

INTEGRATION OF ECOSYSTEM MANAGEMENT IN LIVELIHOOD RESTORATION AFTER A DISASTER



A Dissertation for the Degree of Master in Disaster Management

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ABSTRACT

People and environment become more vulnerable when natural disasters strike in a vulnerable community; and for Bangladesh vulnerability to natural disaster is rooted into its geographic location as it is the world largest delta compounded with a series of hydro - meteorological and geo-physical factors. Furthermore the impacts of climate change have triggered the events of acute natural disasters as flood and cyclone in Bangladesh. The vulnerability of these disasters severely compromises with the rural livelihood capitals of at risk community and existing ecosystem.

It is believed theoretically that Ecosystem Management Approach as a better alternative for sustainable livelihood restoration after any disaster. Based on this ground, this study has been carried out in 4 districts of Bangladesh. Two of them are from riverine flood prone and two districts are from coastal-cyclone prone areas.

The study has outlined livelihood capitals of at risk community, their coping and adaptive strategies and the options for ecosystem approach. The information was collected through participatory methods followed by DIFDs livelihood analysis guidelines. This study was aimed to observe the relationship between ecosystem management approach in livelihood restoration initiatives at disaster prone areas through a multi- scale approach that combines local and scientific knowledge.

The study showed that the ecosystems of both the areas have undergone various short-term and long-term cyclical changes due to frequent disasters, unplanned developmental efforts, management practices of local institutions over time. It has also demonstrated the dynamic interaction between livelihood and ecological systems, and the played institutional gaps and changes to cope during aftermath of disasters.

Each time a natural disaster exacerbates its impacts on environmental elements and vice versa, which affects natural processes, alters resource base and increases vulnerability of at-risk communities. Although environment and disasters are inherently linked, but surprisingly the ecosystem management approach is not integrated yet with implementation practices of sustainable livelihood and other disaster risk reduction options. Specific issue-based initiatives on livelihood and ecosystem management focusing on comprehensive risk reduction through developing frameworks are inevitable. This would further strengthen vertical and horizontal integration by engaging related sectors and concerned organizations.

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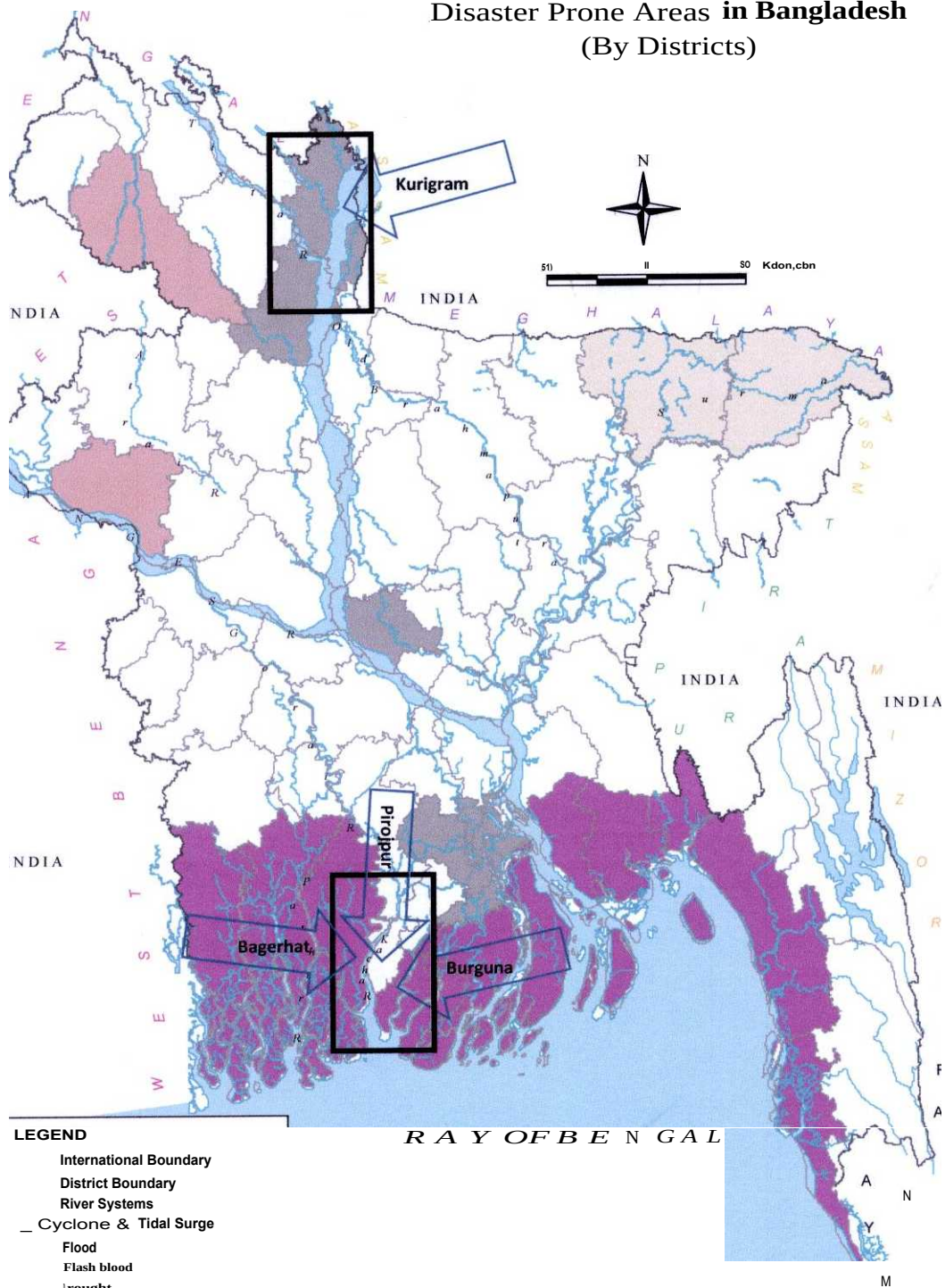
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Disaster Prone Areas in Bangladesh (By Districts)



Management Information & Monitoring (MIM) Division
Disaster Management Bureau (DMB). September 13'99

Map: Featuring the study Areas (Kurigram, Burguna, Pirojpur and Bagerhat districts)

CHAPTER 01. INTRODUCTION

1.1 INTRODUCTION

The environment in the third world is largely a livelihood issue (Blaikie, 1994). People and Environment become more vulnerable when driving forces like poverty and disaster overlap. For Bangladesh vulnerability to natural disaster is rooted into its geographic location as the world largest delta compounded with a series of hydro - meteorological and geo- physical factors. Due to huge inflow of the water from upper riparian coinciding with heavy monsoon rainfall inside the country, a low floodplain gradient, and congested drainage channels, tides and storm surges in long coast line; it has ranked one of the most disaster prone countries in the world. Our people *have* experienced some of the worst floods and cyclone in recorded history of disasters in world. In 1970 super cyclone washed away 330,000 people, 2007 super cyclone Sidr killing some 3500 people and caused massive 4.6 billion dollar damage. In 1988, 1998, 2004 and 2007 devastating flood ruined country economy and cost several lives. According to global DRR assessment report by UNISRD a large number of our people are exposed to acute hazards like flood and cyclone and also chronic hazards like drought, sea level rise and saline water intrusion. The increased frequency and vulnerability to natural disasters distinctly identifies Bangladesh as the most high risk and disaster prone country in 2009 (Global DRR report, 2009).

The vulnerability of any natural disasters severely compromises with the existing ecosystem. Each time a natural disaster exacerbates the impact of environmental degradation, which affects natural processes, alters humanity's resource base and increases vulnerability of at risk community; in term of livelihood and natural resource depletion. During any crisis period ecosystems play a key in rural livelihood and in many instances, our local knowledge and institutions have developed mechanisms over many generations of trial and error that enable them to cope with crisis in change of ecosystems. There of these ecosystems has undergone various short-term and long-term

cyclical changes due to frequent disasters, corrupted management practices and local institutions over time.

An effective approach of ecosystem management could integrate development planning and risk reduction strategies to reduce disaster impacts and improve both livelihoods and biodiversity- outcomes. Ecosystem management can contribute to more effective reduction of disaster risk in two major ways. Well-managed ecosystems can **mitigate the impact of most natural hazards, such as landslides , flood and cyclones. In addition, productive ecosystems can support sustainable income-generating activities and are important assets for people and communities in aftermath of a disaster. For ecosystems to make these contributions, it is essential that they be factored into relief and rebuilding efforts in the post-disaster response phase. Not taking care of critical ecosystems after a major disaster can cause significant economic and environmental losses, and impose hardships on already vulnerable communities.**

This study came about for two reasons. In the first instance , it emerged from an earlier studies that during and after any disaster , decision-makers at the national and international levels rely on rapidly acquired information to analyze impacts, set priorities, identify gaps, plan early recovery responses, mobilize resources and engage in advocacy. **Timely and well founded information on post-disaster environmental impacts and possible risks to health, livelihoods and the environment and ecosystem services is an invaluable contribution to these efforts.**

Despite a growing recognition of the important links between the environment and other life-supporting sectors and systems, **environmental information to inform decision making is often unavailable or inaccessible in a post-crisis situation. But often our national databases or census data are ceased to function or outdated. The capacity of relevant state institutions are also weakened , poorly rpoured and in serious need of support. Insecurity or poor communication with affected areas also constrain access to primary data, while competing interests or priorities also hamper the gathering of vital**

information. Often, therefore, despite good **intentions, environmental considerations are often overlooked.**

The second impulsion for the study was the community assessment component of the Millennium Ecosystem Assessment (MA, 2003) and sustainable livelihood approach to which this study is linked . The MA community assessments seek to understand a) societal resilience , and the role played by human (skills, education and knowledge) and social (local level institutions , community networks and organization) capital in the development of resilience; b) the impact of disturbances from varying scales on the local level, and the mechanisms used to cope with and recover from these disturbances; and c) the impact of changing socio-economic conditions over time on the demand for ecosystem goods and services. On the other hand sustainable livelihood approach assesses human, nature, social, financial and physical capitals as livelihood assets (DFID, 1997). A discussion of the strengths and weaknesses of the MA framework and SL framework is provided in following Section.

The overall perspective of this study is that after a disaster or crisis local level. institutions are the ultimate determinants in the allocation and the use of ecosystems by people This use of ecosystems influences and shape the capacity of livelihood assets. Ecosystems often generate services, which are available for human use and influence on human choices, preferences of livelihood . But in context of our country the ecosystem management approach for sustainable livelihood is overlooked.

1.2 HYPOTHESIS AND RESEARCH QUESTIONS

The over- arched question or hypothesis of the study is that "Ecosystem Management Approach is a better alternative for livelihood restoration programs after a disaster"- The study seeks to answer of following relevant issues:

- a) What are the existing initiatives in term of coping and adaptive responses taking part after a disaster?**
- b) How local institution interventions are taken in account to livelihood restoration programs after disaster.**

- c) What contribution could local knowledge make to our understanding of ecosystem management at the local level?
- d) What are the possible options of ecosystem management approach in livelihood restoration initiatives?

1.3 OBJECTIVES

1.3.1 Major Objective

This research aims to contribute both theoretically and empirically toward the growing literature on Sustainable livelihood frameworks (SL), Millennium Assessment (MA), and ideas around the Disaster Risk Reduction (DRR) Approach.

Main objective of this study is to examine the relationship between ecosystem management approach in livelihood restoration initiatives at disaster prone areas through a multi-scale approach that combines local and scientific knowledge.

1.3.2 Specific Objectives

- Assessment of livelihood capitals (through SLA framework)
- Examine existing livelihood restoration initiatives
- Examine coping and adaptive responses in livelihood restoration
- Examine options of ecosystem management approach in restoration of livelihood

1.4 THESIS STRUCTURE

In order to accomplish the main objective of the, this thesis begins by introductory chapter followed by conceptual understanding on relevant concepts and approach. Chapter 2 also includes conceptualization of approaches and methodological tradeoffs. Chapter 3 provides the general overview of study area; which includes the hydrology, climatic condition and the control measures taken to combat natural hazards. Chapter 4

describes the methodology and research design framework adopted for this research. It also describes data collection procedure and methods used in livelihood assessment. Chapter 5 presents the results from the field investigation, group discussions and in-depth interviews along with relevant discussion on livelihood assets, coping and adaptive strategies and options for ecosystem management. This final chapter offers recommendations based on detailed understanding of the study with concluding remarks and suggestion of further research.

CHAPTER 02: CONCEPTUAL UNDERSTANDING

2.1 EXISTING CONCEPTS AND APPROACHES

The given perspectives and approaches are the key **issues to** clear conceptual framework for the study to understand human-ecosystem interactions in relation with disaster risk reduction. Some of the key frameworks that many researchers have adopted in order to deal with the **issues in relation** to the focus of this study include; the Sustainable Rural Livelihoods framework (Carney, 1998a; Ellis, 1998; Scoones, 1998), the Millennium Assessment framework (MA, 2003) and more recently. Disaster Risk Reduction Approach (WCDR, 2005)

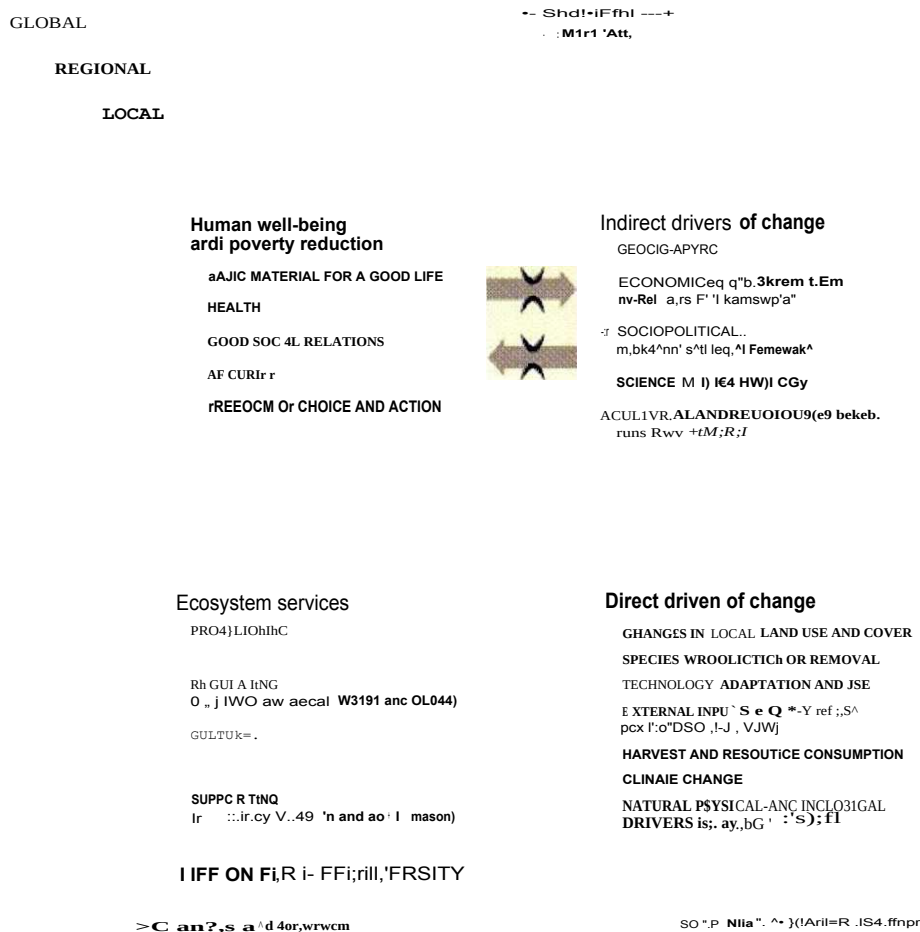
2.1.1 The Millennium Assessment Framework

The MA framework (Figure 2.1) assumed a dynamic relationship between human and ecosystems. Human and ecological systems are considered to be interconnected, with ecosystem change which affect human well-being (MA, 2003). Human well-being is defined within this framework as having multiple constituents, i.e basic material for a good-life, freedom and choice, health, good social relations, and security. These constituents of well-being are recognized as being situation dependant, as experienced and perceived by people, and a reflection of local geography, culture, and ecological circumstances (IA, 2003). An ecosystem is defined a dynamic complex of plant, animal, and micro-organism communities and the nonliving environment interacting as a functional unit. Humans are considered an integral part of ecosystems (MA, 2003).

The framework assumes that the relationship between ecosystems and human well-being cannot be understood without a consideration of multiple spatial and temporal scales, and also recognizes interactions across scales of analysis. The mismatch between the scale of ecosystem processes and the scale of decision-making is considered to be a key reason for many natural hazards. The model also acknowledges that different knowledge systems which is important livelihood analysis (MA, 2003).

Of key interest for this study, is the NI\ concept of 'drivers of change'. A driver here refers to any factor, whether human induced or otherwise, that causes change in an ecosystem. A direct driver refers to a factor that indisputably influences ecosystem processes and can therefore be identified and measured to differing degrees of accuracy. An endogenous driver is a factor whose magnitude can be influenced by the decision maker, while an exogenous driver cannot be altered by the decision maker.

The MA framework therefore provides a conceptual tool that allows for the analysis of linked social-ecological systems, and for the simultaneous consideration of local social and ecological systems. The model also well considers local decision-makers and knowledge as part of the system in question, which is something lacking in traditional approaches to natural resource management (Walker et al., 2002). However, the model alone does not do justice to the dynamism of the interaction between human and natural systems at the local level. In particular, the model does not allow for a consideration of the process of slow or rapid on set disaster such as flood and cyclone, disaster management, adaptation and resilience within these systems.



Changes in factors that indirectly affect ecosystems, such as population, technology, and lifestyle (upper right corner of figure), can lead to changes in factors directly affecting ecosystems, such as the catch of fisheries or the application of fertilizers to increase food production (lower right corner). The resulting changes in the ecosystem (lower left corner) cause the ecosystem services to change and thereby affect human well-being. These interactions can take place at more than one scale and can cross scales. For example, a global market can lead to a regional loss of forest cover, which increases flood magnitude along a stretch of a river. Similarly, the interactions can take place across different time scales. Actions can be taken either to respond to negative changes or to enhance positive changes at almost all points in this framework (black cross bars). (Source: MA, 2003: 37)

Figure 2.1: Millennium Ecosystem Assessment (MA) Conceptual Framework

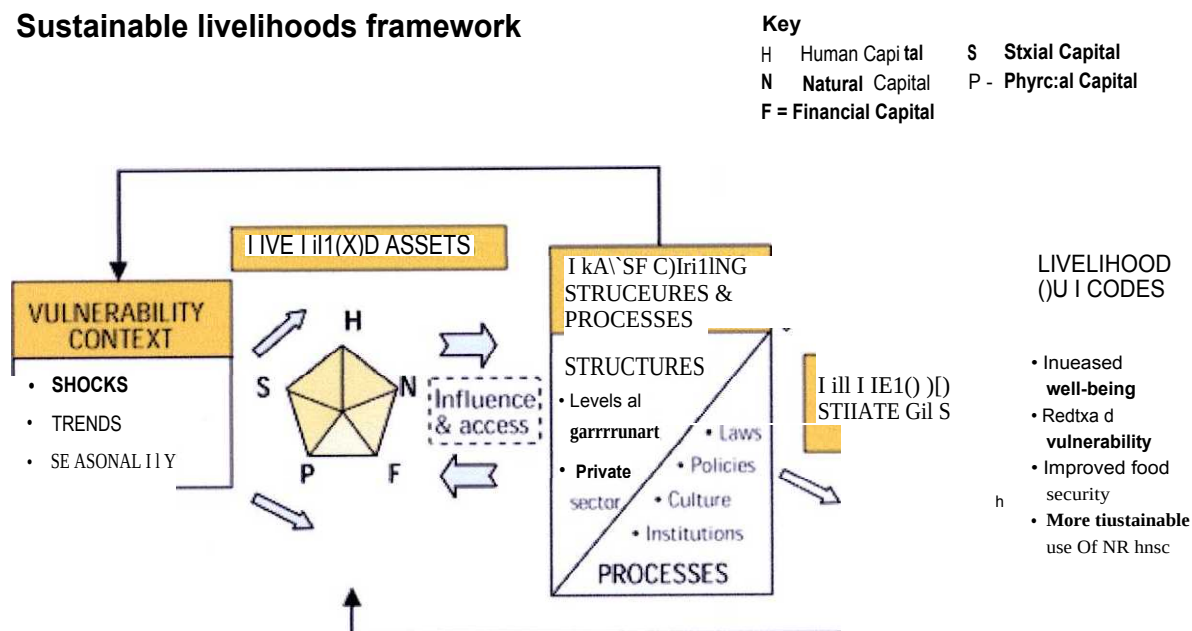
2.1.2 The Sustainable Livelihoods (SL) Framework

The Chambers & Conway definition of livelihoods is considered the staple understanding of the livelihoods approach: "A livelihood comprises the capabilities, assets (both natural and social) and activities required for a means of living; a livelihood is sustainable which can cope with and recover from stresses and shocks, maintain or

enhance its capabilities and assets, both now and in the future, while not undermining the natural resource base" (1992:7). This approach implies that disasters continually threaten livelihoods, thus creating sustainable livelihoods is a continuous process. Livelihoods are also threatened by 'slow-onset' disasters, such as drought. The activity of securing assets, including social cohesiveness, is thus an ongoing development project. People's capacity to survive results from being able to "cope with, recover from and adapt to stresses and shocks" (UNDP, 1999) and therefore need resilient livelihoods which can sustain these changes (Singh 1996; Helmore and Singh 2001). These shocks and stresses can occur on the level of individuals and households (idiosyncratic shocks) or on communities and nations (covariant shocks), thus livelihood mechanisms must work within varied systems with local and international actors (FAO, 2005). To be sustainable, a livelihood also needs to be efficient in ecologically and economically sound resource harvesting and usage, and grounded in social equity. There are some key differences between sustainable development initiatives and the integrated rural development approaches of the 1970's, which should be considered in order to view how this framework has progressed.

The UK Department for International Development (DFID) created a SL framework which incorporates key livelihoods elements, including a focus on people, a holistic approach, and micro-macro links). The UNDP definition (developed by Singh 1996, 1998) of the SL approach is that: "sustainable livelihoods are a systemic and adaptive approach that links issues of poverty reduction, sustainability and empowerment processes.

Sustainable livelihoods framework



The arrows within the framework are used as shorthand to denote a variety of different types of relationships, all of which are highly dynamic. None of the arrows imply direct causality, though all imply a certain level of influence. Source: DFID, 2000

Figure 2.2: The Sustainable Rural Livelihoods Framework

This description dictates that livelihoods are more than jobs - they are comprised of a wide range of actions individuals do to make a living and to sustain life. The SL approach moves development beyond focusing on poverty to an analysis of the actual livelihood systems, strategies and pressures of vulnerable populations, as well as the 'wealth of the poor'-the human and social capital and resilience levels which can be utilized and built upon (UNDP 1999).

A good analysis relies on a participatory process and can be applied to different contexts and situations of uncertainty. It is also flexible enough to take in the multiple tasks of those who survive outside the formal labour market system. It can also deal with the adaptive job market the more modern or urban sectors are experiencing, with an unprecedented level of job insecurity being experienced even in traditional careers (UNDP 1999). Livelihood systems are comprised of available assets and involve dynamic interactions with other systems, including ecological, social, economic and

political dynamics. The role of **coping strategies and interactions is evident in the analytical framework** for SL which **is used** by UNDP.

2.1.3 The Disaster Risk Reduction (DRR) Approach

The WCDR Secretariat defines the DRR framework as "the conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development" (WCDR 2005). The framework itself encompasses the active components of risk awareness and assessment, knowledge development, public commitment and institutional frameworks comprised of organization, policy, legislation and community actions. It also uses the elements of ecosystem management and planning measures and early warning systems. While these components seem to necessitate a level of community involvement and partnerships, DRR strategies are often undertaken in a separate, sectional way by specialist departments following specific policies (UNDP 2005). However, just as micro decisions in ecosystem management efforts should complement macro-level maneuvers, to ensure they are successful; DRR strategies should also be synchronized across decision-making levels to be effective.

Levels of loss experienced during a disaster can be reduced by using methods of mitigation and preparedness, including DRR frameworks. These frameworks increase the resiliency levels of individuals, communities and governments, allowing them to mitigate or respond to a disaster in a more effective manner.

2.2 Sustainable Livelihoods in Disaster Risk Reduction Analysis

Feinstein International Famine Centre 2002's definition of sustainable livelihoods is suited to disaster settings: "the ways in which people access and mobilize resources that enable them to pursue goals necessary for their immediate and longer-term survival" (Earth Negotiations Bulletin 2005).

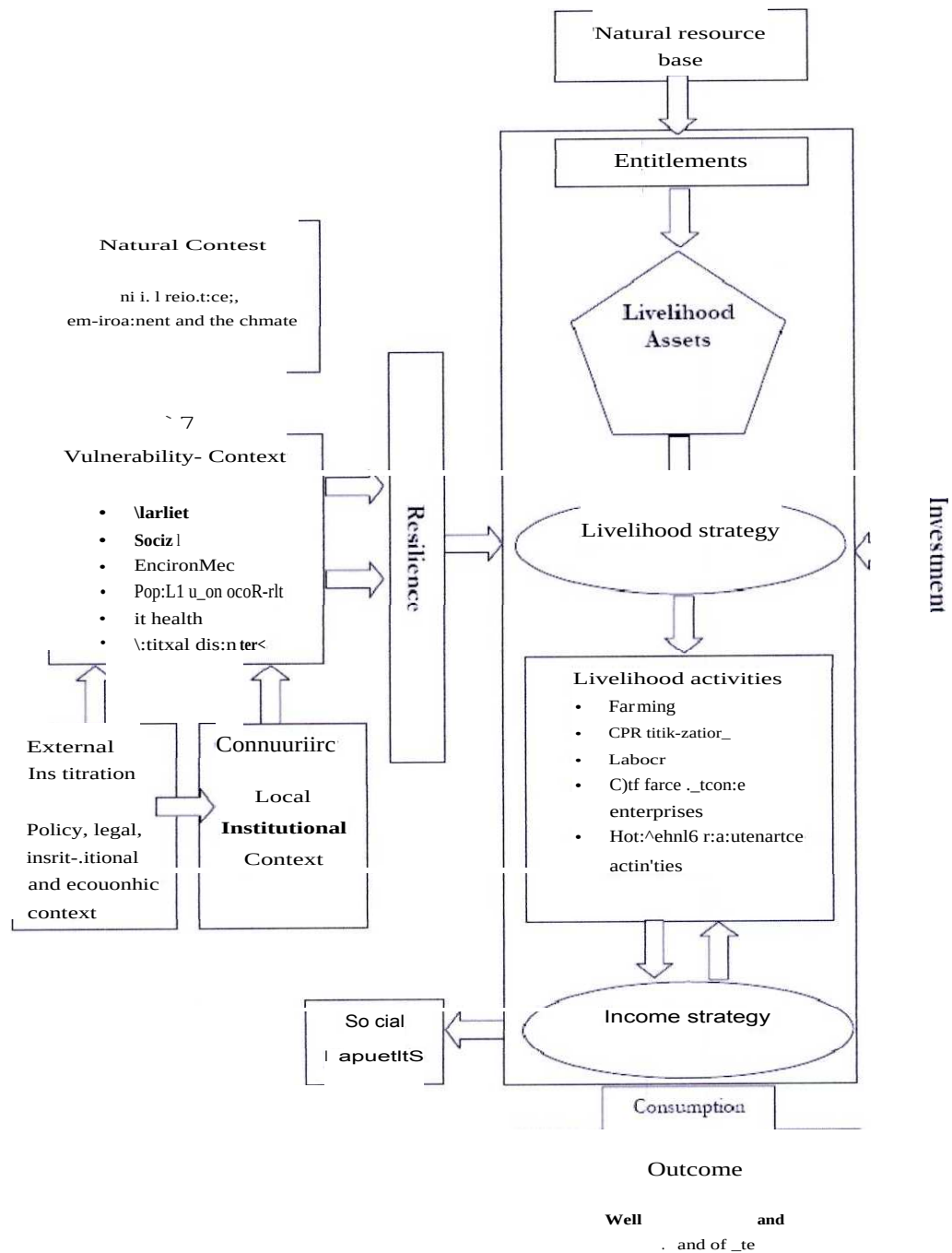


Figure 2.3: A Model of Livelihoods Dynamics

Source : Soussan et al 2003

However, a standard model for measuring livelihoods or integrating the SI, framework into DRRs does not exist. Still the assets and policy determinants within the framework provide opportunities for a marriage of these concepts. "Integrating an assets approach in order to establish indicators for sustainable livelihoods is the most popular way to measure the effectiveness of the SL approach for an individual household, or a community. Assets consist of five different types of capital: human (skills, knowledge, creativity, adaptive strategies), financial, physical (buildings, roads, machinery, crops and livestock), natural (land, water, air, forests and vegetation) and social (governance structures, decision-making power, community and other institutions, culture, participatory processes), which can then be divided into two categories: stores and resources, and claims and access (UNDP, 1999). Assets (particularly physical assets such as built environments) can be created with interventionist strategies in mind, and thus be designed to withstand hazard events.

2.3 Combining SL and Ecosystem Management Approaches

The SL approach is not meant to be used in isolation from other development tools. It is, in essence, an integrating device, and can indicate where other methods and techniques could be useful to decrease vulnerability (Farrington *et al* 1999). The Ecosystem Management Approach is also one which needs to be connected to other tools, in a systemic way, and therefore can effectively build upon the SI. framework. Becoming just as evident in conservation as in development literature is the notion that each are most successful when the other is involved - conservation initiatives in particular are more effective when there is a strong local interest in the environmental concerns that are critical to local livelihoods, well-being, and industrial and commercial enterprises. Wyckoff-Baird *et al* (2000) describes this as positive, "integration of conservation with the attainment of sustainable development" (68). This intersection of systems approaches works directly to utilize and increase the resilience levels of communities. Fostering the resiliency of social and ecological systems is a central goal in both development and disaster risk reduction projects - building resilience on a

community level involves strengthening and/or creating mechanisms, institutions, and capacity at local levels to decrease vulnerability.

A concept evident in SL is people's interconnectedness to the natural world around them. A key concept of SL, is that assets such as healthy ecosystems can keep households resilient against shocks and disasters. Natural resources are not limitless in nature, and as such, cannot be consumed and/or produced in an unsustainable manner without leaving livelihoods vulnerable. The clear links between levels of sustainable livelihoods, ecosystem health and vulnerability are shown in progression of vulnerability model, adopted from ADPC report (see Figure 2.4). Livelihoods can only be sustainable if they do not have negative impacts on the natural environment.

Communities without access to a healthy ecosystem can become marginalized, leading to livelihood and environmental insecurity. Incorporating the SL approach with Ecosystem Management discussions incite questions such as: What natural resources is livelihoods dependant on? How are these resources vulnerable? What policy or structures are working, or should be created, to protect ecosystem-based livelihoods? These queries could also be used in DRRs: How do disasters affect natural resources vital to livelihoods? How can these resources be made less vulnerable to disasters? What DRR components could protect ecosystem-based livelihoods?

An important consideration regarding the use and management of ecosystems for livelihoods by local communities is that of the threat of a 'tragedy of the commons'. A collective management of natural resources can be threatened by community members working to maximize their own utility, therefore threatening the total Ecosystem Management and SI, levels of both themselves and others. Actions taken on a micro level should serve to complement sustainable efforts undertaken at a macro level to ensure that they are effective. The combining of SI, theory with Ecosystem Management Approaches requires a continuous monitoring of systems to ensure that social equity, ecological security, and economic integrity is maintained (UNDP,1999).

CONCEPTUAL UNDERSTANDING

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Poor people are generally more dcpendant on ecosystems for their livelihoods,

Fig: 2.4 Progression of Vulnerability Model

Source: Adopted form ADPC, 1999. Also in Blaikie et al., 1994 and Twigg, 2001

affected, so are their livelihoods (Reid and Iltis 2005). The reliance of the poor on the environment determines that ecosystem management should therefore be a core element of the SL strategy. For example, regions of the coast of India which had dense mangrove plantations were less damaged by the 2004 Indian Ocean tsunami than areas where the ecosystem had been cleared. Areas which have protected ecosystems such as mangroves not only shelter coastal regions from hazards, but also ensure the sustainability of livelihoods, including aquaculture production. This approach is accepted by numerous organizations, including the International Institute for Sustainable Development (IISD), Stockholm Environmental Institute (SEI), World Conservation Union (IUCN) and interoperation: "This combination of a secured natural resource base, reduced exposure to natural hazards and diversified livelihood activities has increased resilience to future threats, including climate change" (Task Force on Climate Change, Vulnerable Communities and Adaptation 2003;2).

2.4 Integrating conceptual frameworks

To date, no conceptual guide exists that brings these three key approaches to human-ecosystem interactions together, although recently some analysts have attempted to combine various aspects of the Resilience approach with the Livelihoods (Berkcs et al., forthcoming) and the ecosystem management approach with sustainable livelihood approach (Farrington et al 1999). Figure 2.5 presents a graphic representation of how these issues are conceptualized in this study. The figure is modified from a previous study (Bandu, 2005) and considered as a work in progress, since the ideas expressed herein are new and evolving. In this framework, livelihood -ecosystem interaction is outlined and represented through lines that connect different components which in needed to be considered.

The connection between these different components of the system takes place through livelihood pentagon, institutional intervention and ecosystem change considering disaster aspect is shown in the framework. Institutions here represent

mediate the allocation and use of ecosystems by people. Specially, determine; a) the ways in which the ecosystem and trends influence local livelihoods and therefore patterns of resource use, and b) the ways in which this use affects ecosystem change. This process is dynamic, particularly at the local level; institutions strengthen and weaken through interactions with factors outside of the local context, and are constantly negotiated and readjusted through a process of social learning and adaptation in response to changes in the local environment, and through interactions with the wider social-ecological environment.

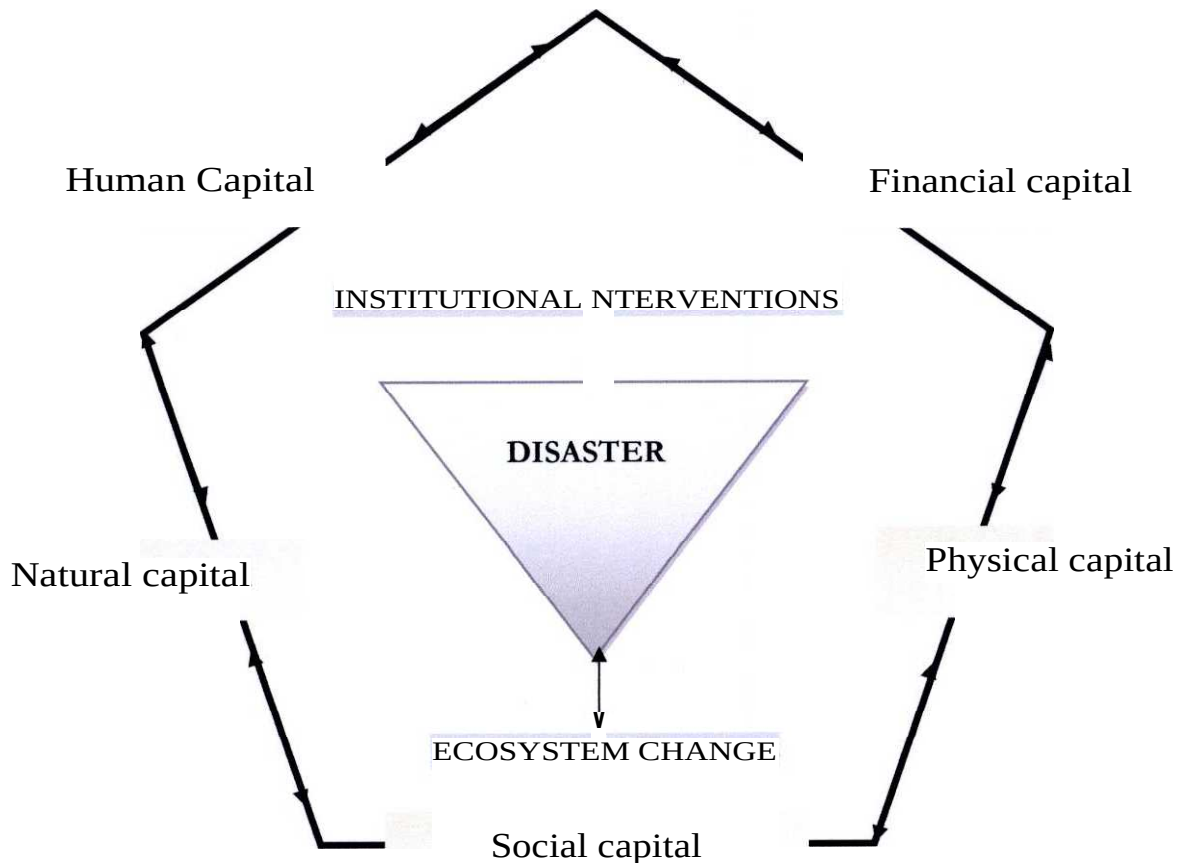


Figure 2.5 Conceptual framework of Livelihood-Ecosystem interactions at the local level after disaster. (Modified from Bandu 2005)

2.5 PUTTING FRAMEWORKS INTO PRACTICE

Participatory learning Approach (PLA) is the dominant strategy adopted in this study. PLA is a term used to refer to a wide range of similar approaches, including Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) (Chambers, 1994). The common theme is the participation of people in the processes of identifying **their needs and opportunities, and in the action required to address them (LIED, 2003).** A wide range of PLA methods are chosen from DFIDs sustainable guidance sheet and used for assessment of different aspects of this thesis. Therefore, in the interests of clarity, each of the techniques is briefly described in chapter 04.

The PLA allowed for an inclusive and participatory process in this study, and, perhaps most importantly, these methods opened up spaces for context-specific challenges and opportunities to come to the fore in application of frameworks. However, the selection of conceptual and practical frameworks in any research process necessarily brings with it trade-offs that must be carefully weighed by researchers. It is **essential to acknowledge these trade-offs at the outset of any research process, this** provides an opportunity to both off-set anticipated biases, and to state upfront the biases present throughout the study (Munda, 2000).

2.5.1 Methodological Trade-offs

The trade-offs identified in this study related to:

- a) The convenience of pre-designed frameworks, vs. the loss of alternative perspectives on human-environment relationships;
- b) The inclusiveness of a trans-disciplinary approach, vs. superficial research outcomes; and
- c) The confrontation of uncertainty through the incorporation of more integrated and broad-based information that is more difficult to disaggregate and test statistically, vs simple data that is easy to quantify and analyze. Each of these trade-offs is discussed in turn below.

a. Pre-designed frameworks, vs. alternative perspectives

This study incorporated local knowledge predominantly from ecosystem management perspective. This approach proved very useful in the identification of the underlying causes of change, adaptive processes at the local level. The use of these frameworks also improved the legitimacy and validity of the local assessments in the eyes of scientists and most policy makers.

However, these models and relationships represent particular worldviews, developed outside of the local context to identify processes deemed important by scientists. Therefore, this study has to compromise between utilizing local cosmologies to understand changing **human**-environment relationships, **and a** prior identification of processes relevant to the scientific arena, in the form of pre-determined models and conceptual frameworks. The negative trade-off was that the process **was less** participatory than that advocated by the options of ecosystem management, and possibly less legitimate **than** a true 'bottom-up' **assessment** in the eyes of local people.

b. Inclusiveness vs. superficiality

Working across disciplines is indispensable when dealing with complex systems. Local **management** systems and resource use patterns know no disciplinary boundaries, and the drivers of social-ecological systems are ecological, geographical, climatologic, historical, political and economic. Therefore, a trans-disciplinary and inclusive approach allowed the researcher to appreciate and record the multitude of factors that influence such systems. The negative trade-off, however, is superficial, because a more detailed understanding of key processes was sacrificed.

In this case, participatory research, household surveys and key informants interview were conducted simultaneously. While this allowed for a broad and inclusive analysis of key processes and linkages between them, it was impossible **to attain an in-depth** understanding of the respective processes. Some of these processes, such as the relationship between diversity and productivity **in natural** and anthropogenic landscapes, are critical to complex system research but remain poorly understood.

c. Confronting uncertainty, vs. simplification

This research sought to confront uncertainty, and to acknowledge uncertainty as an inherent property of both complex systems, and of research that incorporates local knowledge. However, results obtained in this way are often difficult to validate through traditional scientific methods. Thus, a significant trade-off was made between simple data that lends itself to validation, and more integrated and broad-based information that is more difficult to disaggregate and test statistically, but which provides a more realistic reflection of the relationships between drivers of change both exogenous and endogenous.

In order to deal with the ambiguity that this approach generated, the researcher sought to validate information through the validation of results by both the communities involved, and through quantitative research techniques such as household and biological surveys. Local knowledge was treated **as an** equally powerful source of knowledge, and was therefore subjected to scientific cross validation through quantitative surveys and **relevant literature**. Although scientific rigor is a significant trade-off in participatory local level studies even then ; this process of validation also has the positive effect of encouraging deliberative and reflexive **learning as** local participants are forced to debate responses **and opinions**.

Therefore, all of these trade-offs were acknowledged **at the outset** of the research process. Overall, pre-designed frameworks became an indispensable tool in dealing with the complexity that a social-ecological system approach presented. For this reason, alternative perspectives on human-environment relationships, for example those based on local cosmologies have not been included, although mentioned made throughout this thesis when these perspectives offer something particularly **relevant** to the study. Finally, while quantitative techniques and tools have been incorporated **into** the study, confronting uncertainty was considered a key challenge. Therefore, on the whole, the study has relied predominantly on integrated and broad-based information about the processes taking place.

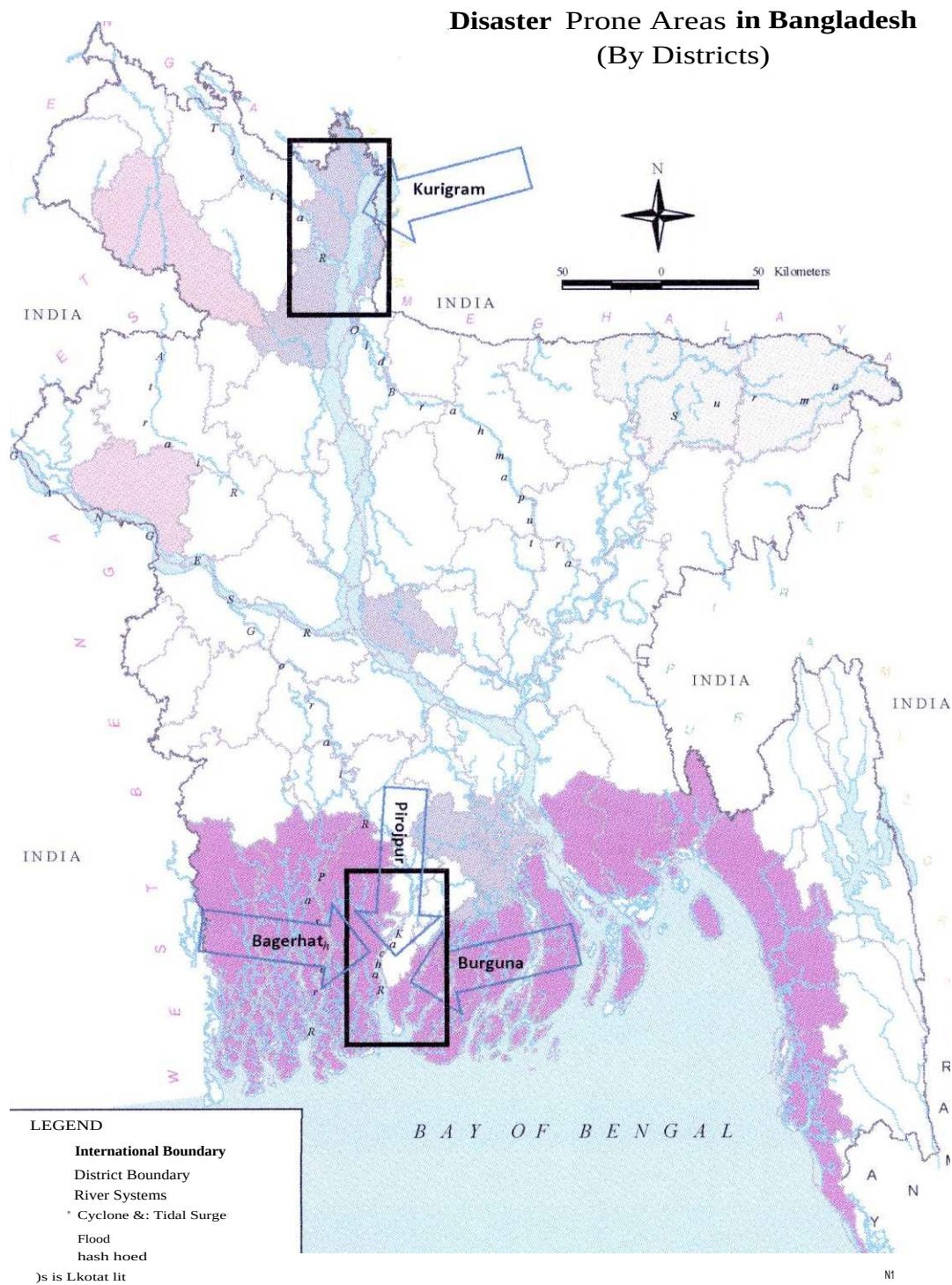
CHAPTER 03. OVERVIEW OF STUDY AREAS

3.1 SELECTION OF STUDY AREAS

The acute natural hazard in terms of people exposed and damage in contexts of our country are Flood and Cyclone. The associated secondary with these hazards are river erosion and storm surge. For a successful endeavor of this study areas subjected to severe flood and cyclone are chosen; to bridge the gap between approaches and conceptual framework. This chapter provides description of the study areas on which the following chapters are based apart from introductory chapter, and where necessary, additional information is provided within each of the following chapters.

The study areas chosen for flood hazard were Nageswari, Ulipur, Chilmari Burungatnari upzilas. All are in Kurigram district adjacent to river Lira Hinaputra and Dudkumar; on the coastal part areas chosen for cyclone hazard are Pathaghata, Mithbaria, Sarankhola and Morelgong upzila are in Burguna and Bagerhat and Pirojpur districts adjacent to river Baleswar.

Although the study areas, which are focus of this thesis fall under different Upazilas and districts but they are geographically adjacent to one another, they fall within alongside of Bhramaputra, Dudkumar and Baleswar River Basin.



ylap 3.1: Location map of Study ;Areas

3.2 RATIONALE FOR THE SELECTION OF THE STUDY AREA

The riveruic study area along side of Brahmaputra and I)udkuinar river basiii is a part of 'l'ista floodplain; which is recognised as the largest floodplain also a region of major climatic, topographical and geological transition, due to seasonal flooding, drought and river erosion. On the other hand the coastal part of study area along side of river Baleswar basin is part of Ganges tidal floodplain consisting one of the largest mangrove ecosystem of the world.

't'able: 3.1 the study areas

Type of major Districts			Upazila		Area in
Hazard					Sq. Km.
Flood	and	River	Kurigram	Nageswari	416
Erosion			I' urigram	Ulipur	504
			kurigram	C hillnari	225
			Kurigrarn	Bhruntramart	236
Cyclone	and	Burguna		Patharghata	387
Strom surge		Pirojpur	i\ latlibaria		353
		Bagerhat	Saranl:hola		757
		Bagerhat	iorrelgong		461

The livelihood of millions of people depends on the healthy and functioning ecosystems of the selected study areas. Over the years; river erosion, regular flooding, cyclone like Sidr and \ila has a significant contribution on changing the dynamic equilibrium between ecosystem and livelihood. Moreover inhabitants of these areas are considered as most at risk community to disaster and also experienced the devastation of disasters through out their life time. focusing on most affected upzillas in slow on set disaster like flood and river erosion and rapid on set disaster such as cyclone and storm

surge based on national statistics 8 upzillas on both categories were chosen. Therefore the areas were purposely chosen to fulfill the focus and objectives of the study.

Considering the major types of hazards and geographical setting the study were grouped into two; riverine and coastal part. This is also done to reveal a comparative view among the study areas. Based on the hazard ty-1)c a brief overview of study areas dawn out on following headings.

- Riverine **area** : subjected to flood **and river erosion**
- Coastal **area** : **subjected** to cyclone and storm surge

3.3 HI VI "RI NF STUDY ARFA: SUBJLC;TED'1'O FLOOD T UAI_\'RD

The study area is located in the northern part of Kurigram district in the north-western region of Bangladesh. The area is hounded in the north by the abandoned railway line, iii the east and south-east by the I7udkumar and the Brahmaputra river respectively, in the west and south-west by the l)harla river and in the north-west by the international boarder with India. The study area covers Nageswari, Llipur, Chilmari and Bhrwigamari Lpazila. The gross area of study is about 42,800 sq.km with 839000 population (BBS,2007).

3.3.1 Communications

The surveyed area is well provided with almost all kinds of communications. The main Dhaka- Ramna (Chilmari) railway and Dhaka -- Chilmari bus route connects with capital city. The surveyed areas are mainly depended on water communication for local transportations. Aumerous rivers channels support traffics by motor boats and country boats through the year. Besides this the areas arc directly connected with huri rain radar and with other adjacent zilas by road. As the entire areas are connected with metalled and non metalled roads; public buses, rickshaws, bullock carts, and motor vehicles are available for local transportation.

3.3.2 Climate

The area has a pronounced tropical monsoon climate. There are three main seasons: the monsoon season from June to October which is warm and humid and during which about 80 percent of total annual rainfall is received; the winter, from November to February during which very little rainfall occurs and has the lowest temperature and humidities of the year; and the pre-monsoon, from March to May which is hot and has periodic thunder - showers.

The mean monthly temperature at Kurigram varies from about 65°F in January to 85°F in April and May, the mean annual temperature is about 78.5°F. Absolute maximum temperature of 111°F and 43°C have been recorded in the months of May and February respectively. During the monsoon season mean temperatures are in the eighties. Absolute maximum rainfall is about 100 inches, absolute minimum about 45 inches and mean annual rainfall is about 70 inches. (BBS, 2007)



Map 3.2 : Kurigram District, featuring the riverine part of the study area

Source: <http://banglapedia.org/i/Lips>

Winds are ordinarily light through the year, except in the hot season, March to May when North - west wind up to 50 miles per hour may occur in association with thunder storm. Occasional had storms may occur in this period as well, when crops, livestock and property may be damaged. The cyclone storms originating in the Bay of Bengal during April and May and October and November which affect the southern part of Bangladesh do not reach this area.

3.3.3 Geology and Landforms

All of the surveyed area is covered by the floodplain which is dominated by silt and clay sized particles sediments. Most of the flood plain area has a very gently undulating topography. Physically, the floodplain stretches between the Himalayan Piedmont Plain in the west and the right-bank of the north-south flowing Brahmaputra in the east. The diversity results from the fact that the floodplain has occupied and abandoned several different channels during the past few thousand years. The small floodplains of Jaldhikumar, Darda and Jangadhar rivers are included in this floodplain. The main geomorphic agent of this unit is river floodplain also a part of Brahmaputra. This river along with the others brings sediments of different sizes to the floodplain at different times.

The difference in elevation between ridge and adjoining basins are slight. Elevations on the floodplain above the mean sea level range from a maximum of 57 feet in north east to a minimum of less than 35 feet in south east.

The flood plain comprises numerous Chars (Temporary Island) and filled channels in the bridge of Brahmaputra. River together with alluvial land adjoining it. Chars and area adjoining active river channels or new alluvial deposition. The deposits are stratified sand and silts and the relief is irregular with relatively high ridge separated and depressions. Adjoining floodplain is less level to change by river corrosion and receive new alluvial deposit only periodically.

3.3.4 Hydrology

The most significant feature of the hydrology in relation to agriculture development of the surveyed area is the seasonal flooding which affects about 80 percent of the total area. Flooding is mainly due to the accumulation of rain water except over small areas along Brahmaputra and river which are affected by overbank flow from these rivers. Rainfall directly affects the ground water table which often rises above ground level during the period of heavy rainfall in the monsoon season. In the vicinity of the rivers, it appears that the flood water is unable to drain away because of the high river levels during the rainy season.

About 80 percent of the total area is flooded to varying depths for 3-7 months during the monsoon season. The surface drainage system of the survey area is mainly provided by a series of rivers such as Jorala, and Jodhkumar.

3.3.5 Vegetation and Land use

Most of the area is under cultivation, but natural vegetation remains in several small areas. Mixed forest, scrubs and replanted Gazari and Sal occupy patch areas. Floodplain soil was probably covered with grassland. Crops are grown almost everywhere and farming practices have strongly influenced the present vegetation.

The present land use is mainly determined by elevation of the land in relation to the duration and depth of seasonal flooding and by the availability of soil moisture in the dry season. Rice mainly Aus and transplanted Amati (1-aman) is by far the most extensive crops in the floodplains, where the land is only shallowly flooded or water can be kept on the land by artificial field builds, farmers grow Aus followed by 'T'- aman. Where sufficient dry season moisture is available. A dry land crop is often grown after the aman harvest. Where flooding becomes too deep for T- aman, or where rapid rise of the flood level may cause loss of crops in most years, deep water deep water Amaze. Sometime mixed Aus is grown. Basin areas with sufficient water for dry season irrigating are used for Boro cultivation.

Jute is the principal cash crop and usually- replaced about 15 - 20 percent the Aus crop in the *flood* plain areas. Locally the sugar cane is important the rabi crops grown include chilies, khaesri, lentil, wheat , potato , mustard and maskalai .

Man made platform and home stead are used for vegetables, bananas, fruit trees, betel-
vain and seed bed for aman rice.

3.3.6 Flood Protection and Drainage

The total surveyed areas are severely subjected to seasonal flood upto on average 2-5 feet for 4 -5 months during monsoon season. 't'hrough out most of the area flood controls measures are observed; which include embanking the rivers, blocking the creeks traversing the land. All theses measures are part of Kurignam Flood control project.

The huriorram Flood Control project was started with the main aim of increasing agricultural production by means of flood control, improved drainage and irrig, tion. The study recommended, for the North Unit, construction of earthen embankment along the right bank of the Brahmaputra and the Dudkumar, and both banks of the Dharla river to provide flood protection to a gross area of about 103,500 acres (41,900 ha); construction of four drainage sluices for efficient drainage of runoff generated due to internal rainfall and diversion of Dudkumar water for gravity irrigation to I, list irrigable area of about 74,000 acres (29,960 lha) by a pumping station at Pateswari having a capacity of 2028 cfs (57.43 m³/s.). (BBS, 2007)

3.4 STUDY AREA B: SUBJECTED TO CYCLONE HAZARD

The study area comprises four upazilas njamely Patharghata, Alathbaria, Sarankhola and Morrelg,nj respectively located in 13urguna, Pirojpur and Bagerhat districts of Sothern part of Bangladesh. The study area of around 2800 sq gun facing Bay of Bengal on the south and Mlongla upzila on the west. Common river of this area is Balleshwar,; which is crossed between all the upzillas and fall in Bay of Bengal, Bishkhali Haringhata and Chandpai are others major rivers . The Sundarban covers

major area of the Patharghata upazila. The gross population of the area is around 890,000.

3.4.1 Communications

The surveyed areas are almost entirely depended on water communication for local transportations. Numerous rivers and creeks support extensive traffics by motor lunches and country boats through the year Lunch services are available with district level. Besides this the areas are directly connected with hhulna and Dhaka by regular bus services. Entire areas are connected with metalled and non metalled roads where public buses, rickshaws, bullock carts , houses and country boats are the common means for local transportation .

3.4.2 Climate

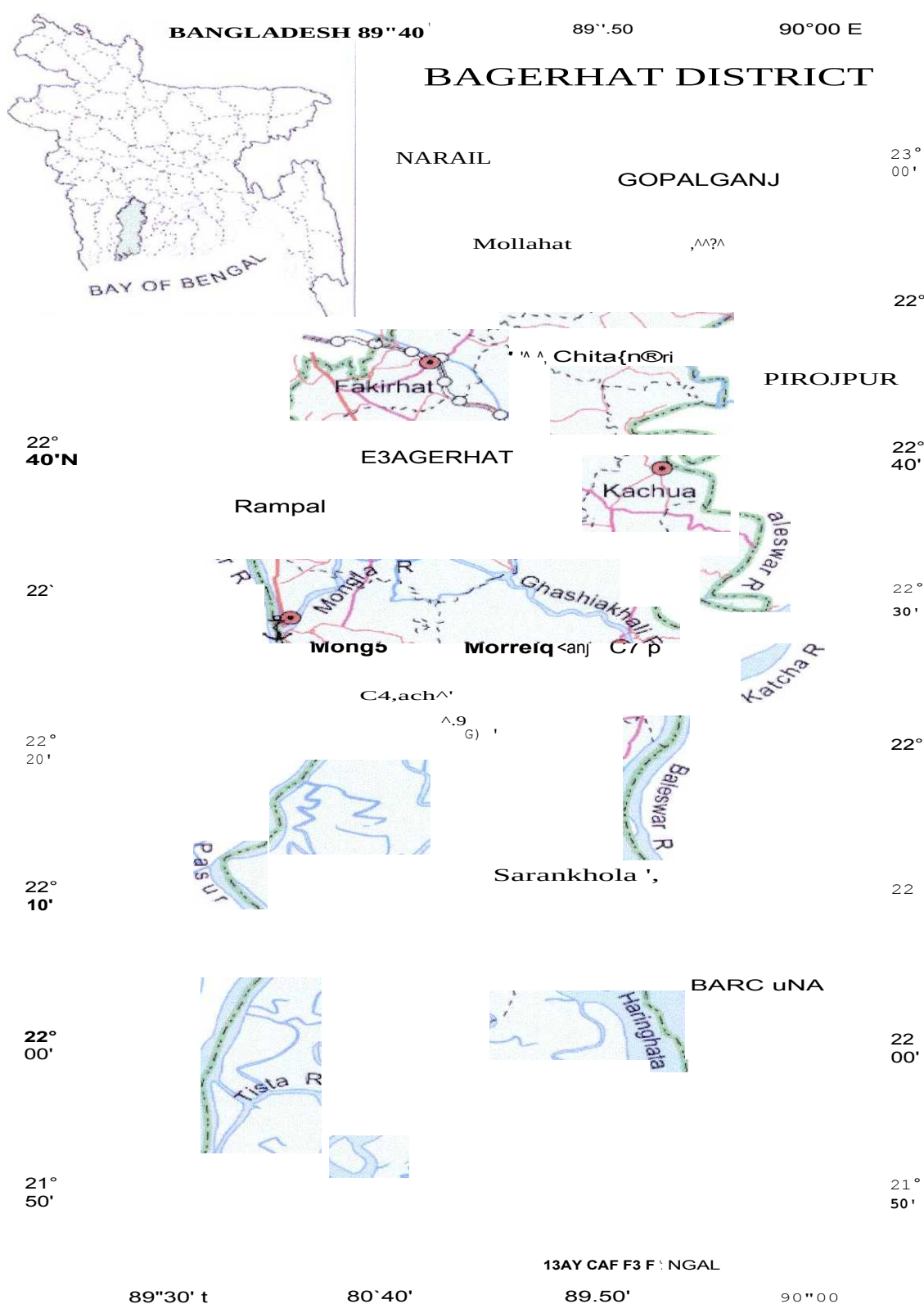
The area has pronounced tropical monsoon climate. 't'here are three main seasons; the monsoon (or rainy) seasons from June to October which is warm and humid and during which about 77 percent of the total annual rainfall is received; the winter (or dry) season from November to l'ebruaiy during which very little rainfall occurs and has the lowest temperatures and evaporation rates of the year and during which occasional thunder showers fall.

Mean **monthly temperature at hhulna town varies from about 68 1 in January to about 86°F in April and May. Mean annual temperature is about 79°E. Absolute maximum temperature of 105° E has been recorded in the months of April and may** whereas the **absolute minimum temperature of 47°N' had been recorded in the month of January.** (BBS,2007)

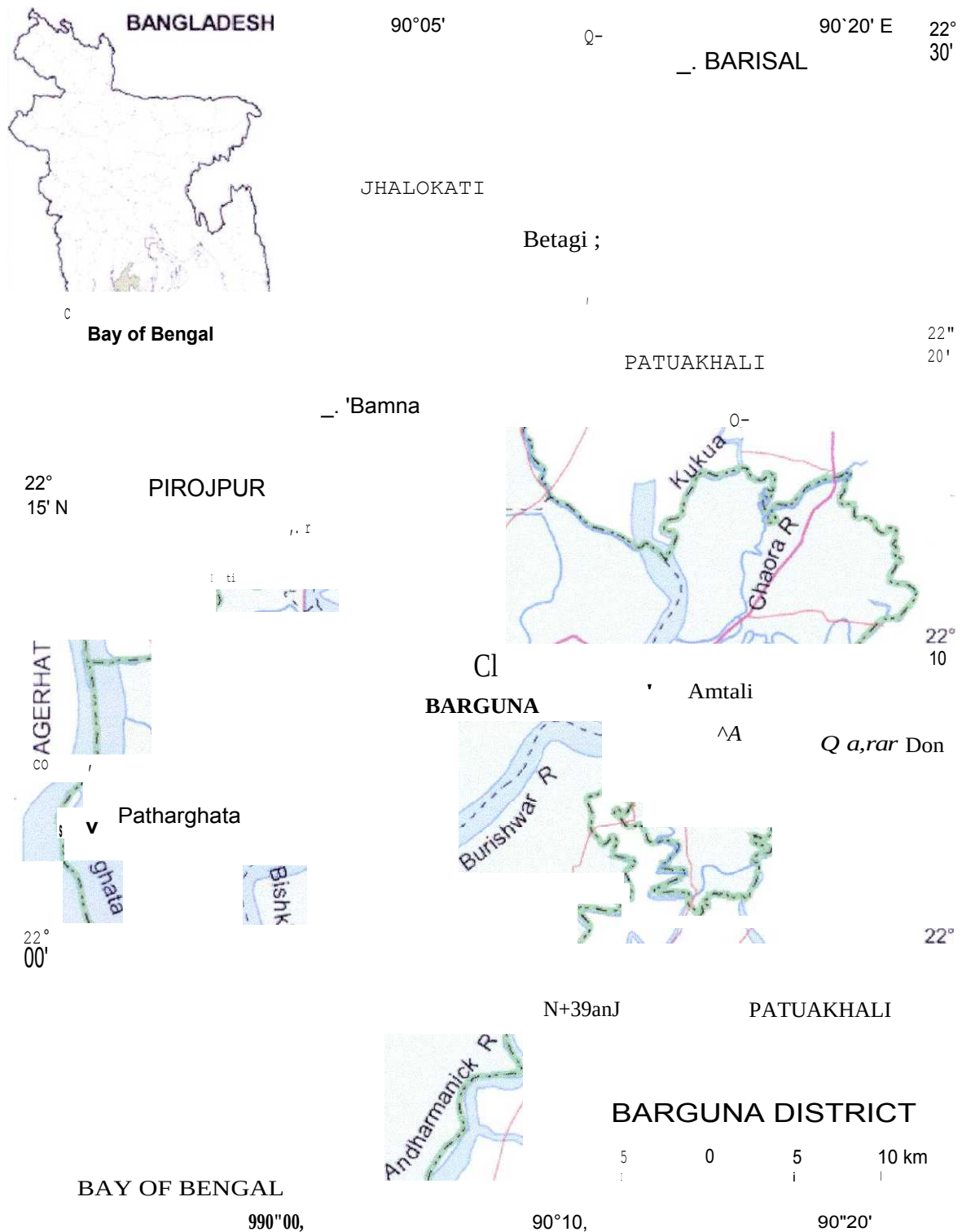
Absolute **maximum rainfall is about 106 inches ; absolute minimum about 48 inches and mean annual rainfall recorded is about 67 inches. During monsoon season about 51 inches annual rainfall is received and the excess of mean rainfall over evaporation in the rainy season is about 29 inches. The mean annual evaporation is about 54 inches. The highest recorded is 90 percent in July and 72 percent in February.**

Winds are ordinarily light throughout the year but stronger winds blow for short periods in the pre monsoon season often in association with thunderstorms and occasionally with hail. These storms may cause damage to crops, livestock and property.

The climatic data referred to have are indicative. Normal duration of the rainy season (monsoon) as well as distribution of the rainfall varies from , year to year and no kind of periodicity could be established between droughty years or per humid or flood year. In some years short spells of drought and flood alternate (which have significant influence on agriculture) without materially affecting the total rainfall of the season.

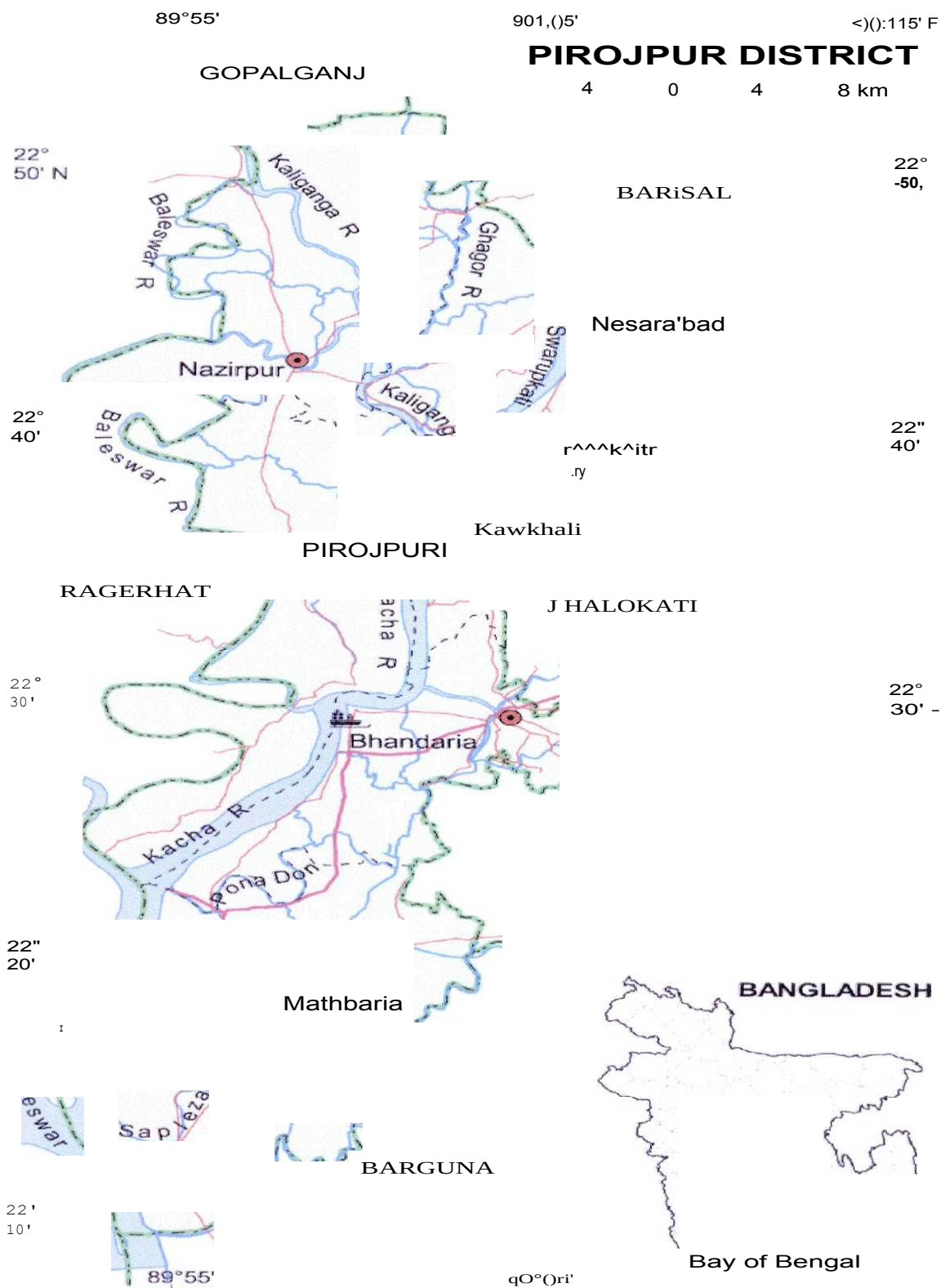


Map 3.3 : Bagherhat District, featuring the coastal part of the study area



Map 3.4 : Barguna District, featuring the coastal part of the study area

,ourcc: [http://l^^n hipcdi^\).or /Maps](http://l^^n hipcdi^).or /Maps)



Map 3.5: Pirojpur District, featuring the coastal part of the study area

Source: <http://banglipedia.org/wiki/ips>

3.4.3 Geology and landforms

The study area comprises a landscape of mixed meander and tidal floodplains consisting of ridges and basins. In some places ridges are slightly irregular, gently undulation. It is crossed by innumerable tidal rivers and creeks. The landscapes comprise low-lying flat broad basins bounded by narrow ridges along creek and channels.

The river Baleswar basin soils are usually grey to dark grey, strongly structured clays, whereas the ridge soils are mostly silty clay loam to silty clays. The soils of this part may or may not be calcareous in the profile. In the basin depressions, calcareous soils are predominant. In the areas not completely protected from the saline water tidal flooding, the soils are mostly saline. Decalcification is apparently unrelated to salinization since tidal deposits are decalcified in saline and non-saline conditions. It seems to take place during soil formation, as the sediments slowly accumulate in the basins, since the topsoils on such land are acidic in nature, in some areas buried peaty or mucky layers occur within the profile.

3.4.4 Hydrology

The most significant features of hydrology in relation to agriculture development of the surveyed area is the seasonal flooding which affects about 85 percent of the total area. The areas within the embankments are flooded mainly by rainwater. Rainfall directly affects the ground water table, which often rises above ground level during the period of heavy rainfall in the monsoon season.

Improvement in aquaculture or continuous cultivation would require more water than is available. Now the possibility of storing fresh water for irrigation by closing creeks in the saline area to be investigated. Ground water resources for tube-well irrigation also need investigation.

3.4.5 Vegetation and land use

Due to intensive cultivation no evidence of natural vegetation in the surveyed area is seen except a very minor area outside embankments is covered by mangrove vegetations. Crops are grown almost everywhere and farming practices have strongly influenced the present vegetation. Most of the surveyed area is under single cropped. Due to dry -season salinity no Rabi or Aus crops are grown in the tidal floodplain. Besides T-aman and ITI'V aman minor area is used for Jute production

3.4.6 Coastal embankments

The surveyed areas are protected from saline water flooding by coastal embankments. These areas were inundated by saline tidal water for most or all of the year before the completion of the embankment and during cyclone and storm surge. The ultimate aims and objective of coastal embankment are to reclaim the salinity of the soils, so that the cropping intensity and agricultural production can be effectively raised up. With the provision of tidal sluices in the embankment, salt water can be excluded from the areas and flooding caused by monsoon rainfall can be regulated. Also, evacuation of this rain-water flooding is expected to leach out salts present in the soils so that they become suitable for rice cultivations throughout the kharif season and possibly also for cultivating of dry land Rabi crops.

Some problems have developed in the embanked area. After the heavy rainfall in the monsoon season, the height of the water rises up in the basins and damages the transplanted aman crop. As land level inside the polder area is not uniform, excess water on the upper accumulates on the lower parts of the landscape and as consequents the basin centers are too deeply flooded for transplanted rice crop. On the other hand, if the depth of water in the basin centers is restricted in an optimum depth of less than one foot, then higher margins will suffer from inadequate flooding. This problem might be alleviated by the provision of subsidiary builds and sluices within the polder so that all the land retains optimum depth of the water. Also the main sluices may have to be made reversible, so that river water can enter the polder at times of the year when in

non - saline so as to maintain adequate water level on the land during periods of inadequate monsoon rainfall.

Necessary measures are to be taken up for the proper maintenance of the embankments. Planting of Mangrove forest along the edge of the embankments might the storm waves beating against them.

3.4.7 Salinity

The surveyed area are usually slightly to moderately saline and moderately to strongly saline in the degree of salinity is very- variable locally, usually- the basin soils are more saline than the, ridge soils.

The salts have apparently been derived mainly- from regular tidal flooding by saline water- The water in the main rivers is fresh almost to their mouth at the highest of the monsoon season flood. But salt water gradually penetrates further inland during the, dry season.

The aims and object of coastal embankment project is to protect the land from saline tidal water flooding. Reclamation of these soils may be hastened by providing a net work of drains connects with sluice. Deep drains would keep down the ground water table and reduce the risk of re-salinization by capillary- movement of salt water during the dry season. The fresh rain water of monsoon may develop a sweet ground water table.

Because of the constriction of the coastal embankments along major river, there is possibility that salt water may penetrate further in land than at past because the tidal flow will be concentrated within the channels instead of spreading out over the land presently subject to flooding at high tides.

Eventually, the area affected by salt water flooding may need to be reclaimed for continuous crop production by the closure of the main estuarine channels to exclude saline water by construction of coastal embankments.

3.4.8 Cropping system and land use

Rice, mainly transplanted aman and broadcast .\us is by far the most ostensive crop grown in the surveyed area, both in terms of acreage and crop value. Til (sesamum) has recently been introduced to the extent of about 5 percent in place of ;aus or jute .wheat , kheshat mustard , linseed , barley , chilies, potatoes etc. are the main Rabi crops. Rabi and kharif vegetables such as brinjals, gourds, ladies finger, arum, cabbage, cauliflower , potato and tomato etc are grown on man- made land , highland ridges and man made land . Mostly the whole area is used for a single crop of transplanted aman. A double cropping pattern of Aus or 'T'll followed by transplanted aman is being practiced very- recently on ridges after the completion of the embankments. Locally II1-V' boro followed by transplanted aman are practiced with irrigation. (BBS,2007)

CHAPTER 04. METHODOLOGY

4.1 RESEARCH DESIGN

The research started by preparing a scientific research proposal with extensive literature review. A series of discussions with supervisor and field experts to develop the critical thinking on concepts used in this study. A draft of questionnaires was prepared and have been tested in the field in prior to the survey. A few questions have been modified after the field verification and adopted in the field for the study.

The proposal was also discussed with personnel and local stakeholders who helped in planning the fieldwork. Data was collected using the Participatory Learning Approach and methods are adopted from DFIDs sustainable livelihood guidance sheet. Compilation of necessary information, tabulation, processing and presentation were the part of the data analysis. Reporting the results and subsequent discussion led to the conclusions and recommendations. Figure 4.1 illustrate the overall research process, followed by selection of sites (see table 4.1) and methods (see table 4.2). Brief discussions of selected methods are included in this chapter for a clear perception.

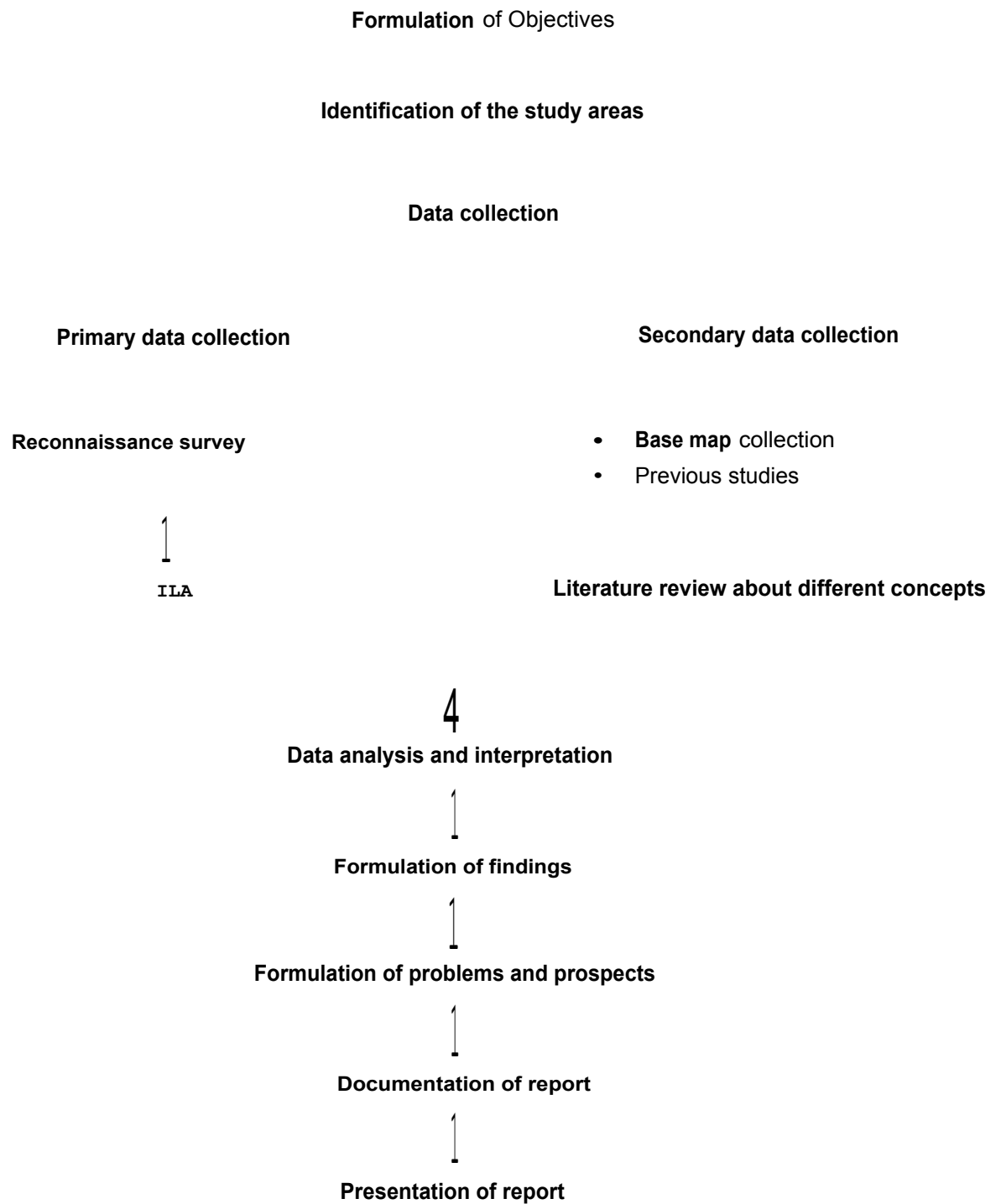


Figure 4.1: Overall research process

4.2 SITE SELECTION FOR PLA

The study was conducted in 8 upzilas of 4 districts though a total of 24 PLA with a convenient sample size of 350 respondents and 120 household. The study sites are listed in the following table 4.1. The PLA sites were selected purposely with help of local NGOs. The NGOs staffs provided support for successful completion of PLA and field investigation. The most affected sites and at risk community exposed towards disaster were chosen to fulfill the focus of the study.

Table 4.1: Featuring **selected upzilas** and number of PLA

Districts	Upazilla	No. of PLA	No. of Respondents	No. of Household
Kurigram	Nageswari	3	39	15
Kurigram	Ulipur	3	47	15
Kurigram	Chilmari	3	43	15
Kurigram	Bhrungamari	3	36	15
Barguna	Patharghata,	3	49	15
Pirojpur	Mathbaria	3	46	15
Bagerhat	Sarankhola	3	47	15
Bagerhat	Morrelgong	3	43	15
		24	350	120

4.3. METHOD SELECTION

In order to measure the different capitals of livelihood assets, assess coping and adaptive responses and options for ecosystem management in the study following methods are adopted.

Table 4.2: Featuring selected PLA methods for assessment

Secondary data collection	Livelihood Capitals Assessment (Human, social, natural , financial, physical) , Coping and adaptive strategies
Environmental Checklists	Natural Capital Assessment j Coping and adaptive strategies
House hold survey	Human Capital Assessment Coping and adaptive strategies Financial Capital Assessment Physical Capital Assessment
Interviews (Group, focus group, key informants)	Natural Capital Assessment Coping and adaptive strategies
Individual and household case studies	Human Capital Assessment Financial Capital Assessment Physical Capital Assessment
Preference ranking	Financial Capital Assessment Natural Capital Assessment
Transect walks	Natural Capital Assessment Coping and adaptive strategies
T'rendlines	Natural Capital Assessment Coping and adaptive strategies

J

4.3.1 Environmental checklists

Environmental checklists containing information, peoples preferences and reasons for these preferences regarding environment. It is also very useful tool that can be used to summarize a great deal of information regarding a range of issues, from species preferences to seasonal variability in harvesting levels. (DFID, 1999).

4.3.2 Household Surveys

Household surveys benefits research by providing in depth and detail view of focus of the study in less time consuming manner . The trade-off is this method is the final results are often less certain. Household surveys are often conducted on a random basis, are a well-known technique that enables researchers to make inferences regarding the population in question or study (Chambers, 1992).

4.3.3 Focus group interviews

Focus group interviews are semi-structured discussions with a group of people who share a common feature. Although it was developed initially in market-oriented research, since the 1980's focus group interviews have been used increasingly in participatory research, particularly in research seeking to identify and describe group perceptions and attitudes (Chambers, 1992).

4.3.4 Key informant interviews

Key informant interviews are either structured or semi-structured interviews with individuals who are knowledgeable about a particular issue. Key informant interviews are aimed at key people that hold specialized information that others don't have (Chambers, 1992).

4.3.5 Group discussions

Group discussions are unstructured discussions around a key theme. "These discussions are conducted in a relaxed setting, and are usually used to follow up on sensitive issues raised during other exercises (Chambers, 1992;). Group discussions are especially useful to introduce new topics, and to get participants involved in thinking critically about key issues.

4.3.6 Preference Ranking

Preference Ranking involves placing issues or objects in order of significance. Ranking can be used to determine the relative importance attached to various choices, activities, environmental attributes, and stakeholders. The actual rank is not as important as the comments and the debates that are generated during the exercise. An example is wealth ranking, a type of socio-economic community profile, and is important because socio-economic inequalities influence people's behaviors, coping strategies, and views (DFID, 2000).

4.3.7 Transect walks

Transect walks are used to determine the validity /accuracy of local knowledge. Transect walks are conducted through a rapid observation of the whole survey area and random questionings of local people without control or focus group discussion participants (Chambers, 1992).

4.3.8 Trendlines

Trendlines are used to demonstrate trends in resource use, resource management, ecosystem health, co-operation between farmers, and so on. The example of the trend line constructed to change in resource management and ecosystem health (Chambers, 1992).

4.3.9. Secondary data collection

Review of literature of relevant concepts and approach applied for livelihood restoration and ecosystem management was the first step of the secondary data collection. Later on the documentation of livelihood programs conducted by different local and international organizations were studied. Field base map and other necessary data were collected from University library, different government office libraries and local NGOs project office.



Household Survey



Individual case study



Checklists



Group interview



Key informants



Focus group discussion



Trendlines



Transect walk

Plate 4.1: Featuring different PLA methods

4.4 DATA NORMALIZING AND ANALYSIS

The quantitative data obtained from the field was first coded, then the data entry process was done using an appropriate computer package , namely "Statistical Package for Social Sciences (SPSS)", which facilitates the process of data analysis in a more precise and appropriate way (SPSS, ver.15). Statistical tools such as the correlation and analysis of variance to test the differences in significance. Furthermore, simple statistics such as percentage count were used to analyze the socio-economic data gathered from the household survey. Microsoft Excel was also used for producing descriptive statistics in form of bars diagrams, pie charts and tabular form. In addition, Livelihood Assets pentagon was analyzed by following guidelines provided by DIFDs guidance note 10.

4.5. LIMITATION OF THE STUDY

- a) Every study needs sufficient time to explore and find ground state reality relating to the specific field of study. The study duration was only three months, which was not sufficient to find out the optimum amount of data for analysis.
- b) Respondents were very busy in their daily activities that did not correspond with my study time; getting information on time with related person was difficult.
- c) The respondents did not want to tell openly regarding their house hold income also in mind they expected some immediate benefits from the survey . In most cases it was not a problem as the enumerator had good communication skills, but in a few cases respondents were not entirely co-operative.
- d) It is general practice to limit the size of a questionnaire to interviewing time of about 30 minutes . But it took more than 30 minutes to administer the main questionnaire.

CHAPTER 05. RESULTS AND DISCUSSION

5.1 ASSESSMENT OF LIVELIHOOD CAPITALS

DIN1)'s livelihood framework identifies five core asset categories or types of capital upon which livelihoods are built. The livelihoods approach is concerned first and foremost with people. It seeks to gain an accurate and realistic understanding of people's strengths (assets or capital endowments) and how they endeavor to convert these into positive livelihood outcomes. The approach is founded on a belief that people require a range of assets to achieve positive livelihood outcomes; no single category of assets on its own is sufficient to yield all the many- and varied livelihood outcomes that people seek. As most of the respondents in this survey represent the at risk poor community- of our country- .Therefore, Dlhlls Sustainable livelihood model is chosen for livelihood analysis of them; keeping in mind that respondents access to any given assets category tends to be very limited. The asset pentagon analysis is followed by the livelihood assessment at the end of this section.

5.1.1 Human Capital

Human capital represents the skills, knowledge, ability to labour or occupation and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives. At household level human capital is a factor of the amount and quality of labour available; this varies according to household size, health status, etc. the results of human capital obtained through household survey is presented as follow.

1.5.1 HH size and composition

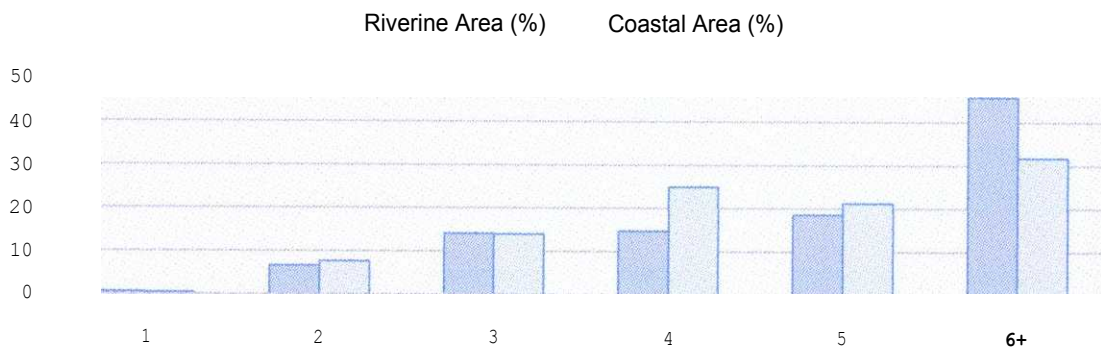
The average household size of riverme study area; which represents a part of Kurigram District is 5.5. This is **significantly** higher than the national average of 4.9 (BBS). This might be the contrary to the conventional wisdom that poor households have a larger household size in agro-economy. The observation reveals around 45.7% of family size remains above 6+ members. On the other hand average household size of

coastal hart; which represents the coastal part is 4.9. The average maximum family, size. remains in between 4 to 5 for both areas.

Table 5.1: **Featuring household composition of the study areas**

|--|--|

Household Composition



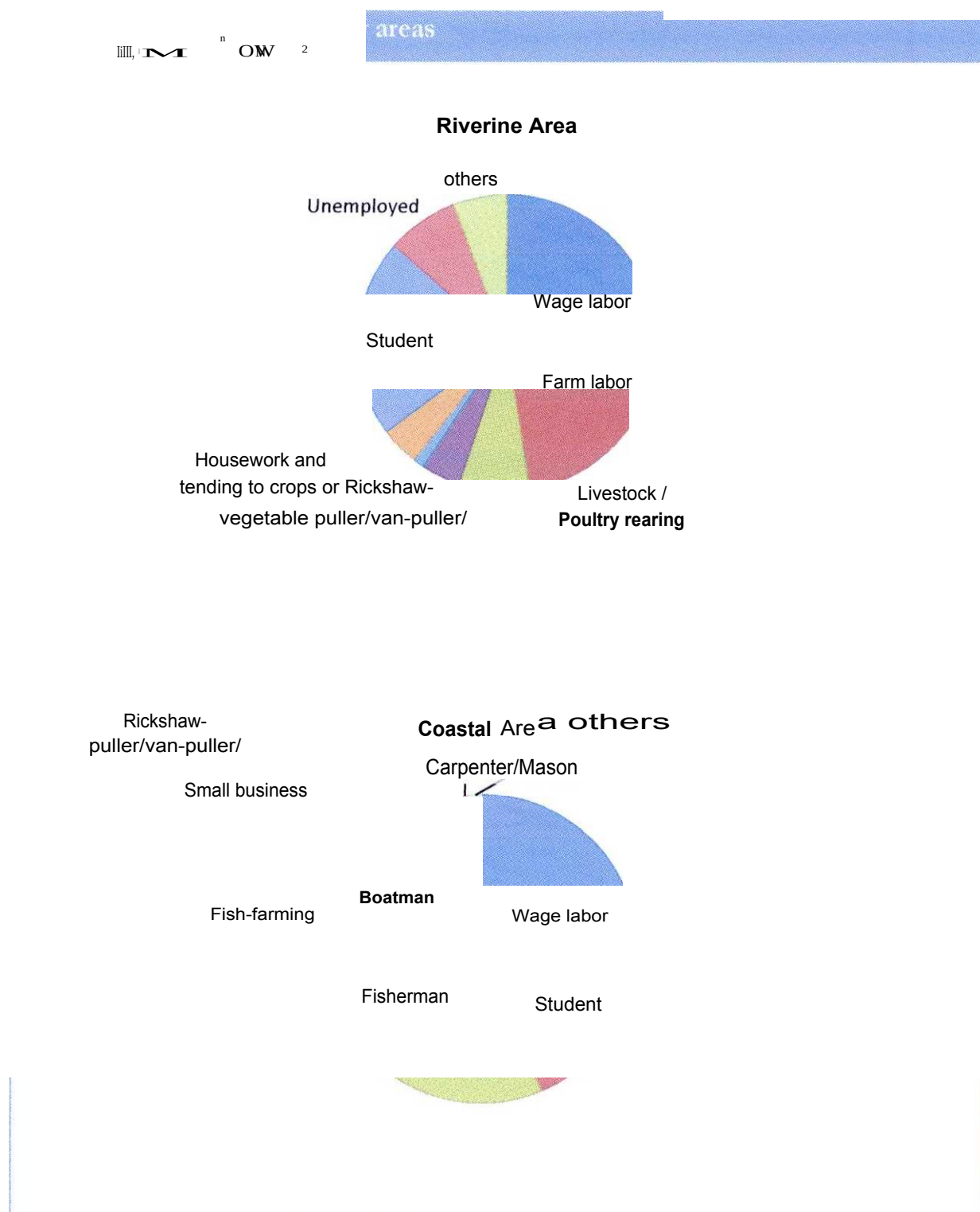
	Riverine :rca	Coastal Area
Number of members		
1	0.6	0.5
2	6.6	7.6
3	14.1	14.0
4	14.7	24.9
5	18.6	21.3
6+	45.7	31.7
Total	100.0	100.0
Mean Size of I lousehold	5.5	4.9
5.1.5.2 Main occupation		

The major occupation of both the study areas is wage labour on daily basis either in agricultural field or fishing boat. Details are as follows:

- 25.2 % of household heads are primarily employed as agricultural daily-wage laborers in riverine part on contrast 27.2 % in coastal part
- farm labor is 23.6 % is considered as main occupation in upstream part and in coastal part 32.8 % are fishermen.
- Livestock and poultry rearing is more practice as source of income in riverine part (7.9%) coastal part (0.5%)
- Rickshaw pulling is the main occupation of a 4.3% of households in riverine area
- Small business (4.6%) significantly is preferred by coastal people more than riverine part (1.3%)

Besides these the next most prevalent occupation for riverine area is housework and tending to crops or vegetable (4.3) and for coastal part it is Boat man (13.2) as fishing is **their main** occupation

Table 5.2: Featuring **Main occupation** of the study areas



	Riverine Area
Wage labor	25.2
farm labor	23.6
Fisherman	0.9
Fish-farming	0.5
Boatman	0.6
Livestock / Poultry- rearing	7.9
Ricksha\ v-puller/van-pulley/	4.3
Carpenter/Mason	0.7
Small business	1.3
Begging	0.2
lius, tempo, scooter driver	0.1
Job in hotel/restaurant	0.1
Housework and tending toy crops or vegetable	4.3
Student	22.3
L nemploVcd	8.0
'1'otil	100.0
<i>5.L5.3 Literacy rate</i>	

Coastal Area

Area

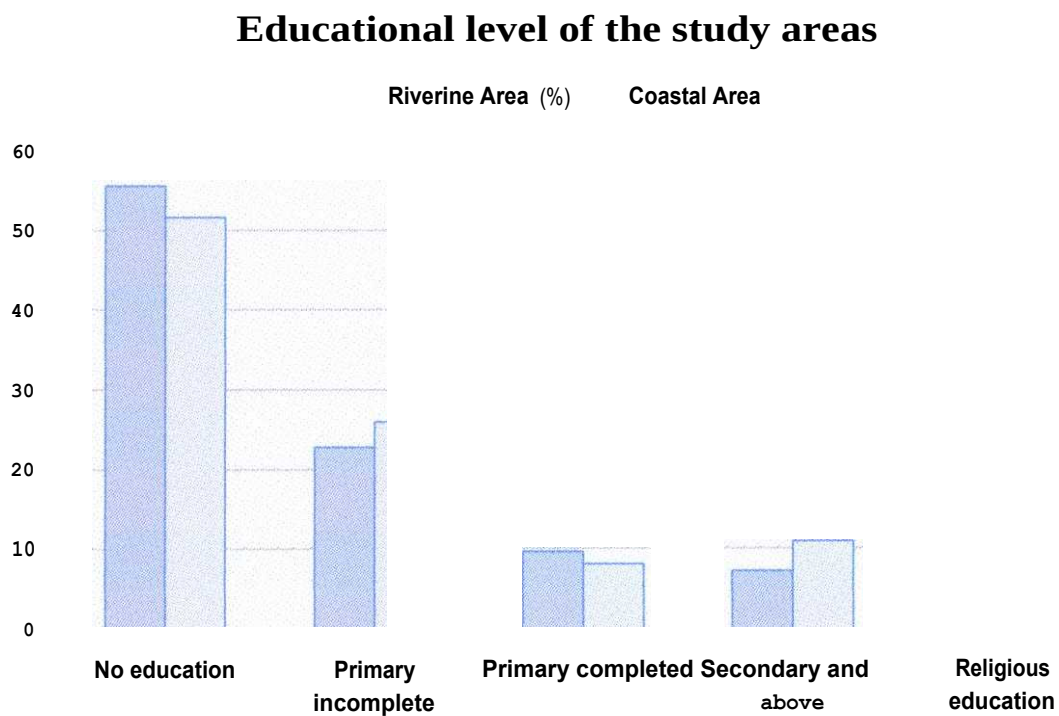
1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the problem.

The study results on literacy rate reveals a disappointing status. More than half of the populations have, to achieve any level of education. Based on preliminary- observation at field the literacy rate data were collected in five categories shown as follows -

- No education -respondents never went to school
- Primary incomplete -respondents dropped out from school before class V

- Primary complete respondents those completed class V and above
- Secondary and above - respondents those completed secondary or above

Table 5.3: Featuring educational level of the study areas

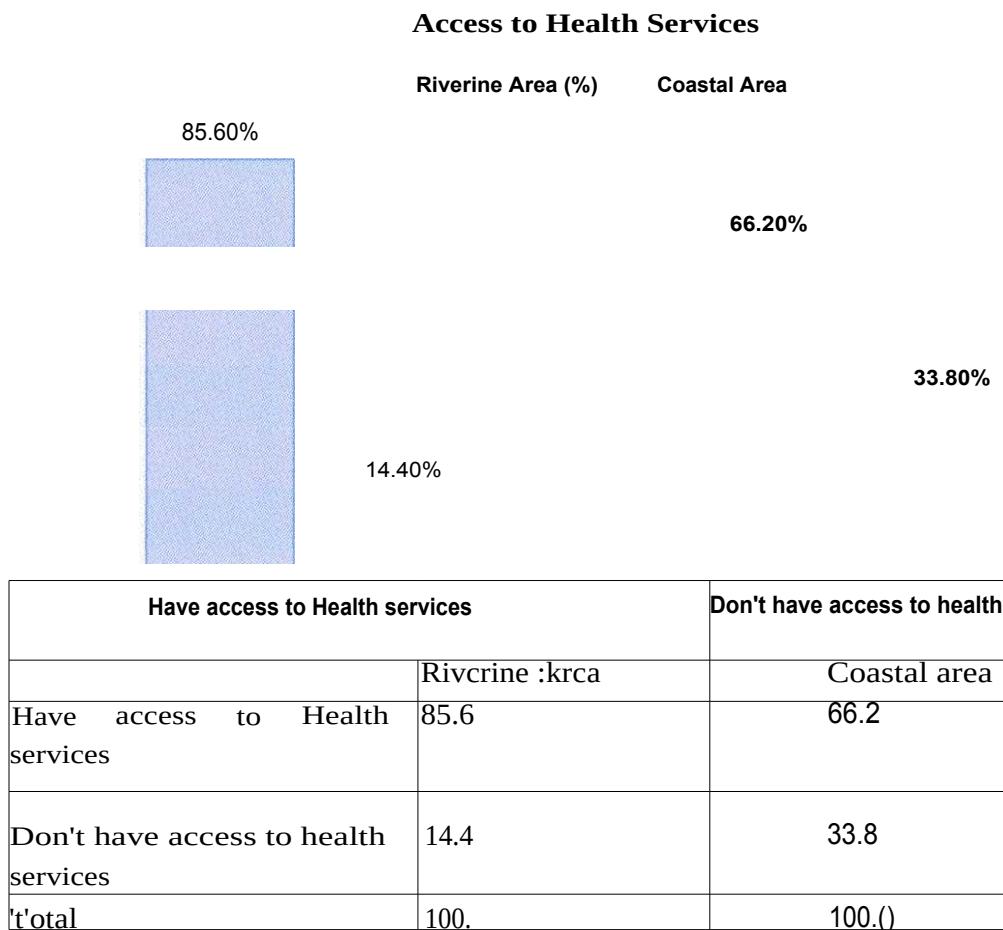


	Riverine Area	Coastal Area
No education	55.5	51.6
Primary incomplete	22.8	26.0
Primary, completed	9.6	8.1
Secondary and above	7.2	10.9
Religimis education	3.3	3.6
Total	100.0	100.0

5.1. 1.4 Access to Health Services:

The access to health services largely depend on the number of community health services centers and the means of transportation facilities available. The study observation shows about 85.6 % respondents in riverine part and 66.2 % in coastal part are deprived from access to health service. The observation figures of not having health services in study areas are higher due to poor transportation facilities. Most of the respondents of at risk community lives in char lands or far-off main land health service provider.

Table 5.4: Featuring access to health services of the study areas

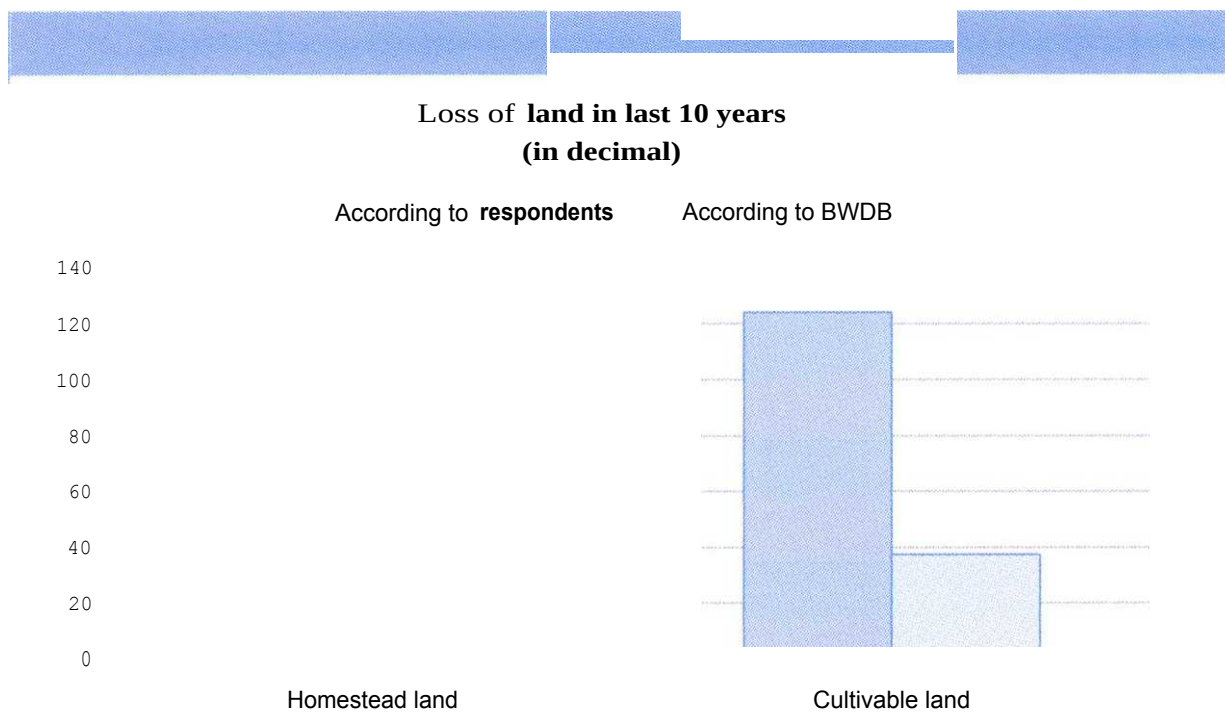


5.1.2 Natural Capital

Natural capital is the term used for the natural resource stocks from which resource flows and services (e.g. nutrient cycling, erosion protection) useful for livelihoods are derived. There is a wide variation in the resources that make up natural capital, from intangible public goods such as the atmosphere and biodiversity to divisible assets used directly for production (trees, land, etc.). Within the sustainable livelihoods framework, the relationship between **natural** capital and the Vulnerability Context is particularly close. Many of the shocks that devastate the livelihoods of the poor are themselves natural processes that destroy natural capital (e.g. Cyclone that destroy forests, floods and storm surge that destroy agricultural land) and seasonality is largely due to changes in the value or productivity of natural capital over the year. For this study the loss of major natural capitals as a result of disaster is presented in below.

5.1.2.1 Loss of land

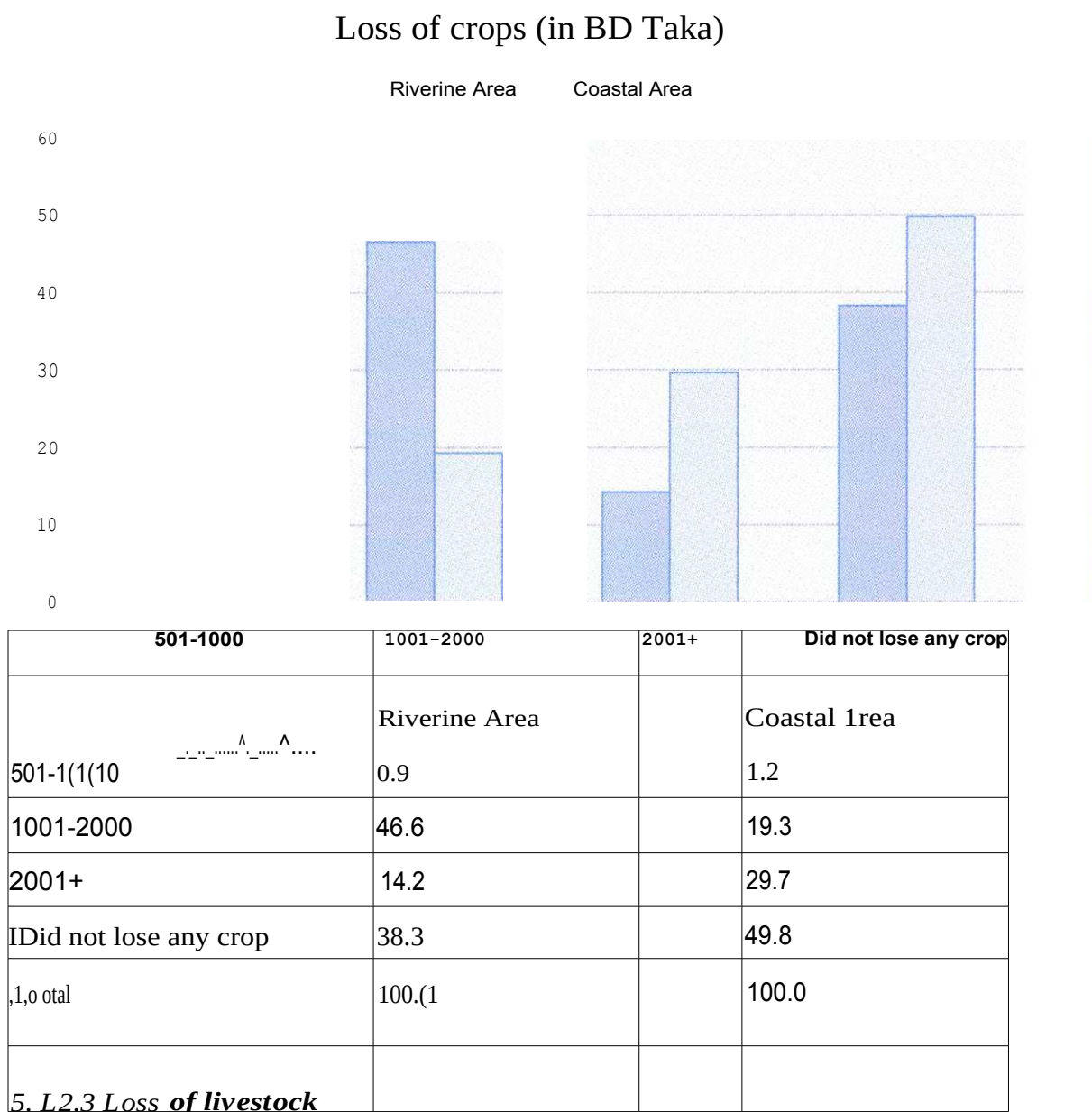
Loss of land in riverine area due to river erosion and flooding is a severe hazard that threatens the local livelihood over years. The interview and discussion with local respondents reveals that life span of char lands are in between 12 to 15 years. There are when char land went under water they lose both homestead and cultivable land. Similar scenario is observed in main land due massive river erosion. A comparison between the results gained from local respondents and Bangladesh water development board report (BWDB, 1998) is shown in below. Each year a large amount of people has to lose the houses and property due river erosion and flooding and unfortunately there is sustainable solution observed for this significant incident.

Table 5.5: Featuring loss of **land in last 10 years**

	According to respondents	According to BMTDB
Homestead land	5.1	1.9
Cultivable land	124.0	37.4
5. L2.2 Loss of crops		

Loss of crops due to flood and cyclone in study areas in terms of monetary value is presented in the following figure. The respondents in this study represent the poorest section of the society and most of them were landless. The large figure in not losing any crops usually don't have any land or didn't have any standing crops during disaster. The reason of crop loss in coastal part (29.7 %) is higher than riverine area (14.2 %) is due to the facing rapid onset disaster as cyclone then slow onset disaster like flood.

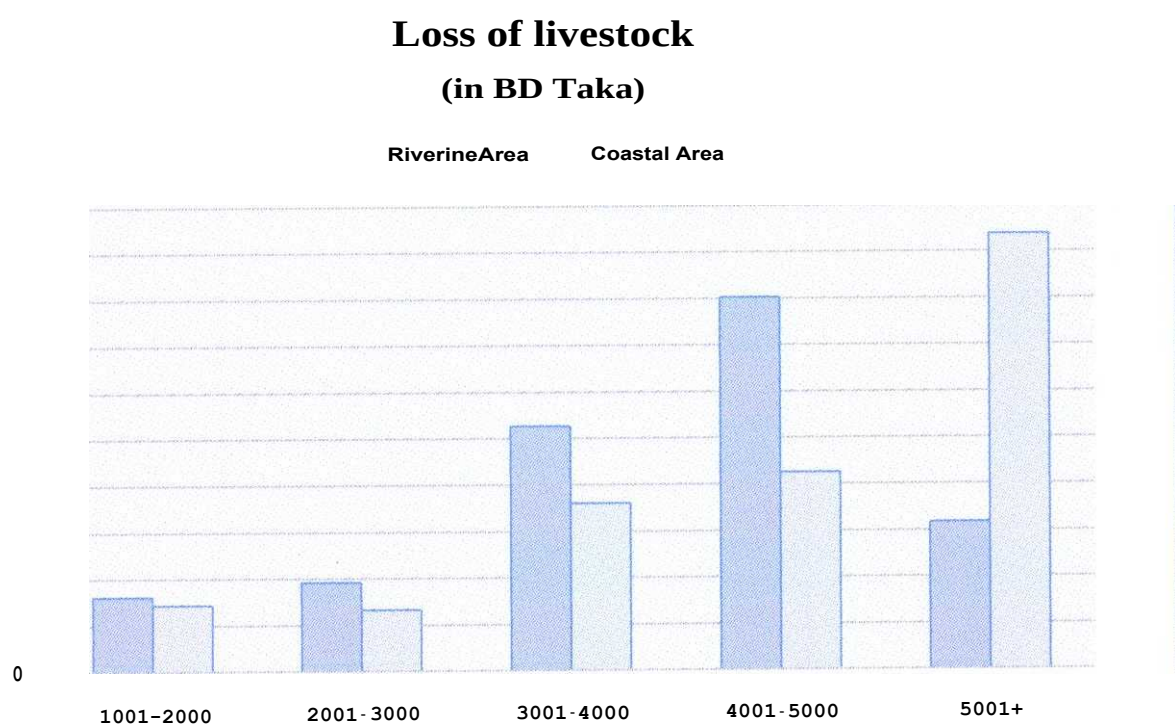
Table 5.6: Featuring loss of crops



Loss of livestock due to flood and cyclone in study areas in terms of monetary value is presented in the following figure. Apparently the observations and discussion intend that the respondents in riverine part usually tend to lose livestock more than the coastal

area. The factor of rapid and slow on set disaster might be also a reason of consideration here.

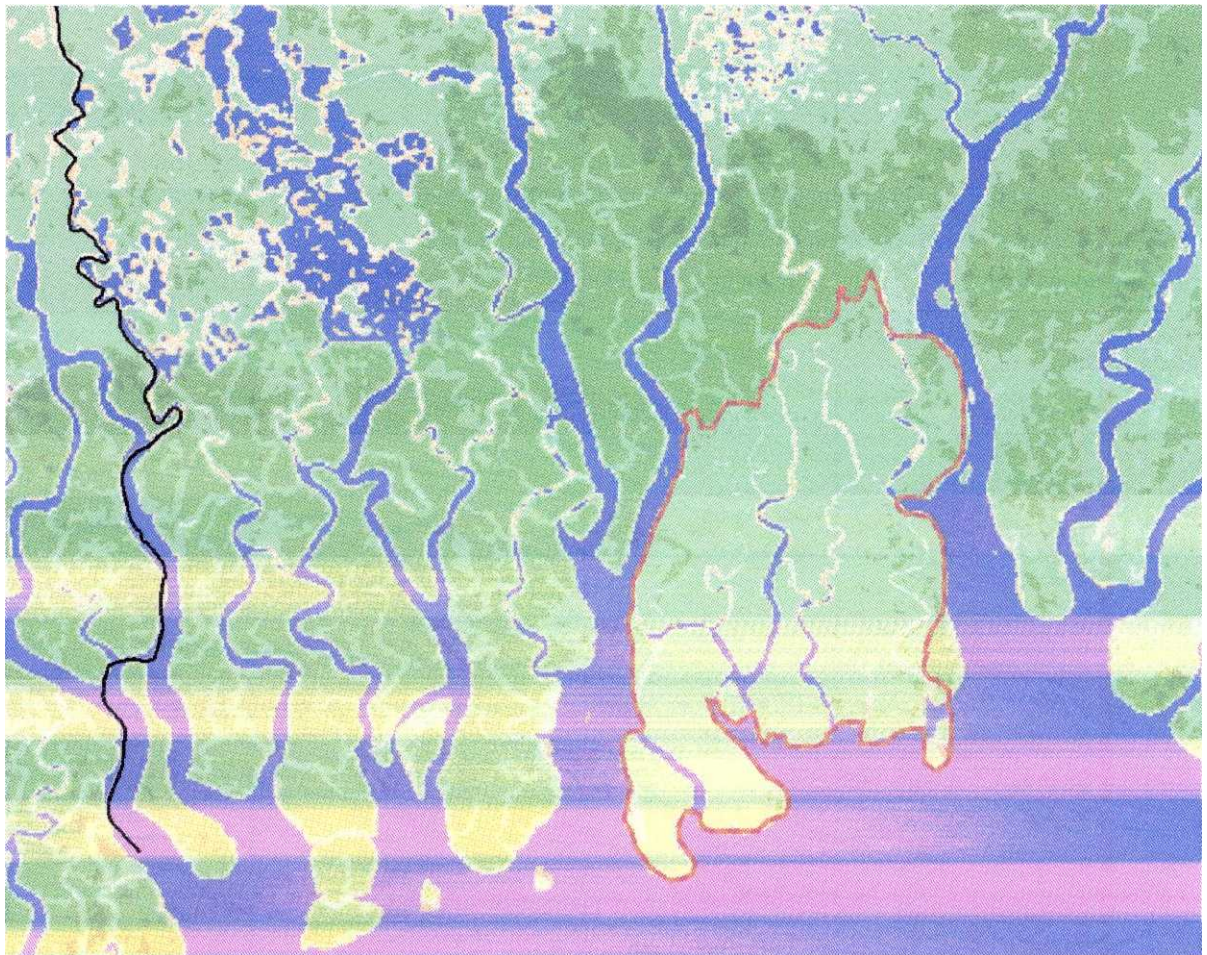
Table 5.7: Featuring loss of livestock



	RIN-emic Area	Coastal Area
1001-2000	8.1	7.2
2001-3001)	9.6	6.6
3001--1000	26.3	18.0
-1001-5000	40.1	21.3
5001+	15.9	46.9
total	100.0	100.0

5.1.2.4 Loss of woodland

loss of woodland resources is evident in both parts of the study area as a effect of disaster. In case of riverine part loss of woodland occurs mainly due to river erosion, loss of land mass and unauthorized use resources. People often clear and cut-off wood patches in anticipation of river erosion. On the other hand woodland loss 111 coastal part occurs due to unauthorized use and smuggling of mangrove trees. Super cyclone like Sidr and .Ala caused a massive destniction of woodland which was clearly observed during field visit.



Map 5.1: CTS image of Mangrove ecosystem loss in coastal part of the study area.



Plate 5.1: Destruction of mangrove ecosystem due to cyclone Sidr.
(photo reference: Prothom Alo)



Plate 5.2: Destruction of woodland (photo reference: field visit , 2009)

5.1.3 Financial Capital

Financial capital denotes the financial resources that people use to achieve their livelihood objectives. The definition used here is not economically robust in that it includes flows as well as stocks and it can contribute to consumption as well as Production. However, it has been adopted to try to capture an important livelihood building block, namely the availability of cash or equivalent, that enables people to adopt different livelihood strategies.(1)II"D - 2000)

A overview of financial capital of respondents in the study areas are represented in the following headings.

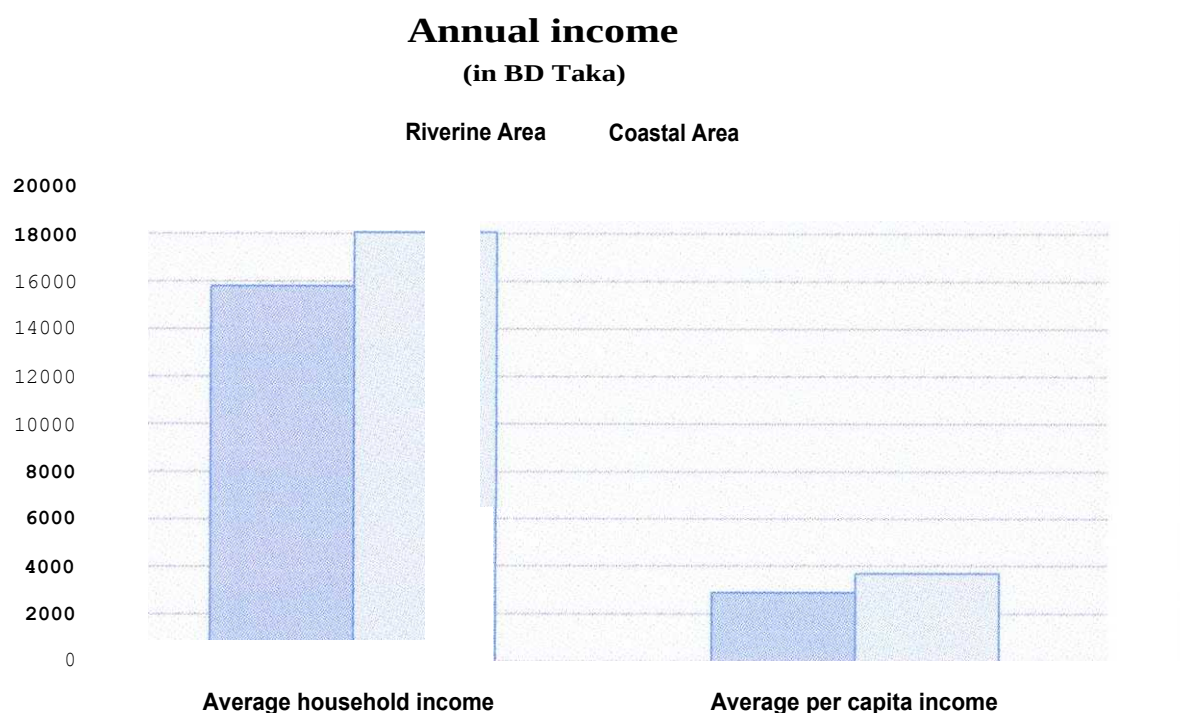
5.L3.1 Average annual income ofhouseholds

In view of the survey the income base of the respondents can be obtained form two main sources; available stock and regular inflow of money.

- Available stocks: Includes cash, micro credit, bank deposits or liquid assets such as livestock and jewellery-.
- Regular inflows of money: Excluding earned income, the most common types of inflows are pensions, remittances or other transfers from the state such as VGh card, widow pension, pension for old, food for work.

The table in below represent the average annual income obtained from all sources. As mentioned **earlier** the respondents represent the poorest community of our country. The annual incomes of respondents are way far from meeting any standards. According to Bangladesh Bureau of statistics average per capita income of the country is 470 US dollar (BBS, 2007); which is more than 30000 BD '1'aka. Despite of this the study outcomes indicate significant increase in per capita income in coastal part rather then riverine part. This increase is due difference in between the average household size of coastal part (4.9) and riverine part (5.3).

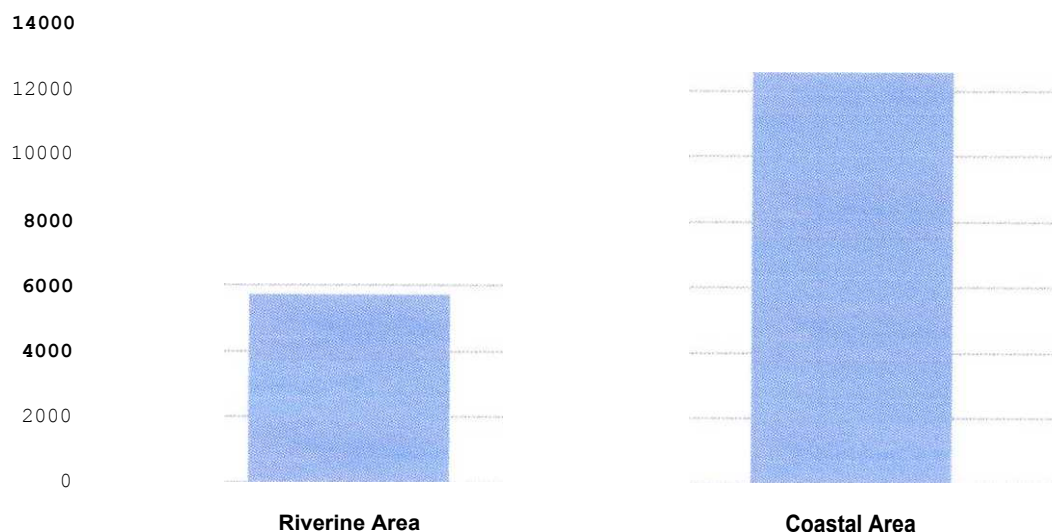
Table 5.8: Featuring average annual income of house hold



	Riverine Area.	Coastal Area
Average household income	15792	18060
Average per capita income	2871	3678

5. L3.2 Expenditure incurred due to displacement by Disaster

The following table summarizes a tentative amount of expenditure incurred due to displacement by Disasters. The riverine respondents were asked to provide expenditure on shifting and repair of houses, health, education, livelihood investments and repay of loans during the response period of disasters. The cost is significantly reduced in case of riverine people as they have the option and time in hand to shift their assets in prior of slow onset disaster like flood and erosion. In contrast coastal people don't avail the option facing rapid onset disaster like cyclone.

Table 5.9: Featuring expenditure incurred due to displacement by Disaster**Riverine Area****5720.00****Coastal Area****12560.00**

5. L3.3 Saving and credit scheme

The respondents in both areas didn't respond to any kind of saving scheme as they hardly afford their daily expenditures. The following table summarizes a tentative form the discussion with respondents and local NGOs. The main source of credit scheme is NGO's micro credit programme. But as respondents have to deal with basic requirements and procedure of NGOs; they often seek credit source from money lender. Others include borrowing money- from friends and relatives. NGOs working in coastal parts tend to have a greater credit scheme than riverine part. According to local NGOs in the maintenance and building of sea fishing boat and net requires large amount of money than the river boat and net.. Another cause is the response of micro-credit is higher in coastal part as the number of working NGOs are higher there in contrast with riverine part.

Table 5.10: Featuring Credit scheme

	Riverine Area	Coastal Area
NGO	10,000 -20,000	15,000-35,000
Money Lenders	500 - 7,500	500 - 20,000
Others	<5,500	< 12,000

5.1.4 Social Capital

The term 'social capital' in the context of the sustainable livelihoods framework it is taken to mean the social resources upon which people draw in pursuit of their livelihood objectives. These are developed through networks and connectedness, membership of more formalized groups, relationships of trust, reciprocity and exchanges that facilitate co-operation, reduce transaction costs and may provide the basis for informal safety nets amongst the poor. "The social capitals for this study are determined through following headings. The benefits received from government and NGOs indicator of social resources. The membership and migration status is included as an indicator of safety net.

5.1.4.1 Benefits received through government schemes

The respondents listed a number of Benefits received through different government schemes such as -

- Widow pension
- Pension for old
- V.G I card
- Food for work
- Shelter and relief
- Social security

They argued that these schemes are inadequate for livelihood security. Furthermore, anal practice and corruption often deprived them from these schemes. Discussion and interviewed disclose that most of the receivers of these schemes depend on it as their only source of income.

5.1.4.2 Benefits received from NGOs

Interview with local NGO staffs and respondents outlined the types of benefits received **through different** NGOs schemes such as

- **Micro - credit**
- **Primary Education**
- **health**
- **Shelter and relief**
- **Sanitation**
- Drinking water supply
- Crop seed **and plantation**
- others

Almost all local NGOs provide micro credit. They run free schools for primary education with support from donor agencies. During crisis period shelter and relief, sanitation, drinking water supply and other commodities are provided according with demand and funding of donor agencies. The respondents appreciate the activities of NGOs during crisis period and there after.

5.1.4.3 Membership of informal group

In both study areas respondent are related with at least one or more informal groups. Usually they are member of Village committee, co-operative organization, religious social group, and cultural organization and NGO village organization. These insure a better safety net among the respondents of viral area.

5.1.4 Migration status

The study finding reveals increase of migration as a threat to local safety net. Due to lower wage and income insecurity and frequent **disaster** the **migration status has** increased in both study areas. Usually male respondents of household leave their home for 1 to 6 months in search of work and better income.

5.1.5 Physical Capital

Physical capital comprises the basic infrastructure and producer goods needed to support livelihoods. Infrastructure consists of changes to the physical environment that help people to meet their basic needs and to be more productive. Producer goods are the tools and equipment that people use to function more productively. The following components of infrastructure are usually essential for sustainable livelihoods:

- Affordable transport;
- Secure shelter and buildings;
- Adequate water supply and sanitation;
- Clean, affordable energy; and
- Access to information (communications).

5.1.5.1 Housing Structure

The most common types of housing structures observed are listed below.

- 1 logla roof and wood wall
- Straw roof and bamboo mat wall
- CI sheet roof and wood wall
- CI sheet roof and CI sheet wall
- Bamboo mat roof; polythene, wood and bamboo mat wall

In riverine part most of the homesteads are on raised plinth from the surrounding. Usually these plinths are made of mud. Similar housing was also observed in coastal area.

The number of CI sheet homestead was larger in number in coastal **part than riverine part.** **_Apparently** CI sheet homestead are received as relief form **donation** after cyclone Sidr. For those who didn't receive CI sheet homestead **remain in I logla roof and wood wall.** **In case of riverine part respondent has to shift their** homestead **material during** river erosion **and flood and the use** of CI sheet is very uncommon practice here



Plate 5.3: Different types of housing structures in study area.

5.1.5.2 Water supply and Sanitation facilities

The respondents of surveyed area are mostly depended on neighbour's tube-well, water reservoir such as River/canal/pond and rain water harvesting as common source of water supply. They use the option which is easy accessible and available ; mostly do not bother for maintaining sanitation. In case of using toilet; still a large number of people use open space. Although options of sanitary/slab latrine or pit latrine are quite available for them.

5.1.5.3 Access to Energy

The surveyed area has a limited access to electricity. Most of the respondent live in remote areas where state utility services are not available . furthermore there are a number of respondents those who can not afford electricity. The available types of energy source and their use is listed as follows.

Table 5.12: Featuring Access to energy

	Use of energy
Paraffin	Lighting
L kerosene	Lighting cooking
Charcoal wood	Lighting , cooking, heating ,water boiling
Cattle dung	cooking, heating water boiling
Electricity	Lighting

5.1.1.3 Access to information

Radio and Television are most common and accessible way gain information for the respondents .. Almost all the market places and cluster community has radio or TV. The use of personal mobile phone was also observed , although the number was very few.

5.2 THE ASSETS PENTAGON ANALYSIS

The asset pentagon lies at the core of the livelihoods framework, 'within' the vulnerability context (see fig: 2.2). The pentagon was developed to enable information about people's assets to be presented visually, thereby bringing to life important inter-relationships between the various assets. This section integrate the analysis of five core capitals of asset pentagon of; which are individually analyzed in previous section for both the study parts.

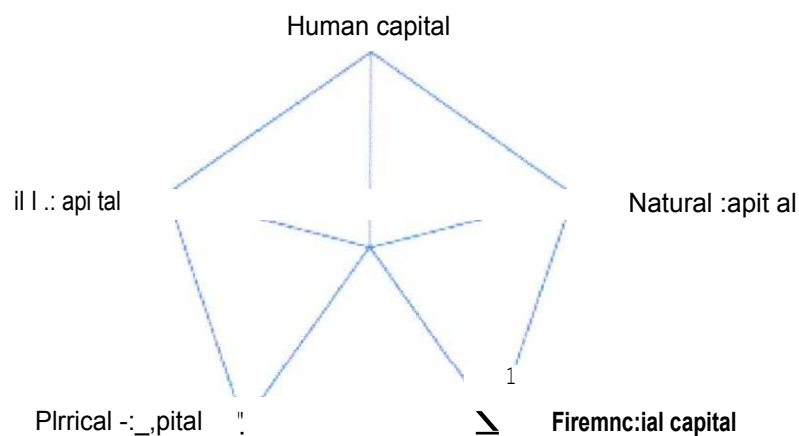


Figure 5.1: Asset pentagon in livelihood framework

The shape of the pentagon is used to show schematically the variation in respondent's access to assets. The idea is that the centre point of the pentagon, where the lines meet, represents zero access to assets while the outer perimeter represents maximum access to assets. On this basis different shaped pentagons are drawn for different communities or social groups. The detail procedure of pentagon analysis is given in DIFDs sustainable livelihood guidance sheet (section 2.1). A generic description of pentagon analysis is given in Annex-13 for reader's perception. The pentagon analysis is done by using SPSS-ver.15. Data gained from each capital for 350 respondents were normalized and correlated. Finally on the basis asset scoring form () to 3 (see table 5.13) capitals were placed in pentagon. The result of final analysis is presented in figure 52.

Table 5.13: Livelihood **asset base of at risk communities** of Study Area

Asset Base	Asset Score	
	Riverine part	Coastal part
Human Capital	2	2.5
Social Capital	2.5	2
Financial Capital	1	1.5
Natural Capital		2
Physical Capital		2

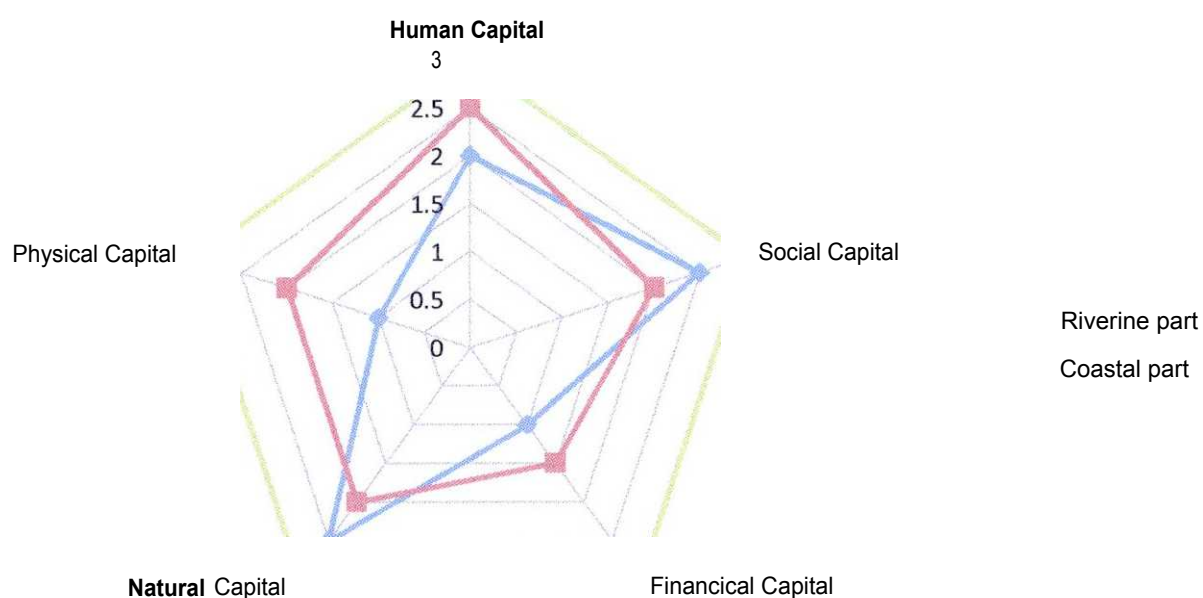


Figure 5.2: Analysis of asset pentagon

The analysis of asset pentagon provides a comparative scenario of core livelihood capitals of riverine and coastal part of the country also demonstrate the lacking form standard parameters. It reveals the respondents of coastal part has better access to

livelihood capitals than the riverine part. This is due to the household composition, occupational pattern, migration status and type of hazard faced by the at risk community. It is not conclusive that slow onset disaster like flood cause more loss of capitals and vice versa. The geographical location, institutional intervention, coping and adaptive strategies also has influence on shaping livelihood capitals.

The following section describes the coping and adaptive responses taken by respondents of the study area focusing on the use of ecosystem. The final section bridge up other sections and entails the options for ecosystem management.

5.3 ASSESSMENT OF COPING STRATEGIES AND ADAPTIVE RESPONSES

This section explores the coping and adaptive strategies employed by local people in the study areas in order to deal with aftermath of disaster. In order to conceptualize these strategies, the DIFDs livelihoods framework is used as a guide throughout. The focus throughout this analysis is on the role of local institutions in **determining** whether local responses are appropriate for the ecosystem; which they depend on. Later on the options of Ecosystem Management Approach is discussed in next section.

Coping strategies refer here to periodic responses to stress caused by short-term disturbances that threaten livelihood systems (Berkey and Jolly, 2001).

five major coping strategies have been identified for rural people dealing with poverty and disaster. These include:

- land use change (e.g. stocking rates or crop types),
- changes in resource management, changes in assets (e.g. livestock, savings),
- changes in labor allocation (e.g. migration), and
- changes in market relationships (e.g. reciprocal or local exchanges)

Adaptive strategies, on the other hand, refer to the ways in which local people change their local rules and institutions to secure livelihoods in response to slower changing trends in the long term (Berkes and Jolly, 2001). Examples of adaptive strategies include: ensuring mobility and flexibility, strengthening social networks, and intercommunity trade (Berkes and Jolly, 2001).

The distinction between coping strategies and adaptive strategies is vital, and is linked to the issue of selecting appropriate management system. An emphasis on short term coping strategies in response to crises alone may lead to the conclusion that local people are reactive rather than proactive. Other hand emphasis on adaptive responses on the other hand leads to conclusions emphasizing the adaptive and proactive nature of local people. However, this study reveals in reality people are both proactive and reactive, they respond on a daily basis to threats and in the long term through a process of social

learning where experiences are internalised and used to avert or cope with a recurrence of a threat.

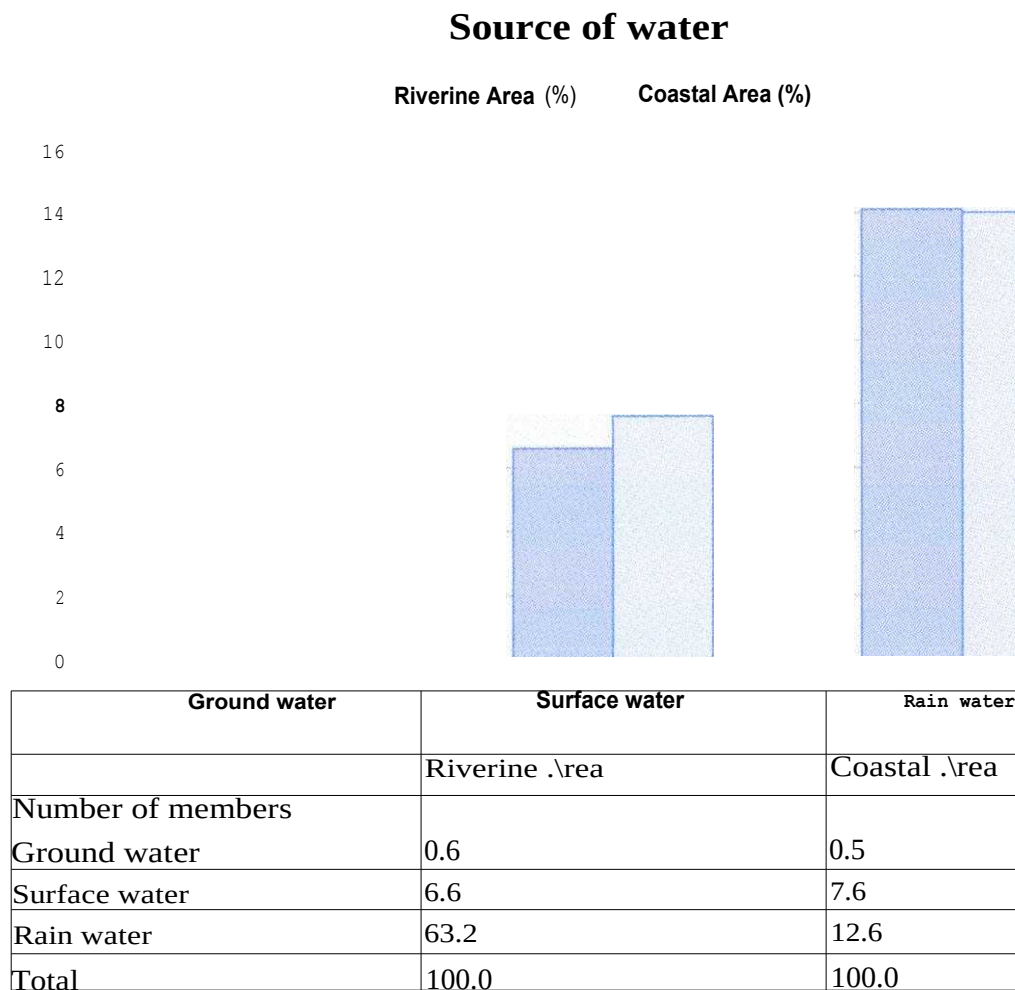
5.3.1 Coping Strategies

*5.3.1.1 Coping with **water** scarcity*

People innovate both technologically and socially in order to cope with recurrent flooding and drought and sudden shock of storm surge. Technological innovations include an investment in rainwater tanks.

The survey found that 63.2 % of households have access to rainwater tanks in coastal part . This is due to high salinity- of surface water. About 12 % of households use rainwater tanks riverine char lands. Mostly- this initiative was taken by local NGOs with support from donor agencies to increase the use of **rain** water as safe water in Char lands. Subsequent group discussions revealed that almost all the water tanks were introduced by NGOs.

"Table 5.14: Featuring sources of water.



5.3.1.2 Coping with NGO intervention

After any crisis the sources of credit became important for affected people. 1.specially for those families who have no savings or any family members sending remittances from urban centers. In most cases these respondents has to take loan form local NGOs in from of micro credit scheme to restore their livelihood after crisis. They also try for money lenders and borrowing form friends and relatives as discussed **earlier**.

5.3.2 Adaptive strategies

When taken in isolation, the coping strategies described above appear to represent short-term responses to crisis. I Iowever, when considered collectively, and

over a longer time period, they form part of larger strategies to diversify outcomes, and maintain flexibility in livelihood options. The key difference between the coping strategies described in the previous section, and the adaptive strategies outlined below, can be found in the impetus for the strategies themselves. People of at risk community shows diversity and flexibility in there livelihood to adapt with crisis.

5.3.2.1 Investing in diversity

Diversifyiing livelihood outcomes is probably the most important way- in which people manage risk and uncertainty over the long term. Investing in diversity ranges from household income sources , sources of food, the variety of crops cultivated, to an investment ill many different species of livestock for rural livelihood.

Livestock can perform several important livelihood functions , including a store of wealth and a form of financial security or insurance during times of hardship. 't'herefore, rural people raise livestock as their source of income. But when they were asked to rank source of income for better livelihood; they chose remittance over livestock. Ranking of their ancestor's livelihood like fish farming and farm labor were placed below small business . Fro m this query it is evident that people welcome diversity in income generation rather than depending on ecosystem recourses.

Table 5.15: Featuring source of income

	Riverine Area	Coastal Area
Number of Rankings		
1	Remittances	Remittances
2	Sale of livestock	Small businesses
3	Service	Service
4	farm labor	Sale of livestock
	Small businesses	\\'age labor
6	\\'age labor	Fish farming
	Other,	Others

5.3.2.2 Ensuring flexibility

Flexibility is also demonstrated by peoples' changing preferences for particular ecosystem products, such as fuelwood. The maintenance of flexibility allows people to respond to feedback from the environment, for example when particular species become scarce, preferences shift to other species that are more available. The flexibility of choosing livelihood options is outlined in the table below.

Coping strategies come into play in response to cases. Adaptive strategies, on the other hand, manifest in the day to day, and year to year, social and cultural norms of the community. These adaptive strategies are intended to avert risk, rather than respond to it, in this sense, coping strategies can be described as reactive, while adaptive strategies are proactive. This is revisited in the discussion exploring options for ecosystem management in botli riverine and coastal part.

Table 5.16: Summary of long and short-term coping and adaptive strategies

Type of disaster	Coping strategy	Adaptive Response
flood /River erosion	Social networks, familial exchange, preferences shifting	flexibility, mobility
	Migration	Small businesses
	Breaking rules	Investing in diversity
	Extensive use of ecosystem	Sale of livestock
	Microcredit	
Cyclone / Storm Surge	Microcredit	Investing in diversity
	Migration	flexibility, mobility
	Breaking rules	Investment in industrial development



Plate 5.4: Different types occupation in study area.

5.4 OPTIONS FOR ECOSYSTEM MANAGEMENT APPROACH

This section demonstrates the dynamic interaction between local people, their immediate environment, and processes and surprises outside of their control. Many synergies exist between the livelihoods framework and the resilience approach, and these should be harness for an improved understanding of appropriate management responses. In chapter 2 both approaches identify disaster as forces of change. The livelihoods framework calls this the 'vulnerability context'. Both identify the importance of feedbacks and non-linearity. The models also have comparative strengths that should be explored. The livelihoods framework is most **useful in** its analysis of short term coping strategies and livelihood responses, while the resilience approach allows the analyst to explore the broader context of institutional adaptations, and the role of **institutions** in shaping livelihoods.

Thus far, this study has described the assessment of local livelihoods in terms of capitals and coping and adaptive responses to these capitals. In next, existing ecosystem health and its fluctuations due to disaster along With ecosystem trends and dynamics are discussed to explore the options for ecosystem management

5.4.1 Existing Ecosystem health

Results from house hold survey and discussions with key informants the fuel wood, water and livestock user groups indicated that local respondents considered ecosystems to be 'healthy' when:

- a. 't'here is enough forage for their livestock
- b. Herders do not have to walk long distances to fiiid forage for their livestock
- c. There is enough fuel wood and construction wood in the woodlands to meet local needs
- d. Fuel wood collectors do not have to walk long distances to find the desired species
- e. The rivers and ponds **are clean** and not covered with "green slime"

It was not possible to place these points in order of importance, as different groups considered these attributes to hold different de pees of importance. For example, herders felt that forage was the key indicator of ecosystem health, whereas women felt that fuel wood species provided the most important indicator of ecosystem health. They agreed on a common aspect that ecosystem is adversely affected by disasters like river erosion and cyclone. Also agreed on the point that the lack of institutional control is equally responsible ecosystem damage.

5.4.1. 1 Short-Term Fluctuations due to disaster

local respondents in survey claimed that the ecosystems surrounding their area have undergone various non-permanent cyclical changes, largely in response to changes

in rainfall, and some more permanent changes linked to natural hazards such as river erosion and cyclone that have lead to changes in land use.

According to them during drought years, the condition is usually considered as 'bad', but this improved shortly aftet-ward within one or two years of the event.

Local respondents claimed that, during the drought years the quality of river water declined because a green slime (identified as an indicator of water quality) increased. Respondents could not identify any long-term changes in water quality. However, more permanent changes are considered to have taken place in ecosystems over the past ten years, particularly in relation to changes in land use and resource utilization patterns .As there is no control of state or local institution over utilization of natural resource.

5.4.1.2 Lasting changes as effect of disaster

Many of the long term changes identified are related to the effect of disaster. In the Upstream part main land Lost due to river erosion cause a huge impact on permanent ecosystem loss. Respondents expressed concern that droughts are no longer easy to cope with. There is very little control over where livestock graze, and rules are difficult to enforce without fences to indicate the different grazing areas . For this reason, while rangeland condition currently continues to fluctuate according to climatic changes, livestock owners struggle to cope with these fluctuations due to political changes.

Secondly, more long-term changes in the health of ecosystem have also been noticed as effect of cyclone. The Mangrove ecosystem health is considered to have serious declined as effect by two mighty cyclones Sidr and :\\ila. The respondents put their opinion as - the massive scale damage to ecosystem can not be recovered with out proper institutional regulation.

5.4.2 Ecosystem trends and dynamics

Ecosystem management is dependent on ecosystem trends and dynamics which is highly value-laden and context dependant concept **that can** only be described qualitatively (Heldridge and Moen, 2003). Therefore, availability of forage, fuel wood, construction materials and water and energy supply in both study **areas** vary from each other depending on the level of reliance on these different ecosystem goods.

5.4.2.1 Fuel wood is more abundant and less in demand

The potentially negative livelihood impact of the perceived cyclical and permanent changes due to disaster in ecosystem health already described. But an interesting observation came out from group discussion is, local people no longer require the full set of ecosystem goods and services in order to **maintain** their livelihoods as their ancestors did 20 to 30 years back. People believe that there has been a rapid decline **in the** use of fuel wood since the availability of alternatives such as paraffin and electricity **came in** use. The ability of the woodlands to provide the desired levels of goods for local livelihoods, such as fuel wood, has therefore not declined, **despite a** perceived decline in woodland health.

5.4.2.2 Institutional interventions in trends of Ecosystem Use

The result of transient walk, key informants interview suggests that on the whole, there is no longer term trends have been ever applied for ecosystem use either from any government or non government organizations. Any kind of activities or control regulation from forest department was absent. Local respondents are almost unaware of any regulatory body. In riverine part; which is the subjected to river erosion, local NGOs like Solidarity initiated social forestry as livelihood option in small scale. But due to poor monitoring and low value of wood resources in local market; this good practice was jeopardized.

Similar response came from coastal part, low market price of wood resources discourages them to take social forestry as livelihood. Besides government institutions,

activities of local institutions like NGOs are largely donor depended. 't'herefore; both financial constrain and awareness kept them away from ecosystem management as livelihood option. In particular, these trends reduced the ability of local decision makers to cope with both short and long term fluctuations of ecosystem.

5.4.3 Local adaptations to change

The study revels that people ili both study areas respond to changes in the abundance of ecosystem components, such as fuel wood and natural streams, by adapting their preferences, switching to alternatives (for example substituting paraffin and electricity/ solar panel for fuel wood), and/or relying on technology (for example investing in rainwater tanks during drought periods / salinity), and adapting their institutions to accommodate these changes.

In case, of coastal area; which is the coastal part of the country the at risk community people received brick built houses in response of relief after Cyclone Sidr and Aila. Now most of the respondents vote for brick built houses as better housing options. According to key informants a significant number of brick built has increased in after math of cyclone Sidr.

Oil the riverine part at risk community- living in upstream chars; are receiving high quality foreign commodities as a part of different donor agency projects. Most of the time the project period extends form 3 to 5 years. Respondents appreciate foreign commodities as a part relief. But they could not comment on the freduency and extended period of receiving theses commodities ultimately creating dependency or not. Theses types of local responses after disaster are adaptations are taking place in rural livelihoods which will ultimately expand on ecosystem health in long term.



Plate 5.4: Rural livelihood

CHAPTER 06: CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

Through a combination of theoretical discussion and field survey following participatory methods in four districts, this thesis has argued that ecosystem management approach for sustainable livelihood restoration is a better alternative and the approach which is continuously overlooked. From this ground, the thesis has outlined livelihood capitals of at risk community, their coping and adaptive strategies and the options for ecosystem management approach. It has also demonstrated the dynamic interaction between livelihood and ecological systems, and the played institutional gaps and changes to cope during aftermath of disasters.

Analysis of five core capitals of livelihood pentagon provides a comparative scenario of riverine and coastal part of the country also demonstrate the lacking form standard parameters. It is evident from the study that a livelihood capitals varies with geographical location. Also there is a profound influence of disaster with lacking of capitals, coping and adaptive strategies.

As the respondents are from the poorest section of the society; they draw enormous lacking on human and financial capitals. The respondents failed to meet any standards on literacy rate, health services, and household and income status. The findings of the study support the notion that even poorest community can enjoy better per capita income only through reducing household size. This was reveal during analysis of annual average per capita income of coastal and riverine people. Where as costal people are around 1000 BD taka ahead of riverine people in per capita income; which eventually increases their financial capital than the other part.

The study observations reveals possession of less physical capitals than demand, this is because of lack of government initiation in development sector. It also indicates the increased migration status is gradually breaking social safety nets and the preference of income source.

The costs of natural capitals damage through crops and livestock loss due to disaster is recoverable through relief. But the damage through land loss and woodland destruction and mangrove ecosystem loss due to floods and cyclones, are much higher to recover in anticipatory technical, structural and institutional measures. It has a long-term effect on prevention of disasters among the population and the cyclic recurrence of this type of events.

By combining the three approaches of Millennium Assessment, Sustainable Livelihoods and Disaster Risk Reduction with local knowledge about ecosystems dynamics, some critical outcomes were exposed which should be taken in consideration in livelihood restoration initiatives -

- Firstly at risk communities should be defined in terms of geographical location and hazard types. As the livelihood and ecological system are operated in close context therefore effective ecosystem management depends on the understanding of knowledge and trends ecosystem dynamics.
- Local people respond to disasters both reactively and proactively. As demonstrated in section 5.3, it appears to be a short-term response is often part of a broader resilience building adaptation such as livelihood and cultural flexibility and livelihood diversification. Therefore, research on disaster risk reduction at any rural livelihoods must consider broader time horizons in their analysis of coping strategies.
- The study findings make certain that the patterns of resource use and ecosystem dynamics at the local level are influenced by local institutions and knowledge. As there was no long term trends taken by government or NGOs the vital development of local institution remain fragile in ecosystem protection.
- Rural people are gradually becoming less reliant on ecosystems, which might have potentially negative impact on local livelihoods in long-term. In addition, it is very possible that this declining reliance on ecosystems might have a positive impact on ecosystem health in the future.

So far, Government and NGOs working at field level yet not integrated Ecosystem Management Approach with implementation of sustainable livelihood and disaster risk reduction options. 'Therefore issue-based initiatives on livelihood and ecosystem management focusing on comprehensive risk reduction} through developing frameworks should be inevitable. This initiative will further strengthen vertical and horizontal integration of related sectors and concerned organizations.

6.2 RECOMMENDATIONS FOR FURTHER RESEARCH

The implication of this study for future research into Ecosystem management Approach linked with sustainable livelihood and disaster risk reduction requires a multi-scale and trans - disciplinary study. Researchers should to explore a conceptual and practical approach which exists on practitioners' domain. In particular, the future of sustainable livelihood management lies in the ability of researchers and practitioners to shake off the mental constructs that they have inherited from a knowledge system that is founded on arbitrary lines between 'natural' and 'social' systems. Also we should keep in mind that knowledge based approach might not be effective for different geographical location.

In context of Bangladesh restoration of livelihoods should consider existing and degraded natural capital and local institutional structures. There can be a space for talk of increasing livelihood capitals linked with ecosystem management approach.

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Questionnaire - Ecosystem and livelihood restoration after a disaster in Bangladesh

Household no.: Respondents name:.....

Village :.....Union..... Upazila..... District...

A) Household Composition

1. How many people are living in this house/compound?
2. Do you farm together? Yes/ No
3. Do you all use the same granary (ies) or store room? Yes/ No
4. Do you cook together Yes/ No
- Is the house/compound divided into several sections ('households')? Yes/ No
- If yes, how many?
5. Are there any absent household members? Yes/ No
6. Why are they absent (seasonal labour migration, education, staying with family elsewhere, start own household)?
7. Are they absent for a period longer than 6 months? Yes/ No
10. Why do they leave the house (seasonal labour migration, education, staying with family elsewhere, split up household)?

B) Household History

1. When and how did you start your own household?
2. Where was that?
3. What were your main economic activities in that place?
4. When did you leave that place?
5. Why did you leave that place?
6. Have you and your household also lived in any other place? Yes/ No
7. Where was that?

8. What were your main economic activities in that place ?

9. When did you move to that place ?

10. When did you leave that place ?

11. Why did you leave that place?

• Father's occupation

• Seasonal labour migration in the past '

C) Determination of Natural Resources

1. Do you own land?Yes/ No

2. Do you farm?. Yes/ No

3. Do you also farm land that you do not own ?Yes/ No

4. Under what arrangement do you use this land?

5. Do you farm **all the** land you own?Yes/ No

6. What do you do with the land you own and do not farm?

7) Could you tell us the long term changes over time of the following items:

Cropland	+	f			+			
Woodland	+	±		Forest /Fuel wood	+	+		Construction wood
Natural Ecosystem	+	±		Local Species	+			Lakes /ponds /river
	+	f			+	+		
	+	+			+	f		
	+	+			+	+		
	+	+			+	+		

8. Do you **own animals** ?Yes/ No

9. Did you **own animals in the past**? Yes/ No

10. How did you lose your animals?.....

D) Determination of Income Source

a) Cashincome Generating Activities

Household member (who?)	Activity (source of income)	Seasonality (when is activity carried out)	Estimate of income level per time unit	Estimate of time invested
	Pension			
	Labour migration			
	Crop sales			
	Animal sales			
	Farm labour			

b) iVoncash Income Generating Activities

1. Is any household member part of a farming group?

..... Yes / No

2. Did any of you work on other people 's farms in exchange for food/pito'?

Yes/ No

3. Did you get any food out of hunting/fishing

Specrly)? Yes/ No

4. Did you get any food out of other activities(fruit trees,

gardening)? Yes/ No

5. Did you get any goods(incl.food stuff)by exchanging them for

other goods(bartering) Yes/ No

6.If ;'e.v: Which goods did you give and which goods

did you receive ?

7. Did you receive any food aid (not only this

year)?.....

c) Trends in Income Generating Activities

- Has your nonfarm income increased, decreased or stayed the same over time (describe the trend)?..
- Has the **number** of income sources for your household increased, decreased or - stayed the same over time (describe the trend)?

d) Trends in Savings and Credit Schemes

- Do you **save** money for future **need**? Yes/no
- What are **the available credit Schemes**/...../.....
- What is the amount of credit schemes?/...../.....

E) Cash Expenditure (during or after disaster)

Type of expenditure		Estimate of costs	Expenditure during/after disaster
Food			
Education			
Health			
Consumer goods:	Clothes		
Firewood / kerosene			
Transport			
Housing: repairs & improvements			
Productive investments			
Repay of loans			
Others:			

- . Which types of expenditure have increased most sharply during/after disaster?
- In the past ten years, how many years did you have to be displaced?.....

F) Possessions

<i>Indicators of physical capitals</i>							
Mobile		Lantern		House		Others:	
Van/rickshaw		Radio		Access to water			
Bicycle		Flashlight		Access to energy			
Cart		Scissors, machine		Sanitary toilet			

G) Migration

1. Have any members of this household left the area for over a month in the past year ? Yes / No

Name of migrant Destination Time interval (months) Activity / motivation

| |

H) Education

No	Name	Age	Place of birth	Education completed	Main (economic) activity	Other (economic) activities
1						
2						
3						
4						
5						
6						
7						
8						
9						

1) Please answer the following questions

- What do you understand by ecosystem health?
- What do you think about the effect of disaster on ecosystem?
- What do you think about the NGO intervention?
- What was your coping strategy during disaster?
- How can you diversify your livelihood?
- What are the adaptive responses of your locality?
- How do you ensure flexibility in livelihood options 9

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SUSTAINABLE LIVELIHOODS FRAMEWORK

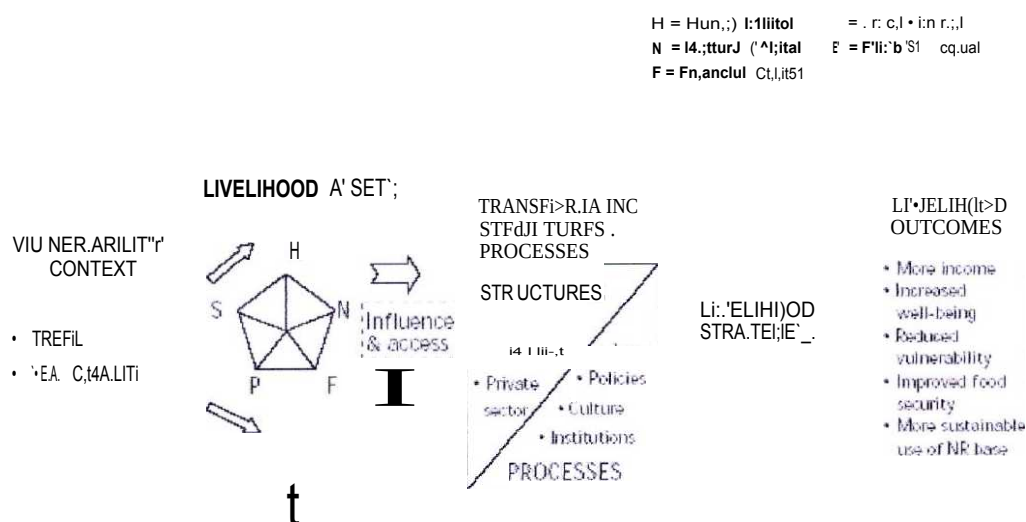
FRAMEWORK

INTRODUCTION

2.1

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Figure 1. Sustainable livelihoods framework



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DFID

SUSTAINABLE Livelihoods (SHEETS)

FRAMEWORK

VULNERABILITY CONTEXT

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VULNERABILITY CONTEXT

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Understanding the nature of vulnerability is a key step in sustainable livelihood analysis.

Seasonal migration is usually associated with rural areas. It can however be found in urban areas especially when the people spend a large proportion of their lives in the city. In the case of seasonal migration, the people are usually engaged in agriculture or other seasonal work.

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FRAMEWORK

LIVELIHOOD ASSETS

2.3

The livelihood - al framework identifies five types of capital upon which livelihoods are built. Increasing access to any of these can take the form of a number of different measures. For example, increasing access to financial capital is a primary concern for DFID in its support to microfinance and private sector development.

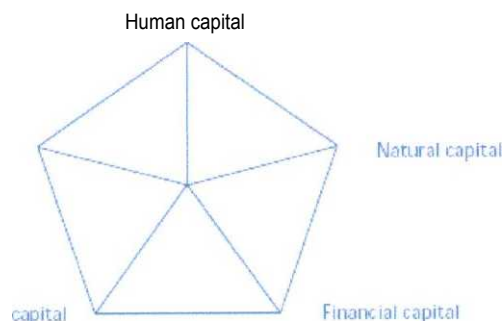
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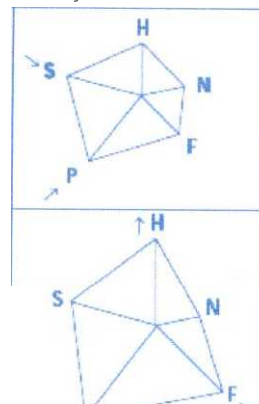
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