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# Climate Change, Loss of Livelihood and the Absence of Sustainable Livelihood Approach :

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## A Case Study of Shymnagar, Bangladesh

**Muhammad Asiful Basar**

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Supervisor

Dr. Pernille Gooch

Human Ecology Department

Lund University

## **Abstract**

*The devastating effect of climate change can be seen especially in geographically vulnerable countries. Every year, a disaster-prone country like Bangladesh; loses much of its resources as a consequence of natural calamities. Bangladesh is situated in a geographical position where natural devastation occurs often-resulting in substantial damages to poor villagers. Expected natural transformation, such as rise of sea level, increasing salinity, floods and loss of land could make millions of coastal people climate refugees. It has also been observed that both natural and man-made changes can alter the patterns of poor peoples' lives and livelihoods. Faulty development policies and economic interests of the rich, such as promoting shrimp farming in a saline-prone zone make the environmental settings more vulnerable. Communities living around the Sundarbans region have suffered severely from environmental changes which have created huge obstacles against livelihood options or economic development in the region. These changes are threatening the food and water security of poor communities and making them more marginalized than before. The purpose of this study is to scrutinize the reasons of ongoing changes of livelihood patterns of these communities and to examine the strength of government policies against environmental exploitation.*

### **Keywords:**

Bangladesh, Climate Change, Livelihoods changing, Salinity, Shymnagar, Shrimp, Sundarbans, Sustainable Livelihoods.

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## **FORWARD**

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## **1. INTRODUCTION**

The term ‘Climate change’ and ‘Global warming’ are akin to catchphrases in today’s academic world. Growing public concern also marks these issues as among the greatest challenges for human civilization for the future. So far tremendous effort has been given by the scientists and the researchers toward exploring the scientific impact of climate change and global warming on the lives of human being and other living creatures . Besides these scientific works , increasing social and anthropological research works are also ongoing in different parts of the world for identifying the social , economical and political impacts of climate change on contemporary human civilization . My study has its inspiration from the socio- economic studies of contemporary climate research.

### **1.1 Research problems**

Climate change is becoming the greatest threat in the history of humanity. Bangladesh is one of those countries that has been fighting against this global threat for the last few decades. Every year it is losing a valuable amount of GDP to severe natural disasters, like flood, cyclone, riverbank erosion etc. According to a World Bank (WB) report, the losses associated with environmental degradation are estimated at more than 4.3% of Bangladesh’s GDP and result in reduced the capacity of government’s poverty alleviation programs (WB, 2006). A major concern for Bangladesh is climate change victims who are increasing in numbers and must seek attention from world communities due to the loss of their lives, lands and livelihoods. The most vulnerable groups among these climatic victims are peoples living in the coastal areas of Bangladesh. Among them, the people living in the greater Sundarbans, which is the largest Mangrove forest in the world and proclaimed a World Heritage site in 1997, is likely most vulnerable. The importance of Sundarbans in Bangladesh’s economy and regional ecosystem is enormous. More than four million people who live around this region survive on their extracting resources of this forest. Fifty thousand people from local area rely on forest for their livelihoods (Anisur, 2001, 101). But in recent years, especially after two great cyclones, Sidor and Aila, the Sundarbans region has seen severe environmental degradation that has brought untold sufferings to its population. Most of the population around the SRF zone, which is dependent for their

livelihoods on nature, sees abnormal changes of their surroundings. The increase of temperature or water and soil salinity, or even decrease of rainfall, especially last 10 years (1998-2008) brought a serious decline of their productivity. Many of them lost their previous livelihoods due to the natural changing that threatens their traditional livelihoods. Some have switched to different occupations, some trying to cope with the new changes; but finally both groups have been seeing a slowdown of their economy activity. Moreover, the lack of pure drinking water and declining productivity of vegetation resulting from increased levels of salinity create a huge threat to their future food and water security. This severe presence of these natural changes inspired the researcher to investigate the actual impact of the climate on the livelihoods of these people by doing a thorough field based research work.

## **1.2 Purpose and research Questions**

The main focus of this study will be on the effect of climate change on the lives and livelihoods of the communities living around the Sundarbans Mangrove forest of Bangladesh. The area chosen for the case study is called *Shamnagar* Upazila of Satkhira district, which is located inside the Sundarbans Reserve Forest (SRF) zone, (ADB, 1998).

The research will investigate how natural and man-made changes affect the livelihood of coastal communities in Bangladesh and how these changes force them to switch from their traditional livelihoods to new 'unsustainable livelihoods'. It will also investigate the changing life patterns of these coastal communities in the context of changing natural settings in the region over the last decade. The study will also answer:

- 1) Why is Bangladesh geographically vulnerable in the context of global warming and climate change?
- 2) How does livelihood loss affect environmental degradation in Shymnagar?
- 3) What is the strength of these affected communities against changing climate scenarios?

### 1.3 Methodology and Selection

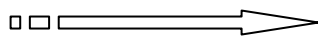
The methodology of this study has been selected on the basis of the research problem. The main books related to research methodology consulted during methodology selection were: *Social Research Methods* (Bryman, 2004); *Qualitative Research: Theory, Method and Practice*. (Silverman, 2004); *Doing Qualitative Research, A practical handbook* (Silverman, 2005), *Constructing Social Research* (Ragin, C., Charles, 1994) and *An Introduction to Qualitative Research* (Flick, 2006).

To understand the strength of rural livelihoods and their future vulnerability, I employ Sustainable Livelihood Approach (SLA) theory. SLA was introduced by Robert Chambers and Gordon Conway in 1991. In 1997, this sustainable livelihood framework was picked up by the UK's DfID. This framework was also popularized by other international NGOs such as CARE, IUCN, OXFAM, UNDP etc.

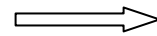
#### 1.3.1 Research Design

In order to assess the impact of climate change on the livelihoods of the Sundarbans inhabitants, the study has followed a 'Triangulation' process (Flick, 2006:37). Both qualitative and quantitative studies based on a single case study were carried out.

#### Qualitative Research



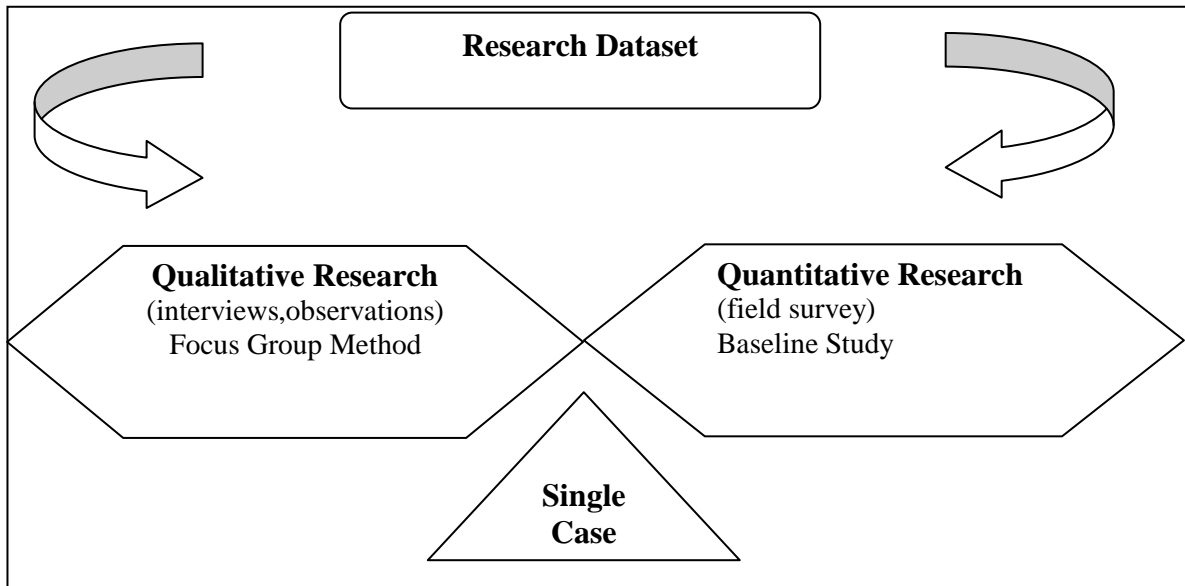
(continuous collection of both sorts of data)



#### Quantitative Research

Graph 1: Intregation of Qualitative and Quantitative research, source: Miles and Huberman, 1994, P. 41





Graph 2: Research Design

### ***1.3.2 Source of Data***

This study made use of various data sources: quantitative survey of selected households in Munshiganj and Gabura Unions, and qualitative interviews and Focus Group Discussion (FGD). Besides, various national and international reports on climate change issues in Bangladesh; academic journals and books, newspaper accounts, NGO publications and government records were also considered. Statistics related with climate and weather, demography and census, and poverty were especially consulted.

### ***1.3.3 Survey design and Sampling***

The baseline survey was conducted on the basis of previously conducted survey by the BBS during the National Census project in 2001. BBS data related with livelihoods and living condition of that region were considered during survey process. Besides, the survey was also inspired by the CARE/DFID's Livelihood Monitoring Project (LMP) which was designed to measure the impact of livelihoods on two CARE projects in Northwest and Southeast Bangladesh. The survey followed the techniques and methods that LMP gathered in their research projects. The main aim of this survey was to collect the data related with people's strength on various social, natural and economic capitals that a human being needs to conduct his livelihood. The survey was also tried to identify the reasons behind the changes of

livelihoods in that region especially, in the context of changing climate and sea level rising. The survey randomly picked 40 households from two Unions of Shymnagar Upazila. The elder and main earning respondents (over 18 years of age) from each household were interviewed. The data was collected by giving them structured questionnaire. The survey ranked all the households into five categories. The owner of more than ten *Bighas* cropland or shrimp farm, and having permanent shelter were considered rich. Less than ten, but more than five *Bighas* owner were considered as upper middle; less than five, but more than one considered lower middle and less than one *Bighas* land owner or having no land people considered poor in terms of household wealth categories. The person who owns no land and having no permanent place for living and no permanent job for surviving was considered as extremely poor.

#### ***1.3.4 Reliability and Validity of Data***

The data reviewed in this research bears a close relationship with issues of climate change. The statistics collected from different governmental and nongovernmental organizations clearly show the way that the climate has changed in the last ten years of the selected coastal region of Bangladesh and how these changes have affected the lives and livelihoods of those communities who live in the region. In order to understand local people's experiences during my stay in Shymnagar, four focus-group based semi-structured interviews were conducted in the field, as well as one expert's interview with Bangladeshi renowned environmentalist Dr. Atiq Rahman. The expert's interview was recorded with the permission of the interviewee.

The participants of those four focus-group interview sessions were twenty in number (five from each group) and the interview session took place in different places of four selected localities: Harinagar (FG-A), Shimultoli (FG-B), Munshiganj (FG-C) and Gabura (FG-D). At Harinagar, I chose a shrimp fry shop where all the interviewees were gathered, while at Shimultoli the interview session took place under a big tree. Here, four out of five respondents were women and all were housewives. These women were fetching water from neighboring village and agreed to take part this interview session. The other two interview sessions took place at Gabura and Munshiganj Union. Gabura is an island, very close to the Sundarbans and severely devastated by the cyclone Aiala in 2009. The first interview session was held at a small place near a tea stall, and the last one held at a local hatchery club.

My key informants, Sannat Ali and Abdur Rashid played a vital role in organizing people for these interview sessions. Because of their familiarity with the local people and customs, all the participants took part voluntarily. The participants were of different ages and from different religions. Some of the participants were moderately rich, some of them from middle class, and some of them came from the marginal communities, and have no permanent shelter or secured job. All the interviews took approximately 20 to 30 minutes. The interviews were conducted in the afternoon, when most of the men come back from their work and have free time for little conversation.

The expert interview with the famous Bangladeshi environmentalist and the chairman of Climate Action Network- South Asia (CANSA) and the Executive Director of Bangladesh Centre for Advance Studies (BCAS), took place on July 22nd, 2009 at 12 AM in his office at Gulshan in Dhaka. The interview lasted for about 25 minutes and followed a structured questionnaire. The interview was recorded under the permission of the interviewee, and I informed him that the interview will only be used in this Master thesis, not for other purpose.

### ***1.3.6 Criticism of the Sources***

The main drawback I encountered during my research period was limitation and scarcity of data, especially updated data. The absence of previously conducted livelihood surveys is also mentionable. The scarcity of data related to salinity, sea level rise and climate change on the studied region reduced the size of analytical framework of this research. Besides, limited sampling may influence the result of the survey. The sampling could not show the whole image of the problems related to livelihoods or climate change.

### ***1.3.7 Ethical Considerations***

As a student of Lund University, the whole master's thesis work has been done under the guidelines of the Swedish Research Council (ISBN: 91-7307-008-4). In field visit and taking interviews for the thesis, the researcher has introduced himself as a student of the masters program of Asian Studies of Lund University. The interviews were carried out in a way where every respondent was well-informed by me about the objectives of the interview before the

interview session. The researcher also took some photographs of the field with the permission of local people.

## **2. WHAT IS CLIMATE CHANGE AND GLOBAL WARMING?**

In general, climate change refers to ongoing changes of global climate or environment in a negative way. It indicates the transition from a human-favored tolerable climate to an unfavorable climate. Climate change in IPCC usage refers to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable times (IPCC, 2007: 30).

The phrase global warming refers to the documented historical warming of the Earth's surface based upon worldwide temperature records that have been maintained by humans since the 1880s. The term global warming is often used synonymously with the term climate change, but the two terms have distinct meanings. Global warming is the combined result of anthropogenic emissions of greenhouse gases and changes in solar irradiation, while climate change refers to changes caused by global warming in weather (temperatures, precipitation, frequency of heat waves, etc.) and other climate system components, such as Arctic sea ice extent (The Encyclopedia of Earth).

## **3. WHAT IS LIVELIHOOD AND SUSTAINABLE LIVELIHOOD APPROACH?**

In general, livelihood is the manner of someone's living. In his writing Carney says,

A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when

it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Carney, 1998:4).

The term “sustainable livelihood” first came in 1991, when Robert Chambers and Gordon Conway introduced sustainable livelihood as a concept of knowing people’s poverty from their inner strengths (Chambers and Conway, 1991:1). According to Chambers and Conway, sustainable livelihoods establish the linkage between objectives and methods of rural development and between various disciplines working with rural development by combining three concepts of *capability, equality and sustainability*. They defined *capability* as the ability of an individual to achieve certain basic operations. *Equity* is defined as less unequal allocation of assets, capabilities and opportunities and especially enrichment of those of the most deprived. Sustainability has been defined socially rather than environmentally as “the ability to maintain and improve livelihoods while maintaining and enhancing the assets and capabilities on which livelihoods depend” (Chambers and Conway, 1991:4).

According to Chambers and Conway, the idea of sustainable livelihood as an integration of capability, equity and sustainability is justifiable as an effort to better judge what is right and possible, and what fits the condition and priorities of the deprived (Chambers and Conway, 1991:4). They also added that “a sustainable livelihoods perspective would not only have implications for research on rural development, but also, and perhaps more importantly, for application and decision making”.

The concept of sustainable livelihoods relates an extensive set of issues which allow a much broader debate on the interactions between poverty and environment. In his writing Carswell and others point out that the “definitions of sustainable livelihoods are often unclear, inconsistent and relatively narrow. Without clarification, there is a risk of simply adding to a conceptual muddle...” (Carswell et.al, 1997:10).

The patterns of livelihoods might vary from place to place, from rural to urban area, from remote to core. There are five important forms of livelihood assets that determine the foundation of

livelihoods. These are Natural capital, Social-Political capital, Human capital, Physical capital and Financial capital (IISD, 2003:13). All these assets largely determine the way the people, especially, the most vulnerable and poor, will respond to the impact of climate change and broaden their scope to the adaptation process. The major five resources that have described by the DFID's Sustainable Livelihoods Guidance Sheets are discussing below (DFID 1999, sec 2).

- a. **Natural Capital:** The natural asset comprises those naturally available resources that a humane being utilizes for operating his or her livelihoods. These resources include land, water, forest, wildlife, biodiversity, minerals etc. Climate change has a direct impact on this asset and any kind of changes of natural settings can limit the livelihoods approach of an affected communities.
- b. **Social-political Capital:** Social capital is the set of social relationships upon which people draw in pursuit of their livelihood objectives (IISD, 2003: 12). These relationships include networks, membership of groups, relationships of trust and access to wider institutions of society that are important in actual operation of livelihood. Trade union, cooperative organization, NGO, different political and non-political organization has an influential role in forming social capital for livelihood operation.
- c. **Human Capital:** Human capital represent the necessary skills, knowledge, ability to labor and good health that together facilitate people to pursue their livelihood strategies. In the household level this capital determine the quantity (number of productive individuals) and the quality (skills and the ability to work about those individuals) of human resources. It is agreed that the poor has limited human capital and that's why their livelihoods are more vulnerable (IISD, 2003: 12).
- d. **Physical Capital:** The basic infrastructure for communication such as rail, roads and telecommunications, buildings, malls or bazaars, electricity or other source of energy, water management, productive capital (tools, machines, cattle etc.) are the components of physical capital. It includes both the physical resources that people own and that they have access to whether provided government, local authority or private sector and whether it is

free or paid for. This physical capital has an influential impact on poverty reduction. Assessment says that lack of particular infrastructure facility is considered to core dimension of poverty (DFID, 1999:13). Limited accessibility of services like water or energy deteriorates human health which weakens livelihood strategies and also lead to long periods of human life in non-productive activities such as water or fuel wood collection.

- e. **Financial Capital:** Financial capital indicates those financial resources that people use to achieve their livelihood objectives. This includes savings, supply of credits, regular remittance and pensions, social security payments or insurance, aid and grants etc. Financial capital has an important role in post disaster livelihood activities. Recovering from present stage and reconstructing livelihood are one of the main works of financial capital. Besides, it also fosters future livelihood approach.

All assets are equally important, although poor people tend to depend heavily on natural capital because access to other capital is very difficult for them. It is assessed by the livelihoods expert that the poorest are more dependent on natural asset rather than others and that makes them more vulnerable in the context of climate change and global warming (IISD, 2003, vii). Vulnerability of natural systems due to storms, lower rainfall, sea level rise or even salinity has pronounced implications to these poor communities' livelihoods because they have limited access to other non-natural resources and so they are unable to cope with many changes. Therefore, changes of natural settings severely affected their lives and livelihoods and make them most vulnerable (IISD, 2003: vii).

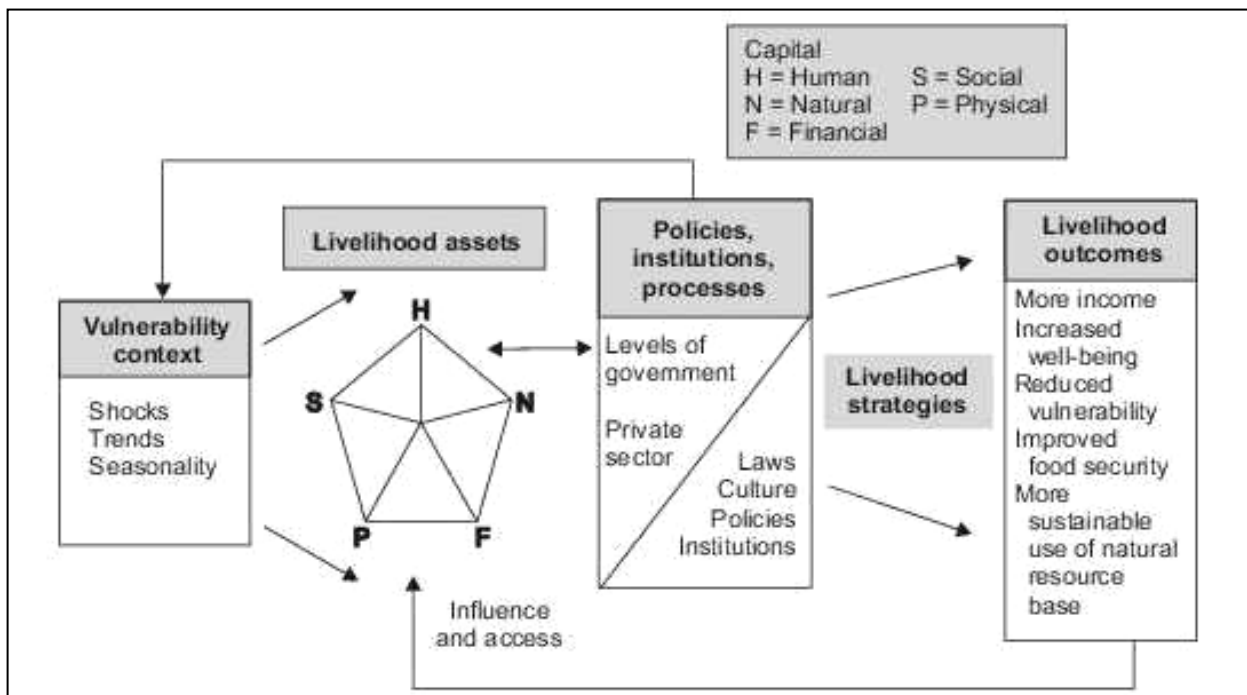
### **3.1 Sustainable Livelihood Framework (SLF)**

The sustainable livelihood framework is a tool for understanding the livelihood strength and strategies of a particular population, especially about poorer population. This framework also assists government and non-government agencies to implement their development goal for a given community. According to Knutsson, when SL referred to as a framework, it signifies a system of interrelated factors that determine whether a livelihood is sustainable or not, and which forms part of the Sustainable Livelihoods Approach (SLA), though it does not necessarily give

any guidance as to how sustainable livelihoods should be applied, but pinpoint which factors should be taken into consideration and gives indications of how they are related (Knutsson, 2005: 23).

The analytical framework of sustainable livelihood first came up in 1998 by Ian Scoones which investigates the role of livelihood resources and institutional process in sustainable livelihood approach (Scoones,1998). Later this framework was modified and elaborated by various development agencies, though the importance of the former framework remains active. In 1999 DFID introduced a new version of the Sustainable Livelihood Framework, which is often call DFID framework in livelihood literature (DFID, 1999). This new framework added important components, such as Vulnerability Context, which introduces more elaborate discussion on this framework. The framework emphasizes more on main factors that influence livelihoods, and it allows us to know the inner relationships among these factors.

Figure 1: Sustainable Livelihood Framework



Source:DFID sustainable Livelihood Guideline Sheet



The DFID's framework is centered on people and does not aim to show the model of reality rather it helps to the stakeholders to engage in 'structured and coherent debate' about the many factors that influence livelihoods, their relative value and the way in which they interact (DFID,1999:1). The main feature of this framework is obviously 'Livelihood assets', which comprises five important capitals that have already discussed earlier. These five capitals form an 'asset pentagon' which lies at the core of livelihood framework. The shape of the pentagon shows schematically the variation in people's access to these assets. The centre point of the pentagon, where the lines meet, represents zero access to assets while the outer perimeter represents maximum access to assets. In that way a complete pentagon represents the availability of adequate resources for livelihood operation while squeezed pentagon represents vice-versa. On the basis of resource availability different shapes of pentagon can be drawn for different communities or different social groups within the communities.

The other important component of this framework is the vulnerability context. According to DFID guideline sheet, human livelihood and the wider availability of assets are primarily affected by critical trends as well as by shocks and seasonality – over which they have limited or no control (DFID, 1999: 3). The trends include population or demographic trends, national and international economic trends, political trends, technological trends etc, while shocks comprise human health shock, natural or environmental shock, conflict, economic shock etc. Seasonality refers to the seasonal shifts in price, employment, food availability etc. All of the three vulnerable factors have an influential impact on livelihood resource status and their usable outcome.

### ***3.2 Limitation of Sustainable Livelihood Approach***

The concept of sustainable livelihood brought a lot of discussions in recent livelihood literatures. It obviously introduced a new mode of knowledge production ((Knutsson, 2005: 41). Despite its accomplishment in academia, the SLA also got criticism from different disciplines; such as Van Dillen indicates "belongs to the group of holistic approach that seeks to capture the enormous complexity of development problems, but do so at the cost of focus, depth and analytical clarity" (van Dillen, 2002: 251). She also mentioned that the SLA frameworks are actually descriptive rather than analytical (van Dillen, 2002).

Obscurity of SLA definition is also notable. Carswell expresses:

Definitions of sustainable livelihoods are often unclear, inconsistent and relatively narrow. Without clarification, there is a risk of simply adding to a conceptual muddle (Carswell, 1997: 10).

Here Scoones also agreed when he states that:

The terms 'sustainable livelihoods' relates to a wide set of issues which encompass much of the broader debate about the relationships between poverty and environment. Yet, in the existing literature there is often little clarity about how contradictions are addressed and trade-offs assessed (Scoones, 1998: 5).

Knutsson viewed the SLA framework as a system of interrelated concepts, which together formed a livelihood system. He says,

“When the concepts are related to each other they form a system that describes a livelihood. The ability to describe a system based on concepts that are not usually considered interrelated is an integrative quality of SLA” (Knutsson, 2005:42).

He also argues that,

“The construction of livelihood system within SLA is the one form of knowledge integration which shows the highest degree of actual integration. However, this does not automatically imply that the system can be applied analytically or that different definitions and theories behind each concepts of the system are integrated” (Knutsson, 2005:42).

He also suggested that in order to utilize these interrelated concepts analytically, each concept needs a detailed definition through an in-depth review, and the process of deconstruction and reconstruction and knowledge integration based on different definitions and theories need to be considered (Knutsson, 2005:42).

Besides these arguments, some other arguments could be drawn on the basis of SLA analysis. For example, the term 'Capital' itself a debatable concept in economics and must needs analytical

clarity. Scoones uses the concepts of capital, assets and resources in his theory without differentiate their meaning and usage. Here, Knutsson questions that

“according to Micro-economic theory, capitals are production factors that can be substituted for one another in the process of production. In that context of SLA, can natural capital be substituted for financial capital?” (Knutsson, 2005:42).

The DFID framework is also criticized by livelihood experts, including DFID itself. Some say that “methodological framework should not be over codified and institutionalized, and specifically the DFID framework is insufficiently dynamic, in the sense that it fails to capture ‘change’ both external and internal to household” (Beall 2002, DFID/FAO 2000, Ellis 2000).

### ***3.3 Relationship between Climate Change and Sustainable Livelihood***

Climate change has a great influence on livelihoods, especially the livelihoods that mostly natural resource oriented. In many developing countries, like Bangladesh, rural traditional livelihoods are very much climate dependent. Crops production and fisheries are largely affected by climate change. Therefore, sustainable livelihood relies on sustainable management of our ecosystem. Rennie and Sing focus more on sustainable resource management. According to them, “predominantly the poor of the world depend directly on natural resources, through cultivation, herding, collecting or hunting for their livelihoods. Therefore, for the livelihoods to be sustainable, the natural resources must be sustained” (Rennie and Singh, 1996:16).

The rapid changes of climate has certainly increased the vulnerability of marginalized communities whose livelihoods somehow dependent on natural resources. The 2001 IPCC Working Group II report on Impacts, Adaptation and Vulnerability depicts the picture more vividly. According to their statement,:

“Populations are highly variable in their endowments (of different capitals) and the developing countries, particularly the least developed countries ...have lesser capacity to adapt and are more vulnerable to other stress. This condition is most extreme among the poorest people” (IPCC, 2001:8).

According to their assessment, sea level rise will displace millions of poor people from the vulnerable coastline of the world, including Bangladesh. It is expected that these displaced people will have few opportunities to re-establish their previous livelihoods and naturally they will try to fit in the urban areas where they will obviously find themselves limited livelihood opportunities with high competency. Even where people will not be physically displaced, “sea level rising will reduce their natural capital in ecosystems such as coastal fisheries, mangroves and wetlands that are essential to the current livelihood patterns of many poor communities, while the danger of water supplies will affect these and other coastal communities” (IISD, 2003: 14).

Changes to rainfall patterns and temperature would also affect crop yields and vegetation in many semi-arid part of the world. According to IISD report on Livelihoods and Climate Change (2003), these changes of rainfall and temperature “will dramatically affect the livelihoods of many poor people, particularly through declining food security and problems with the viability of many livelihood activities, including livestock raising, fishing and the use of forest products as well as agricultural production” (IISD, 2003: 15).

Climate change will also minimize the opportunity of new livelihoods. The damage of physical capital such as infrastructure due to frequent natural disasters will limit the opportunity of eco-tourism, which could be work as a sustainable livelihood opportunity for the poor. IISD report claims that “the poor social and political capital, along with extremely limited access to financial capital, mean that these communities are least likely to be protected by investments in infrastructure or disaster mitigation and relief systems” (IISD, 2003: 15); which is absolutely true in many cases. Besides, the worsening situation of water availability and quality in many developing countries will cause severe health risks to poor vulnerable communities. Water-borne (such as Diarrhea, cholera or Arsenic) and vector-borne (Malaria, Dengue etc.) diseases will increase the child’s mortality rate in vulnerable areas, where health care facility is limited or difficult to reach. Therefore, this health hazard will pose another impact on livelihood if the key productive person of a household is lost, or need to expense a lot of money for frequent times. This will close off the natural income source of a household and would lead them to uncertainty.

#### **4. DISPOSITION**

The empirical body of the thesis is divided into six main sections. In the first part, I start a general discussion on Bangladesh in the context of global climate change scenario. It also depicts the importance of Sundarbans in Bangladesh national economy and world heritage. In the second part, I stated the overall condition of Shymnagar's lives and livelihoods. After giving some statistics of Shymnagar Upazila, it proceeds to a couple of sub-sections, where I examined the livelihoods of Shymnagar Upazila and the reasons behind the changes of livelihood patterns during the last couple of decades. In the third part, I bring the issue of changing climate order in Shymnagar and its adjacent localities over the last couple of decades and its impact on people live and livelihood operation in Shymnagar. Here, I use different meteorological data provided by BMD and several other sources for analyzing climate trend in Shymnagar over the last two decades. While answering climate change's impact on livelihoods, I use my own survey and focus groups materials. The forth part of thesis discussed the relationship between livelihood loss and environmental degradation and fifth part investigate the strengths of natural, social, human, physical and financial capitals in order to achieve sustainable livelihoods in Shymnagar. It also includes an expert opinion on the issue of climate change and livelihood. The last part concludes the discussion.

#### **5. BANGLADESH IN THE CONTEXT OF CLIMATE CHANGE**

Rapid global warming has brought fundamental changes to world climate. No country and people know this better than Bangladesh, where millions of people are already suffering. Severe floods are taking place frequently; cyclones, tornados are hitting every year; cold spell claims human lives as well as damage crops. According experts, these are early signs of global warming effects. Sea level rise in the coming decades will create over 25 million climate refugees (Climate Change Cell, 2007).

Being a poor and world's one of the most densely populated country Bangladesh's experience on frequent natural disasters has not good enough. According to U.N. Disaster Risk Index, prepared

by the U.N. International Strategy for Disaster Reduction (UNISDR) Bangladesh along with China became the top risked countries in terms of natural disaster in the world (undp.org/cpr).

Geographically Bangladesh is situated in a very vulnerable position. It is a deltaic plain located in the Bay of Bengal which receives the flow of three mighty rivers of this region: Padma, Jamuna and Brahmaputra. These three rivers created one of the largest water system in this region. It has a plain flat land most of which has an elevation of below one meter from the sea level. These geographical features subsequently make the country more vulnerable to natural disaster and potential victim of climate change or even sea level rise.

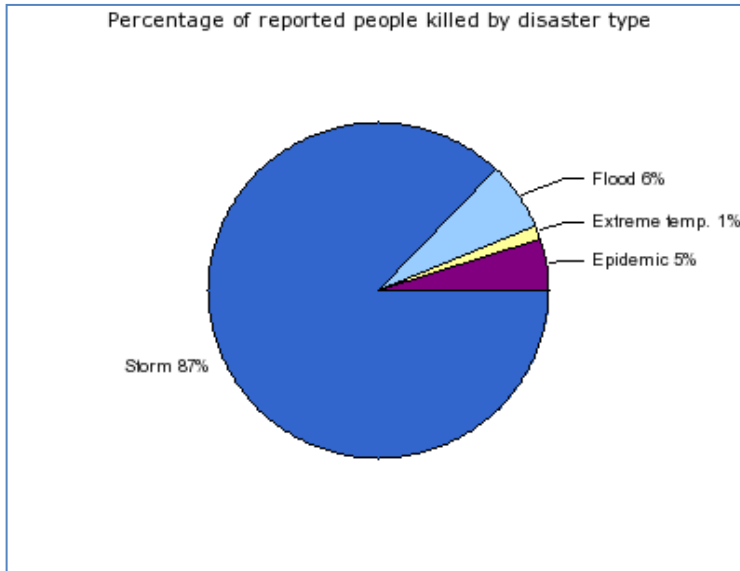
The country has a population over 2500 per sq. mile which indicates that any kind of sever natural disaster will caused massive human toll and bring enormous economic losses to this impoverished country. The following table shows the losses of human lives and its impact on economy that Bangladesh has suffered in the last 28 years.

Table 1: Natural Disasters in Bangladesh, from 1980 - 2008

<b>No of events:</b>	<b>219</b>
<b>No of people killed:</b>	191,344
<b>Average killed per year:</b>	6,598
<b>No of people affected:</b>	317,454,534
<b>Average affected per year:</b>	10,946,708
<b>Economic Damage (US\$ X 1,000):</b>	16,802,500
<b>Economic Damage per year (US\$ X 1,000):</b>	579,397

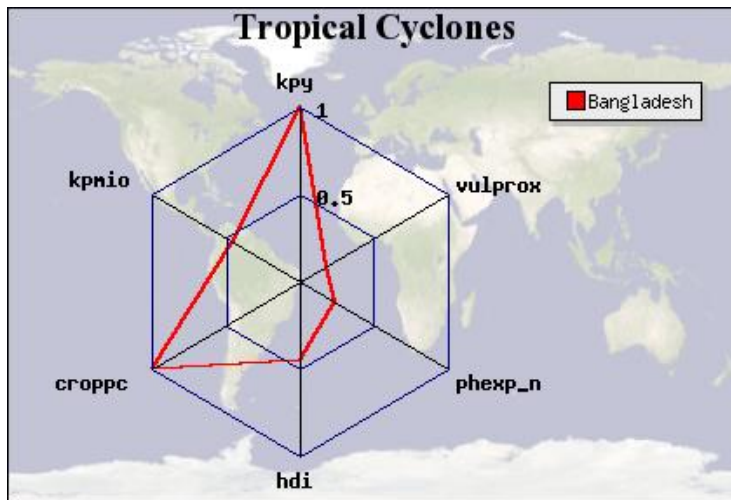
Source: PreventionWeb

The country's most severe natural disaster in terms of loss of human lives is obviously storm (including tropical cyclone and tornado) which has killed more than 166,000 human lives in the last 30 years of its natural disaster history (EM-DAT, accessed 19<sup>th</sup> September,2009).



Source: EM-DAT: The OFDA/CRED International Disaster Database

A large portion of this human loss was actually caused by tropical cyclones. Nearly 145,000 people died by tropical cyclones in that respected period. The following spider graph shows the overall impact of tropical cyclone on Bangladesh in the period of 1980 to 2000.



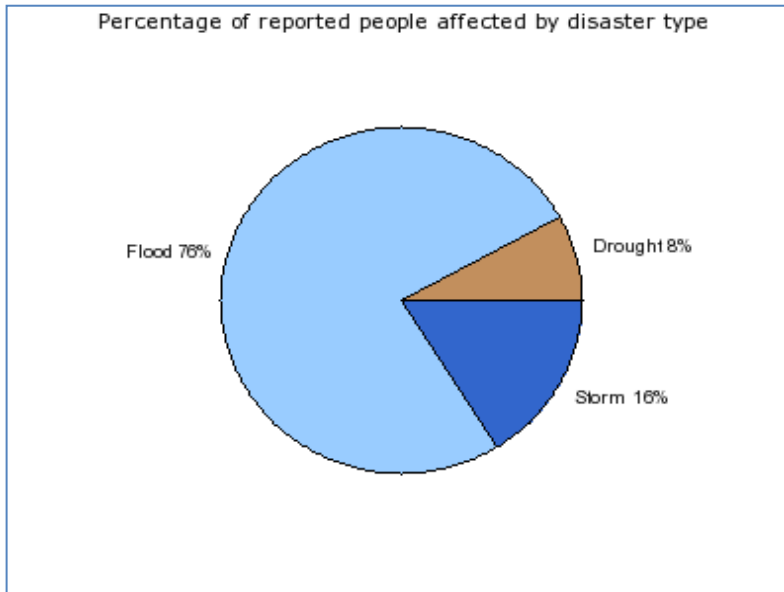
kpy = Causalties kpmio = Killed per million. Inhabitants croppc = Arable land hdi = Human Development Index phexp\_n = Physical exposure vulprox = Relative vulnerability

The spider graph displays the values in relative terms. The value "1" represents 100% of the maximum value found within this parameter.

Source: Global Resource Information Database (GRID), UNEP

In terms of the extensiveness of a natural disaster, flood is considered the prime disaster that affected the most of the population of Bangladesh. There are two types of flooding that Bangladesh faces every year, seasonal flooding and coastal flooding. Both the flooding has a

visible impact on the agricultural production of Bangladesh. The seasonal flooding brings well hopes to the farmers because it carries valuable silt that makes farmers' land fertile. Whereas, coastal flooding causes saline water intrusion which further degrades the quality of land.



Source: Source: EM-DAT: The OFDA/CRED International Disaster Database

### ***5.1. The Coastal Region of Bangladesh***

Bangladesh is one of the most populated countries in the world having a coastal area of 47,211 sq. km., which is 32 % of its entire land. The coast of Bangladesh is approximately 710 km. long which has a very low-laying flat land. 62 % of the land have an elevation less than three meters and 86% have less than five meters (Hasan, Mobassarul et al. 2009). According to the population census of 2001, about 35 million people live in its coastal area, which is 28% of the total population (BBS, 2001).

UN Inter-Governmental Climate Change (IPCC) 2007 says, the temperature of the world might be increased from 1.1 to 2.9 degree in 2100 and sea level might be raised 23 inch due to temperature increase. If the sea level rises one meter, 15-17% Southern areas of Bangladesh will be drowned in the sea. Already 4 million people of Bangladesh became an environmental refugee due to river erosion. Scientist warns that it will be exceed 20 million in the future. In between 2030 sea might be expanded 120 kilometer inside of Bangladesh (IPCC, 2007).



Rise of sea level will also affect to the ecosystem and biodiversity of the coastal region of Bangladesh. Saline water intrusion to the drinkable water source will cause severe threat to the lives of the species living around the world greatest Sundarbans Mangrove forest.

Coastal areas of Bangladesh are being submerged gradually due to the global warming and sea level rise. The collision between downwards current of fresh water and uprising sea level creates strong spinning that cause erosion to its coast. Per capita land availability in the coastal area is relatively less than that of the mainland of the country. In the interim period of 1991 through 2001, the yearly increasing rate of birth in the coastal areas was 1.29%. According to this rate, the total population of the coastal area by 2020 would be 45 million (coastbd.org).

The overall review presents an insecure future of the large coastal communities of Bangladesh. This insecurity of human being also becomes more insecure when people drop off from their means of living and lost their all kinds of coping strength.

### ***5.2 Sundarbans, the Wonder of the World***

Sundarbans is the single largest mangrove forest in the world (Chowdhury I. Quamrul, et.al, 2001). It extends across Bangladesh and Indian state of West Bengal with a total area of approximately 10,000 square km. The Bangladeshi part of Sundarbans comprises 60 % of the whole area which is largely a flat coastal land formed across the area of ancient Ganges delta (ADB, 1998: 1). According to Chowdhury I. Quamrul and others, the most important physiographic feature of Sundarbans is its wetlands and water bodies which create a unique reservoir of bio-diversity (Chowdhury I. Quamrul et al., 2001:5).

The Sundarbans Reserve Forest (SRF) located within the administrative district of Khulna, Bagerhat and Satkhira. The SRF has divided into four forest ranges, namely Sarankhola, Chandpai, Khulna and Burigoalini and all these ranges are administrated by the forest department of Bangladesh government. Three patches of the SRF have been declared as ‘wildlife sanctuaries’ by the forest department and these areas have been recognized as the ‘World Heritage Sites’ by UNESCO in 1997 (Chowdhury I. Quamrul et al.,2001:5).

Map 1: Sundarban Reserve Forest



Source: ADB, 1998

The forest topography is very flat and the maximum ground elevation is about three meter from sea level. It has a tropical humid climate with temperature varies between 20.4° to 31.5° Centigrade. The annual rainfall is recorded about 1640 to 2000 mm, out of this about 85% rain falls during monsoon, which usually last between June to September (Chowdhury I. Quamrul et al., 2001: 6). The natural hazards that SRF faces year after year are cyclonic storms, storm surges and coastal flooding during the high tide period. Storm surge and coastal flooding brings the saline sea water into the flat land which increases the salinity level. During monsoon season because of heavy rainfall the salinity level becomes lowered with the influence of onrushing fresh water from the upstream region, and vice-versa scenario occurs during post monsoon season (Chowdhury I. Quamrul et al., 2001: 6). Cyclones generally occur in between October to November and March to April each year and cause severe ecological damage within SRF boundaries. The recent two cyclones: Sidor and Aila brought enormous damage to SRF and its surrounding areas.

The uniqueness of SRF lies in its diversity of species which includes the mighty Royal Bengal tigers and the beautiful spotted reindeers. It also has diversified flora and fauna which comprises a variety of plants including trees, shrubs, grasses, epiphytes and lianas (Chowdhury I. Quamrul et al., 2001: 6). Although because of increase salinity level and frequent natural hazards, all the species of SRF have to fight for surviving.

The livelihoods of the inhabitants living within SRF zone or surrounding areas of SRF are unique. Near about 4 million people directly dependent on SRF resources for operating their livelihoods and millions of others are indirectly dependent on it (Chowdhury I. Quamrul et al., 2001: 6). The main livelihoods in SRF surroundings are: wood cutter (Bawalis), fuel wood and Golpata collector, honey collector (Mouals), fisherman, shrimp fry collector, crab and shell collector, small farmer, shrimp cultivator etc. All these occupations have its dependency over SRF.

The SRF has an important role in Bangladesh economy. About 45 percent of all timber and fuel wood comes from Sundarbans and that provides direct income and subsistence for at least half a million households living around the SRF boundary (ADB, 1998: 2). It is estimated that including eco-tourism and wildlife, the SRF contributes about 93 million USD to Bangladesh's GDP annually (ADB, 1998: 3).

Despite the importance of SRF in Bangladesh economy, it has also seen that over-exploitation of SRF by the surrounding communities and invaders caused severe damaged of its ecosystem in the last 30 years. This process especially accelerated after the introduction of shrimp farming in this region. According to local people, wide scale shrimp farming enhances the opportunity of over-exploitation in Sundarbans region. In the Chokoria Sundarbans, the second largest mangrove patch in Bangladesh has seen devastated man-made destruction of mangrove forest in 1990s due to the invention of shrimp industry. After introducing in 1975, most of the 7500 ha. of mangrove florals has been cleared for shrimp farming, leaving only 973 ha. of scrub forest in 1988 (Choudhury, Quadir & Islam 1994). This scenario is not only common in Sundarbans mangrove forest; rather it is visible in other mangrove regions in the world too. According to Primavera (1997:816), in addition to agriculture, industrial and residential development, shrimp cultivation

accounts for the destruction of about 20 to 50 % of mangrove forest worldwide in recent times. Shrimp cultivation also affects the surrounding environment of Sundarbans. The use of saline water in shrimp culture contaminates the source of drinking water and thus it fosters salinization process. This process further creates the conversion and salinization of rice and other agricultural lands which also leads to the marginalization of coastal rural communities (Primavera, 1997: 821).

The deprived farmers and other fishermen then have to leave their traditional livelihoods and are forced to seek work elsewhere, migrating to the cities and bulge the ranks of the urban unemployed (Alauddin & Hamid 1996). According to Baird & Quarto (1994), 'the development of shrimp farming in the Satkhira region (which is mostly covered by Sundarbans) of Bangladesh so far has displaced nearly 120 000 people from their farmlands'. These land lost people later became the workers of shrimp industry or had to find out their own way of living. So, in conclusion of this section, it can be said that both natural and man-made factors increased the vulnerability of Sundarbans in recent time.

## **6. SHYMNAGAR AT A GLANCE**

Shymnagar is the largest Upazila in Satkhira district in terms of area and second largest in terms of population (BBS, Community Series, 2007, see table 1). The upazila located between 22°36' and 22°24' north latitudes and between 89°00 and 89°19' east longitudes (BBS, Community Series, 2007). The distance of this place from the divisional headquarters Khulna is about 120 km and from capital city Dhaka 400km. The upazila has an area of 1,968 sq. km. from which 1,623 sq. km. is undercover by forest (BBS, Community Series, 2007). The upazila consist of 13 unions, of which two unions, Munshiganj and Gabura were taken for field study. These two unions are very close to Sundarbans reserve forest and their livelihoods mostly dependent on the ecological resources of Sundarbans. Besides, all over Shymnagar has the same pattern of livelihoods that has been found by researcher's observation.

Munshiganj is located in the southeastern part of Shymnagar. This union is very close to Sundarbans. The union has several villages; two of them have been visited during my fieldwork

visit in July. At that time, the entire Shymnagar and its surrounding were severely affected by the terrible cyclone that stroke in May. The study found a devastated image of Shymnagar while conducting focus group discussion and field survey. The cyclone and the subsequent sea-surge destroyed several Dams of the Shymnagar Upazila, which were built to protect its fifty thousand people and entire economy of Shymnagar. The economy of Shymnagar is vastly affected by this cyclone. Thousands acre of shrimp field has been washout by Aila. Besides, sea saline water has seized all the sources of drinking water in Shymnagar. The roads and infrastructure were badly damaged.

Map 2: Shymnagar and Munshiganj



Source: Google earth

The most affected area among my visited locality was Gabura Union, where I have seen thousands of people taking temporary shelter on the embankment, which was built by water development board for protecting the whole union from river erosion. The embankment was also destroyed in several places. Only eight km of this 28.1 km long embankment is still saved from destruction. I have seen nothing except this temporary settlement place in Gabura. The vast area alongside the embankment was waterlogged and it was hard to find out a hut or someone's home in that situation. According to local Union Parishad Member, about six thousand families

have taken their shelter on this embankment. The respondents said that about thousand people died or lost after that terrible cyclone. The displaced people got very little support from the government or aid organizations. According to them, until my field visit date, some of the families have only received plastic tent, blanket, some dry food and 3000 Taka (equivalent 44 USD) in cash from Government and aid agencies. This small amount of support was nothing to them and large-scale humanitarian support was needed.

Table 2: Shymnagar Upazila at a Glance

Items	2001	1991	Growth Rate	
			Decadal	Annual
<b>1. Area (Sq. Km)</b>	1968.24	1968.24		
<b>2. Household</b>	59 885	46 592	28.53	2.54
<b>Upazila</b>	57 056	44 548	28.08	2.51
<b>Rural</b>	2 829	2044	38.49	3.30
<b>Urban</b>				
<b>3. Household Size (Dwelling)</b>				
<b>Upazila</b>	5.2	5.6	(-)6.15	(-)0.74
<b>Rural</b>	5.2	5.6	(-)6.15	(-)0.74
<b>Urban</b>	5.1	5.4	(-)5.56	(-)0.57
<b>4. Population</b>				
<b>Both Sex</b>	313 781	265 004	18.41	1.70
<b>Male</b>	160 294	133 721	19.87	1.83
<b>Female</b>	153 487	131 283	16.71	1.57
<b>Rural (Both Sex)</b>	299 294	253 983	17.84	1.66
<b>Urban (Both Sex)</b>	14 487	11 021	31.45	2.77
<b>5. Density (Per Sq. Km)</b>				
	159	135	17.78	1.65
<b>6. Sex Ratio (M/F)</b>				
<b>Upazila</b>	104	102		
<b>7. Literacy Rate (7 Years and Over)</b>				
<b>Both Sex</b>				
<b>Male</b>	39.69	28.20	40.74	3.48
<b>Female</b>	47.75	38.80	23.07	2.10
	31.33	17.40	90.06	6.06
<b>8. School Attendance (Both Sex)</b>				
	57 963	35 779	62.00	4.94
<b>9. Geographic Unit</b>				
<b>Union</b>				
<b>Village</b>	13	13		
	216	216		

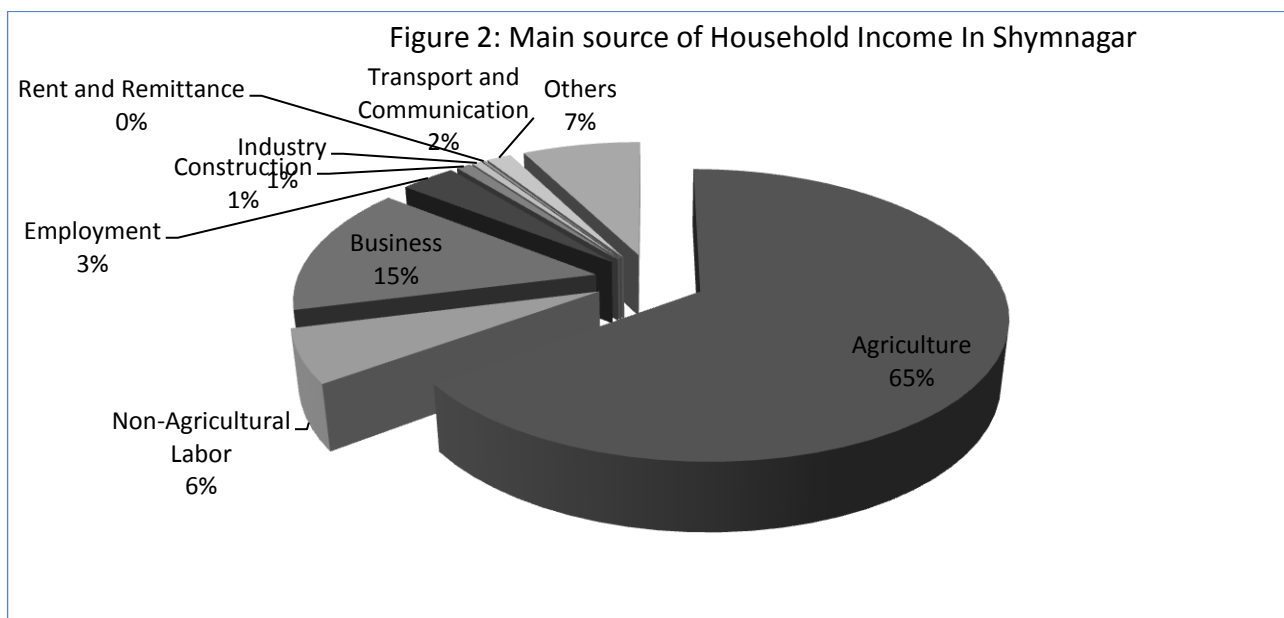
Source: BBS, Community Series: Satkhira, p30

### 6.1 Statistics of Shymnagar

Shymnagar is one of the Upazila in Satkhira district which has enormous potential of development and at the same time more vulnerable in the context of climate change and sea level rise. It has a very flat land which is divided by two rivers. The elevation of its land is less than one meter up from sea level.

According to government's statistic the number of households in this area in 2001 was 59,885, of them 99.43 % was dwelling households. The average household size was 5.2 persons (Community Series: Satkhira, BBS, 2006). About 90% of the dwelling households have Kutcha structured house, only 3 % has Pucka houses.

The statistics also present that most of the households largely depended on ponds water as a main source of drinking water. Fifty one percent households use pond's water, whereas 31% has tube-well and rest of them has other sources. Forty percent of dwelling households have sanitary latrines facility, whereas 47% has non-sanitary latrines. Among other facility, only 7.40 % of households have electricity connectivity in this Upazila, which indicates a very low level of economic development opportunity of this region.



Source: BBS, Community Series: Satkhira, p30

The main source of household income is predominantly dependent on agriculture. Sixty five percent of total population has involvement with agriculture, of them 38.16% depends on cropping, livestock, forestry and fisheries as their main source of income, and 26.82% comes from selling agricultural labor. Others household income sources contribute barely to Shyamnagar's economy.

## ***6.2 The Livelihoods patterns of Shymnagar***

The livelihoods patterns of Shymnagar Upazila widely dependent on climate and natural settings of SRF zone. The mighty Sundarbans has an enormous influence on its lives and livelihoods. After the devastating cyclone 'Aila', Most of the families living in Shymanagar get their income from extracting its resources. This study explores a severe picture of livelihood approach of these communities living around Shymnagar Upazila. The survey found wide range of unsustainable livelihood approach in the context of present development risks of Shymnagar. The qualitative study has revealed a controversial history of shrimp industry that replaced the past agriculture based economy to shrimp based economy. The survey found that about 80% of the total respondents had directly or indirectly dependent on rice based agro-economy twenty years ago, now their lives somehow dependent on shrimp based economy.

Shymnagar was famous for rice production before the introduction of shrimp culture in 1970s. At that time most of the families have their own fertile land where they used to produce their own crops, specially rice, jute and vegetables. While talking with the elders in focus group discussion (Focus Group A), I came to know the glorious story of Shymnagar's past. According to them, that time was the golden era of Shymnagar's history. A seventy year old man told the story in his own voice:

“I had four hecters of fertile land where I along with my two brothers produced paddy and vegetables. We had our own cattle, a wooden house and a pond for cultivating fish and supplying household water. We could feed our family with our own produced crops, we could sell our surplus and made money from that, now I have nothing, just a piece of land to stay and a livelihood of catching shrimp fries.”



Most of the respondent of this focus group expressed same kind of feelings. They said they had better life 30 years ago, when the climate was favorable, had enough rainfall and land was fertile enough to produce bountiful production. According to them, the decline of Shymnagar's land productivity came after the introduction of shrimp cultivation in 1970s. They said the popularity and demand of shrimp cultivation forced some of them to switch from their traditional livelihoods to a new kind of livelihood, which was basically unknown to them at the beginning and had required a lot of technical knowledge and skills to adapt with it. At the beginning, this industry was promising and profitable; some of them made good money from that. Some of my respondents said at the beginning shrimp farming was more than 10 times profitable than rice farming. So people got easily attracted by promising shrimp industry, and many of them converted their livelihood to this industry. But later they realized their mistake.

Table 4: The changing livelihood patterns in three surveyed localities

Name of the village/Union	Number of Respondent	Previous Livelihood (before 1995)		Present Livelihood (2009)	
		Shrimp Dependent	Rice/agriculture dependent	Shrimp Dependent	Rice/agriculture dependent
Harinagar	9	2	6	6	3
Munshigang	4	1	3	2	1
Gabura	7	0	6	5	1
Total	20	3	15	13	5

Source: Household Survey, 2009.

The increasing number of shrimp firms and indiscipline government policy wasted their land and future. The man-made saline water intrusion for helping shrimp industry in late 80s caused a great threat to its future land productivity. One respondent (59) from Harinagar village told the researcher that they were really ignorant about their future; they believed what the local leaders and NGO activist made them to believe. These groups had symbolized shrimp as the golden opportunity to shift their economical backwardness. Lots of money and training was available at that time. Rich people, especially from Khulna, Satkhira and Jessore came with their healthy money to provide loan for growing shrimp industry; some of them tried to take lease their land for a long period of contract. These outsiders know as *Dadon* in local language and suddenly became very powerful in the political economy of Shymnagar and its surrounding. Besides these

*Dadons*, policy adjustment of Bangladesh government in 1980s to provide trade incentive for shrimp producers and various international funding for this growing industry impacted on Shymnagar's economic scenario in late 80s. Both money and training were coming at that time; NGOs were also expending their activities in Shymnagar and its surroundings.

At that time, Bangladesh Government declared shrimp cultivation as an industry and proposed tax holidays and financial support to shrimp entrepreneurs (Rahman, A, Ali, Liaquat and Mallick D:L, 2006:232). Bangladesh also received various institutional funding for its growing shrimp industry. The World Bank (WB) provided 62.7 million USD under the third fisheries project for supporting shrimp cultivation in Bangladesh. Other agencies project, such as FAO/SIDA Bay of Bengal Program or ADB's first and second Aquaculture Development Project also had significant influence on booming shrimp industry in Southern coastal Bangladesh, especially in SRF zone (Rahman, Matiur, 2002:4). But most of the benefits were going to large and rich shrimp farms owners. Because of their political power and financial strength, they could manage to lease large amount of crop land into their authority. During the period of 1975 to 2000, Bangladesh's shrimp farming area has increased for less than 20 thousand hectares to 141 thousand hectares and shrimp export revenue raised up from USD four million to 360 million (Ali,2006:421).

While talking with the local NGO officials, I came to know that all the NGOs have their own fisheries project, where they train and support their members for producing mostly shrimps and crabs. Crabs cultivation is also becoming popular in very recent time in Shymnagar. I was informed by a Crab businessman from Burigoalini village that there are almost three hundred families currently involving in Crab business in Shymanagar Upazila and at least two thousand people are directly or indirectly working in this new industry. While talking with a respondent (24 years of age) who started this business in 1999, the research found that at least 28 sellers have their own crab shops at Kalbari bazaar in Munshiganj. They collect crabs from small crab-catchers of the locality, who catch crabs from Sundarbans and its surrounding rivers. The respondent said, after buying crabs from small sellers they conduct several methods of processing to make it finest export product. Then the big buyers from Dhaka, Khulna and Chittagong collect their products to export it mostly in Southeast Asian countries. The main

destinations of Shymnagar's crabs are Hong Kong, Taiwan, Singapore and Korea. The respondent said that the main season of crab business come in winter and June to August is the worse period of their business.

Only in Harinagar village, the study found three farmers who own cropland and cultivate rice. They have not changed their livelihoods since the introduction of shrimp cultivation in their village. They maintain their traditional livelihood even though the rice production decreased over the years due to shrimp cultivation and intrusion of saline water into their land. While talking with focus group participants FG-A, I was informed by some of participants that rice production was profitable even ten years ago, when they can produce significant amount of rice with ending little effort and money. But now the cultivation cost rose several times and the production amount did not increase that much, though the amount of the cultivated land in Shamnagar Upazila has increased in some aspects.

According to them, the main reason behind their land degradation and high level of salinity is not entirely natural; rather it came due to misuse of their land for shrimp farming. They also criticized governments and NGO's faulty policy of promoting shrimp farming to their land in early 80s. While asking a common question to FG-A and FG-D, on whether they want to give up shrimp farming and switch back to their previous livelihood of agro farming, the study found a common answer. All the respondents in those two FGs including shrimp businessmen said that they do want that, if we can give them back their lost land with. Some even said that they want nothing except the prohibition of shrimp farming on their land.

The study found another group of people who are locally known as saline water supplier. Supplying sea-saline water to shrimp farms as a business became popular in late 90s. According to these suppliers, there are at least 100 people currently involve in this business in Shymnagar. Few of them have their own water pump for importing the sea water to shrimp farms. Rest of them work as field workers. This business only run six months in a year, from August to January, the rest of the year they have to engage in other businesses. Some of them produce salt in their field; some of them collect shrimp fry, crabs and honey from SRF zone, some of them just work as human labor in different occupations. The Survey found two families who are

involving in this business and have their own water pumps. The researcher observed a wide-range of network of saline water supply in Shymnagar upazila; especially in Harinagar and Munshiganj village, where study found lots of long-narrow canals which was built to drain the salty sea water to shrimp fields.

The other livelihoods that the study found include honey and Golpata collectors, woodcutter, Riksha and Van pullers and fisherman.

Table 5: Livelihoods Chart of two Studied Localities

Livelihoods		Locality	
Total respondent 40		Harinagar Village	Gabura Village
Shrimp Cultivation	Bagda	4	2
	Galda	2	1
Shrimp fry collection		2	4
Crab Business		4	1
Crab Collection		1	4
Rice Production		3	0
Saline Water Seller		1	0
Honey and Golpata Collection		1	3
Shrimp, Crab and Salt production labor		2	1
Others (No specific job)		1	1

\*The data collected from Household survey and Focus Group Discussion.

### 6.3 Why did People change their Livelihoods?

While asking this common question to my respondents in different places of Shymnagar, I got the answer that there were several reasons that influenced them to take that decision. Among them, increase of salinity levels, unstable rainfall patterns and temperature variation, frequent inundation by tidal surge, increasing production cost of rice farming, promising and profitable future of shrimp farming, and available financial and technical supports for shrimp farming have tempted them a lot.

This question was asked in the time of focus group discussion when all the groups responded in same way. They mostly indicated two factors; one is the change of climate and the other one is the change of government's development policy. Most of them were saying that the usual climate patterns were changing over the last few decades, but they do not know exactly what the reasons behind these changes are. Very few of them have a minimum knowledge of climate change. In fact, the survey found that only four out of 40 respondents are familiar with the term of climate change. In Bengali, the term expresses like this way *Jolobayo Poriborton*. The four respondents, three from Harinagar and one from Munshigang, said that they heard the term from various sources. All the respondents from Harinagar said that they were told about the risk of climate change when they were getting training for cultivating *BRRI 47* rice on their field by the local agriculture officers. But all of them said that they have very little knowledge on climate change and its future impact.

## **7. THE CHANGING CLIMATE PATTERNS IN SHYMNAGAR AND ITS IMPACT**

The climate of greater SRF zone has been significantly changed over the last couple of decades. A lot of researches have done so far on this issue and proclaims the truth of climate change in this region (Hasan, Khan and Mahmud 2009; Rimi, Rahman, Karmakar and Hussain, 2009; Rahman, Matiur, 2002, etc.). But the present study will only focus on three important components of climate which have been impacting on livelihood operation over the decades in Shymnagar upazila. These three impacting factors are water and soil salinity, rainfall patterns and temperature variation. According to my respondents, these three factors have an enormous impact on their livelihood operation or selection. The data of these three elements variation was collected from different secondary sources, especially from Bangladesh Metrology Department, Institute of Water Modeling, Bangladesh Soil Research Institute and previous relevant research papers. The main shortcoming of these data is that they are quite old and very few of them is particularly focus Shymnagar upazila. They mostly represent Satkhira Zila, of which Shymnagar is a part of this Zila.

To understand the overall impact of climate change the study presents a figure which will briefly describe the situation. The figure 1 shows how natural and human made changes affected people's livelihoods and lives in rural areas of developing countries, especially vulnerable countries like Bangladesh. It also explores how the change of climate and introduction of shrimp industry deteriorated the living condition of Shymnagar by degrading land and water security and increasing loss of livelihoods or poverty.

### **7.1 Salinity**

Salinity is the most influential factors for livelihood operation in greater SRF zone. The previous researches on this issue explore the reasons behind the increase of salinity in SRF zone. According to those, rise of sea level (SLR), frequent coastal flooding, cyclonic storm, storm and tidal surge, changes of upstream water discharge, water logging and permanent inundation, irregular rainfall patterns, rudimentary and unscientific infrastructures and unplanned shrimp culture among the top reasons behind salinity intrusion in SRF zone.

The rise of sea level and non-availability of fresh water during the months of winter when rainfall usually less, cause serious salinity intrusion to inland water system. It has found that during the month of June to September, the salinity front falls back towards the sea. From the beginning of winter, November to April, it reaches to its maximum level (Islam, Nazrul.,1990). It has been found by contemporary data that salinity level in greater SRF zone and its surrounding increasing rapidly and every year vast area of farmlands are infringing towards salinity belt (Table 6). The most threatening story is that the level of salinity is also changing rapidly, which is leading an uncertain future of both human and other living species of this region. According to SRDI survey (2000), 187300 hectares coastal land has occupied by salinity over the last three decades. The most part of Satkhira district are affected by moderate to high levels of salinity. Below, the table shows how the sphere and level of salinity increase between the periods 1973 to 2000 in Satkhira district.

Table 6: Change of Soil Salinity level of Satkhira district

Name of the District/ Upazila	Salt affected area (000' ha)		Salinity Class*								Salinity increase over 3 decades	
			S1 2.0-4.0 dS/m		S2 4.1-8.0 dS/m		S3 8.1-16.0 dS/m		S4 >16.0 dS/m		Area (000' ha)	%
	1973	2000	1973	2000	1973	2000	1973	2000	1973	2000		
Satkhira	146.35	147.08	16.5	27.03	85.6	38.01	33.5	60.3	10.9	22.01	0.73	0.5

Source: SRDI, 2001, \*S1 slightly saline, S2 Moderately Saline, S3 Saline and S4 Highly saline (Karim *et al.*, 1990).

Table 7 also represents similar concern. It specifically indicates that vast land from Shymnagar has already occupied by alarming level of salinity. Eighty eight percent of its land is under saline belt, of which 72 % area is under saline or highly saline zone. Absence of recent data does not represent the changes of salinity level after two catastrophic disasters, Sidor and Aila, on that region. According to Bangladesh Soil Research Institute, salinity data of coastal Bangladesh has already been collected, and will be available for public in 2010.

Table 7: Salinity level of Shymnagar

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

Source: SRDI, 2001

While investigating the impact of salinity on Shymnagar's lives and livelihoods, I explored a very deplorable story. Large amount of croplands and drinking water sources have already become wasted. Vast areas became saline waterlogged and people displaced from their homestead to other places (see pictures).

According to FGs respondents, salinity is affecting their lives in various ways. First, it has reduced their economic opportunity by degrading their land quality and productivity. Secondly, it is lessening the security of their food and water. They said, water has become the most precious product to their daily life. The scenario especially changed after post-Aila period. Lack of pure drinking water is the greatest challenge that they are facing now. I have seen in my own eyes, how young children and women (see picture at Appendix C) are fetching water from Government and NGOs made water tanks, or from remote places where water salinity level still in bearable condition. Those who are unable to fetch pure water, have to drink saline water. One woman showed me her *Sharee*, which became faded, stiff and flimsy because of continuous washing with saline water. That is how various health problems, including diarrhea and skin diseases are occurring frequently in this region.

This study found that women and children are the most vulnerable groups in this scenario. While talking with local women in FG-B, I came to know that women spend a significant period of their daily hours for fetching drinkable water for their family. They often take their children with them for fetching better amount of water. While asking them about how many hours they usually take for water fetching; they said it is about four to five hours per day, sometime it takes more. One respondent (29) said she remembers when she was young, she had to fetch water from her neighbor's tube well; after her marriage, she fetched it from a pond, which was about half km from her home. Now, she has to walk five km every day for fetching water and she does not know how far the water source would be sifting in coming years. This statement truly depicts the real picture of Shymnagar. I saw different government and non-governmental organizations are supplying drinking water by trolleys, but their effort is still limited. Because of huge population, they could not make up their needs. Some NGOs built reservoir in different public places for keeping rain water. But due to irregular rainfall, those reservoirs became empty.

## **7.2 Rainfall**

Rainfall is another important climatic factor of Shymnagar's life. The place has seen gradual changes of rainfall patterns over the last couple of decades. However, present data does not



actually show the real picture of the changes, but while talking with the village elders in FG- D, I got to know that the changes were significant, and it has impacted their lives and livelihoods somehow. They said that they can feel the changes, but do not know the intensity of the changes. Current research on this issue also reveals this fact. Rimi *et al.* (2009) quoted that, after analyzing rainfall patterns of Satkhira station for the period 1981 to 2006, they have found that from the last two decades the seasonal rainfall pattern has been altered. Rainfall in pre-monsoon and winter season had a decreasing trend while it had an increasing trend during monsoon and post-monsoon seasons (Rimi *et al.*2009:37).

Figure 3: Trend of Winter Rainfall Pattern

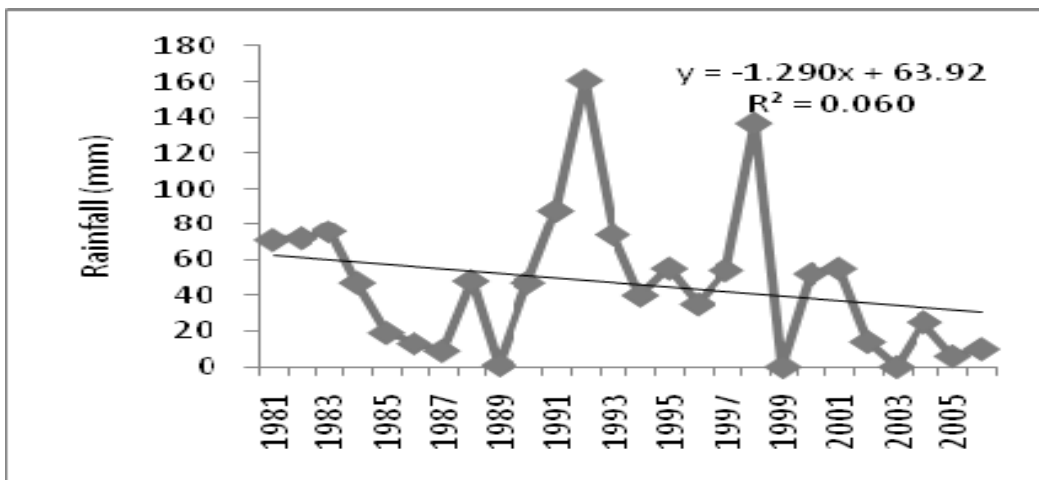
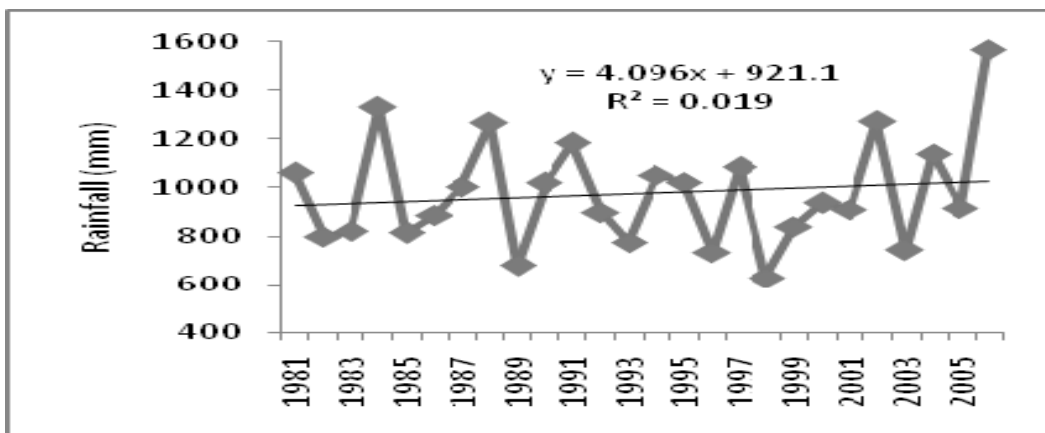


Figure3: Trend of monsoon Rainfall Pattern



Source: Rimi *et al.* (2009).

According to their analysis, the rainfall pattern in Satkhira district has seen steady changes during 1981 to 2005 period, though the changes are statistically not that much significant. But, while analyzing monthly rainfall data, which was provided by Bangladesh Meteorological Department, I found that the rainfall pattern during the months of May to October became very irregular over the period of 1997 to 2008. The Table 8 also shows that the overall annual rainfall trend has altered and became irregular. However, all those statistics are not that much significant in comparative trend analysis, but slightly changes of rainfall can create lot of environmental and economic problems to the people, whose lives are somehow dependent on it.

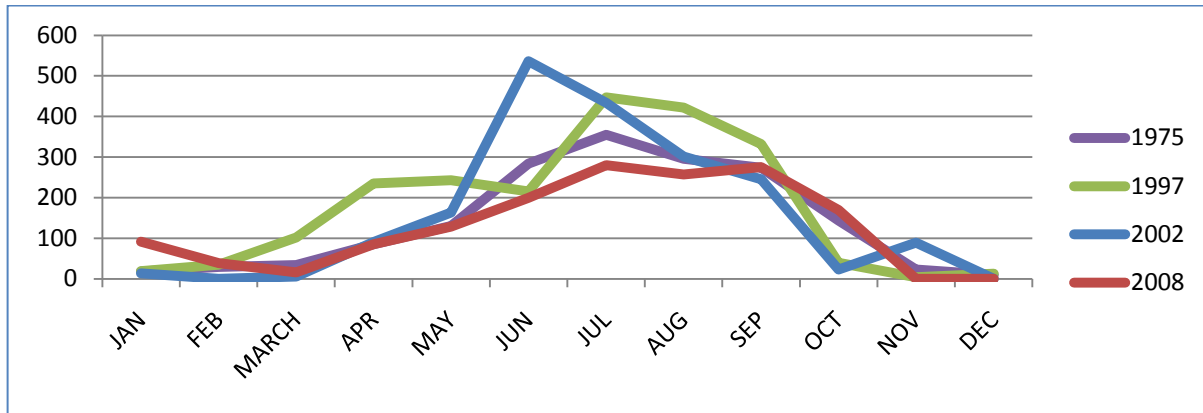
Table 8: Station : Satkhira , Monthly & Yearly Total Rainfall in mm.

Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1997	19	35	102	235	243	215	447	422	332	40	4	13	2107
1998	53	71	164	96	159	123	320	185	189	232	135	0	1727
1999	0	0	0	28	272	217	291	332	361	111	4	0	1616
2000	20	32	10	180	194	218	403	317	486	142	0	0	2002
2001	0	55	38	53	223	411	263	236	230	122	52	0	1683
2002	14	0	6	91	163	536	434	301	245	23	89	0	1903
2003	0	0	121	52	174	252	231	260	202	420	0	25	1737
2004	0	0	4	122	122	382	324	435	398	246	0	0	2033
2005	6	0	120	28	80	261	497	158	338	484	0	10	1982
2006	0	0	24	59	285	260	548	359	403	63	0	0	2001
2007	1	116	19	76	41	254	466	167	459	175	98	0	1872
2008	92	39	16	85	129	200	280	257	275	170	0	0	1543

Source: Bangladesh Meteorological Department, Climate Division

However, if we draw a comparison among four base-years of rainfall pattern, we will see that between the months May to October, the rainfall pattern varied mostly. It is also observed that during the post monsoon time (August to September) the rainfall had a decreasing trend, whereas peak monsoon had increasing trend over those selected years.

Figure 4: Four base year's trend analysis.



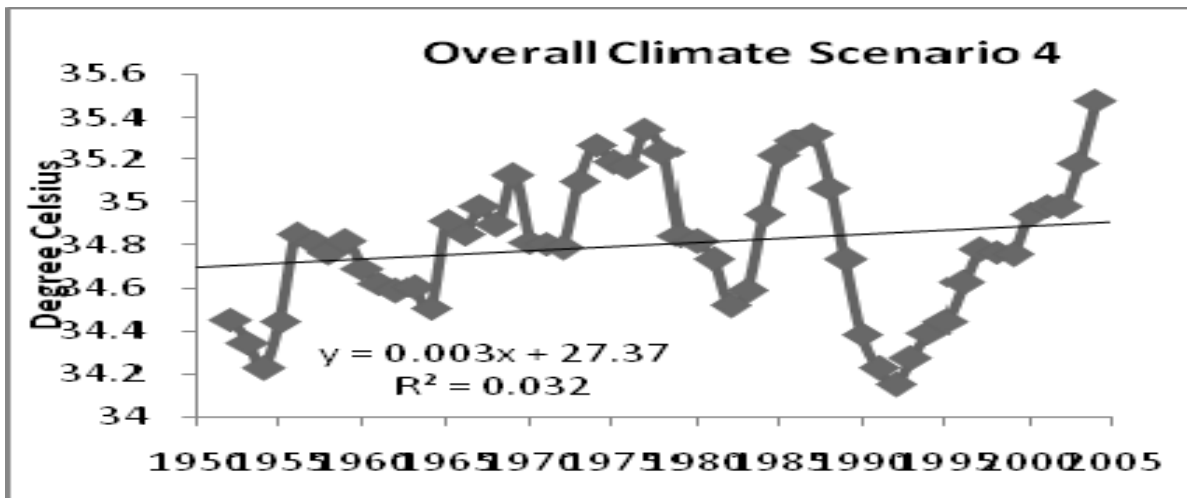
While asking the FG-C respondents about the impact of irregular rainfall on their livelihood operation, I found that irregular rainfall mostly affecting agro-based livelihood operation in Shymnagar. Because of lack of electricity, many small poor farmers have to rely on rain water for watering their soil. Besides, rain is also an important source of potable water in this region. One respondent said that irregular rainfall has an effect on both surface and ground water system. According to him, because of decreasing rainfall patterns in winter, the salinity level of surface water is also increasing. Regular rainfall often helps us to wash out surface water salinity positively. It also increases ground water level geologically. The respondents reported that because of short and irregular rainfall, the groundwater level and water quality also decreased significantly. One respondent (53) from FG-A said few years ago they could get good quality of ground water just by digging 50 feet tube-well. But, now 280 feet of digging becomes worthless. According to him, only 3 to 5 families in Harinagar village still are getting good quality potable water by digging deep tube-well. The situation in Gabura Union is much serious than other places. FG-D reported that 1200 feet deep tube well had failed to pump ground water, and the situation becomes worse day by day.

### 7.3 Temperature

Temperature is another vital factor that has enormous impact on livelihood operation in Shymnagar upazila. According to Rimi *et al.*(2009), There was a statistically non-significant increasing trend of annual maximum and minimum temperature of Satkhira district which had an observable effect on crop yielding (p 37).They showed that the summer crop Aus production was decreasing significantly, when the production of winter crop Boro rice increasing with the

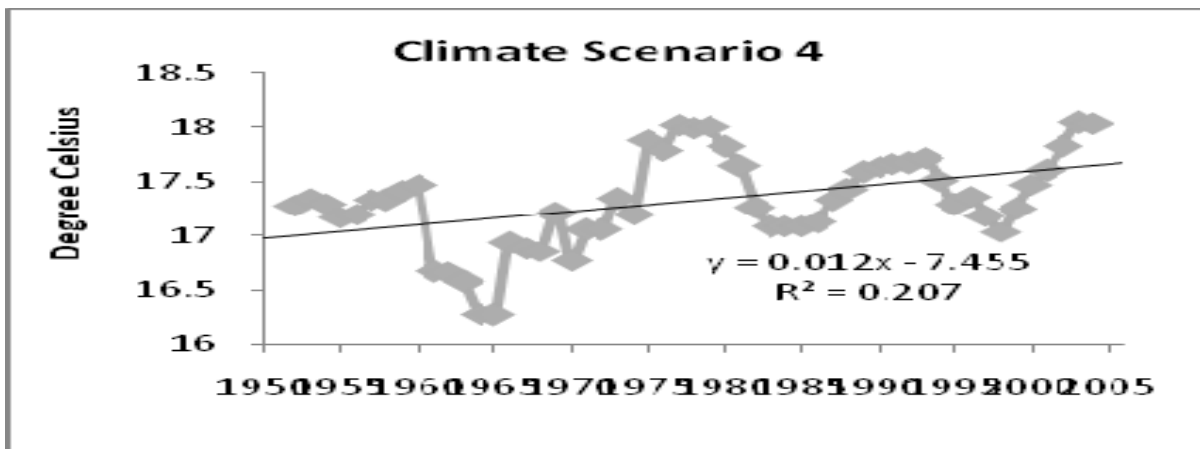
increase of minimum temperature. After analyzing the data of maximum and minimum temperature variation of the period 1950 to 2005, they found that the trend of annual maximum temperature had an increasing trend, though it was not statistically significant to comment on that (Fig 5).

Figure 5: 5 Year moving average maximum temperature (1950-2005)



Source: Rimi *et al.*, 2009

Figure 7: 5 Year moving average minimum temperature (1950-2005)



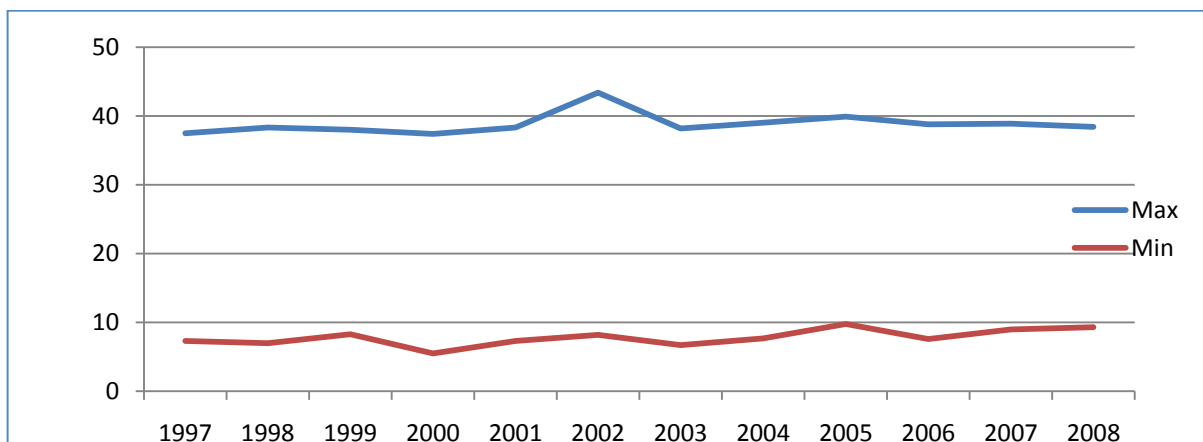
Source: Rimi *et al.*, 2009

On the other hand, the annual minimum temperature for the same period had an increasing trend, which was also statistically not significant (Fig 6). But their impact on rice production, especially, Boro and Aus production was significant.

The production of Aus rice has a decreasing trend when the maximum temperature increases (Rimi *et al.*, 2009: 45). While the production of Boro is increasing significantly with the increase of lowest minimum temperature. It is true that there are other factors that also have influenced rice production over the years, such as coastal flooding, cyclone or tornados, nor'wester etc.

While analyzing BMD's data, I also found same trend of temperature variation in my study. Figure-8 shows that both maximum and minimum temperature from 1997 to 2008 has an increasing trend. Although the trend of maximum temperature is not visibly significant, but the trend of minimum temperature is quite alarming.

Figure 8: Minimum and Maximum Temperature variation over the period 1997 to 2008



The everyday life impact of temperature variation is very much observable according to local people's words. According to FG-A and FG-C respondents, the short period of winter season and long hot summer is much perceivable. One respondent (34) from FG-C said that earlier they had seen winter starting from late October and prolonged until mid of February; but now winter rarely comes in December and disappear before February. At the same time, they noticed that summer has extended its time sphere and other seasonal breaks become invisible.

According to them, this temperature variation is silently affecting their livelihood operation. It has influenced Mangrove ecosystem as well. Those who are dependent on Sundarbans' resources have found mostly displeased for this temperature variation. Wood collection, honey

collection, Golpata leaves collection, Shells and crab collection or fishing; all these jobs follow specific seasonal calendar. When the seasonal length changes, all these jobs have to face earning shortage.

During my stay in Dhaka, I talked with famous Bangladeshi environmentalist and Executive Director of Bangladesh Center for Advance Studies (BCAS) on the issue of climate change impact of livelihood shifting and the role of shrimp farming in environmental degradation. The interview session took place at his office and it was lasted about 25 minutes. While asking my first question on relationship between climate change and livelihood shifting in Bangladeshi context, he replied that climate change has an enormous impact on that. People, especially in coastal region and riverbank area are suffering most. Frequent cyclone, coastal flooding, tidal surge, rise of salinity, river erosion are the most impacting elements of climate change which are causing livelihood loss or shifting.

He said climate change and its related actions will negatively affect natural and physical assets of poorer communities, such as mangrove forest, water resources, fisheries etc. Our major crop rice would be more vulnerable in coming decades, due to increase of temperature, salinity and rainfall variation.

While asking him about the reason behind increase of salinity in SRF zone, he indicates two major reasons. One is the withdrawal of fresh water from its natural flows and the other one is the sea level rise. Fresh water withdrawal started after the building of Farakka Dam by neighboring India on Ganges river, which caused serious water shortage to Bangladesh's premier river Padma over the last three decades. It also caused a large area alongside Padma river under desertification and decrease the down flow of fresh water. According to him, without global, regional and national level climate concerns, this scenario would never change.

## **8. LIVELIHOOD LOSS AND ENVIRONMENTAL DEGRADATION**

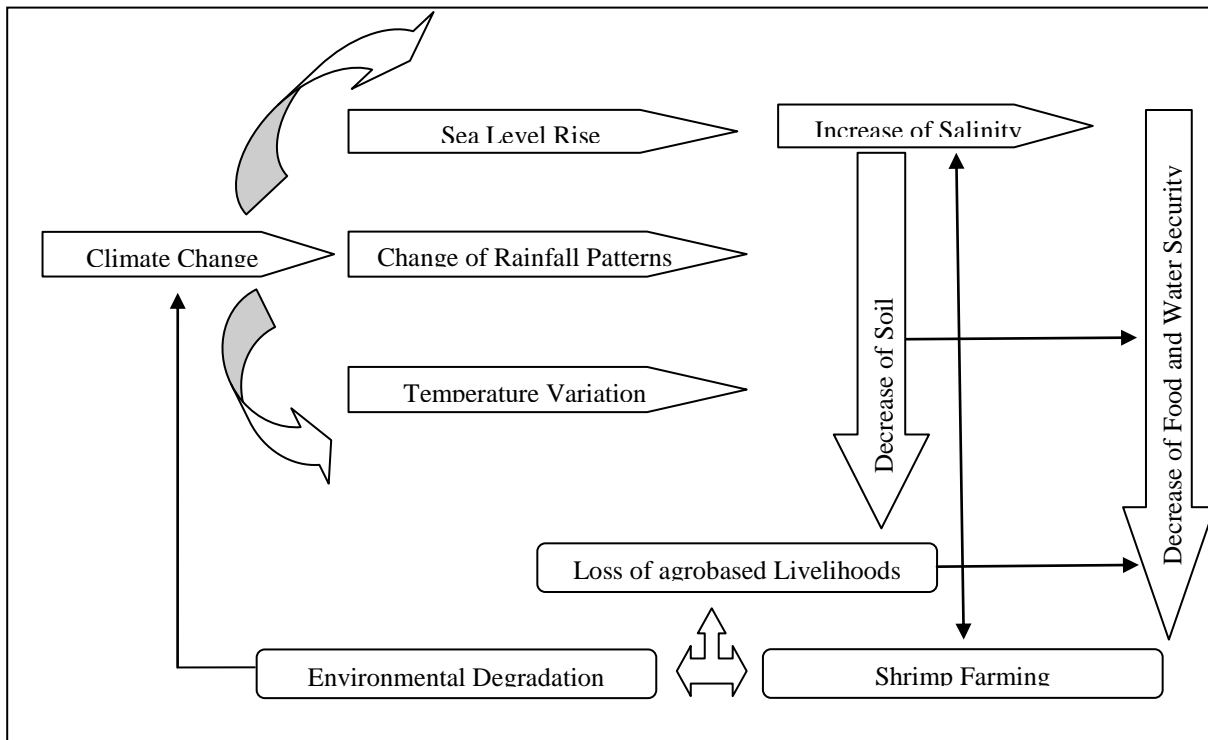
While conducting fieldwork in Shymnagar, I found visible correlation between livelihood loss and environmental degradation. It has been observed that due to loss of traditional livelihoods,

marginalized poor people who do not have the capacity to cope with new changes have engaged themselves in various non-eco- friendly activities, which further deteriorate environmental settings.

During my stay at Munshiganj, I have seen tons of timbers were gathering by poor people every day for selling them to other parts of the country. These timbers were collected from Sundarbans reserve forest, though this operation is illegal and needs legal action against it. But the law enforcement authorities rarely think for it, rather it often allows this illegal activity. According to my key informant, law agencies like Border Guards Bangladesh (BGB), has always allowed illegal timber or wood collection for their own interest. According to his information, the twenty five members' BGB camp, which was located just the opposite side of my living place at Munshiganj, every day collect at least two tons of timber woods from various poor villagers just for cooking their meals. According to one FG-D respondent, the Coast guard also does illegal timber business with the help of local influential people.

The major finding of this study is that the introduction of shrimp farming due to increasing salinity level has deteriorated the environmental settings of Shymnagar. It has made Shymnagar more saline-prone zone than that it was before. It has found that in absence of regulation act for shrimp cultivation, many unplanned shrimp farms emerged in last couple of decades. This over-exploitation of environment caused serious socio-economic problems. Loss of livelihoods, decline of agricultural production, food and water insecurity, various health problems are among the most noticeable. Figure-5 shows us an overall impact of climate change and human induced shrimp farming on lives and livelihoods of Shymnagar. It shows how the changing climate order and brackish water shrimp farming degrading both the condition of livelihoods and environment in Shymnagar.

Figure 5: Climate Change impact Livelihoods in Shymnagar



The study also explored that there are distinctive conflict between influential big land owners and others over the control of *Khash* land (government owned land) and water resources. FG participants reported that due to illegal conversion of government *khash* land to shrimp farming by many influential people, who were mostly outsider, salinity level increased rapidly and thus the quality of land decreased. They said initially local people leased out their land at a regular price to these outsiders, who had told them that their land quality will never be decreased after leasing period they could transform their land to crop yielding. But that does not happen. The land became barren, and they had no other options rather shrimp farming. One of the respondents (30) also said that they became victimized by those who have 200 *Bighas* of land.

It was also observed that many farmers who did not want to convert their land into shrimp farm became unable to do so. According to FG-A participant (61), “this happened because when others started shrimp farming surrounding areas of your cropland, your land automatically becomes saline-prone and unproductive. Then you have no other way but turned your land either into shrimp cultivation or rent it out to others shrimp producers”.



The over-exploitation of Sundarbans' resources also caused serious ecological losses and hampering its biodiversity. It has found that due to human aggression over Sundarbans resources living creatures, such as mighty Royal Bengal tigers and reindeers are decreasing in number. Tigers are often coming to human habitat and causing several killings over the couple of years. Desperate people are also killing tigers in recent time. Very recent incident took place on 15<sup>th</sup> of October. A fisherman (50) from Shymnagar while fishing and collecting crabs inside SRF zone along with his three neighbor, was caught by a tiger and later found dead (*Prothom Alo*, 16<sup>th</sup> May, 2010). Two incidences have occurred in Shymnagar just before my field visit work, when two tigers were killed by raging mob due to their invasion to human habitat. According to local people, the tigers came there in search of pure drinking water. They said frequency of tiger invasion increased over the last two years, after the two terrible cyclones, Sidor and Aiala. The increasing level of water salinity and deforestation in some places of Sundarbans are the two major reasons of tiger invasion.

## **9. STRENGTHS OF RESOURCES IN SEARCH FOR SUSTAINABLE LIVELIHOOD**

One of the mottos of the field survey was to investigate the capabilities of poor people in response to changing climate scenarios. To examine people's resilience in the face of environmental changes, this study used Sustainable Livelihood Approach as a core theory and DFID's Sustainable Livelihood baseline survey as a model for investigation. The survey was designed to answer those questions, and focus on five important livelihood capitals.

### ***9.1 Natural Capital***

The survey sample has found that the natural resources availability in Shymnagar, especially for poor marginal communities, is very poor. Nearly 25 % of total respondents do not own any piece of land, out of them 81% have no permanent settlement. The economic indicators suggests that 55% of total respondents are living in poverty, and most do not have any permanent job; but work as seasonal workers on shrimp farms during production period; and the rest of the time as shrimp fry collectors or any other jobs. According to these respondents, the daily income of varies from 25 Taka to 80 Taka (0.30 USD to 1.5 USD).

Table 9: Wealth Status of respondents

Total Size of Land (in Bighas)	Rich		Upper Middle		Lower Middle		Poor		Extremely poor
	Num *	A/S/O *	Num	A/S/O	Num	A/S/O	Num	A/S/O	
10>	2	2S							
5>10			6	1A/4S/1O					
1>5					10	2A/5S/3O			
No land >1							13	5S/8O	
No Land+ No permanent Shelter									9

\*Num=Number of person; A/S/O= Use of land to Agriculture/Shrimp/Other

The table also indicates that only two out of forty respondents owned large shrimp farm area in the context of their local economic scenario. The percentage of this group is about 5 %. The other groups, both upper and lower middle wealth group occupied 40% of income distribution. Only three respondents were found from both of these groups who are currently engaged in agriculture. The rest of them mostly have shrimp business.

The respondents also refer that the quality of their land has deteriorated over the last 30 years. Thirty one respondents attributed this to shrimp cultivation, where six respondents said it happened because of illegal use of brackish water to farm land and conversion of farm land to shrimp farm by rich outsider.

It was also found that the average house hold size of the extremely poor group is about 5.33, when it is 5.46 for poor group and 5.1 for the lower middle group. The upper group has an average 4.8 person per family, where as Rich group has 6.0 size family.

While asking the question on how important the resources of Sundarbans in their livelihood operation, 55% respondent said it is very important, where 40 % said important and rest of them said they don't know.

45% respondent said salinization is the main environmental problem that affecting their livelihood operation. 25 % said it is coastal flooding that hampering their livelihoods, whereas 15% said it is cyclone that wasted their livelihoods more.

All respondents reported that they are facing serious water scarcity right now which mostly deteriorating their living condition and hindering their livelihood operation. They said government should take necessary measures in order to save their future from water scarcity. These responses determine that land and water are the two major natural resources that required for livelihood operation. The above data says that both of these natural resources are in a vulnerable position in Shymnagar.

### ***9.2 Social Capital***

It is found that nearly 11 NGOs are currently working in Shymnagar Upazila and all of these NGOs have their own livelihood project. The NGOs mostly work with shrimp farmers; some have started agriculture and fishing projects. The study found that the NGOs have established a good social network among the villagers, though in some areas, like Gabura, it has failed to strengthen poor people's livelihood opportunities.

The survey found that 72.5% respondents have membership in several NGOs, where 42% respondents have taken formal training from them. The latter group mostly consists with shrimp farmers or rice producers. Only 17.5% respondents from poor or extremely poor category said that they have membership in NGOs or have taken their training before.

No respondents wanted to say anything of their involvement with any political parties. But according to FG respondents, most of wealthy people have some sort of collaboration with different political parties.

The above discussion refers that the role of NGOs in grass root level is still in primary level where mostly the privileged groups of the society get most of the support and poor become more marginalized in the society.

### ***9.3 Human Capital***

In terms of education, the survey found that the majority of respondents lacked formal education, which is the most important human capital in terms of livelihood operation. The literacy rate (who can read and write) among 40 household heads was 40%. Only 10% of household heads had formal primary education. The rest of them reported themselves to be illiterate. The two rich group members were found to be literate (can read and write). 12 persons from the upper middle and lower middle group were literate, while only 2 persons from the poor and extremely poor group could read and write. The survey data for household members besides household heads found that 48% of them are literate and 32% had received primary education.

While asking about respondents' family budget, 36% said that education and health are not among the top three family expenses. In their words, it is 4<sup>th</sup> and 5<sup>th</sup> important components in their lives after food, housing, and business capital. Only 28% of respondents said that education is one of the top three assets for a better life.

Most of the respondents said that the main health problem that they usually face comes from poor quality water. The high water salinity causes severe health problems such as diarrhea, skin and eye disease, malnutrition, etc.

Thus, the data present a picture of poor human capital skills of the respondents, which further indicates that without proper use of human capital, these communities' future livelihood approach will not be sustainable.

### ***9.4 Financial Capital***

The survey data found that almost 80% of respondents have a tendency to save what little income remains after all of their expenses. 48% said they save it at home, where 14% have their own account in an NGO-operated bank, such as Grameen Bank. 12% said they keep the money in a government bank, such as Bangladesh Krishi Bank or Agrani Bank. The rest of the 26% said they save their money within their own cooperative society.

A total of 26 respondents said they have borrowed a loan from different sources for operating

their business; 14 out of them said they got the loan from different micro-credit banks. Seven respondents said they took initial capital as a loan from local rich people, or so-called *Dadandars*. Rest of them got the money from their own sources. 69 % respondents who borrowed loan started shrimp farming, where as rest of them are operating other businesses.

The loan taking tendency among the poor and extremely poor is very high. Only 81.8 % have borrowed loan mostly from local *Dadons* on the condition that they will sell their collections to these *Dadondars*. The amount of money is not significant. It varies from 500 Taka to 2000 Taka. The survey has observed that in absence of regular banking system, which would be easy to understand and hassle-free for poor communities, the *Dadons* business become popular. NGO's banking is also inaccessible particularly for these poor communities.

### 9.5 Physical Capital

Interviews and FGD participants' opinion says that the overall infrastructure facility in Shymnagar is in very poor condition. Especially after two mighty cyclones, the existed infrastructure collapsed in some places. The study found very limited electricity facility in this area. The Gabura Union found less electricity facility than Munshiganj Union. According to local Union office, only 65 villages out of 216 villages are now under Rural Electrification Project.

Table 10: Statistics of Physical assets of Shymnagar

Items	Quantities
<b>Health Service</b>	
Govt. Hospital	1
Pvt. Clinic	12
Pathology center	4
<b>Infrastructure</b>	
Full Concrete	92 km.
Semi Concrete	30 km.
Mud Road	307 km.
Small Bridge/ Culvert	71/230 km.
Electricity Line	65 km.
Number of Village has electricity	35
Number of telephone	185
Number of Cyclone Center	1

*Upazila office: Shyamnagar*

It has found that the whole Shymnagar Upazila has only one Cyclone center, which could not accommodate over 300 people in disaster period.

The survey found 46% people use boat as their main transport for transporting their products, while 28% use non-motor vehicles. Rest of them uses motor vehicles. The two study areas have very limited healthcare facilities. Only one primary health care centre was found in Munshiganj union, which could not provide all kind of medical facilities. The nearest medical center is about 11 km far from these two localities. The survey also found one primary school in Munshiganj union and three other NGO school in Munshiganj and Gabura. According to FG respondents, these four schools could not meet the demand of their huge population.

All these information show that the infrastructure in Shymnagar is still in rudimentary position, and facilities to the poor are very limited. According to FG respondents, without improving infrastructure and electricity facility, new livelihood opportunity will not be created.

## **10. CONCLUSION AND KEY FINDINGS**

After the overall discussion, the study presents four major findings: 1) the climate has been changing over the last few decades in the greater Sundarbans zone; 2) due to climate change, livelihood patterns of the coastal communities in SRF zone are also changing; 3) unplanned shrimp cultivation in brackish water has caused severe environmental problems in SRF zone and increased salinity levels over the last few decades, 4) the resources of these vulnerable communities for achieving sustainable livelihood are deficient, which further increase their vulnerability.

The above discussion presents that climate change is already taking place in different parts of Bangladesh, especially in Sundarbans mangrove zone where marginalized communities are becoming more vulnerable of the society. It is also explored that these communities have very little knowledge on climate change and its future impacts. Most of them even do not know where they would move if their land ever submerge due to sea level rise.

The study also shows that after the introduction of commercial shrimp farming in the early 80s, large sums of croplands were transformed into shrimp cultivation, which subsequently caused a significant shift of agro-based livelihoods to more unstable shrimp-centric ones. The impact of these new livelihood practices is serious day-by-day due to increases of salinity and scarcity of pure drinking water. In the words of Anisur Rahman, “the great earnings from the shrimp sector are short-lived , while the real cost of shrimp culture in terms of consequent environmental ruin and social disruption are long-term and astronomical....Observers believe that the environmental and social losses would eventually eclipse profits from the shrimp sector (Rahman, Anisur,2001:28)”.This statement depicts that the impacts of shrimp cultivation on environment is truly uncountable. Furthermore, the absence of sustainable livelihood approach from government policy or NGO’s development works are also visible. It is found that without considering future impact, introduction of non-eco-friendly livelihood option could make the environmental settings more intolerable. Only sustainable livelihood approach could ensure a better long-lasting livelihood option to vulnerable communities.

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## APPENDIX A: ABBREVIATIONS

ADB	-	Asian Development Bank
BARI	-	Bangladesh Agricultural Research Institute
BBS	-	Bangladesh Bureau of Statistic
BCAS	-	Bangladesh Centre for Advance Studies
BMD	-	Bangladesh Meteorological Department
CCC	-	Climate Change Cell
DFID	-	Department for International Development
FEJB	-	Forum of Environmental Journalists, Bangladesh
IISD	-	International Institute for Sustainable Development
IPCC	-	Intergovernmental Panel on Climate Change
IWM	-	Institute of Water Modeling
NAPA	-	National Adaptation Program of Action
SLA	-	Sustainable Livelihoods Approaches
SRF	-	Sundarbans Reserve Forest
SRDI	-	Soil Resource Development Institute
UNESCO	-	United Nations Educational, Scientific and Cultural Organization
WB	-	World Bank

## **APPENDIX B: GLOSSARY**

*Aiala* : The devastating cyclone that happened on 21 of May, 2009 and devastated a large area across Bangladesh coastline.

*Bagda* : Black tiger shrimp, locally known as Bagda

*Bigha*: A unit of measurement of area of a land, it is equivalent 1600 sq yards or 0.1338 hectares or 0.33 Acre.

*Bowali* : Wood Cutter or collector

*BRRRI 47*: Saline tolerant rice invented by Bangladesh Rice Research Institute.

*Dadon* : The local influential people who lends money to others in condition that the receiver will repay it by selling their product with market price to *Dadondars*.

*Golpatta* (*Nypafructicans*): Stemless Palm, the fronds of which are used for roof thatching

*Household* : Person or persons related or unrelated, living together and taking food from the same kitchen from a household. In this research the term household entirely means dwelling household

*Mauza* : A revenue village with a jurisdiction list number and defined area is called Mauza

*Mowali* or *Moual*: Honey collector

*Sundari* (*Heriteria Fomes* ): Used as firewood , Mangrove species , the most valuable timber resources in the SRF

*Taka* : Bangladeshi currency, 1 Taka=0.68 USD (July 2009)

*Thana* : Bangladesh local administrative unit

*Top dying* : The gradual dieback of the topmost part of the Sundri tree , or early senescence as a result of disease, pests, or changing soil condition

*Union* : Smallest electoral unit of rural area in Bangladesh which is comprised of Maujas and villages is known as Union

**APPENDIX C: PHOTOS**



**Figure 1 Inundated Gabura**



**Figure 2 Temporary Settlement on Embankment, Gabura**



**Figure 3 Children fetching water from remote sources**

**APPENDIX D: FIELD SURVEY QUESTIONNAIRE**

**Field Survey Questionnaire**  
**Surveyed area: Shymnagar Upazila**  
**Date: 16<sup>th</sup> July to 17<sup>th</sup> July, 2009**

-----  
Name of the Area:

Surveyed Date:

1. Respondent Name:

Gender:  1 Male 2 Female Religion:  1 Mus 2 Hind 3 Bud 4 Chrs/Others

Age:  5 2 6 to 10 3 11 to 15 4 16 to 20 5 21 to 25 6 26 to 30 7 31 to 35 8 36 to 45 9 46 to 55 10 56 to 65 11 66 and up

Education:  1 Can Read and Write 2 Primary 3 Secondary 4 H. Secondary 5 Graduates 6 None

Occupation:

00 Unemployed 1 Agriculture 2 Share Cropper 3 Agriculture share Cropper 4 Agriculture Labor 5 Non-agriculture Labor 6 Rickshaw/Van Puller 7 Fishing 8 Rural Professional (Blacksmith, Cobbler, Carpenter, Sewing, Mechanic etc) 9 Small Business (Grocery, Restaurant etc.) 10 Handicraft 11 Salaried Contract Worker 12 NGO Worker 13 Beggar 14 Student 15 Housewife 16 Honey/Wood/Golpata Collector 17 Shrimp Fry Collector & Seller 18 Salt Producer 19 Saline Water Seller 20 Shrimp firm Worker 21 Shrimp Cultivation 22 Crab collector and Seller 23 Shrimp/Crab Wholesaler 24 Driver 25 Boatman 26 N/A (for person below 10 years of age)

2. Household wealth Category:  1 Rich 2 Upper Middle 3 Lower Middle 4 poor 5 Extremely Poor

3. Household Size:  1 1 to 3 2 4 to 6 3 7 to 10

4. Type of House:  1 Brick 2 Bamboo 3 Tin 4 Wood 5 Mud 6 Straw 7 Others

5. Number of Rooms:  1 one 2 two 3 Three 4 Four or More

6. Type of Latrine:  1 Pit 2 Sanitary 3 Open

7. Household Information

Name	Age	Sex	Marital Status	Education	Present Occupation (2009)	Previous Occupation (before 1995)

8. Household Assets

Items	Number	Ownership Type*
Radio		
TV		
Bike/Rickshaw/Van/Motorbike		
Sewing Machine		
Power tiller		
Irrigation pump		
Hand Tube well		
Tree(s)		
Livestock <i>Cattle</i> <i>Goat</i> <i>Poultry</i>		

\*1 Shared 2 Own/Personal

9. Household Land Asset

Type of Land	Size of Land (Acre)	Current Value in Taka
Agricultural		
Belongs to House		
Pond		
Barren		

10. Cultivation of Paddy/Rice:  Y/N\*



11. Cultivation of Vegetable:  Y/N

12. Cultivation of Fish:  Y/N

13. Cultivation of Shrimp:  Y/N

\*Y=1, N=2

**14. Part A: Natural Capital**

Way of cooking:  1 fuel wood 2 Gas 3 Electric Stove 4 Kerosene Stove 5 Coal

Source of Drinking Water:  1 Pond 2 River 3 Shallow tube well 4 Deep Tube well 5 Well 6 Rain water 7 Not Specific

Distance of the drinking water source from house:  1 within compound 2 within 500 meters 3 within 1 km 4 within 2 km 5 more than 2 km

The reason behind salinity intrusion:  1 Shrimp Cultivation 2 Saline water Business 3 don't know

Importance of Natural resources in livelihood operation:  1 very important 2 important 3 less important 4 don't know

The main environmental change that affecting livelihood:  1 cyclone 2 coastal flooding 3 decrease of rainfall 4 increase of rainfall 5 salinisation 6 increase of temperature 7 don't know

Importance of Sundarbans in livelihood operation:  1 very important 2 important 3 less important 4 don't know

**15. Part B: Social-political Capital**

Have any membership in local institute:  Y/N

Have any membership in political party:  Y/N

Have any involvement with local NGO:  Y/N Name of the NGO

Have got any training from NGO /Govt:  Y/N

### 16. Part C: Human Capital

Household yearly expenditure for selected items (in taka, Monthly exp. X 12= Yearly exp.)

Items	Amount	Percentage of total expenditure
1.Food		
2.Education		
3.Health		
4.Clothes		
5.Social/religious occasion		
6.Business capital		
7.Entertainment		

Which three from above are most important while making family budget:

### 17. Part D: Physical Capital

Distance of the main nearest concrete road from home:  1 **within 500 meters** 2 **within 1 km** 3 **within 2 km** 4 **more than 2 km**

Distance of the nearest bazaar from home:  1 **within 500 meters** 2 **within 1 km** 3 **within 2 km** 4 **more than 2 km**

Number of Schools/Madrassa within the locality:  1 **Primary school** 2 **secondary school** 3 **NGO School**

Number of Health centre/hospital within the locality:  1 **Govt. Hospital** 2 **primary health centre** 3 **Private Clinic** 4 **NGO clinic**

The Main way of transport to go a long distance:  1 **Boat/Ferry** 2 **Bus** 3 **Cycle/Van** 4 **Other**

### 18. Part E Financial Capital

Do you save money?  **Y/N**

The way of saving:  1 **Home** 2 **Bank** 3 **Cooperate Society** 4 **NGO** 5 **Other**

Have you borrowed any loan in the last 12 months?  **Y/N**

From where do you usually borrow?  1 **Bank** 2 **NGO** 3 **Microcredit Bank** 4 **Local rich people** E **Relatives** F **Other**

Do you pay interest on your debt?  Y/N

Why do you take loan?  **1 For buying food 2 For health & medicine 3 For commercial purpose 4 Form rebuilding home from natural disaster 5 For repaying other loan 6 other**

How easy is the loan taking process?  **1 Very easy 2 Easy 3 Complicated**

**General Question:**

19. How challenging is the present livelihoods pattern for you in compare to previous:   
**1 Very Challenging 2 Challenging 3 Not Challenging 4 Don't know**

20. Do you have any idea about what is climate change and how it is happening?   
**1 Good idea 2 Some idea 3 No idea**

21. Do you have any idea on sea level rise?   
**1 Good idea 2 Some idea 3 No idea**

22. Where would you be like to settle permanently if you lost your land by sea level rising in next 15 years?

**1 Nearest town 2 Divisional Head 3 Dhaka 4 Other (specific name) 5 Don't know**

Date of survey: