fields and cannot go away due to high embankments which were built to protect the area from floods and water from tidal and storm surge. This natural inundation of water and their stay in the areas for several months is considered as flood water by the respondents though it can better be termed as water logging.

Drought is another common phenomenon like cyclone in these areas. But it is not that severely perceived. According to Habiba et al. (2013), insidious disaster drought is very common in Bangladesh but especially in the northwestern part of Bangladesh. Thus, drought is highly persistent in the northwest zone rather than southwest zone. The data of the current study showed that the mean score for drought in both villages is 3+ pointing to the medium/average level of measurement scale.

Respondents did not have any idea about loss of bio-diversity. But they said that they observe few seasons like summer, winter and rainy seasons in Bangladesh. Soil erosion is responsible for loss of biodiversity due to turbidity (Breure, 2004). Due to deforestation, tidal surge and flooding, soil erosion is highly perceptible in both areas as mean score is 4.92 for Keyabunia and 4.69 for Katabunia.

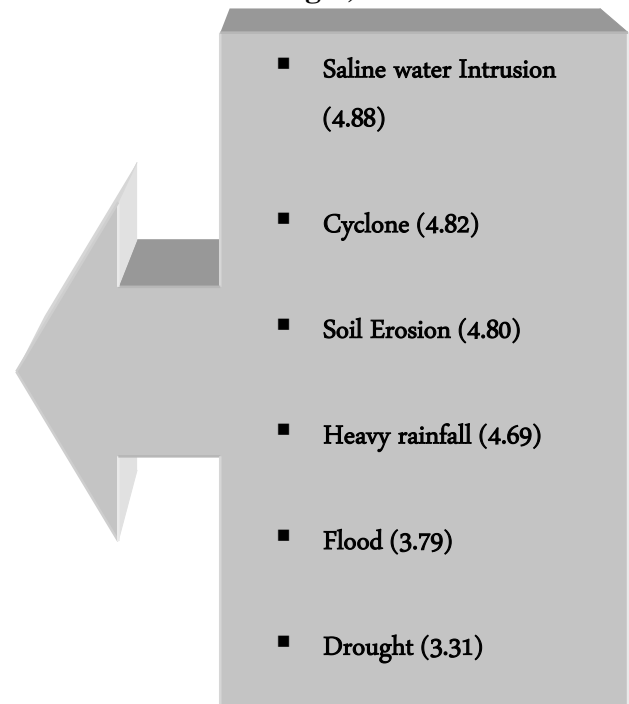
It is reported that about 1.74 m ha land is prone to soil erosion. High seasonal rainfall (highly persistent in the study areas) is one of the major causes of it. Erosion is also responsible for saline water intrusion. Due to erosion, sea water can easily enter into the villages. Saline water intrusion has affected almost all the sources of water. According to salinity survey findings and salinity monitoring information, about 1.02 million ha (about 70%) of the cultivated lands are affected by varying degrees of soil salinity. About 0.282, 0.297, 0.191, 0.450 and 0.087 million hectares of lands are affected by very slight, slight,

moderate, strong and very strong salinity respectively (Haque, 2006). This is also ‘very highly’ perceptible in Keyabunia village (mean score 5) and in Katabunia village (mean score 4.77) of the current study (see findings on perception in section 6.1.3).

The adverse impacts of climate change will be very striking for developing country like Bangladesh due to high dependence on natural resources (Halim et al., 2001). In the current study it is also evident that 85 per cent respondents of Keyabunia and 75 per cent respondents of Katabunia village are highly dependent on water resources. According to Mahmood and Ansary (2013), majority of the poorest people took shrimp fry collection as their main livelihood option. In the Keyabunia village, most people were found earning their livelihood by fishing. Women of this village are primarily shrimp fry collectors. They sell it to the fish farmers who are mostly involved in Shrimp cultivation. Thus, shrimp fry collection ultimately contributes to national economy through Shrimp cultivation. People of both areas were also found dependent on homestead and social forestry, livestock and to some extent on agriculture too.

**Figure 7.1: Summary of Hazards Perceived by the Respondents of both Villages
(Ranked based on combined mean score of both villages)**

Hazards



Source: Survey, 2014

Table 7.2: Gender-based Perception towards Climatic Stressors

Occupations	Male		Female	
	Stressors	Major concern	Stressors	Major concern
Fishermen	Cyclone	Declining resources, Loss of boat, net, life, Food insecurity	Cyclone/Tidal surge	Declining resources, Food insecurity
Farmer	Salinity	Crop Failure, Food insecurity	Salinity	Homestead plantation Food insecurity
Day laborer	Cyclone	Unemployment, Food insecurity	Heavy rainfall	Unemployment, Food insecurity
Housewife			Salinity	Pure drinking water, Food insecurity
Farmer (Livestock)	Salinity	Lack of animal fodder and grazing land	Salinity	Lack of animal fodder and grazing land

Source: Survey, 2014

7.3 Asset Analysis

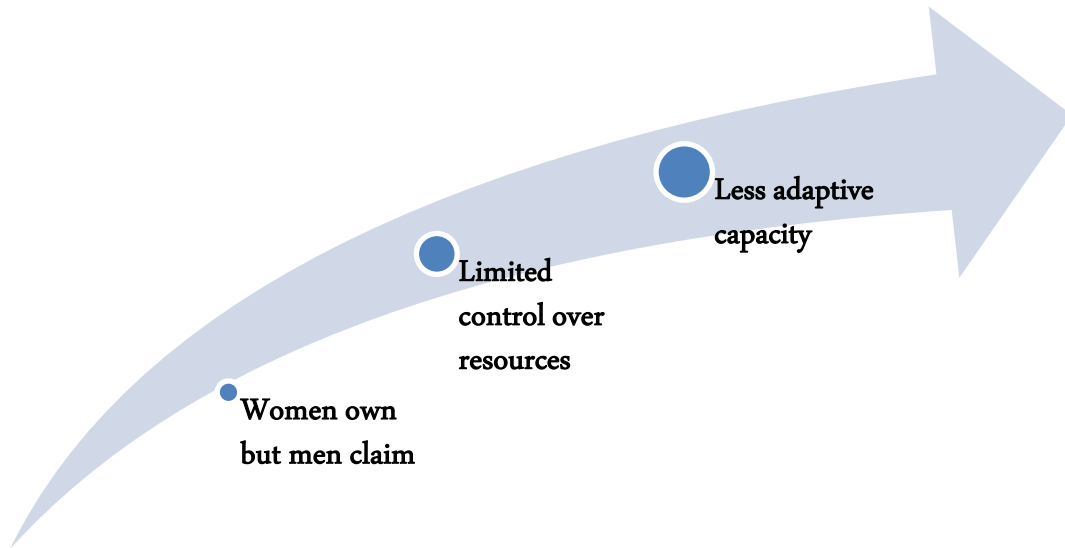
According to IPCC Third Assessment Report, within all developing countries, the poorest, who have the least resources and the least capacity to adapt, are the most vulnerable (IPCC, 2001a). Nandy and Ahammad (2012) stated the same. Sen (1981) mentioned that individual's coping capability is connected to his/her entitlement status. Among the world's poor, more than 60 per cent are women. Being the 'vulnerable within the vulnerable', women have limited access to resources (Ariyabandu and Foenseka, 2006). In the current study, it is significantly evident that a woman owns just half of those resources which a man owns. A man's total asset has been calculated approximately 38,968 taka compared to approximately only 20,043 taka of a woman. A woman usually does not own land. A very few number of women were found in the study who inherited land (agricultural and homestead). On the other hand, gold is an asset over which men feel an invisible ownership. Though women own properties, they do not have control over it.

Table 7.3 ‘Root causes’ extracted from Asset Analysis

<ul style="list-style-type: none"> ▪ Women gave information about the household’s income; not about the asset that they personally own.
<ul style="list-style-type: none"> ▪ A few number of women said that they own land but they have limited control over it.
<ul style="list-style-type: none"> ▪ Men were found feeling an invisible ownership over the resources of women like land, gold, livestock etc.

Source: Field Survey, 2014

Figure 7.2 Relationships between Ownership Status and Adaptation Capacity



Source: Field Survey, 2014

7.4 Salinity, Agriculture and Vulnerability

The salinity will have extra bearing on agriculture in the coastal areas of Bangladesh (Abedin and Shaw, 2013). From the logit model of the current study, it is distinctly evident that salinity has significant impact on food security (see section 6.1.11). It is also supported by existing literatures (Mahmud, 2011; Mahtab, 1989; ADB, 1994; Haque et al., 1996). Salinity has destroyed the soil quality which affected the rice production most. Abedin and Shaw (2013) said that in the winter months costal croplands suffer a lot due to less availability of rain water. This makes large number of coastal lands unsuitable for production and restricts cultivation of *boro*. Salinity also affected the fruit plants and other homestead plantations like vegetables. The mean score for all of them exceeded 4

meaning ‘very highly’ affected by the salinity (see section 6.1.4). But the mean score for timber trees is less than 4 pointing to the above ‘average level’ of the measurement scale. This means that timber trees are not as much affected as paddy and other vegetables are.

Many lands went under the control of land owners of Keyabunia village. They cultivate shrimps by storing the saline water in those lands. As a result amount of cultivable lands have been shrunk. More than 90 per cent respondents of both villages reported about reduced amount of cultivable lands, declining soil quality and finally death of crops/plants and other type of vegetations. Keyabunia village is almost excluded from vegetation and any other plantations. Thus less availability of plants and trees and scarcity of fresh water for the animals is another big challenge reported by respondents. Thus, increased salinity has a profound negative effect on the health of livestock due to decrease of fodder production. Shrimp cultivation practices also affected the production of livestock feeds (Rahman et al., 2011). But this problem is not as distinct in Katabunia as it is in Keyabunia. People of Katabunia somehow manage to feed their animals with locally available agricultural residues.

The fisheries sector in the southern coastal region is very likely to face significantly yield reduction in future due to climate change (Islam, 2010). Fish species will probably shift their distributions as warmer-water species and colder-water species are both expected to move pole wards (Beare et al., 2004a, 2004b). But most of the respondents of study areas are not that much experienced of this problem.

What is most striking in the study areas is that they do not get any significant support from government to carry on their agricultural production. But some NGOs are playing important role in this regards as most of the respondents of both villages acknowledged the support that they received from NGOs.

Table 7.4 Major findings needed to be highlighted

<ul style="list-style-type: none"> ▪ Among all crops, production of <i>boro</i> is highly affected during winter when rainfall is less.
<ul style="list-style-type: none"> ▪ Salinity kept significant negative impact on food security by the reduction of cultivable land and soil quality.
<ul style="list-style-type: none"> ▪ It is difficult to herd animals due to decrease production of animal fodder.

7.5 Alternative Livelihood Options

Alternative livelihood option is one of the most important adaptation strategies as reported by the respondents of both villages. It is also supported by Howden et al. (2007). They said that under more severe climatic changes, diversification of production system and livelihood is a must. Among them, fishing in deep sea, wage laboring, crab fattening and livestock farming are the most dominating alternative livelihood practices. Few other occupations are pond fishing, collecting honey, wax, and fruits, starting small business etc. also contribute to overall household's income.

Among these alternative livelihood options, Shrimp cultivation kept significant negative impact on cultivable lands as about 62 per cent respondents of both villages reported this. Rahman et al. (2011) said that land owners pressurize small and marginal farmers to lease their lands to them for Shrimp cultivation. After completion of Shrimp cultivation between March and September, large and influential land owners do not flush the saline water from their lands which is highly harmful for any sort of agricultural production. The current study finds that it is also responsible for generating unemployment since 81 per cent respondents of Keyabunia said that Shrimp cultivation requires a very less number of human labor. Only one farmer is needed to maintain a land of one acre.

Labor market also produces risk as it cannot employ the total work force regularly. Around 66 per cent respondents of both villages reported this. They said that they do not get work every day and thereby need to starve on that day.

Again problem for the collectors is not less. The chances of fear of being attacked by wild animals are very high among the people of Katabunia since one person was killed by a tiger few days before the interview was taken. About 89 per cent respondents of this village reported this.

7.6 Coping Mechanisms with Food Insecurity

Respondents of both Keyabunia and Katabunia experience food insecurity in one way or another. Adult females are the worst victim of food insecurity as 64 per cent respondents of Keyabunia followed by 61 per cent respondents of Katabunia reported this. Women of both villages are basically involved in food cooking and food distribution. On the other

hand, men are involved in food processing and food distribution. Respondents identified several reasons for their food insecurity. Among these, crop failure (80% respondents) due to prevalence of salinity, unemployment (60.5% respondents) and high price of food (89.5% respondents) are identified by the respondents with much importance. According to logit model, salinity and its consequent crop failure keep significant negative impacts on food security. Few strategies extracted from the current study to combat food insecurity are given below:

Changes in Food Consumption Pattern

Respondents of both Keyabuni and Katabunia were found bringing significant changes in their food consumption pattern. Akram (2014) also observed changes in dietary practices among the coastal people. Respondents consume vegetables like potatoes, chilli, ladies finger, stem of water lily, leaves of cucumber, gourds etc. for family consumption. These people hardly manage meat for their children occasionally. Respondents of Keyabunia are fishermen. They can manage fish like shorputi, shrimp fry, curfu etc. They cook them with vegetables. People of Katabunia raise more number of hens/ducks/cows/goats etc. than that of Keyabunia. Thereby, respondents of Katabunia can sometimes manage milk or egg for household consumption more compared to the respondents of Keyabunia.

Sacrificing Own Meal/Taking Smaller Meal/ Starvation

Sacrificing meal is a coping mechanism which is naturally practiced by women. It is found in both villages that adult members of the households especially women reduced their meals to allow their children and old family members to eat more. It is also supported by existing literatures (Akram, 2014; FAO, 2008). In both study areas the mean score for women is 4.3 indicating 'high practice' of these coping mechanism by women. On the contrary, the mean score for men is 3.72 indicating 'medium practice' (see in detail in section 6.1.6).

Reducing Expenditure on Non-food Items

Respondents of both study areas were found to reduce expenditure on non-food items like health, clothing etc. This is very highly practiced by the respondents according to data as the mean score of respondents' experience is 5 in Keyabunia and 4.04 in Katabunia (See

section 6.1.6). This coping strategy is observed in other studies too (FAO, 2008; Akram, 2014; Zug, 2006a). These literatures found that people reduced expenditure on education. But in the current study 'withdrawing children from school' is less practiced because respondents receive incentives from different NGOs against the enrollment of each child. But they restrict their children from buying *chanachur*, chips, ice-cream or toys of any types due to economic hardship. Respondents also reduce expenditure on health. It is found in the study that adult women are highly vulnerable to various types of diseases especially gynecological problems. They were found to accept it very normally rather than visiting a doctor.

Substitution between Foods and No Rich Food

These are other two coping strategies highly practiced by the respondents. Respondents of study areas have already reduced times of taking major meals. Sometimes they pass their times by taking dry foods like biscuits, *muri*, bread/loaf etc. instead of taking staple cereal products like rice in order to suppress their hunger. It is already mentioned earlier that vegetables is a common food item for most of the respondents. Though vegetables cannot meet up bodily demands of carbohydrates, protein and fat, respondents are least bothered of nutritional value. It is found in the current study that the average calorie intake by a coastal man or a woman is only 1414 kilocalorie which is much less than the average bodily requirement of 2122 kilocalorie. Mistri (2015) also found that 64.2 per cent of the respondents do not consume nutritional foods and the day to day consumption highly depends on purchasing which was domestically produced few years ago. Most of the respondents mentioned that they cannot think of taking food like beef, chicken, mutton etc. They experience food variation only when they take meal in the house of a rich person of their locality only occasionally during Eid or Puja or in any other social occasions.

Fewer Mealtimes per Day

Reducing number of major meal is a very important coping mechanism observed in existing literatures too (Shariff and Khor, 2008; FAO, 2008; Akram, 2014). The mean score of respondents' experience is 4.68 for Keyabunia and 4.45 indicating 'high

practice' of this strategy (See section 6.1.6). Respondents take their major meals twice a day. They take their breakfast in the late morning and lunch in the evening.

Bartering for food

Respondents of both study areas share each other's food. This is more practiced by women (mean score 4.9 indicating high practice) than that of men (mean score 3.8 indicating medium practice) according to data. In order to supplement their meals, they exchange curry with rice or vice versa with their neighbors with whom they have very close relations. Though they do this to save firewood, it indicates intimate bonding among the coastal people.

Conservation of Pond water/ Boiling water/ Using Potassium/ Filtering Salt

The problem of drinking water prevails extremely in the study areas. Currently respondents have taken many adaption techniques, already discussed under adaptation mechanisms, to combat the scarcity of drinking water. Initially people had no other alternative but to use the pond water. Still respondents of Katabunia use recently re-excavated pond water as one of their main sources of drinking water. But the use of pond water in Keyabunia village is a bit less. They use it only for washing clothes and cleaning houses etc. A very few number of respondents of both villages talked about few other coping mechanisms like boiling and filtering water, using potassium etc. A few number of respondents received water filter from some NGOs as 10 per cent female respondents of Keyabunia and 17 Per cent female respondents of Katabunia reported about filtering water. Others either drink pond water directly or purify them by boiling or by using potassium. Thus many of them need to spend money or fuel wood for managing pure drinking water. Mistri (2015) found that 29.79 per cent of the respondents spent 61 taka to 80 taka monthly for water.

Using Agricultural Residues/ Cow-dung/homestead plantation

Homestead forest still works as an important source of energy resources in Katabunia village (45% respondents responded) compared to Keyabunia (only 26% respondents responded). Again in Katabunia, more than 60 per cent male respondents said that they are dependent on agricultural residues and cow-dung as source of domestic fuel.

Collecting and Buying Golpata/ Using Wood of Sundarban Forest

The Sundarbans is the biggest source of energy resources (66% respondents of both villages reported). Hussain and Karim (1994) also stated that The Sundarbans Reserve Forest (SRF) is an important source of wood and non-wood resources. People usually cut the branches of Geua, Keura and Sundori trees. On the contrary, respondents said to collect *golpata* from The Sundarbans. They carry them all by boat. It is an important source of business too. Many people sell *golpata* in the market. About 68per cent respondents of Keyabunia are dependent on market for fuel wood. One mound of *golpata* that costs 150 taka goes one week easily as the source of domestic fuel.

Drawing down Social Networks

Respondents remain totally detached from their relatives when saline water remains stagnant inside the locality and disrupt the communication adversely. Moreover, good network with relatives requires few responsibilities which include inviting relatives or visiting them occasionally, carrying food while visiting a relative's house, entertaining guests with rich food etc. But these formalities increase their expenditures a lot. Thereby, respondents have no other way but to avoid their relatives. Data of the current study showed that respondents of both villages reported this with much compassion. The mean score for 'drawing down social network' is 4.05 indicating 'high practice' of this strategy by most of the respondents (please see section 6.1.7).

Disposal of Women's Assets

Selling asset has been identified as a very common way for rural households to face any challenges posed by climate change by existing literatures (Nasreen, 2012; Sharrif and Khor, 2008; Akram, 2014; Agarwal, 1998). Nasreen (2012) found that assets like jewellery, livestock and other household items are more likely to be sold during crisis period. The result of current study shows the same. Assets which belong to women are more likely to be sold than those of a man. Decisions about assets which will be sold and which will not be are taken by men. This is because of the fact that women have less control over their resources. Thereby, mean score for women is less than the mean score

of men. It indicates that selling asset is a coping strategy which is practiced more by men than by women though women's assets are the first to be sold.

Borrowing from Money Lenders/ Buying Food on Credit/ Mortgaging asset

Poor people usually don't have access to formal loans from banks. Thereby, they are bound to take the services from local money lenders (Zug, 2006a). Data in the findings section part VII shows that this is very highly practiced by all the respondents of both villages though the rate of interest is very high. More than 90 per cent respondents of both villages mentioned that they are somehow surviving by borrowing money from money lenders. The loan that they take is never repaid. Very often they are denied by the money lenders. Same thing happens with the grocery shop keepers. One respondent of Katabunia made a loan of 50,000 taka and he is unable to pay back till now.

According to data, mortgaging assets is comparatively less practiced by the respondents (mean score is 3.3 indicating medium practice of this strategy). They usually mortgage land which is also observed by (Zug, 2006a). They said that they do not have any valuable asset left to keep mortgaged.

Most of the respondents denied to have received grants from NGOs. Only 17 per cent male respondents of Keyabunia followed by 12.5 per cent respondents of Katabunia admitted that they received grants from different NGOs. The percentage for women is also very less though most of the NGOs' target population is women. Only 16 per cent female respondents of Keyabunia and 20 per cent female respondents of Katabunia reported to have received grants from NGOs. They said that they received those grants to invest in their small homestead to grow vegetables. But most of them failed to produce vegetables.

Begging from Rich Neighbors

Respondents send their children to neighbor's houses to take lunch in the day they have not put fire on their stoves. About 54.2 per cent female respondents of Katabunia reported to beg food from their rich neighbors. Receiving food from neighbors is identified as one of the coping strategies as found in other studies too (Shariff and Khor, 2008; Akram, 2014).

Migration/ Temporary Dislocation of the Population

Sea level rise is a critical issue for large populations in coastal areas of Asia. Inhabitants living on low-lying coastal plains are also at risk from displacement from the coastal zone (Eriksen et al., 2006). The SLR might make an impact on the country as a whole by inundating one-tenth of the total land area along the coastal belt. If this happens, about ten million people living in the coastal areas of Bangladesh will be forced to migrate further inland (Nishat et al., 2013). This will put a tremendous population pressure on the mainland. But it is observed in the current study that this is basically practiced by men rather than women. Men go to Sundarban for collecting honey, wax, etc. during the lean period of the year. Many of them go for catching fishes, crabs etc.

Table 7.5 Coping Mechanisms Followed by Men and Women

Usually Practiced by Men	Usually Practiced by Women
	Changes in food consumption pattern
	Sacrificing own meal
	Taking smaller meal
	Starvation
Reducing expenditure on non-food items	
Fewer meal times	Fewer meal times
	Bartering food
	Collecting of pond water
	Boiling/Filtering water
	Using agricultural residue as fuel
Collecting golpata	Using cow-dung/collecting golpata
	Drawing down social network
Mortgaging women's asset	Mortgaging own asset
Disposal of women's asset	Disposal of own asset
	Begging
Migration	

7.7 Adaptation Mechanisms

Change in Crop Production Strategy

Based on the soil quality and nature, salinity research centre and local NGOs introduced the cultivation of crops which are suitable to the climate. Presently there no such crop which can grow in the salinity level of 6-12 dS/m in the country. Bangladesh Agricultural Research Institute (AGRI) has found that using raised beds, mulches and drip irrigation, it is possible to grow crops like tomato, chilli, watermelon and cucumber in the saline soil of 4.5-11.0 dS/m (Islam, 2004). In the Keyabunia village, only one respondent was found growing vegetables by preparing artificial raised soil beds. Another woman planted a guava tree in a big drum. She put salt free mud into the drum and planted it. Introducing crop varieties tolerant to high soil salinity is still time demanding (Abedin and Shaw, 2013).

In Katabunia, respondents were found channelizing the lands with other lands to allow the rain water to enter into their lands. After channelizing rain water into their lands, they put fence with mud so that water cannot go away. By preparing the lands in such way, people were found producing paddy at least once in a year during the monsoon.

Since the process is not that easy, many people of both villages switched to other occupation by this time especially the people of Keyabunia. Thereby, the mean score of respondents' experience on 'practicing modern techniques in agriculture' were found 0.73 for Keyabunia and 2.89 for Katabunia (please see section 6.1.7).

Introduction of Crop Varieties Suitable to Climate

In slightly saline or moderately saline areas, cultivation of crops of special varieties is possible. People of Katabunia village produce *boro* rice once in a year. They also produce high yielding salt tolerant varieties *BRRIdhan47* and *55*. BRAC has introduced sunflower cultivation in some villages on an experimental basis. In a nearby village of Katabunia, sunflower cultivation in sweet water was seen. But this technique has not yet reached Katabunia village.

Some women of Katabunia village were found growing potatoes and *lalshak* on their homestead. There is a small canal running behind their houses. This canal was connected to the river Poshur. Saline water enters into their homestead through this canal. They put fence on the mouth of the canal to stop the flow of saline water and grew potatoes and other vegetables. The mean score of respondents' opinion on 'growing crops suitable to climate' was calculated 3.29 for men and 1.77 for women (please see for detail section 6.1.8). About 62 per cent male respondents of Katabunia brought changes in crop varieties whereas 85 per cent respondents of Keyabunia village brought a very little change. The livelihood of the respondents of Katabunia is still dependent on agriculture. Many of them are trying to increase production in various ways.

In Keyabunia village, men are no more involved in agricultural production. Few women were found producing vegetables on their homestead. They collected seeds from a seed supplier who went to that village to sell saline soil suitable seeds. They were trying to produce potatoes, ladies finger and cucumber. The mean score of respondents' opinion on 'growing crops suitable to climate' was calculated 0.73 for men and 1.34 for women in Keyabunia village (please see for detail section 6.1.8).

Changes in Land Use Pattern

In case it becomes extremely impossible to continue agricultural production, people make an alternative use of land. In Katabunia village, people produce *boro* during monsoon. In this village, shrimp cultivation in saline water has been banned by the protest of Local people under the leadership of BELA. Thereby, people were found cultivating shrimp in sweet water in other seasons of the year. It is known as 'Lockpur model' in Khulna-Bagerhat region (Abedin and Shaw, 2013). But a very few number of people were found involved in such shrimp cultivation in Katabunia village. Thereby, the mean score was calculated only 1.06 for male and 1.01 for female indicating 'low practice' of this strategy.

In Keyabunia village, people are less dependent on land. Thereby they are not concerned about different land use pattern.

Cultivating Fish Fry in a Reservoir

The shrimp fry collection as a new alternative livelihood has a great prospect in Bangladesh (Mahmood and Ansary, 2013). It is estimated that nearly 45 per cent of the landless households living in the coastal region are involved in shrimp fry collection. This in association with shrimp fry trading contributes nearly 60 per cent of the total income of landless people (Hossain, 2006 in Mahmood and Ansary, 2013). Like men, women in Keyabunia also catch fish. They catch shrimp fry and contribute to households' day to day income by selling them in the market. In this village, one household was found where people made a reservoir with brick where for storing water. They put shrimp fry there for several days to grow bigger after catching them from seashore. They do this for getting better market price. The mean score calculated for women of Keyabunia was 0.83 and for men was 0.5 pointing to very low level of measurement scale which means that this practice is very less in the community. On the other hand people of Katabunia do not practice this at all.

Living on Grants/Credit

When people experience potential loss of a particular crop failure or a particular livelihood option, they accept it for the time being as a part of their coping mechanism. But in the long run they try to overcome it with grants from different GOs and NGOs. Mahmud (2014) shows that amount of credit is one of the significant determinants of household expenditure. Other than grants people of Katabunia received cattle/goats etc. from NGOs after Ayla. Again people of Keyabunia received Gazi tank, grocery shop, seeds suitable to climate, goats etc., from different NGOs. The mean scores of respondents' experience of 'taking grants' were 1.6 for Katabunia and 1.07 for Keyabunia. But findings show that women receive grants more than that of men. NGOs look for most vulnerable women to provide incentives which their husbands claim ultimately.

Diversifying Income Sources

People of both villages were found diversifying the occupation a lot. Each individual was found involved in more than 2-3 occupations. In Katabunia village, people work in the

field and produce paddy during monsoon. In other season of the year, they work as day laborer or go to deep sea for catching fish or crabs. In case of Keyabunia, most people are fisherman. They go to the Sundarban for catching fishes, crabs and collecting goldpata. Thus, crab fattening, fishing and wage labor were found three most important alternative livelihood options of the study areas.

Most accepted alternative livelihood option of Katabunia village is working in wage labor market. Respondents of Katabunia told that they do not get work 5-7 days in every month in the labor market. It becomes very difficult for them survive on those days. Otherwise, they get 150 taka per day as wage. These people also go to deep sea for collecting crabs, fishes etc. when no development project runs in the village. Again many women of Katabunia village were found raising animals. They got cows, goats etc. from different NGOs as aids after the cyclone Ayla.

On the other hand, crab fattening is mostly accepted livelihood option of Keyabunia village. It is no more considered as the alternative livelihood option rather it has become their main livelihood. In the past, women were involved in crab collection with simple technique (Alam et al., 2013). They used to sell it in the local market at a very low price as now they are selling fish fry. But now crab fattening has become a very profitable business and naturally men became involved in the process. They collect crabs from the sea and keep them in a pond or hatchery to grow them mature. If a landless fisherman does not have a pond, he takes the share of a pond with others and make them mature. But in most cases they sell crabs to hatchery. They earn 10-25 thousand taka yearly by selling crabs. For this, respondents need to stay in the Sundarbans for a particular time period as already mentioned earlier. From August to December they stay in the Sundarbans for catching crabs. In between every after 2 weeks or 3 weeks they alternately come back home with their products for the fear of pirates. It is to mention here that each crab takes a very less span of time (<28 days) to grow mature (Alam et al., 2013).

Not only crabs women are involved in catching fish fry with handmade nets. Each fry costs 10 taka only. When they grow and become lobster, each costs even more than 1000 taka depending on their size. Besides these, men and women of Keyabunia villages also

work in developmental projects as day laborer. It is mentioned earlier that women are also involved in various homestead plantations. They also herd goats, hens, ducks etc.

Diversifying livelihood option is found as the most important adaptation practice as mean score calculated for men is 4.33 and for women is 3.50 of Keyabunia village. In case of Katabunia, mean score for men has been calculated 4.26 as compared to 3.11 for women. For the scores of men of both villages, the measurement scale indicates the level of 'High practice' and for women 'Medium practice'.

Making Savings

Making savings is another important adaptation strategy practiced by the respondents. It is already mentioned that people of both villages are involved in diversified income generating activities. Wage labor market can meet up their day to day demands. But it cannot contribute to their savings. While crab fattening is a livelihood option that contributes to the savings a lot. By crab fattening each individual can earn even more than 50,000 taka at a time. Fishing, collecting etc. also contribute a lot to savings. People use this savings when they are in acute crisis.

Rain Water Harvesting

Respondents of both villages are familiar with rain water harvesting. They have learned techniques from NGOs and make proper utilization of it. In every house of Katabunia, a pipe was found connected from the roof of their house to a bucket placed on their veranda. In comparison with this village, rain water harvesting is less practiced in Keyabunia. These people store rain water but not following the process like Katabunia people. When rain comes, people of Keyabunia come out with their buckets, drums etc. and place them in their yards. Few of them pour that water into the tank which they received from NGO, World Vision. Thereby, only 34 per cent respondents of this village reported to harvest rain water. Abedin et al. (2014) conducted a study in Khulna and Shatkhira coastal regions. They found that about 45 Per cent respondents in areas experiencing severe drinking water deficits adopted rainwater harvesting as a very suitable option to cope with a lack of drinking water at the personal level. They also said that people considered the water as their personal property since they could use it

whenever they would feel like. Farhana (2011) also found rain water harvesting as a very important adaptation strategy of the coastal people of Bangladesh.

Collection of Supply Water from the Nearest Town

About 69 per cent respondents of Keyabunia are more used to with pipe line water supply rather than rain water harvesting. Women of this village cross a long distance to collect water from pipe line. Women who stay closer to the union i. e. in the front side of the village need to spend only 1- 1.5 hours to collect pipe line water. But women who stay at the end of the village need to cross a distance of 6 miles which takes almost 3-4 hours per day. Many women send their husbands by boat to collect supply water from the town which takes much less time. Woman whose husband does not have a boat hires the boat of other people. Each boat is able to carry more than 10 medium size drums containing 20-30 litres of water. Two drums of water can easily run a week. Respondents of Katabunia do not have this adaptation practice.

Pond re-excavation/ Pond Sand Filtration

Pond re-excavation and pond sand filtration are two major adaptation strategies which are generally promoted by the GOs, local and international NGOs with support and cooperation of a community's people. Various local and international NGOs such as Sushilan, Uttaran, ActionAid, Caritas, Concern Worldwide, UNICEF (United Nations Children's Fund), USAID (United States Agency for International Development), and government organizations such as DPHE (Department of Public Health) and CDMP (Comprehensive Disaster Management Program) are involved in supplying drinking water in coastal Bangladesh (Abedin et al., 2014). About 89 per cent respondents of Katabunia and 51 per cent respondents of Keyabunia reported to use water from re-excavated pond. Only one pond in Katabunia was re-excavated with the help of GOs and NGOs. This gave a great relief to the people though the water of this pond was not fully saline free.

Installing Deep Tube well

Abedin et al. (2014) found that besides the pond sand filter and rainwater harvesting technology, 8 per cent and 18 per cent of respondents of Shatkhira and Khulna from

severe and moderate scarcity areas respectively use deep tube wells with overhead tanks installed by the local NGOs Iswaripur Development Foundation (IDF), with GIZ (German Development Cooperation) assistance. The current study also found that installation of deep tube well from individual level is another adaptation strategy followed by only 15 per cent respondents of Keyabunia and 28 per cent respondents of Katabunia. The tube wells those people established no more work in Keyabunia village. Even then, people of Katabunia use the water of these tube wells finding no other alternative. This water is comparatively better though not fully salt free.

Table 7.6 Gender-based Adaptation Mechanisms

Usually taken by men	Needs	Usually taken by women
Changes in crop production strategy	Needs training	
Introduction of crop varieties	Needs seeds	
Changes in land use pattern	Needs land	
	Needs training	Cultivating fish in a reservoir
Taking grants/credit	Needs network	Taking grants/credit
Making savings	Needs income	
Diversifying income sources	Needs access and freedom	
	Needs training	Rain water harvesting
	Needs time	Collecting pipeline water supply
Installing deep tube well	Needs money	
Migration	Needs freedom	

7.8 Salinity, Health and Vulnerability

From the study it is clearly evident that in both study areas women and children are highly vulnerable due to salinity. On average 69 per cent and 77 per cent respondents of both villages mentioned about women and children respectively. IPCC 4th assessment report shows that climate change has altered the distribution of some infectious disease vectors; altered the seasonal distribution of some allergenic pollen species; and increased heat wave-related deaths (IPCC 2007). These all are reported by the respondents of the

current study. About 42 per cent respondents of Keyabunia and 64 per cent respondents of Katabunia said to experience malaria, dengue etc. more than they would before in 1990s. In Keyabunia, local people reported the death of two persons due to heat stroke about which they had no idea before. Diarrhea and Dehydration related stomach problems are very common both in Keyabunia (Around 77 per cent respondents reported) and in Katabunia (86%). Other than these gynecological problems, skin diseases are very common to most female respondents of both villages.

7.9 Housing and Infrastructure

Most of the houses of the study population are made up of mud and their roofs are made up of tin, *golpata*, bamboo etc. In both villages BRAC is implementing WASH program under which all the households are covered with a ring slab sanitary latrine. Thereby, an average of 74 per cent respondents of both villages said to have ring slab latrine (semi-sanitary). Most of the respondents cannot afford independent kitchen. Rather they use their small yard for this purpose.

Infrastructure plays a very important role in disaster risk-reduction. People get access to labor market, resources, credit facilities and NGO services easily if they have good communication with the main town. About 90 per cent respondents of Katabunia stay 5/6 km away and 63 per cent respondents of Keyabunia stay 3/4 km away from the nearest NGO. Thereby, they receive minimum supports from NGOs. However, they receive few services from NGOs which have been discussed in detail in section 6.2. Existing literatures have put emphasis on housing in case of flood and cyclone. But infrastructure is very important for getting access to resources as well as opportunities.

7.10 Impact Factor Analysis: Logit Model

Part 6.1.11 of findings elaborated the variables which kept significant impact on food security.

Table 7.7 Summary of the logit model

Independent Variables	Relationship	Dependent Variable
Gender	Negative (-)	Food Security
Total amount of land	Positive (+)	
Intensity of salinity	Negative (-)	
Experience of crop failure	Negative (-)	
Grants received	Positive (+)	
Distance from NGO	Negative (-)	
Access to electricity	Positive (+)	

7.11 Results of Hypothesis Testing

1. Coastal people are more vulnerable to climate change due to their more exposure to the unsafe natural conditions than the people who are less exposed.

It is proved by this model that intensity of salinity keeps significant negative impact on food security of respondents.

2. Women and men perceive and experience the impact of climate change differently.

Women and men do not perceive climatic changes differently. But their perceptions towards particular issues are different as already mentioned in table 7. 2.

3. Women are more vulnerable than men due to climate change

The model shows that if the individual is a woman, she is definitely at more risk of being food-insecure.

4. Women can cope and adapt better with the vulnerability than that of men.

From table 10.5 and table 10.6, it is clear that women can cope better compared to men. But adaptation mechanisms are dependent on training, network, freedom and finally on asset or income of which a woman is usually deprived of. From the asset analysis, it is significant that a woman owns half of that, a man owns. More, existing literatures also affirmed that more assets mean more resilience. The logit model showed significant positive relationship between land and food security. If an individual owns land, the probability of being food secured is more for him/her. Thus, women's adaptation capacity is less than that of a man.

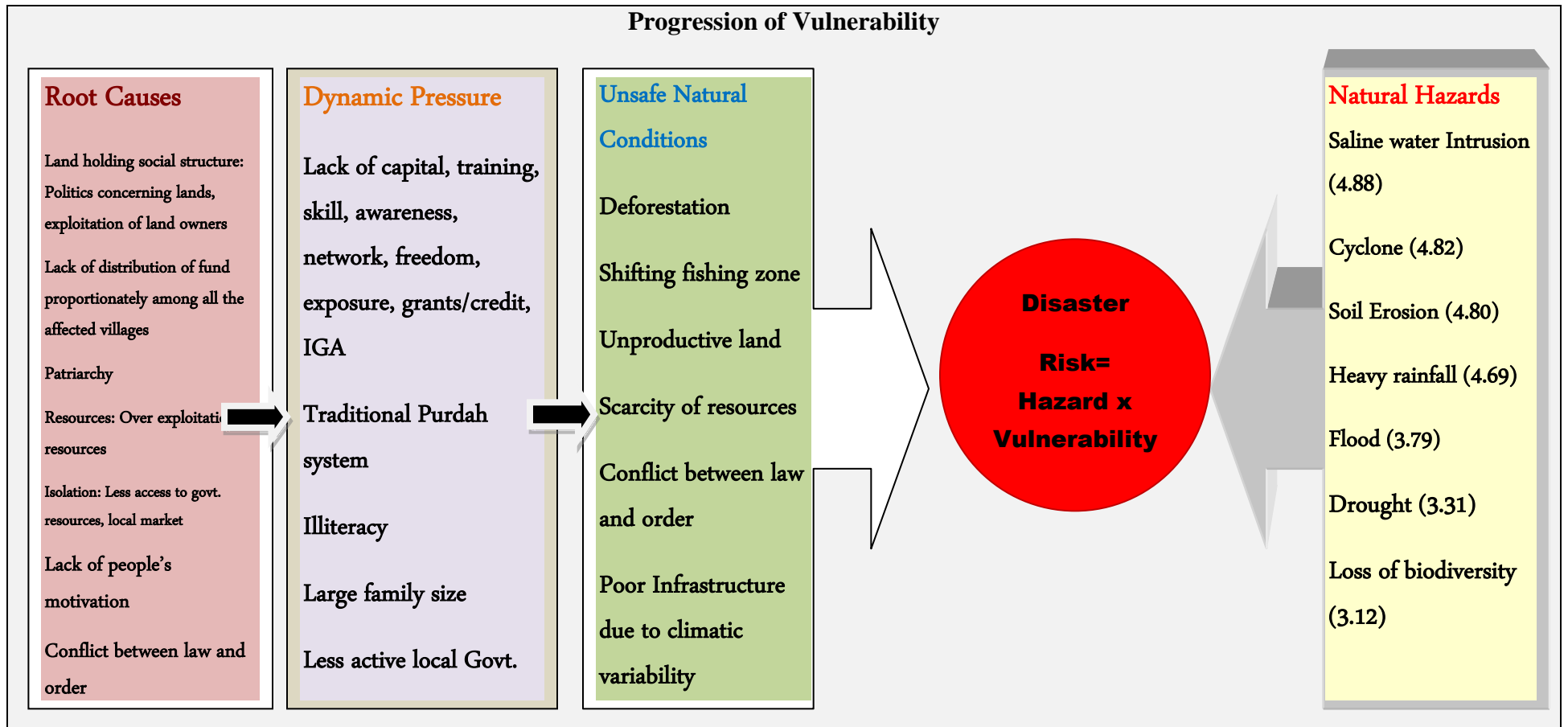
5. People with institutional supports are better able to cope with extreme climatic conditions.

It is found in the model that if the distance of NGO increases 1 km more, the probability of being food insecure will be more. This means that NGO supports keep significant impact on food security. More so, the model shows that if a person gets grants, the probability of being food secured is more for him.

Table 7.8: A Comparative Analysis of Keyabunia and Katabunia

Issues	Keyabunia	Katabunia
Marital status	Mostly married	Same
Nature of HH	Mostly male headed	Same
Type of family	Mostly extended	Mostly nuclear
Educational status	Mostly illiterate	Same
Occupational Status	Mostly fishermen	Mostly Farmer
Asset holding status	Men own more, female less	Same
Nature of decision making	Men make mostly	Same
Perception towards CC	Major concern 'Cyclone'	'Salinity'
Impact of salinity	Severe impact	Same
Agricultural production	Not that profitable	Still profitable
Food security	Food-insecure	Same
Main source of water	Pipe line water supply	Pond, tube well
Adaptation with water	Rain water harvesting	Same
Main source of fuel	Collecting and buying <i>golpata</i>	Agricultural residue/cow-dung/ <i>golpata</i>
Alternative livelihoods	Crab fattening, collectors	Day laborer, Raising animals/fishermen
Vulnerability to health	Mainly women and children	Same
Housing condition	Very poor	Poor
Infrastructure	Poor	Very poor

7.12 PAR Model based on Quantitative and Qualitative Data of the Study



7.13 Oxfam's Adaptation Model based on Qualitative and Quantitative Data

The study took **Oxfam's Adaptation model** to evaluate the adaptation capacity of the study areas. The way Oxfam intends to build the adaptation capacity includes knowledge generation, awareness raising, responsive policy environment, empowerment, innovation, availability of alternatives and options.

7.13.1 Assessing Adaptation Capacity of the Study Areas Based on Oxfam's Adaptation Model

The villages under study lack GO's and NGO's interventions on sustainable agricultural production. Few people of Katabunia were found growing paddy using saline tolerant seeds. They got information from other farmers of distant villages. But people of both villages directly received training on rain water harvesting from NGOs.

People of both villages were found aware of pure drinking water, schooling of their children and raising livestock though within their limited capacity. For example, people were found aware of drinking pure water but they used pond water for cooking. Many people of Katabunia were found raising livestock which they received from NGOs after Ayla. But the physical condition of those livestock was very poor. Many of these were malnourished too.

NGO intervention for empowering women was very insignificantly observed in Katabunia village. A very few number of women were observed having a sewing machine as a result of training they received. In fact coastal women of both study areas were found still prejudiced and less interested about training.

Availability of alternative livelihood options was very less in both study villages. Once upon a time the Sundarbans was a very important source of livelihood of the coastal people. Still people consider the Sundarbans as their main livelihood source. Due to extreme climatic variability, the resources of the Sundarbans have been devastated. It has become a very risky zone for livelihood of Bawali, Mawali etc. About one million people live on these resources of the Sundarbans. With that life risk people still visit the Sundarbans for the search of livelihood on a regular basis.

7.13.2 Factors Hindering Adaptation Capacity of the Study Areas Based on Oxfam's Adaptation Model

Based on this model the study has identified the factors which limit the adaptation capacity of the study areas.

Coastal economy plays a very important role in the development of a community. In both study areas lack of fund is a common factor hindering the adaptation process. The numbers of ponds which are re-excavated are not sufficient to meet up the needs of the community. In Keyabunia village, not a single pond was re-excavated. As a result people especially women needed to cover a long distance to fetch pure drinking water. No initiative was found taken by GO and NGO for sustainable agricultural production in both villages.

All the funds of GOs and NGOs were utilized centering those few number of villages which were highlighted by the media. But the study villages are not at all focused by government. Few NGO interventions were seen about rain water harvesting and about schooling of the children. Undoubtedly these are important for the development of the communities, but their traditional livelihood option is shrinking up to a larger extent. Funds should be distributed proportionately because in both study areas GO and NGO activities were not significant as compared to other cyclone affected areas. Thereby, much more political attention is needed in both the study areas.

Local elites came to a mutual understanding with the local political leaders and took the control of these *khash* lands or commercial Shrimp cultivation. As a result local people became deprived of their access to these government resources. Government *khash* lands should be utilized properly. No policy is taken yet about the settlement of *khash* lands. More so, the employment opportunities are very less in the areas due to poor economic condition. A few number of projects, which were running, were the main sources of employment in those areas. Thereby, when projects got finished, a large number of people became unemployed. Commercial Shrimp cultivation is another source of employment which needs to employ a very limited number of farmers.

In both study areas, women are yet to get any training. Many of them are not allowed to receive any training due to the traditional *pardah* system. Apparently these women seem very open-minded and progressive, but their movements and freedom are highly restricted by their husbands due to religious and cultural norms and values. NGOs naturally target women who were highly occupied with their traditional gender role and patriarchy as reported by NGO workers of the localities.

7.14 Verification of Theories and Concepts

By framing the findings of the study on PAR model and Oxfam's Adaptation Model, it is clearly evident that salinity as a disaster is not solely responsible for the vulnerability of the coastal households. Salinity being multiplied by social and cultural limits, politicization of government resources, and prevalence of social stratification, disproportionate allocation of fund and misuse and misappropriation of resources, has made the livelihood of coastal people more difficult and more uncertain. The vulnerability of coastal people is, thus, constructed socially, economically, politically and culturally (For details, please see FGD 4 of Katabunia village).

As per eco-feminism approach women of both study areas were found more prompt in coping up but the study finds that their capacity to face the future challenges is less due to their less access to resources. Women's better coping capability proves that they are better able to respond with as well as adapt with any sort of disaster in future. But their less access to resources limits their capacity a lot. Being considered as the changing agent of the society, women's entitlement to more resources would definitely enhance the household's adaptation capacity a lot. Thus the concepts 'adaptation capability' and the 'adaptation capacity' are not synonymous.

Despite having the capability to best use the natural resources, women's adaptation capacity is low due to their less access to resources. More so, disaster costs women's assets a lot. Thus, it is clear that simple coping would not help women much to reduce their vulnerability.

CHAPTER EIGHT

CONCLUSION

This chapter consists of two sections. First section includes the summary of the study. This section focuses on the objectives of the study, rational of the study, data collection procedure, findings and conclusion in brief. The second section focuses on policy implication.

8.1 Summary and Conclusions

Coastal people perceive many different types of climatic stressors in their locality. These are cyclone, heavy rainfall, drought, flood, soil erosion, loss of bio-diversity and saline water intrusion. Among all these climatic stressors, currently salinity has become a major concern for the southwest coastal people of Bangladesh. A big chunk of the fresh water zone of these areas went under saline water due to sea level rise. Saline water intrusion has subsequently affected so many other sectors which all are important for the live and livelihood of the coastal people. Since the livelihood of these areas are highly dependent on natural resources related to agriculture, water availability, fish and other aquatic resources, vulnerability originates in the effects of salinity on them. Thereby, the current study aims to analyze the socio-economic impacts of salinity on coastal people. A combination of qualitative and quantitative study was conducted to collect data from two study areas Keyabunia of Chila union, Mongla and Katabunia of Pankhali union, Dacope. Data was collected from 318 respondents from both villages based on non-probability sampling technique. It is found in both villages that traditional sources of food have become unpredictable and scarce due to loss in productivity. The main staple food of coastal people i. e. rice production is badly affected. Salt in the ground causes the root of paddy rotten and ultimately plants die out. This happens not only to paddy, but also to other sorts of plants such as vegetables, fruits, timber trees etc. People especially women of both study areas have become highly food insecure due to this. Livestock which is considered as a very important source of income also suffer from lack of fodder. Their income, savings, expenditure on health as well as overall social status decreased a lot. Scarcity of pure drinking water is another major concern of the costal people. All the

sources of water are affected by salinity. Women need to cross a long distance to collect pure drinking water. Few people established tube wells, water of which is also not salt free. The GOs and NGOs have re-excavated only a very few numbers of ponds which cannot meet up the demands of so many communities of the union. Due to lack of pure drinking water people especially women and children are suffering from various types of stomach diseases. Skin disease is common to everyone due to using clothes which are washed with saline water. Crisis of fuel wood always keeps coastal women worried. Due to lack of vegetation in the area, they need to depend on the Sundarbans for *golpata*. Many people also need to buy *golpata* from the market.

Social security is a major threat to coastal women and girls. Many of them most often become the victims of eve teasing, unethical proposal of local *mastans* etc. Though rape was not reported by women, many young women and adult girls also become the victims of rape as reported by the educated class of areas. Such case usually happens to the woman or girl in the evening while coming back home after collecting drinking water from a very distant place.

Coastal people have developed various coping practices against salinity and its subsequent food insecurity. They have brought huge changes in their food consumption pattern. Reducing mealtime, having smaller meal, starvation, sacrificing own meal for others, bartering food, begging are few common practice that people especially coastal women follow to cope with food insecurity. Loss in production most often results in selling or mortgaging assets or household products. In acute crisis, people become bound to sell their domesticated animals. All these force them to over-exploit their resources which in turn reduce opportunity to enjoy the services of natural resources in a balanced way.

Success of adaptation practices depends on asset. As most of the people of coastal areas are landless and have a very limited asset base, adaptation strategies don't always work out successfully. Especially women's adaptation capacity is very low despite being the key agent of social change. Even then people have developed various adaptation strategies to survive. Changes in the land use pattern, introduction of new techniques and new varieties of crops are few ways that people are adapting to hold back their traditional

livelihood sources. But lack of NGO intervention is a major obstacle in their way to success.

Coastal people have diversified their occupations from agriculture to other sectors. Many people live on catching fish, fish fry and crabs from sea though the resources are scarce at present. Many of them have turned into day laborers. Again many of them have become collectors. Among them few are risky like fishing in deep sea, collecting *golpata*-honey-wax from deep jungle etc. They need to stay in the Sundarbans for several months for this purpose. But the period of 'Chhata Dewa' has been reduced due to attack of pirates. They now stay in jungle alternately. After two or three weeks, one of them comes home back with their products. When he joins back, another member comes back. More so, catching crabs, collecting honey, wax etc. are also very risky due to the attack of wild animals. Again few of these occupations are less profitable like catching fish fry. Unemployment is another big problem related to diversifying income sources. Shrimp cultivation and crab fattening are very profitable in these areas. But both of these farming require land. But land ownership system of these areas is constructed in such way that benefits only a particular group of the area isolating poor people. The situation of women is even worst. The study finds that a woman owns half of an asset that a man owns. Thus, landless people especially women are in the face of greatest challenge to fight with shocks. Building ownership and engaging local community in participatory form of land management can be a step towards this.

The combined effects of land holding social structure, loss of agriculture due to salinity, lack of aquatic resources, lack of IGA, lack of grants or credit are putting people into such a complex system which is driving people to leave their original place and to migrate to different urban centers. All these factors re-established the theory that disaster is socially constructed. Thus, in order to retain a close tie of coastal people with their origin, immediately comprehensive policies with specific practical guidelines are needed to be taken. Thereby, current study emphasizes more on skill development and indigenous knowledge which will contribute to increase the coping and adaptation capacity of the household by minimizing the effects of salinity. Stereotypical attitude towards women is needed to be challenged otherwise vulnerability of women will continue.

8.2 Policy Implications

In light of the conceptual framework of the study, this section has categorized the roles that different organizations/individual are supposed to play to address salinity.

8.2.1 Role of Local Govt.: Structural Changes

- ***Land holding Social Structure*** Social structures of both study areas is basically land holding whereas majority of poor people are landless. Thereby, people with lands have got lot more scopes to exploit landless. Strict policies should be taken to regulate the land owners so that they cannot make a small farmer bound to sell lands to them.
- ***Ensuring Access of Landless to Khash Lands*** Government should prepare all *khash* lands of coastal areas in a more productive way and should ensure access of landless people to those lands.
- ***Changes in Land Use Pattern*** Govt. may promote shrimp cultivation in one season and cultivation of saline tolerant rice in another. Release of saline water and irrigation of sweet rain water is needed in this regard.
- ***Policy to Promote Sweet Water Shrimp Cultivation*** Govt. can also promote sweet water shrimp cultivation rather than saline water shrimp.
- ***Raising the Height of Embankment*** In some places of both study areas, embankments are broken. Thereby, they are unable to prevent saline water intrusion. These embankments are needed to be reconstructed. More their heights should be increased with the increasing rate of SLR.
- ***Building Sluice Gate for Regulating Saline Water*** Sometimes due to the tidal surge, saline water becomes trapped into the areas. Thus, Sluice gates are needed to release saline water immediately from lands.
- ***Determining the Sea Line for the Coastal People's Livelihood*** Being the source of plenty of resources, sea is one of the major sources of livelihood to coastal people. But coastal people face a lot of challenges in using these resources. Thus, sea area should be specified for them.

- ***Proper Drainage of River*** Proper drainage of river is needed so that flow of water becomes smooth rather than striking the banks. If river banks could be saved, much of coastal lands could have been saved.
- ***Easy Communication*** It is already mentioned earlier that good infrastructure allows people to have access to opportunities and services delivered by GOs and NGOs. In both villages, communication with the union is very difficult which deprives people of getting many services provided by GOs and NGOs. As due to saline water intrusion and heavy rainfall these roads get broken in each year, proper steps should be taken to reconstruct them after a particular interval. More, roads of Keyabunia should be widened so that at least a rickshaw can enter into village.
- ***Energy Coverage*** In both Keyabunia and Katabunia, electricity is not available. In Katabunia village, only a very insignificant number of respondents had solar panel which they got from NGO. The use solar panel should be promoted. Local Government should bring both villages under the coverage of electricity. Availability of electricity can open up many opportunities for the local people.
- ***Promoting Investment*** If both study areas can be brought under the coverage of electricity, many farms will be established. Irrigation will be easier. Commercial cultivation will be possible at a massive scale. Donors will show their interest to invest in these coastal areas.
- ***More Coverage of Pure Drinking Water Supply*** Local Government should bring more number of areas under pipe line water supply.
- ***Pond Re-excavation*** More number of ponds should be re-excavated in both study areas.
- ***Interrelation between GOs and NGOs*** Local govt. should work in collaboration with NGOs. NGOs have funds but they need administrative supports to run their projects.
- ***Making Agricultural Extension Office more Active*** In both study areas most of the people rarely meet with Agricultural Extension officer. However, this office is needed to be more active.

- **Implementation of Crop Insurance** Crop insurance will encourage poor farmer to invest in agriculture.

8.2.2 Role of Department of Agricultural Extension (DAE) to Address Salinity

- **Introduction of Saline Tolerant Seeds** Agricultural Extension office of Keyabunia said about the introduction of a few number of saline tolerant crops such as BINAdhan 8, 10, 11, BRRIdhan 55, AMANdhan 41 etc. Few of these varieties can sustain at a saline level 12-14 dS/p and few of them can sustain upto 15-25 dS/p. But crop failure still persists in the study areas. Thus, they should invent new variety suitable to the soil of Keyabunia and Katabunia.
- **Demonstration and Monitoring** Agriculture Extension officer should show the demonstration of new techniques of cultivation. They should also monitor whether community people are going on track or not.
- **Regular Meeting with the Community People** Agricultural Extension officer should conduct regular meeting weekly or monthly on the basis of the requirement of the task assigned.
- **Changes in the Land use Pattern** Agricultural Extension office may bring changes in the land use pattern to get the maximum benefit from the land.
- **Afforesting the Sundarbans** Agricultural Extension office can take initiative to afforest the Sundarbans. They can grow mangrove and other trees like *sundori*, *gewua*, *keura* etc. Community people then need not to go deep into the jungle for getting forest products.
- **Establishing Poultry Farm** Livestock is a very important part of agricultural production. Extension office may take initiatives to establish poultry farms in coastal areas and give people training on it.
- **Establishing Saline Tolerant Tree Orchard** Extension office may establish orchard of coconut, Sundory or Kewra tree. They can grow *golpata* there so that people need not to go to deep sea for collecting them.
- **Promoting Commercial Plantation** Commercial plantation like water melon, sunflower, coconut can be produced at a massive scale under the supervision of Extension office.

8.2.3 Role of NGO to Address Salinity

- **Capacity Building** NGOs should bring all the poor coastal people especially women under their training program for skill building and generating awareness among them.
- **Introduction of New Techniques in Agriculture** Raised bed is a technique which is used only for vegetables and fruits. Only this technique is seen in Keyabunia. On the other hand, no scientific techniques were observed in agriculture. But there are several other techniques like ‘Mulching’, ‘Ditch and Dyke method’, ‘Mound Plantation’, ‘Floating Mats’, ‘Embankment Cropping’, ‘Compartmentalization’ which can be applied in these areas.
- **Promotion of Commercial Plantation** There are many crops such as chili, soybean, bitter gourd, sweet gourd, ground nut, maize, mustard, cowpea etc. which can be introduced in these saline prone areas. Different saline tolerant rice varieties are there which can be produced. These are BRRI Dhan-47 and 55, BINA- 8, BRRI Dhan-46, 40, 41, 53 and 54
- **Channelizing Rain Water** Rain water can be channelized to different connected lands by proper drainage system.
- **Promotion of Aquaculture** NGOs should help coastal aqua farmers to develop more salt tolerant fish species.
- **Increasing Number of IGAs** NGOs should focus on diversifying the income sources of poor landless people. They can give training to women on
-handicrafts and sewing, candle making, flower making, pottery, doll making etc.

For men, NGOs can provide training on honey cultivation, sweet water shrimp cultivation, salt production etc.
- **Creating a Linkage between Villages and Local Market** Only training is not enough to reduce vulnerability. Rural people are needed to be connected to the market so that they can sell their product and can make profit.
- **Overhead Tank/ Reservoir** Other than rain water harvesting, NGOs can build overhead tanks to reserve saline free water and supply it through pipe.

- ***Community based Pond Sand Filter*** NGOs should apply PSF technique in at least one pond of every community of the coastal areas.
- ***Provision of Micro Credit/ Grants*** NGOs should provide micro-credit to the poor people so that they can invest.
- ***People's Opinion Needed to be Accounted*** NGOs should involve local people in the implementation of any policy.

8.2.4 Role of Health Complex

- ***Changes in the Dietary Pattern*** Health service provider can visit house to house and can teach people especially women about the dietary pattern for children, old people and for the adult.
- ***Creating Awareness*** Health service provider can make people aware about various types of climate induced diseases and can teach them about their primary treatments.

8.2.5 Role of Community People

- ***Good leadership*** Coastal people should create a community leader who will guide people in emergency situation.
- ***Acceptance of Leader and Trust Building*** Leaders should be capable of building trust among local people.
- ***Community Savings*** Community people can develop cooperative society and accumulate their small savings to run a project.
- ***Build Consensus*** Local people should co-operate each other rather than creating conflicts among them. They should come to a consensus regarding any decision which is supported by most of the people.

8.2.6 Role of School/ Mosque

- ***Culture Attitudes and Motivation*** Teachers/Imam can play role in changing stigmatized local people's attitudes towards gender stereotypes. They also can play role in changing motivational status of the frustrated farmers.
- ***Teachers can be Leaders*** Teachers should come forward to support or protest any policy if it is in favor or in disfavor of their community.

- ***Highlighting through Drama*** Students can play drama by highlighting the community problems.

8.2.7 Role of Researcher

- ***Conducting Research*** Increased number of research should be conducted to identify the gap between theory and practice.
- ***Knowledge Sharing*** National and International seminar, conferences can be conducted for knowledge sharing.

8.2.8 Addressing Gender Issue

- ***Gender Neutral Climate Change Policies*** In Bangladesh, gender approach is completely missing in climate change policies. Policy makers need to be aware of this approach. They should take a gender perspective while taking policies.
- ***Lack of Knowledge*** More number of workshops and seminars should be organized for the public administration officers to develop a gender perspective within themselves.
- ***More Female NGO workers needed*** Usually NGO workers are posted in different vulnerable areas where women workers are not interested to go. As a result male NGO workers fail to hit the actual points which can make them interested to receive training. Local women can be employed to serve this purpose if required.
- ***Resource allocation for the implementation of Adaptation Strategies*** Women usually are the target population of NGOs. After receiving training these women cannot implement those techniques due to lack of resources. When they demand money or seeds or homestead or any other thing and finally fail to make profit out of them, they become the victims of gender violence like wife beating. These women dare not to demand money for the second experiment. Thus, NGOs should provide all the resources necessary to implement their training, as the conceptual framework of the study already suggested.
- ***Creating Equitable Employment Opportunities*** Women have already proved their better coping capability throughout the world. Thereby wage labor market should be gender neutral.

- ***Ensuring Property Rights of Women*** Law should be stricter to ensure women's right to properties and also to ensure full control over their resources.
- ***Right Based Approach*** The context of women is always underestimated. Their basic rights are denied and their other simple rights are easily ignored. Every aspects of women's life should be analyzed from a right based approach. It should be men not only women who should be aware of these rights.

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APPENDIX A

QUESTIONNAIRE FOR SURVEY

**The Socio-economic Impact of Climate Change: Assessing Vulnerability and
Adaptation Capacity of South-West Coastal People of Bangladesh**

1. Name of the Respondent:
2. Village:
3. Union:
4. District:

1. Name of the interviewer:
2. Date of Interview:

Part I: Socio-demographic Information

Sample no.	Relationship with household head	Gender Male=1 Female=2	Age	Marital Status	Educational Status	Primary occupation	Secondary Occupation
C1	C2	C3	C4	C5	C6	C7	C8

Code for C2	Code for C4	Code for C5	Code for C7	Code C8 & C9
1. Household Head 2. Husband/Wife 3. Son/Daughter 4. Father/Mother 5. Brother/Sister 6. Son-in-law/ Daughter-in-law 7. Grandson/Grand daughter 8. Nephew/Niece 9. Brother-in-law/Sister-in-law 10. Father-in-law/Mother-in-law	1. 15-19 2. 20-24 3. 25-29 4. 30-34 5. 35-39 6. 40-44 7. 45-49 8. 50-54 9. 55-59 10. 60+	1. Married 2. Unmarried 3. Divorced/ Abandoned 4. Widow 5. Separated Others (Please Specify)	1. Class 1-----10. class 10 11. S.S.C 12. H.S.C 13. B/A, Diploma/ Honors 14. Masters 15. Can sign only 16. Illiterate 17. Vocational Training 18. Madrasa education	1. Farmer (Crops) 2. Farming (Livestock) 3. Cattle traders 4. Collector (Honey, wax, crab, shell etc.) 5. Shrimp farmer 6. Fisherman 7. Dry fish processor 8. wage labourer 9. Businessman 10. Salt producer 11. Net makers 12. Housewife 13. Handicrafts 14. Boat builders 15. Muri traders 16. Disable 17. Unemployed 18. Others (Please specify)

Part II: Information about family:

Instructions: Code for C1: 1=Nuclear family, 2= Extended family

Type of Family	No. of Family Members		No. of Children		No. of School Going Children		No. of Dependents		Nature of Household	Nature of Decision Making
C1	C2		C3		C4		C5		C6	C7
	Male	Female	Male	Female	Male	Female	Male	Female		

For C6: 1= Male headed, 2= female headed de facto, 3=female headed de jure

For C7: 1= Self, 2=Dependant on husband, 3=Dependent on wife, 4= Both, 5= others (Please specify).....

Part III: Possessions of Assets (Please circle the following codes)

Sl. No.	3.1. Do you have following assets?	1=Yes	2=No	Amount /No.	Market Price in taka
a.	Land (own)	1	2		
b.	Radio/CD player/TV	1	2		
c.	Fan	1	2		
d.	Mobile phone	1	2		
e.	Sewing Machine	1	2		
f.	Chair/table/show case/wad rob	1	2		
g.	Bed	1	2		
h.	Mosquito net	1	2		
i.	Gold	1	2		
j.	Cow/bull/duck/hen/goat/sheep	1	2		
k.	Pump for irrigation /Plough/Tractor	1	2		
l.	Boat	1	2		
m.	Fishing net	1	2		
n.	Rickshaw/Van/bicycle	1	2		
o.	Tree	1	2		
p.	Others (Please specify).....				

Part IV: Perception about Climate Change

Ques. No.	Question	Answer					
4.1	Are you aware of climate change? 1=yes, 2= No						
4.2	If yes, what sort of climatic changes you observed in your locality in the last one year?	Rank them by circling as per severity where 1= very low, 2=low, 3= moderate, 4= high, 5= very high, 6= no comment					
Climatic Changes Observed							
a.	Prolonged rainy season	1	2	3	4	5	6
b.	Increased number of cyclone	1	2	3	4	5	6
c.	Increased number of flood	1	2	3	4	5	6
d.	Drought	1	2	3	4	4	6
e.	Loss of bio-diversity	1	2	3	4	5	6
f.	Soil erosion	1	2	3	4	5	6
g.	Saline water intrusion	1	2	3	4	5	6
h.	Others (Please specify).....	1	2	3	4	5	6

4.3 How much you are dependent on natural capital? (Please circle)

Sl. No.	Nature of dependence Sectors	1= Heavy dependence	2= Partial dependence	3= No dependence
i.	Agriculture	1	2	3
j.	Forestry	1	2	3
k.	Water resources	1	2	3
l.	Livestock	1	2	3

Part V: Salinity, Agriculture, Vulnerability and Adaptation

Ques. No.	Questions	Code				
5.1	Does salinity keep any adverse impact on agriculture? 1=yes, 2=No					
5.2	If yes, Which crops/plants/trees were severely affected due to salinity in the last one year?	Rank them by circling as per severity where 1= very low, 2=low, 3= moderate, 4= high, 5= very high				
Sl. No.	Crops/Plants/trees Severely Affected	1	2	3	4	5
a.	Paddy	1	2	3	4	5
b.	Vegetables	1	2	3	4	5
c.	Fruits	1	2	3	4	5
d.	Timber	1	2	3	4	5
e.	Others (please specify).....	1	2	3	4	5

5.3. How does salinity affect your agricultural products? (Rank them by circling as per severity where 1= very low, 2=low, 3= moderate, 4= high, 5= very high)

		Effects of Salinity					
Crops/ Plants/ Timber	a.	Reduced cultivable land	1	2	3	4	5
	b.	Reduced soil quality	1	2	3	4	5
	c.	Cause the root rotten	1	2	3	4	5
	d.	Diseases and retardation of growth	1	2	3	4	5
	e.	Top dying	1	2	3	4	5
	f.	Premature fruit dropping	1	2	3	4	5
	g.	Death of plant	1	2	3	4	5
	h.	Others (Please Specify).....	1	2	3	4	5
Livestock	a.	Less availability of plants and trees	1	2	3	4	5
	b.	Less availability of grazing land	1	2	3	4	5
	c.	Suffering from water-borne diseases	1	2	3	4	5
Water resources	a.	Shifting fishing zone	1	2	3	4	5
	b.	Increased death rate of water species and fish stocks	1	2	3	4	5
	c.	Others (Please specify).....	1	2	3	4	5

5.4. What coping and adaptation strategies you are following? (Please circle)

		Strategies Taken	Code
Coping Strategy	a.	Selling asset	1
	b.	Taking grants, subsidy, loan	2
	c.	Mortgaging assets	3
	d.	Switching between farming and fishing	4
	e.	Exploring alternative livelihood options	5
	f.	Migration	6
	g.	Others (Please specify).....	7
Adaptation strategy	a.	Using more adaptive seeds/ modern fertilizer and pesticides	1
	b.	Use of floating plants	2
	c.	Merging two or more cultivation fields for the best use of land	3
	d.	Changes in the cultivation season	4
	e.	Seasonal migration	5
	f.	Cultivating fishes suitable in saline water	6

	g.	Tree plantation	7
	h.	Others (Please specify).....	8

5.5 Where do you get information about agriculture? (Please circle)

Sl. No.	Sources of Information	Code
a.	Agricultural extension office	1
b.	Other farmers	2
c.	Seed suppliers	3
d.	Friends	4
e.	Neighbors	5
f.	Media	6
g.	Don't get any information	7
h.	Others (Please specify)...	8

Part VI: Alternative Livelihood Options and Vulnerability

Ques. No.	Questions	Answers/Code
6.1	Are you switching between two or more occupations? 1=Yes, 2=No	
6.2	If yes, what?	Codes (Please Circle)
Sl. No.	Alternative Livelihood Options	
a.	Shrimp farming	1
b.	Pond fishing	2
c.	Wage labor	3
d.	Crab fattening	4
e.	Honey, wax, fruit, firewood collecting	5
f.	Starting small business	6
g.	Livestock farming (cow, goat, poultry etc.)	7
h.	Others (Please specify).....	8

6.3. What problems do you face related to these alternative livelihood options?

Sectors	Sl. No.	Problems	Codes (Please Circle)
Shrimp Farming	a.	Destruction of land for crop cultivation	1
	b.	Pollution of pond water	2
	c.	Small numbers of farmers needed	3
	d.	Land use conflict and increased land related disputes	4
	e.	Exploitation of the land owners	5
Livestock Farming	a.	Decline of grazing lands	1
	b.	Lack of space for their shelter	2
	c.	Less availability of homestead plantation	3
	d.	Attack of the wild animals and death of livestock	4
	e.	Death of livestock due to various water borne diseases and viral infection	5
	f.	Less availability of snails due to extensive use of pesticides	6
Wage Labor Market	a.	Lack of job opportunity	1
	b.	Poor wage	2
	c.	Long distance	3
	d.	Not getting wage on time	4

	e.	Sexual harassment by the employer and other male laborers	5
Problems as a collector	a.	Less availability of trees near the shore	1
	b.	Attack of wild animals	2

Part VII: Climate Change, Food Insecurity, Vulnerability and Adaptation

Ques. no.	Questions	Code
7.1	Are you food secured? 1=Yes, 2= No	
7.2	If no, Why do you feel that you are food insecure? 1=Less availability of food, 2=Lack of purchasing capability, 3=Future uncertainty, 4=Others (Please specify).....	
7.3	How many times you can afford food for your family? 1= Only once in a day, 2=Twice in a day	
7.4	Who is mostly vulnerable in terms of food insecurity? 1=Adult male, 2=Adult female, 3=Children 4=Old people	

7.5. What are the major causes of food insecurity? (Please Circle)

		Major Causes	Codes
Unsafe climatic condition	a	Crop failure due to salinity of water	1
	b	Loss of livestock due to extreme weather events	2
	c	Water stagnation	3
	d	Unpredictable rainfall	4
Dynamic pressures	a	Lack of skill	1
	b	Unemployment	2
	c	Gender discrimination in the wage labour market	3
	d	Large size of the family	4
	e	Lack of grants, loans etc.	5
	f	More busy in the household chores and caring activities	6
	g	Traditional Purdah system	7
Root causes	a	High price of food	1
	b	Exploitation of land owners	2
	c	landlessness	3

7.6. How you are involved in food security of your household? (Please Circle)

	Sl. no.	Activity related to Food Security	Codes
Food Processing	a.	Collection of forest products	1
	b.	Producing food	2
	c.	Purchasing food	3
Food Cooking	a.	Cooking	1
	b.	Collection of pure drinking water	2
	c.	Collection of fire wood	3
	d.	Chopping tree log	4
Food Distribution	a.	Ensuring food for all	1
	b.	Ensuring pure drinking water	2

7.7. How do you cope/adapt with food insecurity? (Rank them by circling as per severity where 1= very low, 2=low, 3= moderate, 4= high, 5= very high, 6= no comment)

	Sl. No.	Measures Taken	1	2	3	4	5	6
Coping strategy	a.	Reducing expenditure on non-food items	1	2	3	4	5	6
	b.	Substitution between foods	1	2	3	4	5	6
	c.	Smaller meals	1	2	3	4	5	6
	d.	No rich diet	1	2	3	4	5	6
	e.	Fewer mealtimes per day	1	2	3	4	5	6
	f.	Payment in food for casual labor	1	2	3	4	5	6
	g.	Bartering for food	1	2	3	4	5	6
	h.	Collection and consumption of wild food	1	2	3	4	5	6
	i.	Drawing down on social networks	1	2	3	4	5	6
	j.	Withdrawing children from school	1	2	3	4	5	6
	k.	Borrowing from moneylenders	1	2	3	4	5	6
	l.	Selling asset/livestock	1	2	3	4	5	6
	m.	Begging from rich neighbors	1	2	3	4	5	6
	n.	Taking grants (Govt. & non Govt.)	1	2	3	4	5	6
Adaptive mechanism	o.	Mortgaging own things	1	2	3	4	5	6
	p.	Others (Please specify).....	1	2	3	4	5	6
	a.	Building up stores of grains	1	2	3	4	5	6
	b.	Making savings	1	2	3	4	5	6
	c.	Using modern technology in agriculture	1	2	3	4	5	6
	d.	Growing crops suitable for the climate	1	2	3	4	5	6
	e.	Building up livestock herds	1	2	3	4	5	6
	f.	Diversifying crops	1	2	3	4	5	6
	g.	Diversifying income sources	1	2	3	4	5	6
h.	Taking grants	1	2	3	4	5	6	
i.	Others (Please specify).....	1	2	3	4	5	6	

Food Consumption Pattern

Ques. No.	Questions	Code
7.8	Have you brought any changes in your food consumption pattern? 1=yes, 2=No	
7.9	What type of changes you have brought to your food consumption pattern (How many times you consume the following products per week in number)?	X
Items	Before Salinity (in 2012)	After Salinity (2013)
Rice		
Wheat		
Meat		
Fish		
Vegetables		
Fruit		
Egg		
Milk		

7.10. What are the different sources of water you use for drinking? (Please Circle)

Sl. No.	Sources of Water	Code
a.	River	1
b.	Pond	2
c.	Tube-well	5
d.	Rain water	7
e.	Others (Please specify).....	8

7.11. How does salinity affect your drinking water? (Please Circle)

Sl. No.	Effects of Salinity on Drinking Water	Code
a.	Saline water intruded into all the sources of water	1
b.	Shrimp cultivation is affecting water resources	2
c.	Extensive use of fertilizer and pesticides affecting water sources	3
d.	Others (Please specify).....	4

7.12. How you are coping with the existing situation? Have you taken any preparation to reduce vulnerability in future? (Please Circle)

	Sl. No.	Strategies Taken	Code
Coping Strategy	a.	Storing rain water in bucket	1
	b.	Using potassium to purify water	2
	c.	Crossing long distances to collect tube-well water	3
	d.	By filtering salt	4
	e.	By boiling	5
	f.	Others (Please Specify).....	6
Adaptation Strategy	a.	Creating reservoir to collect rain water	1
	b.	Setting up deep tube-well	2
	c.	Digging well	3
	d.	Pond re-excavation by GO and NGO	4
	e.	Others (Please specify).....	5

Part VIII: Climate Change, Energy Consumption and Vulnerability

8.1. How do you manage fuel wood? (Please Circle)

Sl. No.	Sources of Fuel wood	Code
a.	Using homestead plantation	1
b.	Forestry	2
c.	Cutting down trees and branches	3
d.	Collecting Golpata	4
e.	Using cow-dung	5
f.	Agricultural residue	6
g.	Others (Please specify).....	7

8.2. What problems you are facing in managing fuel wood due to salinity? (Please Circle)

Sl. No.	Problems in Managing Fuel Wood due to Salinity	Code
a.	Lack of homestead plantation and deforestation	1
b.	Death of animals and lack of cow-dung	2
c.	Going deep into the forest	4
d.	Crossing a long distance	5
e.	Others (Please specify).....	6

Impact of Salinity	Sl. No.	Socio-economic Impacts	Code
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8.3. How much time it takes to collect fuel wood and pure drinking water? (Please Circle)

Sl. No.	Total Time	Pure drinking water	Fuel wood
a.	1 hour	1	1
b.	2 hours	2	2
c.	3 hours	3	3
d.	More than that	4	4

Part IX: Climate Change, Health Issues and Vulnerability

9.1. What sort of diseases you suffered most in the last one year due to climate change?(Please Circle)

Sl. No.	Major Climatic Conditions Responsible for Diseases	Code
a.	Diarrhea, cholera, heat stroke, dehydration, aggravation of cardiovascular diseases etc.	1
b.	Gynecological problem, skin diseases	2
c.	Cough and cold, chest pain, asthma etc.	3
d.	Malaria, dengue, skin and eye diseases	4
e.	Death	5
f.	Others (Please specify).....	6

9.2. Which group of people is the most vulnerable due to health problem? (Please Specify)

Sl. No.	Group	Code
a.	Men	1
b.	Women	2
c.	Adult boys	3
d.	Adult girls	4
e.	Children	5
f.	Old people	6
g.	Others (Please specify).....	7

9.3. Where do you go usually for treatment? (Please Circle)

Sl. No.	Organization for Treatment	Code
a.	Upazilla hospital	1
b.	Local clinic	2
c.	Unspecialized doctor	3
d.	No proper health care centre	4
e.	Others (Please specify).....	5

Part X: Impact Measurement of Climate Change on Different Socio-economic Dimensions

Due to salinity and food insecurity	a	Decreased income	1.
	b	Decreased savings	2.
	c	Joblessness	3.
	d	Migration and increasing female headed household	4.
	e	Increased malnutrition and illness	5.
	f	Increased isolation (roads and communication)	6.
	g	Withdrawal of the children from school	7.
	h	Cutting down social network	8.
	i	Others (Please specify).....	9.
Impact of less availability of pure drinking water	a	Halting daughter's education and sending her to collect fresh water	1.
	b	Getting tired and can't play other roles at home properly	2.
	c	Eve teasing and sexual harassment while collecting water	3.
	d	Extra time investment	4.
	e	Children remain unattended	5.
	f	Suffering from various diseases due to lack of fresh drinking water	6.
	g	Increased expenditure on treatment	7.
	h	Others (Please specify).....	8.

10.1. Assessing Socio-economic Impacts of Salinity. (Please Circle)

10.2. Measurement of Socio-economic Impact of Salinity:

Factors Affected	1=Increased (In 2010)	2=Decreased (In 2013)	Before Salinity	After Salinity
Income (In taka)				
Savings (In taka)				
Expenditure on food (In taka)				
Agricultural production (in tones)				
Cost in agricultural production (In taka)				
Cost of health treatment (In taka)				
Child mortality			x	x
Maternal mortality rate			x	x
Sexual harassment			x	x
Rate of migration			x	x
Social status/Prestige			x	x
Household assets (in taka)				
Death rate of livestock			x	x
Amount of loan (In taka)				
Mortgaging assets (in taka)				
Schooling status of children			x	x
Overall living standard			x	x

Part XI: Information about Housing and Infra-structure

Ques. No.	Questions about Housing	Code
11.1	House: Pakka=1, Bamboo=2, Mud=3, Tin shed=4, Others (Please specify)	
11.2	Any Kitchen? Yes=1, No=2	
11.3	Toilet system: Sanitary=1, Ring slab=2, Hole=3, Open=4	
Ques. No.	Questions about Infra-Structure	Answer
11.4	Distance of NGO from your house (Km)	
11.5	Distance of village market from your house (Km)	
11.6	Distance of Upazilla Agricultural Office from your house (Km)	

11.7	Frequency of your meeting with Agricultural Extension Worker during last 6 months	
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Part XII: Suggestions and Recommendations

What is your expectation to the GO and NGO to improve the present vulnerable condition?

CHECKLIST FOR CASE STUDY

1. Socio-demographic profile of the cases (Age, gender)
2. Occupational status
3. Educational status
4. Nature of household
5. Nature of decision making
6. Nature of vulnerability due to salinity (especially food, water, energy)
7. Coping strategies with salinity
8. Adaptation strategies with salinity
9. Support received from NGO and other organizations
10. Health problems due to salinity
11. Housing system
12. Ways of communication with the nearest town

QUESTIONNAIRE FOR IN-DEPTH INTERVIEW

1. Are you aware about climate change?
2. What sort of climatic changes are taking place in your locality?
3. How is local economy being affected by salinity?
4. How the local people are being affected by Salinity?
5. How they are coping with the situation?
6. What services you have provided to the local people?
7. Have you faced any hindrances in implementing those steps?
8. Would you please tell us about the local marketing system?
9. How rich farmers are exploiting small scale farmers? Any steps you have taken against them?
10. What more Govt. and NGOs should do in this regard?

CHECK LIST FOR FGD

FGD no.....

Total Number of Participants.....Male..... Female.....

1. Socio-demographic Information
2. Perception about climate change (Rank them out of 10)

a. Prolonged rainy season		e. Loss of bio-diversity	
b. Increased number of cyclone		f. Soil erosion	
c. Increased number of flood		g. Saline water intrusion	
d. Drought		h. Others (Please specify)	

3. Agriculture and vulnerability due to salinity of water
4. Salinity and Food insecurity
5. Causes of food insecurity, scarcity of pure drinking water and fuel wood
6. Coping and Adaptation Strategies (Rank the following options out of 10)

Reducing expenditure on non-food items		Withdrawing children from school	
Substitution between foods		Borrowing from moneylenders	
Smaller meals		Selling asset/livestock	
No rich diet		Mortgaging own things	
Fewer mealtimes per day			
Payment in food for casual labor		Storing rain water in bucket	
Bartering for food		Using potassium to purify water	
Collection and consumption of wild food		Crossing long distances for tube-well water	
Drawing down on social networks		By filtering salt	
Begging from rich neighbors		By boiling	
Taking grants (Govt. & non Govt.)			
Selling asset		Switching between farming and fishing	
Taking grants, subsidy, loan		Exploring alternative livelihood options	
Mortgaging assets		Migration	

Building up stores of grains		Creating reservoir to collect rain water	
Making savings		Establishing deep tube-well	
Using modern technology in agriculture		Digging well	
Growing crops suitable for the climate		Pond re-excavation by GO and NGO	
Building up livestock herds			
Diversifying crops		Using more adaptive seeds/ modern fertilizer and pesticides	
Diversifying income sources		Use of floating plants	
Taking grants		Merging two or more cultivation fields for	

		the best use of land	
		Changes in the cultivation season	
		Seasonal migration	
		Cultivating fishes suitable in saline water	
		Tree plantation	

6. Socio-economic Impact of Salinity

7. Alternative livelihood options and Challenges

8. Gender Violence

9. Health problems

10. Suggestions and Recommendations

APPENDIX B

FGD 1 Katabunia

6.2.2.1.1 Perception towards Climate Change

Sl.no	Climatic changes	Severity ranking (out of 10)
1	Increased number of cyclones	10
2.	Prolonged rainy season	6
3.	Sea water stagnation	9
4.	Increased number of flood	4
5.	Soil salinity	10
6.	Drought	8
7.	Loss of bio-diversity	8
8.	Soil erosion	10

Source: FGD, 2014

Table 6.2.2.1.2.1 Perception towards Climate Change (FGD 2, Katabunia)

Sl no.	Climatic Shocks	Severity of problems (Ranking out of 10)
1.	Increased number of cyclones	10
2.	Prolonged rainy season	6
3.	Sea water stagnation	9
4.	Increased number of flood	4
5.	Soil salinity	10
6.	Drought	10
7.	Loss of bio-diversity	5
8.	Soil erosion	10

Source: FGD, 2014

Table 6.2.2.1.2.2: Coping mechanisms with Food insecurity followed by Katabunia Male (FGD 2, Katabunia)

Sl. No.	Coping Mechanisms	Ranking out of 10
1.	Major meal twice in a day	10
2.	Skipping meal	7
3.	Buying food on loan	7
4.	No balanced diet	10
5.	Mortgaging asset	7
6.	Selling asset	6
7.	Smaller meal	4
8.	Collecting wild food	0

9.	Begging from rich neighbor	0
10.	Simple food menu	10
11.	Drawing down social network	4
12.	Bartering food item	4

Source: FGD, 2014

Table 6.2.2.1.2.3 Adaptation strategies followed by Katabunia Male (FGD 2, Katabunia)

Sl. no.	Adaptation Mechanisms	Ranking out of 10
1.	Rain water harvesting	10
2.	Domesticating animals	8
3.	Running small business/ Making <i>charo</i>	4
4.	Diversifying occupation	10
5.	Changes in the cultivation season	10
6.	Seasonal Migration	10

Source: FGD, 2014

Table 6.2.2.1.3.1: Perception towards Climate Change(FGD 3, Katabunia)

Sl no.	Climatic Shocks	Severity of the problem (Out of 10)
1.	Increased number of cyclones	10
2.	Prolonged rainy season	6
3.	Sea water stagnation	8
4.	Increased number of flood	5
5.	Soil salinity	10
6.	Drought	10
7.	Loss of bio-diversity	4
8.	Soil erosion	10

Source: FGD, 2014

Table 6.2.2.1.3.2: Coping Strategies practiced by Katabunia Female

Sl. no.	Coping Mechanisms	Ranking out of 10
1.	Major meal twice in a day	10
2.	Skipping meal	10
3.	Buying food on loan	8
4.	No balanced diet	10
5.	Mortgaging asset	6
6.	Selling asset	4

7.	Smaller meal	10
8.	Collecting wild food	10
9.	Begging from rich neighbor	8
10.	Simple food menu	10
11.	Drawing down social network	8
12.	Bartering food item	10

Source: FGD, 2014

Table 6.2.2.1.3.3: Adaptation Mechanisms Followed by Katabunia Female

Sl. no.	Adaptation Mechanisms	Ranking out of 10
1.	Rain water harvesting	10
2.	Domesticating animals	9
3.	Running small business/ Making <i>charo</i>	7
4.	Diversifying occupation	4
5.	Changes in the cultivation season	6
6.	Seasonal Migration	0
7.	Homestead plantation	5

Source: FGD, 2014

Table 6.2.2.1.4.1: Perception towards Climate Change (FGD 4, Katabunia)

Sl no.	Climatic Shocks	Severity of the problem (Out of 10)
1.	Increased number of cyclones	10
2.	Prolonged rainy season	7
3.	Sea water stagnation	9
4.	Increased number of flood	4
5.	Soil salinity	10
6.	Drought	10
7.	Loss of bio-diversity	8
8.	Soil erosion	10

Source: FGD, 2014

Table 6.2.2.2.1.1: Perception towards Climate Change (FGD 1, Keyabunia)

Sl no.	Climatic Shocks	Severity of the problem (Out of 10)
1.	Increased number of cyclones	10
2.	Prolonged rainy season	7
3.	Sea water stagnation	10
4.	Increased number of flood	6

5.	Soil salinity	10
6.	Drought	7
7.	Loss of bio-diversity	8
8.	Soil erosion	10

Source: FGD, 2014

Table 6.2.2.2.1: Perception towards Climate Change (FGD 2, Keyabunia)

Sl no.	Climatic Shocks	Severity of the problem (Out of 10)
1.	Increased number of cyclones	10
2.	Prolonged rainy season	5
3.	Sea water stagnation	9
4.	Increased number of flood	6
5.	Soil salinity	10
6.	Drought	6
7.	Loss of bio-diversity	5
8.	Soil erosion	10

Source: FGD, 2014

Table 6.2.2.2.2: Coping Mechanisms followed by Keyabunia Female

Sl. no.	Coping Mechanisms	Ranking out of 10
1.	Taking major meal twice in a day	10
2.	Skipping meal	10
3.	Buying necessary things on loan	7
4.	No balanced diet	10
5.	Mortgaging asset	6
6.	Selling asset	4
7.	Smaller meal	10
8.	Collecting unpalatable food from street side	8
9.	Begging from rich neighbor	8
10.	Limited food items	10
11.	Drawing down social network	9
12.	Bartering/exchange of foods	10

Source: FGD, 2014

Table 6.2.2.2.3: Adaptation Mechanisms followed by Keyabunia Female

Sl. no.	Adaptation Mechanisms	Ranking out of 10
1.	Rain water harvesting	10
2.	Domesticating animals/hens/duck	4
3.	Running small business/ Making <i>charo</i>	2
4.	Diversifying occupation	4
5.	Changes in the cultivation season	0
6.	Seasonal Migration	0
7.	Storing pure water in tank	5
8.	Homestead plantation	4

Source: FGD, 2014

Table 6.2.2.2.3.1: Perception towards Climate Change by Keyabunia Female Headed HH.

Sl no.	Climatic Shocks	Severity of the problem (Out of 10)
1.	Increased number of cyclones	10
2.	Prolonged rainy season	5
3.	Sea water stagnation	9
4.	Increased number of flood	4
5.	Soil salinity	10
6.	Drought	7
7.	Loss of bio-diversity	5
8.	Soil erosion	10

Source: FGD, 2014

Table 6.2.2.2.3.2: Coping Mechanisms followed by Keyabunia Female Headed Households

Sl. no.	Coping Mechanisms	Ranking out of 10
1.	Food twice in a day	10
2.	Skipping meal	10
3.	Buying food on loan	10
4.	No rich diet	10
5.	Mortgaging asset	5
6.	Selling asset	4
7.	Smaller meal	10
8.	Collecting wild food	9
9.	Begging from rich neighbor	5
10.	Simple food menu	10
11.	Drawing down social network	9
12.	Bartering food item	9

Source: FGD, 2014

Table 6.2.2.2.3.3: Adaptation Mechanisms followed by Female Heads

Sl. no.	Adaptation Mechanisms	Ranking out of 10
1.	Rain water harvesting	10
2.	Domesticating animals/hens/duck	6
3.	Running small business/ Making <i>charo</i>	0
4.	Diversifying occupation	10
5.	Changes in the cultivation season	0
6.	Seasonal Migration	10
7.	Storing pure water in tank	10
8.	Homestead plantation	6

Source: FGD, 2014

Table 6.2.2.2.4.1: Perception towards Climate Change (FGD 4, Male, Keyabunia)

Sl no.	Climatic Shocks	Severity of the problem (Out of 10)
1.	Increased number of cyclones	10
2.	Prolonged rainy season	5
3.	Sea water stagnation	9
4.	Increased number of flood	5
5.	Soil salinity	10
6.	Drought	6
7.	Loss of bio-diversity	5
8.	Soil erosion	10

Source: FGD, 2014

Table 6.2.2.2.4.2: Coping Mechanisms followed by Keyabunia Male

Sl. no.	Coping Mechanisms	Ranking out of 10
1.	Major meal twice in a day	10
2.	Skipping meal	6
3.	Buying food on loan	8
4.	No balanced diet	8
5.	Mortgaging asset	6
6.	Selling asset	7
7.	Smaller meal	7
8.	Collecting wild food	0
9.	Begging from rich neighbor	0
10.	Simple food menu	10
11.	Drawing down social network	8
12.	Bartering food item	6

Source: FGD, 2014

Table 6.2.2.4.3: Adaptation Mechanisms followed by Keyabunia Male

Sl. no.	Adaptation Mechanisms	Ranking out of 10
1.	Rain water harvesting	10
2.	Domesticating animals/hens/duck	4
3.	Running small business/ Making <i>charo</i>	2
4.	Diversifying occupation	10
5.	Changes in the cultivation season	0
6.	Seasonal migration	10
7.	Storing pure water in tank	5
8.	Homestead plantation	0

Source: FGD, 2014

APPENDIX C

Output5 - SPSS Viewer

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Output

- Logistic Regression
 - Title
 - Notes
 - Active Dataset
 - Case Processing Summary
 - Dependent Variable Encoding
 - Block 0: Beginning Block
 - Title
 - Classification Table
 - Variables in the Equation
 - Variables not in the Equation
 - Block 1: Method = Enter
 - Title
 - Omnibus Tests of Model Coefficients
 - Model Summary
 - Hosmer and Lemeshow Test
 - Contingency Table for Hosmer and Lemeshow Test
 - Classification Table
 - Variables in the Equation
 - Observed Groups and Predicted Probabilities

Omnibus Tests of Model Coefficients

Step	Chi-square	df	Sig.
1	82.578	15	.000
Block	82.578	15	.000
Model	82.578	15	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	326.277 ^a	.229	.316

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	10.288	8	.245

Contingency Table for Hosmer and Lemeshow Test

Step		Are you food secured? = 0		Are you food secured? = Yes		Total
		Observed	Expected	Observed	Expected	
1	1	30	30.784	2	1.216	32
	2	30	28.723	2	3.277	32
	3	28	26.950	4	5.050	32
	4	25	25.150	7	6.850	32

secured? Yes 59 50 45.9
Overall Percentage 72.3
a. The cutvalue is .500

Variables in the Equation

Step		B	S.E.	Wald	df	Sig.	Exp(B)
1	gender	-.748	.284	6.954	1	.008	.473
	NoH	.101	.312	.105	1	.745	1.107
	Ldcml	.366	.167	4.775	1	.029	1.442
	Prorain	.319	.292	1.193	1	.275	1.376
	Sal	-.796	.303	6.900	1	.009	.451
	Cropfail	-.997	.387	6.659	1	.010	.369
	Takgrants	1.220	.333	13.391	1	.000	3.386
	Income	.000	.000	1.903	1	.168	1.000
	DNGO	-.406	.178	5.203	1	.023	.666
	DMarket	.068	.051	1.803	1	.179	1.070
	Exten	.347	.099	12.360	1	.000	1.414
	Meeting	.239	.294	.661	1	.416	1.270
	Electricity	1.857	.550	11.416	1	.001	6.406
	NIGA	.084	.175	.233	1	.629	1.088
Education	.021	.025	.709	1	.400	1.021	
Constant	-.895	1.942	.212	1	.645	.409	

a. Variable(s) entered on step 1: gender, NoH, Ldcml, Prorain, Sal, Cropfail, Takgrants, Income, DNGO, DMarket, Exten, Meeting, Electricity, NIGA, Education.

Step number: 1

Observed Groups and Predicted Probabilities

16 1

Output5 - SPSS Viewer

File Edit View Data Transform Insert Format Analyze Graphs Utilities Add-ons Window Help

Output

- Logistic Regression
 - Title
 - Notes
 - Active Dataset
 - Case Processing Summary
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 - Block 0: Beginning Block
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