Political Ecology of Disasters:

An Examination of Vulnerability in South-West Coastal areas of Bangladesh

---

DISSERTATION

Presented to the Department of Development Studies, University of Dhaka, in partial fulfilment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Supervised by
Dr. Kazi Maruful Islam
Professor, Department of Development Studies,
University of Dhaka

Presented by
Shankor Paul
PhD Reg. 114/2013-14 (Re-reg. 110/2019-20)
Dept. of Development Studies
University of Dhaka

October 2023

Political Ecology of Disasters:
An Examination of Vulnerability in South-West Coastal areas of Bangladesh

---

ABSTRACT

The study examines vulnerability and disasters with the lens of political ecology. The contemporary research is mostly applying the apolitical approach that overlooks the causation of differential vulnerabilities and the risk of disasters. The literature is still silent to find answers of 'how the power led process and drivers are shaping/changing the ecology of an area and causing differential vulnerabilities and risks in the society? There is still no specific answer on 'why a section of people are facing life-long vulnerabilities and placing in unsafe conditions? On this backdrop, the research sets three major aims: i) to examine the power-led processes and drivers of ecological change of an area causing differential vulnerabilities and risks of disaster; ii) to define underlying factors of differential vulnerabilities and risks in the society; and iii) to mapping of people and places being gradually vulnerable to disaster in South-West coastal areas of Bangladesh.

The research systematically examines the existing processes and drivers of ecological changes in south-west coastal study areas that causing differential vulnerabilities and risk of disaster. The apolitical analysis of vulnerability rarely attempts to examine power-driven processes of ecological change that forces a section of people to be vulnerable and stay at risk in situation of disaster. The study has made a specific focus on assessing human-environment interactions through analysing three interlinked processes (i.e., traditional, functional, and historical) and power-led drivers of ecological change in study areas. It applies three forms of analysis: i) situation analysis; ii) spatial data (satellite remote sensing data) analysis, and iii) perception analysis to find the answers to research queries. The analytical findings reveals the functions of three diverse processes and several power-led drivers in changing ecology of south-west coastal areas and causing differential vulnerabilities and risks of disasters. This also defined a set of underlying factors, which are active to create unsafe condition and risk situation for a section of people in the society.

The study also examines changing scenarios of landscape changes in south-west coastal study areas from 1980 to 2020. The landscape change process visualises five specific areas: i) agricultural land; ii) settlements and homestead vegetation; iii) shrimp firms and water bodies; iv) rivers, and v) forest areas.

The findings reveal a declining trend of agricultural land but an increasing trend of human settlement & homestead vegetation, and shrimp firming & water bodies that refer to the functions of human-induced actions in modification of the natural environment, as well as changing ecology of south-west coastal areas. The competitive and conflicting human actions are contributing to making maximum benefits for the rich and powerful, where the poor and vulnerable people become the main losers. The people's perception has defined a positive correlation of power relations with prevailing discriminations, landlessness, and exclusion from the decision-making process and practices in south-west coastal areas of Bangladesh. The study potentially examines root causes, dynamic pressures, and unsafe conditions in line with the Pressure and Release (PAR) model, which is causally linked with the progression of vulnerabilities and the risk of disasters. The analysis refers to a statement that people, who live in unsafe conditions are at risk of disaster if they face external hazards. The study finds out that the statement is not fully correct in the context of south-west coastal areas of Bangladesh. It signifies that the people, who are in unsafe conditions always living in a disaster like situation due to their lifelong vulnerabilities. And it is not always required the functions of external hazards for their risk situation. The research further suggested a set of actions for reducing the adverse impacts of causal factors for differential vulnerabilities and the risk of disasters in the society.

Finally, the study further identifies the proportionate vulnerability of the people and places as a key concern of changing ecology. This is taken into consideration for developing a framework for ecological resilience as a safeguard for the vulnerable people and places in south-west coastal areas of Bangladesh. It is expected that the findings will guide new researchers, development planners and policymakers to realize and consider the forces of power-led process and drivers of ecological change in national development planning, policy formulation and strategic documentation that may add value to achieve sustainable development in Bangladesh.

Thesis Declaration

I certify that the work presented in this dissertation under the title *Political Ecology of Disasters: An Examination of Vulnerability in South-West Coastal areas of Bangladesh* is, to the best of my knowledge and belief, original, except as acknowledged in the text. I hereby declare that I have not submitted this material, either in full or in part, for a degree or any other institution or university other than the University of Dhaka.

I also certify that the dissertation is an original piece of my research that has been written by me. Any help and assistance that I have received in my research work and the preparation of the dissertation have been appropriately acknowledged.

Shankor Paul
Date:

I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality as a dissertation for the degree of Doctor of Philosophy.

Dr. Kazi Maruful Islam
Professor, Department of Development Studies
University of Dhaka
(PhD Supervisor)

Date:

ACKNOWLEDGEMENTS

First of all, I would like to extend my most sincere gratitude and thanks to my research supervisor, Dr Kazi Maruful Islam, Professor, Dept. of Development Studies, the University of Dhaka for his support, guidance, and inspiration throughout my PhD research. His extended cooperation and valuable feedback helped me to complete my research successfully. I also express my heartfelt gratitude to Dr Sheikh Tawhidul Islam, Professor, Institute of Remote Sensing and GIS, Jahangirnagar University for his valuable guidance, support with necessary literature and inspiration in the whole process of my PhD research. My sincere thanks to Dr Farhana Begum, Professor, Dept. of Anthropology and Dr Zobaida Nasreen, Associate Professor for their advice and cooperation in advancing my fieldwork.

I am thankful to Professor Dr Niaz Ahmed Khan, Professor Dr Taibur Rahman, and Dr Shubhasish Barua, Department of Development Studies for granting my PhD application and allowing me to continue my PhD research. I am also grateful to Dr Rashed Al Mahmud Titumir, Professor and Chairman of the Dept. of Development Studies, the University of Dhaka for his cooperation and support to complete the academic and administrative process of my PhD research.

I am especially grateful to Mr Krishna Prosad Mondal, Institute of Remote Sensing and GIS, Jahangirnagar University for his valuable support and assistance in mapping and analysis of remote sensing image data. I am thankful to my colleagues, particularly Md. Mahbubul Haque and Lubna Yasin for their assistance in analysing perception survey data and information. I also expressed my special thanks to Champa Das and Gobinda Munda (trained youth leaders, HRP-UNDP) for their support and cooperation in the collection of field information.

To conduct my fieldwork in south-west coastal study areas, I sought the help and assistance of many people and institutions, many of whom have been extremely supportive and a source of encouragement in the research work. The persons, whose names are still unmentioned in Annex II, I highly appreciate their support and contributions. My sincere thanks to all those people, who have spared their precious time to take part in the interview and FGD sessions. These include a cross-section of villagers, local leaders, and officials, who express their willingness to cooperate and support in understanding ground realities.

Finally, I extend my heartfelt thanks to my parents, wife, brothers and sisters, friends and colleagues for their blessings, emotional support, and encouragement that helped to reinforce my mental strength to complete the PhD research.

With my sincere thanks to all, I accept all the responsibilities for the mistakes in this study.

Shankor Paul
Date:

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND LOCAL TERMS

ADB	= Asian Development Bank
ADRC	= Asian Disaster Reduction Center
BBS	= Bangladesh Bureau of Statistics
BCPR	= Bureau for Crisis Prevention and Recovery
BWDB	= Bangladesh Water Development Board ()
BCCAP	= Bangladesh Climate Change Strategic and Action Plan
BCCTF	= Bangladesh Climate Change Trust Fund
BCCRF	= Bangladesh Climate Change Resilience Fund
CEIP	= Coastal Embankment Improvement programme
CCA	= Climate Change Adaptation
CEP	= Coastal Embankment Project
CDMP	= Comprehensive Disaster Management Programme
CPP	= Cyclone Preparedness Program
CFP	= Climate Fiscal Framework
CIP-EFCC	= Country Investment Plan for Env. Forestry and Climate Change
CRA	= Community Risk Assessment
CERD	= Centre for Research on the Epidemiology of Disasters
CSO	= Civil Society Organization
DDM	= Department of Disaster Management
DMC	= Disaster Management Council
DM	= Disaster Management
DRR	= Disaster Risk Reduction
DMB	= Disaster Management Bureau
DFID	= Department for International Development
ECHO	= European Commission Humanitarian Aid
EM-DAT	= Emergency Events Database
FAO	= Food And Agriculture Organization
FCDI	= Flood Control, Drainage, and Irrigation
HDI	= Human Development Index
HFA	= Hyogo Framework for Action
GCF	= Green Climate Fund
GDP	= Gross Domestic Product
GEC	= Global Environmental Change
GO	= Government Organization

GTZ = German Agency for Technical Cooperation
IPCC = Intergovernmental Panel on Climate Change (IPCC)
IDNDR = International Decade for Natural Disaster Reduction
ISDR = International Strategy for Disaster Reduction
IMDMCC = Inter-Ministerial Disaster Management Coordination Committee
IDNDR = International Decade of Natural Disaster Reduction
IFRC = International Federation of Red Cross and Red Crescent Societies
ICZMP = Integrated Coastal Zone Management Plan of Bangladesh
LGIs = Local Government Institutions
MDGs = Millennium Development Goals
MoDMR = Ministry of Disaster Management and Relief
NDRCG = National Disaster Response Coordination Group
NGO = Non-Government Organization
NSSS = National Social Security Strategy
OECD = Organisation for Economic Co-operation and Development
RRAP = Risk Reduction Action Plan
SOD = Standing Orders on Disasters
SDGs = Sustainable Development Goals
UNISDR = United Nations International Strategy for Disaster Reduction
UDMC = Union Disaster Management Committee
UzDMC = Upazila Disaster Management Committee
UNIDO = United Nations Industrial Development Organization
UNESCO = United Nations Educational, Scientific and Cultural Organization
UN = United Nations
UNDP = United Nations Development Programme
SES = Social - Ecological System
SDGs = Sustainable Development Goals
SSNP = Social Safety Net Programme
SFDRR = Sendai Framework for Disaster Risk Reduction
SAARC = South Asian Association for Regional Cooperation
SFA = SAARC Framework for Action
UNCHS = United Nations Center for Human Settlements
VCA = Vulnerability and Capacity Analysis
VGF = Vulnerable Group Feeding
VGD = Vulnerable Group Development
WARPO = Water Resources Planning Organization
WFP = World Food Programme

PART I

THE STUDY

Chapter One
INTRODUCTION

1. Introduction

Disaster is now a key concern of the global development debate. Because it tolerates huge human, economic and environmental losses, and restricts the processes of sustainable development. From 1950 to 1979, the world faced a total of 1779 natural disasters increased to 4212 and 7348 from 1980 to 1999 and 2000 to 2019 accordingly. It was affected a total of 4.87 million population with an economic loss of $78 billion during 1950-79, while it is 3.25 billion population with an economic loss of $1.63 trillion during 1980-1999 and 4.03 billion with an economic loss of $2.67 trillion during 2000-2019 period. Over the last 20 years, a significant rise observed in climate-induced disasters[1] that caused a total of 510,837 people's deaths with causalities of 3.9 billion people in the world (CRED, 2020). There is also defined as an uneven distribution of deaths, affected population and economic loss in different income groups. High-income countries accounted for a total of 67% of economic losses with a total of US$ 1.99 trillion during 2000 to 2019 but it bears limited economic losses and relatively high human loss in low-income countries per disaster event[2].

The status revealed inequality of disaster impacts between rich and poor countries It refers that disaster affects the people and places disproportionately. The high-income countries, that have advanced knowledge, capacity and technology witness a very limited human loss, while it is high in the income countries like Bangladesh. The country is placed in the 7th position of climate risk with 0.39 deaths per 100000 inhabitants, a loss of 0.41% per unit GDP, and 191 climate-induced disasters during the last 20 years[3]. The status revealed that disaster has a potential impact on human, economic and environmental dynamics that substantially reinforced in recent decades and limiting the desired progress of national development.

Hence, if we look at the disasters in Bangladesh, it demonstrates a similar trend and impacts on people and places. From 1972 to 2017, Bangladesh experienced a total of 297 natural disasters[4] affecting 47.47% by cyclones followed by 28.96%, 7.41% by extreme temperature, 9.76% by epidemics and the remaining by other forms of disasters. Since 1972, the disaster severely affected a total of 396 million, 520,0peoplee's death and an economic loss of $19 billion (EM-DAT, 2018). The number of people exposed to cyclones and floods are placing Bangladesh in the 6th rank

[1] During 2000 and 2019, total 6,681 climate-related disasters occurred.
[2] CRED Report, 2020, page-22)
[3] Global Climate Risk Index 2020 (page 6)
[4] Art-Bangladesh-floods-753-4466-3-PB.pdf (publichealthdisasters.eu)

out of 89 and 1st rank out of 162 countries[5] and defined as 1the 0th ranked risk-prone country in the world[6]. The exposure of disaster translated into 14% GDP per year[7]. The context reveals that the causal factors of disaster are potentially linked with poverty and inequalities in Bangladesh. The context is verified by the World Bank country assistance strategy (2011-2014). Though Bangladesh has a proven capacity of handling disasters like cyclones and floods by reducing the number of deaths, it is still an alarming concern for a section of people, who are living in at-risk situations and facing the negative impact of disasters from generation to generation. If we refer to the example of two major cyclones in Bangladesh, it is clearly defined that the number of death and economic loss in the 1991 cyclone was much higher than the Cyclone Sidr in 2007. The 1991 cyclone killed 135,000 people and caused more than $1.5 billion in economic loss and damages, whereas the 2007 cyclone Sidr killed 3,363 people with an economic loss of $2.3 billion[8]. The trend demonstrates a decline in human losses as a reflection of added human capacity but an increasing trend of economic loss. It has added a new form of vulnerability to people and places that continue to generate a disaster situation.

Most of the studies that focused on disasters and vulnerabilities examine the technical causes of physical vulnerability, socio-economic links and its alignment with livelihood and gender perspectives. The remaining studies are natural hazards centred and guided by the structural and apolitical perspectives that overlooked the causal analysis of differential vulnerabilities and risk of disasters in Bangladesh. There are still knowledge gaps in the existing literature to find the answer to 'why a section of people facing lifelong vulnerabilities and the risk of disasters? Hence, the traditional apolitical analysis of disasters is unable to explore causal grounds of differential vulnerabilities and risk of disasters in the context of a particular area in Bangladesh.

This study is therefore attempting to integrate political ecology perspectives to examine the changing situation of the ecology of an area and its links with differential vulnerabilities in south-west coastal areas of Bangladesh. This will also explore the causal link of disaster risk. The study potentially applied areal data and images to designate the pattern of landscape changes of an area and the functions of political ecology to help understand the causal grounds of differential vulnerabilities and risk of disasters. It is expected that the wider examination of the problem considering its multi-dimensionalities may contribute to national development planning and management of disaster risks as a key requirement for attaining SDGs by 2030 in Bangladesh.

[5] The Global Assessment Report, UNISDR, 2011
[6] The World Risk Report, 2019: World RiskReport-2019_Online_english.pdf
[7] Daily Star "Reducing the risk of disasters", 13 July 2013.
[8] USAID Cyclone Sidr Fact Sheet (March 31, 2008)

1.1 The Problem Statements:

The review of literature on disasters and vulnerability issues reveals some knowledge gaps that demonstrate three problem statements in my study:

Statement-1:

The contemporary disaster research concentrates on structural, social and development perspectives that truly assess human response, vulnerability, and risk of disasters in line with the loss and damages. It is an attempt to correlate the development with human capacity but is silent to define the role of power, which is immanent in all social relations. The relations of power contain a force that pushes a section of people to live in at-risk situation. Hence, the political ecology perspective critically examines the nature-society relations, particularly looking at the power relations to explore the causal ground of disparities and vulnerabilities. It is an attempt to examine disparities and vulnerabilities that results from ecological changes, such as unequal access to resources and uneven exposure to risks. From this point of view, this perspective is more applicable to examine the power led processes and drivers that results in changing ecology of an area. The changes create a space for differential vulnerabilities and risks of disaster in an area. The contemporary political ecology research tried to explain environmental/ecological problems with the lens of political economy. But how the power led process and drivers are shaping/changing the ecology of an area and causing differential vulnerabilities and risks in the society? is truly missing. The searching of answer is significant in mapping of appropriate solutions towards filling the knowledge gaps for building a resilient society in Bangladesh.

Statement-2:

The existing disaster research refers that vulnerability induced risks have role to create a disaster situation. It is strongly defined in the risk-hazard approach but silent is analysing the underlying causes of vulnerabilities that creates the risk situation in disaster (Blaikie et al., 1994). Several studies that focused on the analysis of vulnerabilities tried to introduce the frame of ‘’unsafe condition’’ as ‘’zero’’ condition of the people (full inability) but the reality is that the people have minimum capacity to cope and survive in a risk situation of disaster in Bangladesh. This conceptual argument reveals a space to define the underlying factors that creates condition for vulnerabilities and risks situation in the society. The searching of answer is important to find appropriate actions for the release of vulnerability and risks of the people, who lives in unsafe condition.

Statement-3:

Most of the disaster research attempted to define ‘disaster’ as a natural phenomenon or as an outcome of hazard and vulnerability. The analytical findings also refer to a situation of during and post-disaster context but rarely examines the pre-disaster context

of the people. Besides, the conceptual definition of disaster also refers a situation, where the shows their inability to cope with the situation. The reality reveals that the people's ability is not always driven by the functions of hazards. But still the analysis of disaster is considering the natural (hazards) and apolitical phenomena, where the role of power relations is missing in mapping of vulnerable people and places. The apolitical approach is well demonstrated in the assessment templates and checklists of the Government, CSOs, and other strategic institutions, working for disaster risk reduction in Bangladesh but there are no specific queries in searching answers of "why are the people and places affected differently? and ‘’why are they facing greater difficulty to cope and recover?" The existing disaster analysis is also silent to answer, "why the people live in severe hazard-prone areas"? though they are facing repeated and multiple forms of disaster risk in those geo-ecological areas. The searching of answers is necessary for mapping of risk population and places to tackle the risk situation of disaster. This will guide to define appropriate solutions for resilient development planning in attaining of 2030 Agendas for Sustainable Development.

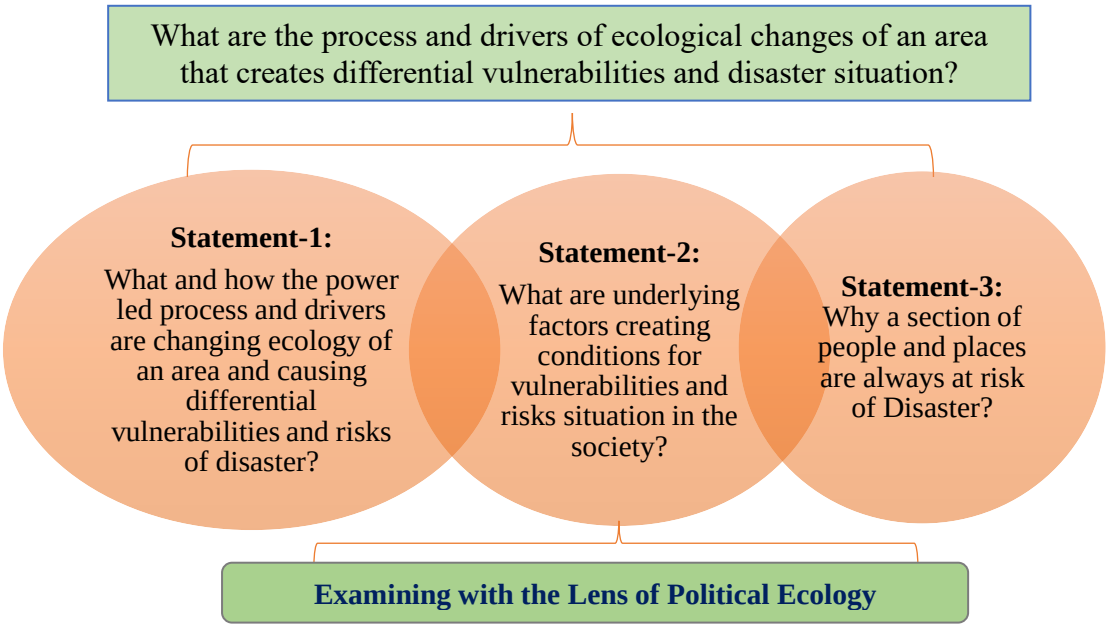


Figure-1: The Research Statements (Source: Author)

1.2 Aims and Objectives

The study aims to ‘’examine functional processes and power-led drivers of ecological change creating differential vulnerabilities and risk of disasters in South-west coastal areas of Bangladesh. It is an attempt to analyse and explore interlinked functions of power-led processes and drivers of ecological change in coastal area. This has applied both spatial and temporal data/information to explore the causal grounds of differential

vulnerabilities and the risks of disaster. It is further defined the underlying factors that creating conditions for vulnerabilities and risks situation in the society through using of remote sensing data and temporal data/information. The lens of political ecology is applied for defining vulnerable people and places as part of developing a framework for disaster resilient development in Bangladesh.

Considering that the study sets its focus on:

- ✓ Examine the functions of power-led process and drivers contributing to changing ecology and creating differential vulnerability in south-west coastal area.
- ✓ Explore the underlying factors creating conditions for vulnerabilities and risks situation in the society.
- ✓ Mapping of most vulnerable people and places that are always at risk of disaster.
- ✓ Developing a framework for ecological resilience development as a safeguard of the people and places so that the differential vulnerabilities and disaster risk issues can be better realised and addressed.

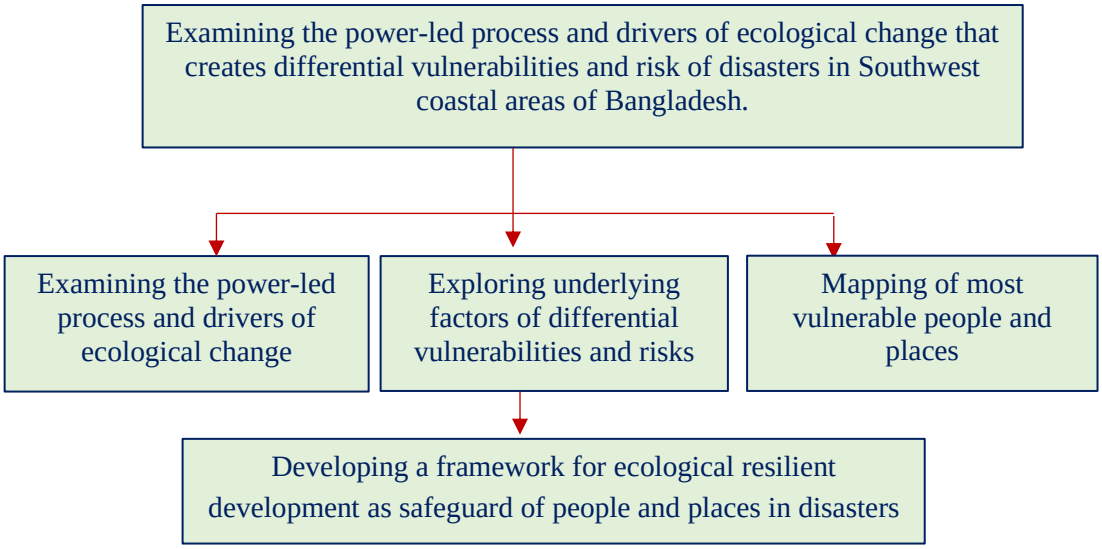


Figure-2: The Study Focus (Source: Author)

1.3 The Research Question

Based on three major problem statements and knowledge gaps, the research defines a key question, which is as follows:

What are the power-led process and drivers of ecological change that creating differential vulnerabilities and risk of disasters in South-west coastal areas of Bangladesh.

The key question is further examined in line with a set of queries:

1. What and how the power-led process and drivers are changing ecology of an area and causing differential vulnerabilities and risks of disaster?
2. What are underlying factors creating conditions for vulnerabilities and risks situation in the society?
3. What are the places and people being gradually vulnerable to disaster in South-west coastal areas of Bangladesh?

1.4 Development Objectives

The study has considered development objectives as the foundation of ground realities, where the people face differential vulnerabilities and risk of disasters that deny the progress of sustainable development in Bangladesh. It applies political ecology perspectives and integrates the recent development and disaster frameworks for setting an appropriate approach as a safeguard of vulnerable people and places for resilient development. Regarding this, the sub-objectives are as follows:

- Reducing vulnerabilities and risks of disasters through potential uses of people's capacity in advancing disaster resilient development.
- Addressing the processes of ecological change that force a section of people to be vulnerable and placing at-risk situations of disasters as useful actions for reaching the targets of stainable development in Bangladesh.

1.5 Research area

The research has a specific focus to examine the existing power led processes and drivers of ecological changes in the context of South-west coastal areas of Bangladesh. This also explores a set of causal factors that create differential vulnerabilities and risk situations of disasters. Considering that the research has chosen two diverse locations in South-west coastal areas of Bangladesh:

(i) Area-1: Shyamnagar Upazila, Satkhira district
(ii) Area-2: Koyra Upazila, Khulna district

Both areas are prone to multiple hazards induced disasters that would be helpful to examine and explore the answers to key research questions.

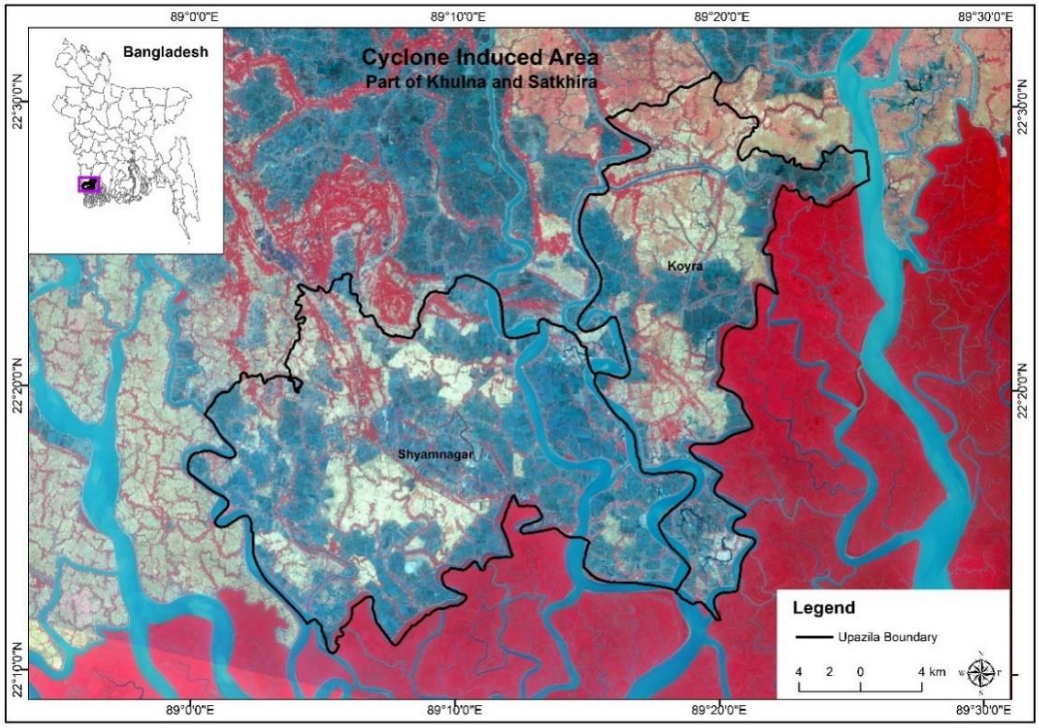


Figure-3: The Research area (Source: Author)

1.6 Organization of the dissertation

The dissertation has seven segments and ten chapters. Part I "the study" contains chapter one that describes the contexts and problem statements with a special focus on the aims and objectives of the study. This is further extended with key research questions, study areas and limitations.

Part II is titled "Review of Theory and Practices" and contains with chapter two. Hence, the chapter strategically explained conceptual position and theoretical orientation of the study. This also highlights most relevant models and approaches in analysing vulnerability and the risks of disaster that results in identification of appropriate models and approach. This is further justified with the lens of political ecology perspectives.

Part III is titled "Research methods" with the highlights of chapter three. This chapter potentially explains the applied study methods by spelling out methodological consideration, selection of methods, sources of data/information and analytical frameworks. The study contains specific focus on three methodological frameworks, such as: i) situation analysis (perception based); ii) geo-spatial analysis; and iii) qualitative analysis to extract all relevant data/information from both primary and secondary sources. Finally, it illustrates the analytical process of collected data and information as to support specific queries under the research questions.

Part IV is titled "Examination of Vulnerability and Disaster" and consists of three chapters. Chapter four demonstrates major disaster situations and its management practices in south-west coastal areas of Bangladesh. This includes: i) cyclone induced disasters; ii) salinity induced disasters; and iii) waterlogging induced disasters. It is further explained the impacts of all three forms of disaster situation on human lives and livelihoods that contributes to reshaping of power relations in the society. With the highlights of differential impacts of disaster situation, the chapter demonstrates the context of disaster management and existing practices in pre, during and post disaster situation in addressing needs of the people in Bangladesh.

Chapter five highlights the power-led process and drivers of ecological change in south-west coastal areas of Bangladesh. To examine the functions of power-led process, the chapter focuses on three interlinked process dynamics, such as: i) everyday dynamics; ii) episodic dynamics and iii) systematic dynamics. The explanation of processes dynamics is justified with evidential information and photographs on ground situation. This is further explained with a set of functional process that contributing to change the ecology in south-west coastal areas of Bangladesh. The ecological change process is verified with the visualisation of changing status of i) agricultural land, ii) human settlement and vegetation; iii) shrimp farming and waterbodies; iv) riverine area; and v) forest areas during the period of 1970 to 2020 in study areas. The changing process of landscape is also visualised and verified with remote sensing data/information in study areas. The analysis of functional process is also elaborated with the evidence of historical process in context of 1960's, 1970's, 1980's, 1990's, and 2000 and beyond. This chapter is also identified community perceived power-led drives of ecological change. Then, the functions of drivers categorically explained with geophysical and environmental, social, economic, and political dimensions. Finally, the chapter examines the influence of power dynamics with discriminations, landlessness and decision making to justify the role of power relations in the process of ecological change.

Chapter six is highlighted the underlying factors of differential vulnerabilities and risks in the society. It examines vulnerability and its underlying factors in line with three basic elements of PAR model, such as: i) root causes, ii) dynamic pressures; and iii) unsafe conditions. It provides an overview on how the root causes are contributing to placing a section of people to an unsafe condition and while they face hazard situation, it bears a risk situation for them. After that the chapter has defined a set of actions/solutions to release the underlying causes for making a risk-free society. At the end, it has explored the proportionate vulnerabilities of people and places along with their risk tolerance level in study areas to find appropriate solutions for reducing the vulnerabilities and risks.

Part V is titled "Framing the Safeguard" and consists of chapter seven. This chapter initially articulates the conceptual frame for building of ecological resilience and its significance in context of Bangladesh. Then it strategically relates the needs of vulnerable people and places for ecological resilient. It proposed a set of actions for restoration of political-ecological system that contributes to reduction of differential vulnerabilities and risks of the people and places in South-west coastal areas as requirement of development in Bangladesh.

Part VI contains chapter eight as a "summary and conclusion". This chapter summaries overall discussion points with the highlights of i) linkages of political ecology and ecological change; ii) the impact of ecological change; iii) identified issues and challenges for reducing pre-disaster and post-disaster vulnerabilities; iv) the revisited theory and methods; v) redefining disasters; vi) policy implications and suggestions; and vii) contribution of research to the existing knowledge. This also explores future research directions for the next level of development planners and researchers.

Table-1: Organisation of the research (at a glance)

Political Ecology of Disasters	
Research Question: ***What are the power-led process and drivers of ecological change that creates differential vulnerabilities and risk of disasters in South-west coastal areas of Bangladesh?***	
PART I: THE STUDY	Chapter One • Introduction • The Problem statements. • Objectives • Research question • Development objectives • Research areas • Organisation of the study • Scope and limitations
PART II: THE REVIEW OF THEORY AND PRACTICES	Chapter Two: • Political Ecology in analysing vulnerability and disaster.
PART III: RESEARCH METHODS	Chapter Three • Introduction • Methodological considerations • Selection of methods • Major sources of data and information

	• Methods for analysing data and information
PART IV: EXAMINATION OF VULNERABILITY AND DISASTER	Chapter Four: • Major disaster situations and its management practices Chapter Five: • Processes and drivers of ecological change in south-west coastal areas. Chapter Six: • Underlying factors for differential vulnerabilities and risks in the society • Mapping of vulnerable people and places
PART V: FRAMING THE SAFEGUARD	Chapter Seven: • Safeguards for vulnerable people and places
PART VI: SUMMARY AND CONCLUSIONS	Chapter Eight: • Summary • Conclusions
PART VII: BIBLIOGRAPHY	• Bibliography

1.7 Scope and limitations

The study builds on three interlinked processes and power-led drivers of ecological change. It examines underlying factors of differential vulnerabilities and risks in the society. It does not follow traditional framework in analysing pre, during and post-disaster phases in isolation, it looks at the causal grounds and their impact on people and places. It is very much exploratory but deductive and it applies the lens of the political ecology. The study tries to examine the theoretical frame of political ecology in analysing vulnerabilities and disasters with a special focus on human-environment interactions as a form of ecology. But the study strategically considered a balanced framework for defining the changes in ecology. Even it focuses on specific geo-ecological contexts and situations of interaction. Initially, the study contextualizes major disasters situation in Bangladesh and then it extends its analysis to examine functional processes and power-led drivers of ecological changes at multiple scales to explore the causation of vulnerabilities and the risk to people and places in study areas. The study does not claim that the analytical findings in two specific coastal areas are similar, but the differences are seen in line with contextual and locational points of view.

Therefore, the study consists of a mix of micro and macro-scale analyses of context and situation. The limitation of resources restricts detailed field investigation of functional processes and drivers of ecological change. The study is used both primary and

secondary data/information extracted through the application of a set of research methods. There are some facts related to the functions of power-led drivers, which are not checked on the ground. For this, the secondary information is validated with reference to those facts.

In general, the research deals with causal drivers and its causal links of vulnerability and the risk of disasters through the lens of political ecology. It simply looks at a major form of disaster and its surrounded issues that transforms the situation of vulnerabilities into disasters. The disaster is a diverse issue because of its link with the social, economic, political, and environmental processes and multiple scales. Therefore, I have had to consider the selective processes, drivers, and scales of analysis due to the following reasons:

a) The human-environment interactions as a form of ecology, which is dynamic and changing over time. The human-dominated nature of ecology has a role to generate inequalities, landlessness and unequal power relations in the society that forces a section of people to live with vulnerabilities from generation to generation.
b) Some with each other, and it is difficult to justify the role of a single driver in defining the causal links of vulnerability in evidence.
c) There is some indigenous knowledge and evidence, which are not in recent practices of local people, really difficult to extract as support to the analysis of disasters.
d) Historical perspectives of ecological changes (i.e., landscape changes) can be discovered through analysis of satellite remote sensing data/information and people's perception in the context of specific areas.
e) The satellite remote sensing images and data are useful for mapping vulnerable places but its link with power relations on multiple scales is not fully discovered.

So, the research has a specific focus on the interlinked functional processes and power-led drivers of ecological change that creating conditions for differential vulnerabilities and risks of disasters in society. This has examined with the lens of political ecology. So, the discovered knowledge on causal grounds of differential vulnerabilities and risks of disasters may contribute to developing an ecological resilience development framework as safeguard for the vulnerable people and places in attaining sustainable development of Bangladesh.

PART II

REVIEW OF THEORY AND PRACTICES

Chapter Two

POLITICAL ECOLOGY IN ANALYSING VULNERABILITY AND DISASTER

2. Overview

Chapter two demonstrates a conceptual framework of political ecology and its position in analysing vulnerabilities and disasters. Firstly, it illustrates the conceptual position of vulnerability and disaster and then it signifies the appropriateness of different moles and approaches to uncover the causal grounds of vulnerability and the risks of disaster. Finally, the chapter examines the significance of political ecology perspectives to analyse vulnerability and disaster situation in line with specific research queries. The explanation uses the evidence and information from secondary sources to explore a new window for analysing vulnerability and disaster in context of Bangladesh.

2.1 Political Ecology

2.1.1 Concept and Position

The initial concept of political ecology was developed by challenging the natural control views of Malthusian theory on the global environmental crisis and Marxist theory (Frank, 1969; Wallerstein, 1974). It refers to the power, conflicts, and modernisation as a force of reshaping and destabilising the human-environment interactions. The critical analysis of the initial concept further turned into a red-green debate and explores a new concept of 'radicalised' political ecology. The analysis of Enrlichet. al (1990) contributes to the development of a 'radical political ecology'. This was reshaped as an idea of neo-Malthusianism. But the neo-Malthusianism argument rarely focused on the political notion of third world environmental change and ignores the political obstacles to define solutions for environmental crises. The reshaped conceptual position has made initial ground to realise the environmental change process in line with the political notion.

The intellectual shift of power centric analysis helped to examine the link of power in the environmental or ecological change process in the context of third world. It defines a process of enquiry into ecological change. O' Keefe (1975) and Wisner (1978) reveals an alternative research agenda in the analysis of disasters and concurrently refers to gaps in the analysis. As a fundamental concept, it was reshaped as an ecological concern of political economy. In the early 1980s, some researchers tried to illustrate the ideas of neo-Marxism in their place and non-placed based analytical framework. This illustration helped to explore the 'radical theory' in the analysis of contextual insights of the problems. At this time, the attention of some political ecologists concentrates on

defining the links between social conflicts and the environmental change process with the broader lens of political economy (Blaikie, 1985). The neo-Marxism led ideas of political ecology truly contribute to examining environmental conflicts as a link of class relation and over resource extraction for production. Hence, the functions of small-scale politics in the resolution of conflicts were rarely noted. In the 1980s the deterministic ideas of neo-Marxism in the analysis of development contributes to starting another phase of political ecology that is mostly driven by theoretical sources. Realising this idea, Blaikie and Brookfield (1987) and Guha (1989) tried to search for the answer to 'how power mediates human-environment interactions?'.

The direction of power-led analysis helped to explore the 'social movement theory' that was well-founded as a link between potential power and everyday resistance of grassroots actors in environmental conflict (Guha, 1989; Peluso, 1992). The power centric analysis contributes to generating a new dimension in the concept of political ecology that helped to illustrate the 'post-structuralism' and 'discourse theory' in the mapping of power-led ecological outcomes (Peet and Watts, 1996). It generates a conceptual view that the environmental or ecological change process should understand in combination with the relations of power.

In the mid-20th century, the concept of 'cultural ecology' or 'ecological anthropology' was introduced by anthropologist Julian Stewards. But it was heavily criticised because it ignores differences within societies, e.g., class, gender, and social organization. Realising the fact Hjort (1982) and Grossman (1984) examine the anthropological insights of human-environment interactions, which is further defined as 'progressive contextualization' by Vayda (1983). The insights analysis firstly refers to an argument that it has a limited focus on power and inequality. It contributes to shifting conceptual focus on power and difference in the interactions between humans and the environment.

Another conceptual framework of political ecology was developed as a result of human response to hazards and disasters. This concept sought to understand 'why individuals misperceived, ignored, or responded' in diverse ways to the environmental crisis. As searching for the answers, the University of Colorado, and Ohio State University undertook several research on disasters and the findings revealed that disaster response initiatives are disasters linked with power-led processes. Though the conceptual focus of political ecology is diverse in nature, it has a strong intellectual stand that contributes to developing an interdisciplinary political ecology. Hence, Bryan (1997) noted that:

> *Political ecology examines the political dynamics surrounding the material and discursive struggles over the environment in the third world*[9].

[9] Bryant, R.L., Bailey, S., (1997), Third World Political Ecology. Routledge, London

With a similar notion, Raymond L. Bryant (2016) argued that the analysis of political ecology requires a more detailed understanding of political and economic obstacles[10] that function in the changing processes of the environment. It also focuses on human and environmental drivers of disasters that may shape the development of an area. It explores a new development perspective in changing context of the environment (Peet and Watts, 1993; Schmink and Wood, 1987; Painter and Durham, 1995) and formulate an approach to disaster (Blaikie et. al, 1994). This idea refers that nature and society may act together to form disaster situations.

From this point of view, a disaster situation is not only dependent on natural dimensions but also a result of the social, economic, and political process that makes the vulnerable society. Hence, vulnerability is the key and most crucial concern because it is politically expedient. The understanding of vulnerability to disaster requires an analysis of social inequalities and human abilities as fundamental. It focuses on insights of social inequalities that refers to the question of 'how inequalities influence the risks confronted in everyday life?' and 'how it affects the people's ability to cope with loss or damages of disasters (M. Watt, 1983; K. Hewitt, 1995; Oliver Smith and Hoffman, 1999; B. Wisner et. al, 2004). All these queries can effectively contextualize with the use of political ecology perspective to explore the existing drivers of inequalities leading to create differential vulnerability and exposure to disasters.

From this point of view, I have applied "political ecology perspectives" in my research because:

- it examines and critically explains the causal grounds of ecological change.
- it explores the role of human actions.
- It allows a fundamental ethical position that drives with the rights of the poor.

2.1.2 Theoretical Orientation

The theoretical orientation of research is to analyse disasters using the lens of political ecology. It refers to an argument that how is power (politics) shaping the ecology of an area and continues to form a disaster situation? Hence 'power' is defined as social relations that are founded on uneven distribution of resources and risks" (Alf Hornborg, 2001). The politics is understood as the practices and processes of power, while it is welded and negotiated. The power relation is deep-rooted in the historical modification of nature and society, and it is expanded the from global to local level (Dietz, 2011). So, the political ecology demonstrates a way to examine 'how is the power relation mediates human-environment interactions as a form of ecological change (Figure-4).

[10] Raymond L. Bryant (2016). 'Power, knowledge and political ecology in the third world: a review, Progress in Physical Geography: Earth and Environment, SAGE publishing, India.

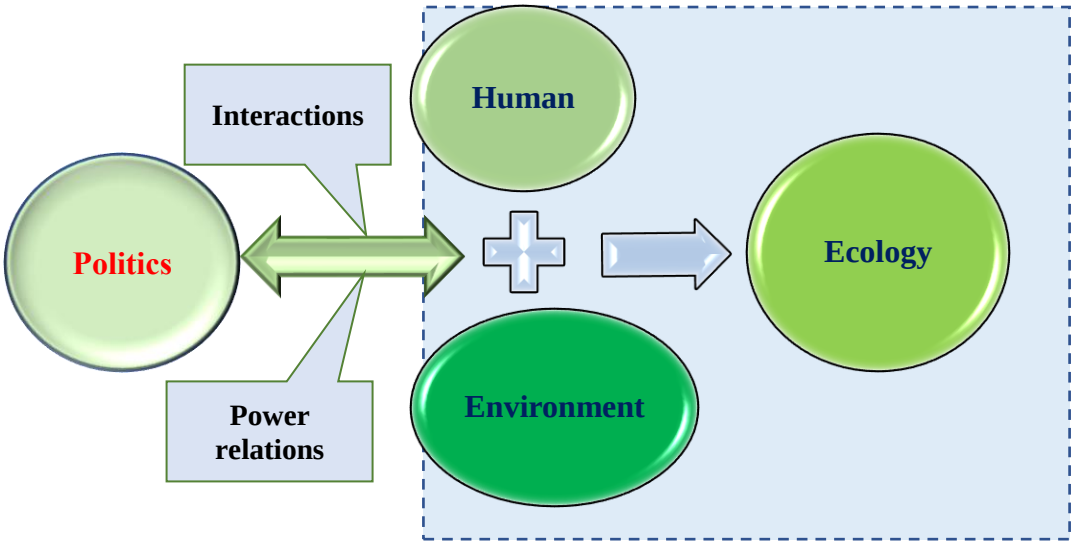


Figure-4: A conceptual link of political ecology (Source: Author)

The human-environment interaction is significant for analysing the processes of ecological change and defining the practical solutions of environmental problems. Because 'political ecology' argues that the environmental problems can't be contextualised in isolation that needs to analyse in line with political and economic context, where the problems are created (R.L Bryant and Baily, 1997). As reference, Bryant and Bailey (1997) reveals that the environmental/ecological changes are the result of power-led process. It refers the following assumptions:

Firstly:	The impacts of environmental change are unevenly distributed among the actors.
Secondly:	The environmental change reinforces social and economic inequalities that drives the poor to be powerless.
Thirdly:	The process of environmental change drives with a set of power-led actions and interactions.

The assumptions refers that the power-led processes are functional for environmental/ecological change and produces differential outcomes. It has added a new dimension in the analysis of environmental/ecological change that focuses on power-led processes and drivers. It makes the poor as main loser. Besides, the political ecology examines the environmental problems in line with multiple scales. There are some problems such as: soil erosion, deforestation that can be examined on a local scale, but disaster and climate change issues should examine on a national and global scale. It is fact that the human impact of global-scale environmental problems may have significance on local and regional scales. The reality is that the high-income countries

are mainly responsible for global scale environmental problems, while they suggest the low-income countries like Bangladesh to adopt a 'technical problem-solving approach' that required the technical and professional inputs of such powerful countries. Here the key argument is that the powerful actors (including states, multi-national institutions) are often played a major role in making suggestions or directions for devising a solution to environmental problems. As an example: construction of coastal embankment and polders in line with the suggestion of the Krug Mission Report (1956) that applied engineering solution of coastal flooding problems but over time it creates a situation of "water logging" in some part of south-west coastal areas in Bangladesh. The critical argument of Robbins (2004) added value to search the answers to 'how power relations of actors' changes at different scales (i.e., local, and global scales). But overemphasis on power centric analysis offers limited space to explore the insights of ecological change. However, the power centric analysis in the frame of political ecology refers to three interlinked issues:

(i) The processes and drivers that led to change by power-led actors.
(ii) The functions of power relations in changing environment.
(iii) The ability of powerless people or groups to recover the changes.

The power relations are often visible as control over access, ideas and practices that lead to the marginalisation of weaker grassroots actors. It reveals a theme to search the answer of 'how unequal power relates to diverse actors and reflects at the physical environment? The answer can specify a spatial pattern of power and resistance. But the ground reality is that the ability and control of the weaker grassroots actors over the environmental resources are quite limited. In the power centric approach of political ecology, the state is defined as a key institution as it is connected to pursue economic development. Hence, states have to play dual roles. Firstly, take measures to control or restrict any forms of destructive events on the environment at the grassroots level and secondly, support preventing actions to solve environmental problems at the global scale. The functions of global capitalism allowed the States to extract more natural resources for development, while it results in environmental crisis. In reality, Bangladesh has a very limited natural resource and alternatives to ensure optimal uses of its resources for national development. So, it is necessary to make the stability in the functions of development. The State has finally grasped the ground realities to revisit or reform the national laws and policies to cope with the changing situation. It has a strong link with national security that guides the states to make decisions on accepting ecological resilience development.

The multilateral institutions (e.g., IMF, ADB, FAO, and UNIDO) are also found very much active to revisit their actions in third world states. But the reality is that the actions of multilateral institutions have very limited success to prevent environmental problems. The Rio Conference in 1992 and Stockholm Conference in 1972 reveal the

space for long run dialogues and debates of states. So, the debates in environmental concerns in the ways of involvement of states and other institutions are the key point of argument of political ecology, which is missing in contemporary development research. The debates contribute to develop a notion of 'risk society' in the third world (Pepper, 1993, Norgaard 1994 and Beck 1992). The theoretical framework introduced by Blaikie (1994) defines a link between hazards and vulnerabilities. It was explained by the functions of three components: exposure, resilience, and resistance. It was further extended by Adams (1990) and Escobar (1996) with a concept of sustainable development. Rocheleau (1996) used the feminist political ecology approach to demonstrate a link between gender inequalities and environmental conflicts. The conflict issues are examined as an outcome of interactions (Long and Long, 1992) and as the struggle of multiple actors with overlapping mandates (Bryant, 1997).

The specific attention on risk society and vulnerability has made a significant contribution to explore a new debate on analysing causal grounds. Hence, Pelling (1998) pointed out that the power and ability to make the decisions are the central concern of differential vulnerabilities of the people. It is not a concern of the present or the future, but it bears the results of the past (Oliver Smith, 1996). So, the causation of vulnerability requires a historical analysis of power relations to understand the context, casualty, and situation in a particular geographical setting. Eakin (2005) has examined 'vulnerability' as a multi-scalar phenomenon. It also determines the level of community resilience to face disasters. However, the basic theoretical orientation of political ecology is to explore the root causes of environmental problems.

Despite that, the framework of political ecology is criticized by Brown and Purcell (2005) due to its failure to explain the issue of scale. It also fails to analyse the "local trap", which is necessary to examine human-environment interactions in the development processes. Another debate in the approach of political ecology is that it explores the dominant socio-political views in disaster studies with little attention to the physical hazard. Realising the facts and debates, the causation of vulnerability and its transformation to form a disaster situation is taken as a key issue in the application of the political ecology framework. It is significant that the frame of political ecology allows integration of the human-environment interactions in this research, and it was also strongly explored by Blaikie (1985); Blaikie and Brookfield (1987) as a requirement of interdisciplinary study to address the environmental/ecological crisis.

The consideration of the apolitical approach in the majority of vulnerability and disaster research in Bangladesh is still an issue of debate due to its missing link with power relations, scales, and actors. Hence political ecology is significant due to its compliance with these missing links and exploration of the causal ground of the environmental/ecological problems.

2.2 Why Vulnerability?

2.2.1 Concept and position:

The term vulnerability was firstly used in the early 1970s in the analysis of natural disasters. The concept was applied and explained in various disciplines in line with their focus and interest which often diluted its usefulness. But the rise of comprehensive approaches to disaster planning during the IDNDR eases those doubts. This was inspired by technology-driven hazard-perception of disaster risk in the 1970s in defining a core notion of the term as "potential for disruption or harm" (Alexander, 2000). But the over-emphasis on infrastructural solutions to hazards places it in the challenge with an argument that engineering solution is not enough to reduce the losses or people's harm. This argument contributes to generating a new concept of vulnerability that contains specific attention to the analysis of social, economic, environmental, and informational dimensions of a group of people. At this time, an explorative concept of vulnerability was developed by Amartya Sen (1981; 1989) that noted as a concern of the entitlements. It was further explained by Drezeand Sen (1989) as the buffer of households. The entitlements will fail to buffer if the households are unable to sustain them. The 'vulnerability' approach is often paid more attention to individual groups or communities as a concern of their coping capacity.

The term 'vulnerability' became more confusing, while the ecology perspective was introduced in disaster studies. It encompasses attention to people's ability to react or protect them from disasters. But the political perspectives focus on people's ability to recover and cope with the emerging unsafe condition and adapt to the existing and future risks. It refers to a causal ground: 'why is a section of people becoming poor?' And 'who lives in an unsafe condition?'. It is further explained by the UN in 2005 in the Hyogo Framework 2005-2015 as the functions of physical, social, economic, and environmental factors or processes that increase the susceptibility of communities. The framework produced a generic description of unequal access and opportunities to resources. The knowledge gaps contribute to explore a new concept of resilience in the discourse of vulnerability. It refers to a new space in assessing and understanding vulnerability through alignment with the environmental change processes.

2.2.2 Defining vulnerability:

There is still no concise or well captured well-captured vulnerability. The initial definitions were mostly focused on natural hazards (Editorial, 2006). R. Chambers (1989) firstly introduced a more systematic definition of vulnerability that focuses on the ability and experiences of communities to cope with stresses and difficulties. The definition of vulnerability shifted its focus, while it applies the concept of marginalisation and dependency in analysing disasters (Susman, O'Keefe and Wisner, 1983). G. Wilches-Chaux (1993) refers to the incapacity of the community to adjust to

the impact of the changing environment, while Alexander (2000) noted it as a potential force of causality, destruction, disruption and other forms of loss and damages. From this point of view, Cardona (2004) denoted that vulnerability instigates as a result of:

1) Physical delicateness
2) Socio-economic delicateness; and
3) Lack of resilience.

As part of the concept of entitlement, Amartya Sen (1981) refers to vulnerability as the ability of individuals and communities to access and control resources in adverse situations. It explores the human capacity to handle adverse situations and stresses. Klein and Nicholls, 1999 also define 'vulnerability' as the function of resistance, resilience, and susceptibility. In the majority of hazard research, vulnerability is measured in one with the loss and damages. It captures people's inability to protect themselves against possible loss or damages in adverse situations. Hence, Pelling (2003) explains it as exposure to risk. But Oliver-Smith (2004) introduced a fundamentally political concept of vulnerability that critically explains it as the nexus of people and their environment. UNISDR (2004) defines it as a situation that forces a section of people to face the impact of hazards. However, a critical argument has been proposed by Wisner (2005) in defining vulnerability as:

> *A situation that influences people's ability to manage, survive and recover from the impact of hazards.*

Therefore, the above definition reveals that vulnerability involves people with higher risk than others because of its connection with the ability of people or groups to resist harmful effects of hazards. The differences and debates in the definition of vulnerability demonstrate three key approaches and frameworks:

1) Risk-hazard approach.
2) Political Ecology approach; and
3) Ecological resilience approach.

It is fact that risk-hazard issues are often running with engineering solutions to the problems, while ecological resilience issues drive by human actions in changing the ecosystem. Both are focused on an apolitical approach. But the vulnerability has grown up in a context of inequality, inability, and powerlessness to exert control by rights or threats with the own coping capacity of individuals or groups, which is missing in the techno-centric hazard approach. The vulnerability approach signifies that it forces a section of people to live in at-risk situations. Hence, political ecology is significant to search for the causation of people's vulnerability and explain the capacities of a group

of people or communities to cope and adapt to the changing situation. Therefore, vulnerability issues signify the accessibility and ability of the people or groups to cope with an adverse situation. But the reality is that people have differential access, opportunities and exposures in society and face differential vulnerabilities.

2.3 The theoretical frameworks of vulnerability

The conceptual models of vulnerability have been analysed by different authors to examine the interactive processes and components of vulnerability to disasters. The research strategically examines the relevance of such models in analysing vulnerability to disasters.

2.3.1 The Hazards-of-place model

The model demonstrates that the vulnerability of places depends on a combined situation of hazard experiences and the response of society. Cutter (1996, et al. 2003) introduced this model to examine the underlying social and biophysical elements of the vulnerability of places (Figure-5). The model examines the interaction of risk and mitigation that contributes to creating hazard potential. Hence, the hazard potential drives by the geographic context and underlying social fabric to create the place of vulnerability. It contains with:

- ✓ Socio-demographic features.
- ✓ Risk experiences.
- ✓ People's ability.

On the other hand, the place itself creates a situation of biophysical vulnerability.

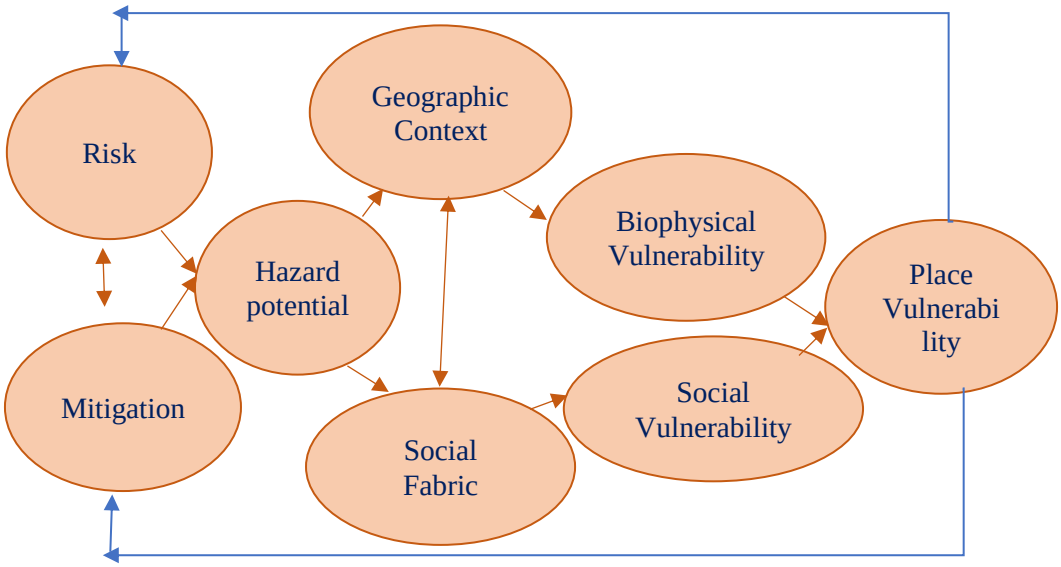


Figure-5: The Hazards of place model (adapted from Cutter, 1996**)**

Besides, the model refers that element of physical and social vulnerability are mutually linked and create a space for overall place vulnerability. The situation of a place can be changed over time, and it depends on the risk situation, mitigation measures and local context. The model attempted to highlight three major elements:

i) Biophysical.
ii) Social, and
iii) Place of vulnerability.

But the key argument is that the model mostly focuses on physical and social dimensions of vulnerability rather focuses on its underlying causes. The model is also silent to signify people's ability and functions of the human dimension as the underlying causes of vulnerability.

2.3.2 Risk-Hazard Model

This model (Figure-6) is a combination of risk and hazard that generates disaster risk through the functions of vulnerability and hazard (R =V X H). It contains two major elements:

- Experiences to face the hazard situation; and
- Responses of the people; and.

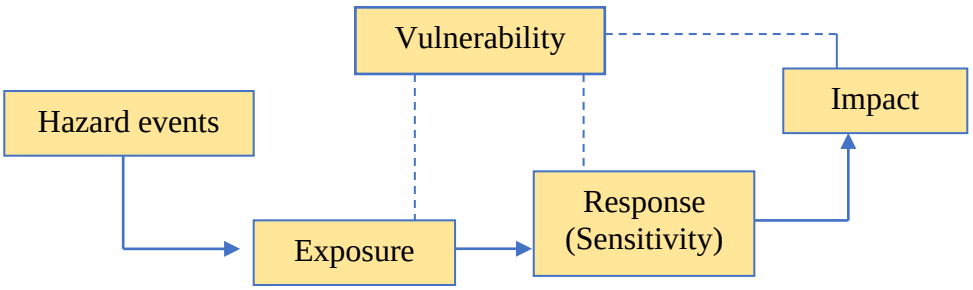


Figure-6: Risk-Hazard model (adapted from Turner et al., 2003**)**

The key argument is that the model has limitations to analyse the disaster situation. It is also silent to search for the answer to queries 'how the system influences the impact of natural hazards?'. It also denies the role of political and economic institutions in the shaping disaster situation.

2.3.3 Pressure and release model

The Pressure-and-Release (PAR) model is appropriate for analysing the causal grounds of vulnerability and disasters (Figure-7). The model signifies that risk is the product of vulnerability and hazard situations. It claims that the vulnerable population is mainly exposed to disaster situations (Blaikie, et al.,1994; Wisner, et al., 2004).

The PAR model focuses on two interactive forces:

(i) progression of vulnerability; and
(ii) hazard situation.

It underscores an argument that the process of vulnerability forces a section of people into an unsafe condition, and they face the risk of disaster if they face the impact of hazards. The model signifies that the risk of disaster contributes to create a pressure situation for the people, who live in an unsafe condition. On the other hand, it reveals opportunities to relieve the pressure. It refers to an equation:

Disaster (Risk) = Vulnerability (V) X Hazard (H)

The above-mentioned equation denoted that disaster is a combined force of vulnerability and hazard situation. It bears a risk situation for the people, who live in an unsafe condition. The PAR model (Figure-6) traces the progression of vulnerability in line with the three contexts:

1) ***Root causes:***
These are effectively connected with existing social, economic, and political processes that result in differential power relations in society (Blaikie and Brookfield 1987).. As an example, the poor and marginalized people are defined as the powerless, while the rich and political elite people hold and exercise the maximum power in society.

2) ***Dynamic pressures***
It refers to a set of processes and actions that may transform the effects of root causes to create an unsafe condition in society. The processes and actions can be illustrated clearly by the example of migration or human displacement that arises in Bangladesh as a force of inequalities inherent in root causes.

3) ***Unsafe conditions***
It contains a situation, where people face an increased level of vulnerabilities in a specific time and space. The situation depends on the status of human well-being, that may vary in line with scales and social elements (i.e., households and

individuals). As an example: a section of people has to live in hazardous locations, while they are mostly unable to afford safe living conditions and engage in uncertain livelihoods. It allows to examine the causal factors of vulnerabilities, that are interlinked and potentially transformed as roots causes, dynamic pressure, and unsafe conditions.

The strength of this model is that it has systematically explained the causal factors of vulnerabilities and their link to create a disaster situation. The model has also defined the pressure release issues in disaster situations as guidance for reducing vulnerability and avoiding disaster. Though this model puts more emphasis on macro-scale issues, it has enough space to examine the causal chain of vulnerabilities using micro-scale elements. It is basically outlined as a precondition of disaster situations.

Considering that the study strategically applied the framework of PAR model to explain the causal ground of vulnerabilities and formation of disaster situations for specific groups of people. The analysis of vulnerable areas, coping capacity and accessibility to safety may add value in applications of this model in different scales and contexts of Bangladesh.

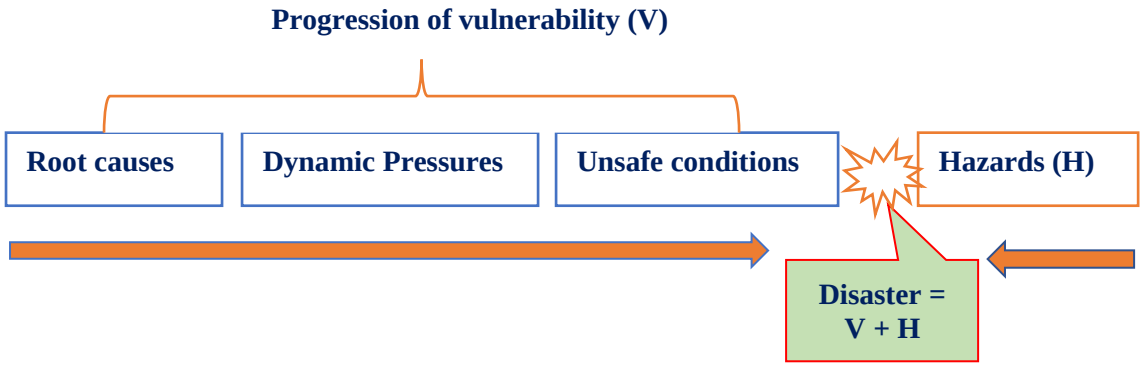


Figure-7: Pressure and Release (PAR) Model (by Blaikie et al. 1996, Wisner et.al. 2004**)**

2.4 Theoretical approaches in analysing vulnerability

The discussion on a theoretical model of vulnerability reveals differential arguments and debates around how to analyse vulnerability in theory and practices. This has continued to the framing of approaches to analyse vulnerability and the review of such debates explored three broad intellectual lineages. These are as follows:

1) Risk-Hazard or biophysical approach,
2) Political ecology approach, and
3) Ecological resilience approach.

The above-mentioned approaches have a different focus and framework but contain specific end results in addressing vulnerabilities.

2.4.1 Risk-Hazard Approach

This is an initial conceptual framework for analysing vulnerability. It determines the risk with interactions of hazards and vulnerability. It is mostly applied by engineers and economists in their technical literature on the disaster. Brooks (2003) noted that the approach considers negative outcomes as a function of biophysical risk and the 'potential for losses' of the exposed population (Brooks, 2003). It focuses on a set of queries on a broader scale of analysis:

- What refers to the risk?
- Who are becoming vulnerable?
- Where and when the risk situation occurs?
- What are the impacts of risk situations?

It is a very important fact that the risk-hazard approach refers to a clear distinction between the 'hazard' and the 'vulnerability' that determine the risk to a particular system. Hence the hazard is a destructive physical or human-induced event that are potentially uncovered in line with its location, intensity, and frequency. On the other hand, vulnerability is denoted as the function of hazards and potential losses or damages (Coburn, 1994; UN, 2004). This function refers to a simple equation:

Risk = Hazard x Vulnerability

The function demonstrates an interpretation of risk and vulnerabilities that are defined by Sarewitz (2003) as 'outcome risk'. This outcome risk is illustrated as:

- Potential loss or damages for a given time and space (Adams, 1995).
- Results of interactions between hazard and vulnerability.

But increasing attention on social drivers and institutional performances in vulnerability analysis that defines differential sensitivity and capacities to environmental stress in the late 1990s made significant contributions to impact-oriented research rather than hazard centred vulnerability analysis (Kelly and Adger, 2000). The changing attention helped to clarify that hazard impact is necessary to understand the changing environment with the lens of the human-environment system. The risk-hazard approach argues that traditional ways of dealing with hazards through building more engineered structures is expensive, irrational and does little to deal with the underlying human problems (White, 1945). It is demonstrating a valuable insight into human-environment

interaction and the traditional distinction between natural and social and noted that mitigation is difficult when viewing the environment as a hazard. The environment is becoming hazardous as a result of human development (Burton, et. al, 1993). Therefore, it is clear that this approach is widely applicable in reducing the probability of hazards and impact of risk (by engineering or technological solution), but it fails to explain the differential sensitivity and capacities of the people.

2.4.2 Political ecology approach

The political ecology approach was developed as a response to analysing the impact of climate change and disaster (Blaikie et al., 1994). The key argument is that the technocentric focus of vulnerability analysis was unable to explore its causal grounds. The gaps in the analysis of vulnerability contribute to reshaping the frame of disaster and vulnerability research in line with the concept of political ecology (Hewitt, 1983). This reshaped framework has grown up with structuralism and neo-Marxist thought (Liverman, 1994), and recently shifted its focus on scale and causation of differential impact. It examines some specific questions:

- Why are the people becoming vulnerable?
- How are they becoming vulnerable? and
- Who is exactly being vulnerable?

Considering the key questions, Wisner (2005) denoted vulnerability as a situation that refers to people's ability. The political ecology approach is therefore focuses on examining differential experiences, impacts and capacities of people or groups to recover and/or manage the risks. Hence, the concept of coping capacity is usually implied in this approach. It has a strong linkage with Sen's entitlement concept (Sen, 1981). It also refers to the strength of people to respond for minimizing stress. The approach reveals evidence that a section of people or group is often facing more loss, damages, and suffering due to their existence and the impact of hazards. Realising the fact, political ecology researchers are often concentrating on people's ability to recover from the harmful situations of natural hazards (Wisner et.al., 2003).

In a similar contextual framework, Ulrich Beck (1992 and 1995) introduced two important books[11], where he contextualizes the 'root causes of vulnerability to disaster, as linked with the environmental crisis. The contextual analysis illustrates the nature of differential vulnerabilities of the people or groups that are denoted as 'risk society. It is created by power-led processes and drivers, not by natural forces. From this point of view, there is developed a common concern 'what are the functional processes and power-led drivers that create differential vulnerabilities and risk in the society. To

[11] The books titled Risk Society: Toward a New Modernity? (1992) and Ecological Politics in the Age of Risk (1995)

understand this extended context, Blaike et al. (2003) introduced the PAR model and tried to examine the intersection of two opposite forces:

a) Existing process that generates vulnerability; and
b) Hazard event that forms a disaster situation.

However, the political ecology approach has the potential to explore the causal ground of vulnerability in the changing context of an area. It signifies the importance of scales, functions of human-environmental interactions and their outcomes. The political ecology approach not only focuses on political dimensions of vulnerability but also signifies inequities, power relations and points of conflict within the society. Thus, in comparison with the Risk-Hazard approaches analysis, this (political ecology) approach is more people-centred and exploratory in defining the causation of vulnerability. As vulnerability refers to people's ability to cope with risk situations, it has a strong focus on social, economic, and political dynamics to explore the root causes of vulnerabilities and the risk of disasters.

2.4.3 Ecological resilience approach

This approach is relatively a new concept to the discourse on vulnerability. Hence, Ecology refers to a dynamic system of human-environment interactions. And the 'resilience' was firstly used by Holling in 1973 and illustrates as people's ability to fascinate the changes. The concept is rooted in ecology that considers an antonym of vulnerability. It explores resilience with two qualities:

i) Inherent; and
ii) Adaptive

These two qualities can be potentially applied to the existing institutional, social, economic, and structural systems. It recognises people as active agents in development. So, it was a concern of recent development debates as it determines the response capacity of society. There is an argument that a community-based management system enables people to improve the flow of knowledge, learning and information at different levels of governance (Olsson and Folke, 2003; Newman and Dale, 2005; Berkes et al., 2000). The idea of resilience is adopted in the Hyogo framework on DRR.

Table-2: Three conceptual lineages in vulnerability research

Key point	Theoretical approach		
	Risk-hazard	**Political ecology**	**Ecological resilience**
Key points	- Hazard - impacts - Time and places of hazard events	- Differential effects on people and places - Differential coping capacity - Cause and effect of differential vulnerability	- Causal grounds of systems change. - Response capacity to change. - Underlying processes and - People's ability
Key features	- Exposure - Sensitivity	- Capacity - understanding - experience	- Changing processes - People's learning ability
Unit	- Places, landscapes	- Individuals, - communities, - livelihoods	- Ecological systems
Scale	- Regional, - International	- Local, - National - International	- Landscapes - Scales
Disaster narrative	Reducing hazard impact	Reducing vulnerability and increasing capacity	Increasing Resilience

Source: Adapted from Eakin and Luers (2006)

2.5 Is political ecology appropriate for analysing vulnerability?

The term "vulnerability" has been turning up frequently in analysing disasters. Most of the cases, disaster researchers have tried to extricate physical hazards from disaster. Maskrey (1989) illustrates that:

> *Disaster is considered the result of interactions of hazards and vulnerability. It bears a risk for people, who are placed in a vulnerable situation and faced multiple forms of hazards.*

The critical part of examining vulnerability is that it requires examining people's ability to cope with the situation. It also refers to an argument that 'vulnerability' has a link with poverty (Cluny, 1983). But the simple clarification of the poor as 'vulnerable' can never help to formulate a development plan. The ground reality is that all people don't face an equal level of suffering in a disaster situation and also don't have equal levels of ability to cope with the situation. Considering that the strategic development plan contains a special focus on the elimination of poverty that requires taking of long-term actions to address the issues of inequalities, resource distribution and social protection. But disaster may not wait for the result of long-term actions.

Another argument is pointed out that the risk of hazards is not uniformly distributed through the population. This argument provides an insight that disaster is not only a natural event but also the result of power-led processes and drivers in society. It is fact that the argument never denied the significance of natural hazards, but it contains true attention to the causation of differential vulnerabilities that forces the poor to be the main victim of the disaster. The reality is that unequal exposure is the result of social inequalities. The process illustrates a framework to examine the 'political ecology of vulnerability' (B. Wisner et. al, 2004). It explores an insight into people's economic and political positions in society that determine their vulnerability to disasters and environmental crises (Bryant and Bailey, 1997).

Therefore, the framework reveals that vulnerability weakened people's abilities due to functions of external forces. As a reference, the effect of laws and policies, conflict situations, livelihood insecurity or climate change can act as an external force. The frame of political ecology refers to a view that the least powerful people or group in society often lives in a hazardous environment (P. O'Keefe et al. 1976). It bears a clear indication that a section of people often lives in at-risk areas, where they have to face differential vulnerabilities. On the other hand, the analysis of disaster with the lens of vulnerability deliberates an insight of its causal ground that intensified as the effect of climate change, particularly in Bangladesh. From 1970 to 2009, Bangladesh witnessed a total of 213 major natural disasters by which 376 million people were severely affected and 520,000 deaths (EM-DAT[12], 2010). So, disaster may occur when a natural hazard strikes vulnerable people.

Therefore, vulnerability is a forward-looking concept and appropriate for policymaking to transform a vulnerable community into a disaster-resilient society, which is a pre-requirement for sustainable development. The context or situation may change over time if the people's ability is declined. According to Sen (1981) and Blaikie (1994), the people hold their ability to compete for access to rights, resources, and assets with their fluctuating status. It also refers that people's capacity to protect themselves from vulnerability depends on their livelihood security, existing self-protection, and social protection elements (i.e., relations with the state or social and political structures and support institutions). It is general evidence that disaster in developed countries has little impact in terms of people's death but causes more economic loss and damage. It is truly the opposite scenario in third world countries. However, it is not valid evidence that vulnerability is only the issue of third world countries. There is a sizeable group of people in developed countries who are economically vulnerable to disaster. In the United States, for instance, there is evidence that low paid or unemployed people a much more likely to suffer human and economic losses in hurricanes or earthquakes.

[12] EM-DAT: The OFDA/CRED International Disaster Database

There is little or no space for ‘zero vulnerability’ in the historical realities of changing society. Both the hazard dynamics and the society are changing continuously, while the initial forms of vulnerabilities are diminishing but new ones emerging. Considering that the changes in people’s abilities may result in differential vulnerabilities. The circumstances also conspire to make people’s lives and livelihoods in hazardous locations, such as cyclone-prone coastal areas, where the environments expose people to unsafe conditions. Pelling (2003) also signifies that unsafe condition is created in the inherent space of under development and the process forced a section of people to live there.

From this point of view, the political ecology is very significant to reveal the causal drivers’ factors that create potential harm and make a group of people ‘vulnerable’. As it hurts society as well as national development, we should have to search for the ability of society to find a way to cope with any destructive situation.

2.6 Why the Disaster?

2.6.1 Concept and Position

In the early stage, the disaster was defined as ‘Acts of God’. It was mostly considered the sign of the divine in the Middle Ages. Quarantelli (2001) illustrated the idea with its implication that nothing could be done about their occurrence, while it explained by Burton and Kates (1964) as elements of the natural environment. An important shift in the concept of disaster is defined in the age of enlightenment. At this stage, the rise of scientific knowledge contributes to altering people’s perception of disaster. The concept was reshaped as ‘Acts of Nature’. The increasing experience of society and the spirit of humanity in a response to disaster contributes to exploring ideas of disaster as ‘collective stress’ because of their links with crises (Quarantelli, 1998). Dynes (1978) denoted it as the study of ‘social pathology’. Another expression came out from Kreps (1995) who explained disaster as “social disruption and physical harm” considering environmental, technological, and socio-political events. In recent years, the conceptual position of disaster is most intently defined by sociologists and geographers. In particular, Barton (1969) conceptualised disaster as a stress situation.

However, the changing concept of disaster demonstrates a formidable capacity for community resilience. Since the 1980s, the ideas of disaster have given preference to community resilience instead of emphasizing the elements of resilience. The elements of resilience have links with the vulnerability of communities to disaster experiences. The conceptual transformation revealed that society becomes more vulnerable, while the internal processes are unable to manage the impact of natural hazards (Adger and Brooks, 2003).

It refers that the focus of disaster has been transformed from the sociological to ecological perspectives with the changing environment and risk realisation. There is a conceptual illustration that disaster is not a natural phenomenon. Natural hazards turned into disasters through human actions. This is also validated by the remarks of Kofi Annan, 1999 as human behaviours may transform natural hazards into unnatural disasters that should be called unnatural disasters.

Therefore, the paradigm shift from a 'hazard-oriented approach' to a broader political ecological approach is visible in the analysis of the whole spectrum of disasters (Wisner et al. 2004). Based on that idea, several political ecologists explain the disaster as a result of human-environment interactions where they analysed the insights of disasters to contextualise the politicized environment with the intersection of ecological, social, economic, and political processes. They pointed out that disaster occurs when social, economic, and political systems interact with natural hazards and communities. All these potentially referred to a crucial conceptual argument that why and how disasters happen? Realising this, the study refers to the concept of 'disaster' as a complex form of human-environment interaction.

2.6.2 Defining the Disasters

The term "disaster" is defined as diverse dimensions that appear in hazards literature. The initial definition of disaster came up with some extensive debates. Primarily, 'disaster' was denoted as 'Acts of God' while Kreps (1984) defined it as a 'summative concept'. Sociological perception leads in the early 1970s to define:

- Disaster as a "Collective Stress situation" (Barton (1969).
- Disaster as "Social pathology" (Dynes, et al, 1978).
- Disaster as "Social disruption and Physical harm" (Kreps (1995)

Since the 1980s, the ideas of disasters have given preference to community resilience rather than emphasizing resilience. This has contributed to the shifting of the main focus of disaster definition from sociological to ecological perspectives. In the 20th century, technological advancement tried to redefine 'disaster' in line with the 'techno-centric approach' for the reduction of disaster impacts. It refers to a variety of definitions, such as Charles Fritz (1961) interpreted disaster as a situation, where the society suffers from serious disruptions and damages. During the last twenty years, a realisation came into the mind of disaster researchers that disaster isn't the result of human-environment interactions as it links with human ability. This realisation was helped to develop a more precise definition of disaster. UN (1992) has defined it as a serious disruption of social functions, while the people showed their inability to survive on their own. IPCC (2012) denoted disaster as 'severe alterations in the functions of society. The analysis of scale

and causation of disasters is the central concern of political ecology perspectives in which B. Wisner et. al, 2003 defined a disaster as:

> *"The product of social, political and economic environment (distinct from the natural environment) because it structures the lives of various group of people" (Wisner. et. al., 2003).*

The political ecology perspectives denoted disasters with causation of social and environmental interactions. It raises an important point in searching for the answer to 'why does disaster happen? The concept illustrates that disaster is the product of power led processes and drivers that force to change the ecology of an area and create differential vulnerabilities among the people. However, if we analyse the notion of the above-mentioned definition of disasters, we may define three major focuses:

1) trigger the role of nature.
2) human response, economic and political consequences; and
3) social causation of disasters that makes differential vulnerabilities and risks without denying the role of extreme events.

So, both nature and human dynamics are acting as a combined force to create a disaster situation. Considering the ground realities, the research considers the 'causal grounds' in defining disaster.

2.7 The Theoretical Perspectives of Disaster

The theoretical perspectives of disaster can explain in line with i) techno-centric; ii) social, and iii) political ecology perspectives.

2.7.1 Techno-centric perspective of disasters:

The technocratic approach was developed in the early 20th century with a special focus on logical assumptions. Bolt (1977), Bryan (1991) and Smith (1992) revealed that diverse scientific initiatives were taken at this time for examination of environmental change events rather than human-induced actions. It means that the technocentric approach endorsed 'disaster' as a natural force, while Bankoff (2000) moted it as a way of finding the technological solutions for disaster. This is mainly a hazard-focused approach. The key focus of this approach is techno-centrism, which provides a strong attention on technical or technological solutions of disaster. Though disaster research is often focused on hazard impact and risk analysis, it bears a strong argument in the application of applied scientific disciplines (i.e., engineering) in the 20th century. The policy-led institutions are heavily influenced by this approach. According to Heweitt (1983), this approach is basically focused on earth-centric processes, which are linked

with: i) tracking the processes; ii) planning and management of the processes and iii) introducing response initiatives (early warning). The technocratic process is apparent in different strategic frameworks of disaster management. UN IDNDR, in 1990 strategically considered the techno-centric approach in the management of disasters. The planning and applications of this approach is mostly dependent on technical and scientific institutions that deny the space for the grassroots actors. So, it refers to a top-down approach.

2.7.2 Social perspectives of disasters:

The sociological approach was developed in the early 1990s with a special focus on human responses to disasters. Quarantelli (1978) outlined this approach as the functions of community or society. The initial ideas were extended by Luhmann (1993) in search of the answer to queries on 'how differential social system deals with the uncertainties? He made a significant contribution to the social discourse of disasters. Susan Cutter (1988) further extended this social discourse with a statement that 'social response may contribute to minimising the impact of hazards. At this time, the social scientists began by examining issues of vulnerability in disaster studies. It was referred that the severity of vulnerability depends on the ability of people or communities to live in a difficult situation. Aptekar and Boore (1990) and Morrow and Enarson (1996) signified that it has a diverse impact on different groups of people due to their social position. The conceptual position of vulnerability and people's ability made a significant contribution to illustrate the social perspectives in disaster. There was a long debate and discussion on 'why the people face disaster situations?' As part of this debate, Blaikie (1994) noted that the vulnerability issues are rooted in the society and the analysis of vulnerability can provide an initial understanding of the causal grounds of disaster.

From this point of view, the social perspective of disaster has a special focus on social aspects of vulnerability, which were largely ignored in techno-centric perspectives. It has provided an illustration that the analysis of social loss is missing in the post-disaster situation report. Considering that the social perspective recognizes 'disaster' as social causation of vulnerability due to its linkages with social forces. The explanation denoted that social perspective recognises 'disaster' as social causation of vulnerability due to its linkages with social forces. Social causation is also responsible for influencing or shaping people's ability to respond. It means that the social causation of vulnerability is an integral part of risk analysis in disaster because of its link with people's ability to respond.

2.7.3 Development perspectives of disasters:

The development perspectives of disasters denoted a relationship between disasters and development (Figure-8).

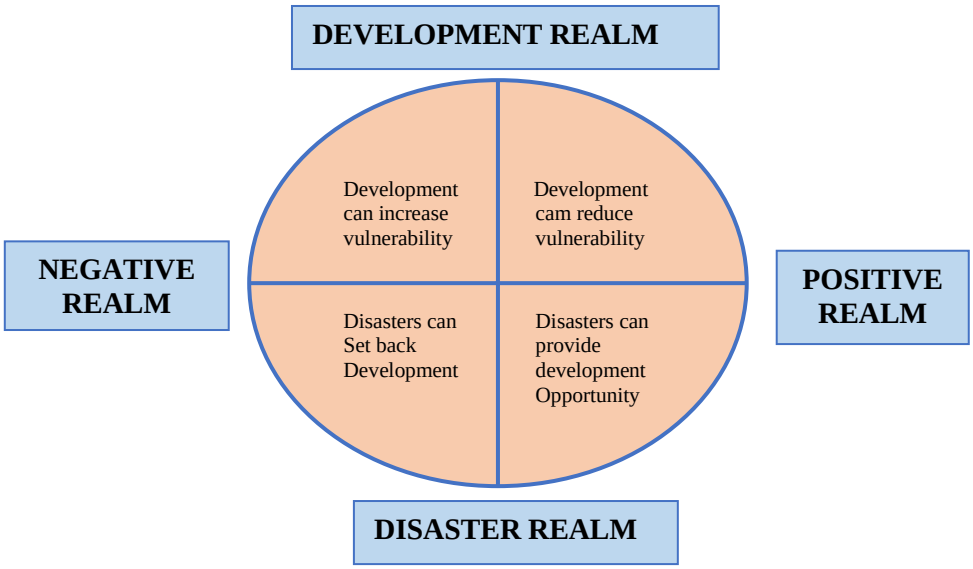


Figure-8: Relations of Disaster and Development (adapted from UNDP, 1992)

It focuses on two major facts: i) suffering, and ii) coping capacity. Hence, the relationship refers to both positive and negative aspects of disaster and development. The losses and damages of disasters occur due to functional actions of development (Mileti, 1995), which is further illustrated by Cunny (1994) with the statement 'disaster can set back development. The views are extended in the sense that the development perspective should be part of post-disaster operations. UNDP (1992) also refers to a three-dimensional link of disaster with:

i) Development.
ii) Vulnerabilities and
iii) Opportunities.

The relations illustrate that when the society shows its inability to survive, the crisis transforms into a disaster that reflects a basic failure of development. Lewis (1999) reveals a contradiction in the statement of linkages on development and vulnerability as well as with coping capacity. The concept of development is very crucial, while it is examining the interrelationships between disaster and development. Albert Hirschman (1958) noted that unequal development can facilitate the advancement of an area, while others either stagnated or fall behind. It is an illustration of unbalanced growth of development, which is aligned with the notion of dependency theory. So, the differential impact of development on population and locations may have influential roles to create vulnerability to disasters. Disaster may severely reduce the long-term development potential of a country. It requires the prioritisation of development programmes of the government. Anbarci (2005) argued that poverty and disaster risk reduction are complementary to each other. But there is still no equation used in measuring the effects of disaster on development. The contemporary disaster

framework is able to define potential loss and damages of disaster, which are partially linked with measuring effects of disaster on development. The conceptual framework of ADRC (2005) also tried to examine potential impact of disaster on development. The framework signifies that disaster has an additional role in destruction of development (Figure-9).

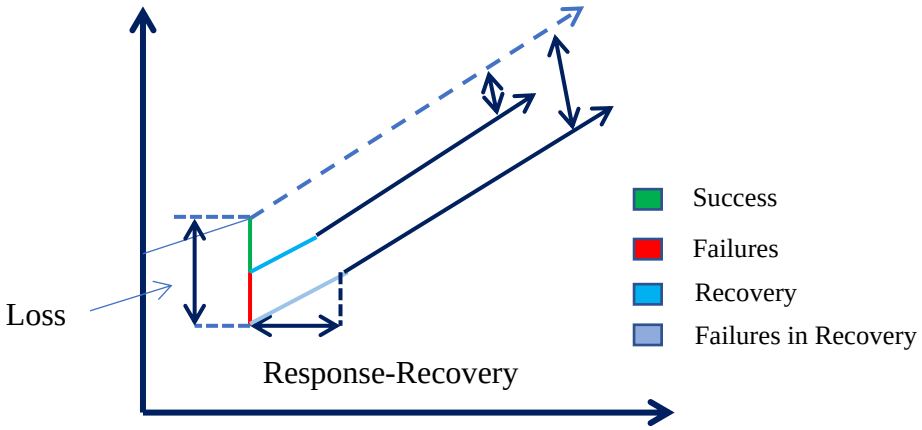


Figure-9: Impacts of Disaster on Development (adapted from ADRC, 2005)

There are some logical arguments defined that disaster could explore additional options and opportunities. Regarding this, Tierney (1989) pointed out the need for negotiation for new extracting resources in a disaster. Another form of argument comes in defining the relations of disaster and development. The argument refers that disaster has a link with the social and economic crisis that has a potential life history. It depends on:

a) Initial ground situation
b) Occurrence of hazards
c) Ability of the society to respond.

But the setting of time and space in each period of disaster is very difficult. But the analysis of the above-mentioned phases has a significant contribution to make a constructive direction for the development perspective of disaster. It requires a relative assessment. For this, Cunny (1983) and Lewis (1999) suggested an integrated analytical framework that will consider the situation of all phases: i) ground situation; ii) impact of hazards; and iii) success in response and recovery in measuring the links with development.

2.7.4 Political Ecology perspectives of disasters:

The intellectual root of political ecology lies in studies of disaster. The initial notion of the political ecology perspective was mostly based on “conventional hazard research (Wisner et. al. 1976). It focuses on natural and technological problems faced by human communities. Political ecology examines the interactions between the people and the

ecosystem (Blaikie and Brookfield, 1987; Schmink and Wood, 1987). The framework critically reviewed the 'dependency theory' and the 'world system theory' and redefines disaster as a situation of interaction. The concept explores a critical argument 'why does disaster happen'? Wisner et. al (2003) defined it as the product of social, political, and economic environments. Oliver Smith (1999) noted it as part of a long run human-environment interaction that explores its incomplete control and incomplete knowledge. There is evidence that the environmental change process may generate a condition, where natural hazards may transform into a social crisis.

The statement was further extended by Watt (1983) using an argument that the risk of disaster exists in the society and the hazard plays the role of catalytic agent to generate social crisis or risk. The argument demonstrates that disaster is the result of dynamic relationships between humans, its socially generated and politically enforced patterns, and its natural environment. It signified those social institutional measures by which humans' access and alter the natural environment are the key to forming disasters. The process reinforced a structure that transforms the society socially and economically vulnerable. Whenever the society face natural hazards, it creates a disaster situation. The core view is that disaster reveals a situation that creates the interface of two forces: i) the human population, and ii) the functions of destructive agents in society. In this view, if the vulnerability is considered essential to the understanding of the disaster, the question of time becomes fundamental. It is fact that society develops through time, it may reduce or increase its patterns of vulnerability to specific hazards through adaptation or in building people's ability. The political ecology perspective appears to explore causal grounds of disaster and its link with development. There was another evidential analysis introduced by Peet and Watt (1993) and Schmink and Wood (1987), where they defined a strong connection of the environmental change process with development.

2.8 Is Political Ecology appropriate for analysing Disasters?

The central argument in the lens of political ecology is that "vulnerability caused disaster not hazard". In support of this argument, the political ecologist noted that environmental events, such as cyclones, and floods, which are termed hazard phenomena, but it has a strong link with ecological and social functions. The hazard can be transformed into a disaster situation when the people or communities are unable to cope with the situation. Hewitt (1997) added an argument that 'no disaster is natural. The argument contributes to develop a political notion of disaster.

Considering this point of view, political ecology has appeared as an approach to counter the apolitical notions in analysing ecological problems. Because it examines the causal

grounds of vulnerabilities when evaluating any problems. The examination of UN ISDR, 2004 definition of disaster[13] reveals three key points, which are as follows:

2) It causes extensive losses and damages.
3) It affects the community or society, where the people show their inability to survive.
4) It focuses on how hazards affect the people but not enough emphasis on the surrounding social environment.

The above-mentioned points reveal the following queries:

- ✓ Why do disasters happen?
- ✓ Why are the people in the community or a society affected differently? What are the processes and drivers that contribute to differential vulnerabilities and risk?
- ✓ Why the people have different abilities?

Hence, the political ecology may contribute to search the answer to such queries.

Firstly:

Political ecology is significant to examine the crucial argument of 'why disasters happen?'. The existing focus on disaster is mostly driven by natural events but not enough emphasis on the surroundings of the social environment. It has been observed that a section of people lives in adverse economic situations that oblige them to reside in hazardous prone areas. In such a situation, they have to face multiple and repeated forms of stress and shocks that contribute to extending their lifelong struggle. The struggle is denying the ability of a section of people to accumulate resources and savings and ultimately creating a risk group in society. The reality is that the people, who live in at-risk group in society are the main victim of disaster situation.

Secondly:

Political ecology is significant to analyse the processes (i.e., social, economic, political, and environmental) and drivers (internal and external) that are functional in the surrounding social environment to create differential vulnerabilities. The Basic Emergency Management doctrine refers to those disasters that affect people differently. It is often measured with loss and damages, but the political ecology examines why a group of people always become the main losers in disasters? Political ecology also analyses the failures of institutions and actors in the implementation of legal/policy frameworks in addressing the impact of disasters.

[13] UN ISDR definition, 2004 *"A disaster is a sudden, calamitous event that causes serious disruption of the functioning of a community or a society causing widespread human, material, economic and/or environmental losses which exceed the ability of the affected community or society to cope using its own level of resources".*

Thirdly:

The political ecology approach is significant to examine differential abilities and coping capacities of the people or a group of people in the society as a force of social inequalities. It is appropriate to uncover the causal grounds of unequal power relations and inequalities in the society that create differential access, control, and opportunities among the people. Besides, the political ecology can illustrate a situation that extends the struggles of a section of people in the society to survive, while they express their inability to cope with disaster situations.

The political ecologist explores another contextualization that the poor and marginalised groups are mostly suffering from existing vulnerabilities and the risk of natural hazards. It is also observed that women, persons with disabilities, old aged, widows and other excluded groups are more sufferers than others due to their dependency and social limitations that often deny them to take shelter during extreme events in high-risk areas. There is evidence that 91% of fatalities in Bangladesh after Cyclone Gorky (held on 29 April 1991) were women (World Bank 2012). The UNDP's DRR Index reveals that disaster hits poor people disproportionally. HELMER and HILHORST (2006) illustrate that the poor have very limited capacity to handle disaster situations and it results in the extension of their vulnerabilities to face the next disaster. According to Wisener (2003), the existing process of analysing disasters is often a reluctance to deal with causal factors due to its political notion. It refers that the functions of social, economic, and environmental processes and power-led divers have a significant role in creating a disaster situation. But it may vary from disaster to disaster. Besides, human-induced actions also make a significant role to modify the natural (i.e., deforestation may contribute to flooding in downstream areas), and other power-led processes (i.e., social, economic, and political) are often modified by a disaster. Therefore, the consideration of time and scale is very important in analysing disasters.

Political ecology has a special focus to uncover the causal grounds of vulnerabilities and the risk in society in line with a longer time duration. It also considered the role of hazards, and it may offer additional resource allocations and opportunities, but it may create conflicts. According to Pelling and Dill (2006), disaster can trigger political action. The evidence suggests that the occurrence of the 1970 cyclone in East Pakistan reinforced the independence movement of Bangladesh. In reality, the stress of disaster also reinforces the process of social transformation that acts as a 'trigger event' disrupting the balance of the society. From this point of view, if the disaster contains the result of social-ecological inequalities, it needs to explore insights into five dimensions, which are:

1) Unequal distribution of ecological risk.
2) Uneven people's ability.

3) Uneven response to ecological changes.
4) Unequal functions of socio-ecological crisis. and
5) Unequal power relations and asymmetries in searching for solutions.

It is noted here that the political ecology perspective strategically considers the drivers of social-ecological inequalities that create a space for disaster. The conventional approaches to disaster are reluctant to examine the social-ecological inequalities because it has a political notion. So, the study has applied the political notion of disaster under the frame of political ecology to uncover the causal grounds of vulnerabilities and the risk of disaster. It also signifies the functions of two paradigms: i) vulnerability, and ii) resilience as linked with political ecology to examine the progression of the vulnerability framework for a resilient development (Table-4).

Table-3: Four disaster paradigms

Disaster narratives	Security is about	Security Referent
"Hazards"	Reducing Probability	Infrastructure
"Risk"	Reducing Probability X Impact	Flood plains/ Coastal areas
"Vulnerability"	Reducing Probability X Impact X Vulnerability & Increasing Capacity	Community/Group of people
"Resilience"	Increasing Resilience	Social system

Source: Adapted from McEntire et al., 2002

2.9 Why is the Resilience Approach?

The research considers disaster resilience as an approach due to its significant role in sustainable development. It is taken as an opposite force of vulnerability and indicates the capacity of a section of people to deal with future shocks. It refers to the adaptive capacity of the people. Adaptive capacity is a central concept of the 'Sustainable Livelihood Framework' introduced by Chambers and Conway (1991). The term resilience has become increasingly applied in disaster management. UNISDR, 2009 defined it:

> *The capacity of a system, community or society exposed to hazards to resist, absorb, accommodate, and recover from the effects of a hazard in a timely and efficient manner (UNISDR, 2009).*

Resilience depends on the ability of the community or society to cope with the changing situation. It refers to a positive approach. Gallopin (2006) illustrates the linkages of vulnerability and resilience where the people's capacity is denoted as a central concern in addressing changing situations. The illustration argues to look at it together to work

out the overall ability to retort and recover (Figure-10). It was revealed as a positive approach in the field of development.

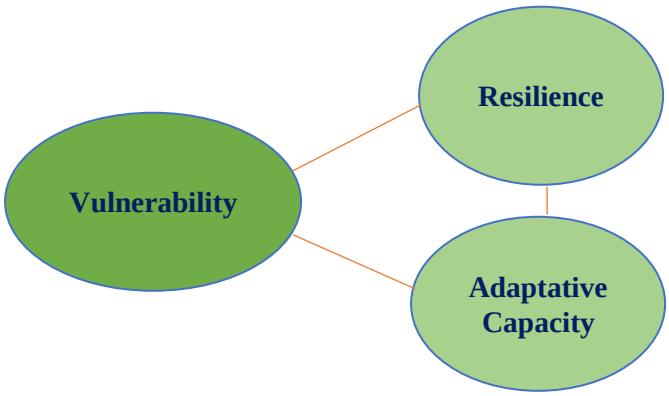


Figure-10: The linkages of vulnerability and resilience (Source: adapted from Gallopin, 2006)

The concept of resilience is significant for the disaster risk reduction approach due to its prime focus on the reduction of vulnerabilities at the individual and community level (Figure-11).

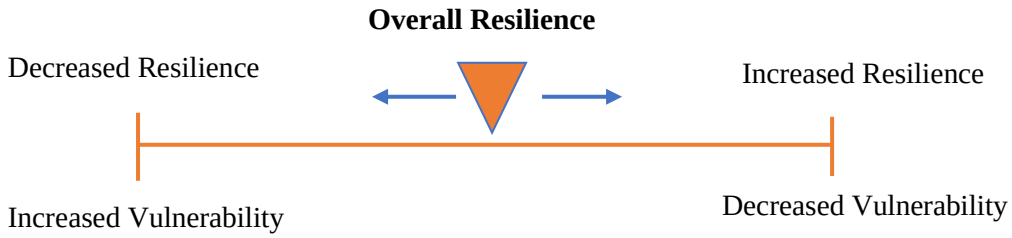


Figure-11: Vulnerability as Resilience (Source: Author)

The resilience approach is significant to examine resilient development in the context of disaster. Because disaster extends the vulnerability of people and places and undermines people's ability to cope with changing situations. It also undermines all aspects of sustainable development. Hence, Wisner (2004) denoted that disaster has an unequal impact and it forces the poor to stay in the cycle of poverty. The situation may force them to be less resilient to absorb and recover from the changing situation of disaster. Disaster has some indirect impacts that create pressure on the national economy with the increase of national indebtedness or inflation. As an example: the Government of Bangladesh borrowed USD 309 million to recover the loss of the 1998 flood in Bangladesh (Pelling, Özerdem and Barakat, 2002). It has been observed that the existing development process and policy are also leading to create disaster risk in the society. It has made a significant contribution to increase people's exposure to hazards by placing or forcing a section of people to live in unsafe areas. The unplanned development also generates a force to push many people into poverty and

simultaneously reduces the state's capacity to provide social safety nets, thus increasing vulnerability to disaster (Wisner, 2003). It creates diverse challenges for sustainable development. Considering that the reduction of disaster impact is an urgent priority for sustainable development (Middleton and Neil-O'Keefe, 2001).

IPCC (2001) has also made a clear statement on the role of people's adaptive capacity in addressing climate change because of its link with the increasing disaster situation. With this notion, the international community has made substantial efforts to introduce diverse frameworks of disaster (i.e., IDNDR, 1990; HFA, 2005; and Sendai, 2015) aiming to reduce disaster impacts on people and places. It has an ultimate impact on native development. Realising that the HFA and Sendai framework of disaster significantly introduced the resilience framework for sustainable development. The resilience approach provides an ''window of opportunity'' to cope with the ecological changes and recover from the negative impact of disasters. This is not significant for the protection of people's lives and resources but also for social, economic, and environmental sustainability to reduce socio-economic vulnerability to disasters. So, there is a need for a paradigm shift from a risk-intensive development approach to a risk-sensitive approach as a requirement of sustainable development. This will have a significant contribution to avoiding any new risk of the people and communities with better resilience to disasters.

2.10 Conclusion

This chapter contains special attention of explaining conceptual framework of political ecology and its position in analysing vulnerabilities and disaster. As the first steps, it highlights the conceptual position of vulnerability and its theoretical farmwork to explain theoretical linkages of vulnerability with the relevant models and approaches. It reveals a comparative link and significance of three potential models and approaches in analysing vulnerability in context of Bangladesh. This is extended with an analysis of appropriateness of political ecology as a framework for analysing vulnerability. The analysis explores the potential links of pressure and release model and political ecology approach to uncover causal grounds of vulnerability, which is largely missing in the risk-hazard model and approaches.

Similarly, there is another attempt to explain conceptual position and theoretical perspectives of disaster. This explanation reveals the appropriateness of different theoretical perspectives in analysing disaster situation. The development perspective of disaster contains a link of disaster with development, while the vulnerability perspective considers disaster as a negative force on development because it declines ability of the people to survive in any form of adversity. Hence, the political ecology perspective appears to explore causal grounds of disaster and its link with development.

It has a potential to explain causal grounds of vulnerabilities and its links with disaster situation, which is important for findings appropriate solutions in advancing people's coping ability and recovery for sustaining development. The theoretical analysis clearly reveals that political ecology perspective is significant in analysing causal grounds of vulnerability and disaster situation that may come up with a set of solutions for strengthening people's ability to be part of the mainstream development. It has a potential role in formulation of development plan and appropriate actions in reducing people's vulnerability and the risks of disaster in Bangladesh.

PART III

RESEARCH METHODS

Chapter Three
RESEARCH METHODS

3. Introduction

The chapter focuses on diverse of sources data and methods. It also demonstrates methodological considerations in the application of different methods aiming to uncover the research problems and queries. Hence, I have illustrated the context of the study area and then select the applicable methods relevant to the analysis of context with evidential data and information from various sources. To find the answers to my research questions, I have systematically applied two diverse methods: i) satellite remote sensing and mapping, and ii) social research methods. It contributes to examine ecological changes and their relations with the creation of a risk situation in south-west coastal areas of Bangladesh.

Besides, I have systematically used remote sensing data and information for the analysis of landscape and land-use changes. This also contributes to the mapping of the most vulnerable places/areas in the context of coastal cyclone induced areas of Bangladesh. Then I have used the collected data and information from primary and secondary sources to analyse existing social, economic, environmental, and political processes and power-lead drivers that shape the ecological changes in study areas. It is vital to assess the ecological changes and their links with differential vulnerabilities that construct a disaster situation. Simple quantitative and qualitative research methods are applied to extract relevant data and information as support to examine the process and drivers of changes. The study also applied perception survey, key informants' interviews, focus group discussion and participatory appraisal methods to extract ground information for assessing the causal grounds of differential vulnerabilities and risk of disasters. This also attempts to define the most vulnerable people and places to signify the requirements of disaster-resilient development in the context of a particular geographical situation.

3.1 Methodological Considerations:

The research strategically considered two propositions, such as i) power-lead processes and drivers are changing ecology of coastal areas in Bangladesh, and ii) unequal power process and the functions of multiple drivers are contributing to differential vulnerabilities and situation of disaster. The deductive research approach is considered to examine the existing processes and drivers that change ecology and shape differential vulnerabilities and risk for a section of people in line with the lens of political ecology. There are several issues and queries relating to these, which pose challenges in defining appropriate methods in this research.

3.1.1 Discovering potential links and relevance of political ecology.

A general theme of political ecology is constructed with two dynamics: i) politics (power relations), and ii) ecology. Hence, politics is the practices and processes through which power is exercised and negotiated in multiple forms (Roseberry, 1988) whereas ecology refers to relations or interactions between human groups and their environment. Considering this idea, political ecology demonstrates causal links in defining the role of power relations to mediate human-environment interactions. It views social and ecological changes as interlinked processes and rooted in unequal power relations (Blaikie 1999; Bryant 1998). This reveals an important argument of political ecology, which is potentially aligned with this research.

The research focused on a point of understanding the ground situation of the people that force them to be the victims of a disaster. Disasters happen when a natural hazard assaults vulnerable people. But it considers both the level and process of vulnerabilities that are created in the existing social and political systems. If the people become less vulnerable, then a hazard may occur but not create a situation of disaster. This explores a sense that the people, who live in vulnerable socio-environmental conditions and have limited abilities to cope with changing environments are often facing disaster situations. The fact reveals that disasters are not natural because it affects people differently and may have very different impacts. These unequal effects and forces of disaster are basically the function of power relations and are deeply rooted in the existing social, economic, and political system. Realising that the research tried to examine the functions of existing social, economic, environmental, and political drivers to make the people more vulnerable. But the concern is that differential vulnerability of the people is rarely addressed or tackled in the existing knowledge of disaster studies. Thus, the research considers two important aspects in analysing vulnerability and disasters:

- Existing processes (i.e., every day, episodic, and systematic) of human-environment interactions create a space for making the people vulnerable and at risk of disasters in the context of coastal areas.
- Power-lead drivers of ecological changes and their causal links with differential vulnerabilities and risks of disasters for a section of the people or communities.

3.1.2 Scientific methods as relevance to Political Ecology

The analysis of functional processes of ecological change over time is very complex. It requires an application of a scientific approach to find reliable evidence for measuring the changes. The research tried to explore an analytical space to answer the specific queries ‘’how do people or groups experience differential vulnerabilities and the risk of disaster? This is an integral part of the phenomenological approach, where the

data/information on specific phenomena focuses on the immediate, and direct experience of people. The study attempts to extract relevant data/information from the people, who have experienced disaster situations as an important area of understanding political ecology. Within the lens of political ecology, the research tried to demonstrate a combination of the interactive and reflexive processes to understand the insights of human-environment interactions as a form of ecology.

It is fact that the explanation of ecological changes is often focused on scientific' explanations of environmental science that are guided by the policies based on assumed universal laws of nature. This explanation is currently accepted as a real-world experience and values of powerful people, but it is rarely considered in the local socio-political contexts and reflections. It applies the conceptual frame of political ecology to illustrate empirical evidence and define the changes in the existing ecological system. It explores a space for analysing people's political perceptions to speak out on inequalities and domination. As an example, the analysis of power-led drivers may provide more privileges to a certain group of people that may overlook the needs of poor and powerless groups of an area. The research has special attention to connect the voices and perceptions of the poor and powerless to extract ground realities of power relations.

To understand the real-world scenario of changed ecology, the research attempts to extract the perception and observations of multiple groups of people and actors, who have ground experiences to align the problems with realities. This also tried to observe the ground situation of ecological changes and destructive actions of the powerful actors in the eyes of insiders and affected groups as an empirical study. The study strategically considers the frame of ''progressive contextualization'' and ''chain of explanation'' as referred by Piers Blaikie and Harold Brookfield but it bears a little space to develop an empirical research model to follow and expand. The conceptual gaps in the exploration of a causal chain in political ecology influences to fill with the application of multiple methods, which are suitable to search for answers to the research question. So, the application of the political ecology framework is context-specific, where the researcher is unable to predict the functions of interactions between human and the environment. It only explores the possibility of interactions using the possible sources of evidence. Realising the fact, I have defined a set of research queries to extract relevant data and information aiming to uncover the processes and drivers of ecological change that results in differential vulnerabilities of the people using the lens of political ecology.

3.2 Selection of methods

I have applied a set of methods to collect all relevant data and information as a requirement of answering the key questions. The methods contain three forms of analysis (Figure-12), which are as follows:

- Geo-spatial analysis
- Situation analysis (people's perception based)
- Qualitative analysis

The methodological framework of this research is illustrated below:

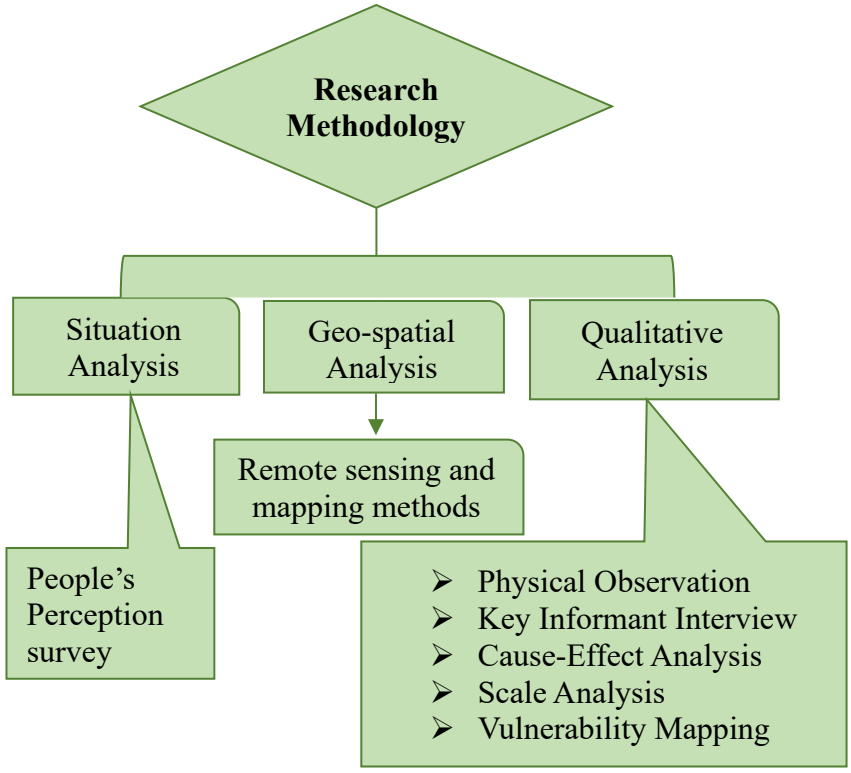


Figure-12: The Research methods (Source: Author)

3.2.1 Geospatial analysis

As an integral part of geospatial analysis, the research applied remote sensing and mapping methods to explain the multi-scale dynamics of human-environment relations as a process of ecological change in an area. This method uses remote sensing images and GIS mapping as tools to examine the changes in land use as links with environmental change in a micro-scale. The remote sensing data and information is useful for:

- Providing empirical data and information on land use patterns and changes in an area; and
- Linking detailed local studies to broader scales.

As my research has specific attention to exploring the interactions of the human environment as a force of ecological change, I have strategically applied remote sensing data and GIS mapping to visualize the changes on the ground.

I. Remote sensing data gathering

In my research, I have utilised multi-spectral Landsat data of Sirajganj, Satkhira and Khulna districts that obtained from six different times such as 1975, 1980, 1995 and 2018 (Table-4). Then, the images and relevant data are taken from the USGS free archives[14] that are used for image classification and feature identification. It is noted here that the images of 1975 and 1980 were taken from the Landsat 1 sensor, while the images of 1995, 2009 were taken from Landsat 5 sensor. Besides, the images of 2014 and 2018 were taken from Landsat 8 Operational Land Imager (OLI).

Table-4: Landsat sensors and images used for change detection and mapping[15].

Satellite Sensor	No. of Multi-spectral Bands	Resolution (m)	Satellite Path-Row	Recording date
Landsat 1 MSS	4	60*	Path: 148 Row: 43, 45	1975-12-05
Landsat 1 MSS	4	60*	Path: 148 Row: 43, 45	1980-01-16
Landsat 5 TM	7	30	Path: 148 Row: 43, 45	1995-01-28 2009-01-18 2009-09-15
Landsat 8 OLI	11	30	Path: 148 Row: 43, 45	2014-03-05 2014-09-29 2018-12-13

Source: Author

II. Applied methods

Though it is very challenging work to compare Landsat data due to instrumental errors allied with the sensors, I have applied the geometric and radiometric correction proceedings to overcome the error. I have combined the multi-spectral bands using geospatial software (ArcGIS 10.3) and strategically classified them according to their class. After the classification, I have compared both classes with the ArcGIS Base Map and Google Earth time-series images. Then, I made a reclassification of classified data and a clip of the area of interest (AOI) to calculate the geographic area. The

[14] https://earthexplorer.usgs.gov/
[15] Ibid

methodological steps are shown in the flow chart (Figure-13). Additionally, for the estimation of flood inundation areas in 2009 and 2014, I also applied the same proceedings in the context of study areas.

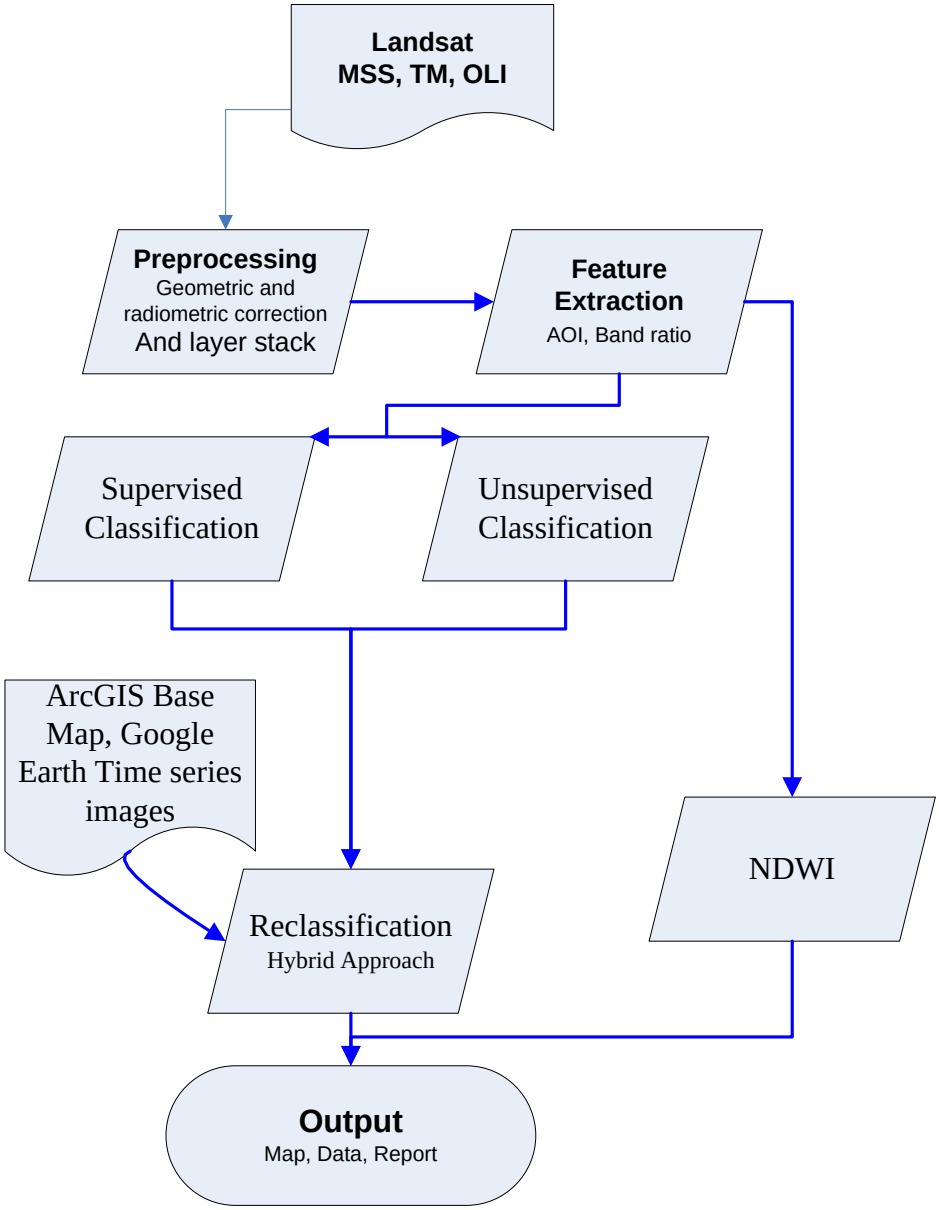


Figure-13: Flow chart of RS and Mapping methods (Source: Author)

3.2.2 Situation analysis (people's perception based)

In my research, I have analysed ground situation based on data/information extracted from the 'perception survey'. The 'perception survey' method is important to assess people's opinions and their experiences at the time of disaster situation. Realising that a simple response template (annexe 1) is applied to search the answers on specific issues from a cross-section of people in study areas of Bangladesh.

Sample size and sampling design:

The study includes 200 samples with a proportion of 50:50 in the context of Shyamnagar, Satkhira and Koyra, Khulna areas to understand people's perceptions on some specific issues and concerns on social, economic, environmental, and political dynamics (Table-5).

Table-5: Distribution of sample in study areas

Study area: Coastal cyclone induced area	Sample population (N)
Shyamnagar Upazila, Satkhira	100
Koyra Upazila. Khulna	100
Total sample =	200

Source: Author

The study applied a random sampling process to select the sample in both rural and urban sets up of coastal study areas to extract overall perception of people on specific issues. The selection of the sample strategically considers a representative segment of people with an age group of 18-30 and 31-60 years to understand ground knowledge, information, and experiences in diverse context of coastal communities. Besides, the study consulted with elderly populations to collect evidential information on the historical change process and disaster situations in study areas.

3.2.3 Qualitative Analysis

In my research, I have introduced qualitative analysis to explain the diverse questions focusing on the 'what', 'how' or 'why' of a phenomenon rather than 'how many' or 'how much. The analysis uses a set of qualitative methods to explore the functional processes and drivers of ecological change as a result of interactions between individuals or a group of people with the environment. Creswell (1998) noted it as an inquiry process of understanding social or human problems and realities. He identified four techniques of qualitative research that can be adopted to collect relevant data/information for examining causal reasons or real facts (Figure-14).

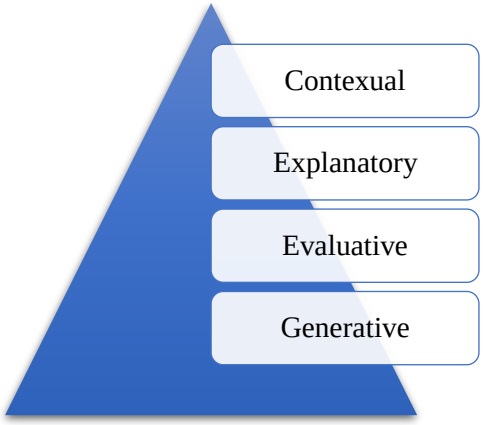


Figure- 14: Four dimensions in qualitative research
(Source: adapted from Creswell, 1998)

Considering that qualitative research is the best method for the exploration of ground knowledge and information on specific problems or issues. So, I have chosen the qualitative research methods to search the answer of 'why does the particular problem occurs in the society? And why a section of people faces differential vulnerabilities and risk of disasters?'. It examines the problems and explains causal links of the problems as a unique tool. From this point of view, I have applied a set of qualitative research methods, which are as follows:

- Field Observation,
- Key Informants Interviews
- Participatory Rapid Appraisal (PRA)
  - Scale analysis
  - Cause-Effect analysis
- Document analysis.

As a core research approach, qualitative methods are more participatory and interactive to understand the insights of the problems. It introduces an interactive process, which is liberating, empowering and educative, and builds a collegial relationship to bring local poor and powerless communities into the policy debates and, validate their knowledge. Realising that I strictly maintained the three key ethical issues: i) privacy; ii) consent; and ii) confidentiality in all stages of applying qualitative research methods.

3.3 Major Sources of data and information

The research is focused on "Political ecology of disasters: an examination vulnerability in South-west coastal areas of Bangladesh", which systematically examines the process and drivers of differential vulnerability and its causal links to generate a disaster situation. This requires extracting relevant data and information from both primary and

secondary sources. The methodological consideration discussed earlier clearly noted the importance of qualitative and participatory methods by engaging individuals and groups of people or communities in study areas. However, I have applied a set of research methods to extract all relevant data/information on specific research queries, which are as follows:

3.3.1 Qualitative methods

In my research, I have applied a set of qualitative methods to understand the ground situation, people's perceptions and extract relevant data/information to comply with research queries. These are as follows:

I. Field Observation:

Field observation is an important source of information. It helps to understand the ground views of the existing processes. I have visited the field areas (south-west coastal areas) to capture some ground scenarios and understand the real-life situation of a diverse group of people. As part of this method, I have taken the initiative to communicate with multiple stakeholders in field areas (Shuamnagar and Koyra areas). In some cases, I took the assistance of local CSOs and youth leaders to gain access to individuals and at-risk communities in study areas. In the whole process of field observation, I have tried to draw a ground view of human-environment interactions that force to change the landscapes in the study area.

II. Key Informants Interview:

I have applied KII as an important method to understand the diverse observations and opinions of stakeholders on specific issues. Considering the level of knowledge and ground experiences, I have selected a total of 20 key informants as representative of diverse groups, particularly representative of vulnerable groups, socio-politically powerful groups, and civil society actors' groups (Table-6). The relevant people are identified through field observation, consultation with local people and existing local CSOs. A section of targeted people has been taken into consideration for an informal discussion to understand the ground context and realities in south-west coastal areas. I have had an opportunity to contact other relevant informants that contributes to ensuring greater access to extract views of multiple people in the context of south-west coastal areas.

It is a very important fact that the interview process requires establishing good rapport at the beginning to gain the trust of the informants. And for this as a first step, I concentrated on establishing rapport with the key informants so that they can open up and describe their true perceptions, thoughts, and intentions. Then I started questing in such a way that the informants believe that he or they can talk freely. I have used open-

ended questions on specific contents to extract their open and honest response, which is important to analyse the insights of the problems and issues related to ecological change drivers.

Table-6: Distribution of KII in study areas

Study area: Coastal cyclone induced area	No. of Key Informants
Shyamnagar, Satkhira	10
Koyra, Khulna	10
Total Informants =	20

Source: Author

III. Focus Group Discussion:

This is an interactive method that allows the participation of a small group of people to discuss common problems and issues. I have applied this method because it helps to find the decision of collective conversation of a group of people. It also allows the facilitator to validate the field information on specific issues. The method helped to explore and examine the indigenous knowledge and practices of people in study areas. As a facilitator, I have allowed the participants to develop their questions and views as well as to seek and realise their own needs and concerns in their own words and on their terms. The core view is that it enables to search for insights into some similarities and differences in understandings.

Methodologically, I have included a group of 15-20 people having similar experiences of ground situation. I have conducted a total of 10 FGD that comprises 155 people in both areas (Table-7). As a researcher, I have played the role of a facilitator to make discussions on specific issues in a particular setting so that the participants can feel comfortable enough to engage them in open discussion. I also stimulate a process where the individuals in the session have had a space to rethink their views.

Table-7: Distribution of FGDs in study areas

Study area: Coastal cyclone induced area	No. of Key Informants	Participants
Shyamnagar, Satkhira	5	81
Koyra, Khulna	5	74
Total Informants =	10	155

Source: Author

IV. Participatory Rapid Appraisal (PRA):

PRA is also an important interactive method in qualitative research. It enables and engages people to share or insert their opinion on specific problems and issues. The methods allow local people to interact and facilitate the process of understanding, analysis of ground information and interpretation of specific information. As a Researcher, I have applied a set of PRA tools for both collecting and analysing data/information with visual diagrams. The application process strategically considered multiple steps to extract diverse views of individuals and groups to analyse the risk drivers and assessment of the risk situations. PRA contains a set of methods and off them the following, I have applied as relevant to my research (Table-8):

Table-8: Application of PRA and their justification

PRA methods as relevant to my research	Justification
1. Vulnerability Mapping	Applied for assessing the proportion of vulnerable populations and places along with their associate forces to generate differential vulnerability among the people. This also examines the coping/resilience capacity of such a group of people.
2. Scale analysis	Applied to define the possibility of risk drivers to occur ecological problems and its level of impact in changing ecology in south-west coastal areas.
3. Cause-effect analysis	Applied for defining causal links of specific problems and issues and their diverse impact on people or communities.

Source: Author

V. Documentation:

I am basically a geographer and development practitioner that guided me to document the ecological change process that occurs with the functions of socio-political and environmental processes, which is very important to examine the spatial aspects. The documentation of changes in the study area over time and space is important to illustrate the causal links of the change process. As an example: if there is found any external forces (created by humans) that have a significant role in changing local environmental/ecological systems can be documented. Regarding this, we may insert the changing aspects in the mapping presentation to visualize the changing process in a particular setting.

3.3.2 Methods for collection of secondary information

I. Review of literature

I have reviewed a number of literatures to gain knowledge and information on the political ecology of disasters. This has guided me to find knowledge gaps in the existing field of study and setting of specific queries to solve the knowledge gaps as defined. The important part of this research is to examine the ecological change process in south-west coastal areas of Bangladesh. The knowledge gaps inspired me to use remote sensing data and information, which is useful to assess the land-use changes from the year 1980 to 2020. In addition, I have reviewed many other documents and reports produced by different academicians and researchers on the theoretical framework of vulnerability and disaster management. Finally, I have reported all the literature along with documents and reports as evidence of my research.

II. Evidential images and photographs

The research strategically referred to some image-based information to highlight the ecological change as a result of human interventions in south-west coastal areas of Bangladesh. Some photographs were also used to demonstrate the existing practices of the coastal people. Careful attention is paid to the selection of images and photographs so that they can represent the general features of people's vulnerability.

3.3.3 Blending of data and information

The research applied an integrated approach in blending remote sensing (image-based data) data and ground information to demonstrate the changes in terms of land use, human settlement, vegetation cover and water bodies in south-west coastal areas. In addition, the data and information extracted from the qualitative sources are also used to validate the physical data (image-based data) for assuring data accuracy.

3.4 Methods for analysing data and information.

The research blended all forms of data and information extracted in defining and analysing the processes and drivers of ecological change in south-west coastal areas. This results in three functional processes and four categorical drivers of ecological changes.

I. Functional process:

- Everyday
- Episodic; and
- Systematic.

II. Drivers:

- Geophysical-Environmental drivers.
- Social drivers.
- Economic drivers.
- Political drivers.

The analysis of functional processes and drivers provided a base to define the issues, which are most relevant and align with the PAR model. The analysis of the PAR model in line with extracted data and information helped to demonstrate the progressions of people's vulnerability and the construction of disasters in coastal areas. Finally, the mapping data and information is blended to analyse most people and places as supporting to the development of a framework for ecological resilience in Bangladesh.

3.5 Conclusion

The research considers two basic propositions, such as i) power-led processes and drivers that shaping/changing the ecology in study areas, and ii) underlying factors of differential vulnerabilities and risks of disasters in the society. To examine the functional processes of ecological change, the study applied remote sensing data-based mapping methods. The analysis considers the remote sensing data and images for the period from 1980 to 2020 in context of study areas to visualise changing situation of the functional processes. The remote sensing data and mapping techniques also applied in defining the most vulnerable areas, while the secondary data used for analysing the proportionate vulnerable population in study areas.

The study also examines ground situation through analysing community perception survey data and information of the secondary sources. To support the analysis of the functions of power led processes and drivers, the study also used the qualitative data and information that extracted through application of diverse qualitative methods. The study strategically consulted with several key informants and elderly people to understand the historical perspectives of vulnerability and risks situation in the coastal society. This has guided the study to explore new knowledge in analysing disaster situation with the lens of political ecology. However, the study is guided with the deductive research approach and applied a set of analytical methods to visualise all collected data and information in searching answers to research questions.

PART IV

EXAMINATION OF VULNERABILITY AND DISASTER

Chapter Four

MAJOR DISASTER SITUATION AND ITS MANAGEMENT PRACTICES

4.0 Introduction

The chapter four contains two folds of analysis. Firstly, it highlights major disaster situation in coastal Bangladesh. The analysis has made special attention on three forms of disaster situation: i) cyclone induced disasters; ii) salinity induced disasters; and iii) waterlogging induced disasters to understand the ground reality and the context. It is further analysing the potential impacts of disaster situation on coastal people and places. This is further demonstrated existing disaster management farmwork and practices at local, national, and global levels. It visualises institutional structures of disaster risk management and possible integration of disaster risk reduction and disaster risk management strategies in context of Bangladesh. The shifting of the disaster paradigm over the last few decades is also analysed due to its link with national development. The analysis refers to changing priorities of different frameworks and their alignment with the national policies and practices. Besides, the chapter highlights existing management practices in three different stages of disasters in Bangladesh.

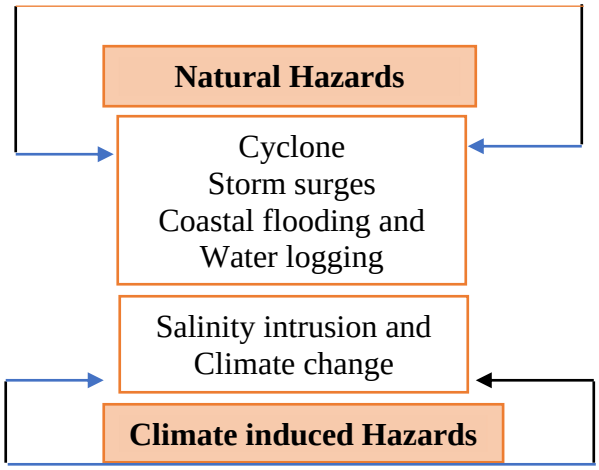
4.1 Major Disaster Situation

Bangladesh faces several disaster situations. Particularly the coastal that comprises an area of 47,201 sq. km, 19 districts[16] and a 38.52 million population[17] suffers from a regular form of disaster. The geophysical features and closure of the Bay of Bengal have made the area vulnerable to disaster. It is often aggravated by the impact of climate change. The coastal area witnessed many disaster situations that were mostly induced by the cyclones, salinity, waterlogging and the lifelong vulnerabilities of the coastal people. UNISDR, 2007 denoted that the frequency and intensity of disasters are increasing over time proven by the disaster-related records in Bangladesh. Despite the areal vulnerability, more than 30% of the country's population lives here to continue their lives. The majority of people are dependent on agriculture, fishing, livestock rearing, shrimp culture, salt production and Sundarban based resources, but the power process is functional here to create differential vulnerabilities for the places and people. Therefore, the contextual analysis of disaster must look beyond the environmental/natural triggers of a crisis because it is not purely a natural occurrence.

[16] The coastal districts include Jessore, Narail, Gopalganj, Shariatpur, Chandpur, Satkhira, Khulna, Bagerhat, Pirozpur, Jhalakati, Barguna, Barisal, Patuakhali, Bhola, Lakshmipur, Noakhali, Feni, Chittagong, and Cox's Bazar.
[17] BBS, 2011

4.1.1 Major disasters in coastal Bangladesh

In Bangladesh, the coastal area suffers from frequent and devastating disasters due to its geographical location, human-induced development actions, and climate change. The people, who live in a situation of vulnerability face a severe risk of disasters. Because the natural hazards intensify the level of people's vulnerabilities and generate a situation where they are alone unable to survive.



The inability of the people is further extended by the changing climatic condition that creates a threat to the millions of people in Bangladesh. It forces people to witness multiple forms of natural and climate-induced hazards. The effect of multiple hazards on the population of Bangladesh placed the country as Rank-1 in the context of South Asia (Table-9). Particularly, the coastal area is one of the worst sufferers of cyclones in terms of causalities. It is reported that a total of 508 cyclones are orientated in the Bay of Bengal and 17% hit coastal areas in Bangladesh during the last 100 years[18]. Bangladesh, India, and Myanmar suffer 75% of the total casualties[19] due to poverty, inability to cope with the changing situation, and irregular livelihood contributes to increasing the vulnerability of coastal people to disasters.

Table-9: Countries at relatively high mortality risk from multiple hazards

Global Rank[20]	Country in SA	Total Area at Risk (%)	Population in Risk Areas (%)
1	Bangladesh	97.1	97.7
2	Nepal	80.2	97.4
31	Bhutan	31.3	60.8
48	Pakistan	22.8	49.6

[18] Dhaka Tribune, Cyclone fatalities fall, economic losses on rise, dated April 30th, 2017
[19] Ibid
[20] The World Bank, 2005; Natural Disaster Hotspot: A Global Risk Analysis, Disaster Risk Management Series No. 5

50	Afghanistan	7.2	46.0
71	India	21.9	27.2

Source: Captured from the Global Risk Analysis Report, World Bank,2005

The hazard analysis in the study area explored cyclones, 'storm surges and salinity as the most devastating event compared to waterlogging and climate change (Table-10). The cyclones accompanied by storm surges that occurred in 1970, 1991, 2007 and 2009 were defined as the most devastating events in the recent past. The coastal people perceived that the cyclone companied by storm surges caused major casualties of their lives and resources. It becomes an integral part of their normal lives. It extends their lifelong struggles and forces them to live in a situation of extreme poverty with a poor structure of housing and nature-dependent livelihoods.

Table-10: People perception on frequency and causality of hazards

Nature of Hazards	Likelihood	The extent of causality and damages
Cyclone	High	High
Storm surges	High	High
Salinity	High	High
Waterlogging	Moderate	Moderate
Climate change	High	Slow

Note: The analysis of people perception on hazards scale: High, Moderate and Low/slow (Source: Author)

It is fact that the economic condition of a large section of people is not enough sustainable due to facing frequent losses and damages that destroy the development that they achieved with their efforts. The situation declines their socio-economic status and undermines their participation in local decision making as they struggle for survival. Salinity and waterlogging are also a concern of the coastal people that extend their struggles to maintain normal lives. Women, persons with disabilities, elderly people and children experienced the most inhuman situation while the main breadwinner of the family either faced death, injuries, or migration for managing the family needs and livelihoods. This results in a continuation of vulnerabilities and risks of disasters in coastal areas of Bangladesh.

I. Cyclone induced disasters.

Bangladesh is a cyclone-prone country. The coastal areas (47211 km²) are particularly vulnerable to tropical cyclones. It originates from the low atmospheric pressures over the Bay of Bengal during the period of mid-April to early December. The coastal area is basically low lying, and the average height is less than 3m from the sea level. As the cyclones are associated with tidal surges and storms, it has emerged as the main concern

of people's vulnerability almost every year. It has been observed that a large section of the coastal people is poor, and landless and continue live with nature dependent livelihoods. The existence of people in unsafe locations in coastal areas creates a difficult situation for this segment of people to survive. The cyclone creates additional harm to the coastal people and forces them to be displaced. The coastal area comprises 19 districts, which are defined[21] as cyclone induced areas in Bangladesh. The level of cyclones is classified according to their wind speed and intensity (Table-11).

Table-11: Level of the cyclone and its wind speed (km./hour)

Types	Wind speed (km/hour)
Depression	Wind speed is up to 62 km/hour
Cyclonic Storm	Wind speed is from 63 to 87 km/hour
Severe Cyclonic storm	Wind speed is from 88 to 118 km/hour
Severe Cyclonic Storm of Hurricane Intensity	Wind speed is above 118 km/hour

Source: Adapted from Choudhury, 1992

As the cyclone drives with high wind speeds, it causes severe loss and damage to the people who live in unsafe coastal areas. From 1948 to 2019, more than 70 major cyclones have been reported and of them, 18 cyclones were severe in their wind speed and associated with loss of lives. The loss of lives due to cyclone induced disaster has been reduced significantly from 300,000 in 1970 (Bhola cyclone) to 138,882 in 1991 (cyclone Gorky), 3,363 in 2007 Cyclone Sidr and only 9 in 2017 (Cyclone Mora) but the economic loss and damages have been increased over the time (Table-13). According to people, it is the result of the early warning system, the active role of the CPP volunteers and advanced sheltering of at-risk people in coastal areas. Coastal afforestation has also made a significant role in the protection of people from the effect of coastal cyclones.

- ***12 Nov. 1970 (Bhola cyclone)***

The catastrophic cyclone named Bhola cyclone hits the coastal areas of East Pakistan (now Bangladesh) on 12th Nov. 1970. It bears a maximum wind speed of 223 km/hour. The cyclone affected the low-lying areas of Bhola, Barguna, Patuakhali and Chittagong with severe storm surges and flooding (Figure-15). It was reported death of more than 500,000 people along with an economic loss of US$ 490 million. Approximately 85% of homes were destroyed or severely damaged. It was defined as the deadliest cyclone in coastal areas of Bangladesh. The severe economic losses and emergence of people's vulnerability contributed to creating a disaster situation in cyclone-affected areas. In such a situation, the people demonstrated their inability to survive in the changing

[21] The cyclone induced area was defined by the Ministry of Water Resources, 2004

situation. East Pakistan Government failed to initiate the rescue and relief operations on time and the failures were seriously criticised and created a legitimacy crisis for the ruling political leadership.

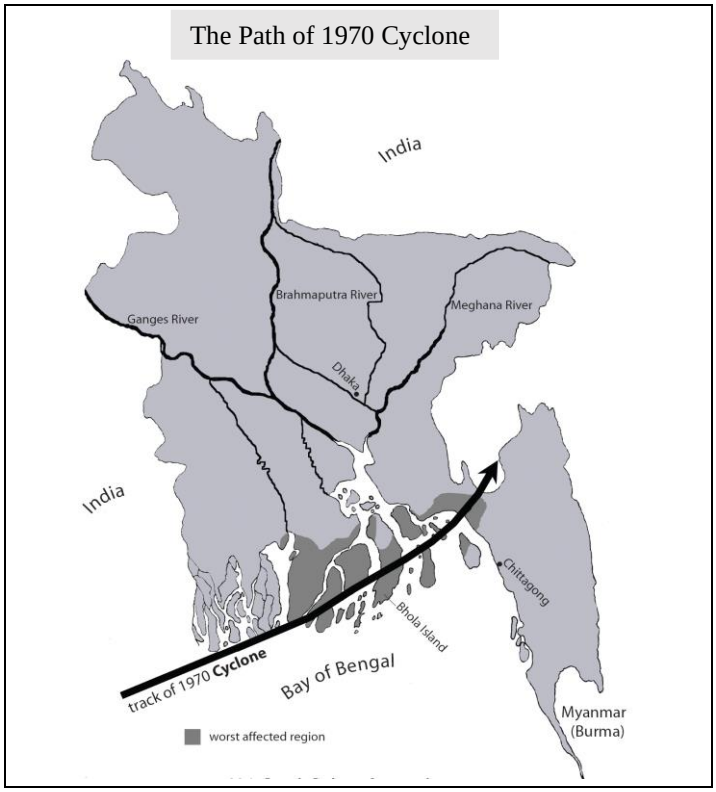


Figure-15: The path of 1970 cyclone in coastal areas
(Source: Adapted from M.A. Samad Cyclone of 1970 and Agricultural Rehabilitation)

- ***29 April 1991 (Cyclone Gorky)***

Cyclone Gorky was another devastating cyclone that hits the southeast coastal areas in Bangladesh. It bears a maximum wind speed of 225 km/hour. The cyclone was accompanied by storm surges that lifted the water up to 20-25 ft. and inundated low lying areas coastal areas. The cyclone killed 138,882 people and made 10 million people homeless. The reported loss and damages were US$ 3000 million. The devastating cyclone created a situation of disaster due to the failure of the Government to transform early warning messages to the people and to take adequate responses during and post-cyclone period. The devastation of cyclone Gorky resulted in the loss of agricultural land and grain crop production and led to unemployment and food insecurity. The situation created differential risks and vulnerabilities for the people in the affected areas.

- ***15 Nov. 2007 (Cyclone Sidr)***

The cyclone Sidr was also defined as a devastating cyclone that hits the south-west coastal areas in Bangladesh. It bears a maximum wind speed of 223 km/hour. The Sidr caused extensive destruction of people and places due to storm surges and flooding of coastal low-lying areas. It created a severe safe water crisis due to the long inundation of freshwater sources with saline water. The cyclone Sidr killed 3406 people and caused injuries of more than 55,000 people. It has been reported that the Sundarban forest made a significant role to reduce wind speed and destruction, but tidal waves caused massive damage to 2290 km coastal embankment and led to the intrusion of saline water inside areas. The Sidr affected more than 2.3 million households and most of them expressed their inability to cope with the situation. The estimated economic loss of Cyclone Sidr was US$ 1.7 billion resulting in a negative impact on the GDP of Bangladesh. The situation transformed into a disaster situation due to extended vulnerabilities of the affected households (as a result of economic loss and damages), the crisis of safe drinking water and immediate food assistance, and delayed response operations of the government and NGOs in addressing the crisis. The situation exposed a section of people with differential vulnerabilities and risks in affected areas.

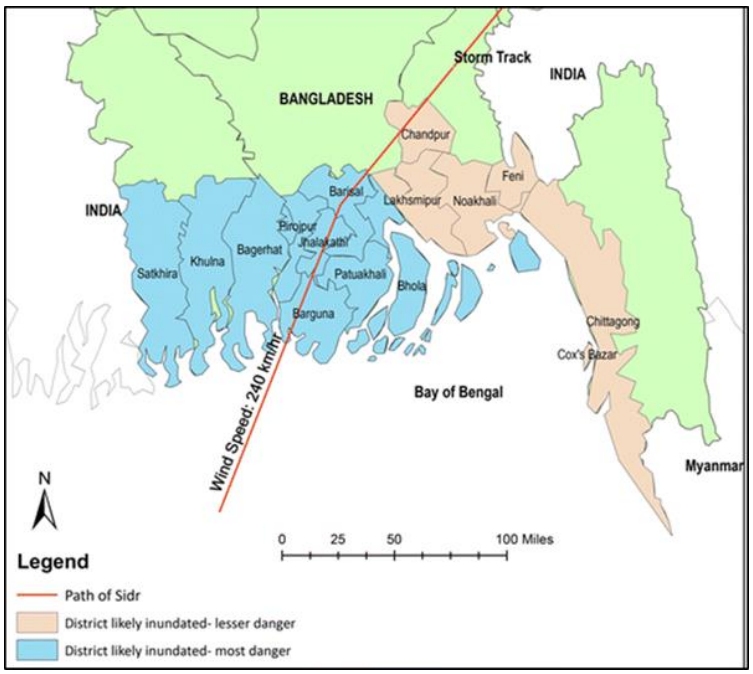


Figure-16: Cyclone Sidr in South-west coastal Bangladesh
(Source: Adapted from https://en.wikipedia.org/wiki/Cyclone_Sidr)

- ***25 May 2009 (Cyclone AILA)***

The cyclone AILA hits south-western coastal areas in Bangladesh with max. wind the speed of 92 km/hour. Cyclone AILA accompanied by tidal waves spoiled river and

flood-control embankments and dikes submerged many villages of Satkhira ad Khulna districts of Bangladesh. It caused about 190 deaths and forced 500,000 people to be homeless. Besides, the homesteads, roads and embankments were destroyed due to the floods associated with the cyclone AILA. The economic loss of cyclone AILA was estimated at US$ 270 million. The main economic activities of south-west coastal areas are defined as fishing, agriculture, shrimp farming, livestock rearing, and salt farming but Cyclone AILA washed away most of the houses, crops, shrimp farms and cultivated lands. This led to the loss of livelihood and employment of the people, particularly in Khulna and Satkhira districts. The situation forced a section of people to be displaced to other areas due to the loss of houses, food insecurity and safe water crisis. The government is not only unable to recover from the disaster situation but also showed its failures to create alternative livelihood options for the affected people. The struggle of the coastal people transformed into a disaster situation.

- ***16 May 2013 (Cyclone Mahasen)***

The cyclone Mahasen hits the southern coast of Bangladesh with heavy rains and a wind speed of 175 km/hour. It affected 10 coastal districts including Patuakhali, Barguna, Bhola, Barishal, Bagerhat, Khulna and Satkhira. The cyclone killed 17 people and affected 1.5 million population[22]. It damaged 151,005 houses and forced the poor people to take shelter on roadsides and temporary locations. Though the people responded to early warning, the cyclone caused a huge economic loss of US$ 1.1 billion. It contributed to extend the vulnerabilities of a large section of poor and landless people that forced to face disaster situations.

- ***21 May 2016 (Cyclone Roanu)***

Cyclone Roanu hits the southern coast of Bangladesh on 21 May 2016 with a wind speed of 100 km/hour. The most affected districts were Chittagong, Cox's Bazar, Bhola, Barguna, Laksmipur, Noakhali and Patuakhali. The cyclone killed 27 people and affected the 1.3 million population forcing them to flee their homes. The heavy rains triggered landslides and caused painful death to the people. The heavy rainwater inundated low lying villages with a storm surge that swelled up to seven feet high and generates a disaster situation.

- ***30 May 2017 (Cyclone Mora)***

Cyclone Mora also hits southeast coastal areas. It brings a wind speed of 135 km/hour and killed 9 people. The cyclone affected 2.5 million people and was inundated in low lying coastal areas with a storm surge of 4-5 feet high waves. The cyclone was forced to displace more than 500,000 people and generated a disaster situation.

[22] The Financial Express, dated May 04, 2019

- **9 November 2019 (Cyclone Bulbul)**

A severe cyclonic storm Bulbul hit south-west coastal areas of Bangladesh on 9 November 2019 with max. wind speed of 130 km/hr. The heavy rainfall and tidal surges caused massive damage to Fisheries and Livestock. Most of the ponds and ghers were flooded and fishes have washed away. Total 11,223 hectares of pond/gher land were affected. I also damaged households, and agricultural lands destroyed plantations and disrupted communication. The cyclone killed 24 people and affected 2.1 million people in coastal areas. More than 200,000 hectares (494,200 acres) of cropland were fully damaged with an economic loss of 31 million USD that forces to keep a section of people into a vulnerable situation.

- ***16 May 2020 (Cyclone Amphan)***

The super cyclone Amphan hits the south-west coastal areas in Bangladesh. It brings a devastating wind speed of 160 km/hour. It occurred in a situation while the country is struggling to fight against the COVID-19 pandemic situation. The Cyclone accompanied by storm surges killed 26 people and affected 10 million population. It forced more than 4 million people to displace from their origin and created a risk situation.

Table-12: Major cyclone hits the coastal areas in Bangladesh: 1970-2020

Date of Cyclone	Max. wind speed (km/h	Height of storm surges (ft)	Most Affected Districts/areas	Damages and losses		
				Damages	Death of people	Loss (US$)
12 Nov. 1970 (Bhola cyclone)	223	20-30	Chittagong, Barguna, Patuakhali, and Bhola	400,000+ houses damages	500,000+	US$ 490 m
29 April 1991 (Gorky)	225	20-25	Chittagong and Cox's Bazar district	10 million people-homeless	138,000	US$ 3000 million
15 Nov. 2007 (Sidr)	223	16-19	Barguna, Bagerhat, Patuakhali, Barisal, Pirojpur, Bhola, Khulna, Satkhira	1,001 people missing and 2.3m HHs affected	3406	US$ 1.7 billion
25 May 2009 (AILA)	92	18-22	Khulna and Satkhira	500,000 people homeless	190	US$ 270 million
16 May 2012 (Mahasen)	175	3-5	Patuakhali, Barguna, Pirojpur, Chittagong, Bhola,	102 injuries	17	US$ 1.1 billion

			Noakhali, Satkhira			
21 May 2016 (Roanu)	100	8-10	Chittagong, Cox's Bazar, Bhola, Barguna, Lakshmipur, Noakhali and Patuakhali	1.3 million people affected	27	US$ 1.2 billion
30 May 2017 (Mora)	135	4-5	Cox's Bazar, Chittagong, Bandarban, Rangamati, Feni, Bhola	2.5 million people affected	9	US$ 1.3 billion
9 November 2019	130	5-7	Satkhira, Khulna, Bagerhat, Barguna, Patuakhali	2.1 million people affected	12	US$ 0.5 billion
16 May 2020[23] (Amphan)	160	5-10	Barguna, Patuakhali, Pirojpur, Bhola, Khulna, Satkhira, Jessore, Chuadanga	10 million people affected	26	US$ 1.1. billion

Source: GoB Disaster report, 2013, The different daily newspapers on the major cyclone.

However, it is now a reality that the coastal people in Bangladesh are witnessing the most frequent and devasting cyclone induced disaster situation as the added effect of climate change. If the intensity (wind speed) increases 5-10%, it would contribute to developing cyclone storms. So, the increased intensity of cyclones can damage human settlement, livelihood options and coastal infrastructures. The economic progress was achieved by the majority of the coastal population with their lifelong struggles, often transformed into an unsafe condition to survive. The Cyclone induced tidal surges has a negative link with the agricultural production of coastal areas. As an example, Cyclone Sidr caused severe salinity in coastal areas that results in the non-cultivation of agricultural land over the last decade. It has created severe food insecurity for a section of people in south-west coastal areas. Besides, the Cyclone AILA (in 2009) also extended the coverage of salinity and largely affected the major sources of drinking water. The situation has extended sufferings of a section of people, particularly women to collect safe drinking water. So, the frequent hit of cyclone and tidal surges generates a risky situation for coastal people that not only limits people's lives and livelihood options but also places them into an unsafe condition that reinforces their lifelong struggles.

[23] The Daily Star, dated on May 20, 2020

II. Salinity induced disasters.

The salinity increase, a serious concern of the people in coastal areas in Bangladesh. It has affected both water and soil that bears the suffering of the people with the scarcity of safe drinking water, irrigation, agriculture, and other uses. The salinity of soil limits food production in coastal areas, while the water salinity limits the normal lives and livelihood options of the people. It creates a safe water crisis and pushes poor people's lives to a more vulnerable position than before. It also contributes to soil salinity limits food production and creates food insecurity among the poor. SRDI (2010) is reported that a total 83.3 of million hectares of land were affected by salinity in 1973 but expanded to 105 million hectares in 2009. The level of salinity increased to 26% during the last three decades (SRDI, 2010). It is fact that the high level of salinity is not only affecting the cultivable land but also creating a severe safe water crisis in coastal areas. It also contributes to create health hazards by spreading of diarrhoea, cholera, skin diseases and causes kidney stones and rheumatism[24]. The cause and impact analysis of salinity (based on coastal people's perception) reveals that both environmental and human-induced actions may create diverse impacts on human lives and the livelihoods of the coastal population (Figure-17). It affects the poor negatively and extends their lifelong struggles to live in unsafe conditions.

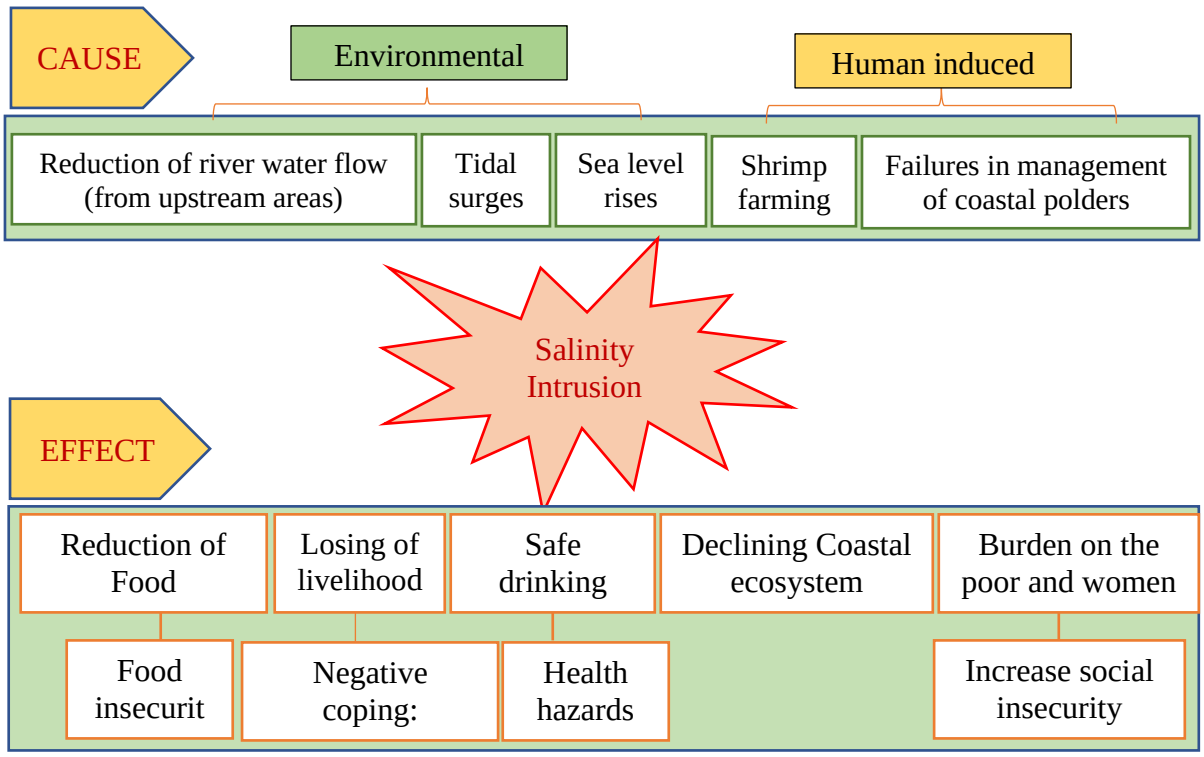


Figure-17: Cause and effect of salinity in coastal areas of Bangladesh
(Source: Author)

[24] (PDF) Salinity-Induced Livelihood Stress in Coastal Region of Bangladesh (researchgate.net)

III. Waterlogging induced disasters

Waterlogging is a pressing concern of the coastal people. It is an effect of coastal flooding and storm surges that captured the tidal water in some parts of south-west coastal areas. The situation continues for a period that inundated the cultivable land and limited the agricultural production for survival. The condition also restricts the socio-economic activities of a section of coastal people, who lose their livelihoods and go far away to search for alternative livelihood options. During this time, women were compelled to live in waterlogged situations, taking all burden of the family. The reasons behind this waterlogging situation are defined as follows:

a) Riverbed sedimentation.
b) Obstruction in the upstream to downstream river flow; and
c) Polderization.

The sedimentation on the riverbed is the long-term impact of the *Farakka* barrage over the Ganges River that drastically reduces the flow of river water to the entire southern coastal areas of Bangladesh (Figure-18). Besides, the human-induced actions in the riverbank areas are also restricting the water flow and causing riverbed sedimentation. The declination of river flow from upstream areas to downstream and increasing of riverbed sedimentation contributes to creating a waterlogged situation with the coastal flood water, tidal water, and heavy rainwater in some parts of south-west coastal areas.

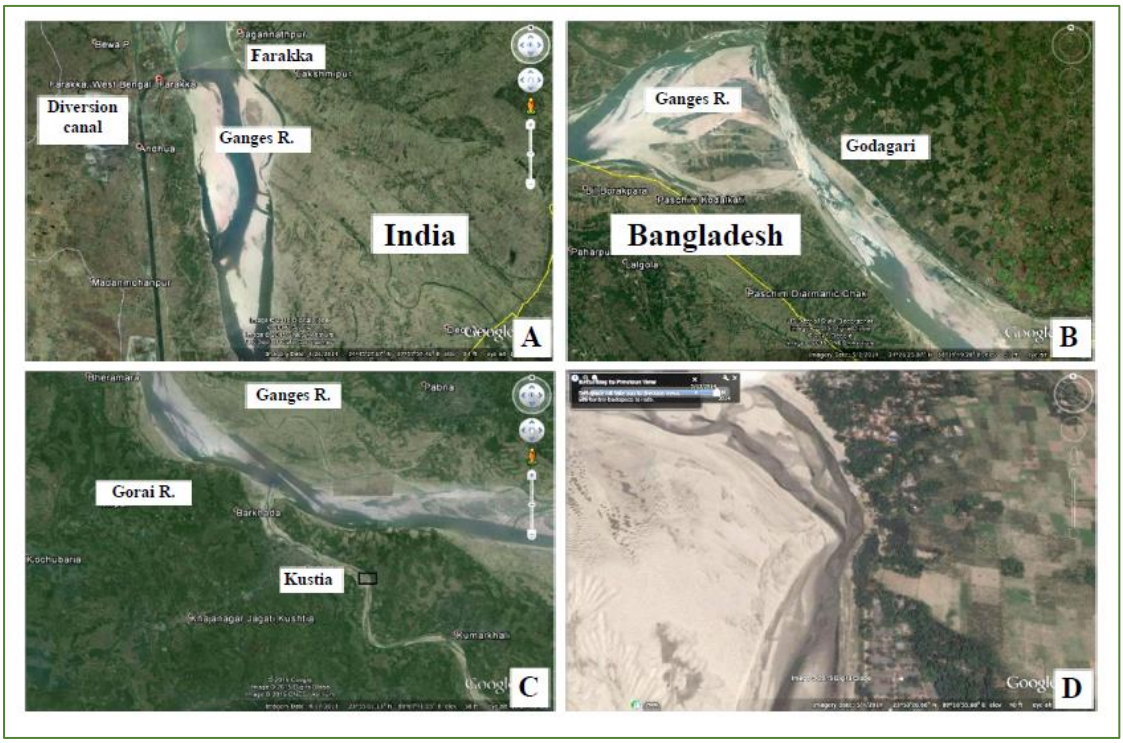


Figure-18: Satellite images of the impact of the *Farakka* barrage
(Source: Adapted from A. Aziz and A.R. Paul, 2015).

As a reference, the analysis of the satellite images (A, B, C & D) highlights that the *Farakka* barrage is diverting the Ganges River water to a canal but expanding sedimentation in the opposite part of the barrage. As a long-term impact of this barrage, it has created large sandbars in downstream areas in Bangladesh and the condition makes the linking rivers (i.e., Gorai River) almost dry (Abdul Aziz and Ashit Paul, 2015).

The analysis refers to the fact that river flow is a dynamic process that functions in the ecological system of an area. But the sedimentation on riverbeds becomes a curse instead of the normal natural system. Basically, the destructive human actions were started in the early 1960s through the construction of a number of polders and embankments in coastal areas of Bangladesh. The initial purpose of these actions was to transform the seasonally flooded coastal areas into reclaimed land for regular agricultural production, as well as to protect human settlements from the effect of the cyclone, tidal surges, and intrusion of saline water. It resulted in the construction of 37 polders and 1566 km embankment and 282 sluice gates to encircle the entire coastal areas of Khulna and Satkhira districts.

On small scale, the polderization of coastal areas made a significant socio-economic impact but its negative impact was visualized at the beginning of the 1980s with the large-scale sediment deposition. The reduction of upstream to downstream water flow of the rivers due to *Farakka* Barrage contributes to worsening the sedimentation problem in south-west coastal areas. The sedimentation in front of the sluice gates restricts the flow of water in polder areas and creates a condition for waterlogging. The analysis of waterlogging areas revealed that the percentage of waterlogged areas are changing over the years, which was 21% in 2006, 30.4% in 2009 and 28.1% in 2013. Besides, the powerful elites people built temporary dams in the drainage channels and transferred the saline water inside the polder for shrimp farming which also contributed to creating the waterlogged situation. The expansion of human settlement and extraction of coastal resources also create an unsafe condition in many places on the coastal embankments. The displaced people, who took shelter on the embankments also faced severe vulnerabilities during the waterlogged situations. The situation keeps a section of people in an unsafe condition where they express their inability to survive in the changing scenario and face the risk of disasters.

4.2 Impact of coastal disasters

Disaster is a situation created by the force of environmental and human-induced actions. It has a long-run impact on people and places. There is a reality that the south-west coastal areas are highly exposed to disaster because of low-lying areas, location of human settlement in at-risk areas and lifelong vulnerabilities of a large section of

people. In study areas, the local people pointed out that the cyclones Sidr and AILA made a remarkable change in their lives and livelihoods. A large section of people are still struggling to return back to their earlier normal situation. It refers that a disaster situation not only affects the quality of human life but also changes the local context. If we assess the impact of AILA, it has made a significant change in the traditional livelihoods of the people. It was reported that 68% of affected people were located in the study areas of Khulna and Satkhira districts (i.e., Shyamnagar and Koyra areas) and almost all shrimp ghers were fully damaged making a significant impact on the livelihoods of more than 40% of people[25] in this area. The people, who directly depend on agriculture are the most affected segment of the population and as almost all the productive agriculture land went under saline water and consequently the small farmers became workless. Besides, all the water sources (tube wells and sweet water ponds were found in unused condition due to salinity intrusion of coastal waterlogging and 81% of the latrine facilities were fully damaged and extended vulnerabilities of the people in the study area. So, the status reveals that coastal disasters can change all traditional processes and practices.

I. Changes people's livelihood

The coastal cyclone induced disaster contributes to create food scarcity and livelihood insecurity of the people. Because the damage of coastal dams and embankments to open up the entrance of saline water severely affected the normal food production and safe water sources in south-west coastal areas. The families, who were dependent on fishing, livestock rearing and farming of agricultural lands for continuing their lives mostly suffered in the changing context. A section of coastal people doesn't have enough alternatives to cope with the changing salinity situation. The salinity is gradually increasing but the coping options are very limited in coastal areas that mostly limit their safe water sources and food production. During the discussion, local people in Iswarpur village, Shyamnagar-Satkhira noted that:

> *Before the cyclone Sidr and Aila, they used to produce sufficient food including rice and vegetables to continue their normal life but the intrusion of saline water after the cyclone Sidr and Aila makes their life more difficult to produce minimum survival food.*

The changes in agricultural food production and practices also made harmful effects on the livelihoods of the coastal population. A large section of poor people has already changed their traditional livelihoods to meet the minimum survival needs of their families. There is evidence that the cyclone Sidr and Aila affected almost 90% of the

[25] The damage report (D report), UNO office, 2009

livelihood sources and the people are still struggling to improve their livelihood conditions. It has been observed in the downwards part of Shyamnagar areas that the people have changed their land-use practices by shifting intensive agricultural land into shrimp farming land. Particularly, the Gabura union is almost covered by shrimp cultivation practices. The transformation of agricultural land into shrimp cultivation land is now mostly done by the local powerful people, who use the illegal pipes and gates to enter saline water inside the embankment. The transformation contributes to generating income inequality and imbalances in society. The poor and landless farmers are replaced as 'wage labourers', who are struggling to meet their minimum survival needs. It has been defined that fry collection and crab culture an alternative income options for the survival of local people. So, the changing situation is often forcing them to live in scattered, isolated, and hazard-prone areas with the construction of temporary houses. The poor land management of the government encourages the poor and landless people to live in unsafe locations. The settlement in unsafe location results in the breaking of existing social networks and communication problems that extend their economic stress.

II. Safe drinking water crisis

The people are facing a crisis of safe drinking water due to the increase in salinity in study areas. The effect of cyclone Aila accompanied by tidal surges in 2009 extended this crisis by entering sea saline water and damaging of freshwater sources. It was earlier noted that only 42.98% of people in the Shyamnagar area and 44.30% in the Koyra areas use tube-well water for drinking but the majority of people is still using other unsafe sources of water that results in the increase of water-borne diseases.

III. Changes in land use

The land use pattern of coastal people is changing rapidly in coastal areas. The transformation of agricultural land into non-agricultural uses at an alarming rate[26]. It is fact that agricultural land is necessary for securing food production, but it is now at risk. The risk is generated due to the unplanned transformation of agricultural land to commercial shrimp farming, expansion of human settlement, infrastructural development and meeting other demands of the people. The coastal lands are mainly used for agriculture, shrimp farming, settlement with homestead vegetation, water points/sources and structural development purposes. The reality is that land use is very much competitive and conflicting in south-west coastal areas (Alam et al., 2002). Though the south-west coastal lands are very much ecologically sensible, the emerging needs and competitive human interventions are contributing to land-use changes. The land use data in south-west coastal areas reveals the declining trend of agricultural land, which is alarming for food security (Table-13).

[26] SRDI, 2013

Table-13: Land use change in south-west coastal areas

Land use	Year		
	1980 (%)	1995 (%)	2010 (%)
Agriculture land	68.42	42.53	37.47
Fallow/Wetland	4.30	2.32	2.66
Forest	1.10	1.19	1.10
Settlements with homestead vegetation	14.97	17.13	26.34
Shrimp farming	2.34	31.51	24.51
Waterbody	5.37	3.99	5.21
Others	3.48	1.33	2.71

Source: SRDI, 2013

The data shows a clear change in land use in south-west coastal areas. The proportion of agricultural land was 68.42% in 1980 which gradually declined to 42.53% in 1995 and 37.47% in 2010. On the other hand, the shrimp farming area was only 2.34% in 1980 which dramatically shifted to 31.51% with massive deforestation and intrusion of saline water in 1995 but in 2010 it was in a declining trend due to the ban on shrimp impart by the European Countries. Besides, the coastal disaster situation also made significant change in the land use and livelihood patterns of the people (UN-HABITAT, 2010). Therefore, two forces are behind this change: i) human action and ii) natural functions, whereas human action is dominated the major changes in land use in south-west coastal areas.

IV. Human displacement and migration

The coastal disasters contribute to displacement or irregular migration of the affected population as means of survival. It has been observed that the displaced people took shelter on the embankments and cyclone shelters in coastal areas. It was a general perception that the displaced people will return to their original locations after the disaster situation, but it didn't happen in all the cases. The loss of traditional livelihoods, failures of post-disaster recovery initiatives and uncertainty forces the displaced people to migrate to urban areas for their survival. A section of male members of the family moved to other places like Khulna, Satkhira, Jessore city or the nearest places to be engaged with brickfields, rickshaw/van pulling, masonry work, or other construction/development works. But the trapped population, particularly women, children, persons with disabilities and the aged people forced to survive in unsafe locations, where they often face diverse forms of oppression and discrimination. The displacement bears a lot of suffering and risks for young women and girls that often deny their choices and respect as human beings.

Table-14: Causal grounds for displacement and migration in the study area

Causal grounds	Attempts	Consequences	Trapped	Status
Cyclone Storm surges and waterlogging Salinity	Took temporary shelters and assumes to back home	Finding no option to return and migrate to other areas	Women, children, Persons with disabilities, and aged people	Temporary/Permanent Migration (mainly men, sometimes with the whole family)

Source: Author

V. Re-shaping of power relations

The coastal disasters have a strong contribution in reshaping power relations. It was reported that coastal cyclones (i.e., Sidr and AILA) accompanied by tidal surges severely affected the poor. The poor are mainly suffered from the loss of agricultural production, traditional livelihoods, and safe water sources. The cultivable land becomes unproductive due to salinity intrusion, and the situation forced the poor farmers to sell their land or transform it into shrimp farms with the influence of powerful shrimp farm owners. The family's needs for arranging daily survival food influenced the small farmers to sell or lease their small piece of land to the powerful/rich landowners. This results in a huge transformation of agricultural land into shrimp farming land under the control mechanism of powerful and rich people in south-west coastal areas of Bangladesh. This has a significant impact on land ownership and landlessness. The loss of agricultural land also threatened the livelihood opportunities of the small farmers considerably affecting their living standards. The changing situation contributes to creating a powerless and voiceless group in the society, while the powerful/large landowners take the control of local decisions. This results in inequalities in the power relations of the society.

4.3 The Context of Disaster Management

Initially, disaster management (DM) was focused on relief and rehabilitation activities led by the central government. But the precautionary measures were largely absent. The gaps in the initial approach to DM result in high death and damage to resources in Bangladesh. Realizing the high loss and damages in the devasting nature of natural hazards, particularly the flood and cyclone of 1991 Bangladesh introduced a significant reform in DM of Bangladesh. The government adopted several plans, strategies, and frameworks in reducing the risk of disasters. Bangladesh established the Disaster Management Bureau (DMB) in April 1993 which made significant changes in the

regulatory frameworks of DM. As part of this framework, the DM system is structured with a key focus on the national and local levels (Figure-19).

Despite this significant change, there were no visible results defined in the DM of Bangladesh. The UNDP supported CDMP[27] took the initiative to assess the functionality of the Union Disaster Management Committee (UDMC). The result of the assessment denoted that no UDMC is rated as good status but 36% UMDCs rated as moderate, and 64% UMDCs rated as weak (CDMP-II, 2013). It has made some significant observations that basic understanding, effective coordination, efficiency in situation handling and regular information flow to the higher authorities are the key to make the DMCs functional in Bangladesh.

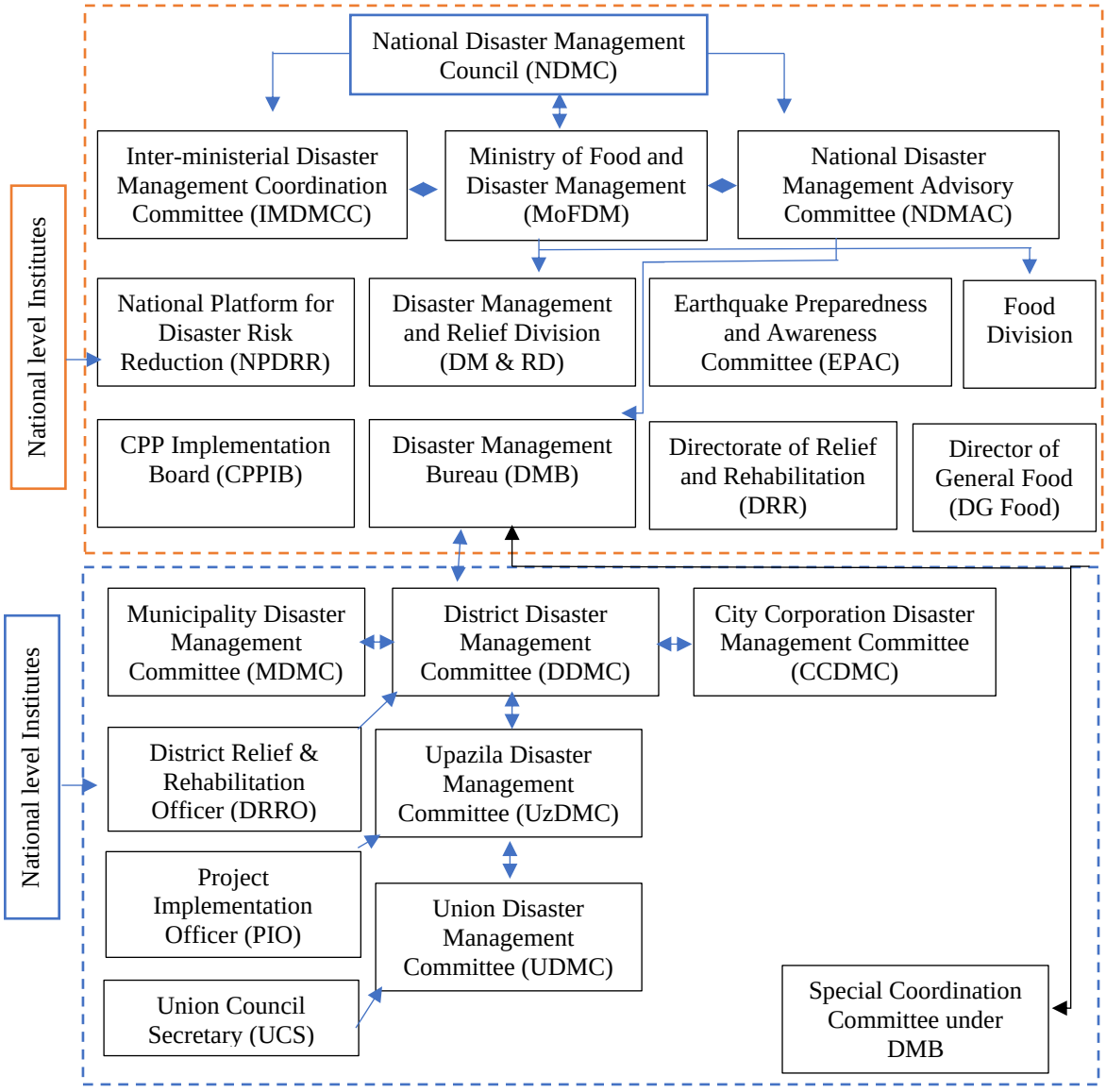


Figure-19: Initial structures of DM (Source: Adapted from the DMB, 2010)

[27] CDMP means the comprehensive Disaster Management Program

In 2012, a major transformation occurs in the DM system of Bangladesh. There is defined a reformation with the full Ministry of Disaster Management and Relief (MoDMR) on September 13, 2012. The DMB was replaced by the DDM[28] under the provision of Disaster Management Act, 2012. Interestingly, the organizational transformation was made at the central level of DM structures, whereas the structure remains the same at the local level (Figure-20).

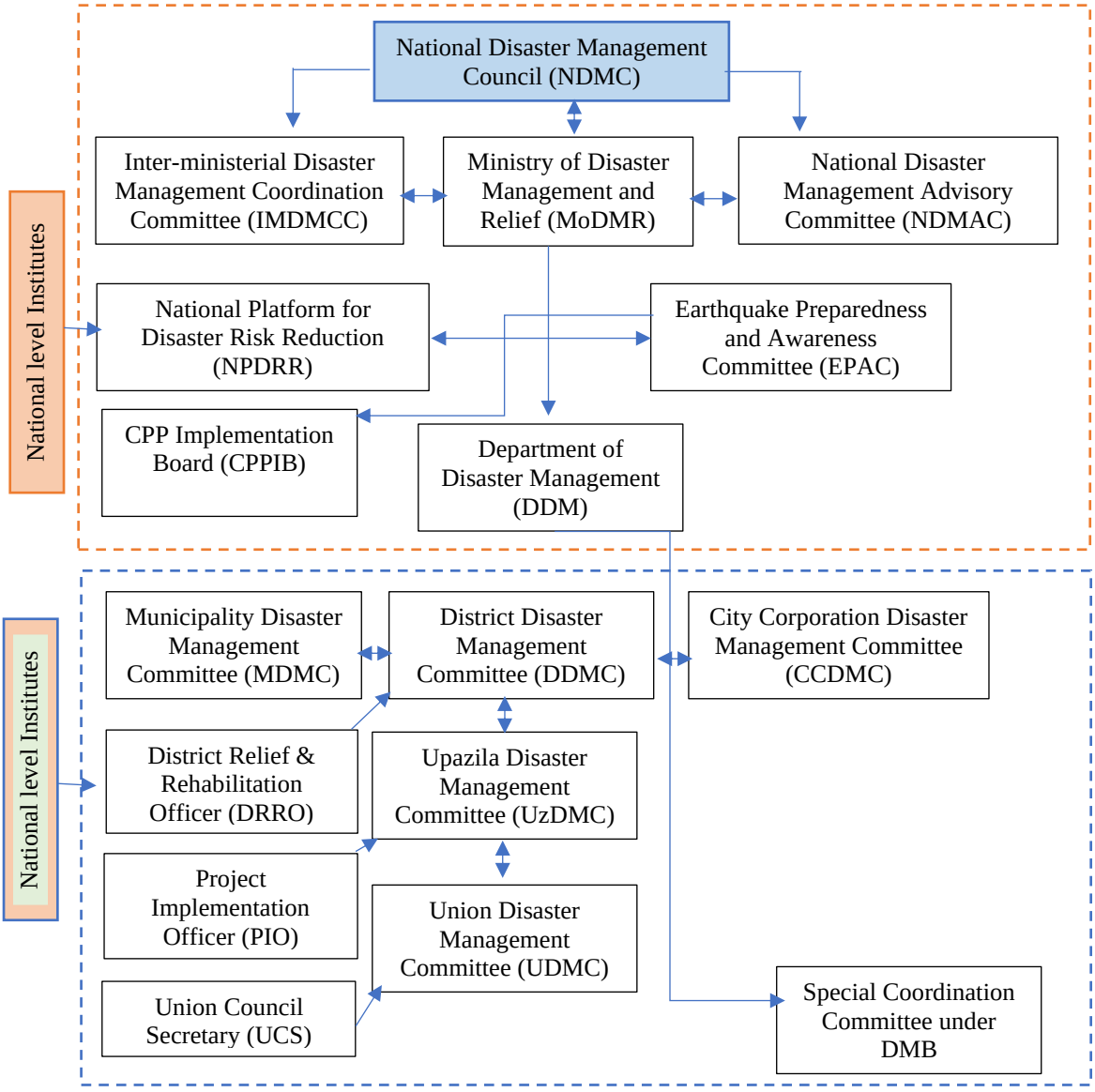


Figure-20: Transformed structure of Disaster Management.
(Source: Adapted from the DMB, 2010a; Cabinet division, 2012)

According to transformed structures, MoDMR is placed at the central point of the DM system and guided the functions of all committees. The MoDMR provides all necessary

[28] DDM refers to the Department of Disaster Management

support and information to DMC, IMDMCC and the NDRCG to assist in strategic decisions on Disaster Management (DMB, 2010b). The local level structures are defined at: i) City Corporation; ii) District; iii) Upazila; iv) Pourashava (municipality), and v) Union level. All these structures of DM are mainly assigned for four different periods[29]: i) normal; ii) warning; iii) emergency response; and iv) post-disaster to reduce people's vulnerability. As a supplement to this transformation of DM structures in Bangladesh, the government has successfully aligned with the international DM instruments (Figure-21). These are as follows:

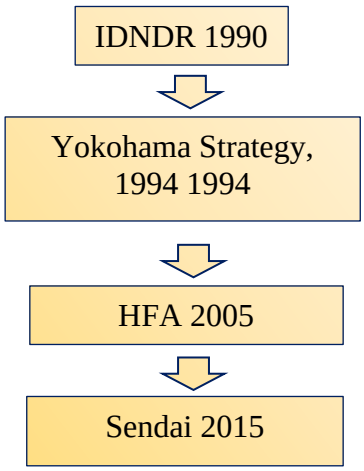


Figure-21: Bangladesh's alignment with the UN steps for the development of instruments in addressing disaster (Source: Author)

Firstly:

Bangladesh expressed its commitment to follow the directions of the UN IDNDR in the 1990s to mitigate the effect of disasters on lives and resources.

Secondly:

Bangladesh shifted its focus from a hazard to vulnerability under the guidance of the Yokohama Strategy and plan was adopted in 1994 for a safer world. This was strategically aligned with four core elements: prevention, mitigation, preparedness, and relief. But there were defined several shortcomings in reducing the risk of disasters. There were:

- Risk identification
- Reduction of underlying risk factors
- Early warning
- Knowledge transformation
- Effective response and recovery

[29] DMB, 2010b

Thirdly:

Bangladesh adopted and aligned the Hyogo Framework for Action 2005 – 2015 in the reviewing of its DM framework to build resilience to disasters. HFA is allowed five key actions. These are i) Priority to DRR actions; ii) Risk informed decisions and actions; iii) Better understanding; iv) Reducing underlying risks, and v) Responsive actions.

But the framework denoted a set of challenges during its application. These are:

- Governance.
- Risk identification and monitoring (including early warning).
- Knowledge management and education.
- Reducing underlying risk factors.
- Effective response and recovery.

Besides, the framework also defined a clear coordination gap among all the DM structures at local and national levels. The areas of the gap are as follows:

- Participation of vulnerable groups in decision making.
- Timely mitigation and adaptation measures for better community resilience.
- Relief centred mindset.
- Area-specific risk information, and
- Technical support to sustainable development.

Fourthly:

Realising the gaps, Bangladesh reiterated its commitment to adopt the Sendai Framework for building resilience and attaining the desires of sustainable development by 2015-2030. With this commitment, Bangladesh has already introduced the National plan for DM, 2016-20 with a set of actions to align the four priorities. The framework signifies the importance of disaster risk governance, which is still a crucial concern in Bangladesh for advancing disaster resilient development. However, the 7th and 8th five-year plan has already integrated a set of activities to align with the priorities of the Sendai framework in addressing multiple hazards (Figure-22).

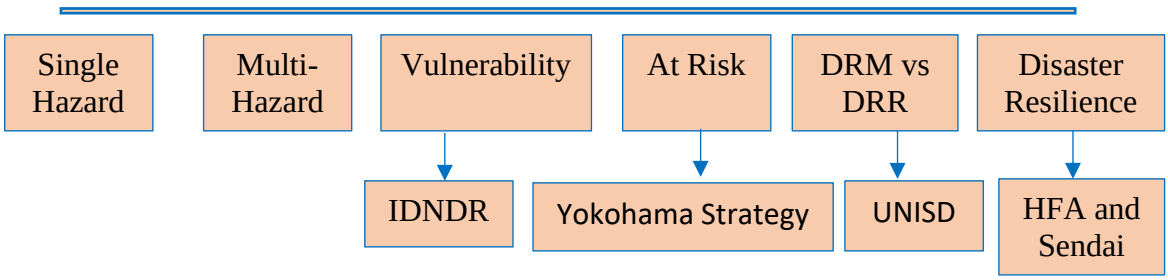


Figure-22: The integration of DRR and DRM (Source: Author)

Bangladesh is still continuing the transformation of DRM and climate resilience on the ground. So, the country is recognized as an important stakeholder of the Paris Agreement (COP21). As a success, the transformation of the DM framework in Bangladesh has made a significant contribution to preparedness (early warning) and mitigation mechanisms in reducing the loss and damage of lives and resources but the reality is that the DM efforts are not fully complying with the reduction or elimination of underlying risk factors. Besides, the ground implementation of the DM framework is mostly focused on institutional resilience rather than community resilience in Bangladesh. As a result, a section of poor and extremely poor people, who are living with a situation of inequalities and differential vulnerabilities/risk, are unable to cope with the effects of external forces, such as hazards. The situation added additional pressure on their lives and existence to survive.

4.3.1 Disaster Management and its Cycle

Disaster management (DM) means the management of disaster risks. The management includes the policies, institutional structures, and practices on the ground to prevent, manage, and reduce the risk of disasters. The disaster management process drives with:

i) Preparedness: policies and planning for effective response to hazards
ii) Mitigation: Actions taken before and after the hazards for reducing the impacts of hazards
iii) Response: Actions taken just before, during and after the hazards; and
iv) Recovery: Actions taken to restore and return a community to normal condition.

Hence the preparedness and mitigation measures are an integral part of development, while the response and recovery initiatives are mostly considered as part of the humanitarian assistance in disaster management. The disaster management cycle is basically considering the development part as pre-disaster initiatives for risk management and the humanitarian assistance part is considered as post-disaster initiatives for crisis management (Figure-23). So, the pre-disaster measures are very important in reducing the risk but the efforts to strengthen the people's ability is also very significant for long-term perspectives of disaster. Regarding this, understanding and identifying the causal grounds of risks and vulnerabilities of an area are essential components to enhancing the resilience of people. Therefore, the risk management is the key in the facing of disasters.

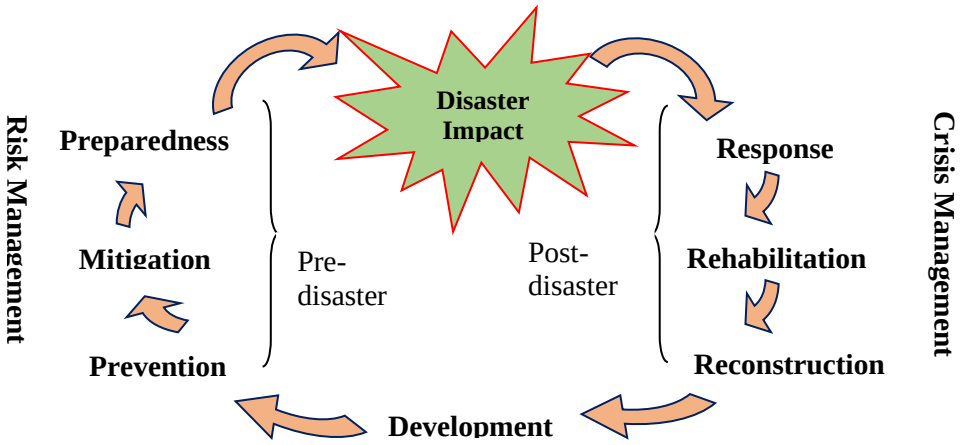


Figure-23: Disaster Management Cycle (Source: conceptualised and framed by Author)

4.3.2 Paradigms Shifts

The framework of disaster management emerged as an integrated part of development after a long paradigm shift (Figure-24). In the 1970s, the risk of disaster was not considered in the planning of the development agenda. There was a reflection that the implementation of the development plan, unfortunately, was interrupted due to disasters and the response initiatives were mostly operated by the UN and IFRC to provide emergency support. After that, the rehabilitation and reconstruction initiatives started to regain the development.

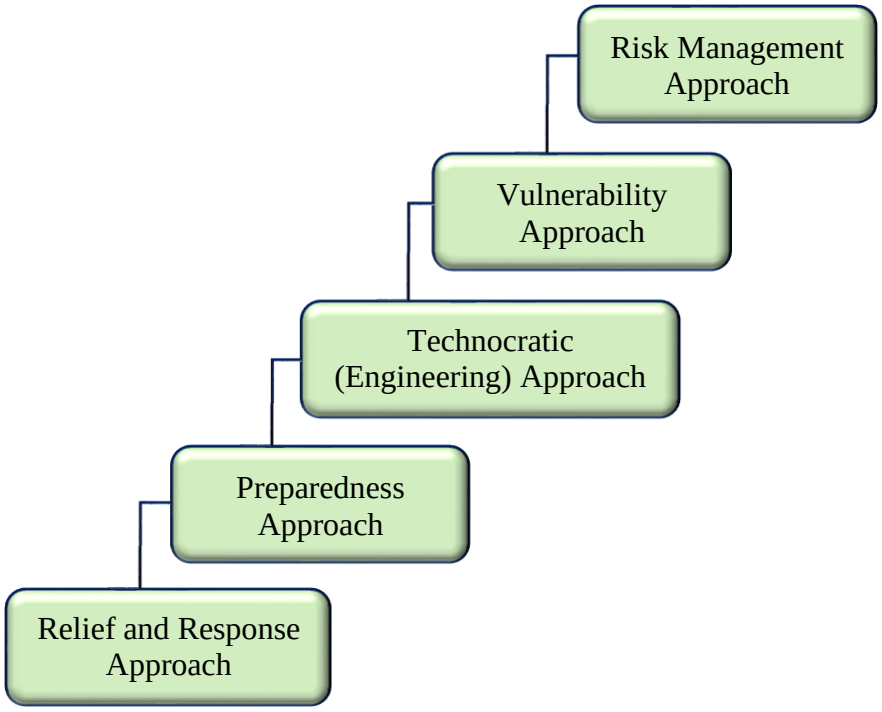


Figure-24: Evolution of Risk Management Paradigms (Source: Framed by Author)

Therefore, the risk management initiatives were initially based on a 'relief and response approach' that was largely guided by the top-down approach. The increase in knowledge and understanding of natural hazards contributes to reframing a more precise 'technocentric (engineering) approach'. This approach was mostly guided by geophysical and engineering knowledge. But the increasing trend of disasters and its impact on people and places made a significant contribution to the increase of people's vulnerability. The nature of vulnerability wasn't uniform among all the people and places. This was a prime concern of introducing the ''vulnerability approach''. It is noted here that the vulnerability approach undermines people's ability to reduce the risk of disaster. The limitation of this approach helped to rethink and develop a more comprehensive risk management approach in recent years. It is defined as a realistic approach due to its alignment with sustainable development.

4.4 The existing practices of disaster management

4.4.1 The early disaster phase

The early disaster phase includes:

- ✓ Preparation.
- ✓ Moderation; and
- ✓ Prevention

The early disaster phase is potentially linked with development. Better preparation, constructive moderation, and preventive measures (i.e., forecasting early warning) are the key to reduce the loss and damages in disasters. UNISDR (2009) noted that 'disaster preparation' is a combination of actions taken before the disaster. This includes the early warning, safeguarding the people and locations, timely shifting of people to a safe place and so on. UNDP's disaster management manual highlighted that disaster preparation signifies the ability of a community or society to face a disaster situation.

On the other hand, 'moderation' measures are the combination of physical and societal actions as required for reducing the risk of disasters. The prevention drives with a set of preventive measures (i.e., early warning) that makes the people alert to respond effectively at the time of disasters.

I. Standard policy approaches and their implications

Bangladesh has introduced different frameworks aiming to manage disaster situations. These are:

- ✓ The Standing Orders on Disasters (SOD), 2010
- ✓ National Plan for Disaster Management, 2016-2020
- ✓ Climate Change Action Plan (2009–2018)
- ✓ Disaster Management Policy, 2015

- ✓ Cyclone Shelter Construction, Maintenance and Management Policy 2011.
- ✓ Disaster Management Act, 2012
- ✓ Guidelines for Government at all Levels

All these legal and policy frameworks of Bangladesh are fully aligned with international instruments. The adoption of frameworks contributes to changing its disaster management mechanisms from a risk-hazard centric to a disaster-resilient approach. The disaster-resilient approach was strategically introduced in the Hyogo Framework for Action (HFA, 2005-2015) that potentially integrated with the national legal and policy frameworks including the 7th five years development plan (2016-20) of Bangladesh.

Despite the application of standard legal and, disaster has become a frequent concern for Bangladesh because of its socio-economic impact on development. The failures in enforcement of policy frameworks, hazard centric response of the institutional structures and lack of governance in the pre-disaster initiatives undermine the international efforts and national commitments to build a visible disaster resilient community in Bangladesh. The fact results in long delays to get the approval of the revised SOD, 2010 (i.e., the first SOD issued in 1997) and the Disaster Management Act (DMA), 2012 but yielded few successes. Realizing the gaps and future challenges in the application of HFA, 2005-2015, the UN adopted the Sendai Framework for Disaster Risk Reduction 2015–2030. Sendai Framework outlines four (4) priorities for actions. These are:

Priority 1: Understanding disaster risk.
Priority 2: Strengthening disaster risk governance to manage disaster risk.
Priority 3: Investing in disaster risk reduction for resilience.
Priority 4: Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation, and reconstruction.

Bangladesh has strategically aligned the disaster reduction priorities of the Sendai framework as an integrated agenda of its development planning and "Vision 2021". It is fact that the actions for reducing vulnerability to disaster require preventive and mitigation measures. The ground reality is that the plan and actions to some extent unable to reduce people's vulnerability. So, the appropriate action and investment are necessary for reducing people's vulnerability. It is strongly aligned with the statement of UNESCO (2007) that 'a one-dollar investment in preparedness and mitigation works will help to prevent four to eight dollars in disaster losses. The action learning inspired the government of Bangladesh to take coordinated actions by engaging the government institutions, CSOs, and local communities for reducing the impact of disasters on people, the economy, and society. The idea is advanced after the 1988 flood and the devastating cyclone of 1991. It refers to a shift in approach and

generates new thinking that if the people are being well prepared, they can easily reduce their losses and damages. Therefore, disaster preparedness is considered the key action for building the resilience of the community.

II. Community-Based Vulnerability Reduction Approaches

In recent years, disaster management efforts are prioritising the community-based and community-led approaches as part of holistic community development (Quarantelli, 1989; Mileti, 2001). This approach contributes to a transformation top-down approach to a bottom-up approach in disaster management. It refers to an illustration that well-informed communities can reduce disaster impacts on their lives and livelihoods. Bangladesh has potentially introduced this proactive approach in areas, where the people are most vulnerable and at risk of disasters. The international organisations are also applying the community-based and community-led approaches to enable people with their extended ownership and the ability to cope with disaster impacts. The statement of the Red Cross, 2001 also signified the importance of a community-based approach[30].

A number of community-based programmes are taken by the Government and NGOs with resource support from external sources to help communities for reducing their disaster vulnerabilities. Such programmes are being undertaken in many disaster-prone developing countries like Bangladesh. Bangladesh introduced a community-based vulnerability reduction approach with the help of IFRCS in 1972 that guided the destruction of the 1970's cyclone, where more than 500,000 people died. Under this CPP framework, the government has taken initiatives to raise public awareness, develop community volunteers and strengthen their capacities to reduce people's vulnerability in a disaster situation. It has been observed that the CPP has played a significant role in reducing the causality of disasters. As a reference, 150,000 people lost their lives in the 1991 coastal cyclone but only 3363 people lost their lives in 2007 cyclone Sidr. The success encouraged the government to introduce a comprehensive disaster management programme (CDMP) in Bangladesh. Basically, the CDMP contains special attention to 'disaster preparation' and transforms it as people's response mechanism in line with risk reduction perspectives.

The application of a community-centric approach has added benefits in disaster management because it recognises the local context, cultures, and dynamics of development. The approach is truly apolitical. It is unable to recognise the casual grounds of the vulnerability of the poor and vulnerable people of an area.

[30] *A community-based approach is the best assurance that perfection in disaster preparedness will be realized and sustained, the supported population must participate in the planning and preparation for disasters. And all actions should address gender issues and the need of most vulnerable groups (Red Cross, 2001).*

4.4.2 The post-disaster phase

The post-disaster management practices depend on the needs and priorities of the country to recover from the disaster impact and to continue the development process. The practices include:

- ✓ Response and recovery,
- ✓ Rehabilitation; and
- ✓ Reconstruction issues are linked with crisis and development.

Hence the 'response' is placing preparation plans into action. The recovery is a set of actions to transform the situation into a normal stage, while the rehabilitation sets actions in the aftermath of a disaster to enable basic services to resume functioning, assist affected persons to repair individuals and community facilities, and facilitate the revival of economic activities. Post-disaster reconstruction is very important to extend opportunities to improve the safety of infrastructures towards successful tackling of future disasters and minimising the loss and damages. It is an integral part of development investment as a physical risk reduction measure that contributes to reducing the structural vulnerability in hazard-prone areas of Bangladesh.

I. Policy Strategies of post-disaster management practices

Bangladesh has experienced a number of devastating disaster situations. It caused massive suffering for the people, particularly the poor. To manage such suffering of disasters, the country has successfully introduced an institutional framework at national and local (i.e., District, Upazila and Union) levels. The framework represents state and non-state institutions for wider coordination in emergencies and post-disaster situations. IFRC (2001) and World Bank (2001) also recognized the importance of policy guidance and appropriate actions in post-disaster situations. So, recovery initiatives are also the key to reducing disaster risk. World Bank (2001) denoted that humanitarian aid and support offsets below 10% of the country's economic losses and damages. In Bangladesh, after Cyclone Sidr in 2007, the World Bank allocated US$109 million as a loan for cyclone recovery and restoration, which wasn't enough.

It is fact that the World Bank is an important policy guiding institution in the management of post-disaster situations. It has provided expert support to the government to include disaster risk-informed development planning and strategies. But the technical and advisory supports are not always reflecting the needs and requirements of the ground reality of the people's vulnerability. So, a realistic development plan and strategy are crucial for disaster recovery in the context of Bangladesh. There is also a need for an adaptive plan for reducing the long-term vulnerability of the people (Turner, 2003). It has been defined those two processes are very important for post-disaster policy strategies, which are:

a) Recovery process; and
b) Development process.

But defining the linkages of these two processes is not so easy. Most of the institutions tried to recognize disaster as a cause of natural phenomena that deny the evidential analysis of causal grounds in making policy decisions. The analysis of causal grounds is important for successful recovery and development. This is also necessary to regain people's confidence that they lost during the disaster.

Realizing this fact, Bangladesh has made a significant change in its policy to transform the relief and response approach to a comprehensive risk management approach. The conceptual transformation in approach contributes to the reformation of development plans and practices in Bangladesh. The transformation is reflected in the 7th and five-year plans in Bangladesh.

4.5 Conclusion

The occurrence of disaster situations is a common feature in Bangladesh. In particular, the coastal area suffers from frequent and devastating disasters due to its geographical location, human-induced development actions, and climate change. The people and places are mostly affected by three forms of disaster situation, such as: i) cyclone induced disasters; ii) salinity induced disasters; and waterlogging induced disasters. The nature of disaster situation has potential impact on traditional process and practices of the people in coastal areas. It has been creating an additional pressure on people and changing their traditional livelihood, creating safe drinking water crisis, forcing human displacement, changing land use pattern, and reshaping the power relations in coastal areas of Bangladesh. In such a situation, a section people are always struggling to survive.

On the other hand, the efficient management of disaster risk is important for sustainable development. Because disaster has a potential negative impact on development. The existing DM framework is mostly focused on immediate and post-disaster elements with limited attention on pre-disaster elements that extend vulnerabilities of the people and communities. The limited attention in pre-disaster elements contributes to extend peoples inability to cope with disaster situation. Therefore, an integrated approach is necessary to address needs and requirements of the people in all phases of disaster risk management in Bangladesh.

Chapter Five
THE PROCESSES AND DRIVERS OF ECOLOGICAL CHANGE

5.0 Introduction

This chapter examines the power-led process and the drivers of ecological change in context of south-west coastal areas in Bangladesh. Initially, it focuses on three interlinked process dynamics, such as: i) everyday dynamics; ii) episodic dynamics and iii) systematic dynamics as evidential link changing ecology and differential vulnerability of the people. The explanation of processes dynamics has been justified with evidential information and photographs on ground situation. This chapter is further explained the functional process of ecological change with the visualisation of changing status of i) agricultural land, ii) human settlement and vegetation; iii) shrimp farming and waterbodies; iv) riverine area; and v) forest areas during the period of 1970 to 2020 in study areas. This is further examined with the changes of landscapes that potentially verified with remote sensing data/information in study areas. The process of ecological change is also elaborated with the evidence of historical process in context of 1960's, 1970's, 1980's, 1990's, and 2000 and beyond. After the evidential verification of interlinked functional processes, the chapter identified community perceived power-led drives of ecological change, while it is categorically explained with geophysical and environmental, social, economic, and political dimensions to explore their causal links with differential vulnerabilities and the risks of disasters. Finally, the chapter examines the influence of power dynamics with discriminations, landlessness and decision making to justify the role of power relations in the process of ecological change. The analysis potentially uses the data (including spatial data) and information from both primary and secondary sources to search the answers of research queries under statement 1.

5.1 The Ecological Changes

Ecology refers to the process of interactions between organisms (i.e., Humans) and the Environment. Hence, we considered 'Humans' as a dominant part of the organism that has direct interactions with its environment (please see the figure 4). The process of interactions is reinforced, while human-induced actions modified the quality of the environment and force the change in the ecology of an area with the functions of three major dimensions (Figure-25).

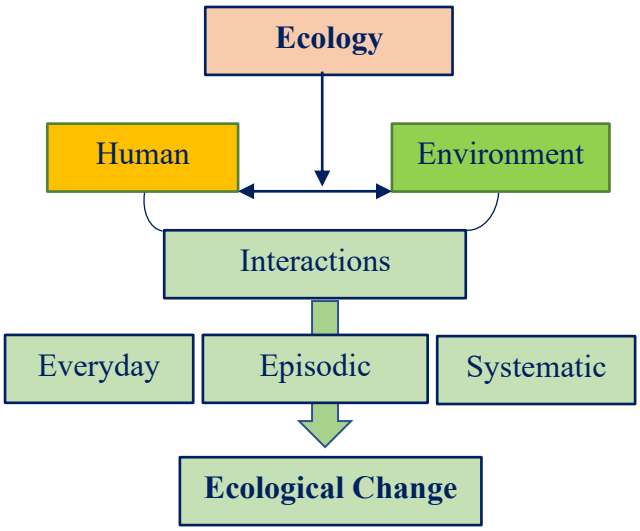


Figure-25: The Dynamics of Ecological Change (Source: Author)

It is a linked system and contains a space for interactions between people and the environment that leads to consumption of natural resources and degradation of ecological and environmental potentials. It is not only forces to destroy the development potential of a country like Bangladesh but also makes it unsustainable.

There is an observation that diverse human-induced external forces are functional at the micro and macro scales to reinforce the changes in the ecology. The change alters the ecosystem's capacity to generate services on which human society depends. As humans are a part of the ecological system (Christensen *et al*., 1996), any change in nature/environment has diverse effects on the societal system. Because the ecological changes create new opportunities, crises and added pressure on the social and economic performances of the society resulting in social and environmental inequalities. The ecological system is increasingly challenged by the force of human needs, which are unequal and generate benefits for powerful groups. The force of human needs is also differential in the society that creates a space for inequalities and vulnerabilities of a section of people. It is a true fact that the contemporary ecological crisis is creating additional pressure on the poor and forcing them to be the most vulnerable. The findings of a discussion with the people living in the SRF (Sundarban Reserve Forest) area reveals that:

> *A small section of powerful and rich people is leading to extracting the SRF resources by placing the poor people at risk. Their only aim is to maximize the profit in a short period, because the financial and logistic investments are high in the process of SRF resource collection, while poor people act like the bonded labour of the powerful investors. Due to declining of SRF resource collection and the debt of the money lenders over the years, a section of SRF resource labours has already been displaced from their location for finding alternatives.*

The profit gaining mindset of the richest/powerful people through overuses and extraction of natural resources is contributing to creating extra pressure on the ecological system in coastal areas. The process is also created a deprived group in society. It is basically an example of the ecological irresponsibility of the richest/powerful people and groups in the society. It contributes to grown-up gaps between rich and poor that are often reflected in the transformation of environmental damages from the richest/powerful to the poorest. The powerful people are always defined as big users of the environmental resources than the poor and often get the favours of environmental policy, but they are mostly responsible for environmental damages than the poor. The existence of powerful/richest people in the environmental comfort zone always keeps them in protected areas from environmental damage.

The existing social and environmental inequalities are responsible for creating a situation of vulnerability and risk, where the poor have little capacity to survive in the changing ecology and tolerate the shock of environmental crises. The situation allowed the people to live in at-risk areas for their survival rather than conceptualizing the concerns of environmental crisis. So, the human-environment interactions are significant and active to change the ecology/environment in coastal areas. So, it is time to rethink keeping balance in this interaction so that the people (humans) can survive in the changing situation of ecology/environment and the risk of disasters in the future. The people should have to realise about their actions forcing them to change the environment. The environmental changes are now visible as 'desperate ecocide' and making a differential impact not only on a global scale but also on regional and local scales. The process arises a question "what are the causal patterns of human-environment interactions; who are creating the environmental problem/crisis and who becoming the victims of this crisis?". There is an assumption that unequal power relations are causally linked with discrimination, inequality, and local decisions. This results in unequal access, control and opportunities for the people and reinforces the environmental crisis in coastal areas of Bangladesh.

The power-driven differential interactions over time and space between humans and the environment is a key factor to lead the evolution of human society, but in turn, the effects of human society/modifies the environment, increasingly more in recent times. This unique interaction is continually active because of human's continual search to facilitate their work that experiences a change both in the quantity of interaction (i.e., how often, on many levels are they interacting and in what size – micro/macro) but also in the quality of interaction (i.e., how significant is the result of interaction/what is the yield of interaction). The interactions act as a driving force for serious degradation of ecological goods and services and produce associated, and often unforeseen, adverse effects on people and places. Increasingly it is clear that these effects are not evenly or randomly distributed in human society and result in differential vulnerabilities on people and places. The differential effects on people are the result of structural and

circumstantial forces, whereas the structural issues deal with the failures of managing the ecological challenges and intangible social realities.

On the other hand, the contextual issues of economic and political forces contribute to creating poverty and inequality by denying the long-term environmental and social needs of the people. It is fact that humans' well-being is truly dependent on ecological/ecosystem services. If there is any breakup in the ecosystem services of particular areas, it generates a potential impact on human well-being that may result in poverty. It has simply been observed that the changes in landscape and ecosystem services result in declining human welfare services and extending the struggle of the poor in society.

5.2 The Dynamics of Ecological Change

The historical/ground information of south-west coastal areas in Bangladesh reveals three functional dimensions of ecological changes in a geographical setting that has been creating differential opportunities and risks for different groups of people or communities (Table-16). We may first examine the causation of ecological changes through the analysis of:

1. Everyday dynamics
2. Episodic dynamics
3. Systematic dynamics

5.2.1 The Everyday Process

The "everyday" dynamics are strongly connected with physical changes (i.e., landscape changes, deforestation, and salinization) of an area. It drives by regular human interventions and practices. This process has an unequal impact on a section of the population and forces them to be vulnerable and marginalised. If we examine the historical process of change in coastal areas in Bangladesh, we may find insight into this change. Until the 18th century, the coastal areas of Bangladesh were truly covered with dense forest that encouraged a large section of people to live in the forest periphery (Asif Ishtiaque, et.al, 2017). Traditionally, the livelihoods of the coastal people were truly depended on the harvesting of forest resources, fishing, and small-scale agriculture. At the time of the British colonial government, the forest lands were started to convert into agricultural lands to increase tax revenues. The colonial government declared the forest lands as *Khas Mohol* (state-owned land) through the formulation of forest policies and Acts. But the conversion of forest lands into agricultural land was continued. The conversion of forest lands into agricultural land was continued due to policy support for this action. The expansion of agricultural lands encouraged the small farmers to start small-scale agriculture with the support of temporary constructed dams

or embankments to protect their cultivable land from flooding. The regular flow of tidal water also encouraged some people to start small-scale shrimp farming in coastal areas. But the reality is that the salinity intrusion created an additional threat to agricultural production, safe water sources and human settlement in coastal areas. The temporary dams or embankments were unable to protect the people and resources from the effects of the cyclones and tidal flooding.

Another reality was that the Coastal Embankment Project (CEP) build 4800 km of high embankments with the assistance of USAID from 1961 to 1978 that intended to protect coastal lands from tidal inundation. The CEP constructed polders and sluice gates temporarily helped the people to increase their agricultural production but the polderization resulted in a negative impact within a short time. It was created drainage problems and a permanent waterlogging situation in coastal areas that and places the millions of coastal people in real threat with differential access, opportunities, and exposures.

The analysis of daily human interventions/actions in the Sundarban Reserve Forest (SRF) areas in Coastal Bangladesh reveals that a section of people living in the extreme frontiers, especially in the 5-kilometre buffer zones (Figure-26) in the Sundarban Impact Zone (SIZ) that mainly hosts the extremely poor people, where social systems and institutions are less effective, disaster impacts are more severe, and livelihoods opportunities are less diverse. Intense agricultural land conversion into shrimp farming also happens in most of these areas, causing salinity problems, breakdown of subsistence-level agricultural productions and livelihoods that results in changing ecology of coastal Bangladesh. There is evidence that commercial shrimp farming created a set of social problems and challenges in south-west coastal areas. Commercial shrimp farming is required less labour than agriculture. It has created a severe livelihood crisis there and often forced the displacement of small-scale agriculture farmers. Since 1970, the powerful elite group gains the economic benefits of shrimp farming due to its high prices and international market demands. The success inspired the small-scale farmers to restart shrimp cultivation in coastal areas. The commercialization of shrimp farming created a section of powerful social elites, who have taken the lead in social power and the basic social hierarchy has broken down. It has created uneven power relation in society.

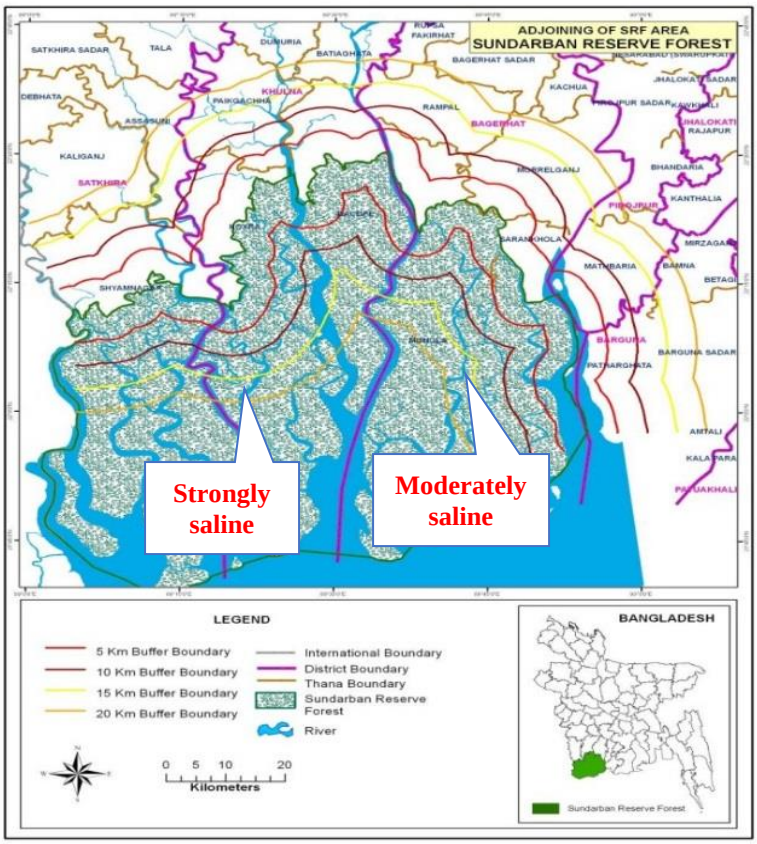


Figure-26: Sundarban Reserve Forest Area
(Source: Adapted from baseline study of the CBAS-SRF project, 2013**)**

Besides, the analysis of human practices revealed that a large section of the poor and extreme poor can enjoy only 5% of the benefits from certain product value chain processes. Because the poor resource harvesters, who directly enter the forest ecosystems, are not the major, but rather minor beneficiaries of harvests in financial terms. Golpata collection, fish, honey, and crab harvests are defined as income activities of a group of people that need financial support or access to credit, tools and equipment, and strong connections with many types of powerful groups/stakeholders. The direct harvesters generally work as wage labourers for powerful groups, who generally do not come to the front, but prefer to manage things behind the scenes. In a value chain study on SRF resources (2010), Dr K. M. Nabiul Islam (he assessed the product value chain for *Sundari* timber, go data, large fish, shrimp, and shrimp fries' resources) showed that the harvesters enjoyed only 5% of the total income (Figure-27), whereas the *Mahajan* and *Aratdars* in the upper tiers of the value chain got most of the income from whole activities.

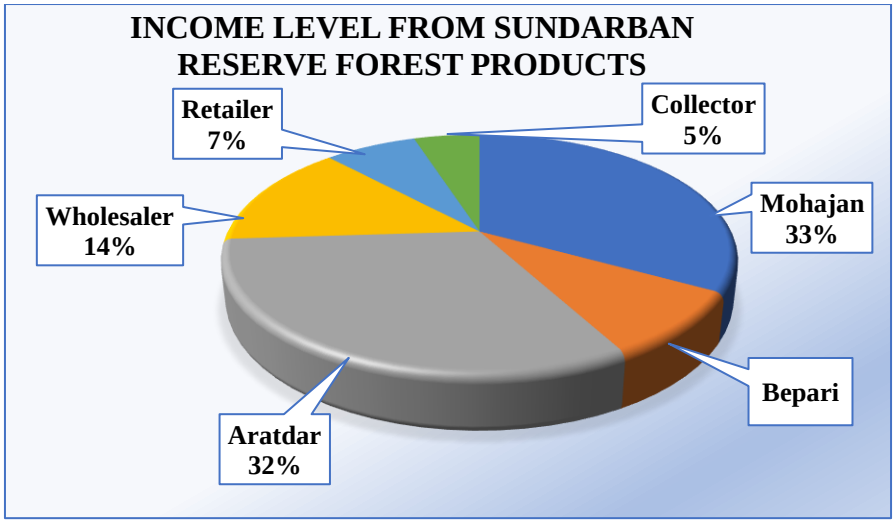


Figure-27: Value chain benefits of Sundarban Reserve Forest products
(Source: Adapted from baseline study of the CBAS-SRF project, 2013**)**

The everyday human practices have a serious pressure on the environment and ecosystem services of the coastal forest areas in Bangladesh. The traditional practices allowed the people (collectors) to enter into the deeper parts of the forests for the extraction of more forest resources (Figure-28). This has been created a degradable condition in the Sundarban due to increasing demands of a section of powerful actors that creates an imbalance, triggering acceleration in resource degradation and spreading inequality in the society.

Figure-28: Vulnerable women are the main collectors of shrimp and fish from the Sundarban adjacent river (Source: the photograph captured by Author at adjacent river of Kalinchi village, Shyamnagar, 2021)

Another fact is the salinization of coastal areas that already graves more than 50% of coastal land in Bangladesh. This is also a reality in study areas (Figure-29). It has been estimated that the saline affected area was 833.45 (000'hac) in 1973 which increased to 1020.75 (000'hac) in 2000 and 1056.26 (000'hac) in 2009. There are observed two functional forces that contribute to increasing salinity in study areas:

a) Rising of sea saline water level; and
b) Reducing the natural flow of river water to downstream south-west coastal areas.

Both the forces are active to expand salinity prone areas in study areas and contribute to changing the local ecosystem/ecology, land use and human livelihoods of the people. The reduction of water flow from upstream to downstream areas has already made a negative impact on the water resource system in the south-west coastal areas. The main reason behind the reduction of upstream to downstream natural flow of river water is the ''*Farakka*" barrage''. The Farrakhan barrage destructed the natural downwards flow of river water and diverted the river flow to another area. Due to the diversion of water flow from the Ganges River, the rivers in the south-west coastal areas are not getting enough water to wash the seawater salinity of the coastal land. It has made a significant contribution to increasing water and soil salinity and surface temperature in south-west coastal areas of Bangladesh.

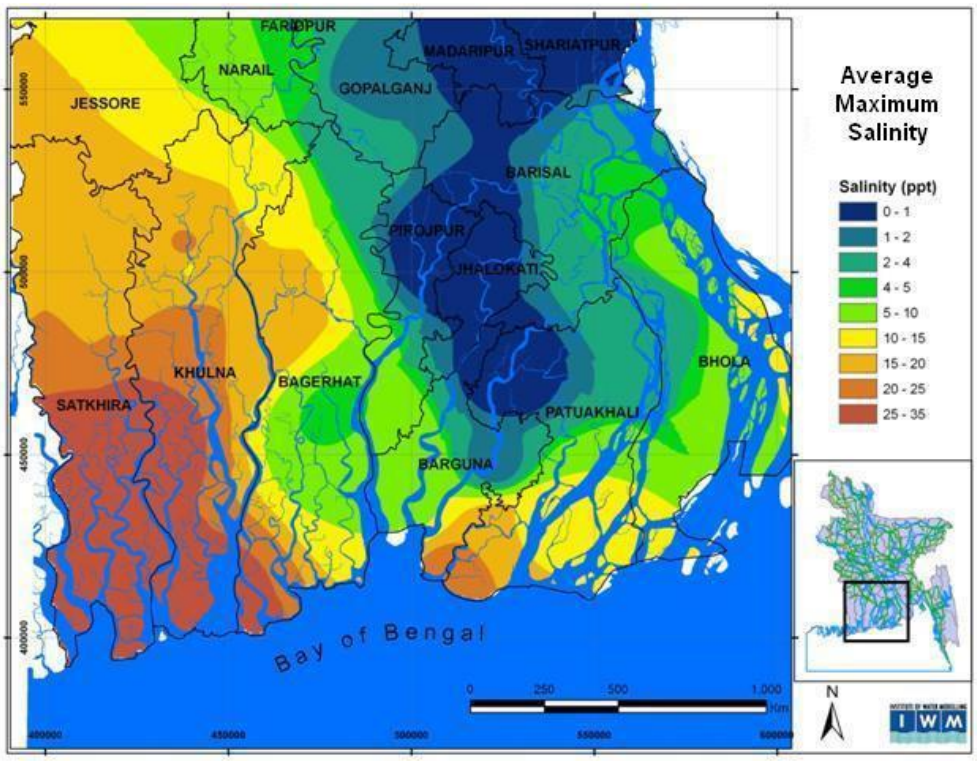


Figure-29: Map of Average Maximum River Salinity in the South-west Region of Bangladesh (Source: Adapted from Dasgupta et al. 2014).

It has been defined that the increase of salinity (in water and soil) and surface temperature is leading to land-use change. Besides, the drying of rivers is making the lives and livelihoods of the fishermen community so difficult to survive. The increase of salinity in the cultivable agricultural lands is also forcing the small farmers to shift their land into shrimp cultivation (Figure-32), which is not only destroying the ecological system in the coastal areas but also creating food insecurity and health hazards.

(Source: the photograph captured by author at adjacent areas of Kalinchi village, 2021)

Figure-30: Increasing salinity forces the small farmers to shift their agricultural land into shrimp farms.

(Source: the photograph captured by Author in Kalinchi village, Shyamnagar

5.2.2 The Episodic Process

The episodic dynamics induced by the natural phenomena (i.e., cyclones, storm surges and waterlogging) that has massive, immediate, and highly unequal exposures and stress on people. It occurs periodically and affects people disproportionally. The people, who are highly exposed and facing stress to natural phenomena are defined as the main losers in a disaster situation. The evidence shows people's inability to face the changing situation is always pushing them to live in unsafe conditions. The poor are the main sufferers in a disaster situation (DFID, 2004; Wisner et al., 2004; UNISDR, 2009b).

The occurrence of natural phenomena has a potential negative impact on human life with death, injury, and damage. As a reference, cyclone Sidr in 2007 killed 3406 people and injured 55,000 people in south-west coastal areas. Most of them were from poor and marginalized families. Another cyclone named 'AILA' occurred in 2009 that also adversely affected a total of 160,432 people, killed 59 people, and forced 45,722 households to be homeless in Shyamnagar Upazila[31]. Before Aila, more than 38% of people directly depends on agricultural food production[32] and almost 27% on selling labour but the Aila significantly changed the agricultural practices and traditional livelihoods of the local people. According to local people, they were used to rare poultry and livestock, but they lost almost 80% of their livestock during cyclone Aila. It is now almost one decade but still more than 70% of Aila affected people struggling to maintain survival needs. The people noted that poor people have little or no surplus to absorb the economic losses and to recover that continue their poverty situation and place them into unsafe conditions face the future vulnerability of disasters.

5.2.3 Systematic Process

The third dynamic is closely linked with human destructive actions that generate an unequal impact on human and the environment and result in changing ecology in the context of south-west coastal areas. The issues of human-induced ecology/environmental change was often unnoticed by some powerful actors, while they transformed or replaced the "original nature" in the name of alternative land use and livelihoods (Figure-31).

[31] UNO Office Shyamnagar, Satkhira
[32] BBS Community Series, 2011

Figure-31: Human destruction of the coastal embankment for entering saline water for Shrimp farming.

(Source: the photographs captured by author in coastal embankment area of Shyamnagar)

Table-15: The dynamics of ecological changes

Dimensions	Physical changes	Rate of impact	Nature of human impact	Key reflection
Everyday	landscape changes, deforestation, and salinization	Gradual in nature	Uneven and affected the poor	Marginality
Episodic	flooding, cyclone, droughts	Often sudden but occasionally drawn out	Unequal exposure	Vulnerability
Systematic	Human-induced destructive actions	Gradual but potentially sudden	Differential vulnerabilities	Risk society

Source: Adapted from Raymond L. Bryant and S. Bailey, 1998.

Basically, the physical change process forces the poor people to relocate to another place, which is economically less important. Due to their placement in economically less priority areas, the poor people have to depend on work offered by the powerful or rich people. A section of the poor is functionally landless and works as day labourers in shrimp farming and agriculture. But the salinity intrusion made the agricultural work challenging due to its low productivity. This results in food insecurity for a large section of people and forces them to be kept under the controlled resources of the powerful people in this area. The practice intensifies social inequities and forces the poor to be most marginalised and vulnerable.

5.3 The functional processes of Ecological Change

5.3.1 Functional Processes

In Bangladesh, the social, economic, and political processes are strongly functional and connected with the landscape and ecological changes. So, the analysis of landscape change is necessary to illustrate the functional process of change and its causal links that results in an ecological change of an area. To analyse the functional processes of ecological change, the study concentrates on landscape change as a result of human-environment interactions (Figure-32). The changes in the landscape are examined in study areas. These areas are prone to natural hazards (i.e., cyclones, storm surges, waterlogging and salinity) and functional to create a situation of disaster.

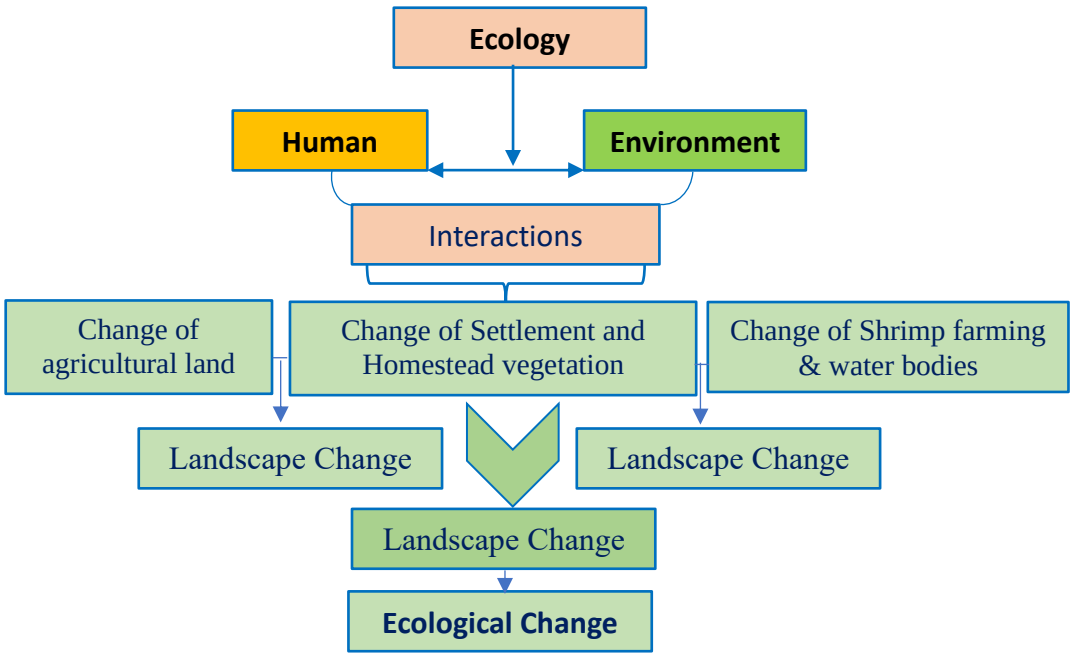


Figure-32: The Processes of Ecological Change (Source: Author)

The study has potentially used remote sensing data for mapping the landscape over time. It allows to compare and illustrate the change of an area in specific time period and also guides the future directions. The change in landscape has a diverse impact on the ecological system of an area. It is not only affecting the local ecosystem services but also changing the lives and livelihood patterns and options of the people. The changing context has made differential options and opportunities to the people, where the poor and landless people are becoming more vulnerable and marginalised transformation of ownership and control of economic and natural resources to the rich and powerful people and groups in study areas.

I. Change of Agricultural land

The human-induced changes in agricultural land are mostly visible in study areas. There is observed a declining trend of agricultural land. The total agricultural land area in Shyamnagar areas was 349.22 sq. km in 1980 that declined to 178.16 sq. km in 2000, followed by 124.61 sq. km in 2010 and 98.06 sq. km in 2020. A similar trend is also observed in the Koyra areas (Figure-33). The increase in human settlement and expansion of shrimp farming areas are the major causes of declining agricultural land. The decline of agricultural land contributes to reducing food production and creating livelihood crises in south-west coastal areas.

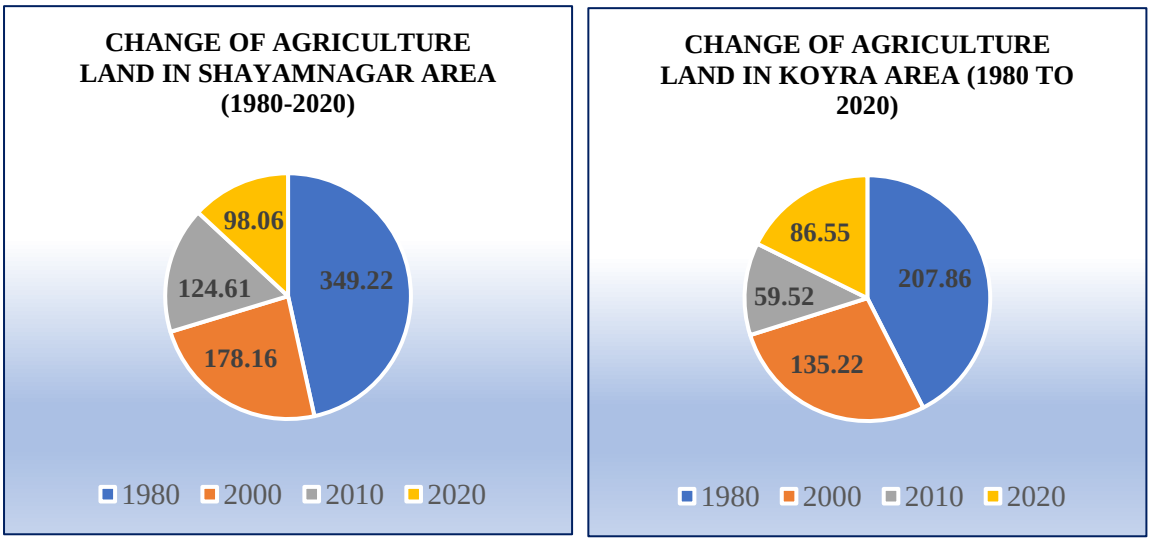


Figure-33: Changes of Agricultural land in Shyamnagar & Koyra Area 1980-2020
(Source: Author)

II. Change of human settlement and vegetation

A functional change is observed in the cases of human settlement and homestead vegetation areas in south-west coastal Bangladesh. The spatial data of Shaymanagar areas revealed that the human settlement and homestead areas were only 50.36 sq. km in 1980 which gradually increased to 55.30 sq. km in 2000, 77.44 sq. km in 2010 and 102.46 sq. km in 2020. A similar trend is also defined in the Koyra areas. The total

areas of human settlement and homestead vegetation were 23.42 sq. km in 1980 increased to 55.64 sq. km in 2020 (Figure-34). Though there is defined as a declining trend of human settlement areas in 2010 due to waterlogging created just after the Cyclone Aila afterwards, it shows a further increase in human settlement area. The status demonstrates the pressure of increasing population in study areas that requires additional space for inhabitants.

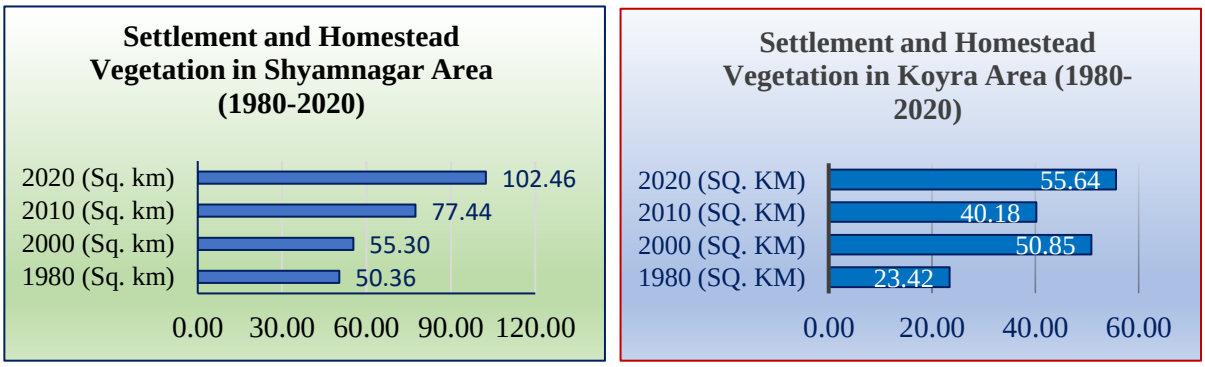


Figure-34: Changes in Settlement and Homestead Vegetation in Shyamnagar and Koyra Area 1980-2020 (Source: Author)

III. Change in Shrimp Farming and Waterbodies

The human-induced modification of the natural environment is functionally visible in the transformation of agricultural land into shrimp firms in the stud areas. The status reveals that the coverage of shrimp firms was only 20.40 sq. km in Shyamnagar areas in 1980 that steadily increased to 186.68 sq. km in 2000, followed by 219.37 sq. km in 2010 and 220.89 sq. km in 2020 (Figure-35).

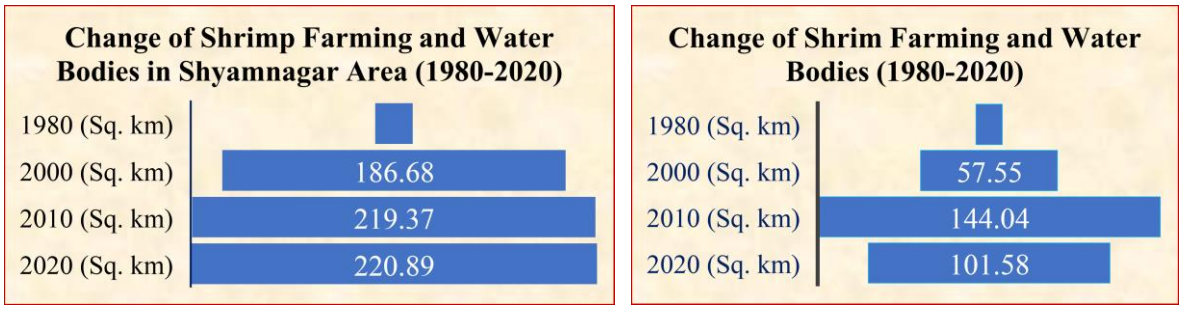


Figure-35: Change of Shrimp farming and water bodies in Shyamnagar and Koyra Area 1980-2020 (Source: Author)

The status refers to more than ten (10) times increase of shrimp farming areas in Shyamnagar areas. On the other hand, the shrimp farming area was only 11.03 sq. km in 1980 in Koyra, which is almost ten times encased in 2020 with a coverage of 101.58 sq. km. The human-induced transformation of agricultural land into shrimp farming

land has made serious social, economic, and environmental impacts. The transformation forces a section of small agricultural farmers to be landless and marginalized due to loss of livelihood options.

IV. Change of Riverine Area

The human-induced actions are visible in the process of declining riverine areas in south-west coastal areas. The declining process is slow, but it is alarming for the function of the natural and river systems. The spatial data reveals that total riverine areas were 36.09 sq. km in 1980 in Shyamnagar which slowly reduced to 34.72 sq. km in 2020. Similarly, the total riverine area was 22.08 sq. km in 1980 in Koyra but reduced to 20.71 sq. km in 2020 (Figure-36). The declining trend of the riverine area is not only limiting functions of the river-based ecosystem but also creating pressure on the natural water flow system from upstream to downstream areas.

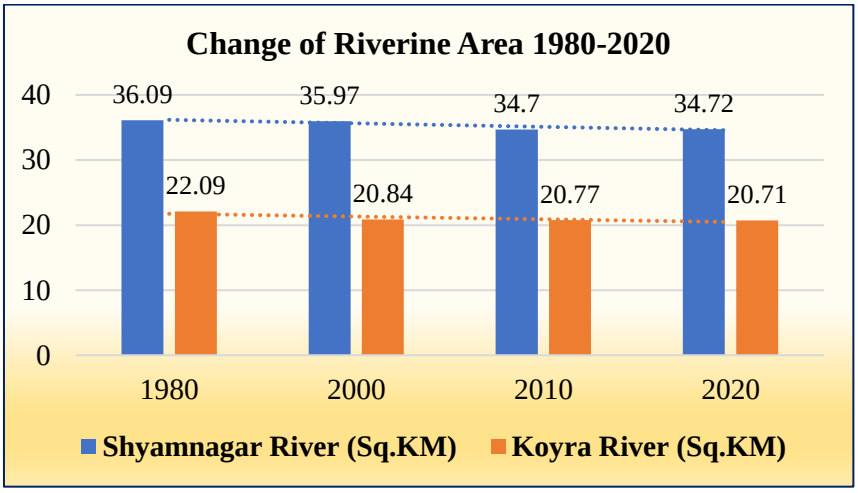


Figure-36: Change of Riverine areas in Shyamnagar and Koyra Area 1980-2020
(Source: Author)

V. Change of Forest Area

The transformation of forest areas is functional in south-west coastal areas. The forest area was 0.70 sq. km in 1980 in the Shyamnagar area, but it reduced to 0.62 sq. km in 2020. A similar trend is also observed in the Koyra areas. Hence, the total forest area was 0.86 sq. km in 1980 that reduced to 0.74 sq. km in 2010 (Figure-37). Though the cyclone Aila severely damaged some forest areas (i.e., coastal belt and Sundarban adjacent areas) in 2009 reflected in the status of forest areas (0.74 sq. km) in 2010 it was further increased to 0.78 sq. km in 2020 as part of natural process.

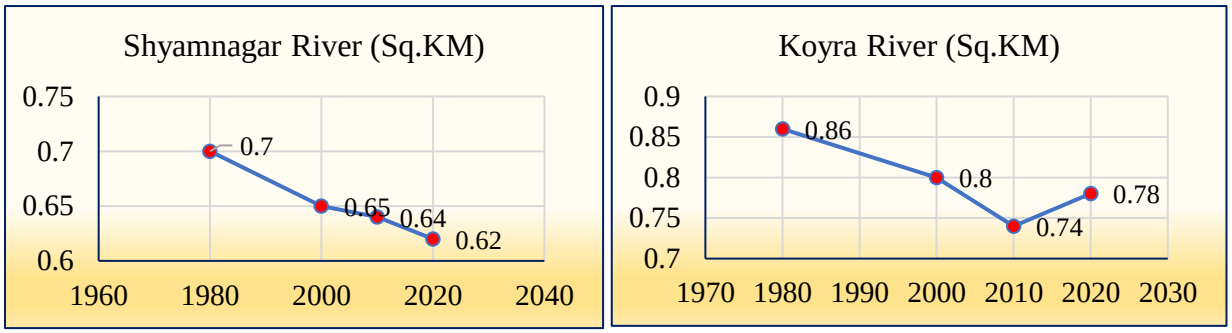


Figure-37: Change of Forest area in Shyamnagar and Koyra Area 1980-2020 (Source: Author)

5.3.2 Landscape Changes (1980 to 2020)

A. Shyamnagar area, Satkhira (1980-2020)

The landscape changes are most visible in the Shyamnagar area. It is occulted through the transformation of agricultural lands. The study used five landscape elements from the remote sensing data to analyse the changes from 1980 to 2020 (Figure:40-43). The changes highlighted:

1) Agricultural land.
2) Settlements and Homestead vegetation.
3) Shrimp firms and water bodies.
4) River; and
5) Forest.

The analysis demonstrates a declining trend in the cases of agricultural land, river and forest areas. But the increasing trend is defined in the cases of settlement and homestead vegetation, and shrimp firms and water bodies (Table-16). The findings explore the dominance of human-induced actions in the natural environment that changing the landscape of Shyamnagar areas. The reasons behind the declining trend of agricultural land are population growth and increasing human needs for settlement and development. As an example, the total population was 196,221 in 1974 that increased to 318,254 in 2011[33]. The increase rate is calculated as 62% in study areas for 37 years. It is fact that the landscape depends on the physiography, climate, and land level of an area (Brammer, 2002). It is defined that natural land areas were 84.51% in 1980 in Shyamnagar, while it was 15.49% for human and commercial uses. But over the last 40 years, total human, and commercial used areas steadily increased from 15.49% to 70.79%. It reveals the increasing trend of human-induced actions in the modification of the natural environment. The process is often turned into competitive actions and conflicting situations, where the poor and marginalised people become the main loser.

[33] Census Report, BBS, 1974 and 2011

Table-16: Landscape changes in Shyamnagar areas during 18980 to 2020

Sl. No.	Landscape	Year-wise Area (sq km)			
		1980	2000	2010	2020
1	Agricultural Land	349.22	178.16	124.61	98.06
2	Settlement and Homestead Vegetation	50.36	55.30	77.44	102.46
3	Shrimp Farm and Waterbodies	20.40	186.68	219.37	220.89
4	River	36.09	35.97	34.70	34.72
5	Forest	0.70	0.65	0.64	0.62
	Total	456.76	456.76	456.76	456.76

Source: Author

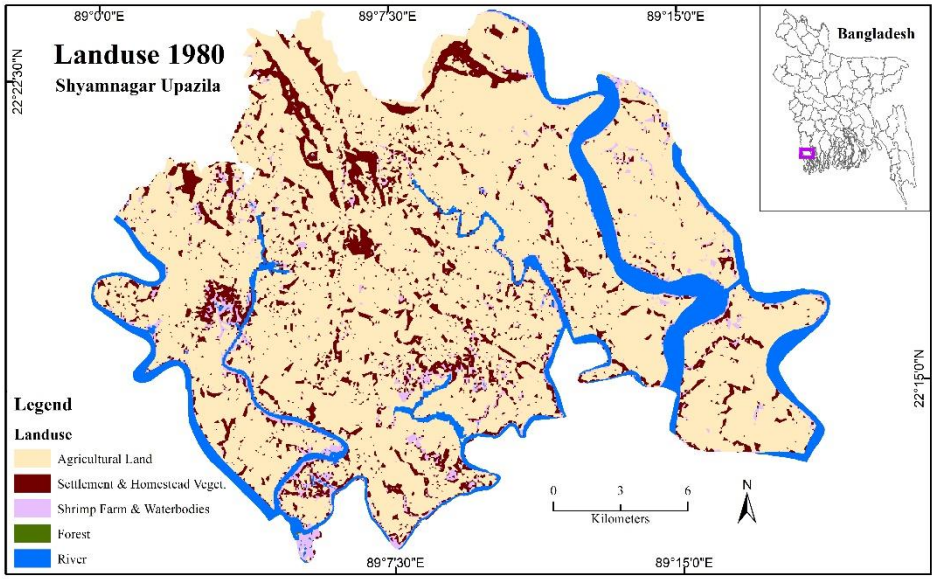


Figure-38: Landscape of Shyamnagar areas in 1980 (Source: Author)

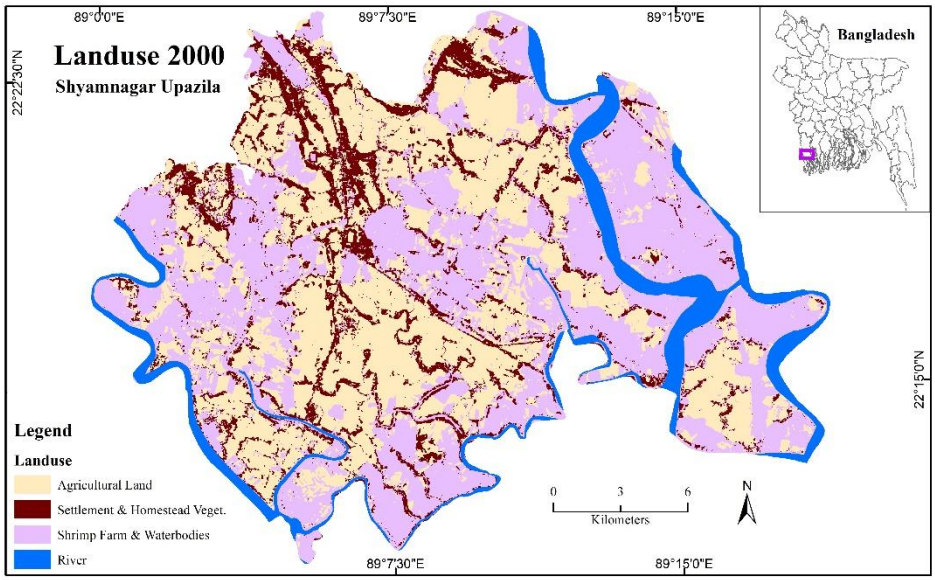


Figure-39: Landscape of Shyamnagar areas in 2000 (Source: Author)

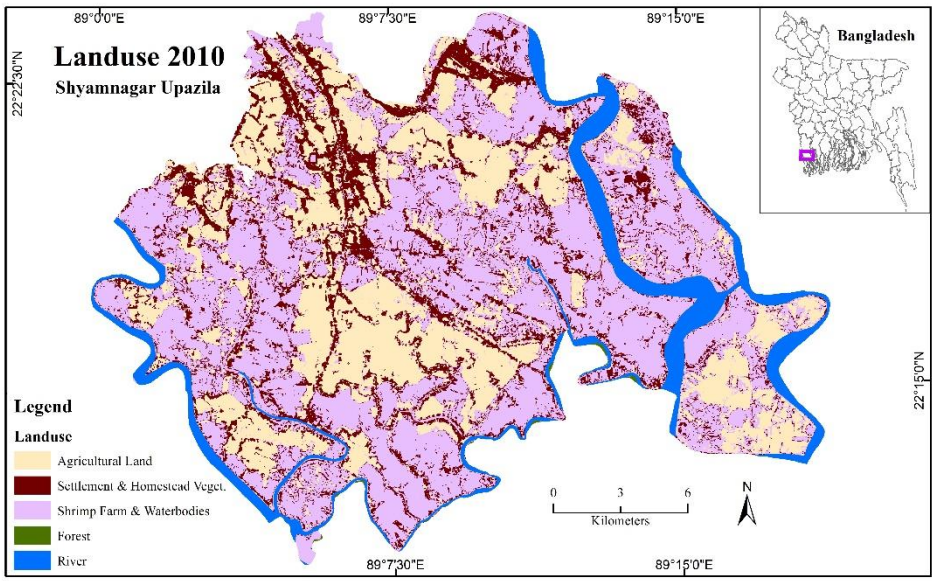


Figure-40: Landscape of Shyamnagar areas in 2010 (Source: Author)

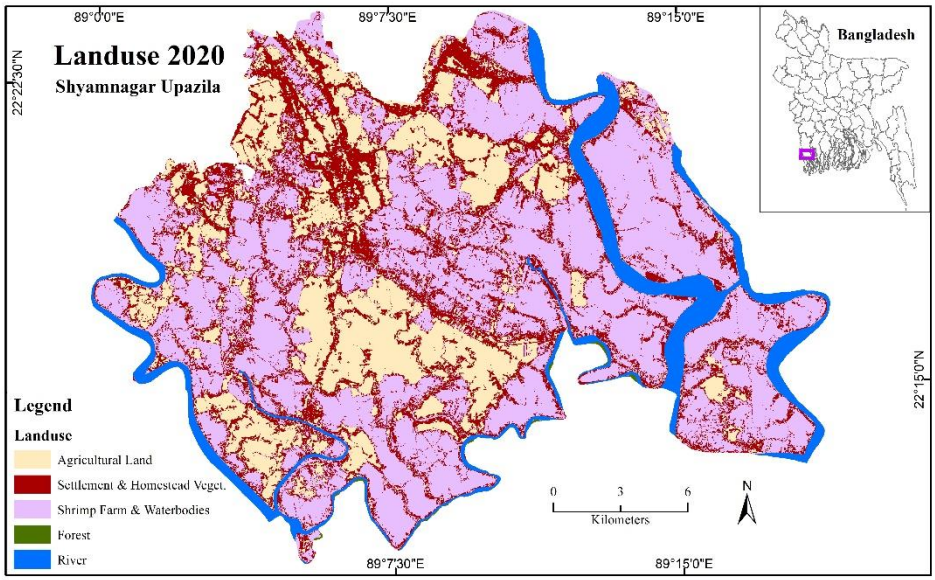


Figure-41: Landscape of Shyamnagar areas in 2020 (Source: Author)

B. Koyra area, Khulna (1980-2020)

A significant pattern of landscape change is observed in the Koyra areas. The change is most visible due to the transformation of agricultural lands and the expansion of human settlement. The study used five landscape elements as noted above for analysing the changes (Figure 44-47). The findings demonstrate a declining trend in the cases of agricultural land, river, and forest areas. But the increasing trend is defined in the cases of settlement and homestead vegetation, and shrimp firms and water bodies (Table-17). The human-induced actions are mostly visible in changing the landscape in the Koyra areas. It has been observed that increasing human needs for settlement, expansion of commercial shrimp farming and development are the main causes for declining of agricultural lands in Koyra areas. As an example, the total population was 91,335 in 1974 that increased to 193,931 in 2011[34]. The increase of population is calculated as 89% in Koyra areas for 37 years.

It is defined that natural land areas were 87.01% in 1980 in Koyra, while it was only 12.99% for human and commercial uses. But over the last 40 years, total human, and commercial used areas steadily increased from 12.99% to 59.27%. It reveals an increasing trend of human-induced actions in the modification of the natural environment. The process is functionally shifted to competitive actions and conflicts that make the poor as main losers.

[34] Census Report, BBS, 1974 and 2011

Table-17: Landscape changes in Koyra area during 1980-2020

Sl. No.	Landscape	Year-wise Area (sq. km)			
		1980	2000	2010	2020
1	Agricultural Land	207.86	135.22	59.52	86.55
2	Settlement and Homestead Vegetation	23.42	50.85	40.18	55.64
3	Shrimp Farm and Waterbodies	11.03	57.55	144.04	101.58
4	River	22.08	20.84	20.77	20.71
5	Forest	0.86	0.80	0.74	0.78
	Total	265.26	265.26	265.26	265.26

Source: Author

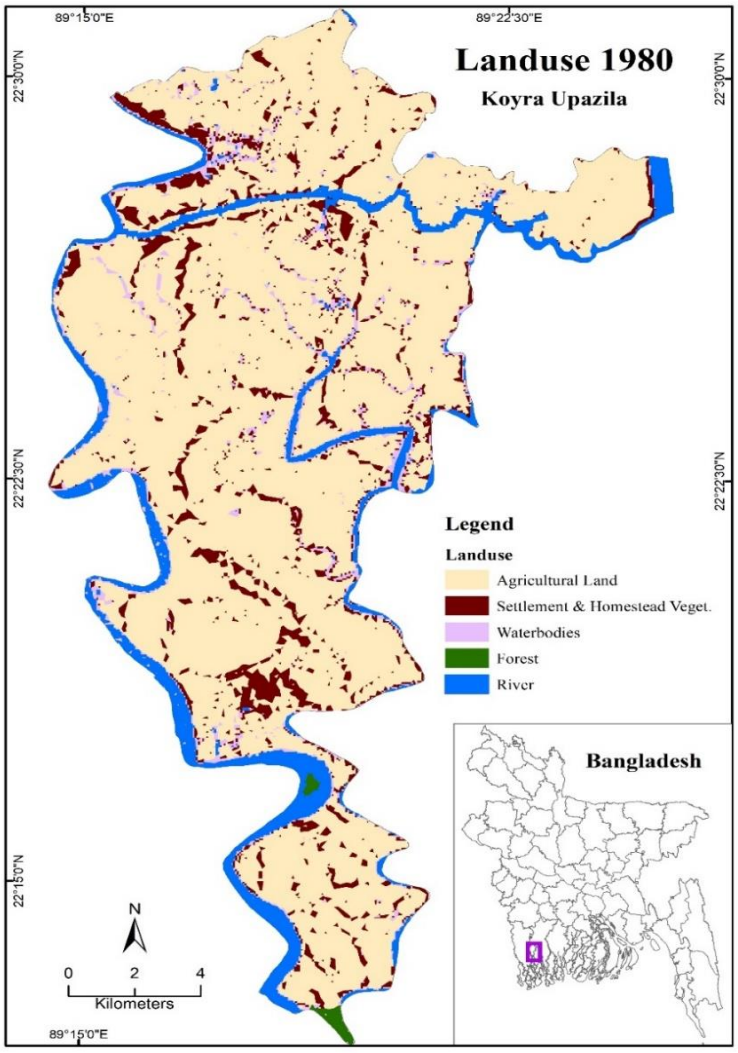


Figure-42: Landscape of Koyra areas in 1980 (Source: Author)

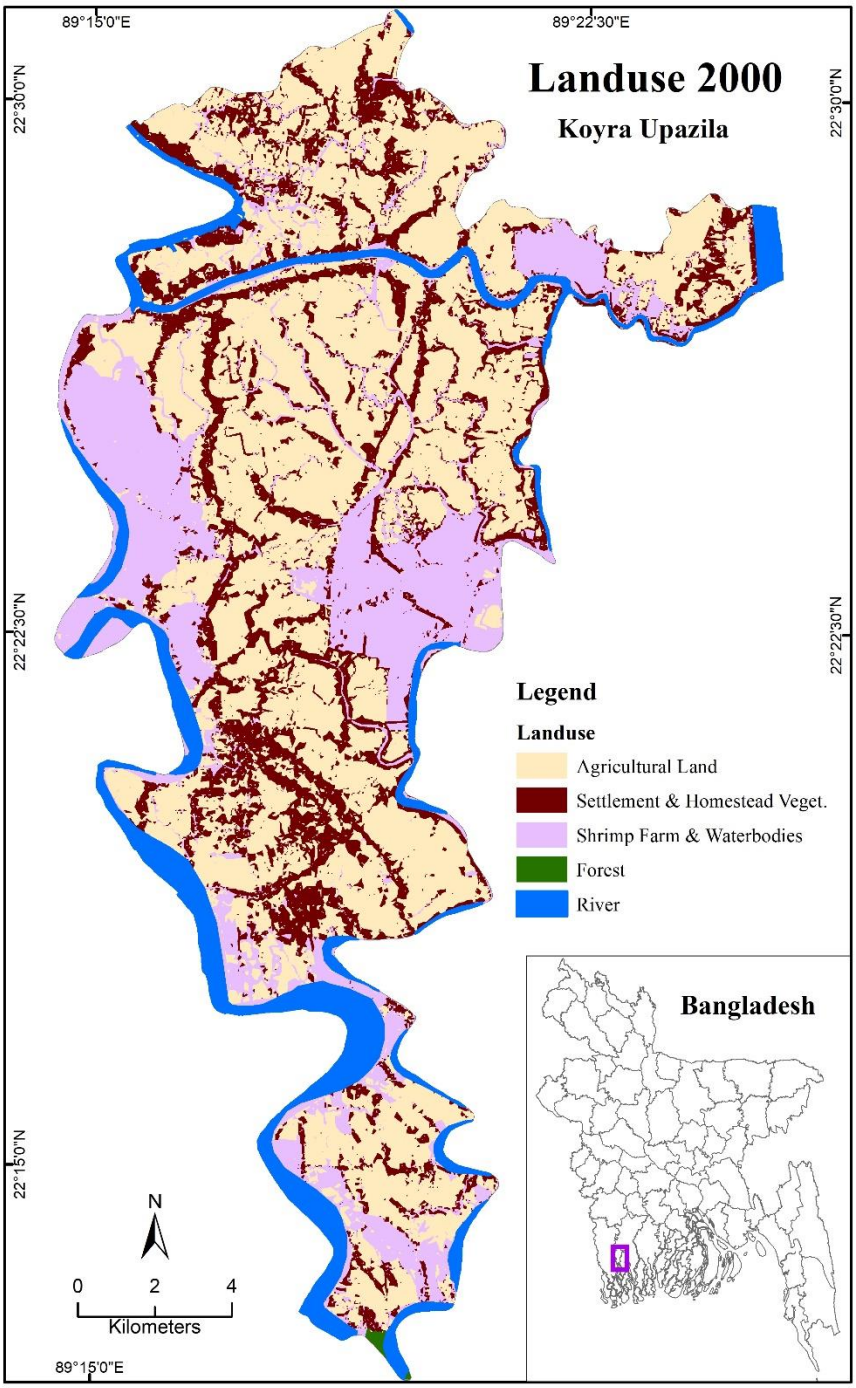


Figure-43: Landscape of Koyra areas in 2000 (Source: Author)

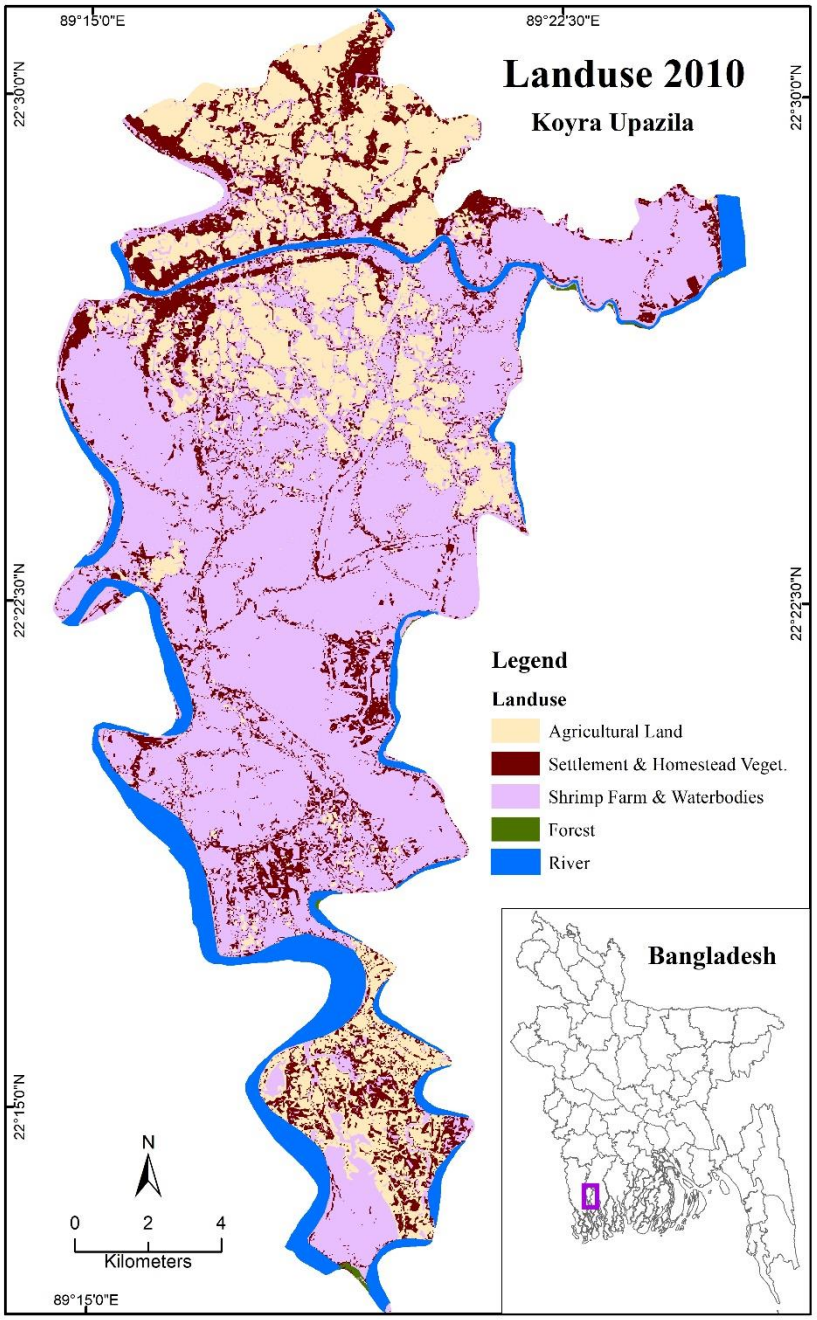


Figure-44: Landscape of Koyra areas in 2010 (Source: Author)

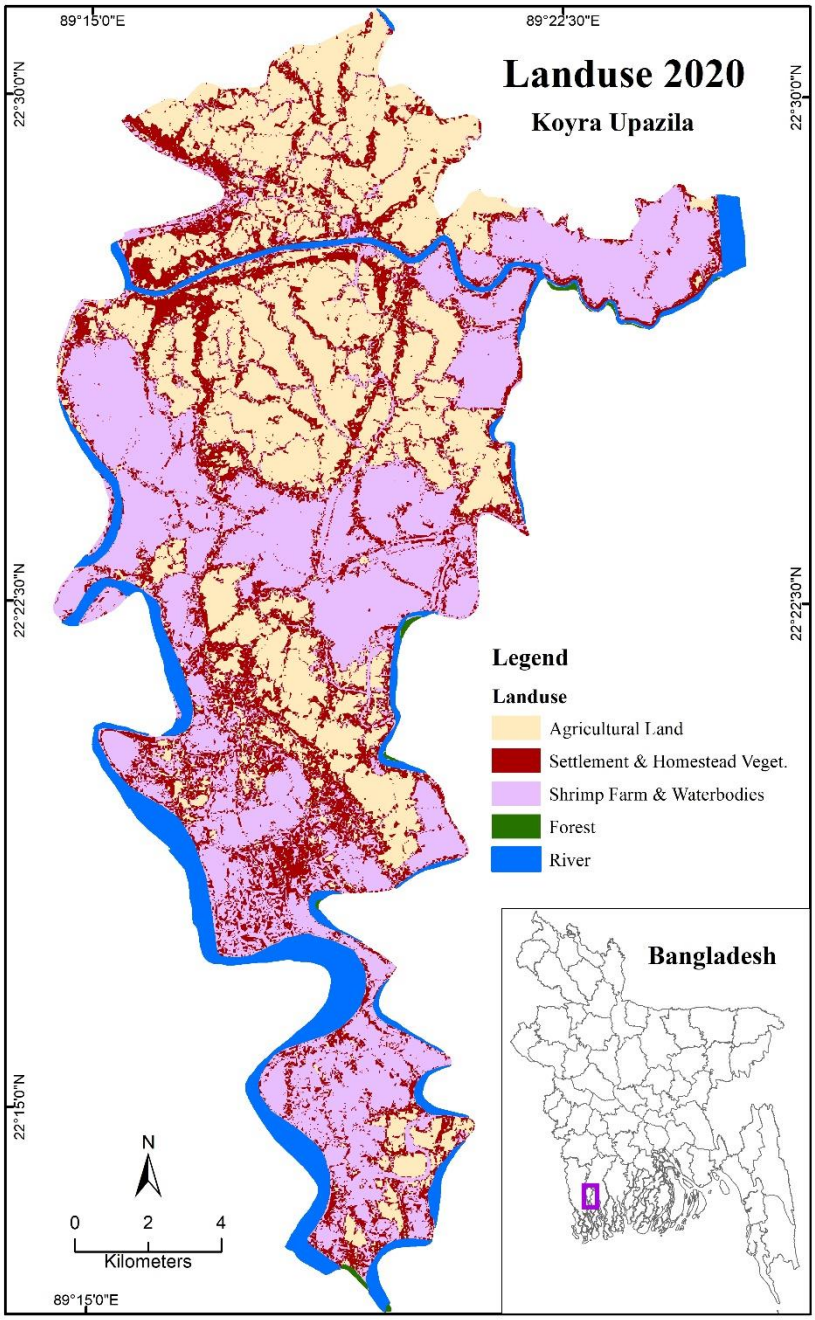


Figure-45: Landscape of Koyra areas in 2020 (Source: Author)

5.3.3 Historical Processes

The historical process is driven by human-induced actions that significantly modified the environment of south-west coastal areas of Bangladesh and influenced livelihood options and opportunities of the people. The modification contributes to environmental change and declines the livelihood resilience of the majority of people in this area.

- ***The context of the 1960s:***

The human-induced environmental modification process commenced in the 196the 0s based on the Krug Mission report, 1957. As a response to the recommendations of the Krug mission report, the government established EPWAPDA[35] in 1959 to tackle and manage the hydraulic initiatives for enhancing resilience in this region. Then the East Pakistan government took the initiative to construct a total of 37 polders with coverage of 1566 km coastal embankment and 282 sluice gates (Van Staveren et al., 2016). This was an integral part of coastal embankment initiatives aiming to control the inflow of saline water for better agricultural production and protection of people from disasters. Despite this initiative, there was a criticism that the coastal embankment initiatives may have little impact on the changed tidal and sedimentation processes.

- ***The context of the 1970s:***

During the 1970s, commercial shrimp farming was functionally started in the south-west coastal region. It was credited with a substantial economic gain through exporting of shrimps in the international markets. The economic benefits of shrimp farming encouraged the farmers, entrepreneurs, and the government to start up commercial shrimp farming in extended coastal areas. This was called as ‘’blue revolution’’ due to its economic contribution to national development. The expansion of shrimp farming has created a set of challenges in coastal areas. The rich and powerful took the control of whole commercial shrimp farming over time, while the small farmers lost their land to them. The process intensifies the conversion of agricultural lands to shrimp firm land. This results in the increase of salinity and decline the agricultural production in the south-west coastal areas.

- ***The Context of the 1980s***

After 20 years of coastal poldarisation, the coastal embankment system began to struggle in the changing riverine system in south-west coastal areas. The sluice gate of the polders failed to maintain the flow of water due to inside sedimentation. On the other hand, the construction of *Farrakka* Barrage made the upstream river flow irregular and uncertain. All these created pressure on the natural environment that

[35] EPWAPDA means the East Pakistan Water and Power Development Authority

results in changing coastal ecology/ecosystem services and restricting the livelihood options of the people.

- ***The Context of the 1990s:***

The government of Bangladesh declared the coastal area a ''free zone'' for shrimp farming. This decision heavily inspired the powerful people and outside businessmen to enter this region and started shrimp farming. They applied different processes to expand their shrimp firms.

- Firstly, they tried to purchase the agricultural lands and convert it to shrimp firm
- Secondly, they take the lease of lands from the small agriculture farmers with lucrative offer.
- Thirdly, they capture the land of small farmers in an illegal way or using the political influences.

The rich and powerful shrimp farmers often use their influence to use the channel for entering saline water to their shrimp firms. All these human-induced actions in the inside of the embankment weakened its construction and obstructed the natural flow of water that results in the collapse of the coastal embankment with the force of tidal surges. The increasing trend of salinity intrusion in the inside of coastal embankments caused declining vegetation coverage and soil fertility that resulted in limited food production. Due to the decline of agricultural production, the small farmers forcibly transferred their land to large shrimp farmers under the long-term lease agreements, where they lost their traditional livelihoods and opportunities for regular income. Besides, the Khas land areas that were used by the poor and landless people for their settlement and grazing livestock were also captured by the powerful shrimp farmers. The process continued to create power conflicts, violence, and social inequalities in society.

- ***The Context of 2000 and beyond***

In recent times, shrimp farming is considered a regular livelihood practice of people in south-west coastal areas. But the rich and powerful elites are taking the ownership and control of the majority of shrimp farms in coastal areas. The small farmers are continuing their lives in lifelong poverty and inequalities. Because the small farmers are mostly dependent on agricultural food production or day labourers as the only option of their livelihoods in South-west coastal areas. It has been observed that shrimp farming is benefited the large landowners rather than the marginal poor farmers. Besides, shrimp farming is less labour-intensive, where the agricultural farmers and labourers lost their livelihood options and opportunities to survive. The existing process is creating tension between the powerful shrimp farmers and marginal poor farmers in some areas of south-west coastal areas.

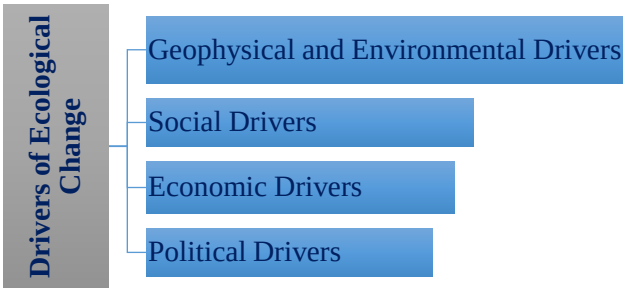
On the other hand, the increase of soil salinity limits the production of livestock feed and homestead vegetation that continues the struggle of the people. The people are facing a crisis of safe drinking water due to salinity instructions. This has created

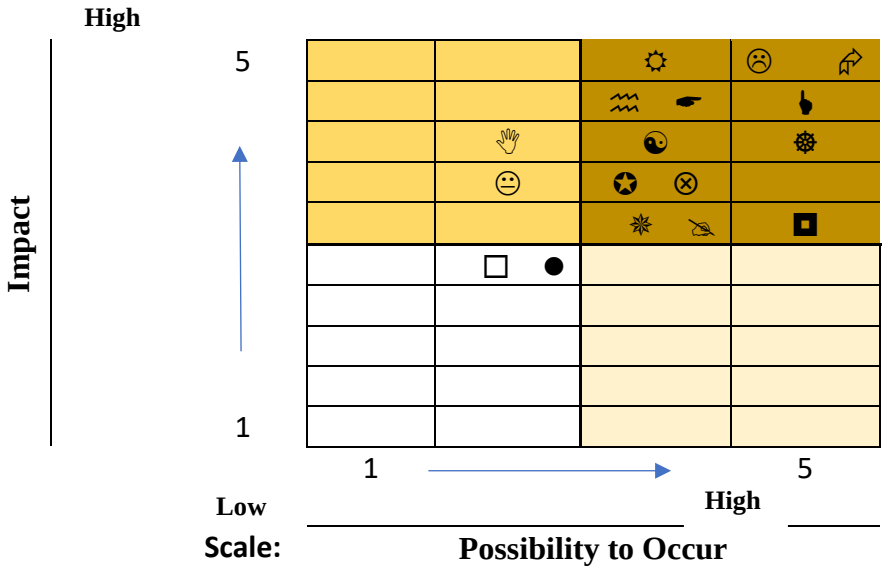
additional pressure on women and children to collect fresh drinking water from long distances. A high level of salinity also affects people's health. As a reference, a section of women reported skin, waterborne and genital diseases as they use saline water for washing and homestead works. The regular destructive action on coastal embankment limits its physical strength to protect the inside people from tidal surges. There is evidence that cyclone AILA (in 2009) fully destroyed some parts of coastal embankment in south-west coastal areas that results in the displacement of people. The displaced people in south-west coastal areas are still struggling to recover their losses. So, timely recovery initiatives in necessary in south-west coastal areas. Besides, the development planning and initiatives should consider the local and changing dynamics of the environmental/ecological system, otherwise, it will force the people to live with lifelong vulnerabilities and risks.

5.4 Major Drivers of Ecological Change

The research assumed that numbers of power-led drivers are functional to change the ecology in coastal areas. To discover these drivers, it considers community perception and local knowledge. It has been observed that the ecological change process drives by several human-induced forces or actions on the environment. Because humans are the key actor to change and modify the ecological system for development. It has a diverse impact on the functions of the societal system. From this point of view, the community perceived risk potential and its impact are considered in defining the river drivers of ecological change. It focuses on both the internal and external drivers that have the potential to drive the change.

As an example, an altered ecosystem creates new opportunities and constraints on land use induced institutional changes in response to perceived and anticipated resource degradation, and increase of social impacts, such as creating income inequalities in the changing environment. Therefore, the changes are often generating pressure on the social and economic performances of the society that creates inequalities and forces a section of people/group to live in a risk situation of disaster. The community-based participatory sessions (i.e., PRA: Scale analysis) reveal a set of risk drivers that have a significant impact and possibility to change the ecology of study areas (i.e., Syamnagar and Koyra) in coastal Bangladesh (Figure-46). The research sorted the drivers with high possibilities and impact on the ecological change process by using of quadrant matrix for detailed analysis. Finally, the drivers are categorically divided into four segments, which are as follows:





LEGEND:

☼	HHs Characteristics
≋	Climate Change
☹	Geographic location and changing natural system
☸	Landlessness
☯	Inequality
✪	Unemployment
☚	Poverty
☝	Increase of Population
⊗	Human settlement and Displacement
■	Power Relations
😐	Functions of the Institutions and Actors
✵	Land Management
□	Enforcement of laws and policies
●	Government Response to tackle disaster situation
	The Exploitation of Natural Resources
	Human Wellbeing
	Local Disputes

Figure-46: Community perceived risk drivers of ecological change (Source: Author)

5.4.1 Geophysical and Environmental drivers

The geophysical and environmental drivers are significant to intensify the risk of the people. This includes ‘’geographic location and natural system’’, and ‘’climate change’’ as two important natural drivers, which are contributing to change the ecology of South-west coastal areas.

I. Geographic location and Natural system

Bangladesh is located at the latitudes 20°34′-26°38′north and longitudes 88°01′-92°41′east[36]. It was formed with the functions of the Himalayas and the Bay of Bengal. Basically, the formation drives by the river-dominated process and tidally modified coastal system (Figure-47). The country contains a total area of 148,460[37] sq. km, whereas the land area is 130,170 sq. km and water coverage 18,290 sq. km. Of the total land areas, only 10.98% of the land (14,290 sq. km) is forest areas.

Figure-47: Geographic location
(Source: Map captured from Encyclopedia Britannica, 1998)

The geographic position is allowed an extensive river network that maintains regular water flow from the upstream to downstream areas in Bangladesh. The river networks played an important role in the lives and livelihoods of the people. The river system brings a huge volume of sediment (approximately 2.4 billion tons) that contributes to replenishing the social productivity that results in increasing agricultural production. The dumping of sediment made a significant contribution to building new land and keeping hope for lives (Figure-48).

[36] Ministry of Foreign Affairs, GoB, 2017
[37] Bangladesh Geography, 2020

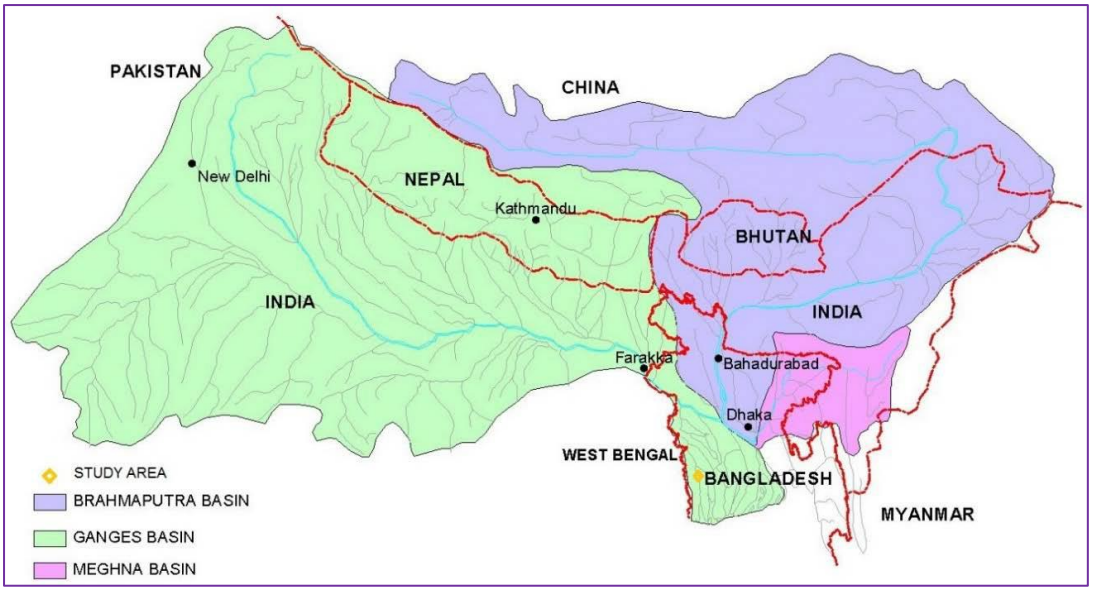


Figure-48: The influence of the river system in Bangladesh (Source: Adapted from CEGIS, 2014).

The river network is defined as a valuable resource for Bangladesh as well as contributory to frequent hazards. The river network is capturing 90% of water discharge from the upstream and carrying within 7% of the river basin areas in Bangladesh. Due to the discharge of huge water, a large of river basin areas are overwhelmed by water and the riverbanks are susceptible to erosion and channel shifting. It often results in vulnerability and displacement of people. Besides, Bangladesh has more than 16,000 sq. km. of wetlands which include rivers and estuaries, lakes, and ponds. The area of wetlands is approximately 11% of the area of Bangladesh.

The geographic position of south-west coastal areas is defined as a tidally active delta. The land elevation of coastal areas is low, which is on average 3-5 meters above mean sea level. It makes this region extremely vulnerable and hazards prone. Though the south-west coastal areas capture the flow of 16 major rivers[38], all are unable to carry enough water discharge from upstream areas due to riverbed sedimentation. The sedimentation makes the rivers slowly die. The declination of river water flow from upstream areas is allowing the intrusion of saline water in coastal areas resulting in a safe water crisis and lower agricultural production in coastal areas of Bangladesh. Basically, the coastal study areas are very much active to witness diverse forms of natural phenomena. The perception survey reveals that natural hazards are creating severe impacts on their normal lives and livelihoods (Figure-49). More than 80% of people perceived that cyclone is the most devastating hazards in their lives, followed by salinity (53%), tidal surges (52%), waterlogging (35.5%) and climate change (20%). It places a section of people to an unsafe condition to face the risk of disasters.

[38] Major rivers in Southwest coastal region: Kobadak, Sonai, Kholpatua, Morischap, Raimangal, Hariabhanga, Ichamati, Betrabati aloing with Kalindi-Jamunaare Bhairab, Pasur, Shibsha, Dharla, Bhadra, Arpangachhia and Maloncha and so on.

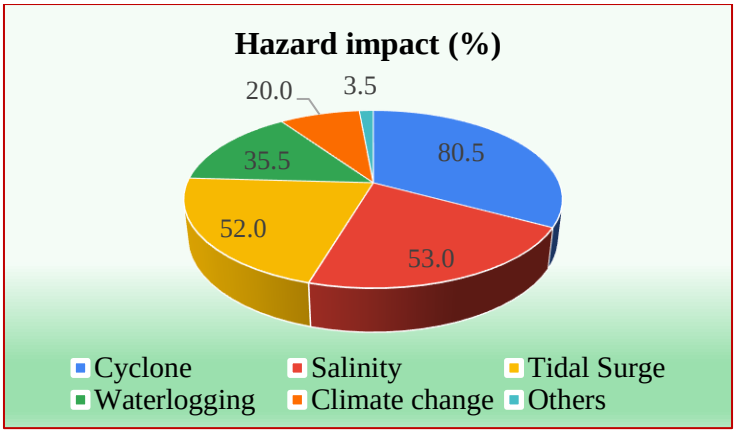


Figure-49: People's perception of hazards impact (Source: Perception survey, 2020)

II. Climate Change

Climate change has been intensifying the vulnerabilities and risks of the people in Bangladesh. It is ranked 7th position in the global climate risk index[39]. It has a wider impact on people and places. It is assumed that more than 70 million people in Bangladesh may face the impact of climate change. Particularly, the coastal people are more vulnerable than in other areas. These areas are highly susceptible to frequent natural hazards that may result in huge human displacement. The extreme temperature, uncertainty in rainfall and flooding, groundwater depletion, salinity intrusion and increased frequency of natural hazards are the major concern of the people. All of these are functional to intensify people's vulnerability in coastal areas. The extreme temperature and salinity intrusion have already affected the coastal people by reducing food production and safe water sources that influence food insecurity.

The increase in salinity is another concern of climate change that has been creating a serious impact on coastal land areas that were traditionally used for rice production. Considering the changing context, local people are shifting their agricultural land into shrimp farms. It has created a livelihood crisis for the coastal people. The people, who were initially dependent on small-scale agriculture, shifted to shrimp farming as labourers or fishing activities. The transformation of agricultural lands and expansion of salinity in coastal areas is creating an imbalance in coastal ecology that results in declining coastal ecosystem services. The ecological imbalance also creating space for the emergence of unusual new transmission of infectious diseases in coastal areas. It is predicted that the risk of diarrhoea will increase to 10% by 2030 (Kafiluddin, 2005). Therefore, the increase of food scarcity and infectious diseases may create health hazards for the poor and marginalised section of people.

[39] *Global Climate* Risk *Index* (CRI) *2021*

As front liners, the coastal people are at risk of diverse natural hazards. The cyclone, storm surges, salinity intrusion and waterlogging are defined as major forms of hazards in this area. Due to the impact of climate change, the frequency of natural hazards has intensified over time and creates additional pressure on a section of people to continue their lifelong struggle. Most of the cases, the natural hazards are creating a disastrous situation in coastal areas due to lifelong vulnerabilities of this segment of people. During the last 100 years, a total of 508 cyclones occurred in the Bay of Bengal areas and of them 17% hits the coastal areas in Bangladesh[40]. The analysis of risk proportion placing Bangladesh as 5th most disaster-prone country in the world (Table-18). The situation places the country as a disaster-prone and vulnerable country about the effect of climate change.

Table-18: The ranking of Risk proportion

Rank	Country	Exposure	Vulnerability	Risk Index
1.	Vanuatu	63.66	57.04	36.31
2.	Tonga	55.27	51.78	28.62
3.	Philippines	52.46	53.35	27.98
4.	Guatemala	36.30	57.16	20.75
5.	**Bangladesh**	31.70	**63.78**	**20.22**
6.	Solomon Islands	29.98	60.54	18.15
7.	Costa Rica	42.61	40.80	17.38
8.	Cambodia	27.65	62.07	17.17
9.	Timor-Leste	25.73	66.59	17.13
10.	El Salvador	32.60	51.81	16.89

Source: World Risk Report, 2015

During the discussion, the local people noticed that the frequency of natural hazards increasing day by day. The most severe destruction was made due to severe cyclones of 1970, 1991, 2007 and 2009 that caused the death of many people in coastal areas. It is also true that the number of peoples' death has reduced significantly but the loss and damages of resources has increased steadily, where the poor becomes the main loser. The disproportionate impact has already created an unsafe condition for a section of people, who are always struggling to survive with the changing situation. The situation revealed through the feedback of people in Aila affected area (Shyamnagar):

> *A coastal cyclone is now a threatening event for us. We feel mental pressure and anxiety if we hear the signal of the cyclone. We suffered a lot due to cyclones by losing our agricultural production, households' assets, and safe water sources. But we have no alternative option.*

[40] The New Humanitarian Report on Environment and Disaster, dated 8 October 2008

So, climate change is increasingly active as a driver that forces a section of people to be unable to cope with the changing situation for survival (Figure-50). This is most active in the south-west coastal areas. It is now not only an environmental concern but also a mainstream political issue, where the IPCC influences the world thinking on climate change. Realizing that Bangladesh ratified the UNFCCC[41] on 15 April 1994, the Kyoto Protocol on 22 October 2001 and the Paris Agreement on 21 September 2016 as a commitment to take necessary measures in reducing climate change-induced vulnerabilities and risks. The response means that Bangladesh has given high priority to addressing climate change issues and concerns. As a reflection, Bangladesh has already introduced several Acts, Policies, rules, strategies, which are as follows:

- National Environment Policy 2018[42]
- National Sustainable Development Strategy (NSDS) 2010-2021[43]
- Disaster Management Ac, 2012[44]
- Climate Change Trust Act, 2010[45]
- Bangladesh Environment Conservation Act, 1995[46]

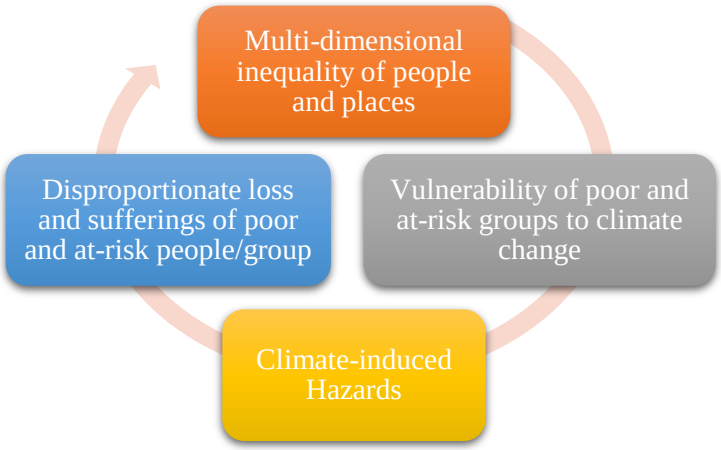


Figure-50: Linkages of Climate Change with People's inability and inequality (Source: Author)

Despite the legal, policy and strategic initiatives of the government of Bangladesh, the economic losses and damages are still very high in coastal areas that reflecting people's inability to recover on their own. This section of people continues to live in a condition of livelihood vulnerably and exposed to the frequent risk of disasters. It is predicted that one in every seven people will be displaced from their origin due to climate change

[41] UNFCC refers the United Nations Framework Convention on Climate Change adopted on 9th May 1992
[42] Ministry of Environment, Forest and Climate Change, GoB, 2018
[43] Economic Relations Division, Ministry of Finance, GoB,2021
[44] Ministry of Disaster Management and Relief, GoB, 2012
[45] Ministry of Environment and Forest, GoB, 2010
[46] Ibid

by 2050 (Arif Chowdhury, 2020). So, the risk situation is added pressure on the life and livelihood of the coastal people continues their vulnerabilities and ultimately results in their displacement (Figure-51). Though the government of Bangladesh has taken diverse initiatives to strengthen the adaptation capacity of the coastal people, there is still no visible changes in securing livelihood of the risk population of climate change.

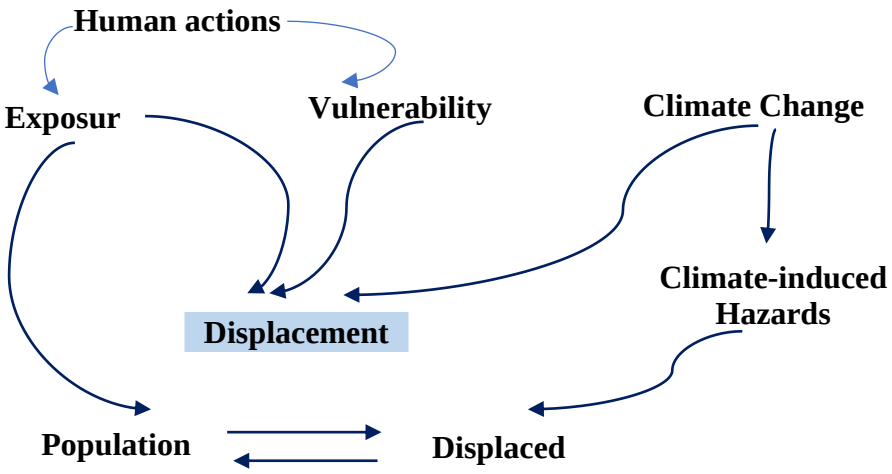


Figure-51: Environment-Human interactions and displacement (Source: Author)

5.4.2 Social drivers

Bangladesh is well defined as a multi-culture and multi-ethnic country. It contains 166.37 million people[47] within a land area of 148,460 square kilometres. Majority of population (89.8%) belongs to Islam followed by 9.5% Hindu, 0.5% Buddhist, 0.2% Christian. A large section of the population (98%) belongs to the Bengali community and approximately 2% are ethnic communities belonging to at least 54 diverse groups. Historically, the social structure in Bangladesh is guided by diverse socio-political forces. The forces made changes in the formation of social institutions, norms, practices, and mindsets of the population. Since 1971, there is observed massive changes in social structures and power relations. This results in the development of rich and powerful elites in the society, who received differential development priorities. It has made a significant role in the widening of gaps between the rich and poor, which is very alarming for equitable social development in Bangladesh. Inequality and discrimination have been creating serious problems to extend social vulnerabilities.
Though the country has achieved significant success in human development, social discrimination and inequalities are still a major concern of society. As a reference, HDI[48] value was 0.386 in 1990 which increased to 0.579 in 2015 and placed Bangladesh as a "medium human development" country. Similarly, a declining

[47] UN (World Population Prospects 2021)
[48] HDI means Human Development Index of Bangladesh

trend is observed at the level of underweight, which was 65% in 1991 and 36% in 2011. But there are still huge gaps in compliance with some social indicators in terms of gender, wealth level, land ownership and rural-urban development context of the population at the grassroots level that continue as a force of vulnerable situation for a section of people in Bangladesh. Realising that the 8th Five Year Plan is heavily focused on reducing inequality.

Several social drivers are functional in Bangladesh, particularly in South-west coastal areas, which are illustrated below:

I. Households Characteristics

Bangladesh remains a highly "patriarchal" society. Households are still led by male members, but an increasing trend of female-headed households (FHHs) observed in coastal areas of Bangladesh due to rapid industrialization, urbanization, and socioeconomic changes. In the coastal society, women are still defined as a vulnerable group in society. Though women constitute half of the total population, they are still struggling to take ownership and control over their lives and resources. They have to face violence and ill-treatment, while they led their families in the absence of their main breadwinner in the family. More than 85% of households are male-headed in society, while only 14% of households are female-headed (Table-19). There is a general perception that female-led households hold limited power and security in society.

Table-19: Household characteristics

Gender	Households (in %)		
	Rural	Urban	Total
Male	86.2	84.9	85.8
Female	13.8	15.1	14.2

Source: Population & Housing Census, 2011

The average household size was 8.3 in 1972 gradually coming down to 4.06 in 2016. The declining trend in household size is defined due to an increase of literacy, economic development, and greater awareness among people in rural and urban areas of Bangladesh. There is evidence that 62.9% of the household population are defined as married, which is 63.4% in urban and 62.7% in rural areas. It is alarming that 66% of girls[49] got married before 18 years of age. This leads to early pregnancy and early aged mothers, who bears a lot of sufferings from birthing complications. As a result, a section of early aged mothers are placed at a serious health risk. The highest proportion (43.9%) of underweight children[50] was found in the poor category of households, followed by

[49] UNICEF, 2019
[50] BDHS, 2007-2014

32.3% in the middle-class households and while the lowest proportion of underweight children (23.7%) was found in the children of rich households. The status reveals a clear inequality in the households by wealth category in Bangladesh.

However, similar household characteristics are also observed in study areas. It has been observed that more than 50% population are female, whereas 48.21% and 49.19% are male in Shyamnagar and Koyra areas accordingly. The average household size is a little more than the national size (4.06), while it is 4.55 in Shyamnagar and 4.24 in the Koyra areas. The majority of the population must belong to the skilled age group (15-49) compared to the dependency age group (Figure-52). The status represents enough potential of the population to contribute to national development. The majority of households (82.6% households in Shyamnagar and 86.9% in Koyra areas) live in *Katcha* houses, while only 7.7% and 4.4% accordingly live in Pucca houses[51] revealing the poor economic status of the households (Figure-53). Only 29.77% of households use electricity, and 28.85% of households use sanitary latrines, which reflect their status of life

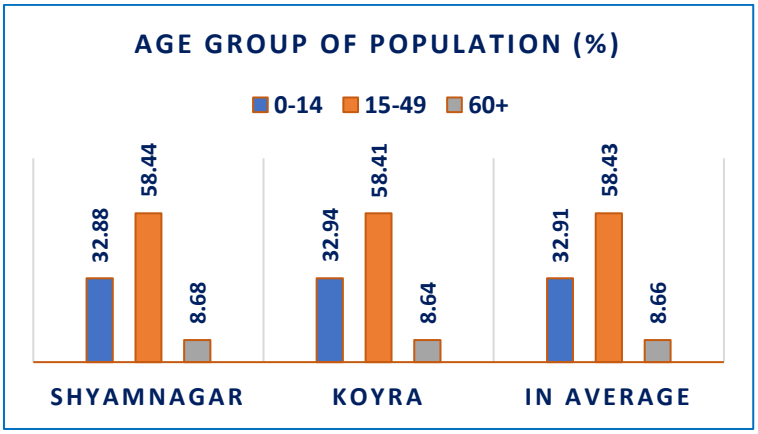


Figure-52: Age group of population in Study areas

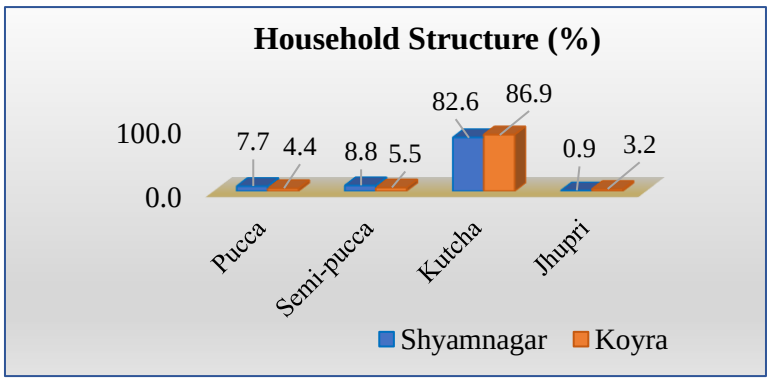


Figure-53: Household structure of the population

(Source: Population & Housing Census, 2011)

[51] BBS, Population and Hushing Census, 2011 (Satkhira and Khulna)

The literacy rate is comparatively low in study areas, where male literacy is higher than female literacy (Table-20) which refers the gender-based discrimination. During the discussion, people noted that before cyclone Sidr and Aila, the outside movement of women was so much restricted but the post-cyclone situation in study areas forces them to be engaged in different labour-based activities for survival.

Table-20: Literacy rate in study areas

Study area	Total	Male	Female
Shyamnagar	60.1	64.3	55.9
Koyra	50.9	55.3	46.5

Source: Population & Housing Census, 2011: Khulna and Satkhira.

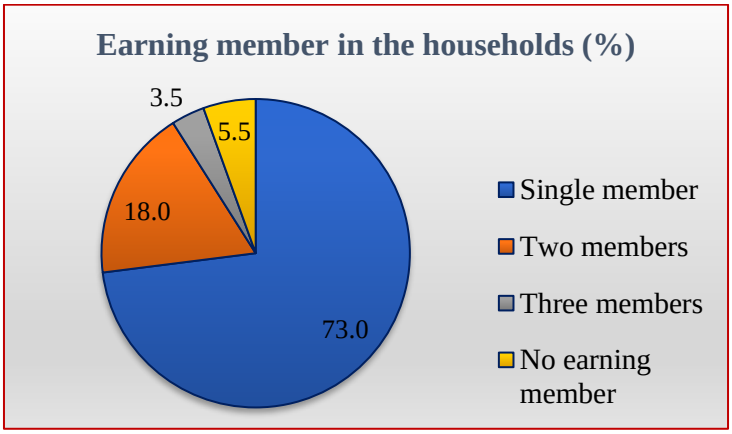


Figure-54: Enable earning members (Source: Population & Housing Census, 2011)

The people also highlighted that the recovery and development initiatives taken by the government after the cyclone (i.e., Sidr and AILA) were not sufficient to give them a space to return to a normal condition. The struggle of the poor and most vulnerable people to lead a normal life is still continuing. There is another fact is that 73% of the households depended on the earnings of single member (Figure-54). If the main breadwinner becomes sick or unable to work, the whole family have to struggle to manage minimum food requirements. The continuous forms of livelihood struggle for a section of people create a pattern of differential vulnerabilities in south-west coastal study areas of Bangladesh.

II. Rapid Increase of Population

The increasing trend of the population has a significant contribution to changing the social dynamics in Bangladesh. In 1970, the population was about 65 million, which

took a sharp rise to 131.58 million in 2000 and 166.37 million in 2018. The density of population also increased from 500 people per sq. km in 1970 to 1127 people per sq. km in 2018 (Table-21). But the growth rate has been reduced significantly during this time. Bangladesh is defined as a large and heavily densely populated country in South Asia. The increase in population poses a challenge to our social, economic and ecological viability. It is not only creating pressure on land but also contributes to increasing dependency, displacement, and pressure on various social sector services in Bangladesh.

Table-21: Increase of population in Bangladesh (1970-2020)[52]

Year	Population	Density (Ppl/km^2)	Population growth (%)
2020	164,689,383	1,265.19	1.01
2010	152,149,102	1,169	1.12
2000	131,581,243	1,011	1.96
1990	106,188,642	816	2.47
1980	81,470,860	626	2.78
1970	65,047,770	500	2.54

Source: BBS, 1981, 1991, 2011

The high density and overpopulation (compared to land and resources in Bangladesh) are creating additional demands for higher production and consumption of goods and services. It extends the space for over-extraction of natural resources and creates additional pressures on the environment. At the same time, the increase of urban population reveals a process of shifting rural agricultural land to urbanisation and it is often restricting the process of naturalness of the environment. It is estimated that only about 9% of the population (6.2 million) lived in urban areas in 1971 but the urban population rapidly increased to 60.8 million in 2018 comprising 36.5% of the population[53] in 2018. The increase in the urban population accelerates unplanned urbanization. The process often influences to alters the land use pattern of an area and puts pressure on a local ecological system that mostly affects the poor due to their existence in less priority areas (i.e., slums). The land areas are becoming highly fragmented as increase of population in the extend areas. It results in an increase of rural-urban (44.3%) and rural-rural migration (43.2%) in Bangladesh[54].

A similar trend in the population is also observed in study areas. The size of the population was only 287,556 in the study area rapidly increased to 512,185 over the last three decades (Table-22). It is noted here that the trend of population increase in the Koyra area is higher than in the Shyamnagar area. But more than 94% of the

[52] Population of Bangladesh (1970-2020): https://www.populationof.net/bangladesh/
[53] ibid
[54] BBS Census data, 2011

population in both areas are located in rural areas (Figure-55). It means that a large section of people is still dependent on land and labour based economic activities, who have no regular income, alternative livelihood options and sufficient savings to cope with the changing situation and disaster impacts. Only a small section of people holds the maximum control over the economic and natural resources in south-west coastal areas. It makes them more powerful and easy access to control the local decisions and development.

Table-22: Rapid increase of population in the study area

Year	Study Area (population)		
	Shyamnagar	Koyra	Total
2011	318,254	193,931	512,185
2001	313,781	192,534	506,315
1991	265,004	165,473	430,477
1881	234,164	125,090	359,254
1974	196,221	91,335	287,556

Source: BBS, 1981, 1991, 2011

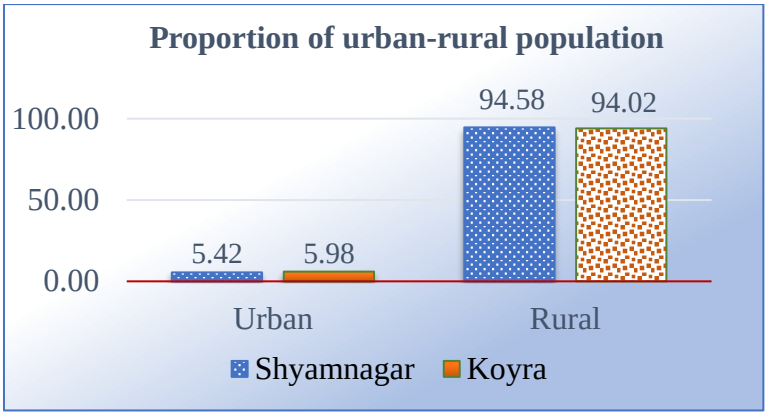


Figure-55: Proportion of urban-rural population in Study areas
(Source: Population & Housing Census, 2011: Khulna and Satkhira).

Despite the increasing trend of population, there are no adequate initiatives taken by the state and non-state institutions to create alternative livelihood options and opportunities for the land and labour dependent people. The irregular nature of their livelihoods never allows them to take part in the leadership process but forces them to follow the direction of the rich and powerful resource owners in society.

III. Human Settlement and Displacement

The people of Bangladesh suffer with diverse forms of hazards (i.e., cyclones, storm surges, salinity, flooding, river erosion). It has made a potential impact on their normal lives and livelihoods and pushes a section of people to live at risk situation. This results

in human displacement and migration. It is now an integral part of the lives of the coastal people. Basically, the coastal people are facing regular forms of natural hazards that extend their lifelong struggles to survive. As a reference, the salinity intrusion results in the reduction of food production and livelihood options for the small farmers and the poor. The estimation of IDMC, 2019 climate-induced disasters triggered more than 4 million new displacements 2019. During the discussion, the people defined a set of issues as push and pull factors, which are functional for the displacement and migration of the people in south-west coastal areas. These are:

A. Push Factors:

- Loss of regular income sources
- Landlessness
- The impact of frequent disasters,
- Loss of land and resources,
- Livelihood crisis,
- Failures to repay the debts or loan
- Marriages

B. Pull Factors:

- Alternative income opportunities (at city areas)
- Desires of higher income
- Lucrative life (in city areas)
- Get relief from family crisis.

A large section of people in both study areas perceived that the crisis of regular work, landlessness and long-run family poverty are contributing to creating an economic risk for their families. The economic risk is often pressurising the main breadwinner of the family to go outside of their areas for earning and survival of the family. There is also evidence that environmental pressure, economic risk, and prospects of remittance income are the key forces of high out-migration in coastal areas (Szabo et al. 2015 and Szabo et al. 2016). The landscape changes, declining ecosystem services, local conflicts, and failures to cope with changing situations also made significant contributions to temporary or irregular migration of the people, particularly male members of the family in south-west coastal areas. During the discussion, people claimed that the families, who lost their land and family resources due to the impact of natural disasters mostly migrate to other areas. A section of landless people in south-west coastal areas takes shelter on the embankment and roadsides for their survival. The reality is that all forms of migration and displacement bear disproportionate sufferings and risks for women and children. There is evidence that in the cyclone disaster of 1991, 90% of the people, who died were women and children[55].

[55] IUCN Fact Sheet: Microsoft Word - Disaster and Gender Statistics.doc (unisdr.org)

5.4.3 Economic Drivers

Bangladesh has made substantial economic progress that makes it eligible to graduate from the least developed country (LDC) status by 2026. The country has already met the UN criteria of graduation in 2018. The average per capita income rose from USD 754 to USD 1909 from 2009 to 2019 that results in the reduction of poverty in Bangladesh. Despite this, economic inequality is still a major concern in the context of Bangladesh. Bangladesh has made significant efforts to continue the safety-net programme to reduce inequality. The allocation for social protection of the most vulnerable and marginalised population was $142.8 million in 2006 increased to $5.77 billion in 2017[56] as 2.3% of the country's DGP. Despite this huge allocation, social protection still has not yielded visible results in the context of south-west coastal areas of Bangladesh.

I. Poverty

Bangladesh has started its journey after indigence as a poverty prone country. But over the last 20 years, Bangladesh made significant progress in reducing its poverty. The national poverty rate was very high at 82.9% in 1973-74 but a declining trend is continued as of 2019. The national poverty rate is further increased to 29.5% in 2020[57] due to the impact of the COVID-19 pandemic situation (Figure-56). At the same time, the extreme poverty status is also declined from 41% to 12.9% with little increase in 2020 due to impact of the COVID-19 pandemic situation. The status revealed that 49.43 million people are still living in poverty situation[58]. It is noted here that poverty reduction is considered as the primary focus of all Five-Year Plans (FYPs) of Bangladesh from 1973-2020 that results in success in the declination of poverty.

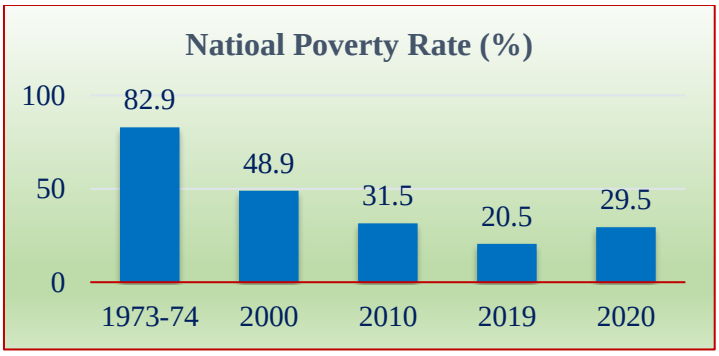


Figure-56: Poverty Rate in Bangladesh
(Source: BBS, 2011 and Dhaka Tribune dated 12 August 2020)

[56] Bangladesh in 2016-17: Progress and Development
[57] Dhaka Tribune dated 12 August 2020.
[58] ibid

Considering the reality of the COVID-19 pandemic and its links with an increase in poverty, the government of Bangladesh has introduced its 8th Five Year Plan (2021-2025) with high priority to the reduction of poverty as well as attainment of SDGs targets by 2030. The poverty rate also explored a differential scenario in an aerial context. The national poverty headcount rate was 31.5% in 2010, while it was 32.1% in Khulna and 46.3% in the Satkhira district (Figure-57).

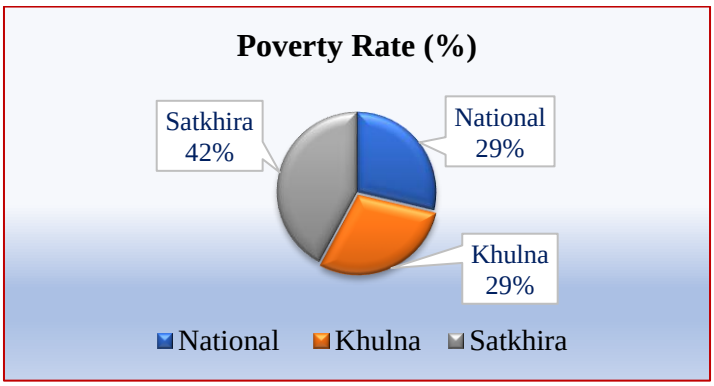


Figure-57: Difference in poverty rate
(Source: BBS, 2011: Community Report)

The status refers to that the existing poverty rate is higher than the national poverty rate. The land and labour-based irregular income activities are the main reasons for higher poverty in this area. Therefore, poverty and income inequality remain a persistent challenge. It has been observed that a large section of people are struggling to manage their regular economic and are unable to break the cycle of lifelong poverty. But women's participation in income activities rose rapidly in south-west coastal areas contributing to improving their family income.

The study area is defined as highly poverty prone areas. According to BBS, 2010, 55.2% of people were defined as poor and 33.8% of people as extremely poor in Shyamnagar areas of Satkhira district, which is truly higher than the national status[59]. This is truly aligned with the status of family income in study areas, whereas 58% families' income in the Shyamnagar areas and 51% in Koyra areas are defined as below 2500 BDT per month. A small section of rich people is leading to maximum income (Figure-58) that represents the ground situation of poverty and income inequalities.

[59] The level of poverty was very high as 82.9% in 1973-74 that declined to 31.5% in 2010 and 22.4% in 2017 in Bangladesh.

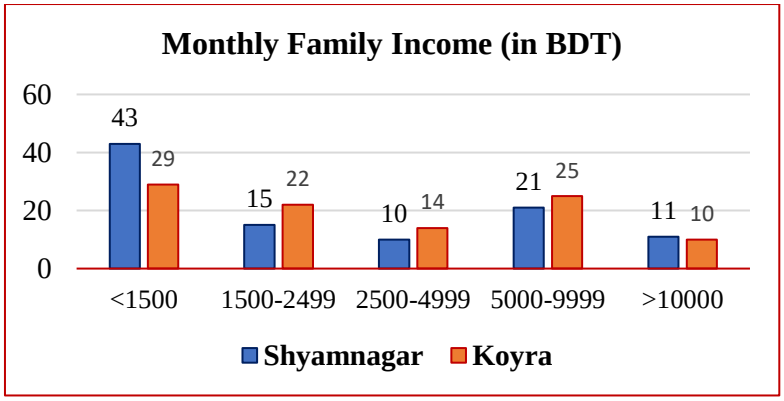


Figure-58: The status of family income (Average income/month)
(Source: BBS, 2011: Community Report)

It is also reported that the severe cyclone Sidr caused an economic loss of US$ 3 billion that has not been recovered yet. This results in a 5% increase in poverty[60]. Before the cyclone Sidr and Aila, the people were mostly dependent on agriculture, but the economy of the people heavily changed over the years. The people are now depending on shrimp farming (including fishing), small scale agriculture, natural resource collection and wage labour activities. The traditional livelihoods of coastal people are often disturbed by the coastal cyclone, salinity intrusion, tidal surges and waterlogging those results in income inequalities in the society. The poverty-stricken families are very much exposed to natural hazards and unable to cope with disaster situations. As they are mostly dependent on agriculture and labour-based activities, they are the most sufferer of disaster and ecological change, because it significantly reduced their food production and labour-based livelihood options in study areas. So, low, and irregular income-based families are always at risk of lifelong vulnerability.

II. Increase of Inequalities

Inequality refers to unequal access, opportunities and control that results in differential status and respect in society. The accumulation of resources and power are the central force of inequalities. It is like an epidemic in the context of coastal and riverine areas of Bangladesh and destroying the desire for equitable development. The situation of inequality creates differential access, opportunities, status, and control mechanism in the society, where the rich and elite groups gain the maximum benefits of development. The situation is not only affecting on living standards and social status of the poor but also impacting their accessibility, ability, and exposure. The functional inequality has created an elite group and leaders as a core group in the society, who controls the overall process of local development. Within this framework, the poor people have no own voice, no access to local resources and no control over their livelihoods and decisions that keep them into the cycle of poverty and inequality generation by generation. As a

[60] UN study (Early Assessment Report on SIDR-2007, Published in 2008

reference, if we analyse the social indicators, we may find a differential scenario in our society (Table-23).

Table-23: Status of social indicators between the poorest and richest quintiles

Indicators	Poorest (%)	Richest (%)
Marriage before age 18 yrs.	74.2	45.4
Received assistance of qualified doctors during delivery	16.2	69.7
Place of delivery as home	73.2	21.5
Teenage pregnancy and motherhood	36.5	17.7
Child malnutrition rate*	50.0	21.0

Source: Bangladesh Demographic and Health Survey, 2017-18 and WDI, 2014

The difference in the status of social indicators refers to an unequal social status between rich and poor in society. The poor people have very limited access, opportunities, and capacity to gain the benefits of development, while the rich always enjoy the benefits of development. It has been defined as a real challenge that benefits of development are not shared fairly in society, and the unequal development has made a significant contribution to widening the gaps between the rich and poor. The unequal access, opportunities, and ability of people in the society generate a social structure, where the poor are placing in the low status and holds little or no power to participate in the process of social decisions. The status defined the context of social relations and space for people's participation in social decisions and actions. In such a situation, the rich and elite groups are always placed in a dominant position to control social processes and decisions.

There is observed an increasing income inequality in the society. A small number of people are holding maximum economic resources, while the majority facing the deprivation and exclusion. It is reported that the share of income held by the highest 10% increased from 21% in 1984 to 27% in 2010[61]. But it is in declining trend for lowest 10% that from 4.13% (in 1984) to 3.99% (in 2010)[62]. It means that the bottom 10% share of national income has decreased but the richest 10% has increased. A similar status was also noted by the people during a discussion on the proportion of economic status of the population in the Shyamnagar and Koyra areas. They revealed that at least 60% of people are poor, 30% middle class and only 10% are rich/elite group but this 10% population holds the maximum power, control, and benefits in the social and economic system (Figure-59).

[61] The Financial Express, 22 March 2021: Bangladesh: The state of income inequality
[62] Ibid

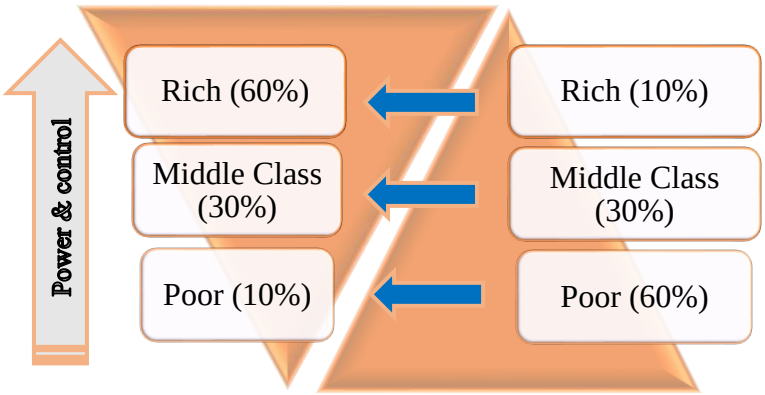


Figure-59: Perceived poverty status of people in South-west coastal areas
(Source: Author)

The status of people's perception bears strong evidence that economic resources are unequally distributed, and the poor holds very limited power and control over the resources. The process contributes to the rise of deprivations in society that added force to a section of the poor to live in at-risk situations. It is most visible in coastal hazard-prone areas. as a result of rising disparities in the distribution of resources and services. Though there is observed a declining trend in poverty from the 1973 to 2018 period in Bangladesh. The status reveals that the rate of poverty incidence was 71.3% in 1973 that declined to 24.5% in 2018, but it is still higher than other South Asian countries[63]. The decline of poverty refers that the level of people's income has increased due to the expansion of economic processes. It has two folds in the change: firstly, it encourages the process of development but creates differential survival strategies of the people and secondly, it has a potential negative impact on the ecosystem, food shortage and human vulnerability. But there is a reality that the landlessness of the population is also increasing day by day due to inequality in the economic process of Bangladesh. Access to land is **inequitable.** It is caught up with social, economic, and political power (UNAID, 2010) that steering the land grabbing and illegal allocation of public lands in favour of the rich and powerful elite groups in the society. It is estimated that the current rate of increase in landlessness is 12.84% in rural areas[64]. Evidence refers that the rate of landless population was 14.whichn 1947 that reached 68.8% in 2001 (Islam, 2005). It has been observed that the rate of landless people is quite higher in coastal and riverine areas than in other locations. During a discussion with a section of people in selected coastal areas, it was revealed that more than 80% of people don't have agricultural land and most of them depend on Sundarban resources to maintain their livelihoods. They also noticed that:

> *Our earnings were high during the rainy seasons (from March to May) when river conditions are rough. Golpata and honey collection from the Sundarban requires permission-based on seasonality aspects of the*

[63] Global Journal of Human-Social Science: E-Economics, Volume 14, Issue-5, Version 1.0, the Year 2014
[64] Agriculture census, BBS, 2008

production of biological resources. The rainy season (disaster time) is challenging for them because of irregular income that places them into many kinds of suffering and finally forces them to depend on receiving loans from the local money lenders. This borrowing trap did not allow us to save money.

It was also revealed that their monthly average earnings are between 2000 to 5000 Taka, but the income level dropped significantly in the months of Vadra, Ashwin, Kartik, Agrahayan while they face serious difficulties to survive with their family members. During this time, approximately 30% to 40% of people suffer from serious food insecurity. This is basically the result of the dependency of people on local natural resources. Besides, the dependency creates uncertainty in income that bears a negative impact on the well-being of the poor in coastal areas. The poverty-stricken families refer that they have limited access to information and state-led services because of their illiteracy, remoteness in existence and irregular nature of livelihoods. The economically powerful people are often taken the advantage of this situation, where they strongly guide the decision, access, and control to poor people's livelihoods. From this point of view, the poor families are particularly facing two forms of poverty situation, firstly, the structural poverty that derives from the landlessness and irregularity of working labours, and secondly, the conjunctional that caused by specific shocks such as climate change or socio-political insecurity. A large section of families in coastal areas have experienced both that placing them into vulnerable conditions while they face more and more climatic shocks and frequent natural disasters compared to the richest and the powerful groups. The analysis of people's perception (with scale: 1-10) revealed that the rich/elite groups have better access, opportunities and control over the natural resources that place them as dominant groups in the society (Figure-60). The poor families heavily depended on agricultural and natural resources in the coastal areas. A large section of poor families utilises natural resources to collect primary goods and produces their food while the rich and elite often try to control the resources with diverse interest and conflicting intentions. The process contributes to creating social inequalities and marginality. It is like an epidemic for Bangladesh that destroys the desires of equitable development.

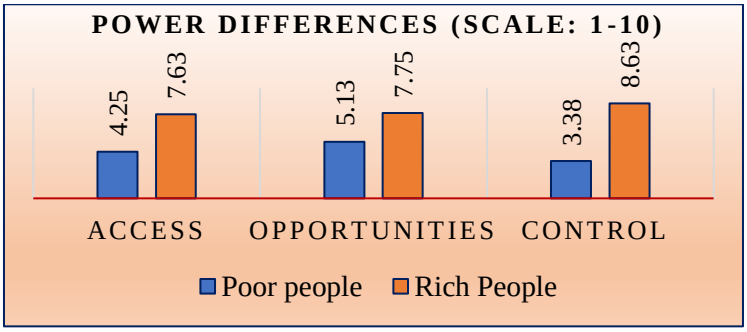


Figure-60: People's perception of power differences (Source: Author)

An unequal power relation is visible in social, economic, and political dimensions in the study areas. If we focus on the distribution of *Khas* land, we may find an illegal capturing of public land that often turned into a conflict situation. The public lands are mostly illegally captured by the rich and powerful elites that deny the eligibility criteria in distribution of *Khas* land. The process demonstrates an increasing trend of the landless population in study areas. Evidence refers that the rate of landless population was 14.3% in 1947 that reached 68.8% in 2001 (Islam, 2005) and it is quite higher in coastal and riverine areas in Bangladesh. During a discussion with a section of coastal people in 4 coastal Upazilas, it was revealed that more than 80% HHs do not have cultivable agricultural land and most of them heavily depended on other's land and coastal natural resources to maintain their lives and livelihoods.

Social inequality forces people's displacement, particularly in south-west coastal areas of Bangladesh. It has been observed that a large section of poor people is negatively coping with the situation, where they lose their survival strength and capacity to recover and place them in the loop of social vulnerability. The ground reality is that a section of poor families living close to the rivers and more likely to send their children for the collection of natural resources (particularly from the forest and nearest rivers). The children, who go to the forests and rivers regularly left education permanently. Similarly, the women from extremely poor families go to the rivers to push nets for shrimp fry collection. Most of them live in the river adjoining areas. They generally go to the rivers twice a day during low/ebb tides. Sometimes they need to go to the rivers deep at night (e.g., 2 am). They push nets for miles along the riverbanks to get fries. During the discussion, they mentioned that this following/chasing of tidal rules creates disturbances in their psycho-physical health. In many cases, women cross the rivers to catch fries in the forest side of the riverbank ignoring the risks of tigers' crocodiles and robbers. Their prolonged presence in the water exposes them to many forms of health hazards like cold/cough, and skin diseases that often-extending vulnerability.

III. Landlessness

Landlessness is a key concern of Bangladesh. It has a strong link with the poverty and food insecurity of the people. It is reported that 61.82% of people live in rural areas of Bangladesh and depend on agriculture and related activities for their livelihoods[65]. The Agricultural Census report, 2019 reveals that one-fourth of the country's farmer families are landless[66]. The proportion of landless households, which was 12.84% in 2000 reduced to 7.84% in 2019. A total of 4.0 million households out of 1.65 crores, farmer households are landless, while 9.1 million agricultural labourers and around 6.8 million households are involved in cultivating others land, either on lease or as

[65] World Bank, 2022
[66] Bangladesh Bureau of Statistics (BBS) on Agriculture Census 2019.

sharecroppers[67]. The status refers to a high proportion of households as landless. It has been observed that landlessness exposes the inability of the people to take the benefits of natural resources. This inability is often creating social insecurity and vulnerability. FAO (2009) noted that 65 million people are defined as unable people to bear the expenses of their basic food for survival. It is defined that 54% of lands are used for crop cultivation. But the expansion of human settlement and urban areas has been creating additional pressure on net cropped land in Bangladesh. It is reported that the net cropped areas have reduced by 4.9% between 1971-72 to 2010-11[68] (Figure-61).

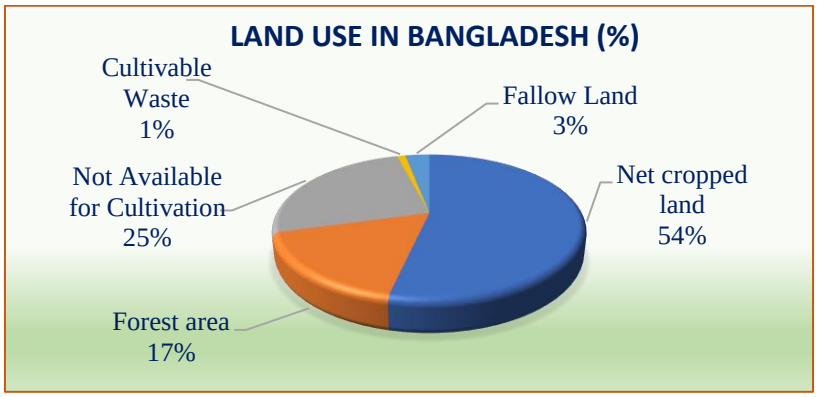


Figure-61: Land use in Bangladesh (Source: BBS, 2011)

It is fact that the country is experiencing imbalances in the man-land ratio, which is now about 0.06 hectors per-capita agricultural land. The transformation of agricultural lands to non-agricultural land uses is now at an alarming rate (SRDI, 2013). It is visible in coastal areas, where the majority of the agricultural lands transformed into shrimp firms. It is a reality that the transformed lands are mostly owned or controlled by the rich and powerful people in society. The small farmers are becoming landless. It has been creating extended pressure on natural resources, ecology, and food security in coastal areas.

The proportion of landless households in the study area is very alarming. The agricultural land ownership data reveals that 43.31% of households in Shyamnagar[69] and 37.24% in Koyra[70] areas are functionally landless. The status reveals that the number of landless households in study areas is about five times higher than the national rate. Similar findings were also defined in the perception survey that noted 65% of households don't have their living and agricultural land (Figure-62). It means all causal drivers are functional here that forcing the people to be landless and insecure.

[67] ibid
[68] BBS, 2011
[69] Shyamnagar Upazila - Banglapedia
[70] Koyra Upazila - Banglapedia

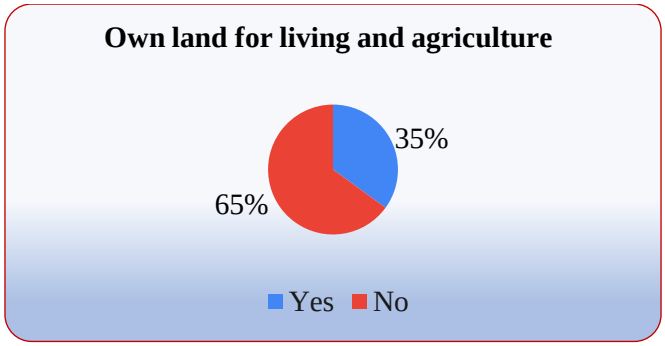


Figure-62: Land ownership of the households in the study area

(Source: Perception survey, 2020)

IV. Employment Status

The state of the employed population is very important for economic development. Despite the increasing contribution of service and industrial sectors, agriculture is still a major employment sector in Bangladesh. A total of 40.6% of people are employed in agricultural sectors, while it is 20.6 in industry and 39% in service sectors (Table-24). The proportion of the unemployed population (15+ years of age) is increased from 20.73 million (in 1972-73) to 60.8 million (in 2017) but 4.37% population71 is still defined as unemployed in 2017. The rate of people participating in the labour force was 43.8% in 1974 whereas 80.4% were male and only 4.1% female. It was increased to 56.5 % in 201772, where 70.86% are male and 29.14% female. It is true that female participation in the labour force has increased but it is still very low compared to male. As a reference, the rate of unemployed women is 6.8%, while it is 3% for men[73].

Table-24: Employment by sectors[74]

Sectors	% of employment				
	1970	2010	2013	2015-16	2016-17
Agriculture	52.4	47.6	45.1	42.7	40.6
Industries	15.9	17.7	23.0	20.5	20.6
Services	26.7	25.5	32.0	36.9	39.0

Source: CPD calculation from BBS Data, 2018

Women's participation in the labour force as full-time workers is combatively better than men's (Table-25) due to the emergence of working opportunities in the RMG and emerging informal sectors in Bangladesh. Besides, educated unemployment75 is still a major problem in the case of women than men. A large section of women has to take

[71] CEIC Data, 2020
[72] World Bank, 2017
[73] The Daily Star, dated: Mar 8, 2018
[74] CPD calculation from BBS Data, 2018
[75] Unemployment rate is 31% in 2017 among people who belong to higher secondary and above level of education (BBS, 2018)

responsibility of household works including child-rearing. The patriarchal social system is still limiting the working space for women outside.

Table-25: Nature of working engagement between male and females

Nature of work	Working status (%)	
	Male	Female
Working Proprietors	33.84	10.66
Unpaid Family Workers	4.06	11.50
Full-Time Workers	59.27	74.06
Part-time workers	1.93	2.25
Casual Workers	0.90	1.53

Source: BBS, 2017

On the other hand, youth is one of the major challenges in Bangladesh. It is further reinforced during the COVID-19 pandemic situation. The rate of youth unemployment was 6.4% in 2010 and increased to 12.13% in 2019[76]. The reality is that the progressive economic growth is functionally unable to deliver employment opportunities for youth. It has been creating frustration among youth and forcing them to be engaged in illegal activities, crimes, and violence, which is not desirable for Bangladesh. It is not only alarming for shaping the future but also restricting the desire for sustainable development of Bangladesh. Compared to the national status, the employment status in south-west coastal areas is also very low, which is about 35.15% in Shyamnagar and 33.46% in the Koyra area (Table-26). The majority of women are engaged with household work, but their work is not treated as a contribution to family income. That is why women are treated as dependent on members of the family. A significant proportion of the population does not have any work. It means they are either children or old age population, both are dependent sections of the population.

Table-26: Status of employment

Study area	Employed	Looking for job	HHs work	No work
Shyamnagar	35.15	0.57	44.59	19.69
Koyra	33.46	0.82	45.63	20.08

Source: Population & Housing Census, 2011

The main sources of income are defined as agriculture, which is 83.22% in Shyamnagar and 89.20% in the Koyra areas. A very small portion of people is engaged in industrial activities (Table-27). The high dependency of people on agriculture and land driven activities has a strong link with low income that has a reflection on their poverty status.

[76] ILO Estimated Data, 15 June 2021

Table-27: The field of employment

Study area	Field of employment		
	Agriculture	Industry	Services
Shyamnagar	83.22	1.74	15.03
Koyra	89.20	2.36	8.45

Source: Population & Housing Census, 2011

There is also observed severe imbalance in the employment between men and women in the study area that shows clear discrimination in recognition of women's labour in employment. According to people, the space for women in employment was very much restricted before cyclone Sidr and Aila but after that, a section of women entered into direct employment, which is mostly labour-based work. But the irregular nature of work never allowed them to take control over their income. It is true fact that the dependency on agriculture and labour-based works are always bearing the risk to sustain the livelihoods of the coastal people.

5.4.4 Political drivers

I. Functions of institutions and actors

The functions of institutions and actors are the key to modify the environment. The institutions and actors, who hold the power and authority to control the environmental and social systems for their economic gains are the main drivers to change the ecology of coastal areas in Bangladesh. There is a tendency of a section of powerful state officials and political leaders to make decisions on the calculations of personal economic gain. The business actors with the support of state institutions are also leading to initiate many physical changes of environment that often create conflicts in the society. There are some destructive actions, such as i. the illegal allocation of public lands to powerful people; ii. transformation of agricultural and forest land into human settlement and commercial purposes; iii. Selective awarding of contracts on environmental resources that function under political and bureaucratic conflicts leads to exploiting the environment. Therefore, the state is an important institution to preserve the environment.

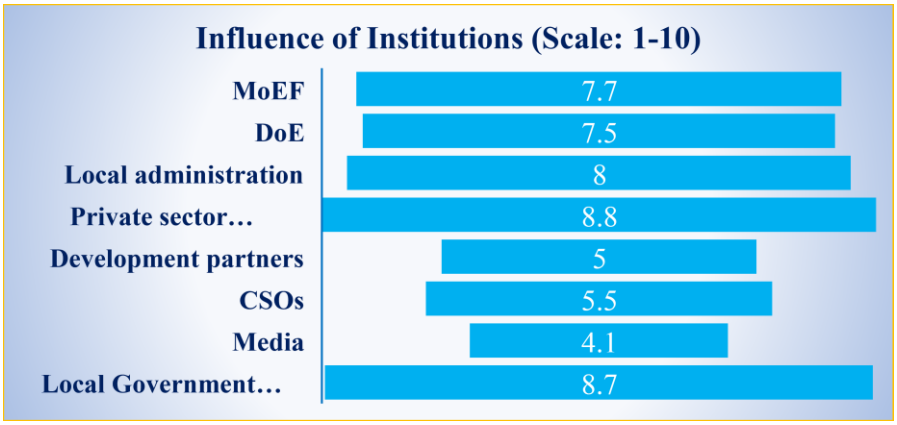
It has been observed that the state agencies are not enough functional to reinforce the environmental rules, acts and policies that aggravated the environmental problems in Bangladesh. Environmental governance is functionally missing, but it is important to make sure that the state institutions, multi-lateral institutions, the business sector, and powerful individuals are responsible for the conservation of natural resources and the environment. There are defined coordination gaps among state institutions and the line ministries of the government to address the environmental challenges in Bangladesh.

The powerful actors and political leaders are playing an influential role to keep them silent whenever they modify the environment to fulfil their desires. The national law and policies are not always applied to restrict the modification of the environment. Though the prime function of the state and its institutions is to protect the environment, it is still not yielded any visible change on the ground.

Besides, the environment is not only an issue in Bangladesh, but it also has a strong linkage with regional and global environmental concerns. So, the environmental changes are not intra-state issues but also inter-state issues. It is applicable to all states (including neighbouring states). Considering that the government of Bangladesh actively participated in the generic processes of protecting the global environment. It requires a clear legislative and policy direction to solve the global and transboundary environmental issues through dialogues and bilateral negotiations. It is fact that Bangladesh has a dependency on trade and investment with other states that may deny the environmental/ecological concerns. Some decisions made under the transnational cooperation may have important social and environmental effects on the country. As reference: the decision of the state to start up the Rampal power plant adjacent to Sundarban areas of Bangladesh.

On the other hand, the role of civil society and grassroots actors is also very crucial to challenging the political decisions of state authorities to manage the people and environment in Bangladesh. They can influence the state authorities and policymakers to reform the existing environmental laws and policies if there is any gap. Even, they can guide the practices of business actors to follow the provisions of the law and policies. The continuous pressure of the civil society was finally transformed into a success with the formulation of the Environment Policy in 1992 and the Environment Conservation Act in 1995 in Bangladesh. So, the coordinated efforts of state institutions and active participation of civil society and grassroots actors in decisions are very important to enforce the environmental laws and policies on the ground. There is an example that the East Pakistan Government took initiative for a coastal embankment project in the 1960s based on the recommendations of Krug Mission, the Netherlands with the financial assistance of multilateral development agencies. As part of this initiative, a total of 37 polders, 282 Sluice gates and 1556 km embankments were constructed in coastal areas (Asif Ishtiaque et. al, 2017). The construction of polders functionally overlooked the feedback of grassroots actors and the traditional natural system turned into a partly engineered socio-ecological system. The system has created an unforeseen ecological problem by creating water logging situation in coastal areas (Agrawala et.al., 2003).

The analysis of people's perception on the influential role of national and local institutions and actors revealed that private sector institutions and local government are the most powerful institutions than the MoEF, DoE and others. Whereas the Business actors are defined as the most influential actors due to the use of environmental resources for their economic and personal gains (Figure-63).



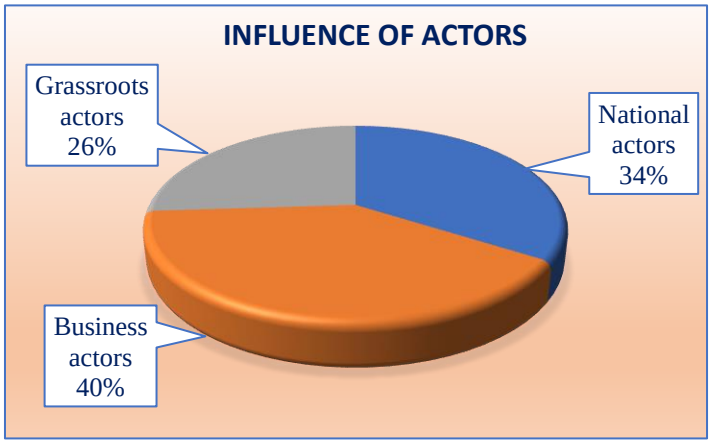


Figure-63: Influential role of institutions and actors in environmental change
(Source: Author)

Though the grassroots actors have a limited influential role in local decisions, they are also linked with the environmental/ecological change processes. The grassroots actors, particularly the poor are heavily dependent on agriculture and natural resources that allow them to take part in destructive actions on the environment. The nearby rivers, coastal water provides fish, crabs, while Sundarban provide timber, firewood, honey and other natural resources for domestic consumption or sale as part of their survival. The primary concern of poor grassroots actors, who lives near to natural resources is short term 'survival'. It has been defined that the people who have limited or non-existent access to fertile cultivable lands and natural resources results in few opportunities to livelihoods with maximum efforts. In some cases, seasonal wage labour, selling of advanced labour and out-migration is certainly alternative ways to meet the survival needs of the grassroots actors. For this reason, the grassroots actors lose their control to get the benefits of local natural resources. It has been shifted to powerful business actors, who are mostly trying to maximize the benefits from local natural resources.

The state institutions are denying the grassroots actors to make their ownership of common natural resources to take over it for large-scale commercial and sustainable

uses. But is necessary for the survival livelihoods of grassroots actors (i.e., farmers, fishermen, resource collectors). The denying moods of state institutions are often forcing them to take illegal steps to extract local natural resources for their survival. Due to the regular extraction of local resources, the ecological landscape changing day by day. It is fact that the grassroots actors are mostly used by the local powerful business actors, while they are forced to enter into a new ecological area. As an example, there is defined a section of the ethnic community (Munda), who displaced more than five times from their initial existence areas since the colonial period and still live outside of coastal embankment areas to survive. In particular, women are severely affected by the changing situation of local ecology due to their close working linkages with natural resources. It is a reality that drinking water and fuel woods are almost collected by women, which is a hardworking and time-consuming activity in the context of south-west coastal areas. As women's work has no economic value, their hard work rarely added value to the socio-political structures in the south-west coastal areas. The existing process keeps them as voiceless actors at the grassroots level. Therefore, it is now evidence that the poor grassroots actors who struggle to meet their survival needs are placing them with limited access.

II. Power Relations

Power signifies the ability of actors to control and influences the natural resource allocations and policy decisions. The power relation is a key to understand the interactions and problems associated with disaster situations. The political elites are defined as the most powerful actors to mobilise and control a wide variety of resources and the ability to influence decisions. The social and political processes are contributing to creating political elites in society. It has been observed that a large section of politically powerful actors is in keeping the control of local resources and influencing the policy decisions. They hold a capitalist mindset to maximise the benefits by denying the desires/expectations of the vulnerable groups. They are also well connected within all spheres of society and patronage is used to retain benefits. The process explores the irresponsibility of a section of people/group to generate a situation of vulnerability. The powerful grassroots actors are very much active in developing a new political order and social leadership to exploit local resources. They are often denied the needs and interests of local people and the general situation of unequal access and dependency in the society (Figure-64).

The political leadership at the national level is often power centric self-beneficial approach rather than ideological or social and economic concerns and the practice is transferred to the bottom lawyer of political leadership. Even, though they hold greater access and control over local resources and state-led relief, recovery, and mitigation measures in the face of disasters, the poor and vulnerable groups are always struggling to survive and hold minimum or no voice. They have limited ability to influence the

policy decisions to reduce their risk. Local administration is also running with a bureaucratic system, where the citizens are treated as subordinates and the administrator as superior resulting in power distance between people and the institutions. The process contributes to emerging an elitist bureaucratic character within the administrative culture where bureaucrats usually think of themselves as superior and people also view themselves as inferior to the bureaucrats.

It is also defined that the powerful and elite groups are located in an environmental comfort zone that protects them from the effects of environmental hazards. They guide the decisions of the poor and use them as resource collectors or resource users in order to maximize the economic benefits. The increasing economic demand of powerful and elite groups has created an additional force on the poor to live in unsafe locations. Similar practices are visible on the international scale, where the rich and powerful countries are responsible for the destruction of the environment and climate change. But they have strong coping abilities to minimise the impact. The opposite scenario is defined in poor and developing countries like Bangladesh. There is evidence that Bangladesh has a very limited role in climate change but faces a serious impact of climate-induced hazards. Therefore, unequal power relations have a significant role in changing the ecology of south-west coastal areas.

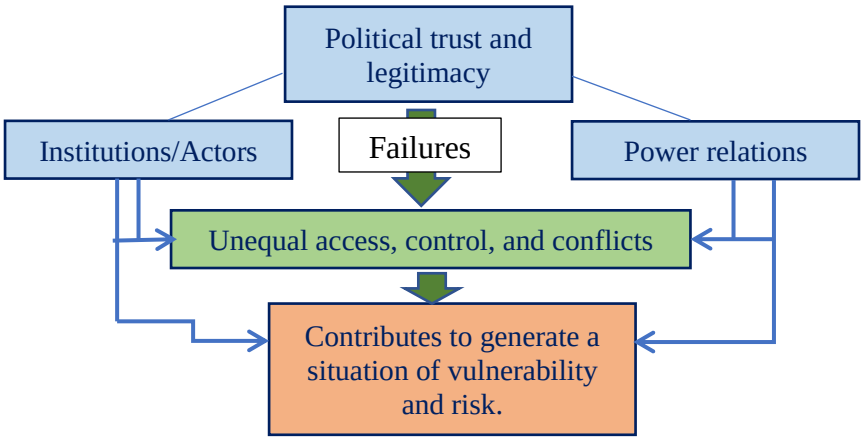


Figure-64: Political context in the south-west coastal area in Bangladesh
(Source: Author)

III. Poor land management

Land management is very important for the well-functioning of economic and livelihood activities in Bangladesh. But the frequent and illegal transfer of land contains a systematic weakness in land administration. The applications of conventional processes to maintain land records are allowing the powerful elites to influence the land

authorities for capturing public lands. The existing process is also denying the land entitlement of the poor and facilitates land disputes in society.

Land disputes are now a common phenomenon in society, which is mostly guided by powerful actors. It occurs as a result of shifting the land and allocation of *Khas* land. It is estimated that the total *Khas* land is 3.3 million acres, whereas the agricultural *Khas* land is 0.8 million acres, non-agricultural *Khas* land is 1.7 million acres and 0.8 million acres of water bodies (Abul Barkat, 2020). The records of land administration noted that about 44% of the total agricultural *Khas* land has already been distributed in the name of the poor, landless and destitute[77]. But there is defined a gap between the official records and the reality. It is revealed that only a small portion of agricultural *Khas* land was transferred to the poor, landless and destitute but the large portion is illegally occupied by the rich and powerful people in the society. According to a statement in Parliament by the Minister for Land on 4 February 2010, a total of 1.3 million acres of public land has been grabbed[78].

During the discussion, the people noticed that the powerful and political elites are playing an influential role in the entire process of *Khas* land distribution. The process contributes to generate social and economic inequalities and conflicts in society. The existing land management in coastal areas is severely poor, where a large section of char land is in the possession of landgrabbers (Abul Barkat, 2007). On the other hand, the ownership of cultivable agricultural land is gradually transferring to the rich and elite groups. The rich and elite landowners are always preferring the sharecropping of land for their benefit. During the discussion, a section of landowners noted that agriculture is not enough profitable and so they only cultivate a portion of their land for their family consumption and transform the remaining portion of land for other purposes. The uses of agricultural land for other commercial purposes like shrimp farming in coastal areas and expansion of business/settlement in riverbank areas) are changing the environment drastically. The process restricts the naturalness of the environment and creates pressure on a socio-ecological system that mostly affects the poor due to their existence in fewer priority areas.

The highest portion of people in rural areas depends on agriculture and accounts for approximately 23% of GDP but the rapid transformation of agricultural land is creating pressure on agricultural production. The coverage of agricultural land was estimated in 1976 as 91.83% of the country's total land which decreased to 87.69% in 2000 and 85.53% in 2010 (SRDI, 2013). The reduced portion of agricultural land is added to rural settlement and urban & industrial accreted land due to increasing population growth and rural-urban migration (Table-28).

[77] Abul Barkat et., al (2000), Distribution and Retention of Khas Land in Bangladesh, prepared for ALRD
[78] Bangladesh: Food Security and Land Governance Factsheet; 2012, IS Academia, The Royal Tropical Institute, Netherlands

Table-28: Changes in land cover in Bangladesh (1976-2010)

Types of Landcover	Year (1976-2010)		
	1976	2000	2010
Agricultural land	91.83%	87.69%	83.53%
Non-agricultural land	8.17%	12.31%	16.47%

Source: SRDI, 2013

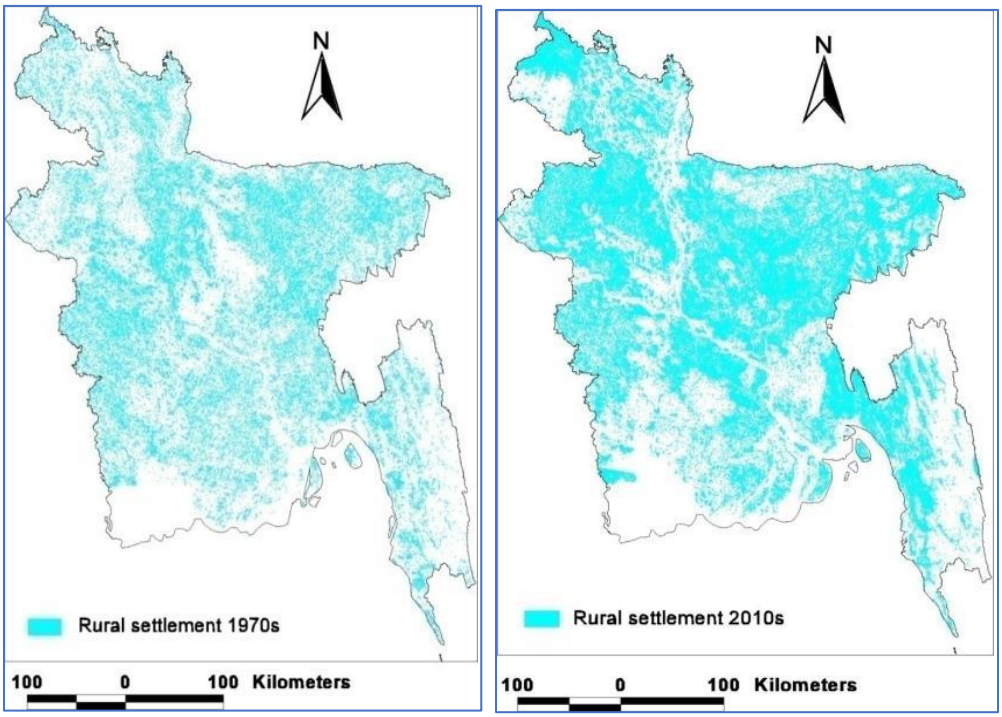


Figure-65: Changes in the rural settlement of Bangladesh
(Source: Rural settlement in 1970s and 2010s, adapted from the SRDI, 2013**)**

According to the remarks of the Secretary, MoEFCC, the total cultivable land area was 9.15 million hectares during 1982-83 which was reduced to 8.02 million hectares in 2017-18. Every year total of 69,000 agricultural lands transforms into non-agricultural land[79], which is alarming for the food security in Bangladesh. The transformation of agricultural land is comparatively higher in the south-west coastal areas. It has already created a food shortage of the poor farmers, who mostly perform as sharecroppers or agriculture labours in the agriculture sector. The poor families and farmers don't have sufficient food to support their fellow community members in need. The needs often force them to sell advanced labour and resources to merchants for survival. During the discussion, local people in Shyamnagar areas noticed that:

> *We always felt unstable and unconfident to meet the survival food needs meet our minimum requirements for survival.*

[79] TBS news Report, 05 March 2021

It is fact that food insecurity to some extent forces them to allow negative coping for 4 to 5 months to meet the family's needs which often places them into the cycle of suffering and poverty. The unplanned expansion of urbanisation, human settlements and development works are also extending the suffering of the poor.

The poor management of forest land is also a key concern of Sundarban and its adjacent areas of Bangladesh. As the poor people are mostly dependent on forest resources in coastal areas, they are acting as the main change agent of land cover changes. It is estimated that the forest coverage which was 12.11% in 1976 of the total landmasses of the country laps decreased to 9.84% in 2010 in Bangladesh (SRDI, 2013) due to the over-extraction of forest resources and the transformation of forest lands. The dynamics of land cover changes are very alarming in the context of south-west coastal areas in Bangladesh (Figure-66). The destruction of the Chokoria Mangrove Forest can be a real example of this change.

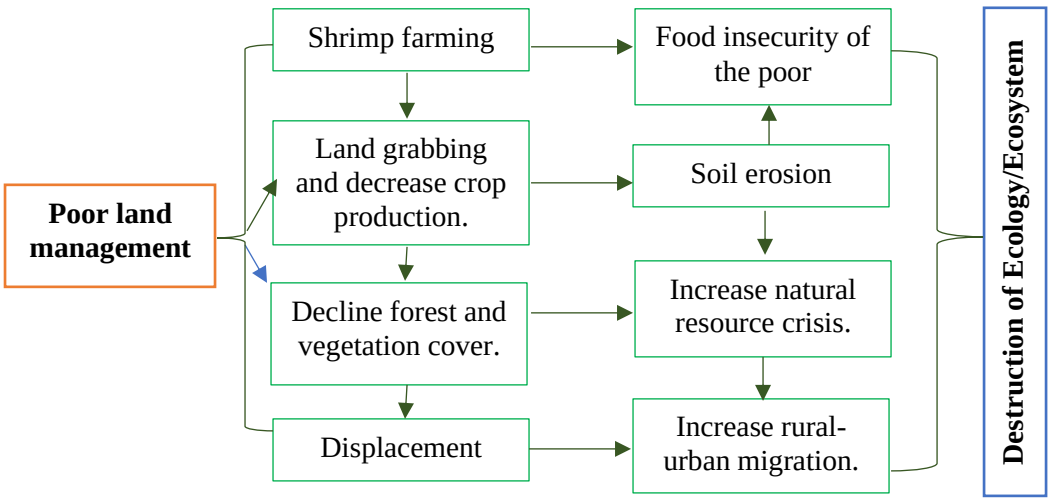


Figure-66: Effects of poor land management (Source: Author)

IV Government response to a tackle disaster situation

Environment and climate-induced disasters have become the major focus of policymaking and public concerns in Bangladesh. In most cases, the researcher investigates the social, economic, and physical dimensions of disasters rather than focusing on their political dimensions. Natural hazards are unavoidable but the failure to manage a crisis has a political dimension. This failure of the government may change people's perception and undermines their legitimacy (Figure-67). There is evidence that the failure to respond in the 1970 cyclone contributes to declining the legitimacy of the West Pakistan Government that triggered civil war to form an independent country in 1971 as Bangladesh (Albala-Bertrand 1993).

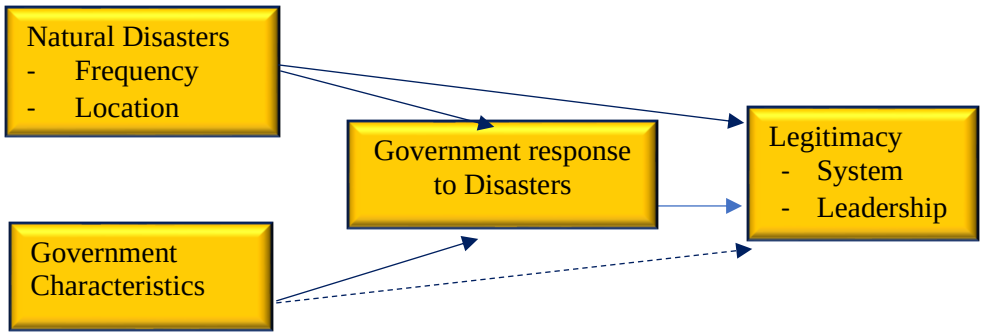


Figure-67: Government response to natural disasters and legitimacy
(Source: Author)

So, the efficient response of the government to handle disaster situations is very important to retain the acceptance of the people. Bangladesh faces a series of disasters from 1970 to 19 that results in lifelong vulnerabilities of the people due to their severity in terms of casualties and monetary losses (Table-29). The struggling situation at the beginning of a newly independent country (as Bangladesh) forces a large section of the people to continue their lives with vulnerability and risk of disaster.

Table-29: Severity of a series of disasters at the beginning of Bangladesh

Year	Disaster situation	impact
1970	1970 Cyclone	More than 300,000 people died in coastal areas of Bangladesh
1971	The civil war for the independence of Bangladesh	Approximately 3.0 million people died[80]
1974	The Famine	Approximately 100,000 people died of starvation and malnutrition[81]

Source: Adapted from Rummel 1997 and the Daily Star, dated Dec 4, 2010

As Disaster leads to human, social and economic loss in Bangladesh, it requires an efficient and accountable government to respond effectively for minimizing the loss. But the ground realities reveal an untrustful message, where the majority of people noted that the elected representatives did not provide any assistance to them at the time of Sidr and Aila induced disaster situation (Figure-68). This failure generates a new challenge and legitimacy crisis of government in the disaster situation.

[80] Rummel 1997.
[81] The Daily Star, dated Dec 4, 2010

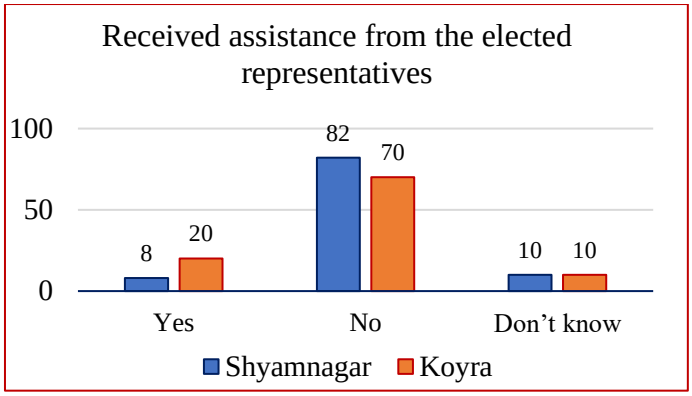


Figure-68: Assistance of elected representatives at the time of disasters
(Source: Perception survey, 2020)

The ground reality is that people's trust in political leadership decreases significantly after disasters if they face more fatalities during disasters. Besides, the fragmentation of political interest and policy decisions have a significant contribution to extending this crisis in the existing political context of Bangladesh. The disaster must be considered an apolitical phenomenon. But the creation of disaster is truly a political phenomenon. The existing framework of disaster management has little scope to consider the role of politically powerful groups and actors in the causation of vulnerability and disasters in Bangladesh. Therefore, the analysis of the role of institutions and actors, and power relations is very significant to understand the political context of disasters in Bangladesh.

V. Weak enforcement of laws and policies

The adoption of laws and policies and their functional implementation is necessary to protect the environment in Bangladesh. Aa s requirement, Bangladesh has introduced an institutional framework for better management of the environment. After independence, there are several policies and laws adopted by the government in addressing environmental issues and concerns. The major legal and policy instruments are:

- National Environmental Policy (NEP), 1992[82],
- National Forest Policy, 1994[83]
- Environmental Conservation Act, 1995[84]
- Environmental Conservation Rules, 1997,
- The National Water Policy, 1999[85]
- National Land Use Policy (2001)[86]

[82] Ministry of Environment and Forest, GOB, 1992
[83] Ibid
[84] Ibid
[85] Ministry of Water Resources, GoB, 1999
[86] Ministry of Land, GoB, 2001

- Environmental Court Act 2000[87] (amended 2002)
- Disaster Management Act (DMA) 2012[88]

It is noted here that the environmental laws and policy were articulated in line with the guiding principles of the UN Conferences on the Human Environment (held in Stockholm, Sweden in 1972) and the Earth Summits (held in Rio De Janerio in 1992). The efforts refer to the commitment of Bangladesh to the better protection of the environment. But the implementation of laws and policies depends on the leading role of the Ministry and the functions of environmental institutions and authorities. The commitment of the government to the environment is also reflected in the transformation of the ministry as the Ministry of Environmental, Forest and Climate Change (MoEFCC) in 2018. But the traditional application of the top-down approach denies grassroots people's engagement in making decisions on local resource management. The coordination gaps are visible between the national and local institutions in addressing environmental challenges in Bangladesh.

Although the environmental institutions are guided to work under the environmental laws and policies, they show their inefficiency to enforce the provision of the laws and policies to manage the environment and ecology and conserve forest resources for national development. The review of the functions of environmental institutions and actors reveals a clear coordination gap in compliance with the national legal provisions and UN standards. These are:

Table-30: Key enforcement authorities and functional gaps

Key Enforcement Authority	Key functions under the policies and laws	Functional gaps
MoEF	Policy guidance and overall management	Coordination and follow up actions
DoE (1977)	- Protection of environment, ecology, and ecosystem - Enforcement of legal provisions and regulations - Initiate corrective measures	- Field monitoring and actions - Coordinated actions with relevant line Ministries (i.e., Land and water resources)
DoF (1876)	- Management of forest resources - protection and management of biodiversity and watersheds	- No visible actions on the protection of the natural forest, biodiversity, and watersheds

[87] Ministry of Environment, Forest and Climate Change, GOB, 2000
[88] Ministry of Disaster Management and Relief, GoB, 2012

Bangladesh Forest Industries Development Corporation (BFIDC)	- Rubber plantation, processing and collecting timber	- No greater initiatives plantation of timber and rubber in forest areas.
Bangladesh Forest Research Institute (1955)	- Research support to DoF and BFIDC - Develop appropriate technology for sustainable productivity	- No visible and innovative research in the expansion of natural forest
Bangladesh National Herbarium (BNH)	- Plant biological diversity - Policy support to plant biodiversity conservation	-
Bangladesh Water Development Board (BWDB)	- All other forms of water management - Operation and maintenance of water-resources	- Project centric short-term actions - Over focus on engineering approach in flood control, drainage, and irrigation
WARPO	- Water Resources Planning - Policy, planning and regulation of water resources	- Non-integration of people's perception in water resource planning
Disaster Management Bureau (1992)	- Coordination with line Ministries and Dept. - Disaster management (local-national level)	- Still focused on relying on and rehabilitation approach - Risk reduction and resilience approaches are rarely visible.
Land administration	- Land management, survey, and land transfer - Ensure environment-friendly land use - Best utilization of land	- Ineffective and inefficient land management - Land grabbing and illegal transformation of land - Limited consideration on environmental issues

Source: Captured information from the website of noted Ministries & Institutions, 2020

Despite the integration of several institutions and the laws, policies, rules and plans, the coordination with relevant ministries, departments and institutions and enforcement of relevant provisions of laws/policies/rules to conserve and protect the environment and forest is still not yielded desired results. The implementation of environmental laws and policies are strongly connected with the MoEF, MoWR, MoL, MoA, MoP, MoDMR and MoF but their coordinated efforts are still missing. It has been observed that the allocation of land by the land administration is often in conflict with the forest

department that facilitates declination of natural forest areas. Recently the Cabinet approved the new name of the Ministry of Environment and Forest as the Ministry of Environment, Forest, and Climate Change but there is no initiative to introduce climate-induced disaster risk management policy instrument. Bangladesh has already introduced Standing Orders in 1997, Policy in 2015 and the Act in 2012 that focused on disasters but do not align with the issues and concerns of climate change impact in Bangladesh. Therefore, there are still gaps to initiate an integrated approach for greater adaptation of climate-induced disasters and resilient development in Bangladesh.

The analysis of people's understanding of the Environmental Conservation Act, 1995 in coastal study areas, it is revealed that only 11% of people know about this Act, while 77% do not have any ideas about this Act (Figure-69). It means that the local people and the polluters both have no basic knowledge and understanding of the legal provisions of the ECA, 1995. It is the basic role of the state institutions to make the people well informed about the laws and impact of the environment so that the people can be more alert.

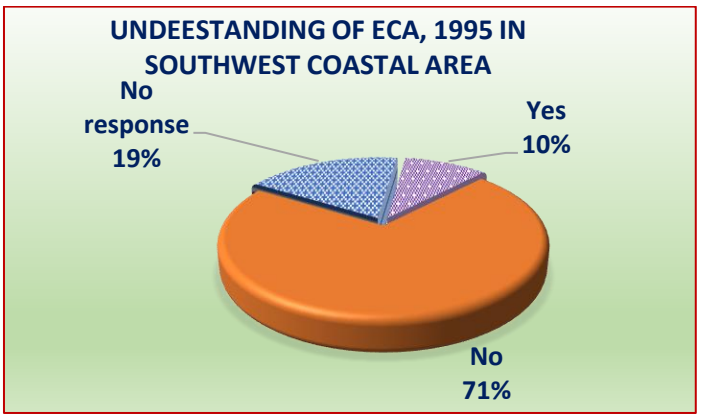


Figure-69: People's understanding of ECA, 1995
(Source: Author)

The local state-led institutions are still operating for short-term actions without consideration of the long-term impact and changes in the environment. The actions are aligned with economic growth but not sustainable uses of environmental/natural resources. It is a reality that when environmental issues come into the debate, the administration is still prioritized economic development. The state authorities are still not enough to conserve the environment and manage the forest resources, which is gradually in a declining trend. The enforcement of environmental law mostly relies on fines and compensation, and there are no visible monitoring mechanisms in addressing the environmental challenges. The authorities are often proving licenses and approval to environmentally irresponsible industries/plants/firms without a comprehensive EIA and environmental clearance, and even several firms/factories operating their profitable

business without any formal approval or clearance of the respective authorities. The weak investigation follows up and corrective measures result in degradation of environmental quality and forcing the people to live and cope with increasing environmental hazards.

The government of Bangladesh has extended its environmental efforts as a party to a number of international environmental instruments, including the Paris agreement. The efforts are visible in the adoption of the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2009 and the development of the Climate Change Trust Fund (CCTF) for advancing the coping capacity and resilience of the people. It is noted here that the action has a special focus on adaptation but no visible initiatives to institutionalize the environmental and climate change issues into broader practices of sustainable development. The ongoing approach of state-led institutions to environmental management is functionally centralized and ad-hoc, where the long-term and decentralized mechanisms are missing. The existing institutional setup and approach are not enough feasible to bring together climate change and the SDGs into the vision 2041 of Bangladesh.

5.5 Defining the influence of power dynamics

The study has defined the influence of power drivers in discriminations, landlessness and local decision making through application of correlation methods. The methodological applications strategically considered the perception data (N=200) in defining the R-value. The statistical calculation R-value is signified the relations of power drivers with three key forces that functional in the south-west coastal areas of Bangladesh.

I. Correlation of power with discriminations

The finding of the perception survey (N=200) has defined a positive correlation between power and discrimination. Hence, the ‘R-value is 0.64 which means a positive relationship of two variables prevail in the study area (Figure-70).

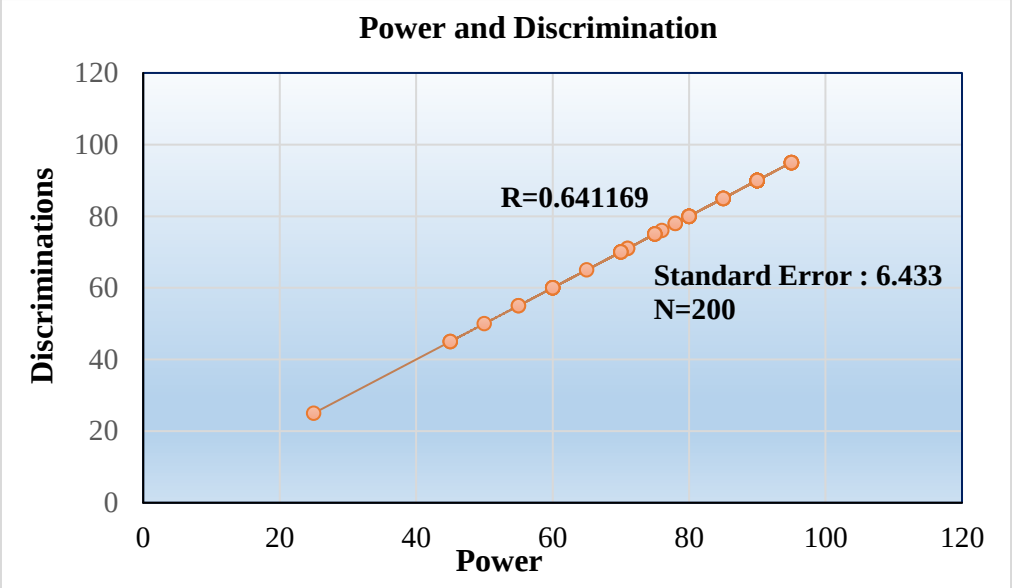


Figure-70: Correlation of power and discriminations in the study area.
(Source: Calculated from perception data, 2020).

II. Correlation of power with landlessness

The finding of the perception survey (N=200) has defined a positive correlation between power and discrimination. Hence, the 'R-value is 0.51 which means a positive relationship of the two variables prevails in the study area (Figure-71).

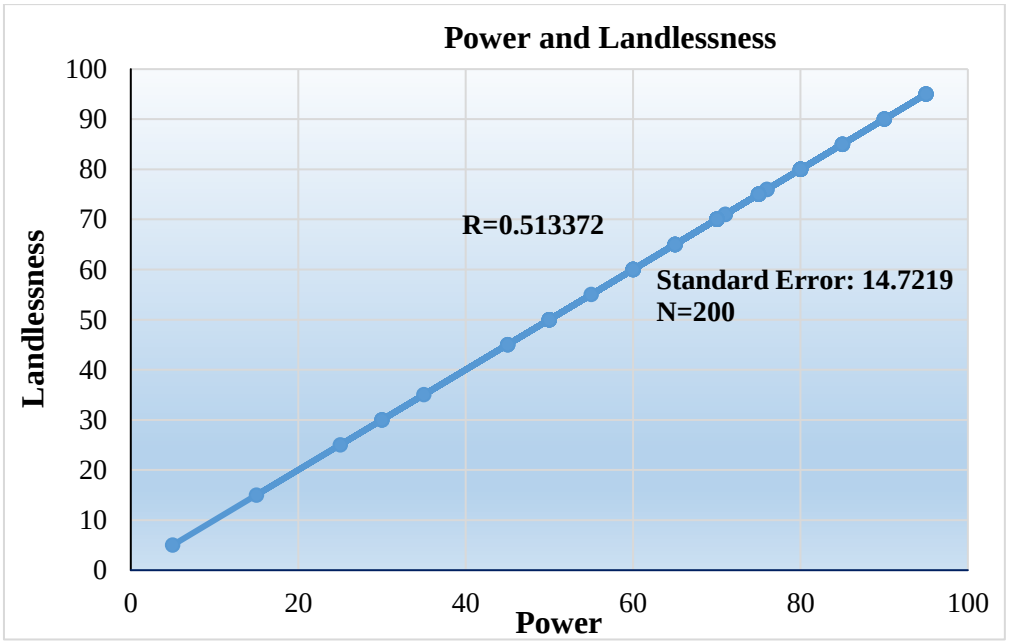


Figure-71: Correlation of power and landlessness in the study area.
(Source: Calculated from perception data, 2020).

III. Correlation of power with local decision making.

The finding of the perception survey (N=200) has defined a positive correlation between power and discrimination. Hence, the 'R-value is 0.85 which means a positive relationship of two variables prevail in the study area (Figure-72).

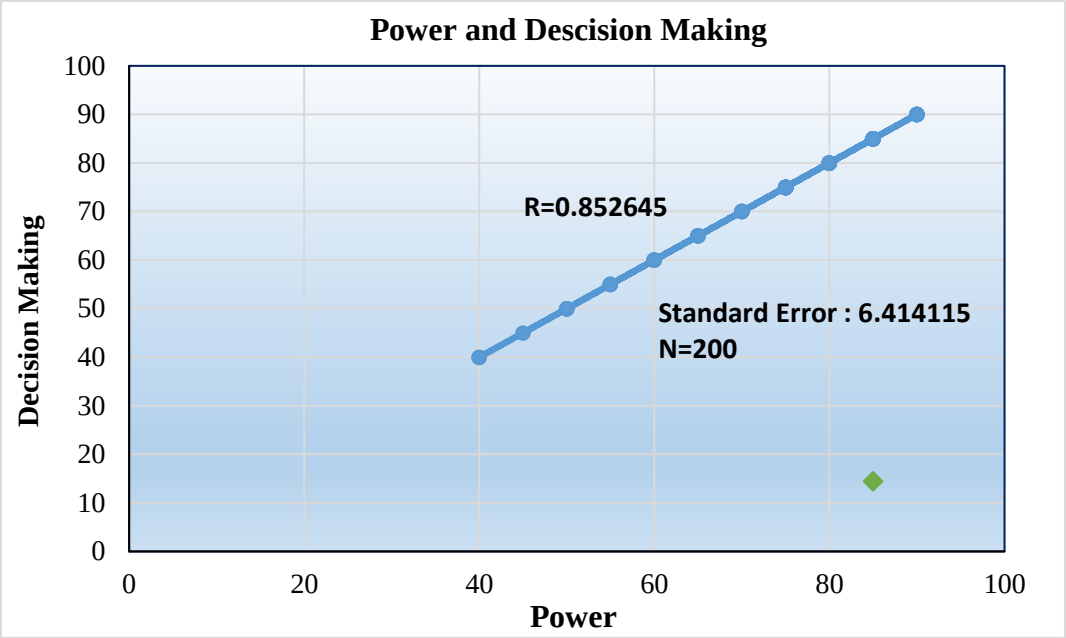


Figure-72: Correlation of power and decision making in the study area.
(Source: Calculated from perception data, 2020).

The results of the correlation between power relations (as the independent variable) and discriminations, inequalities and decision making (as the dependent variable) reveal a positive correlation. It refers that power relations have a significant role in creating discrimination, inequalities, and exclusion from the local decisions. The R-value is highest in the cases of local decision making. It means that the rich and powerful elite groups are controlling the local decisions, whereas the poor have very limited space to participate in the local decision. The dominant role of rich and powerful elite groups is creating a space for differential access, control, and opportunities of the people in the management of local resources and functions of development, where they gain the maximum benefits, but the struggle of the poor continues to generation by generation. Therefore, it can be signified that the power-led process and drivers are causing differential vulnerabilities and risks to a section of people in south-west coastal areas of Bangladesh.

5.6 Causal links of Ecological Change

Human interaction with the environment is a fundamental theme of ecological change. The interactions lead to the evolution of human society, but over time human society

changes/modifies the naturalness of the environment. This has already been explored in the earlier section that the changes made through the functions of three-dimensional processes (i.e., everyday, episodic; and systematic), and intensify with social, economic, environmental, and political actions. This unique interaction is continually active because of human's continual search to facilitate their work that experience a change both in the quantity of interaction (i.e., how often and on what level–micro/macro) but also in the quality of interaction (i.e., how significant is the result of interaction/what is the yield of interaction). Human-induced environmental changes are driving serious degradation of ecological goods and services and producing associated, and often unforeseen, adverse effects on people and places. Increasingly these effects are not evenly or randomly distributed to the people and places but force a section of people or group of people to be most marginal, vulnerable and risk groups. As a reference, the large-scale transformation of agricultural land into shrimp farmland in study areas is considered a severe threat to local ecological systems. It is not only deteriorating the water and soil quality but also changing local food production, ecosystem services and freshwater system. In this changing process, the poor and marginalised section of people often faces unequal access, opportunities, and exposures that force them to live in unsafe conditions (Figure-73).

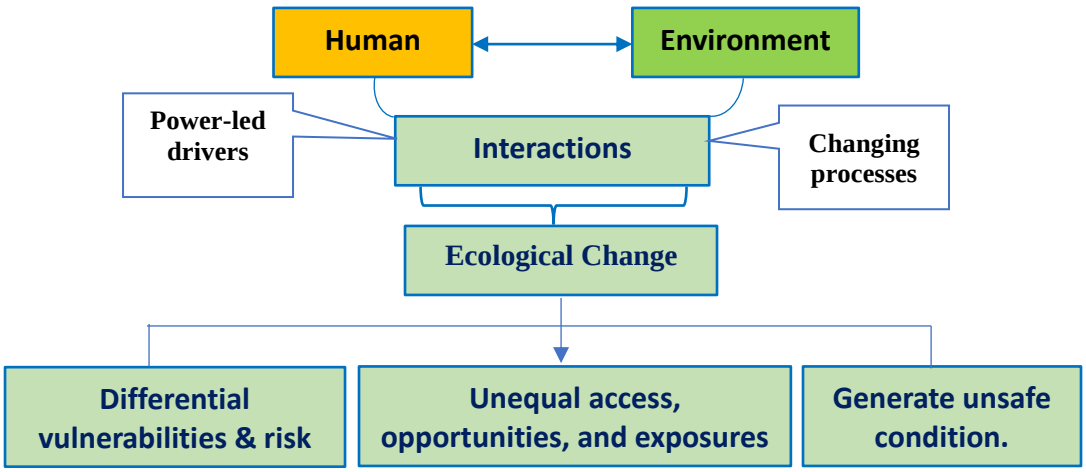


Figure-73: Causal links of ecological changes (Source: Author).

5.7 Conclusion

The dimensions of human interactions with the environment are strongly connected with people's marginalisation and vulnerabilities. The physical changes that are mostly conducted by the powerful people create unequal effects on the poor people to be the main loser. The situation forces poor people to live in unsafe conditions. It has been observed that a section of poor people is pushed into areas that are economically less important and environmentally vulnerable to survive. Due to existence in economically less priority and environmentally risky areas, the poor people have limited access to

local resources and opportunities to work in a regular format, and this forces them to make them dependent on powerful/moneylenders or rich people. The process is extending spaces for inequalities in the coastal society. The existing social-political processes are functional in favour of the rich and powerful people that maximise their economic benefits. The process is creating inequality in society.

The inequalities generate a social structure, where the poor holds a low status and gain little or no power to participate in the process of social decisions. The rich and powerful elite groups are always placed in a dominant position to control the social decisions and isolate a section of people to stay in a risk situation. The study defined a set of power-led drivers, which are active to change the environment and ecology. The existing ecological changes are not viable for achieving the SDGs and vision 2041 for Bangladesh. Therefore, it is the right time to realise the functions of the power-led drivers and take necessary initiatives to fulfil people's desires for sustainable development. Bangladesh has already shown its commitment to adopt several laws and policies in addressing environmental issues and concerns, but the ground enforcement is still not yielded any functional changes.

Chapter Six

UNDERLYING FACTORS FOR DIFFERENTIAL VULNERABILITIES AND RISK IN THE SOCIETY

6.0 Introduction

The previous chapter analyses power-led process and drivers of ecological changes that causes differential vulnerabilities and risks of disaster in south-west coastal areas of Bangladesh. This chapter is particularly identifying underlying factors of differential vulnerabilities and risks in the society. It examines the vulnerability and its underlying factors in line with three basic elements of PAR model, such as: i) root causes, ii) dynamic pressures; and iii) unsafe conditions. It provides an overview on how the root causes are contributing to placing a section of people to an unsafe condition and while they face hazard situation, it bears a risk situation for them. This section is strategically explored the coping inability of a section of people, who are always at risk of disaster situation in the society. The analysis strategically defines a set of actions/solutions that may have a significant contribution to releasing the pressure on people, who are at risk of disasters. It also explores knowledge gaps in the examination of vulnerabilities to disasters and failures in the application of the DM framework at different scales. At the end, the chapter has explored the proportionate vulnerabilities of people and places along with their risk tolerance level in study areas to find appropriate solutions for reducing the vulnerabilities and risks. The chapter strategically applied both primary (perception data) and secondary data/information to examine the ground realities and searching the answers of research queries under the statement-2 of the study.

6.1 Progression of vulnerability

The study examines a causal chain on the progression of vulnerability that forms a disaster situation. It has defined a set of linking causes of vulnerability that forces people to live in unsafe condition. If these unsafe people face any hazard, it occurs a disaster situation for them. It refers to an explanation that the people, who live in unsafe conditions have little ability to cope or reduce the risk of hazards. Wisner et. al (2004) noted the causation of vulnerability as the product of society. It is most prevalent in the south-west coastal area, where a section of people often faces economic inequalities, unequal power relations, inaccessibility to adaptive knowledge and welfare services and unusual social protection.

The situation forces them to live in risk areas of disaster. Placing of people in at-risk areas is not only affecting their ability but also limiting their survival means to face the situation (pre-disaster situation) and short recovery (post-disaster situation). So, social perspective is significant to examine the cassation of vulnerability in specific social groups and spaces.

The causal framework of vulnerability was initially developed by Blaikie et. al in 1994 and further updated by Wisner et al. in 2004. The framework is named as Pressure and Release (PAR) Model. It explains the progression of vulnerability as a central element in the occurrence of disasters. This model recognizes that the vulnerability of at-risk people transformed into unsafe conditions through root causes and dynamic pressures on one side and natural hazards puts pressure on at-risk people on another side that combinedly create a situation of disaster. As part of this model, the study applies the term 'root cause' to explore social, economic, and political forces. The term 'dynamic pressure' applies to explore the external forces in the causation of vulnerabilities and the 'unsafe condition' applies to explore a situation where the people live in an at-risk situation of disaster (Figure-74). The analysis assumes that the people have little or no control over the natural hazards, but the progression of vulnerability and the risk can be minimised through advancing people's ability. Considering that the study uses this model to assess the causal factors of vulnerability that leads to form a disaster situation in study areas.

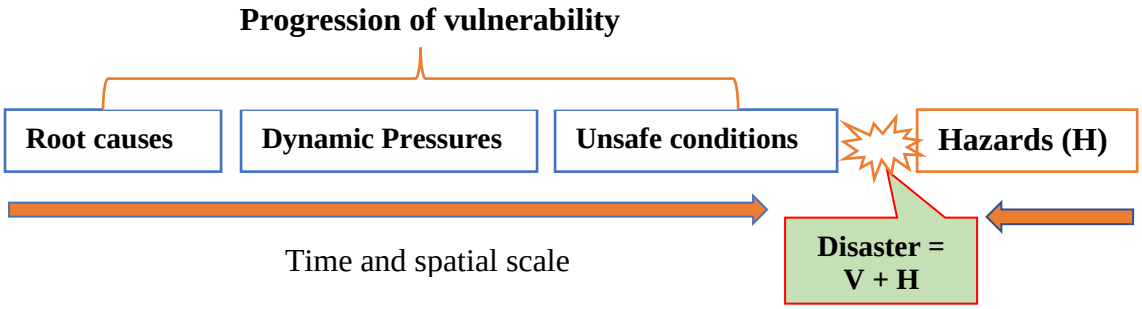


Figure-74: PAR Model (Source: Adapted from Wisner et al., 2004)

6.2 Application of the PAR Model

The study applied the PAR model to examine the causal grounds of vulnerabilities and their link with disasters in the south-west coastal areas in Bangladesh. The context includes Shyamnagar, Satkhira and Koyra, Khulna areas as case areas.

6.2.1 Mapping of the progression of vulnerability

The research systematically maps out the progression of vulnerabilities in line with functional processes and drives that create an uneven risk of people in coastal cyclone induced areas. The analysis of vulnerability considers three key elements:

A. Root Causes
B. Dynamic Pressures
C. Unsafe Conditions

A. Root Causes:

Root causes refer to a set of widespread and general, interrelated processes within the society that contributes to creating vulnerability for a group of people and places. The study identifies some root causes in the context of study areas, which are active to create vulnerability (Figure-75).

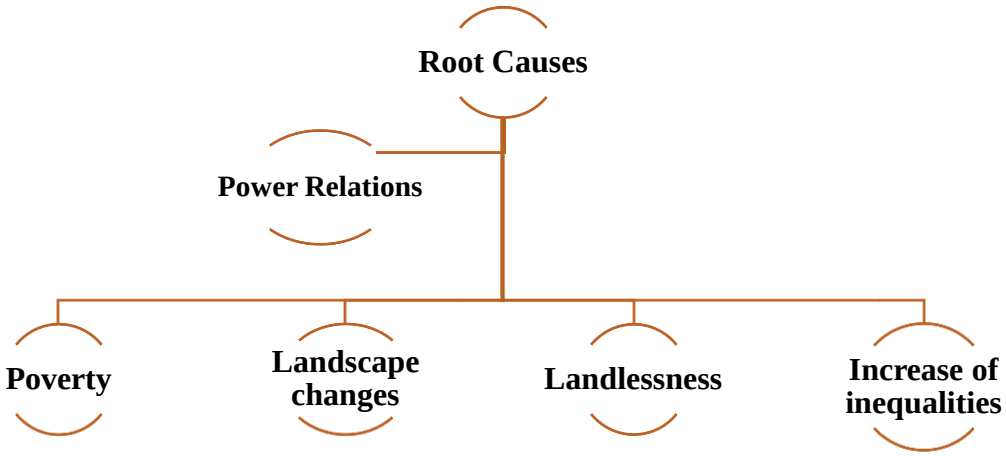


Figure-75: Mapping of the root causes of vulnerability (Source: Author).

I. Power Relations

The power relation is an important causal ground for creating differential vulnerabilities and risks in study areas. The local people in study areas claimed that local landlords and rich people are always gaining priority and privileges to use and control the local natural resources. According to people, approximately 60% of people are functionally poor, whereas only 10% of people as the rich group hold maximum resources and power in the social and political structures. It has created a clear social and economic class difference, where the landlords and powerful elites are placed at the top of the hierarchy. The local political leader and muscleman secured the mid-level, who are mostly and

narrowly used by the top level and the small farmer, poor and labour as a usual victim and taken in the lowest level of the system. The role of civil society is not always visible in raising the concerns of the people who are at risk and vulnerabilities. The people strongly noticed that the land-use changes and transformation of agricultural lands are the major concerns in the south-west coastal area, which made a negative impact on the livelihoods pattern of the small farmers. As a result, a large member of the labour and small farmer has migrated into city areas for safe and secure income. On the other hand, the landlord become more benefited and now they are taking mega projects for hybrid shrimps' cultivation with new technology.

II. Poverty

The study area is high poverty prone. It is reported that the proportion of poor is 55.2% and the extreme poor is 33.8% in Shyamnagar areas of Satkhira district[89], which is truly higher than the national status[90]. A similar trend is also defined in Koyra areas, where the proportion of poor is about 49.8% and extreme poor is 29.5%. The perception survey reveals that 73% of the households depended on the earning of single members in study areas. During the discussion, people noted that if the main breadwinner becomes sick or unable to work, the whole family have to struggle to manage minimum food requirements. The continuous forms of livelihood struggle forces to place them into the cycle of poverty. Poverty is an aggravating force to increase stress on the lives of a section of people. The frequent impact of climate induced disaster bears an extended stress of the people. UN reported that cyclone Sidr caused an economic loss of US$ 3 billion that has not recovered yet and it results in an increase of 5% poverty[91]. Before the cyclone Sidr and Aila, the people were mostly dependent on agriculture, but the economy of the people heavily changed over the years. The people are now depending on shrimp farming (including fishing), small scale agriculture, natural resource collection and wage labour activities that result in income inequalities in the society.

III. Landscape changes

In the south-west coastal area, a large section of people depends on agriculture and homestead cultivation before cyclone Sider and Aila. But due to a devastating cyclone (Cyclone Sidr and AILA), the agricultural lands were fully damaged. The cultivatable lands either inundated with saline water or loses its potentials to cultivate further.

[89] BBS, 2010
[90] The level of poverty was very high as 82.9% in 1973-74 that declined to 31.5% in 2010 and 22.4% in 2017 in Bangladesh
[91] UN study (Early Assessment Report on SIDR-2007) Report, Published in 2008

During the discussion, local people noted that cyclones destroyed more than 80% of animals (i.e., cows, goats, chickens, ducks). The remaining livestock was sold immediately after the cyclone at a reduced price to meet family needs. People denoted that the expansion of saline water made a negative impact on their traditional lives and livelihoods. As survival means, a section of influenced to transform their agricultural land for shrimp cultivation. This is not only creating food shortages but also limiting the production of fodder for the rearing of livestock in the study area. The changing practices are contributing to make the land and water more salter and creating the crisis of safe drinking water. The safe water crisis added pressure on women and girls as they are mainly responsible to collect it for the whole family. A section of women and girls have to walk long distance (max. 5 km) to collect safe water from the water points/sources. In average, they have to spend 4-5 hours a day to collect water. This results in drop out of the girls from school, increase of early marriages and sexual harassment in study area.

Figure-76 (a): January 2001

Figure-76 (b): November 2008

Figure-76 (c): March 2010

Figure-76 (c): November 2013

Figure-78 (d): April 2019

Figure-76 A (a, b, c and d): Land use changes in Dakhin Bedkashi Union, Koyra Upazila, Khulna (2001-2019)

The landscape of the Koyra area has been gradually changed over time. The analysis of four images during the last four different years (2001, 2010, 2013, 2019) based on satellite images of Dakshin Bedkashi Mauza in Koyra Upazila, Khulna reveals a clear change in the landscape. There are defined some areas that were used for agriculture totally transformed into shrimp and crab firms' farms after the cyclone Sidr and Aila (Figure-78 B). So, before cyclone Sidr (in 2007) and AILA (in 2009), a large section of the coastal land area was defined as agricultural land but after that most of the land areas transformed into land for shrimp cultivation due to inundation by saline water. This results in significant changes in the local ecology/ecosystem.

Figure-76 B (a): December 2002

Figure-76 (b): April 2013

Figure-76 (c): April 2013

Figure-76 B (a, b and c): Land use change (a): December 2002; (b) April 2013, and (c) March 2019

The land use satellite images of two different years (2002, 2013 and 2019) near Harinagar Bazar, Munshiganj Union of Shyamnagar Upazila reveals that as of December 2002, a large section of land areas ware used as agricultural land, but it was steadily changed and transformed into large scale shrimp and crab firms in 2013 and 2019 (Figure-80). The land-use change has already made a significant impact on local food production and local ecology/ecosystem.

During the discussion, Mr Babulal Munda (42) shared that:

> "*Most of the areas of Shyamnagar were used for paddy cultivation before but, after the introduction of shrimp culture in this region, some farmers have started to cultivate shrimp in their paddy field as it is more profitable than paddy cultivation. Other farmers got forced to start shrimp cultivation on their paddy fields as the salinity level increased in the surrounding areas of shrimp ponds. As a result, agricultural land got decreased over time and shrimp cultivation ponds increases*."

It has ensured from local sources that landlord is not more benefitted from the traditional agricultural system because, they shown an example that for 1 acre of land need a minimum of 45 labour per 6 months round a crop but for shrimps' cultivation, it is 10 acre of land or *Gher* need only 1 or 2 monthly salaried persons enough, a large number land was to 1 time or not cultivated due to lack of labour in a year-round. So, this is the point of discussion that landlords-imposed shrimps' cultivation as opposed to small farmers due to low labour and maximum profit. They broke the agricultural system by making *Gher* or shrimps' point, filling up saltwater by cutting inland waterway or canals from rivers. These saltwater rivers are blowing inside Sundarbans and connect with the Bay of Bengal in Bangladesh.

IV. Landlessness

Landlessness is one of the key drivers in study areas that forces a section of people to stay in the cycle of poverty, inequalities, and food insecurity. The national status shows that one-fourth of the country's farmer families are landless[92] but it is in a declining trend. The proportion of landless families, which was 12.84% in 2000 reduced to 7.84% in 2019. But the ground realities in stud areas are truly different. The agricultural land ownership data reveals that 43.31% of households in Shyamnagar[93] and 37.24% in Koyra[94] areas are functionally landless, which is on average is five times higher than the national status. The perception survey also revealed that 65% of families do not have their living and agricultural land, and most of them are living in *Khas* land and sides of the embankments.

Due to their existence, most of the families are dependent on irregular and daily labour-based work. Most of their family earnings go for managing daily foods for survival. The situation continues to their lifelong struggle and vulnerabilities.

V. Increase of inequalities

The ground realities of the study area revealed that a large section of people holds limited access to use natural resources, limited control over their resources and gains limited opportunities to use potential natural resources due to prevailing unequal power relations between rich and poor in the society. It caused a slow recovery of cyclone induced loss and damage to take a long-time to return to normal lives and livelihood activities and mostly return to informal employment. The struggle of a section of poor people to lead normal lives and livelihoods makes them reluctant to use their full potential and capacity. They hold only attention to survive. The powerful and elite groups always take the benefits or advantages of this situation, where the poor people are unable to use their voice and control. The survival mindset of a section of people in coastal cyclone induced areas rarely allows them to do savings, proper housing, education and leading of life with rights and social respect. The situation has been transformed from generation to generation and there is no end to their struggle.

During the discussion, the people noted that the area was socially and culturally less vulnerable when they were involved in agriculture. They reported that agriculture is la labour, and crops based eco-system in which all the year-round engaged in different activities. And it was very common even 25 years ago in the area, but now it is a diverse situation due to imposing shrimps' cultivation for more profit maximization. Local

[92] Bangladesh Bureau of Statistics (BBS) on Agriculture Census 2019.
[93] Shyamnagar Upazila - Banglapedia
[94] Koyra Upazila - Banglapedia

landlords, politically powerful people, policymakers, and some Government officials were open shrimp's cultivation first then they forcibly imposed others and now small farmers became more vulnerable. It is fact that small farmers, general people, and civil society were organized to protest the shrimp's cultivation and induction of saltwater breaking agricultural system. But they were failing due to high pressure from the powerful, local authorities and shrimp business owners. The failures of protest ultimately result in the transformation of agricultural land into *Gher* or shrimps' points, and then a large number of local labourers becomes unemployed and migrated to city areas for better livelihood. The natural ecosystem has broken due to the induction of saltwater, average plant size is very low compared to other sweet water lands. The local people also noticed that shrimp cultivation contributes to increasing inequalities and generates a power imbalance in the society where the poor becomes the poorest due to loss of their cultivable lands, loss of agricultural production and labour-driven livelihoods in the study area.

B. Dynamic Pressures

The study has revealed in the previous chapter that a clear gap in applications of existing environmental and disaster acts and policies by the assigned institutions. The gaps result in unplanned land management and development in the coastal cyclone induced areas to extend the pressure on people and places (Figure-77).

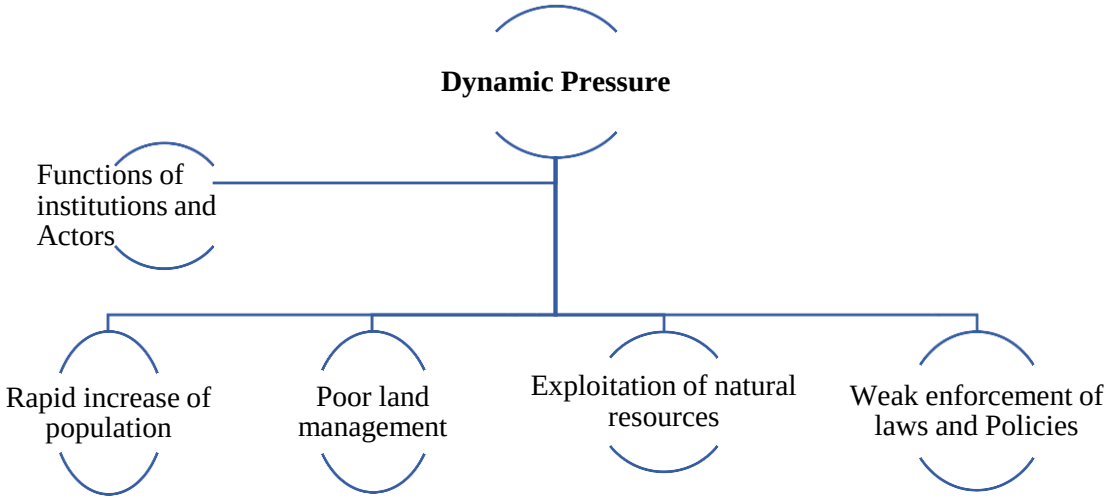


Figure-77: Dynamic pressure of vulnerability in the study areas
(Source: Author)

I. Functions of institutions and Actors

The function of institutions and actors is very important in the shaping of people's vulnerabilities in study areas. It is fact that State holds the prime responsibility to reinforce the implementation of environmental rules, acts, and policies for better management of environmental problems and resources in Bangladesh. There is a serious lacking in coordination among the state institutions and actors. The powerful actors are taking advantage of this lacking and gaining the maximum benefits through the uses and extraction of natural resources. The state institutions are still considering natural resources as a means of the political and economic entity rather than giving more attention on environmental conservation. This kind of mindset has made a significant contribution to making the private sectors (business actors) most powerful than others. According to people, the business institutions, and actors to some extent exercise more power than state institutions. It means that State institutions have limited control and influence on the use of environmental resources that are mostly used by the powerful business actors for their economic gains. Though the grassroots actors have a limited role, they have strong linkages with the changing process of environment and ecology of an area. In the context of south-west coastal areas, the poor people who are mostly dependent on small-scale agriculture and collection of natural resources are also contributing to local ecological change for their survival. But the maximum resource benefits always go in favour of the rich and powerful business actors, who used the poor as agricultural labour or resource collectors. As a function of the State, the government has adopted several acts and policies in addressing environmental challenges and disasters. But the functions of assigned institutions and authorities are not yet yielded good results in the management of the ecological system and its productivity in the context of south-west coastal areas of Bangladesh. It is now heavily disturbed by human-induced actions.

It has been observed that the poor and landless people have very limited access to information and services due to their existence in isolated and hazard-prone coastal areas. The state-led service institutions are mostly based in Upazila level and easily accessible to rich people and landlords, who are mainly located near to Upazila and district. A section of people who lives outside of embankment and at-risk coastal areas are mostly poor and vulnerable because they don't have regular income and livelihood options. They bear life-long sufferings at all forms of disasters. The local institutions and actors are not enough to support this segment of the population. During the discussion, a group of poor people outside of the embankment (Shyamnagar Upazila) claimed that:

> *All the services are available for the rich and powerful people, we always face negligence of the local officials, while we seek their support and services.*

Therefore, the differential access to services and opportunities to gain the benefits of development extended the struggle of a section of people to survive.

II. Rapid increase of population

The increase of population is also playing an important role in changing of landscape and ecology. The increase of population increase in Koyra is higher than in the Shyamnagar areas. From 1974 to 2011, a total of 102,596 population increased in Koyra areas whereas it is 122,033 in Shyamnagar areas. During this time, the rate of population increase is almost double in Koyra areas (Figure-78).

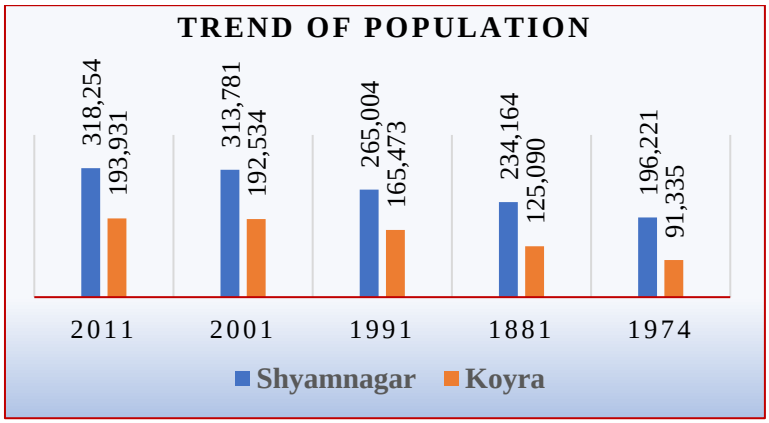


Figure-78: The increase of population in the study area (Source: BBS, 2011)

But more than 94% of the population in both areas are located in rural areas, which are mostly dependent on land and labour based economic activities. Due to the prevalence of a high proportion of landlessness and poverty, a large section of people in study area are struggling to earn a regular income and alternative livelihood options for their survival. As they do not have sufficient savings and family resources, they have to face difficulties to cope with the frequent impact of climate induced disasters. This has been creating social and economic inequalities and forcing the poor to live in a situation of lifelong poverty and struggle. The changing context of inequalities generates a section of rich and elite groups in the society, who have more access and control over the local resources and decisions for development.

III. Poor land management

The land management system is very poor in Bangladesh as well as south-west coastal areas. Land grabbing by powerful actors is seen as a common phenomenon. They are not only capturing the land of poor people but also grabbing the public lands with false documents with the illegal assistance of the officials of land administration. They always take the advantage of poor land management to maximize their benefits. During the discussion, poor people noticed that the rich and powerful people have strong linkages with the local authorities and political leaders. They often use their political links in grabbing land and to some extent, they create mental pressure on the poor families. It is sometimes transforming into land conflicts and violence, where the poor people permanently lose their land. This is the main reason for generating a high proportion of landless families in both the Shyamnagar and Koyra areas. The causal grounds are functional in study areas that result in the existence of five times higher landless population than the national rate. The situation is becoming worse than placing a section of poor and landless people to live within an unsafe condition.

IV. Exploitation of natural resources

The poor and landless people are mostly dependent on the land and labour-based activities that bear their irregular and low income. If they face struggling to survive, they often take advance money from the money lenders or landlords to cope and recover from the vulnerable situation. If they are unable to repay the debt amount it extends their sufferings for a long period. They are often used as bonded labour or resource collectors by the landlords or moneylenders in coastal areas. In such a situation, they have no voice or choice to consider concerns of environment and ecosystem. It never gives them any space to overcome but extend their vulnerabilities from generation to generation. The poor and extremely poor people usually enter the forest ecosystem to collect resource collectors but gain minor financial benefits. It is fact that they generally work as wage labourers for big merchants, who generally do not come to the front, but prefer to manage things behind the scenes. The continuous human pressure on natural resources in coastal and forest (Sundarban) areas made a significant contribution to the declination of ecosystem services. It is the results of increasing local demands and profit gaining interventions of powerful/rich actors that create an imbalance in the natural system, trigger acceleration in resource degradation, and change the coastal ecology. The people realise their roles in changing the local ecosystem but demand the responsive role of state institutions and actors is very important to support the poor and extremely poor families with regular or alternative livelihood options.

V. Weak enforcement of laws and Policies

Bangladesh has adopted several acts and policies in line with the guiding principles of the UN Conferences on the Human Environment (held in Stockholm, Sweden in 1972) and the Earth Summits (held in Rio De Janerio in 1992) to address disasters and the environment. In order to implement these laws and policies, the government has established an intuitional framework at the national and local levels. But the reality is that the functional implementation of adopted laws and policies by the assigned institutions and authorities still has not yielded visible results in addressing the risk of increasing environmental hazards. There is defined a clear coordination gap among the assigned institutions and authorities that results in delaying of their responses. The non-functional role of the assigned institutions in south-west coastal areas is encouraging the powerful actors to continue illegal extraction of natural resources for maximizing their economic gains. Though the powerful people used the poor and landless people in the extraction of natural resources, the rich and powerful actors captured the maximum benefits. This results in declining of local ecosystem services (i.e., Sundarban-based ecosystem services), where the poor become the main loser.

Besides, the poor people are not well informed about the directions of the environmental laws and policies. The analysis of people's perception in the study area revealed that only 11% of people have a minimum understanding of the Environmental Conservation Act, while 77% do not have any ideas about this Act. The findings denoted that the resource collectors and the pollutes or beneficiary groups both have no understanding of the environmental laws. In this case, the assigned institutions and authorities can't avoid their responsibilities to make the people well informed and alert on the environmental impact.

C. Unsafe condition

The unsafe condition has been created as a result of natural and human interventions in south-west coastal areas (Figure-79). The natural condition drives by the geographic location and its functional natural system, while the human natural interventions with the human settlement & displacement, inadequate response to tackle disaster situations and uneven distribution of risk among the population. It is created a situation, where the poor people show their inability to cope with their life-long vulnerabilities and it forces them to be the victim of disasters.

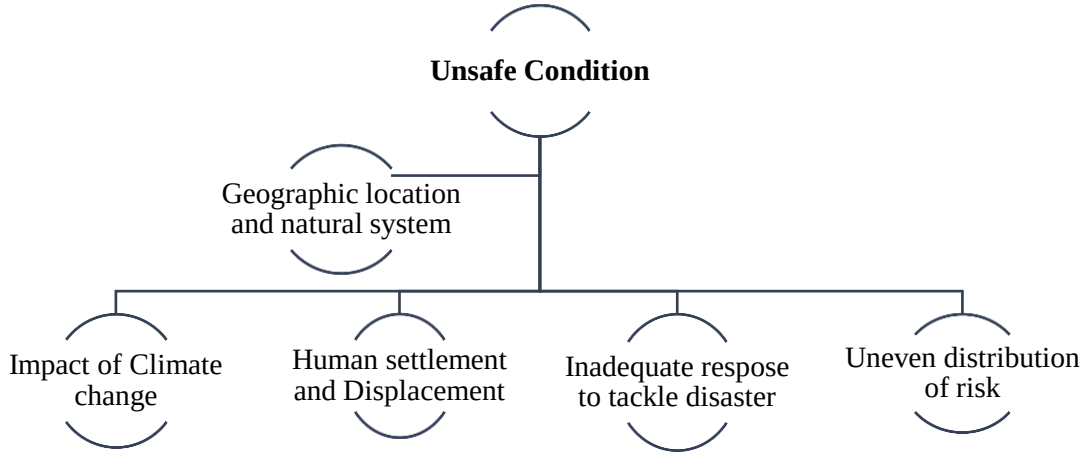


Figure-79: Unsafe conditions for vulnerability (Source: Author).

I. Geographic location and natural system

The south-west coastal area of Bangladesh is defined as low lying tidally active area. The land elevation of this area is three to five meters above sea level. The World Bank (2012) estimated that 62% of coastal land has an elevation of up to 3 meters and 83% up to 5 meters above sea level. The area is an integral part of matured and tidally active delta[95] that is bordered by West Bengal in the West, Sundarban in the north and an active delta in the East. Hence, the study area is located in the matured part of the delta in the south-west coastal area. The area captures the water flow of 16 rivers, but most are unable to carry enough water discharge from the upstream areas in the dry season. The *Farrakka* barrage is controlling the distribution of upstream water but limits the water flow to downstream areas through the Ganges River (Figure- 80). The reduction of water flow to the downstream areas has made an impact on the lives and livelihood of the coastal people. The sedimentation as an effect of high tide in coastal areas is also contributing to fill the riverbed areas and making the river slowly die. The delta formation process is not active in south-west coastal areas but the effect of tidal water causing senility intrusion. It results in a lowering of agricultural food production in this area.

Due to geographic position and the functions of the natural system, the south-west coastal area is highly vulnerable to climate-induced disasters. The people in south-west coastal areas are facing frequent natural hazards, particularly the cyclones, salinity intrusion, tidal surges, and waterlogging that have a potential negative impact on their lives and livelihoods. A large section of people, who are poor and landless are unable

[95] Deltaic floodplains development and wetland ecosystems management in the Ganges–Brahmaputra–Meghna Rivers Delta in Bangladesh | SpringerLink

to cope with the frequent impact of natural hazards and climate change. It generates an unsafe condition for this segment of the population (Figure-81).

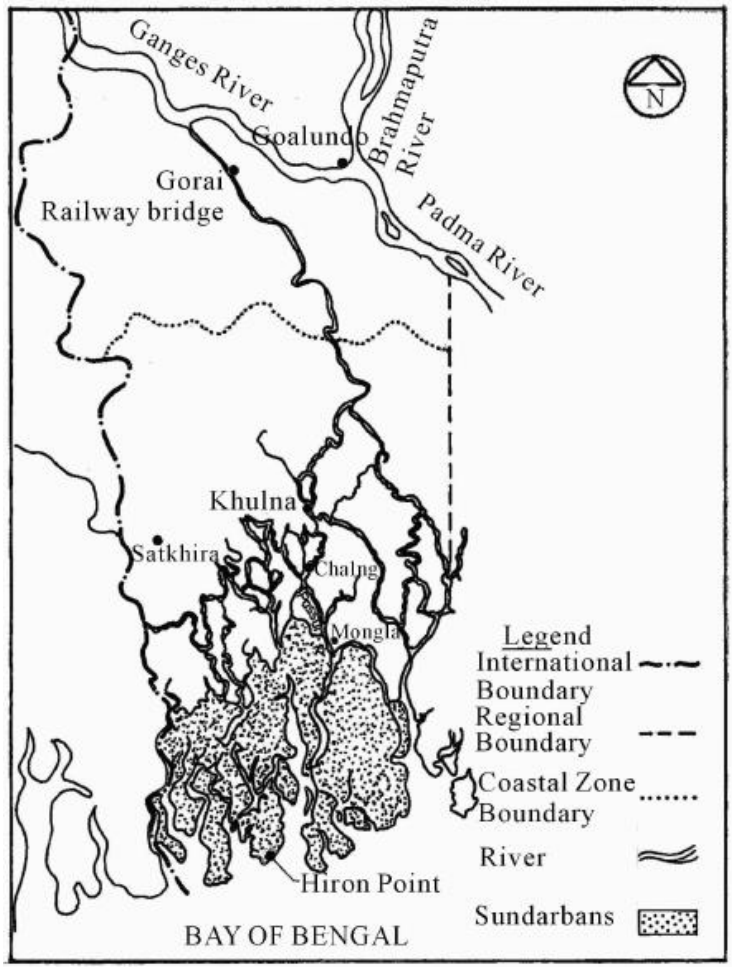


Figure-80: The impact of Farrakka on river system in the south-west coastal area (Source: Adapted from S. Mondal et.al., 2012**)**

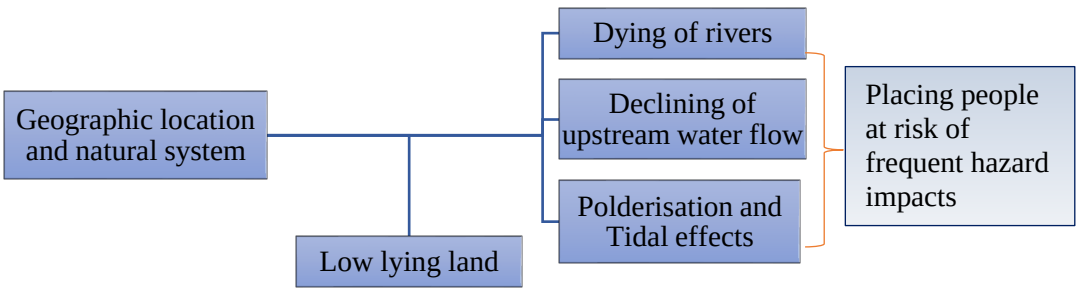


Figure-81: Causal links of geographic location and natural system with an unsafe condition (Source: Author)

II. Climate change

The impact of climate change is visible in south-west coastal areas. It changes the normal condition of nature and underpins the frequency of environmental hazards. From 2007 to 2020, the area was hit by seven (7) major cyclones accompanied by tidal surges. In particular, the cyclone Sidr (in 2007) and AILA (in 2009) were the most devastating. As refence, the cyclone Sidr caused the death of 3406 people and affected 2.3 million households, whereas the cyclone AILA caused the death of 190 people and made 500,000 people homeless. Climate change is reinforcing environmental hazards and extending the struggle of the poor to survive in the changing situation. The people noted that they are facing mental stress and health problems due to the reduction of food production, safe water crisis and irregular livelihood options in their areas. The changing context forces a section of poor people to live in unsafe condition.

Besides, a visible change is observed in reduction of agricultural production in south-west coastal areas. The increase of salinity in the soil and water along with changes in seasonal temperature and rainfall patterns has a potentially negative effect on food production. The sea level rises also contribute to the entering of saline water in south-west coastal areas that have created a safe drinking water crisis. Safe water is now a serious concern of the people. It has been observed that women are taking the additional burden to collect safe drinking water for the whole family, which is far from their houses. The breakdown of coastal embalmment due to cyclones and regular entering of saline water for shrimp farming is also contributing to damage to the sources of freshwater that extending safe water crisis of the people in study areas. There is another reality that the salinity intrusion is forcing the small farmers to change their agricultural land into shrimp firms, but it requires a high cost of capital inputs. The rich and large shrimp firm owners take advantage of this situation to use or grab their land for commercial shrimp farming, where the small farmers permanently lose their food production. It means that climate change has long-term ecological impacts due to the transformation of agricultural land into shrimp farms. It is also destroying small-scale agriculture, homestead vegetation, local ecosystem, and biodiversity that ultimately forces a section of poor people to live with vulnerability and risk.

III. Human Settlement and Displacement

The increasing pressure of population on South-west coastal areas results in extension of human settlement. It is largely contributing to the declining homestead and agricultural land of the households. The analysis of households' characteristics revealed that more than 80% in study areas uses *Katcha* houses and only 28.85% of households use sanitary latrines that reflects their socio-economic status. A large section of these households lives in at-risk areas of natural hazards. As the study area is highly

vulnerable to face climate induced hazards, it bears severe losses and damages of the people. This results in their displacement or migration. Both the pull and push factors are functional here to force or encourage the people in the process of displacement.

It has been observed that the gradual declination of livelihood options, ecosystem services, increase of safe drinking water crisis and frequent impact of environmental hazards made significant contributions to reinforcing the process of human displacement in study areas. In the cases of livelihood struggle, mostly male members of the households temporarily migrate to the nearest areas (including city) and a few months later they return to their households. But the people, who lost their land and family resources due to the impact of disasters mostly migrate to other areas. A section of landless people in study areas is displaced and resettled on the embankment and roadsides for their survival. The reality is that all forms of migration and displacement bear disproportionate sufferings and risks for women and children.

IV. Failures to tackle disasters

The response mechanism of disasters is mainly operating at the time of early, during and post-disaster situations. The early warning system in coastal areas is very much functional due to the active role of community volunteers and Union DRR committees. This is truly reflected in the perception of people, whereas 90% of people in Shyamnagar and 79% in Koyra areas were informed about the early warning of the cyclones (Figure-82). But the reality is that only 8% of people in the Shyamnagar area and 20% in the Koyra areas recognises the support initiatives of the local political/elected leaders (Table-31). Due to non-responsive support initiatives of the local political/elected leaders, 90% of people in the Shyamnagar areas and 77% of people in the Koyra areas noted the lack of transparency in the implementation of their commitment to people. A large section of people in study areas believes that disaster impact is part of their regular life due to the influential role of the local political/elected representatives in local decisions and resource management.

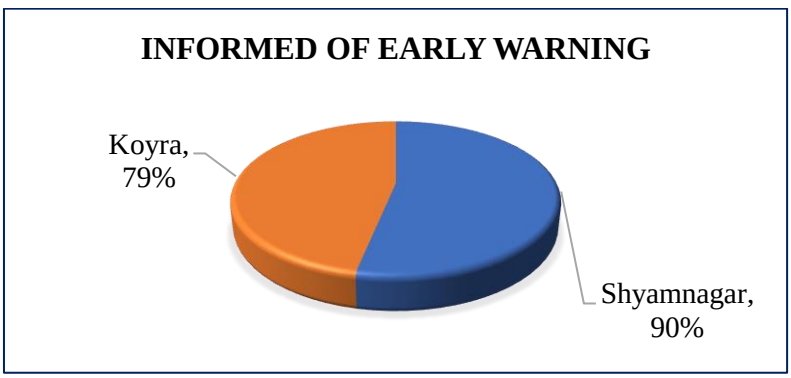


Figure-82: Recipients of early warning information

(Source: Perception survey, 2020)

Table-31: Recognizes the support initiatives of the local elected representatives/leaders.

Responses	Shyamnagar	Koyra
Yes	8	20
No	82	70
Do not know	10	10

Source: Perception survey, 2020

The perception of people reveals that pre-disaster mechanisms are effective but during and post-disaster response initiatives are not adequate to comply with the needs and requirements of the people and places that contribute to extended disaster situations.

V. Uneven distribution of risk

The changing climate situation has made a negative impact on their natural resource-based income and production that forcing a section of people to live with irregular and uncertain income. Despite this situation, the landlords and rich people continuously gain economic benefits through the accumulation of resources that widening inequalities between the rich and poor in society. It is also defined that July to October (4-months) is the most insecure month for the coastal poor people when they face serious food insecurity to survive. As a survival mechanism, a large section of poor families usually takes loans from local money lenders or landlords. The local money lenders/landlords are always taking the advantage of this situation, where they strongly guide the decision, access, and controls of poor people's livelihoods. A section of poor people are functionally displaced from their inhabitants and most of them live on or outside of the coastal embankment, where they are usually exposed to natural hazards. During the field visit, it is observed that more than 60% of poor people live in areas of high risk of cyclones, tidal surges, and salinity. But the rich and powerful people (landlords and money lenders) live in *pucca* houses in the city or near to city areas (Upazila), where gain available information and services. Due to their existence in a safe location, they are rarely exposed to natural hazards. During the discussion, local people noticed that more than 65% of people's death or injury occurred in the cases of poor and extremely poor families in coastal cyclone induced areas.

On the other hand, the houses of poor people were constructed with straw/leaves, bamboo, and temporary materials (*Katcha*) that we're unable to protect them from the force of cyclones and tidal surges in coastal areas. The roads are not well developed as most of the places are not officially designed for human habitat. As they are located in the front lines of coastal natural hazards, they always live at risk with limited or no access to information, protection, and services. According to information, the government has constructed a total of 126 cyclone shelters in Khulna district and 82

cyclone shelters in Satkhira district, wherein an average of 1600 people can take shelter at the time of natural hazards. The capacity of cyclone shelters is not enough compared to the people who live in catchment areas of cyclone shelters. The poor people noticed the long-distance cyclone shelter. Only a small number of people can take shelter at the time of a cyclone, but the majority need to search other locations. A participant recalled the situation of the last devastating cyclone:

> *We realized the difficulties of the last two major cyclones (i.e., cyclone Sidr in 2007 and AILA in 2009) that damage lives and family resources because of late warnings, lack of enough cyclone shelter and long-distance cyclone shelter.*

A section of local people does not have enough information about the cyclone shelters. Even they do not know, who are the most priority people to reach at the cyclone shelter at first. The people explored that the water sources in coastal areas are contaminated by saline intrusion and poor sanitation systems that extend the struggle of a large section of people to manage safe drinking water for their survival. Some people are found using supply water or filter water that mostly uses Pond Sand Filter (PSF). But the people in remote areas use pond water for drinking and other purposes. As a result, poor people usually face waterborne diseases and health problems as a result of water and food crises in coastal areas. The officials of the local government noted that they have a formal UDMC[96] but not enough functional at the pre-hazards time. The reality is that about 60% of people do not know about the functions of UDMC in cyclone induced areas. It refers to gaps in the functions of local institutions and DM structures in addressing hazards preparedness at the grassroots level. All of these have a combined effect on the poor people to keep them in an unsafe condition, where they have limited or no ability to cope with any external destructive events (Figure-83).

[96] UDMC means Union Disaster Management Committee

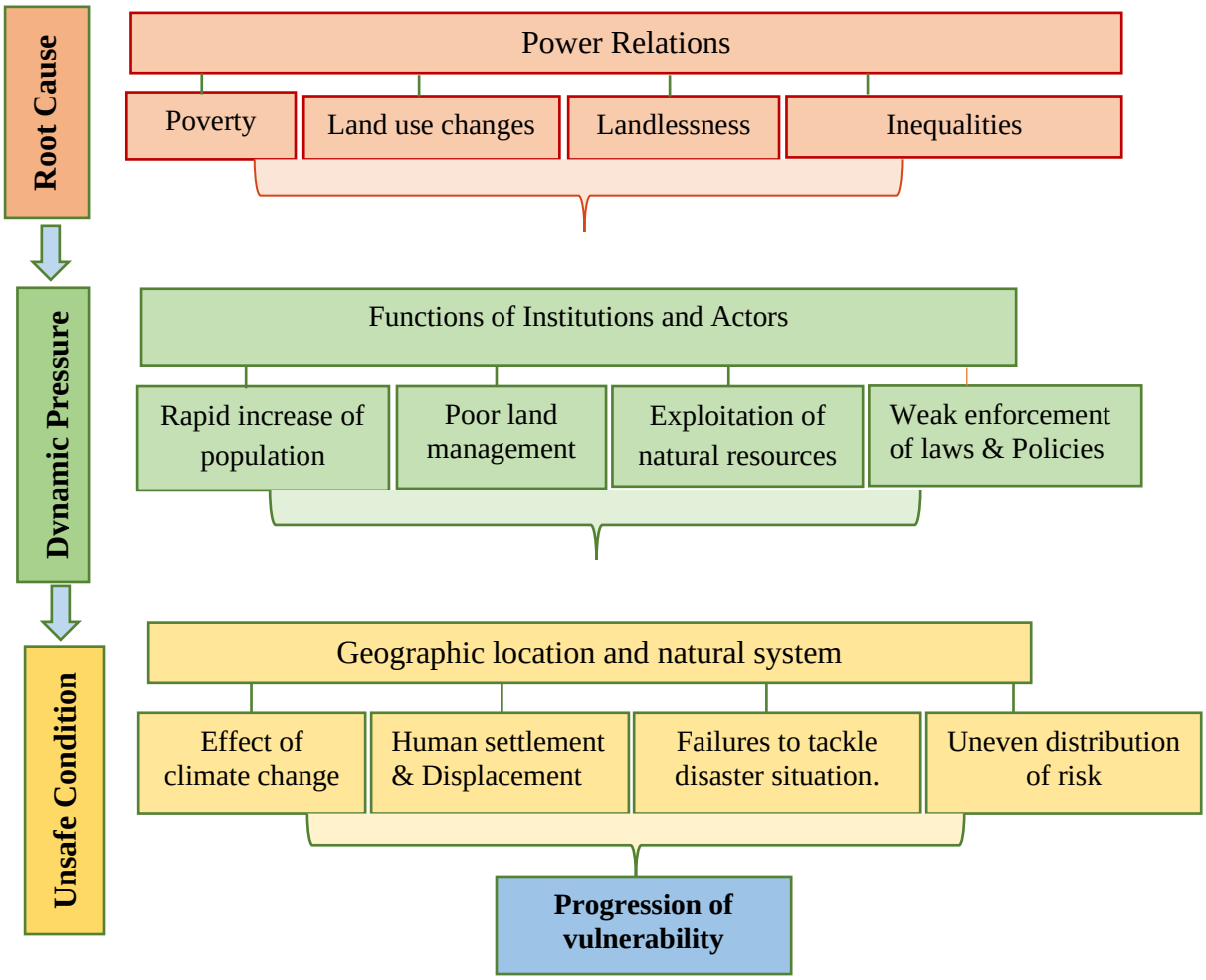


Figure-83: The overall linkages and transformation of the root causes to an unsafe condition (Source: Author).

Hazards

The people located in south-west coastal areas face several hazards. According to people, cyclone, salinity intrusion, tidal surge, waterlogging, and climate change are the most visible natural hazards in study areas that has a severe impact on their lives and livelihoods (Figure-84). During hazard, a section of people shows their inability to survive in the changing situation that pushes them to stay at risk of disaster.

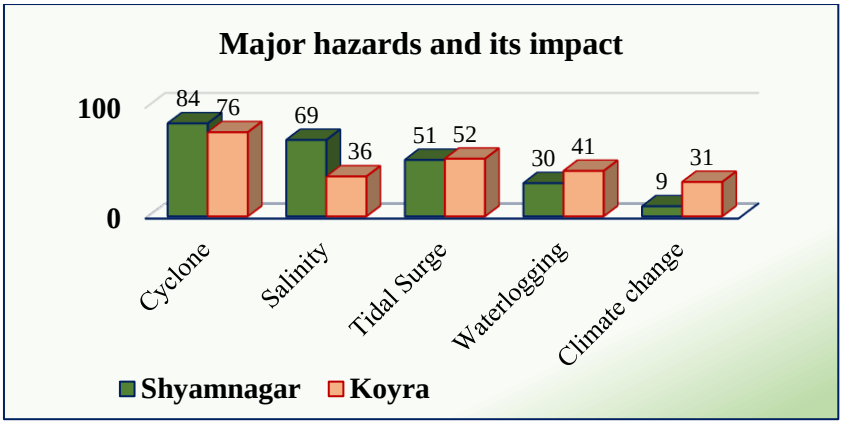


Figure-84: Major hazards and their impact (Source: Author)

The analysis of local hazards revealed that the frequency and damages of the cyclone are comparatively higher than others. The loss and damages of the cyclone and other hazards mostly depends on their location and ability to cope with the situation. It has been observed that a large section of poor and extremely poor people, who lives in the frontline of cyclone areas, are exposed to cyclone and inability to cope with the hazard's situation are the main victims of the disaster.

As key findings, the study demonstrates a set of causal factors that forces the progression of vulnerabilities that occurs a disaster situation in south-west coastal areas of Bangladesh (Figure-85).

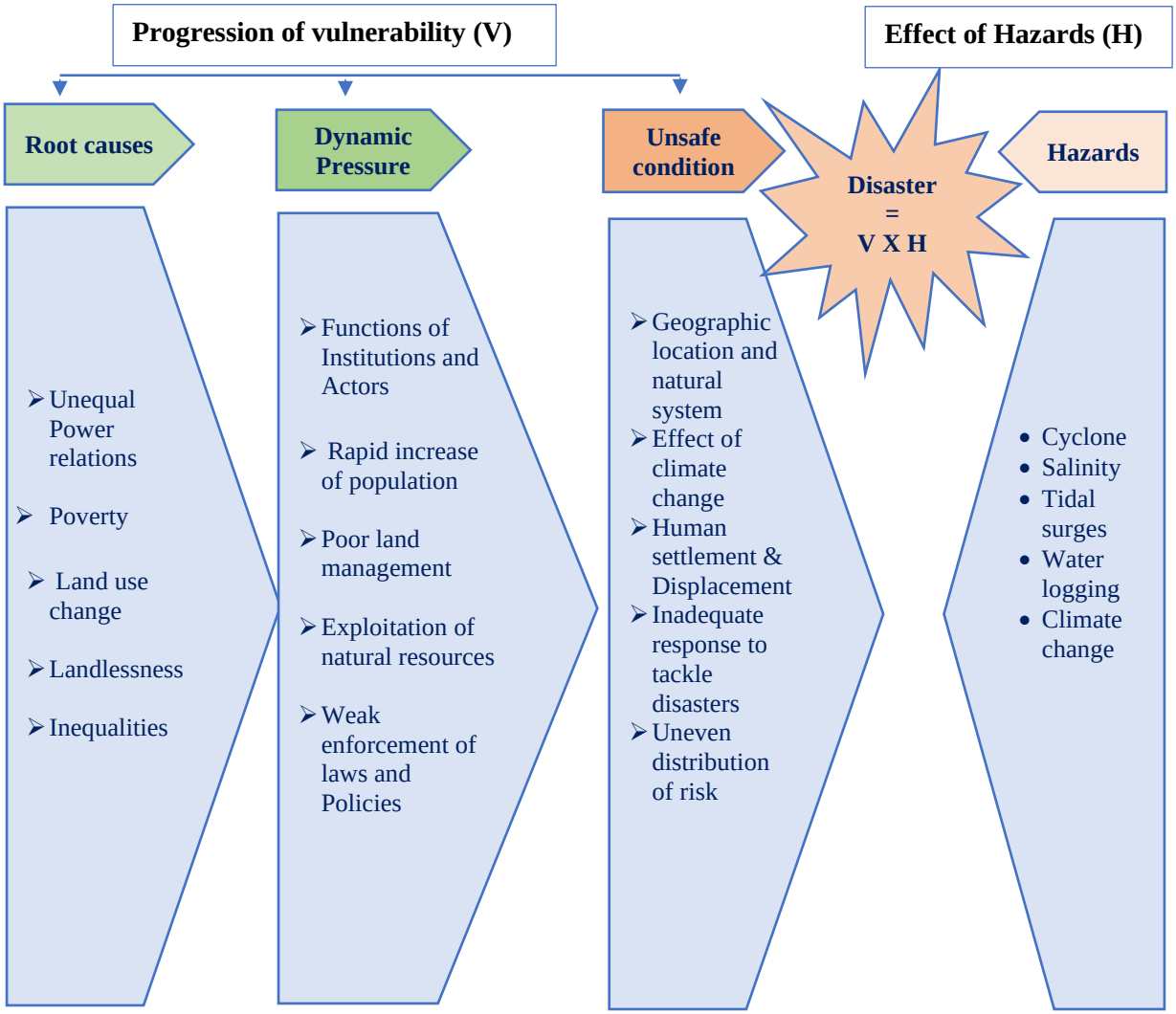


Figure-85: Mapping of the progression of vulnerability in the study area
(Source: Applied the frame of PAR model, Wisner et al., 2004)

6.2.2 Mapping of the release of vulnerability

The study has successfully defined several issues and actions that may contribute to releasing people's vulnerability. These are as follows:

- ***Release of the root causes***
  The actions for the release of root causes are as follows:

Root causes	Actions for Release of the root causes
1. Unequal power relations	• Enhance poor people's access to use local resources. • Develop leadership among the poor so that they can deal with their problems/concerns. • Increase participation of the poor in the local decisions and resource management. • Create space for interactions
2. Poverty	• Explore alternative livelihood options and opportunities for the poor families. • Inclusive poverty reduction and resilience development strategy
3. Land use change	• Appropriate land use planning for shrimp farming • Introduce saline sensitive agriculture.
4. Landlessness	• Proper land management and better governance • Allocation of *Khas* land for the landless families
5. Inequalities	• Legal/policy reformation for reducing the income gaps between the rich and poor in the society. • Strengthen the coverage of the social protection Programme. • Improve the quality of life and alternative livelihood options for at-risk populations.

- **Release of dynamic pressure**
  The actions for the release of dynamic pressure are as follows:

Dynamic pressure	Actions for Release of the dynamic pressure
1. Functions of Institutions and Actors	• Strengthen capacity and performance of assigned institutions and actors. • State initiative to monitor the performance of the institutions and actors

2. Rapid increase of population	• Increase people's awareness on family planning and health concerns of more children. • State initiatives to reduce the rapid increase of population.
3. Poor land management	• State initiatives to reform the existing land laws and policies. • Area-based mapping of landless households • Ensure proper distribution Govt owned Khas land to the real landless for their survival
4. Exploitation of natural resources	• Introduce the best possible livelihood options and opportunities for the poor people, who are used as natural resource collectors and harvesters. • Introduce special schemes for reducing the financial dependency of the poor on local landlords and money lenders
5. Weak enforcement of laws and Policies	• Define the challenges in the application of laws and policies. • Strengthen the institutions and actors. • Regular community feedback or interactive dialogues on assessing the performance of assigned institutions and authorities

- **Create a safe condition**
  The actions for the release of unsafe conditions are as follows:

Dynamic pressure	Actions for Release of the unsafe condition
1. Geographic location and natural system	• Extend national and regional cooperation to continue the natural flow of major rivers in South-west coastal areas (upstream to downstream areas) • Functional engagement of state institutions and grassroots actors to restore the natural system.
2. Impact of climate change	• State initiatives for introducing climate-resilient livelihoods and development. • Strengthen adaptive social protection for the at-risk people • Better engagement of the local community in climate actions

3. Human settlement & Displacement	• Support to strengthen the economic ability of the poor households. • Special actions for the poor on recovery of their disaster impacts • Allocation of alternative living space for the displaced people/households (by natural hazards)
4. Failures to tackle disaster situation	• Undertake timely recovery initiatives. • Develop more shelter and safe places for the disaster affected people
5. Uneven distribution of risk	• Improve the quality of life and alternative livelihoods options for at-risk populations. • More engagement of the poor and extremely poor in local development initiatives • Develop social institutions for responsive, equitable and non-discriminatory society. • Support to an inclusive and uniform development

- **Reducing the Risk of Hazards**

  The actions for reducing the risk of natural hazards are as follows:

Natural hazards	Actions for reducing the risk of hazards
• Cyclone • Salinity • Tidal surges • Waterlogging	• Improve multi-hazard mapping and cyclone early warning system. • Increase the coverage of people under the early warning system. • Rebuild the coastal embankment and introduce tree plantation. • Timely disaster response and recovery initiatives of the state institutions and actors • Introduce proper land use planning. • State initiatives for increasing river water discharge from upstream to downstream areas. • Sensitization and better engagement of state institutions, actors, and the local community in the application of DRR approaches. • Special initiatives for developing safe spaces in coastal hazards prone areas.

6.3 Mapping of the vulnerable area and risk population

In Bangladesh, there is a reality that people cannot live with zero vulnerability and risk in our social endeavour. Wisner et. al (2004) noted that vulnerability is solely a product of society. Realising this, the study has defined the proportional vulnerability based on area and population in the context of south-west coastal areas of Bangladesh. The analysis used the remote sensing mapping data (i.e., remote sensing image of cyclone Aila, 2009) and census information to define the proportional vulnerability.

Proportional vulnerability

The study examines the most vulnerable areas and population in the context of coastal cyclone induced areas (Aila, 2009 affected area). The proportional vulnerable area has been defined through the Landsat 8 image that was captured just after the Aila, 2009 in the context of Shyamnagar and Koyra Upazila (Figure-86). The findings revealed a total of 457.031 sq. km and 265.608 land areas (the calculated area excludes the water body and Sundarban area). Of the total land area, 14.79% at Shyamnagar and 29.13% at Koyra Upazila were fully inundated by cyclone induced floodwater (Table-32), which are defined as at-risk areas.

Table-32: Cyclone Aila induced inundated area at Shyamnagar and Koyra

Upazila	Area (sq. km.)	Flooded Area (sq. km)	% of inundated area
Shyamanagr	457.031	67.574	14.79
Koyra	265.608	77.359	29.13

Source: Calculated from the Remote sensing mapping data (Cyclone Aila-2009).

Besides, the proportionate vulnerability of the population has been calculated in terms of inundated/affected population as a result of cyclone Aila 2009. The result has defined approximately 47, 055 people in Shyamnagar and 56,483 people in Koyra areas as a vulnerable population. The study has applied the following equation in defining the proportionate vulnerability of the population:

$$\mathbf{V} = \frac{\mathbf{q}}{\mathbf{n}}$$

q = Proportion of population inundated/affected area
n = Total population
V = Proportionate vulnerability

The study also made a comparison of vulnerability and vulnerable population in the context of the most recent cyclone Amman (in 2020). The status denoted that out of a total 457.031 sq. km area in Shyamnagar Upazila and 265.608 sq. km in Koyra Upazila, 8.92% (40.77 sq. km) and 11.69% (31.05 sq. km) areas accordingly fully inundated with the effect of cyclone induced floodwater. The inundation made 28,643 people and 23,272 people a vulnerable population in study areas. The mapping of vulnerable areas and the population is important to take comprehensive actions for resilient development in south-west coastal areas (Figure:86-89).

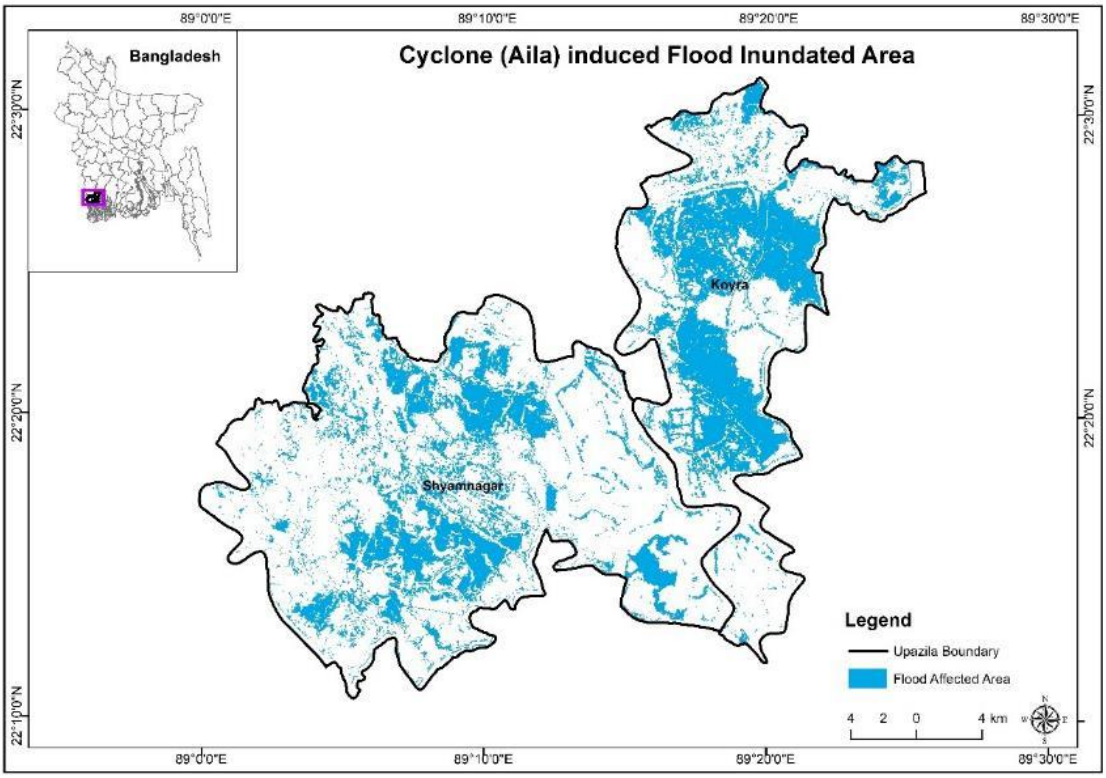


Figure-86: Cyclone (Aila, 2009) induced flood inundated area (Source: Author)

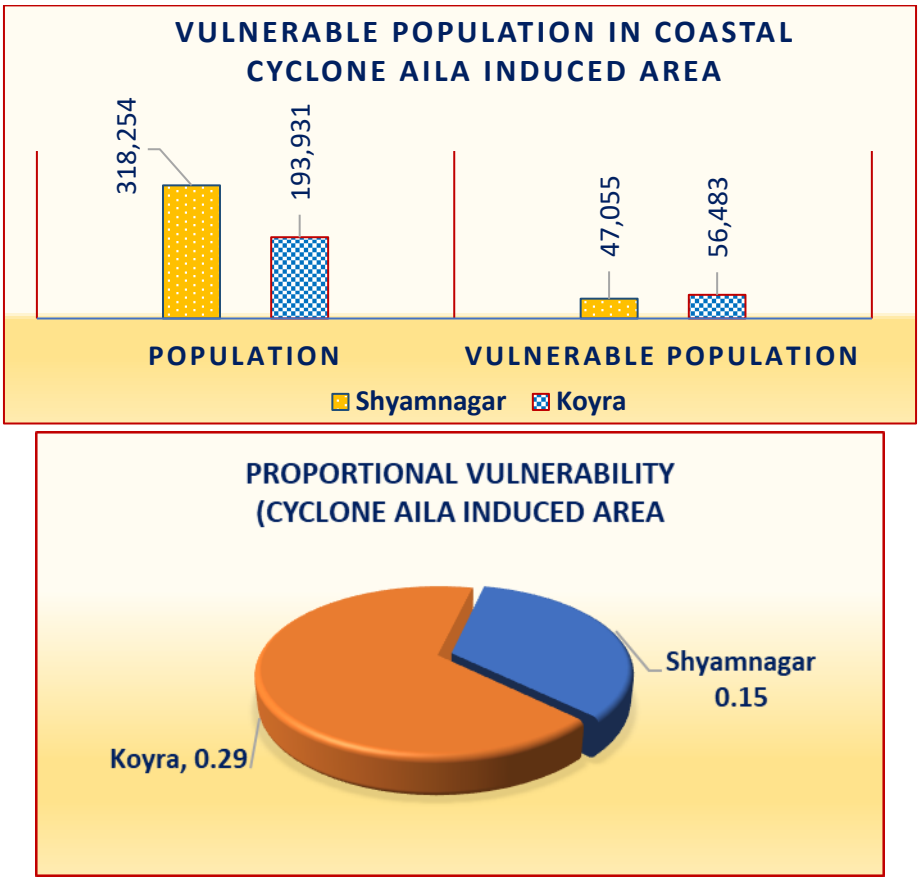


Figure-87: Proportional vulnerability in cyclone AILA induced area.
(Source: Author)

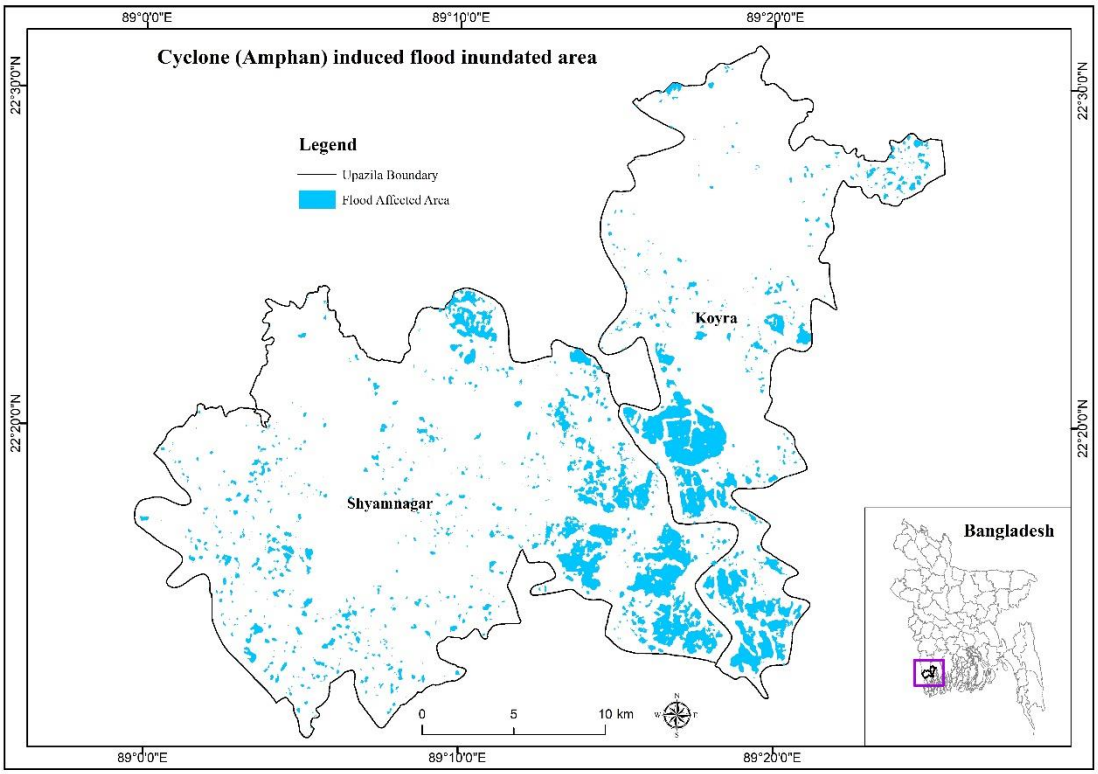
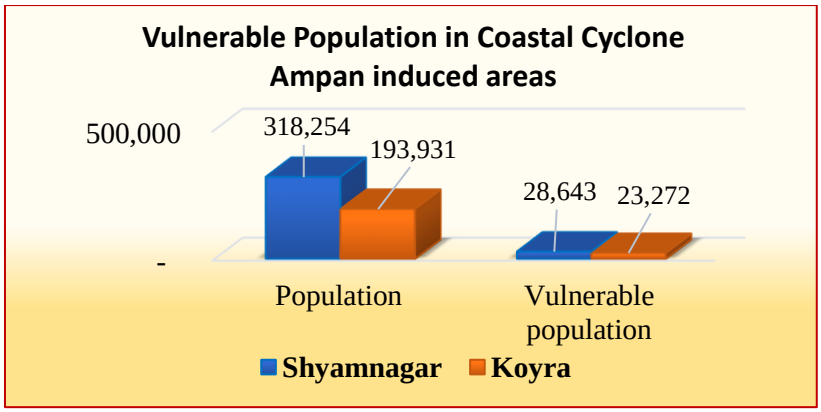


Figure-88: Cyclone (Ampan, 2020) induced flood inundated area (Source: Author)



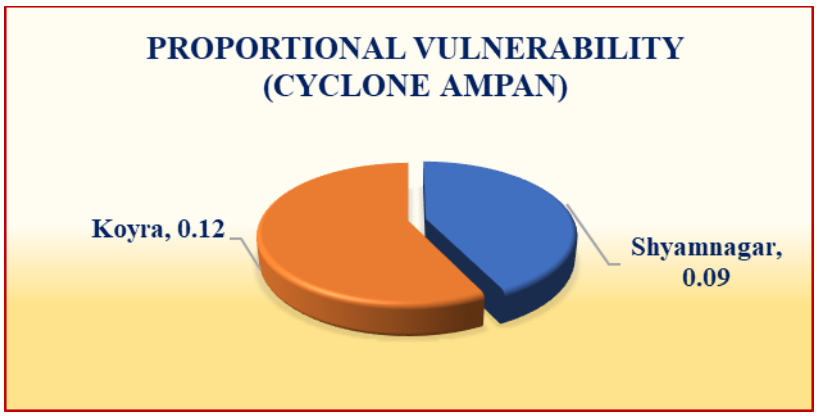


Figure-89: Proportional vulnerability of Cyclone Ampan induced area.
(Source: Author)

6.4 Mapping of post-disaster vulnerabilities

The existing vulnerabilities are often reinforced through policy decisions and functions of local institutions and actors in a post-disaster situation of south-west coastal study areas in Bangladesh (Figure-90). The local community leaders noted that the bureaucratic process in assessing the loss and damages and the making of decisions largely extends the struggle of the poor and disaster-affected families. The delayed start-up of the response and recovery initiatives also create frustration and mistrust in local institutions and actors.

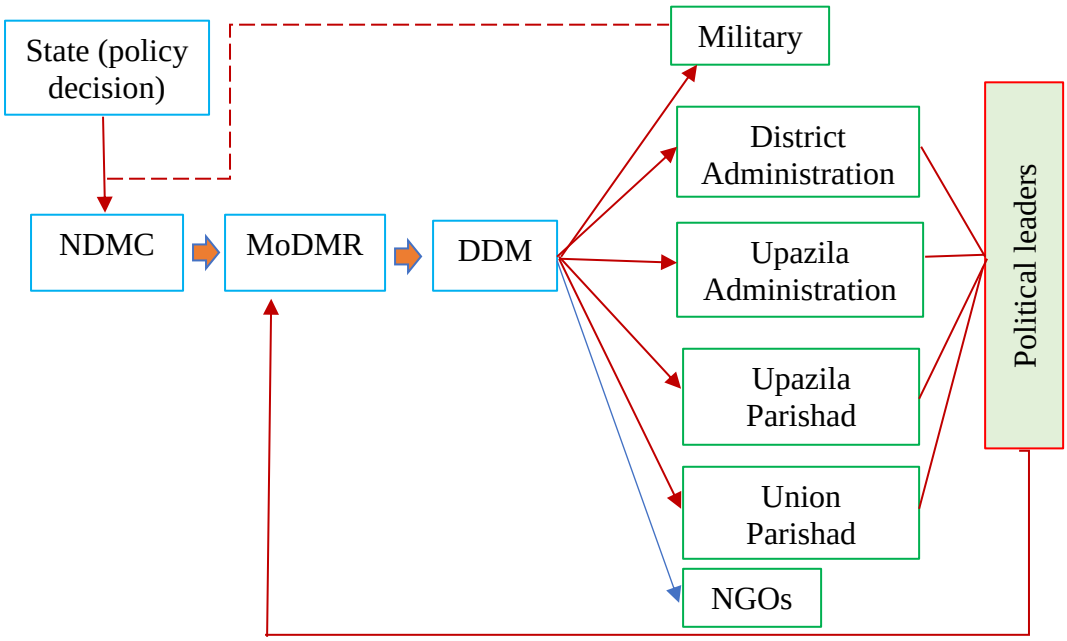


Figure-90: Major responding institutions and actors in addressing post-disaster vulnerabilities (Source: Author).

During the discussion, the people noted that they have to face diverse problems and challenges during and post-disaster situations. All these are categorized and presented in Table-33:

Table-33: The post-disaster vulnerabilities of people

Type	Nature of vulnerability
Human vulnerability	Physical injury
	Food shortage
	Depended on external support
	Diseases
Economic vulnerability	Extreme need of money
	Economic losses and damages
	Lack of alternative livelihoods
Social vulnerability	Social insecurity
	Obtaining loans
	Mental stress/torturing

The status reveals that the affected people in study areas face food shortages, economic losses & damages, diseases, and mental stress while they often apply negative coping mechanisms (obtaining loans, selling of advanced labour or family assets) to overcome their vulnerabilities and risk. The vulnerable people continuously largely depend on external supports during disasters and post-disaster context for their survival needs and recovery of livelihood loss. But the influential role of local political leaders in the selection and distribution of emergency relief largely creates a space of inaccessibility for the real vulnerable people. The process undermines the needs and requirements of the vulnerable people and reinforces their struggles as victims of disasters. Under the DM structures, the state-led institutions are not always functioning properly to realize the local needs, while they mostly depend on the information from local political leaders and elected local representatives. The politically biased information and listing of vulnerable families for relief operations exclude a large section of real vulnerable people from any form of external support. Though there are some NGOs (local, national, and international) that are functional in south-west coastal areas, they often give preference to their targeted beneficiaries in the distribution of emergency relief. In the existing DM mechanism, there is still a vacuum space in the distribution of external support to vulnerable people and families that largely denies people's survival needs. In this situation, they sell their family assets (i.e., livestock's, advanced labour) or take a loan from local moneylenders and social elites that extend their existing vulnerabilities.

6.5 The Risk tolerance level of the people

The study has already been defied a set of risk drivers and their influences in the progression of vulnerabilities that taken into consideration for analysing the risk tolerance level[97] of the coastal people. The analysis reveals the possibility of the occurrence of a specific risk driver and if it occurs, then signify the level of its impact on human lives (see table in the Annex). The discussion on the scaling of risk drivers with local people noted that the risk drivers are mostly active South-west coastal areas that deny the ability and capacity of the people to reduce their lifelong vulnerabilities and risk. They added that the people, located in vulnerable places are always at risk of disaster situations, even if there is no effect of natural hazards.

The existing vulnerabilities of the people and places are contributing to creating a condition of disaster in the society, where a section of people struggling to overcome it. Hence, the frequent impact of natural hazards can only extend their struggle and vulnerabilities that replace them with another level of risk. This statement has already been proved through casual analysis of vulnerabilities using the PAR Model. The PAR

[97] The risk level is defined through people's perception (using the scale: 1-5) on the equation as Risk (R) = Possibility to occur (P) X Impact (I) in Shyamnagar and Koyra areas. The risk tolerance level of the people is defined as 9.

model is significant in analysing the causal chain of vulnerability in the south-west coastal areas. It refers to a situation of unsafe conditions, where the people unable to cope with the changing situation. But the people, who are placed in unsafe conditions face disaster risks, whenever they face natural hazards, which is not fully true. Because the people, who are located in unsafe condition in South-west coastal areas are always living like a disaster situation. They don't need to be at risk of disaster, while they will face natural hazards. As support to this statement, the study examines a set of risk rivers with a scale (1-5) and significantly defined the risk tolerance of the people (Figure-91).

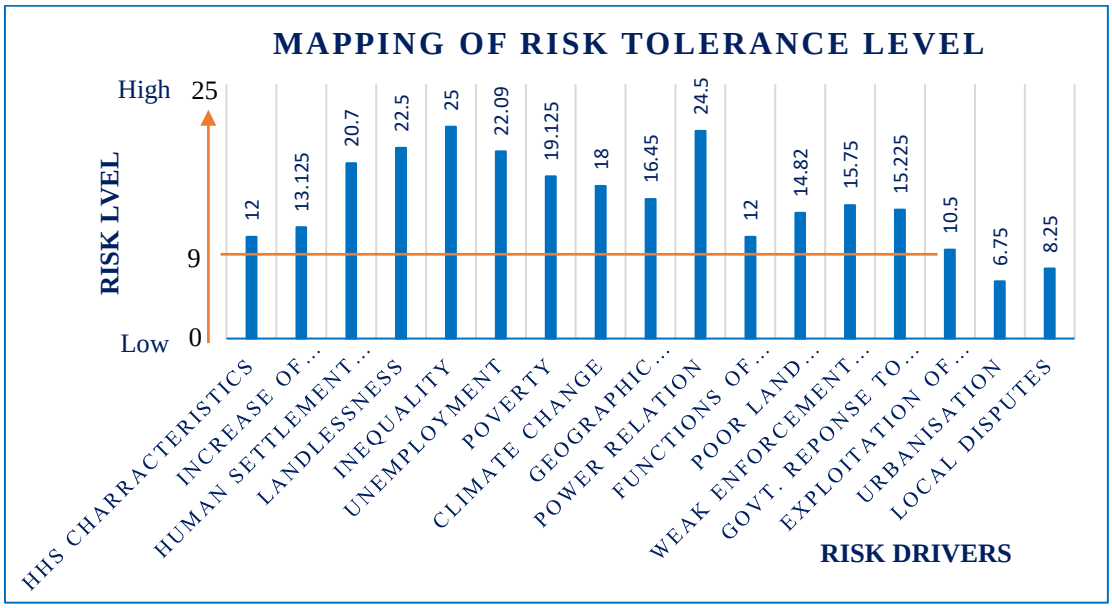


Figure-91 Risk Tolerance level in Study Area (Source: Author)

The findings noted that the people have the minimum capacity to tackle some level of risk, but it requires additional/external support and interventions in dealing with high risk-bearing issues.

6.6 Conclusion

Bangladesh has made significant progress in achieving many development indicators but still, a section of people are placed in at-risk situations and face diverse forms of vulnerabilities. As this section of people living in unsafe condition and placed in the frontline of multiple natural hazards, they are frequently exposed to natural hazards, while they show their inability to cope with the situation. The situation defines it a form of disaster. It is fact that Bangladesh has already shown its success in reducing the number of deaths as the effect of natural hazards, but the level of loss and damage of

resources is intensifying over the years. It refers to a gap in the application of the Environment and DM framework in the context of hazardous prone areas in Bangladesh. However, the study significantly explores a set of factors such as root causes, dynamic pressure, and unsafe condition in the south-west coastal areas. All these factors have inserted and explained in the frame of Pressure and Release model. The explanation illustrates inadequate capacity of a section of people to cope with life inequalities, landlessness and unequal power relations that extends their risks to face disaster situation. The essence of analytical findings is that vulnerability is a 'process' that contains a chain of causal factors to form an unsafe condition for the people in hazard-prone areas. Therefore, to address the causal factors of vulnerabilities that generates an unsafe condition and incapability for a section of people, the application of release model is applicable to uphold people's resilience to cope with the changing situation of disaster in Bangladesh.

PART V

FRAMING THE SAFEGUARDS FOR PEOPLE AND PLACES

Chapter Seven
SAFEGUARDS FOR VULNERABLE PEOPLE AND PLACES

---

7. Introduction

In the earlier chapters, the study examines some functional processes and drivers of ecological change and reveals that power led processes and drivers are causally linked with differential vulnerabilities and risks of the people in south-west coastal areas of Bangladesh. Because the existing drivers are forcing a section of people to continue their lifelong struggle and vulnerabilities and often, they show their inabilities to cope with the changing situation. The nature of vulnerability reveals an insight struggle of a section of people, wherever they face any uncertainty or effect of hazards it destroys their survival mechanism and restricts their desires for development. From this point of view, the study realizes the need for a framework for ecological resilience development for advancing sustainable development. The people-centric ecological resilience approach can provide a basis for better management of ecology to enhance people's ability to manage the stress and shocks that occurred in the process of ecological change.

7.1 A conceptual frame of ecological resilience

The concept of ecological resilience is often applied to the social-ecological systems, but the foundations are in ecology. In ecology, resilience was traditionally understood as a system that functions to recover its prior state after suffering a shock (Holling, 1973). Hence, ecological resilience explains the situation of multiple stabilities in which a system can adapt to the change (Davoudi et al., 2013). Resilience provides a basis for increasing the capacity of systems to absorb, persist, and adapt to inevitable and unpredictable change (Curtin and Parker, 2014). It contains two basic elements:

- Concerns of the ecological system; and
- Concerns about the ability to manage shocks, stress, and disturbances.

Ecological resilience is therefore referring to the concerns of dynamic processes of the ecological system and the multiple adaptive dimensions to the change. Adger (2005) defined a strong linkage between ecological resilience and the social resilience approach. He recognizes it as significant to explore the root causes faced by the vulnerable communities in using natural resources for ecosystem services (Adger et al., 2005). It reveals a space for an inter-dependent relationship between humans and the environment (Folke et al., 2010)

The concept is evolutionary and understood as human-environment interactions that count the functions of institutions and actors in response to external shocks and internal pressures. It refers to people's ability to cope or adapt to stressful situations. The conceptual framework of ecological resilience is significant and applicable for advancing sustainable development in Bangladesh.

7.2 The significance of ecological resilience

The study has explored that a section of poor people in south-west coastal areas is facing the lifelong struggle of vulnerabilities and if they face any forms of external shocks or uncertain events like natural hazards, they have to face risky situations to survive. The study also examines the functions of a set of processes and drivers, which are controlling the ability of the people to cope and adapt to the changing situation of ecology. It refers that the interactions of human and the environment that form an ecology of an area, are unstable and changing with the force of functional processes and drivers in south-west coastal areas. So, the ecological resilience approach is important to:

- Address all concerns of the ecological system; and
- Strengthen people's ability to manage stress, shocks and disturbances.

I. Concerns of the ecological system:

There are three major concerns of the ecological system that are defined in the context of south-west coastal areas of Bangladesh. These are:

1) Changes in a natural system.
2) Climate change.
3) Disasters.

In Bangladesh, the south-west coastal area is mainly vulnerable due to its changing natural system. The changes are continuing with the effect of unplanned human actions and the use of natural resources. Human actions have been creating serious pressure on the natural environment that results in the degradation of natural resources in Sundarban and its surrounding areas and creating imbalances in the Sundarban ecosystem services. The land-use changes are most visible in south-west coastal areas. There is evidence that agricultural land is declining but the human settlement and saline water bodies are increasing due to increasing pressure of population, waterlogging and storage of saline water for commercial shrimp cultivation (Figure-92).

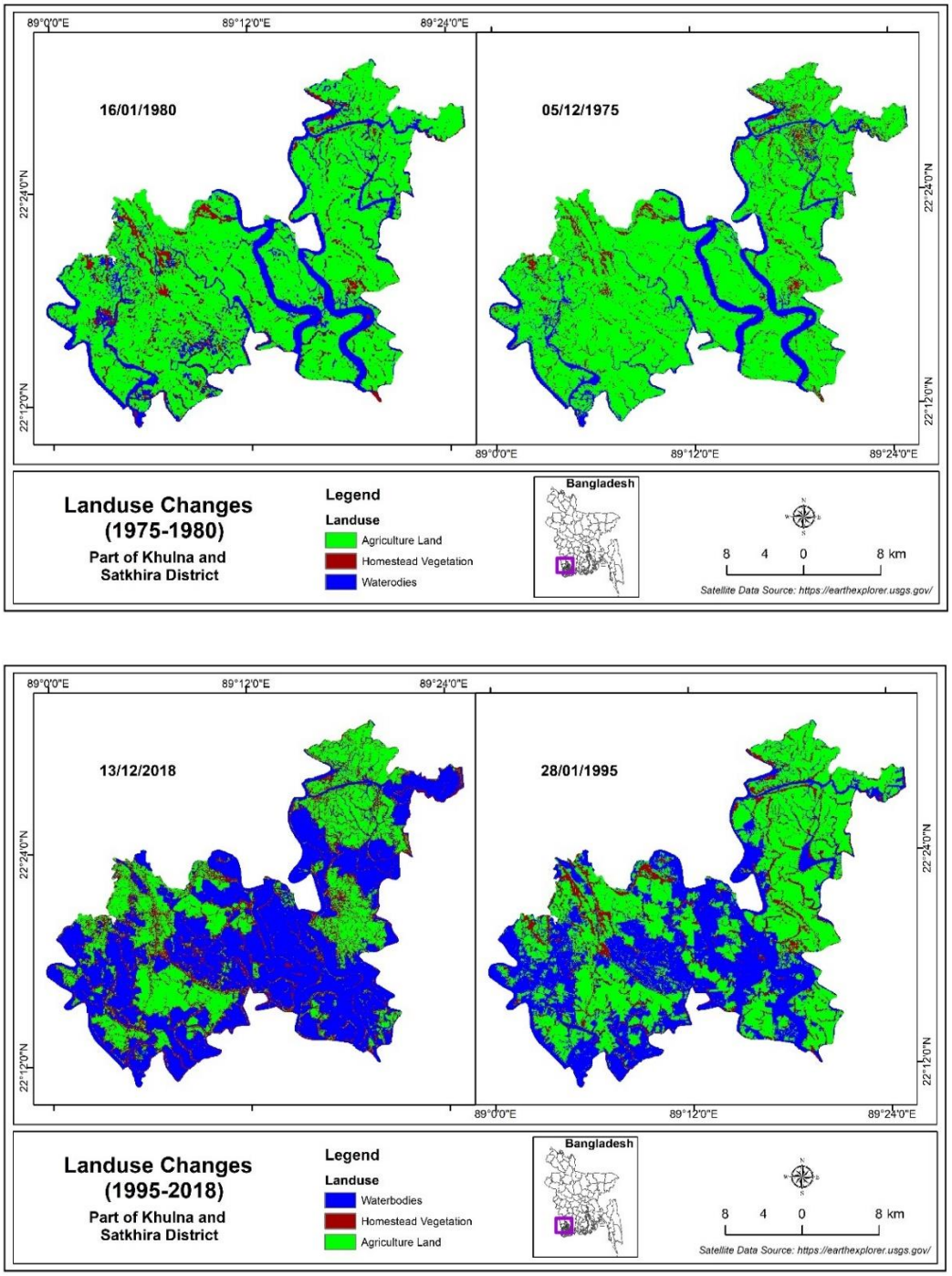


Figure-92: Changes of Land use from 1975 to 2018 in the study area
(Source: Author)

The area captures the water flow of 16 major rivers from upstream to downstream areas, but all are unable to carry enough water in the dry season due to the impact of the *Farrakka* barrage. The *Farrakka* barrage has restricted the flow of storage water to downstream areas but shifted the water flow to other areas. The changes in direction of the normal flow of river water contribute to reducing the water flow of Ganges River networks in the downstream areas. As a result, most of the rivers that are connected

with the Ganges River networks in south-west coastal areas are unable to flow enough water to wash the seawater salinity of the coastal land. The situation contributes to increase water and soil salinity and surface temperature resulting in instability of natural systems and depletion of ecosystem services.

Climate change impact is an emerging concern. It is most functional and visible in south-west coastal areas of Bangladesh. The extreme temperature, depletion of water, and expansion of salinity are the reflection of climate change that creates an ecological imbalance. This has made a diverse impact on people and places. Climate change is not only contributing to the increasing frequency of natural hazards but also creating food insecurity and livelihood crisis. It is fact that the south-west coastal areas witnessing several cyclones accompanied by tidal surges, salinity, and waterlogging extend the lifelong struggle of a section of people. In some cases, the situation forces a section of people to be displaced to other areas for their survival. It has revealed that 51% of people in Shyamnagar and 48% in Koyra areas noted their experiences of displacement at the time of cyclone induced disasters. The risk of disasters is another concern of the ecological system. It has a deeply disruptive effect on human lives, resources, and livelihoods, particularly those, who are already placed in a vulnerable situation. Disaster disproportionately affects the poor people due to their existence in hazards prone and overexposed areas, where they have to depend on natural resources with less ability to cope with destructive events.

II Ability to manage shocks, stress, and disturbances

The ability of people to manage shocks, stress, and disturbance has increased over time. But the human and economic losses are still very high in Bangladesh due to insufficient response and recovery initiatives. Bangladesh has witnessed more than 200 disaster events since 1980, leaving a total death toll of approximately 200,000 people and causing economic loss worth nearly $17 billion[98]. The average yearly economic loss from disasters is estimated at $ 2.0 billion in 2020[99] and it bears 1.8% of the country's GDP but 14% of GDP is exposed[100]. BBS (2015) reported that about 13% of households and 12.64% of the population live in disaster-prone areas, who have to face the direct impact of disaster situations.

It is true fact that the economic cost of disaster has steadily increased but the number of human losses has significantly decreased over the years in Bangladesh (Figure-93). The losses and damages of disasters are 10 times higher today than it was in the 1970s. As a reference, the 1970 Bhola cyclone was considered the deadliest ever recorded, with an estimated death of over 500,000 people. The 1991 cyclone Gorky killed more than 138,000 people, while the 2016 cyclone Roanu (2016) caused the death of only 27

[98] The Daily Star, Disaster Management in Bangladesh: reducing Vulnerabilities, March 10, 2016
[99] The Financial Express, March 22, 2022
[100] Ibid

people in coastal areas. Therefore, the reduction of human losses refers to an illustration of success in disaster management in Bangladesh.

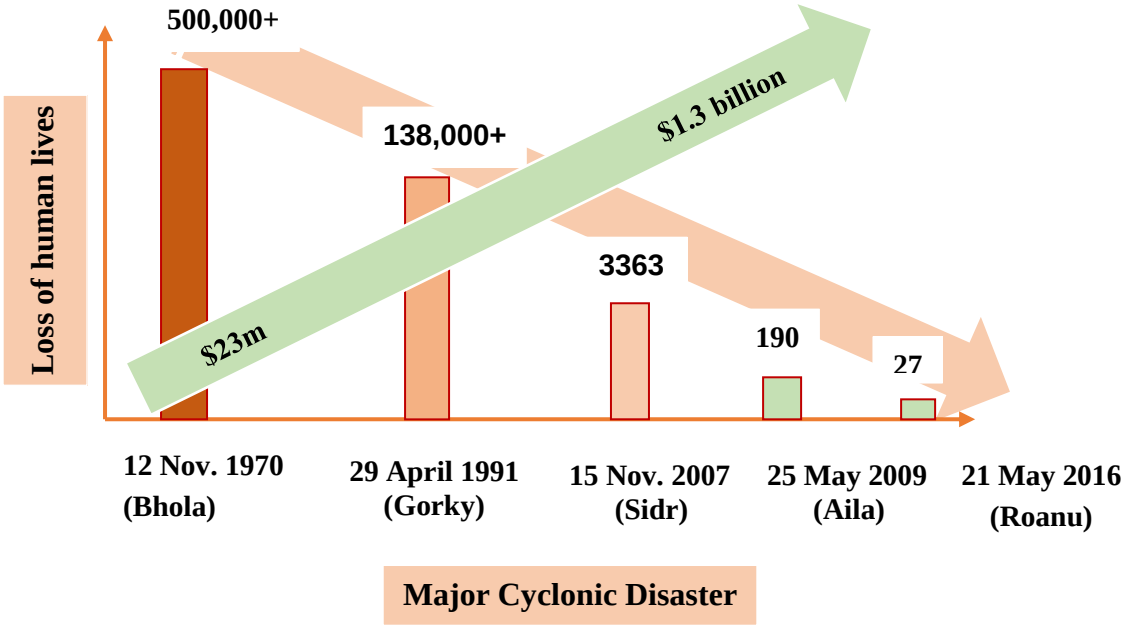


Figure-93: Trend of loss and damages due to cyclonic disasters in Bangladesh
(Source: Calculated from data/information of major cyclone in 1970, 1991,2007, 2009 and 2016)

Hence, the key concern is that disaster impact is measured by assessing the direct losses of human lives and economic resources. It is assessed by both Government and/or NGOs along with UN agencies just after the occurrence of hazards with a special focus on economic dynamics of the affected population, housing, agriculture, industry, health, infrastructure, services and so on. So, the post-disaster economic loss and damages are the focus of existing efforts of disaster response and recovery of development. But the assessment systematically overlooked the causal grounds of vulnerabilities in disaster-affected areas. It reveals that ongoing analysis of hazards and disasters is over-focused on natural or engineering/technological aspects rather than analysing the causation of vulnerabilities and risk society that effectively linked with the people's ability to manage the stress, shocks, and disturbances. The people, who live in South-west coastal areas are witnessed a number of devasting cyclones that extends their life-long sufferings. But the increase of people's ability helped to reduce the risk of disasters. The survival ability of the coastal people has made a significant contribution to reduce the human loss in disaster situation.

7.3 Resilience Building Efforts: Global and National Scales

The initial efforts in addressing disasters were focused on disaster specific responses to minimise the suffering of the affected people. A well-coordinated and united effort was functionally started under the IDNDR in 1990 at the global level aiming to reduce the impact of disasters. As the successor to IDNDR in 2000, the UN adopted the ISDR as a global framework for reducing vulnerabilities and the risk of disasters. But the resilience-building issues took the attention of the UN during the World Conference on Disaster Reduction held in 2005 at Hyogo, Japan. The conference adopted the Hyogo Framework for Action (HFA), 2005-2015[101] aiming to build resilient nations and communities. The HFA focused on an integrated and all-hazard approach as a basic element of UN decades of sustainable development that strongly aligned with development policies and climate change[102]. Though this approach applied an organized and coordinated response mechanism at the ground level, it was not enough visible to face the recurrent disasters. The framework assures the provision of engagement of many specialised institutions and actors but their action in building resilience wasn't yielded visible results. The HFA considers risk-based planning (in line with potential loss and damages of an area) with a special focus on mitigation measures rather than focusing on root causes of vulnerabilities. It was basically an apolitical framework that didn't assess the functions of the power-led process and drivers in the progression of vulnerability. Therefore, it refers to a reality that the reduction of vulnerability needs to address its causal grounds.

Realizing that the global community has recently introduced three major agreements aiming to build the resilience of nations and communities to face disaster situations, which is a pre-requirement for sustainable development. These are as follows:

1) the 2030 Agenda.
2) the Paris Agreement on Climate Change, 2015; and
3) the Sendai Framework for Disaster Risk Reduction, 2015-30.

Bangladesh adopted all these three agreements as a priority of comprehensive disaster risk management and sustainable development The resilience-building is a common focus of these three agreements (Figure-94). It has also given priority to the most vulnerable groups, particularly women, children and youth, older persons, people with disabilities, migrants, and ethnic and caste groups to strengthen their ability to deal with the changing situation.

[101] UNISDR, 2011
[102] UNISDR, 2007

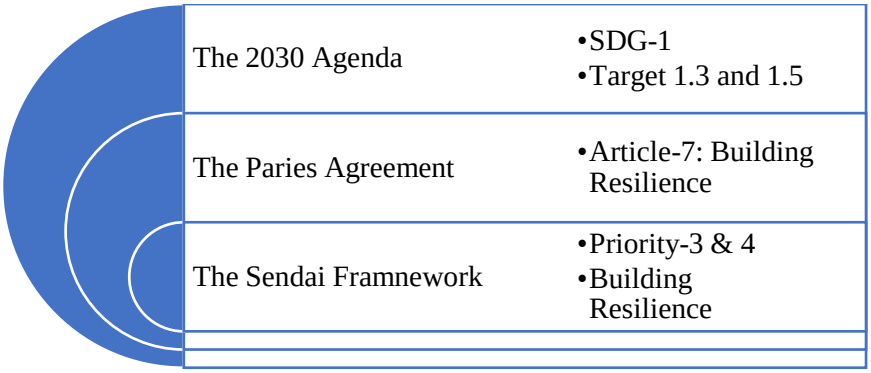


Figure-94: Linking of disaster resilience in three major global agreements
(Source: Captured from the 2030 Agenda, Paris Agreement, and the Sendai Framework).

Therefore, the integration of these three global instruments in the national laws, policies and strategies is significant for advancing resilient development. It provides an ideal opportunity for the development challenges at multiple scales. So, result-oriented actions are necessary to sustain the development achievements by reducing the country's poverty and inequalities. But the reality is that such actions are still missing in addressing development challenges. It results in the increase of vulnerabilities of the coastal people, who are struggling to survive in changing situations. It is reported that 95% of the poor people, who live in coastal areas have to face the adverse impact of the disaster[103]. The situation is deepening with the impact of climate change, while they face declined agricultural production, food insecurity, safe water crisis, health hazards, unemployment, and uncertainty in the livelihood options.

Similarly, the people, who live on the riverbank and outside of the coastal embankment areas also facing the crisis that continued their struggle from generation to generation. Women are defined as the most vulnerable group because of their limited mobility and cultural sensitivity in coastal areas that prevent them to seek livelihood options outside of their locations. They are often forced to stay at home during extreme natural events that result in more deaths of women than men in the cyclones Sidr, Aila and Gorky. World Bank (2012) reported that 91% of fatalities in cyclone Gorky (in 1991) were women104. Considering that the inclusion of left behind people in the process of building resilience is very significant to maximize the benefits of sustainable development for all. The 2030 agenda targets everyone including the most vulnerable people and groups to be part of the actions and benefits of sustainable development. It is a fact that the economic cost for the implementation of disaster-resilient initiatives will be lesser than the joint cost of economic losses and recovery actions. For this reason, resilient development is very significant for advancing sustainable development. The outcomes of resilience initiatives have been incorporated in the 2030 Agenda for Sustainable Development.

[103] The World Economic and Social Survey Report, 2016
[104] World Bank, 2012

The study defines a strong linkage of resilience with three major agreements. It has already been noted that disaster disproportionately affects the poor and vulnerable people with losses and damages that substantially roll back their development progress. It should be a central concern of development planning in Bangladesh. The development approach of the 8th five-year plan of Bangladesh strategically considered the resilience issues as part of the sustainable development pathway. Besides, the country has also aligned disaster risk management initiatives with the UN frameworks, SAARC framework for action: 2006-2015 and SDGs to foster resilient development. The successful alinement and integration of different frameworks encouraged the government to shift its development focus from the hazards-oriented approach to the vulnerability approach and finally the resilient approach. But the ground implementation of the resilient approach still has not yielded successful results in reducing the root causes of vulnerabilities of a large section of people, who live in at-risk areas of disasters (Figure-95).

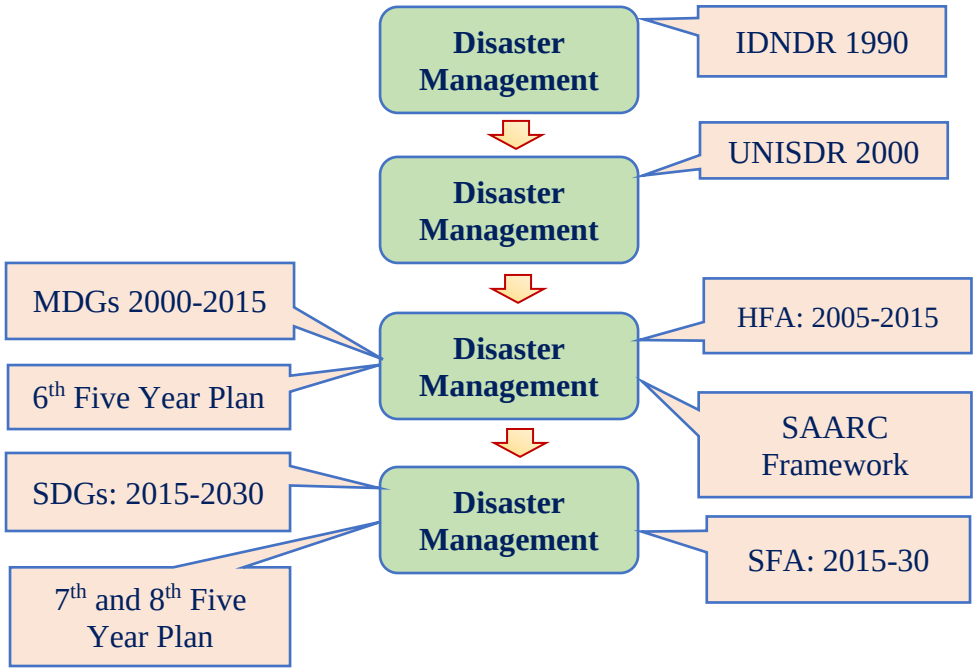


Figure-95: The alignment of Disaster Management with UN frameworks on disasters and development (Source: Author).

As a resilience-building effort, Bangladesh has already introduced a comprehensive Disaster Management (DM) framework that is guided by several instruments. These are:

- The Standing Orders on Disasters (SOD) was firstly introduced in 1997 and revised in 2010.
- The National Plan for Disaster Management, 2010-2015

- Disaster Management Policy, 2015
- National Environment Policy 2018
- Ecologically Critical Areas (ECAs) Management Rules 2016
- Climate Change Action Plan (2009–2018)
- Disaster Management Act (DMA) 2012

On the other hand, resilience to disaster and climate change is considered an integral part of the development approach of the 8th five-year plan of Bangladesh. The approach strategically introduced resilience-building issues with a set of actions for:

- Integrating disaster and Climate Change in development planning.
- Transformation of local knowledge and technology for better disaster resilience.
- Disaster Preparedness, early warning, and swift on-time response to disasters.
- Actions for disaster readiness and decentralisation.
- Promotion of green development

The action considers an 'inclusive approach' to create a space for the left behind people and communities with specific attention to:

- Vulnerable people.
- Ethnic communities.
- Dalits and extreme poor groups.
- Sexual minority groups.
- Persons with Disabilities

The DM framework is strongly aligned with the SDGs that theoretically transformed into the 8th five-year development plan of the government. But the reality is that the 'inclusive approach 'is only applied in the 'social protection' programming that involved five (5) line ministries[105] with ADB allocation of 37.5 billion TK in FY 2015-16 to 82.5 billion TK in FY 2019-20. The ADB allocation is mostly used in relief and mitigations measures rather than using for addressing the root causes of vulnerability. On the other hand, the 7th five-year plan noted its commitment to institutionalizing the Sendai framework and the Disaster Management Act of 2012 but there are still some ground challenges in the implementation and institutionalization of the DM framework in Bangladesh, which are as follows:

- DM is the core function of the MoDMR but it requires effective coordination and support from the other ministries and departments. The coordination is visible at the national level but not at the District, Upazila and UP levels. The lack of coordination and joint efforts of all relevant institutions and actors at the

[105] Five-line ministries: i) MoSW; ii) MoWCA; iii) MoLWA; iv) MoF; and v) MoDMR.

ground undermines the needs and concerns of the vulnerable people, who are living with vulnerabilities and risk.

- The Disaster Management Act provided an option for the establishment of an independent DM fund, which is still missing. The funding support is running with the relief operations and social safety net support schemes.
- Inclusive approach is not net visible in the existing DM framework that strategically denying the needs and priorities of the left behind people and groups, who are at risk of disaster.
- Disaster response is still relief centred. The resilience-building initiatives are largely missing in vulnerable places.

However, Bangladesh has already shown its commitment at the global and national scale to adopt the inclusive and resilience development approach in integration of disaster and climate change issues. As reference of this commitment, the government has introduced:

- Climate Change Strategic and Action Plan (BCCAP) in 2009 for better climate resilience in 2009.
- Climate Fiscal Framework (CFP) in 2014 for resilient development.
- Country Investment Plan for Environment Forestry and Climate Change (CIP-EFCC) in 2017 with the total estimated cost at $ 11.7 billion (as 40% of the Government's fund).
- Bangladesh Delta Plan, 2100 for disaster and climate-resilient sustainable development

Bangladesh has also created the 'Climate Change Trust Fund' in FY 2009-10 with its revenue sources of BDT 3200 crore for building community resilience. The government also secured the Green Climate Fund (GCF) with the storage of $85.42 million as of May 2018[106]. All these are the reflection of government's commitment to make sure greater resilience of the people, who are risk of climate induced disasters. It is fact that Bangladesh is theoretically applied the inclusive and all-out approach in limiting the risk of climate-induced hazards and disasters but the poor and left behind people are still staying in unsafe conditions and struggling to overcome their lifelong vulnerabilities. There is a serious lacking in the conceptualisation of vulnerability and the risk of disasters in the formulation of DM frameworks and the 8th five-year development plan. The traditional concept makes it biased towards 'physical measures' in the reduction of vulnerability and the risk of disaster and climate change. The political perspectives leave little space to address the causal grounds of the vulnerability of the people that force a section of people to live in a risk situation of disaster.

[106] Budget Report: Climate Financing for Sustainable Development, GoB 2019

7.4 Strategic consideration for ecological resilient development

The vulnerable area and population should be a central concern of resilient development in Bangladesh. The development planners should have to realise how the space (nature) and human society shape the causation of vulnerability that forces a section of people to live in an unsafe condition. Hence. Disaster resilient development means that people, communities, actors, and institutions (state and non-state) enable to cope with vulnerability and the risk of disasters as well as having the ability to preserve development gains and face future risks. It is fact that disaster resilient development can help to minimise the economic cost of disasters and the effect of future risk.

7.4.1 Restoration of the ecological system

The ecological system refers to the state of human-environment interactions. The human population are mostly dependent on environmental resources and ecosystem services for their lives and livelihoods, while the environment provides multiple options and opportunities for a human to use it. The positive interaction contributes to creating ecological balance in the natural system, but it is not always visible in the changing ecological system in south-west coastal areas of Bangladesh. The study reveals several forces that changing the ecological system, which are as follows:

- More dependency and over-extraction of natural resources.
- Destructive human action on the natural system
- Changes in landscape

All these power-led forces are active in south-west coastal areas and destroy the balances in human-environment interactions. The imbalances result in:

- Declining of ecosystem services (for the coastal people)
- Creating safe water crisis
- Increasing impact areas
- Increasing risk of disasters.

Realizing the results, we should have to take long term and sustainable actions for creating balance in human-environment interactions. It requires a set of feasible actions for restoration of the ecological system so that the nature/environment can regain its originality to serve the people and places.

7.4.2 Building resilience of the vulnerable people

It has already been revealed that disaster has an unequal effect on the lives and livelihoods of the poor. Basically, the vulnerable people show their inability to face the

disaster situation in Bangladesh. Realizing that the country introduced structural and non-structural (i.e., community-based approach) measures but it is yielded successful results in reducing human losses rather than economic losses. The status reveals that a section of people is still not living in an unsafe condition and facing the frequent impact of disasters. Strengthening the ability of the people is an integral part of building resilience. It requires joint efforts of all relevant institutions and actors, such as local administration, people's representatives, CSOs and media. Though it is not possible to stop disasters in the context of Bangladesh, join efforts can reduce the vulnerabilities and risk of disasters in society. In the context of south-west coastal areas, the most feasible efforts are as defined as follows:

A. Introduce adaptive social protection

Adaptive social protection is a new approach to social protection. It overlaps the basic elements of disaster and climate change. It is strongly linked with Agenda 2030 and the 8th five-year plan and aligned with the Sendai framework. Social protection is necessary for a section of the population, who are struggling to manage economic and social risk, and unable to cope with disasters. It is basically and combination of policies, Programmes and services that creates opportunities for the most vulnerable and at-risk people to enhance their resilience to manage and minimize their social and economic risks. Adaptive social protection is significant because a large section of people is unable to cope with the changing situation.

The government has already recognised the importance of adaptive social protection. The adoption of the National Social Security Strategy (NSSS) in 2015 is a real example of this recognition. The purpose of this strategy is to build an inclusive social security system for the poor and vulnerable population. The six ministries are directly linked with this adaptive social protection approach, such as i) Ministry of Disaster Management and Relief; ii) Ministry of Women and Children's Welfare; iii) Ministry of Agriculture; iv) Ministry of Social Welfare; v) Ministry of Food; and vi) Ministry of Local Government, Rural Development and Cooperatives. It is fact that the government of Bangladesh has taken ''adaptive social protection'' as an alternative approach to the Social Safety Net Programme (SSNP). The analysis of the government's SSNP efforts revealed that a total of 38 projects are running from FY 2011 to FY 2017 and of them, only 11 projects are fully adaptive and aligned with DRR and CCA components. However, the government successively increased its budgetary allocation to encompass the numbers of poor and vulnerable people under the coverage of adaptative social protection mechanisms. As a reference, the total budgetary allocation of SSNP schemes in the FY 2016-17 was BDT 45,230 crore increased to BDT 54,206 crore in the FY 2017-18 (as 13.5% of the total budget) and finally the allocation reached BDT 64, 656 crores in the FY 2018-19 (as 2.55% of GDP and 13.92% of total budget)107. This is a

[107] Dhaka Tribune, dated June 7, 2018

positive move of the government to comply with Article-19 of the Constitution which refers to ‘equalities of opportunity for all citizens, ‘removing of social and economic inequality, and ‘equal participation of women’ and Article-15 (d) the right to social security. Therefore, as part of the constitutional committee, it is an obligation to the government to ensure social protection for the people, who are at risk of disasters and adversities of climate change in Bangladesh.

B. Better Community Engagement

As the risk of disaster is a ‘’social construct’, the interconnectedness of all actors in disaster risk management is very significant. The gaps between government institutions/actors and the local community may undermine people’s confidence and trust in risk management. Regarding this, all stakeholders’ approach is vital to involve all relevant state institutions and local actors (including the local community) in all stages of disaster management. This can make a significant contribution to reducing the risk of disasters in the coastal areas of Bangladesh (Figure-96).

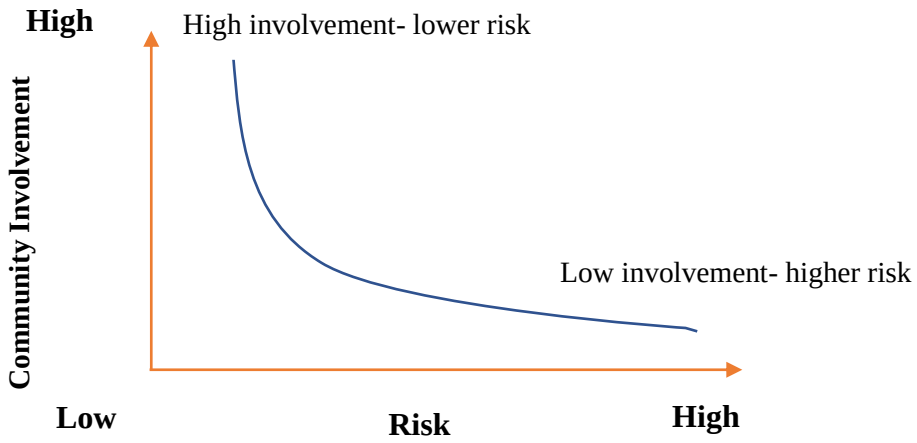


Figure-96: Significance of community involvement (Source: Author).

The analysis of the function of the disaster management committees (national and local levels) and the applications of the disaster management cycle revealed that the local people and communities have very limited space (except for preparedness) to be engaged in planning and decision making. The conventional disaster management cycle provides a routine event with Sigle loop learning, where is limited or no space to understand the unknown challenges added by climate change and the gaining of new learning to cope (Figure-97).

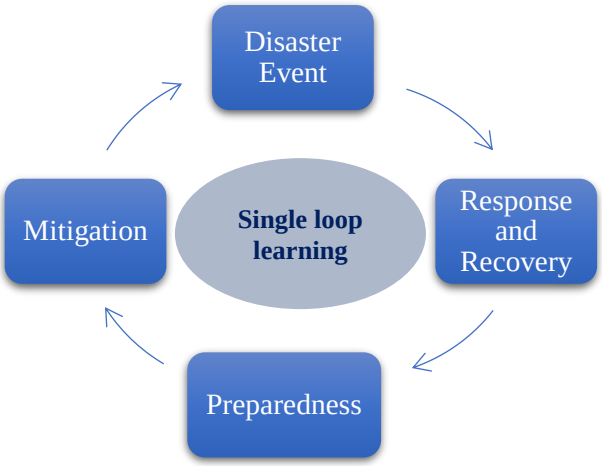


Figure-97: The conventional disaster management cycle
(Source: https://www.gdrc.org/uem/disasters/1-dm_cycle.html)

Regarding this, the use of local knowledge and capacities of the people is very important in all phases of the disaster management cycle, particularly in response and recovery phases. The physical aspects can be done by engineering approach but its planning, placing and applicability issues should consider the local knowledge and capacities. So, there is still a scope to adopt new learning in addressing new challenges with a better coping capacity of the people and responsive performance of institutions and actors.

III. Need for an inclusive approach

There is defined a clear overlapping in disaster and climate change actions. To reduce this overlapping, the country needs a more systematic and integrated approach, which will be effective to maximize the country's resources and experiences. It is a common concern that the coastal areas are facing the frequent risk of climate-induced disasters. But the apolitical analysis of disaster is unable to examine the functions of power-led drivers that change the ecology of an area and create differential vulnerabilities of the people in disaster situations. The existing framework undermines the needs and concerns of the poor and vulnerable people, who are facing the impact of disaster and climate change. It demands an inclusive and coordinated approach to strengthen the ability of the poor and vulnerable people. In these cases, all assigned institutions and actors should act together to transform risk-informed knowledge, innovation, and practices in the community for advancing resilient development in Bangladesh.

IV. Need livelihoods resilience of the poor

The causal analysis of vulnerability noted that the livelihoods of the poor are always at risk. Due to the functions of the power-led social and economic system in south-west coastal areas, the livelihood options and opportunities of the poor are mostly dependent on or controlled by the rich and powerful social elite groups, where they have minimal

ability to ensure their livelihood resilience. In such a condition, the poor always live in stressful situations. Considering that livelihood resilience is very significant, where poor people will be the main actors to cope with stressful situations. The poor and at-risk people would be the central concern of livelihood development thinking, where the existing ecological change process and drivers are the associated factors in building livelihood resilience in the context of society-west coastal areas of Bangladesh.

V. Integrated actions for balancing power relations in the society

The study has identified a set of root causes, dynamic pressure, and unsafe conditions, which are functionally linked with the progression of the vulnerability of the people in south-west coastal areas. The root causes are very much active in the society that requires effective and long-term actions to reduce their impact on the creation of differential vulnerabilities and risk in the society. The power relations are truly unequal in the society, where the rich and elite groups are controlling the local decisions of resource management and gaining maximum benefits of development. In such a situation, the poor used to apply negative coping strategies to survive. The negative coping is making a section of people and communities to be more vulnerable to disaster. The ground situation reveals a strong link of power relations with inequalities, land-use change, landlessness, and poverty of the people. It demands long-term strategies to enable the poor to have greater access, opportunities, and control over local resources. To create a balance in power relations in the society, sets of priority actions are needed (Figure-98). These are as follows:

Figure-98: Feasible actions for balancing power relations in the society
(Source: Author).

7.5 The proposed framework for ecological resilient development

The earlier chapters systematically examine and explained the causal grounds of differential vulnerabilities and risk of disasters in Bangladesh with a special focus on south-west coastal areas. The findings reveal a set of power led processes and drivers, which are functional to change the ecology and create differential vulnerabilities and risks for the people. In this changing ecological system, the poor are becoming the main loser. The study also defines several factors, which are functional as root causes and pressure dynamics to create an unsafe condition for the people. If the people, who are living in unsafe conditions face any forms of external events like hazards, they have to face disaster situations due to their inability to cope with the changing condition. It is fact that existing vulnerability is always keeping the poor in stressful situations and denying their ability to cope with its impacts. The development that they achieved over time was often destroyed due to their negative coping and the impact of disasters. Considering that the study is setting a framework for ecological resilient development as a safeguard of people and place in south-west coastal areas (Figure-99). The application of this framework is not only contributing to reducing differential vulnerabilities and risk of the poor but also reinforcing the ecological resilience for sustainable development.

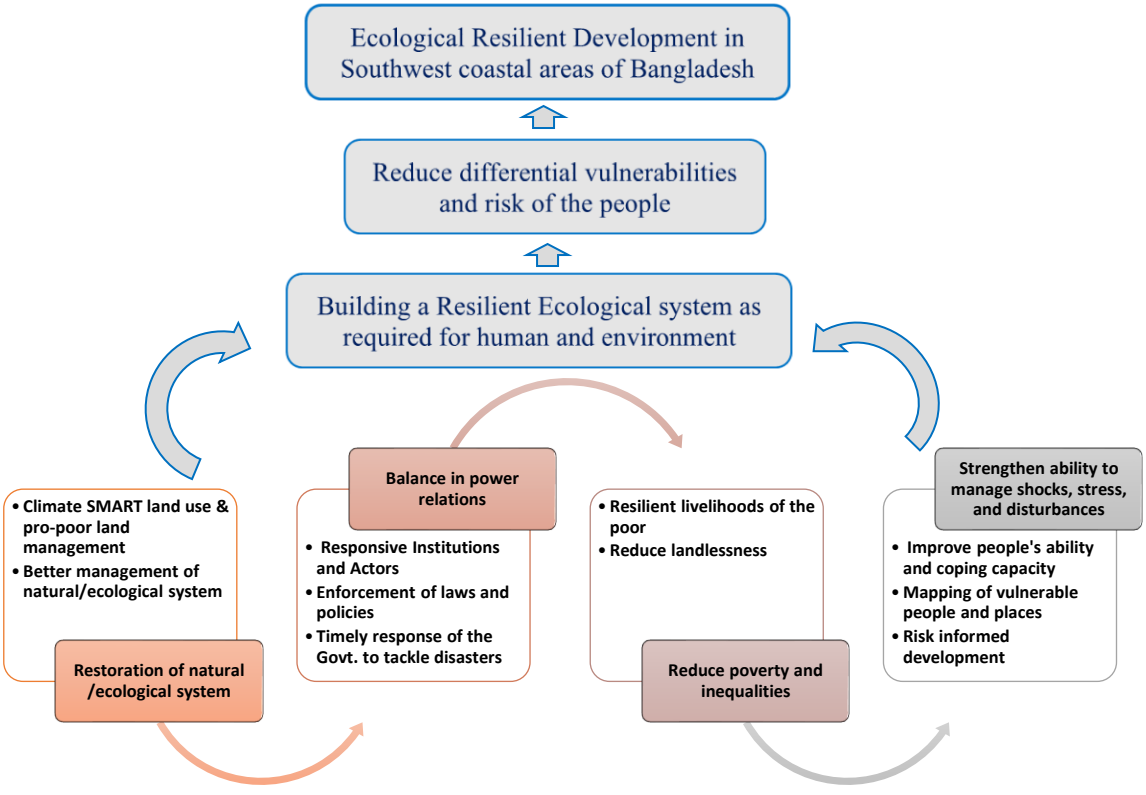


Figure-99: The proposed framework for ecological resilient development.
(Source: Author, 2022)

7.6 Conclusion

In Bangladesh, the impact of disasters is often measured by assessing the direct loss and damages. The loss and damages are assessed by both Government and/or NGOs along with UN agencies just after the occurrence of hazards with a special focus on economic dynamics of the affected population, housing, agriculture, industry, health, infrastructure, services and so on. So, the post-disaster economic loss and damages are the focus of existing efforts of disaster response and recovery of development. But the assessment systematically overlooked the power-led social, economic, and environmental dynamics of disaster-affected areas. However, Bangladesh has sown its success through the application of a transformative Disaster Management framework that results in the reduction of lives lost to natural hazards. In the pre-liberation period, the number of deaths in a single devastating event was more than hundreds of thousand but the recent trend has been steadily downwards, as a reference, the number of deaths due to cyclone induced disasters reduced from 500,000 in 1970 (Bhola cyclone) to 138,000 in 1991 (cyclone *Gorky)*, 3,363 in 2007 Cyclone *Sidr and only 9 in 2017* (Cyclone Mora) but the economic loss and damages have been increased over the time[108].

It has been observed that after the 1970s, there was an increase of disasters at global and national scales that not only affected the global supply chains but also restricted the normal process of economic development. At local scales, disaster harms the local economy, ecosystem services and livelihoods of the people, who live in lower and irregular income brackets. It takes away their means of living and prevents them from breaking the poverty cycle. That is why disaster risk reduction is very significant for attaining resilient development. Hence, Sendai Framework explores a disaster-resilient approach that aligned with the cost required for recovery and reconstruction. As a global phenomenon, climate change is contributing to intensify the frequency of natural hazards and people's vulnerability at multiple scales. The situation has made an adverse impact on fulfilling people's desires to gain the benefits of sustainable development.

Therefore, the ecological resilient development approach is very significant in the context of south-west coastal areas of Bangladesh, where a section of people is always facing lifelong vulnerabilities and facing the risk of disasters. The situation is pushing them to live in unsafe conditions. On the other hand, the government is also increasing its development budget allocation including allocation for social protection every year, but it is yielded successful results. The ecological resilient dynamics should be the central issue of the development planning in Bangladesh that may be aligned with the development agenda 2030 and the DRR framework for resilient development. This will not only reduce the differential vulnerabilities and risks of the people but also sustain people's desires and aspirations to live with minimum standards of living.

[108] GoB Disaster Report, 2013 and the Daily Star report, dated Jun 6, 2017

PART VI

SUMMARY AND CONCLUSION

Chapter Eight
SUMMARY AND CONCLUSION

8. Introduction

This is the final chapter of my dissertation. Here, I have tried to summarise the research findings in line with research statement and key analytical contents. Firstly, I have summarised the statement to find the answers of specific queries through examine the functions of power-led process and drivers contributing to changing ecology in south-west coastal areas. This is also extended with an analysis of impacts of ecological change that reveals diverse changes in areas of land use and ownerships, generating inequalities, human wellbeing, disproportionate loss, and sufferings and above all creating differential vulnerability and risk in the society. This is further extended with an analysis of a set of underlying factors that have significant contribution to create conditions for differential vulnerabilities and risks situation of disaster. The overall analysis fundamentally revealed the links of power led process and drivers in creation of differential vulnerabilities and risks of disaster situation in south-west coastal areas in Bangladesh. The chapter has explored proportionate vulnerabilities of the people and places along with their risk tolerance level to find appropriate solutions for reducing the vulnerabilities and risks in south-west coastal areas. At the end, the study demonstrates a framework for ecological resilient development as safeguard for a section of people, who are facing lifelong vulnerabilities and living at risk of disaster situation in Bangladesh. This has illustrated a numbers of suggestions/action points to guide the national development planning and policies for better connecting vulnerable people and places with government initiatives in the achievement of sustainable development agendas by 2030. Finally, the chapter hights the contribution of this research in addressing the knowledge gaps and explores new areas of knowledge for future research in Bangladesh.

8.1 Theoretical linkages of Political Ecology and Ecological change

I have applied the theory and methods of ‘political ecology’ to examine the nature, process, and power-led drivers of ecological change in the context of the south-west coastal areas of Bangladesh. From in political ecology perspective, the human–environment interactions are seen as a power-driven process rather than an apolitical not. The power relation acts as a force in the human–environment interactions to create differential access, opportunities, and risk for a different group of people or groups in an area. It has been observed that the human-induced forces occurring at different scales (i.e., local, national, regional, and international) reinforce the process of ecological

change that may alter the capacity of an ecosystem to generate services on which human society depends. This results in social and environmental inequalities and a situation of vulnerability and risk in the society, where the people show their inability to cope (Figure-100). As a reference, the construction of coastal embankments, and the polders results in water logging in coastal areas where the millions of people are at risk.

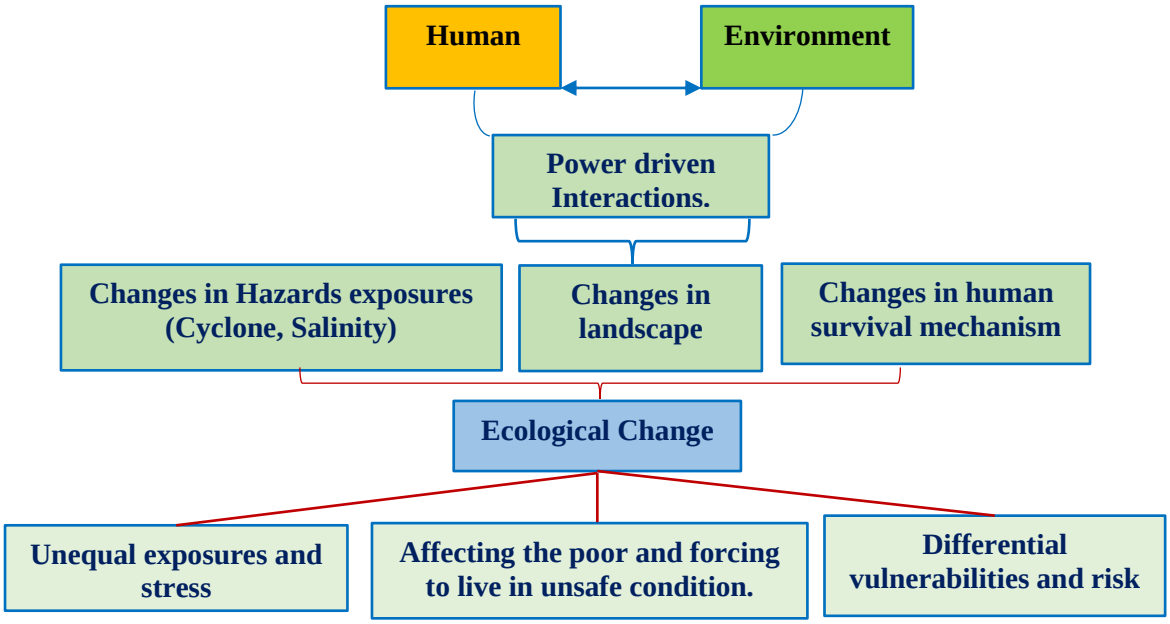


Figure-100: Contextual linkages of political ecology and ecological change
(Source: Author).

The research analysed the nature of ecological change in three basic dimensions: i) every day; ii) episodic and iii) systematic that transform the landscapes with differential opportunities, benefits, and exposures. There is evidence that the south-west coastal forest lands initially are converted to agricultural land[109] and then the agricultural lands are gradually transformed into shrimp farming, causing salinity problems, breakdown of subsistence agricultural productions and livelihoods of the coastal population. This results not only in changing the ecology of south-west coastal areas but also created diverse social problems and income inequalities. It is defined that the rich and powerful shrimp farmers are influencing the small farmers to capture their cultivable lands to expand their shrimp farming for gaining maximum benefits. The process is continuing in the south-west coastal areas due to high prices of shrimp in the local and international markets.

Another scenario is that shrimp farming requires less labour than agriculture that resulting in increasing unemployment and displacement of people from coastal areas to

[109] The coastal forest land conversions started from the 18th century and continued to the end of the Zamindars period, Bangladesh.

city areas. It is fact that the Government of Bangladesh has introduced diverse laws[110], policies[111] and ordinances[112] related to shrimp farming and environmental conservations[113], but the national institutions and actors, who are assigned shows their inability to reduce the ecological impact of shrimp farming. Additionally, the decision of government to declare shrimp farming as an ''industry'' is also responsible for the conversion of agricultural land into shrimp farming without taking any ecological/environmental measures. The decisions force a section of people, who depends on agricultural production as a loser and transform the benefits to powerful and rich people as profit-makers. Functionally, the process results in conflicts, deprivations, and inequalities in the south-west coastal society. The impact of external action ''*Farrkka* Barrage India'' results in the decline of natural water flow of the rivers and an increase of salinity in South-west coastal areas in Bangladesh. This leads to cleaning in agricultural production and destroying river driven livelihoods options of a section the people that extend their food insecurity and livelihood struggle to survive.

The ecological change might be caused by natural or social drivers, but human-induced actions and external forces are found very active in south-west coastal areas in Bangladesh. The causes are mainly anthropogenic, historical and failures of institutions and actors in the implementation of laws, policies, and ordinances. The remote sensing mapping analysis (1980-2020) noted the changes in the landscapes in Shyamnagar and Koyra areas. The findings reveal an increasing trend of human settlement, homestead vegetation, shrimp firms and water bodies, while agricultural lands are declining in south-west coastal areas in Bangladesh. The reasons behind this trend are population growth, an increase of human needs for settlement and development and the transformation of agricultural lands that intensify the human-environment interactions to change the south-west coastal ecology. Hence, humans are using their power to modify the society and environment. The process is creating a space for differential access, control, and opportunities for the people. It generates inequality in society. In such a situation, a section of people are facing lifelong struggles and keeping in unsafe conditions. As they have no/or limited capacity to cope with changing situations, they have to ace differential vulnerabilities and the unequal risk of disasters.

The functions of inequality are deeply rooted in society intensifying the negative coping of the people and creating additional pressure on coastal ecological systems. The process continues to drive by negative forces, such as rapid population growth, poor land management, unplanned development, influential institutions and actors, weak enforcement of existing laws and policies and climate change. Without addressing these power-driven issues, disaster risk management is difficult.

[110] Fish and Animal Food Act, 2010, Ministry of Fisheries and Livestock, GOB
[111] Fisheries Rules, 1985 and National Fisheries Policy, 1998, Ministry of Fisheries and Livestock, GOB
[112] Shrimp Estate (mohal) Management Ordinance, 1992, Ministry of Fisheries and Livestock, GOB
[113] Environment Conservation Act, 1995 and Environment Conservation Rules, 1997, Ministry of Environment, Forest and Climate Change, GoB

8.2 Searching the answer of research statement.

8.2.1 The functional role of power-led process and drivers in ecological change

The study successfully examined three interlinked processes as: i) everyday; ii) episodic; and systematic to illustrate the unequal nature of impacts on the poor and transforming the poor into a marginal, vulnerable, and at-risk situation accordingly. This illustration is further examined with a set of functional processes that contributes to change: i) areas of agricultural land; ii) human settlement and vegetation; iii) riverine areas; iv) forest areas; v) and v) landscapes of study areas during the period of 1980 to 2020. As these changes are mostly done by the human interventions, it bears clear evidence that power-led process are functional in changing ecology of south-west coastal areas in Bangladesh. With the similar notion, the study also examined the historical processes highlighting the context of 1960's, 1970's, 1980's, 1990's, and 2000 and beyond. The analysis revealed that the functions of human induced actions and policy decisions of the government have a significant role in changing ecology of south-west coastal areas. It has an adverse impact on the coastal people and places and forcing a section of people to live with vulnerability and risks of disaster.

The study strategically defined a set of power-led drivers of ecological change through community consultations and interactions with diverse community groups in study areas. All the drivers are then categorically explained with geophysical and environmental, social, economic, and political dimensions to explore their causal links with differential vulnerabilities and the risks of disasters. This is further examined the influence of power dynamics with discriminations, landlessness and decision making to justify the role of power relations in the process of ecological change. All these findings carefully defined the answers of research queries under statement 1.

8.2.2 The role of underlying factors in creation of vulnerability and risk in the society

The study has made special attention to identify underlying factors of differential vulnerabilities and risks in the society through community consultation and interactions in study areas. It examines vulnerability and its underlying factors in line with three basic elements of PAR model, such as: i) root causes, ii) dynamic pressures; and iii) unsafe conditions. The analysis provides an overview on how the root causes are contributing to placing a section of people to an unsafe condition and while they face hazard situation, it bears a risk situation for them. The analysis is also explored the coping inability of a section of people, who are always at risk of disaster situation in the society. The findings strategically defined a set of actions/solutions that may have a significant contribution to releasing the pressure on people, who are at risk of disasters. This also explores knowledge gaps in the examination of vulnerabilities to disasters and failures in the application of the DM framework at different scales.

The essence of analytical findings is that vulnerability is a 'process' that contains a chain of causal factors to form an unsafe condition for the people in hazard-prone areas. Therefore, to address the causal factors of vulnerabilities that generates an unsafe condition and incapability for a section of people, the study suggested the application of release model to uphold people's resilience to cope with the changing situation of disaster in Bangladesh. The analytical findings strategically defined the answers of research queries under statement 2 of the study.

8.2.3 Mapping of most vulnerable people and places in study areas.

The study examines most vulnerable areas and population in the context of coastal cyclone induced areas (i.e., Aila, 2009 affected area and cyclone Amman, 2020 affected area) through using the remote sensing data (Landsat 8 images in areal context of study area). The mapping analysis identified a section of areas functionally inundated during the cyclone, which are defined as at-risk areas (i.e., 14.79% at Shyamnagar and 29.13% at Koyra Upazila). On the other hand, the study also denied the proportionate vulnerability of population through using of secondary data and information in study areas. The mapping of vulnerable areas and the population is important to take comprehensive actions for resilient development in south-west coastal areas of Bangladesh. The findings are then examined with the coping ability of the people to face the disaster situation. As searching the answer of specific quires, the study has defined diverse alarming issues, particularly the increase of inequality, unequal power relations between the rich and poor, landlessness and unemployment that have significant contribution in extending people's inability and facing of lifelong vulnerabilities as their relocation in hazard prone areas. From this point of view, the analytical findings of this section evidentially defined the answers of research queries under statement 3 of the study.

8.3 The impacts of Ecological change

The analysis of ecological change in context of south-west coastal areas has defined some visible adversities in nature and society. These are given below:

I. Land use and ownership

Land use pattern of south-west coastal areas denoted an increasing trend of human settlement and homestead vegetation from 1980-to 2020, while the agricultural land declined due to an increase in waterlogging and saline water storage for commercial shrimp farming. The declination of agricultural land results in a reduction of agricultural production and vegetation cover in the study area. The agricultural land was replaced with shrimp farming forces to transform the land ownership. The majority of coastal land is under the control of powerful and rich people that makes a large section of people landless and displaced. The unequal land ownership is not only

destroying ecological services for the people but also forcing the landless to live in at-risk areas, where they are mostly exposed to diverse hazards.

II. Generate inequalities

The ecological change has a significant contribution to reinforcing social and economic inequalities. The analysis of people's perception reveals that 10% of rich people in coastal areas hold control of 60% of resources, while on average 60% of poor and extremely poor people holds only 10% of resources for their survival. The perception is truly validated with the national trend of inequalities. The recent BBS report[114] reveals that the income shares of the poorest 10% HHs received 1% of the total national income in 2016, which was 2% in 2010. It shows the declining trend of the income share of the poor. But the opposite scenario is defined in the case of the richest 10% HHs, where the income share increased from 36% to 38%[115]. It means that the rich are growing richer in income and wealth day by day. The ownership and control of natural and economic resources generate additional opportunities for the rich people to lead society and social decisions. But the poor people have no or limited access and opportunity to lead society and social decisions. It generates a power imbalance in society and forces poor people to stay out of social leadership and decisions. The people in south-west coastal areas believe more than 80% of social decisions are made by social elites and powerful elected representatives, whereas the poor have limited or no access to be part of social decisions. Besides, poor people have no/or limited ability to manage the changing situations and forcibly face vulnerability and the risk of disasters.

III. Changing human wellbeing.

The ecological change process is contributing to shaping local ecosystem services that have a strong link with human wellbeing. Overuse and extraction of natural resources for economic benefits are the main cause of changing the local ecosystem. The people in both areas depends on the local ecosystem to manage their survival needs but the loss of productivity in the local ecosystem may create additional pressure on the welfare of the poor with minimum requirements of lives.

IV. Disproportionate loss and suffering

Ecological change has a vital role to increase the frequency of climatic hazards. It is revealed that the number of coastal cyclones and the level of salinity has been significantly increased in the last three decades of Bangladesh. Though the loss of human lives due to climatic hazards significantly reduced economic loss and damages increased at an alarming rate. The economic loss and damages disproportionately affect the poor because of their location at the front line of the hazard zone and low coping capacity (Figure-101). As the social structures are highly dominated by the powerful elites and rich groups, the poor families, who are caught in disasters face diverse

[114] BBS (2010), Household *Income* and Expenditure Survey (HIES) *2010, GOB.*
[115] ibid

problems in three basic phases: i) pre-disasters; ii) during disasters, and iii) post disasters. Phase-ii and Phase-iii are struggling for them, when they largely depend on social relations, selling of advance labour, loan and/or outside supports. In such a situation, the poor people have lees means to cope and recover from losses and damages of disasters that often force them back into the cycle of poverty and vulnerability.

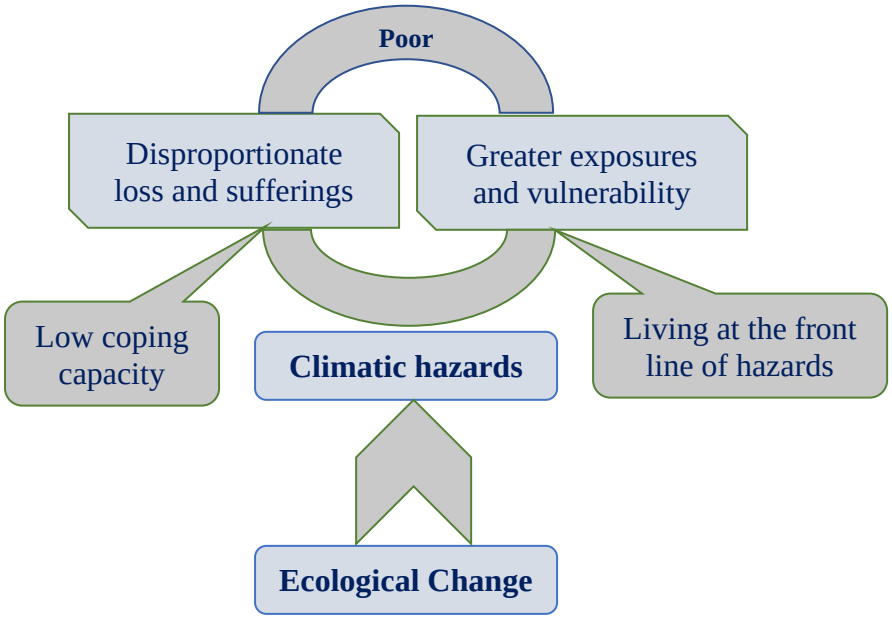


Figure-101: Differential loss and damages as the effect of ecological change
(Source: Author).

V. Differential vulnerability and risk

It has been defined that a section of poor in the south-west coastal areas have limited access, control, and opportunities to use local resources that result in differential forms of vulnerability. Because the local resources are mostly controlled by the powerful elites with the support of state institutions and actors where the poor people have only space to work as resource collectors as irregular workers, wage labourers or small farmers under their control. It has been observed that July to October (4-months) is the most insecure month of the coastal poor people when they face serious food insecurity to survive. As a survival mechanism, a large section of poor families usually takes loans from local money lenders or landlords. The local money lenders/landlords are always taking the advantage of this situation, where they strongly guide the decision, access, and controls to poor people's livelihoods.

The existing process generates a rich and powerful group in the society, who exercise their overall control over the local resources, but it forces the poor to be placed in the marginalized position as powerless. The process also forces them to live in an unsafe location or outside of coastal embankments, which is defined as high risk-prone to

cyclones, tidal surges, and salinity. But the rich and powerful people (landlords and money lenders) lives in *pacca* or semi *pucca* houses in the city or near to city areas (Upazila), where gains available information and services. Due to their existence in safe locations, they are rarely exposed to natural hazards. During the discussion, local people noticed that more than 65% of people's death or injury occurred in the cases of poor and extremely poor families in coastal cyclone induced areas. Due to the existence of unequal access, control and opportunities in society, poor people are usually unable to demonstrate their unity and strength in the making of collective decisions. The isolation and survival mindset of the poor people contributes to extend their struggle in disaster situations and make them the main loser. Besides, they are mostly living at the frontline of coastal embankment areas, where they face limited access to information (Early warning) and inadequate access to state-led institutional services. The situation pushes them into an unsafe condition, where they face lifelong vulnerabilities and the risk of disasters.

VI. Construction of a Disaster situation

The analysis of different theories and methods of political ecology clearly explains that disaster is a complex and socially constructed situation. While a group of vulnerable people is exposed to extreme natural events and unable to cope and recover from the situation, the situation is viewed as a disaster. Hence, the lifelong vulnerabilities of a section of people have a significant role to transform their vulnerabilities into the risk situation of disasters, when they face any forms of hazards (i.e., cyclones, flooding, salinity, waterlogging). It means that the vulnerable people are caught between unsafe conditions (internal situation) and external shock (hazards). As a reference of PAR Model[116], Disaster = Vulnerability X Hazards. The equation refers to the disaster as a combined force of people's vulnerability and hazards. Earlier, it is explained that a section of poor and extremely poor people in south-west coastal areas are struggling to manage minimum survival needs by generation to generation and hold limited ability/capacity to cope with the external shocks. The status and location always keep this group of people in vulnerable situations and while they face any external shocks, it creates a situation of disaster for them. The ground realities of south-west coastal areas allowed the study to apply the PAR model for defining the causal chain of vulnerabilities. The analysis has explored a set of drivers, which are functional as root causes, dynamic pressure, and unsafe conditions for the progression of vulnerability in south-west coastal areas. It reveals an argument that the people in unsafe conditions will face disaster risks, whenever they face natural hazards, but it is always the true fact for all in society. Because the people in South-west coastal study areas, who are in unsafe condition are always living like a disaster situation. They don't need to be at risk of disaster, while they will face natural hazards.

[116] Wisner et al., 2004

8.4 Identified issues in reducing pre-disaster vulnerabilities.

The study has defined several issues, which are active to create a condition of vulnerability in south-west coastal areas. The condition is often intensifying with the functions of dynamic pressure and create an unsafe condition for the poor to face disaster. The study has explored five issues that require special attention and action to create a safe condition to make the poor out of risk in a disaster situation (Figure-102). The root causes are as follows:

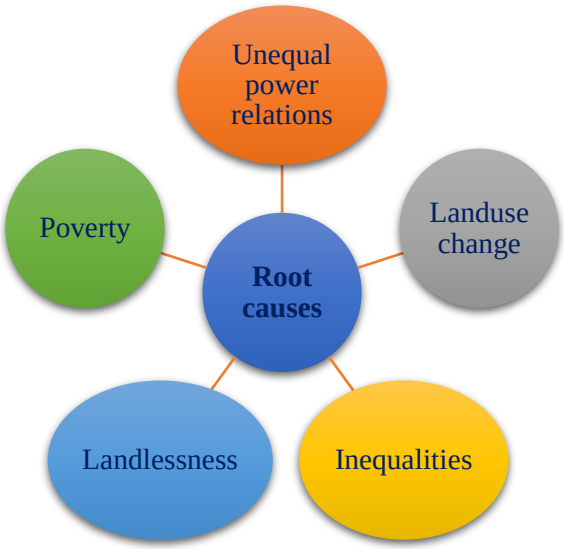


Figure-102: Identified root causes of vulnerability (Source: Author).

The study also defined the issues that may be applied in releasing of root causes in south-west coastal areas of Bangladesh:

Root causes	Actions for Release of the root causes
1. Unequal power relations	• Enhance poor people's access to use local resources. • Develop leadership among the poor so that they can deal with their problems/concerns. • Increase poor people's participation in local decisions on resource management.
2. Poverty	• Explore alternative livelihood options and opportunities for the poor families. • Inclusive poverty reduction and resilience development strategy
3. Land use change	• Appropriate land use planning for shrimp farming • Introduce saline sensitive agriculture. • Promote nature-based solutions for best uses of land
4. Landlessness	• Proper land management and better governance

	• Allocation *Khas* land for the landless families
5. Inequalities	• Legal/policy reformation for reducing the income gaps between the rich and poor in the society. • Strengthen the coverage of social protection Programme. • Improve the quality of life and alternative livelihoods options for at-risk populations.

8.5 Identified issues for reducing post-disaster vulnerabilities.

The mapping analysis of the post-disaster inundated area of Cyclone Aila 2009 reveals that approximately 15% in Shyamnagar and 29% in Koyra areas are defined as the vulnerable population who needs special support in a post-disaster context. The status refers to that on average 22% population in coastal cyclone induced areas needs necessary support for reducing their post-disaster vulnerability.

8.6 The revisited theory and methods

In this study, I have applied the theory and methods of political ecology in analysing the causal chain of vulnerability and the risk of disasters in the south-west coastal areas of Bangladesh. The analysis explored that human-dominated interactions with the environment are active and visible in everyday, episodic, and systematic processes of ecological change. The process is creating differential impacts on the people, where the poor become the main loser. This is also visible in the process of landscape changes during 1980-2020 in study areas (see chapter seven). The theoretical discussion highlights a causal link between the vulnerabilities and the risk of disaster. It illustrates a situation of failures and sufferings of a section of people to survive, while they face external forces. As this section of people has limited knowledge and ability to survive, they are defined as the main loser and at-risk group in society. Considering that the risk of disaster is visualised as:

$$\text{Disaster (Risk)} = \frac{\text{Hazard (H) X Vulnerability (V)}}{\text{Capacity (C)}}$$

Hence, vulnerability is a situation of an unsafe condition of a section of people and when they face any forms of hazards, it creates a disaster condition for them because of the inability to cope with this situation. So, high vulnerability refers to the high risk for a group of people. But if they become unable to resist the harmful effect of hazards to recover easily, this contributes to reducing the risk of disasters. The analysis of ecological change that forms differential vulnerabilities to people and examining the

progression of vulnerability to construct a disaster is a central element of this research. The first part of the research theme is analysed through the lens of political ecology and the second part is examined in line with the PAR model. This model is significant to analyse the causal factors of vulnerabilities. It has demonstrated functional links of vulnerabilities with a set of root causes that transform a section of people into an unsafe condition with the force of dynamic pressures. And, when the condition of vulnerability intersects with hazards, it constitutes a pre-condition for a disaster. Though the PAR model takes a holistic view of vulnerability and places livelihood strategies at the centre of coping mechanisms in disaster situations, there are defined gaps in the analysis of disasters. These are as follows:

- The PAR model doesn't provide enough space to examine human-environment interactions.
- It can't illustrate the causal ground of differential vulnerability and the impact of disasters.
- It is mostly macro-scale focused and not enough focus on micro-scale analysis.

The study significantly addressed the above-mentioned gaps by examining the process of human-environment interactions and the drivers that contribute to change ecology at local and national scales. The analysis also visualises a link between ecological change and differential vulnerabilities that contribute to creating an uneven risk of disasters in society. Finally, the research resolved the scale issues by focusing on the specific context of south-west coastal cyclone-prone areas to explore the causal ground of vulnerability. Considering that it can be claimed that the research fills the gaps in the analysis of vulnerability and disasters (through the use of the PAR model). The research explored an understanding of vulnerability to disaster as 'products' and 'processes'. It has been observed that some issues of vulnerability create a condition of disaster, and it may reinforce and change in post-disaster context as a result of non-response decisions of instructions (state and non-state) and actors. The vulnerability issues can be transformed into normal life situations of the people. So, the analysis of vulnerability and the risks of disasters in south-west coastal areas denoted as a product of:

- Existing process of social, economic, political, and environmental transformation.
- Existing drivers of ecological change.
- Traditional development process; and
- Existing response mechanisms (during emergency and post-disaster context).

I. Existing process of social, economic, political, and environmental transformation

The social structure in south-west coastal areas is predominated by the rich and social elite groups with well-defined roles and relationships. It contributes to transforming the social and economic processes to create a condition of dependency of a section of people on the rich and elite group. The dependency also determines the control system of natural resources. The people, who are running their livelihoods with the extraction of natural resources usually work under the direction of rich and social elite groups in the society. The process continues to create social hierarchy and undermines the needs and requirements for survival of a section of people. This leads to an unequal power relationship among the people, while the rich and social elite groups exercise the power to maximize their economic benefits. Besides, the poor people, who enable to exercise their power and ability hold limited access, control, and opportunities to meet their survival needs. The situation places these people to live with vulnerability and risk, where they become the main loser.

It is fact that the existing social and economic processes in south-west coastal areas are widening the exclusion, and it undermines the excluded section of the population to be part of political leadership. This results in widening of inequalities and increasing vulnerability of certain marginalized people in society. Besides, the day-to-day human practices due to the increasing demands of powerful actors have serious pressure on local landscapes and natural resources in south-west coastal areas. This results in changes in local ecology, declining ecosystem services, and the spreading of inequality in society.

II. Drivers of ecological change

The conceptual view of political ecology has explored nature and power-driven interactions as a process of fundamental ecological change. The research has significantly defined multiple processes and a set of drivers, which are active to change ecology (Figure-103: a, b, c & d). These are as follows:

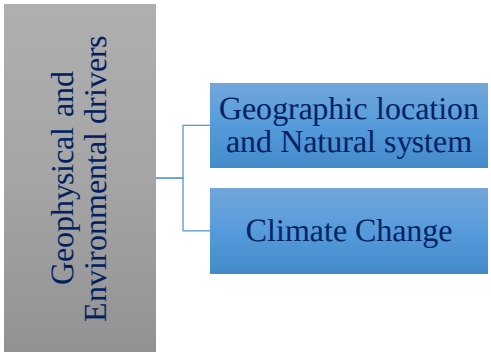


Figure 103 (a): Geographical and Environmental Drivers.

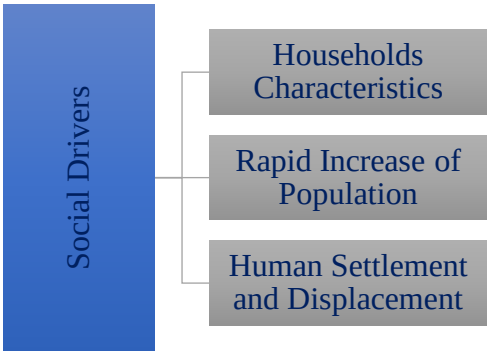


Figure-103 (b): Social Drivers.

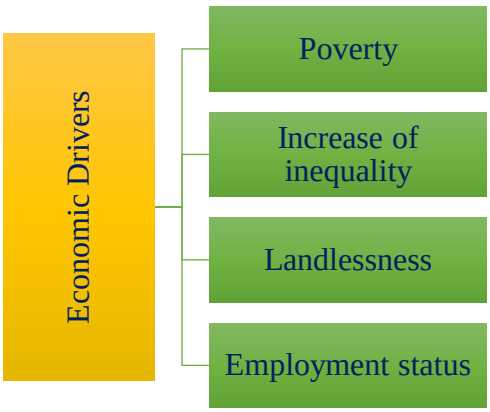


Figure-103 (c): Economic Drivers.

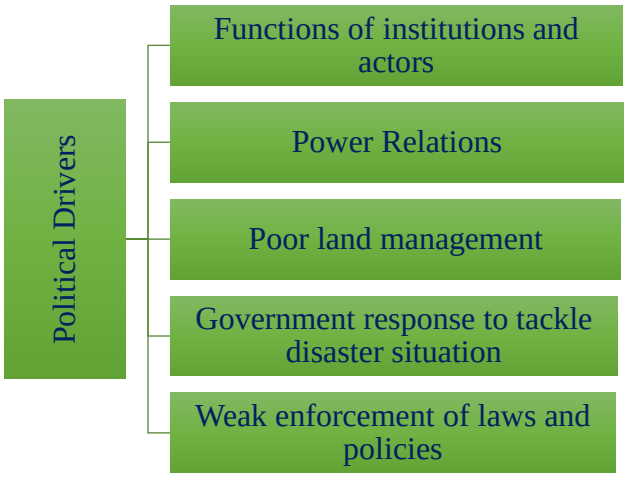


Figure-103(d): Political Drivers.

Figure-103 (a, b, c, and d): Existing drivers of ecological change
(Source: Author).

All the drivers are causally linked and functional for creating an unsafe condition in south-west coastal areas of Bangladesh. It has already been defined that a large section of people is unable to tolerate the impact of risk drivers of ecological change and it forces them to live with lifelong vulnerabilities and risk of disasters.

III. Traditional development process

Vulnerability is the result of the traditional development process. It is mostly applied top-down and engineering approaches in reducing the risk of natural hazards where the local people have very limited space to express their feedback. As an example: the coastal embankment project, 1960 constructed a total of 37 polders, 282 sluice gates and 1556 km. embankment in the coastal areas aiming to protect coastal lands and people from the tidal surges without consultation with grassroots actors (Asif, Ishtiaque et. al, 2017). This results in an unforeseen ecological problem in coastal areas because the embankment disrupts the natural tidal water flow in the rivers and caused heavy siltation on the outside walls of the polders. The process transformed into a frequent water-logging situation in coastal areas. Besides, the unplanned development works that change the natural flow of the rivers also hurt people. So, the traditional development process is unable to comply with the needs and priorities of the poor and vulnerable groups, which often results in displacement and loss of livelihoods. The failures of people-centric development are contributing to extending people's inaccessibility to local services and resources. It results in generation of a marginalized and vulnerable groups in the transformed society. Therefore, the development process should consider local ecological systems and disaster risks to transform them into resilient development.

IV. Existing response mechanisms

The timely decisions and response of local institutions and actors are very important to reduce the vulnerability of disaster. The conventional functions of DM committees (national and local district, Upazila and Union level) preserves a limited space for the vulnerable communities to be engaged in planning and decision making. The routine actions of the DM committees rarely addressed the unknown challenges and new learnings in reducing vulnerability. This results in the exclusion of a large number of affected people from the response initiatives of the Government. It was truly visible at the time of response initiatives of cyclone SIDR in 2007 and AILA, 2009. The existing relief allocation and support mechanisms are heavily biased and criticized by the affected but excluded people. As a reference to cyclone Aila, the recovery initiatives are mainly done with the 'cash for work' and 'food for work' schemes, which are mostly short-term initiatives. The reconstruction of damaged coastal embankments was also delayed due to sustainable planning and budgetary allocation. Besides, there is some social safety net (i.e., VGF or VGD) efforts of the government, the Programme was not

focused on the most vulnerable groups, who urgently require protection117. All these results in widening the struggle of most affected groups to face the impact of disaster situations. Therefore, theoretically (as per the PAR model), the causation of vulnerability is a pre-disaster situation. The existing root causes contribute to the process of vulnerability and extend gaps in risk perception between the people and local instructions and actors involved in disaster management. The condition of vulnerability transformed into a disaster situation at the time of disaster and post-disaster context if the gaps continue to response and recovery stages. Besides, the PAR model refers to the unsafe condition as a "zero" condition of the vulnerable people, but it is not a reality in the context of south-west coastal areas. The condition of vulnerability may change over time but there is no space to live with "zero" vulnerability and risk, where the people frequently witness the condition of disasters.

8.7 Revisit the disaster situation

The causal grounds of vulnerabilities and the creation of a disaster situation reveal the answer to the fundamental question 'why does disaster occur?' The functions of three dynamic processes and power-led drivers of ecological changes maintain a complex and dynamic relationship to create an unsafe condition for a section of people, where they usually show their inability to survive. The situation is redefined as a disaster situation (Figure-104). So, disaster is a socially constructed situation that continues the lifelong struggle of the poor and marginalized. It is noted here that 'vulnerability' is an integral part of the understanding risk of disasters, but the question of time is fundamental.

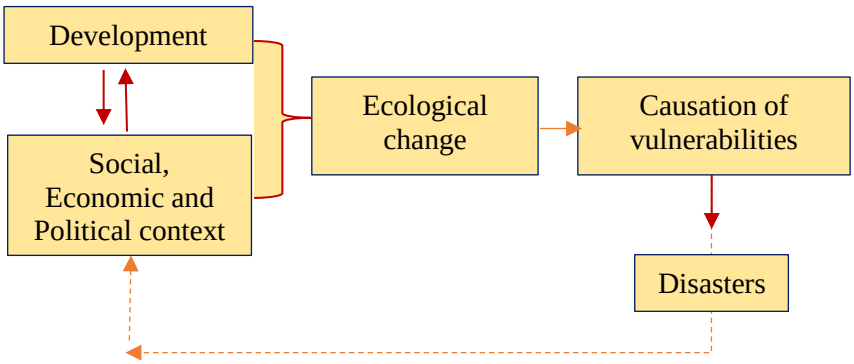


Figure-104: Linkages between Ecological Change, Disasters and Development
(Source: Author).

[117] Recovery Needs Assessment Report of Cyclone Aila affected areas (25-31 October 2009) conducted by a group of international agencies with the support of ECHO.

Therefore, the risk situation can be measured in the analysis of specific context, timing, scales, and human response initiatives. The possible timing of analysis can be:

a) Normal situation (no disaster)
b) Emergency (when a disaster situation occurs)
c) Transitional situation (recovery from disaster situation)

Besides, the causal ground of disaster is illustrated through the application of the PAR model. It reveals the answer to the question 'how does the vulnerability situation progress' and 'how does it create a situation of disaster?'. The analysis pointed out that the vulnerability generates a force for a section of people to live in an unsafe condition and while they face any form of destructive events or natural hazards, they become the victims of the disaster. From this point of view, the PAR model refers to a linear approach of vulnerabilities that results in disaster. Disaster undermines the desire of the people to development. Through the cyclic model of disaster management don't consider development as a specific agenda, it has direct or indirect relations with the desire of development. It is true fact that development failures can create-risk group in society by increasing their societal vulnerability and reducing coping strategies. It refers to a dynamic process and noted the 'disaster' as an outcome of that process (Figure-105).

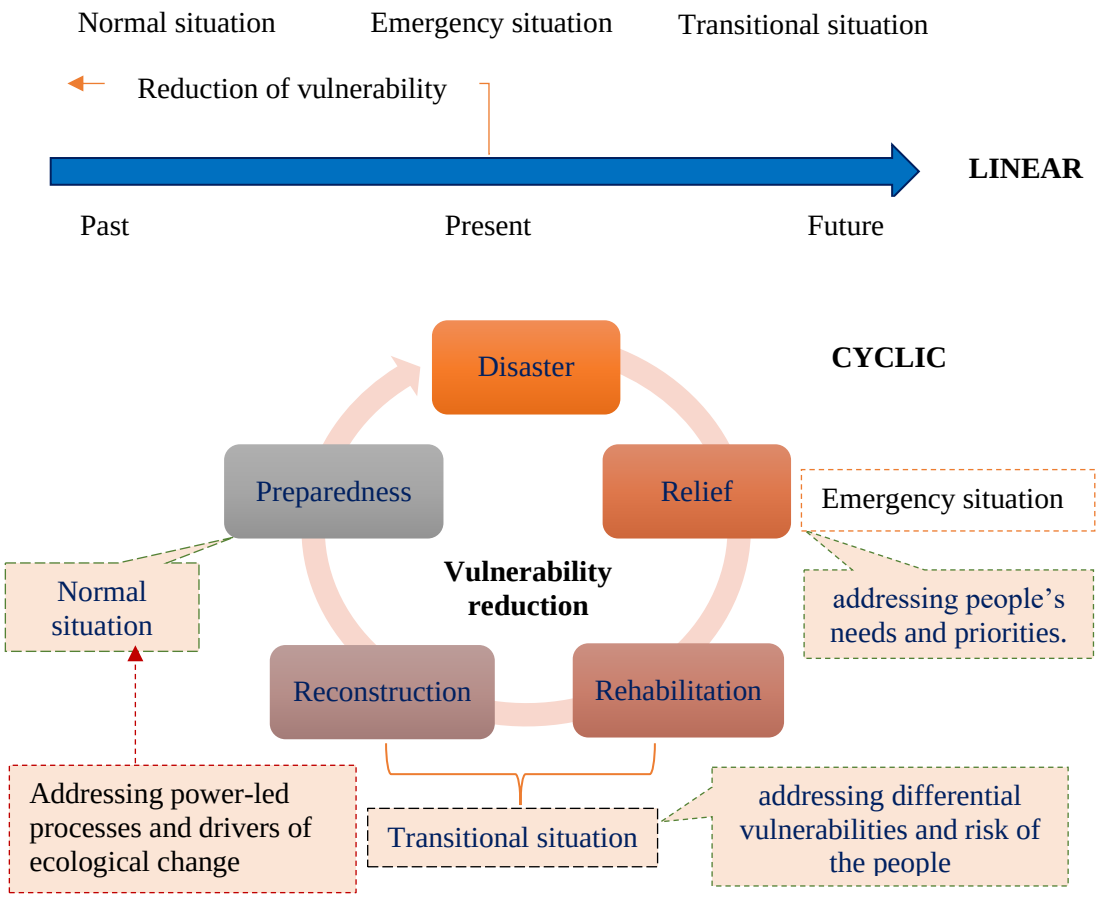


Figure-105: The process of vulnerability reduction (Source: Reframed by Author).

8.8 Policy implications and suggestions

The research highlights a link between theoretical orientation and ground realities to examine the process and power-led drivers of ecological change that have been creating a condition of differential vulnerabilities and the risk of disaster. This has explored a set of actions and strategies for addressing the progression of vulnerabilities and the risk of disasters. The key point is that the people have their indigenous knowledge and skills to use their lifelong learning, experiences, and potential to survive in difficult situations. This is an important point of discussion and action of the policymakers, assigned institutions and actors to define sustainable solutions for the causal grounds of vulnerabilities. This will ultimately contribute to neutralising the functions of the power-led process and drivers of ecological change and shape the futures of the at-risk people in society. The key actions are as follows:

8.8.1 Improve strategies for better land use and land management.

The existing land use pattern revealed an increasing trend of human settlement, homestead vegetation and shrimp firm areas but declining the agricultural land in south-west coastal study areas. The spatial data analysis of Shaymnagar areas revealed that human settlement and homestead areas were only 50.36 sq. km in 1980 and gradually increased to 55.30 sq. km in 2000, 77.44 sq. km in 2010 and 102.46 sq. km in 2020. A similar trend is also defined in the Koyra areas. In the Koyra area, the total human settlement and homestead vegetation area was 23.42 sq. km in 1980 increased to 55.64 sq. km in 2020. Similarly, the coverage of shrimp firming area was only 20.40 sq. km in Shyamnagar areas in 1980 that steadily increased to 186.68 sq. km in 2000, followed by 219.37 sq. km in 2010 and 220.89 sq. km in 2020. On the other hand, the shrimp farming area was only 11.03 sq. km in 1980 in Koyra, which is almost ten times encased in 2020 with a coverage of 101.58 sq. km. But there is observed a declining trend in agricultural land in study areas.

The total agricultural land area in Shyamnagar areas was 349.22 sq. km in 1980 that declined to 178.16 sq. km in 2000, followed by 124.61 sq. km in 2010 and 98.06 sq. km in 2020. A similar trend is also observed in the Koyra areas. The increase in human settlement and the transformation of agricultural land into shrimp farms are the major causes of declining agricultural land. The decline of agricultural land contributes to reducing food production and creating livelihood crises in south-west coastal areas that refer to as failures of coastal land management. However, the land use and land administration in Bangladesh are mostly administered by the following instruments:

- ✓ The Revised State & Tenancy Act, 1972.
- ✓ Land Development Tax, 1976
- ✓ The Land Reform Ordinance, 1984.
- ✓ The agricultural Khas land Management and Settlement Policy, 1997.
- ✓ The Land Administration Manual, 1991

- ✓ The Land-use Policy, 2001
- ✓ The Vested Property Return Act 2001

In addition to that, some supplementary instruments significantly aligned with the land use and land administration in Bangladesh. These are as follows:

- ➢ National Environment Policy 1992; Environment Conservation Act, 1995 (amended in 2000, 2002)
- ➢ National Forest Policy, 1994.
- ➢ National Water Policy, 1999 and Water Act, 2013
- ➢ Coastal Zone Policy (CZP), 2005.
- ➢ National Rural Development Policy, 2001.
- ➢ National Agriculture Policy, 2010.
- ➢ National Housing Policy 1993 and 2001.

The multiple uses of laws and policies by diverse institutions and authorities have created a complexity to implement land use planning and administration of land (including Khas land) in Bangladesh. Besides, the land administration is mostly guided by two-line Ministries: i) the Ministry of Land; and ii) the Ministry of Law, Justice & Parliamentary Affairs, who delivers some specific roles to steer the land recording, administration, and registration. But the coordination, exchange of information and transparency of assigned institutions and authorities are functionally missing on the ground that contributes to creating land disputes and conflicts in the society. This results in the creation of a landless population[118] in the society, which is in increasing in Bangladesh. A comprehensive land-use policy and operationalization of an accountable land administration system are necessary to reduce landlessness. This will also ensure the best uses of agricultural land and *Khas* land for advancing just and equitable development in Bangladesh.

8.8.2 Integration of development planning with agendas for stainable development

The existing development planning of Bangladesh is mostly driven by an "economic growth" centric approach. The approach has shown its success in maintaining a GDP growth rate of over 6% during FY 2011-15 to FY 2016-20. The success is also visible in the reduction of poverty[119] but the approach significantly contributes to generating a social order and inequalities in the society. It has been reported that the income shares of the poorest 5% population are 0.23% of overall income (in 2016), which was 0.78% in 2010. In contrast, the income of the richest 5% population grew to 27.89% from 24.61% in 2010[120]. And such increase in income concentration had been much higher in the urban areas. This means the existing development process is not only supporting resource inequalities between rich and poor but also widening the unequal power

[118] The landless population was 14.3% in 1947 that increased to 68.8% in 2001 (Islam, 2005)
[119] In Bangladesh, the poverty rate is calculated as 71.3% in 1973, 48.9% in 2000 and 22.4% in 2017 but 27.5% in Khulna (Coastal areas)
[120] Based on BBS, 2011 and 2017.

relations in the society. The rapid population growth, urbanization and unplanned development have also been creating pressure on local resources, environment, and livelihoods. This results in unequal access, opportunities, and exposure to hazards, where the poor become the main loser. Therefore, development planning should integrate and align with the agendas for sustainable development. Though the government of Bangladesh strategically introduced its 8th five-year development plan that significantly aligned with 17 goals of SDGs by setting specific targets, it is still not fully complying with the issues of power relations (Table-34).

Table-34: Alignment of identified drivers with the SDGs and 8th five-year plan

Identified drivers of ecological change		Alignment with SDGs	Alignment with the 8th five-year plan
Geophysical and Environmental drivers	Geographic location and natural system	Goal-14 Goal-15	Section-4.6.2 (page-323)
	Climate change	Goal-13	Section-8.5 (page-500)
Social drivers	Household characteristics	Goal-4, Goal-6	Section-10.4 (page-583) Section-11.6 (page-635) Section-14.5.3 (page-747)
	Rapid increase of population	Goal-2, Goal-3	Section-9.6 (page-535) Section-10.6 (page-604)
	Human settlement and displacement	Goal-6, Goal-11	Section 4.6.3 (page-3.25)
Economic drivers	Poverty	Goal-1, Goal-3	Section-2.3 (page-35) Section 4.2.5 (page-100), Section 4.3.2 (page-109)
	Inequalities	Goal-5, Goal-10, Goal-16	Section 4.4.1 (page-106, 109) Section-14.2.3 (page-718) Section- 14.6.3 (page-771)
	Landlessness	Goal-2	Section-14.3.2 (page-732)
	Unemployment	Goal-8	Section 2.9 (page-233) Section 3.3.2 (page-243) Section 3.5 (page-252) Section-13.6 (page-700)
Political drivers	Functions of institutions and actors	Goal-12	Section 1.4 (page-174) Section-7.4.1 (page-448)
	Power relations	Goal-16	?
	Poor land management	Goal-11	Section-4.3.3 (page-3.2)
	Government response to tackle disaster situation	Goal-13	Section 4.7.2 (page-335) Section 4.8 (page-338) Section-14.4 (page-736)
	Weak enforcement of laws and policies	Goal-15	Section-8.2.1 (page-474) Section-8.3 (page-483)

Source: SDGs and 8th five-year plan, GoB, December 2020

The alignment of identified drivers of ecological change has a clear reflection of its alignment with the SDGs and the 8th five-year plan of the government of Bangladesh. But the missing element is that the 8th fiver-year plan has strategically applied the apolitical approach to steer up its development process by denying the functions of power relations in society that force a section of people to live in at-risk situations. As the country holds a significant proportion of the unsafe population, who are facing the adversities of disasters, the government should provide more attention to addressing the power dynamics for assuring sustainable development. Otherwise, the development efforts will never reach to the left behind people.

8.8.3 Reinforce the functions of the DRM framework.

Bangladesh has successfully shaped its DM framework in line with its long ground experiences, shifting of approach and alignment with international and regional[121] disaster frameworks[122]. The framework is structurally functional with some regulatory instruments at the national and local levels. The Ministry of Disaster Management & relief (MoDMR) is placed as the focal point of the DM structure, which maintains an effective flow of information and strategic coordination with the NDMC, IMDMCC, NDRCG[123] and DDM to make and transform strategic decision on disaster management. On the other hand, DDM provides necessary support and information to all DMCs at local administrative levels.

Both the national and local DM structures works under the following instruments:

- ✓ Disaster Management Act, 2012
- ✓ Disaster Management Policy, 2015
- ✓ National Plan for Disaster Management 2016-2020.
- ✓ Climate Change Action Plan (2009–2018)
- ✓ The Standing Orders on Disasters (SOD), firstly introduced in 1997 and revised in 2010
- ✓ Cyclone Shelter Construction, Maintenance and Management Policy 2011.

Hence, the alignment of these instruments with sectoral and local development planning is very important. It is true fact that Bangladesh has made tremendous efforts in shifting its approach from vulnerability to disaster resilience as a requirement of sustainable development but the delegation of roles and responsibilities in all stages of DM structures is still not yielded successful results on the ground. The DM structures at local levels are not enough self-regulatory and well-coordinated in addressing the

[121] Regional framework: SAARC Framework 2005-2015
[122] International frameworks: IDNDR 1990; UNISDR 2000; Hyogo Framework for Action (HFA): 2005-2015; and Sendai Framework 2015-30
[123] NDRCG means the National Disaster Response Coordination Group

underlying causes of existing vulnerabilities and risk of the people in south-west coastal areas.

In Bangladesh, disaster planning, management, and decisions are mostly controlled by the national DM structures where the local DM structures drive with the guidance, allocation, and decisions. It reflects top-down DM management where the local DM structures have little role to make self-regulatory initiatives in addressing the vulnerability and risk of disasters. The role of local DM structures is only visible in transformation early warning messages and operations of emergency relief. The DM structures at the district and Upazila level are mostly controlled and guided by the local administration (DC and UNO accordingly), and the Union level DMC is guided by the UP chairman and members. Due to the control of local administration and elected representatives, the issues, and concerns of the poor and vulnerable are rarely raised in their planning and decision-making process. Besides, the local DM structures are mostly found inactive in the normal situation but reinforce their functions during an emergency and transitional situation.

In addition to that CSOs and the private sector are also defined as vital actors in disaster management. The DM structures should be more capable, cordial, and well-coordinated to take an integrated effort in the implementation of comprehensive response and recovery programs for reducing the risk of disasters (Figure-106).

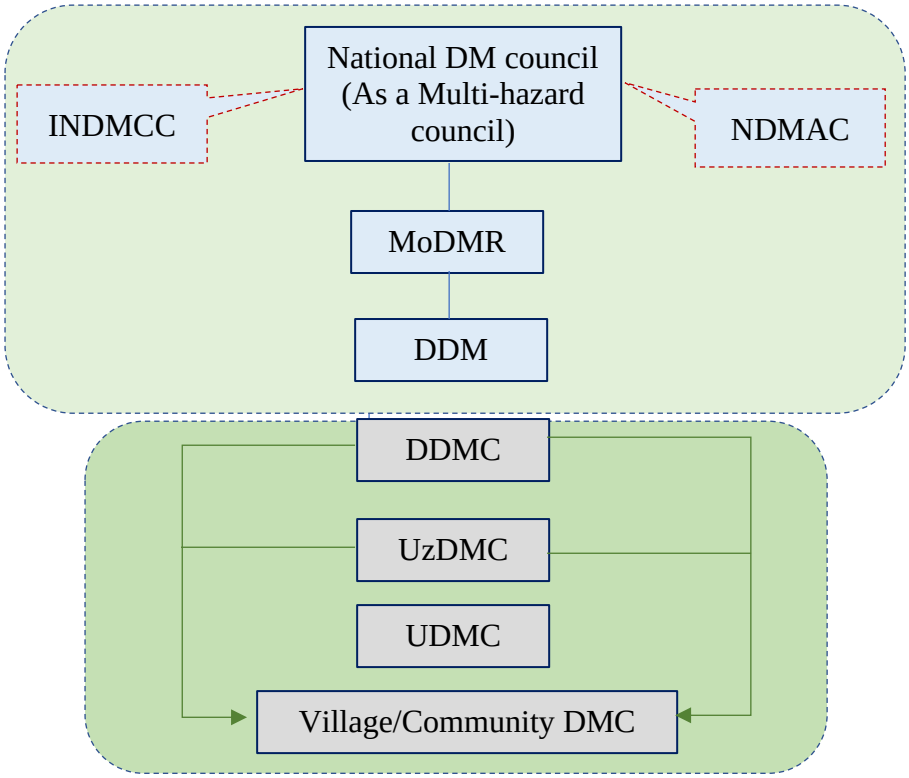


Figure-106: Proposed institutional structure for disaster management in Bangladesh (Source: Author).

Most importantly the community involvement and strengthening of governance in all stages of disaster management are necessary so that local communities can feel ownership and invest their efforts in a long run to improve their coping capacity to face a disaster situation. Otherwise, the short-term efforts of the DM structures and CSOs/NGOs/CBOs will ultimately make the people dependent on external support that restricts the desires for resilient development in Bangladesh.

8.8.4 Integration of local development and disaster risk management

It has been examined that disaster creates a negative impact on the lives and resources of the poor in society. It may destroy development efforts that they achieved over the years and push them into an unsafe condition. So, the inclusion of poor and marginalized groups in local development planning and initiatives is very significant in risk management. The reality is that it is not possible in isolation, and it requires integrated planning and programming to address the social, economic, environmental, and human concerns of local development. Realizing that an inter-disciplinary coordinating mechanism is suggested for local development planning and programming. This mechanism should be institutionalized at grassroots level by involving all relevant institutions and actors (Figure-107). This will not only address the underlying causes of disasters but also contribute to reinforcing disaster-resilient local development in Bangladesh.

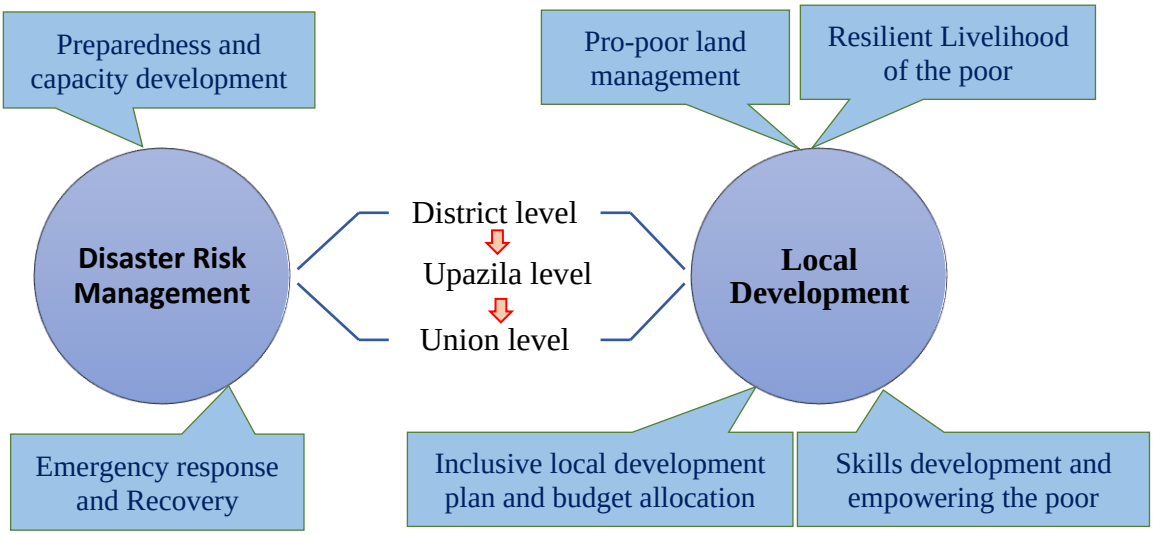


Figure-107: An integrated mechanism for disaster risk management and local development (Source: Author).

8.8.5 Integration of spatial mapping for ecological resilience development

The research significantly highlighted the landscape changes (1980-2020) through the application of remote sensing images and data in the context of south-west coastal areas in Bangladesh. The areal transformation of landscapes can provide evidential data and information for better development planning and initiatives. In addition to that, the inundation mapping as the effect of the coastal cyclone can also be helpful to define the most vulnerable area and population. This may have a significant contribution to introducing disaster-resilient planning and development initiatives.

8.8.6 Strategies for addressing differential vulnerabilities and risks.

As it is already defied that a section of people always faces differential vulnerabilities and risk in the society, who have limited capacity to cope with the adverse situation of disasters. The ecological change process and drivers are very much active in south-west coastal areas that create unequal access, opportunities, and exposures to people and force them to face the maximum risk of disaster. It has already been explained that socio-economic inequalities drive the ecological crisis where the richest group in the society shows their ecological irresponsibility's to maximize their profits and benefits. The inequalities create demands for survival needs among the rest of the population that ultimately declines ecological sensitivity and increase people's vulnerability to disaster at a local and national scale. Another form of environmental inequalities is rising as the effect of climate change at the regional and global scales. Therefore, the ecological change in south-west coastal areas affects the people differently, where the poor mostly apply negative coping strategies to survive (Figure-108). It requires sustainable livelihood initiatives that will enable poor people to have greater access, opportunities, and control over their resources to be more disaster resilient.

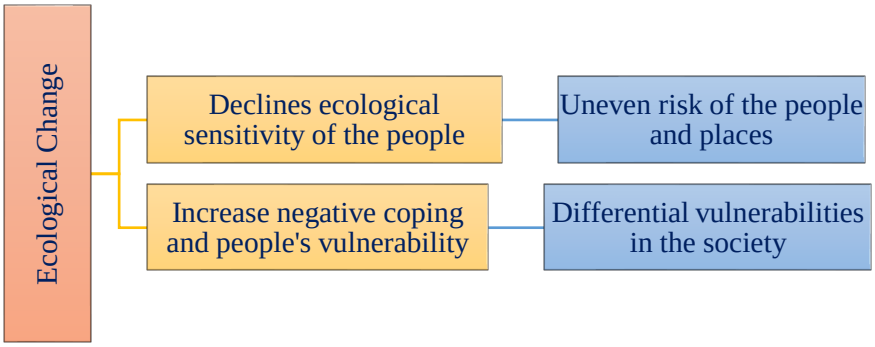


Figure-108: The linkages of ecological change with uneven risk and differential vulnerabilities (Source: Author).

Therefore, to address the differential vulnerabilities and risk of the people in south-west coastal areas, it is necessary to implement a set of integrated actions in reducing the adversities of the ecological change (Figure-109).

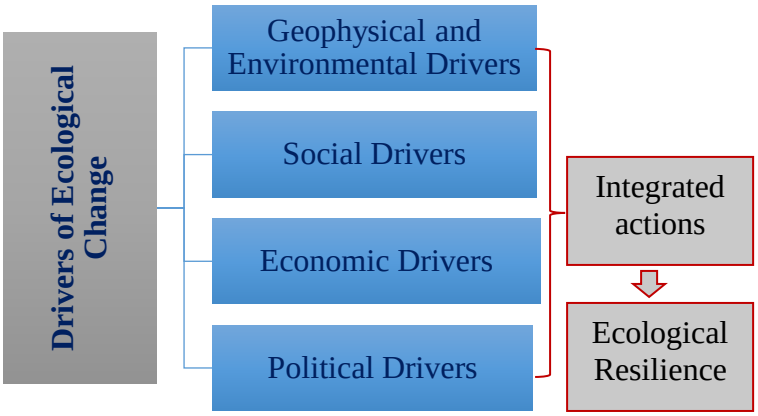


Figure-109: Addressing the ecological change drivers (Source: Author).

Realising the fact, the research proposed a set of actions for reducing differential vulnerabilities and risk of people and places in South-west coastal areas of Bangladesh, which are as follows:

1) Strengthening resilient landscapes.
2) Strengthening adaptive social protection.
3) Scaling up climate-smart and pro-poor land use planning and practices.
4) Improving the allocation of Khas land for landless households.
5) Creating equal access, control, and opportunities to local resources.
6) Assuring better engagement of the poor and vulnerable in local decisions and development actions.
7) Enhancing the understanding of Disaster Risks and adversities of climate change.
8) Reinforcing the implementation of laws and policies related to disasters and climate change.
9) Integrating all-of society engagement and partnership.
10) Taking appropriate actions to neutralise the power drivers in society.
11) Setting of disaster-resilient development as the core theme of sustainable development agenda (by 2030).
12) Transforming causal vulnerabilities into resilience development.

8.8.7 Intervening unequal power relations.

The study reveals a strong correlation of power relations with discriminations, inequality and local decision making. The status denoted that a section of the rich and powerful elite group holds greater access to local resources, control over the resources and decisions of development, who always maximize their benefits of development. Hence, the poor people are used as resource collectors and worked under the control of rich and powerful elite groups, where they do not have their voices. The existing process is creating a condition of inequalities, unequal access, and opportunities, where the poor become the main loser. The rich and powerful elite groups always take advantage of this condition and force the poor to live in at-risk locations with lifelong vulnerabilities. Hence, the local government institutions, civil society organizations and sensible citizen groups should act together to monitor and ensure representation of the poor in existing local decision-making structures for equitable development. The integration of equitable and rights-based approaches is necessary to raise the common voices of the poor people and sensitize the local institutions and authorities for their responsive services. This will contribute to changing people's minds and practices to create a space for the poor to overcome their struggle and risk of disasters. This may create an environment where the rich and social elite groups can realize their roles and commitment to equitable social development.

8.9 Contribution of the Research

The research examined 'vulnerability' and 'disaster' using the lens of political ecology that made a significant contribution to:

Firstly:
Broadening of the analytical framework of political ecology by examining the power-led process and drivers of ecological changes in south-west coastal areas of Bangladesh. The analytical findings reveals that ecological change processes have a significant role in creation of differential vulnerabilities and risks. The study has proven that the ecological change process is creating a trap for the poor, while they are becoming the main loser and exposed to face lifelong vulnerability and the risk of disaster.

Secondly:
Transforming the lens of political ecology, where it was theoretically focused on political perspectives but limited focus on the ecological perspectives in analysing socio-environmental problems. The research significantly addressed the limitation and gaps in applications of political ecology in searching of the power-led processes and drivers of ecological change in south-west coastal areas. It is evidentially proved that human induced actions are playing the key role in changing landscapes of an area and

creating unequal power relations in the society to force a section of people to live vulnerabilities and the risk of disaster.

Thirdly:
Signifying the framework of the PAR model, the study potentially explored a set of underlying factors of vulnerabilities and risks in south-west coastal areas. It examines the vulnerability and its underlying factors in line with three basic elements of PAR model, such as: i) root causes, ii) dynamic pressures; and iii) unsafe conditions. As a process of exploration, the study provides an overview on how the root causes are contributing to placing a section of people to an unsafe condition and while they face hazard situation, it bears a risk situation for them. Though the PAR model has criticism for its applications on macro scale, the study potentially addresses the fact by using micro-scale evidence and contents. The micro-scale evidence explored a causal links of vulnerabilities and risk of disaster that creates conditions for a section of people to face lifelong struggle and vulnerabilities, while it refers to it as an ‘’unsafe condition’’ of the society. The study has proven the statement of PAR model as ‘’partially true’’ because the people in south-west coastal study areas, who lives in unsafe condition are always living with vulnerability and risk situation. It is not necessary to face the external hazards to be part of risk situation of disaster.

Fourth and Finally:
Mapping of the vulnerable area and the risk population in the context of south-west coastal study areas added value in developing a framework for ecological resilience development. The mapping can guide relevant institutions and actors to take actions for:

- ✓ Advancing local knowledge and capacity to address causal factors of ecological change that have a role in creating differential vulnerabilities.
- ✓ Reducing risk of disaster among at risk people.

By keeping eye on the functions of power-led process and drivers of ecological change in creation of differential vulnerabilities and risks of disaster as extended reflection of people’s inability to cope with the changing situation, the study finally defined a set of suggestions/actions with a proposal of an ecological resilience development framework as a safeguard of vulnerable people and places. The study findings will add values in applications political ecology perspectives in the future disaster research as promotion of ecological resilient development for assuring sustainable development in Bangladesh.

8.10 Future Research Directions

The study is successful to explore new windows by adding a new dimension in research questioning, methodologies, and new knowledge. The new windows suggested a set of directions for future research. These are as follows:

1. The research has successfully identified and examined a set of power-led processes and drives of ecological change that contributes to create conditions for differential vulnerabilities and risk of disaster in south-west coastal areas in Bangladesh. Therefore, further research may extend the functions of power drivers in disaster situation at multiple scales and contexts. Hence, the remote sensing data and GIS mapping tools can be applied to add value in further political ecology research.

2. There is still a need for a comprehensive analysis of inequalities, landlessness and power relations that placing the poor into a situation of life-long vulnerabilities and risks in the society. This segment of people are mostly defined as vulnerable and unsafe population in context of disaster management in Bangladesh. But most of them are being excluded from the development initiatives (including the response and recover) of the government. So, there is still a space to do further study to uncover the causal grounds of their exclusion from development efforts/initiatives of the government in Bangladesh.

3. Future research is suggested to mapping of community and areas specific vulnerable people with a microscale analysis of their vulnerability and risks. This will guide to local development planning as well as national development planning and budgeting for assuring sustainable development in Bangladesh.

However, my research has successfully defined and examined three dynamic processes and fifteen power-led drivers of ecological change, which are playing a significant role in creating conditions for differential vulnerabilities and risks in south-west coastal areas. As extended analysis, the study also defined several underlying factors of vulnerabilities in the society that have a role in creation of risk situation for a section of people. The study critically examined causal grounds of unsafe condition of this section of people, who are usually transform into a risk situation and expose their inability to cope with this situation. The study findings are very significant for ecological resilient development in coastal areas of Bangladesh. So, the new research should be more focused on disaster resilience development by searching human potentials in addressing causal chain of vulnerability and risk of disasters in Bangladesh. This will add value to achieving the SDGs by 2030 and the 8th five-year plan by 2025 in Bangladesh. In spite of several limitations, the research uses community perception and simple remote sensing data/information to examine the power-led ecological change process. It is further supplemented with the primary and secondary data and information for better

illustration of the functional processes and drivers that visualises people's vulnerability and risks in the society. There is still need more ground information for better understanding on historical patterns of vulnerabilities and risk of the people in coastal areas of Bangladesh. Despite, the research made all-out efforts to search answers to the research questions, it has made significant contribution in widening of knowledge and evidence for application of political ecology perspectives in disaster studies.

PART VII

BIBLIOGRAPHY

BIBLIOGRAPHY

Abul Barkat, Rowshan Ara, M. Taheruddin, Saiful Hoque, Nazrul Islam, (2007). *Towards a Feasible Land Use Policy of Bangladesh*, HDRC & ALRD, Dhaka

Abdul Awal Khan. (2019). *Social and legal barriers to improving human rights of climate change displaced people in Bangladesh*, J. Interrupted Stud., 2 (1) (2019), pp. 103-117

Adams, W.M. (1990). *Green Development: Environment and Sustainability in the Third World*, Routledge, London.

Adger, W.N. and Brooks, N. (2003). Global Environmental Change. In M. Pelling, ed. *Natural Disasters and Development in a Globalizing World.* London: Routledge.

Adger WN. (2000). *Social and ecological resilience: Are they related*? *Prog. Hum.Geogr*.24:347–64

Adger, W. N., Hughes, T. P., Folke, C., Carpenter, S. R. & Rockström, J. (2005). *Social-ecological resilience to coastal disasters*, *Science*, 309(5737), pp. 1036–1039.

Agrawal, A. (1995). *Dismantling the Divide between Indigenous and Scientific Knowledge, Development and Change*, Vol. 26. Hague: Institute of Social Studies 1995

Ahsan, Rosie Majid and Hafiza Khatun (eds.). (2004). *Disaster and the Silent Gender: Contemporary Studies in Geography*. Dhaka: Bangladesh Geographical Society.

Ahmad M, Jovel R, Narayan A, Mudahar MS, Ferdausi SA, Pusch C, et al. (2008). *Damage, Loss, and Needs Assessment for Disaster Recovery and Reconstruction*. Dhaka: International Development Community with Financial Support from the European

Alam, S., Demaine, H. and Phillips, J. (2002). *Land use diversity in south-western coastal areas of Bangladesh*, Land, 6 (3): 173–184.

Alexander, D. (1993). *Natural Disasters*. London: UCL Press.

Alexander, D. (2000). *Confronting Catastrophe,* Hertfordshire: Terra Publishing.

Ali, A., (1996). V*ulnerability of Bangladesh to climate change and sea-level rise through tropical cyclones and storm surges*. Water, Air Soil Poll., 92 (1-2): 171-179.

Alam SMN, Demaine H, Phillips MJ (2002). "*Land use diversity in south-western coastal areas of Bangladesh*", Land, 6(3): 173–184.

Alley, E.E. (1993). combating the Vulnerability of Communities in Merriman, P.A. and Browitt, C.W.A, (eds.), Natural Disasters: Protecting Vulnerable Communities, London: Thomas Telford

Albala-Bertrand J.M (1993). *Natural disaster situations and growth*: *A macroeconomic model for sudden disaster impacts*, World Development: Volume 21, Issue 9.

Aptekar, L. and Boore, J. A.: (1990). *The emotional effects of disaster on children: A review of the literature*, International Journal of Mental Health 19(2), 77–90.

Anderson, M.; Woodrow, P (1989). *Rising from the Ashes: Development Strategies in Times of Andharia*, J. et. al (2010). *Towards disaster resilience index for vulnerable communities: a Mumbai study*. Tata Institute of Social sciences.

Asian Disaster Reduction Center (ADRC). (2005). *Total Disaster Risk Management: Good Practices*. Westview and UNESCO, Boulder and Paris.

Aziz, Addul and Paul, A.R. (2015). *Bangladesh Sundarbans: Present Status of the Environment and Biota*, Open Access journal on Diversity, 15 July 2015; ISSN 1424-2818

A. Das, N. Hossain. (2017). *Appraising climate change impact mitigation standards to ground realities: the lessons from Bangladesh climate change Trust funded projects Proceedings*, International Conference on Disaster Risk Mitigation (2017), pp. 1-4 Dhaka. Retrieved November 15, 2017

Asian Development Bank (2004). *Country Environmental Analysis*: Bangladesh. http://www.adb.org/Documents/CEAs/BAN/BAN-CEA- Jul2004.pdf

Barton, A.H. (1969). Communities in Disaster: A Sociological Analysis of Collective Stress Situations, Garden City, New York: Doubleday & Company Inc.

Barua, Prabal, Shahjahan, M. Arifur Rahman, Rahman, S.H., and Molla, M.H. (2017). *Ensuring the rights of climate-displaced people in Bangladesh*, Forced Migration Rev., 54 (1) (2017).

Bangladesh Bureau of Statistics (2011). Report of the Household Income & Expenditure Survey, 2010. Bangladesh Bureau of Statistics, Dhaka, Bangladesh.

BARNES, Barry; BLOOR, David (1882). *Relativism, rationalism, and the sociology of knowledge*. In: HOLLIS, M.; LUKES, S. (Ed.). Rationalism and relativism. Cambridge: MIT Press.

BBS. (2006). *Preliminary Report on Household Income and Expenditure Survey, 2005.* Dhaka: Bangladesh Bureau of Statistics (BBS).

BBS (2011), *Population and Housing Census Report*, Government of Bangladesh

BBS. (2011). *Preliminary Report on Household Income and Expenditure Survey 2010.* Dhaka: Bangladesh Bureau of Statistics (BBS).

BBS. (2017). *Preliminary Report on Household Income and Expenditure Survey 2016.* Dhaka: Bangladesh Bureau of Statistics (BBS).

Berkes F, Colding J, Folke C. (2000). *Rediscovery of traditional ecological knowledge as adaptive management*. *Ecol. Appl.*10:1251–62

Ben Wisner, Piers Blaikie, Terry Cannon and Ian Davis (2003). At-Risk: Natural Hazards, People's Vulnerability and Disasters. London, Routledge.

Benson, C., and E.J. Clay (2004). *Beyond the Damage: Probing the Economic and Financial Consequences of Natural Disasters*. Humanitarian Exchange. No. 27.

BENNETT, John W. (1969). *Northern plainsmen: adaptive strategy and agrarian life*. Chicago: Aldine Publishing.

Benbasat I, Goldstein D K and Mead M (1987). *The Case Study Research Strategy in Studies of Information Systems*. MIS Quarterly, September, pp.369-386

Blaikie, P. (1985) *The political economy of soil erosion in developing countries*. London: Longman.

Blaikie, P., Cannon, T., Davis, I. and Wisner, B. (1994, 1997*) At Risk: Natural Hazards, Peoples Vulnerability and Disasters*. New York: Routledge

Blaikie, P. and Brookfield, H. (1987). *Land degradation and society*. London: Methuen.

Blaikie, P.M., Cannon, T., Davis, I., Wisner, B. (1994). *At-Risk: Natural Hazards, Peoples Vulnerability and Disasters,* Routledge, London.

Birkmann, J. (2005). *Danger Need Not Spell Disaster – But How Vulnerable Are We*? Research Brief (1), Tokyo: United Nations University (ed).

Bohle HG, Downing TE, Watts MJ. (1994). *Climate change and social vulnerability—toward a sociology and geography of food insecurity*. Glob. Environ. Change 4:37-48

Bohle, H-G. Vulnerability and Criticality: Perspectives from Social Geography. IHDP Update (2001). *Newsletter of the International Human Dimensions Programme on Global Environmental Change*. (2001). Vol. 1-7.

Bryant, R. L. (1992). Political Ecology: an emerging research agenda in Third World studies, *Political Geography* 11, 12-36.

Bryant, R. L. and Bailey, Sinead (1998). *The Third World Political Ecology*, London, and Network: Routledge.

Bryant, R.L., Bailey, S., (1997), Third World Political Ecology. Routledge, London

Brooks N. (2003). *Vulnerability, risk, and adaptation: a conceptual framework*, Working Paper 38 Tyndall Cent. Glob. Environ. Change, Univ. East Anglia, Norwich, UK.

Brammer H (2002). *Land use and land use planning in Bangladesh*, The University Press Limited, Dhaka

Burton, I., Kates, R.W. and White, G.F. (1993). *The Environment as Hazard*, The Guilford Press, New York, NY.

Burton, Ian, Robert W. Kates and Gilbert F. White. (1978). *The Environment as Hazard.* New York: Oxford University Press.

Bunker, S.G. (1985). *Under developing the Amazon: Extraction, Unequal Exchange and the Failure of the Modern State*, University of Illinois Press, Urbana.

Burch WR Jr, DeLuca DR. (1984). *Measuring the social impact of natural resource policies.* Albuquerque (NM): New Mexico University Press, pp 216.

BWDB (1991). *Annual flood report. Surface Water*, Hydrology-2. UNDP/WMO-BGD/88/013. Dhaka, Bangladesh.

BWDB. (1991). *River training studies of the Brahmaputra River*. Second interim report. Dhaka: Sir William Halcrow & Partners and Danish Hydraulic Institute Engineering & Planning Consultants.

Cabinet Division. (2012). *Bangladesh Gadget-13,* September 2012, Additional Volume, Government of the People's Republic of Bangladesh).

Cardona, O.D. (2004a). *Disasters, Risk and Sustainability*, presentation regarding the Sasakawa Prize Ceremony in Geneva, Geneva (unpublished).

Cardona, O.D. (2004b). The Need for Rethinking the Concepts of Vulnerability and Risk from a Holistic Perspective: A Necessary Review and Criticism for Effective Risk Management, in Bankoff, G., G. Freaks and D. Hilhorst, eds, *Mapping Vulnerability: Disasters, Development and People*, London: Earths can.

Cannon, T. (1994). Vulnerability Analysis and the Explanation of 'Natural' Disasters, in A. Varley (ed.) *Disasters, Development and Environment*. Wiley, New York

Cannon, T. (2000). *Vulnerability Analysis and Disasters*, in Parker, D.J., (ed.), Floods. New York: Routledge

Campanella, T. J. (2006). *Urban Resilience and the Recovery of New Orleans*. Journal of the American Planning Association, 72(2), 141-146.

CDMP (2009). Cyclone Shelter Information for Management of Tsunami and Cyclone Preparedness. In Comprehensive Disaster Management Programme, Ministry of Disaster and Relief; Government of Bangladesh: Dhaka, Bangladesh.

Chapin FSI, Peterson G, Berkes F. Callaghan TV, Angelstam P, et al. (2004). *Resilience and vulnerability of northern regions to social and environmental change*. Ambio 33:344 -49

Choudhury, A.M., (1992). *Cyclones and the coastal zones of Bangladesh,* The Bangladesh Quarterly, Dept. of Films and Publications

Creswell, J. W. (2007). *Qualitative inquiry and research design*: Choosing among five traditions (2nd ed.). Thousand Oaks, CA: Sage

Cunny, F.C. (1983) *Disasters and Development*. Oxford: Oxford University Press.

Cunny, F.C. (1994), *Disasters and Development*, Oxfam, Dallas, TX.

Cutter SL. (1996). *Vulnerability to Environmental Hazards*. *Prog. Hum. Geogr.*20:529–39

Chatterjee, P. and Finger, M. (1994). *The Earth Brokers: Power, Politics and World Development*, Routledge, London.

Chambers, R. (1995) *Poverty and Livelihood: whose reality counts*? Online Article of the International Institute for Environment and Development, University of Sussex, UK.

Chambers, Robert (2008). *PRA, PLA and pluralism: Practice and theory*. In Peter Reason & Hilary Bradbury (Eds.), The Sage handbook of action research. Participative inquiry and practice (2nd ed., pp.297-318). London: Sage

Clayton, A. (1994). *INDR Conference protecting vulnerable communities*, the Royal Society and the Institution of Civil Engineers, London, 13-15 October 1993, *Disasters* 18, 89-90.

Clark, G.E., Moser, S.C., Ratick, S.J., Dow, K., Meyer, W.B., Emani, S., Jin, W., Kasperson, J.X., Kasperson, R.E., Schwarz, H.E., (1998). *Assessing the vulnerability of coastal communities to extreme storms: the case of Revere*, MA., USA. Mitigation and Adaptation Strategies for Global Change 3 (1), 59–82

Cosgrove, D. and Daniels, S.J. (eds) (1988). *The Iconography of Landscape: Essays on the Symbolic Representation, Design and Use of Past Environment*, Cambridge University Press, Cambridge.

Corbane, C., Lang, S., Pipkins, K., Alleaume, S., Deshayes, M., García Millán, V. E., Michael, F. (2015). Remote sensing for mapping natural habitats and their conservation status – new opportunities and challenges. *International Journal of Applied Earth Observation and Geoinformation*, *37*, 7–16.

Cox, R. (1987). *Production, Power and World Order*, Columbia University Press, New York.

Currey, Bruce. (1978). The Famine Syndrome: Its Definition for Relief and Rehabilitation in Bangladesh' *Ecology of Food and Nutrition* 7(78):87-98.

Custers, Peter. (1993). 'Bangladesh Flood Action Plan: A Critique' *Economic and Political Weekly* July 17-24, 1993: 1501-1503.

Cutter, S., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., et al. (2008). *A Place-Based Model for Understanding Community Resilience to Natural Disasters*. Global Environmental Change, 18(4):598-606

Davoudi, S., Brooks, E. & Mehmood, A. (2013). Evolutionary resilience and strategies for climate adaptation, *Planning Practice and Research*, 28(3), pp. 307–322.

Dasgupta, S., F. A. Kamal, Z. H. Khan, S. Choudhury & A. Nishat (2014). *River salinity and climate change. Evidence from coastal Bangladesh*, The World Bank

Demeritt, D. (2002). *What is the "social construction of nature*? A typology and sympathetic critique. Progress in Human Geography 26:767–90.

DMB (2007). DMIC (Disaster Management Information Center) Cyclonic storm SIDR, Situation Report

DMB (2010a). National Plan for Disaster Management (NPDM). Government of the People's Republic of Bangladesh

DMB (2010b). Standing order on Disaster (SOD), Government of the People's Republic of Bangladesh.

Dilley, M.; Chen, R.S.; Deichmann, U.; Lerner-Lam, A.L.; Arnold, M. (2005): *Natural Disaster Hotspots. A Global Risk Analysis*. Publisher: World Bank.

D. L Mallick, A Rahman, M Alam, Juel ASM, Ahmad AN, Alam SS. Bangladesh Floods in Bangladesh: A Shift from Disaster Management towards Disaster Preparedness. Institute of Development Studies Bulletin 2005 36 4 53 70

Dunning, A.T. (1990). Ending Poverty, in L.R. Brown (eds), *State of the World 1990*, Unwin Hyman, London.

Dynes, Russel R. *et al* (eds) (1978). *Sociology of Disasters: Contribution to Disaster Research* Italy: franco Angeli.

Eakin, H. and A. Lures *(*2006). *Assessing the vulnerability of social-ecological systems*. Annual Review of Environment and Resources, Volume 31, pp. 365-394.

Editorial (2006). Resilience, vulnerability, and adaptation: A cross-cutting theme of the International Human Dimensions Programme on Global Environmental Change, *Global Environmental Change*, 16(3), 237–239.

Elliott, J.A. (1994). *An Introduction to Sustainable Development: The Developing World*, Routledge, London.

Escobar, A. (1996). Constructing nature: elements for a post-structural political ecology, In Peet, R. and Watts, M (eds). *Liberation ecologies: environment, development, social movement*, London: Routledge.

Fritz, C.E. (1961). 'Disaster' in R.R. Merton and R.A. Nisbet (eds.) *Contemporary Social Problems*, New York: Harcourt, Brace and World.

Folke C, Carpenter SR, ElmqvistT, Gunderson LH, Holling CS, Walker BH.2002. Resilience and sustainable development: building adaptive capacity in a world of transformations. Ambio 31:437–40

Folke, C., Carpenter, S., Walker, B., Scheffer, M., Chapin, T., & Rockstrom, J. (2010) Resilience thinking: Integrating resilience, adaptability and transformability, *Ecology and Society*, 15(4).

Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C. S. & Walker, B. (2002) Resilience and sustainable development: building adaptive capacity in a world of transformations, *AMBIO: A Journal of the Human Environment*, 31(5), pp. 437–440.

Goudie, A. (1993). *The Human Impact on the Natural Environment*, fourth edition, Blackwell, Oxford.

Grossman, L.S. (1984) *Peasants, Subsistence Ecology and Development in the Highlands of Papua New Guinea*, Princeton University Press, Princeton.

Grove-White, R. (1996). Environmental knowledge and public policy needs: on humanising the research agenda. In: Lash, S., Szerszynski, B. Wynn, B. (Eds.), *Risk, Environment and Modernity: Towards a New Ecology*, London.

Guha, R. (1989). *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya*, Oxford University Press, Delhi.

Guha-Sapir, D., Hargitt, D., Hoyois, P. (2004). Thirty Years of Natural Disasters 1974–2003: The Numbers. PUL, Lovain-la-Neuve.

GIDDENS, Anthony (1990). The consequences of modernity. Stanford: Stanford University Press.

Giddens, A. (1984), The Constitution of Society, Cambridge: Polity Press

Grawala, S., Ota, T., Ahmed, A. U., Smith, J. and Aalst, M. (2003). Development and Climate Change in Bangladesh: Focus on the Coastal Flooding and Sundarban, OECD, Head of the publication service, 75775 Paris, Cedex 16, France.

Green, E. P., Mumby, P. J., Edwards, a. J., & Clark, C. D. (1996). A review of remote sensing for the assessment and management of tropical coastal resources. *Coastal Management*, *24*(1), 1–40. doi:10.1080/08920759609362279.

Harvey, D. (1993). The nature of environment: the dialectics of social and environmental change, in R. Miliband and L. Panitch (eds), *Real Problems, False Solutions: Socialist Register* 1993, Merlin Press, London.

Hecht, S.B. (1985). Environment, development and politics: capital accumulation and the livestock sector in eastern Amazonia, *World Development* 13.

Hecht, S.B. and Cockburn, A. (1992). Realpolitik, reality and rhetoric in Rio, *Environment and Planning* D: Society and Space 10 367-75.

Hewitt, K. (1995). Excluded Perspectives in the Social Construction of Disaster, *International Journal of Mass Emergencies and Disaster* 13.

HELMER, M.; HILHORST, D. Natural disasters and climate change. Disasters, v. 30, n. 1, p. 1-4. 2006.

Hjort, A. (1982). A Critique of 'ecological' models of pastoral land use, *Nomadic Peoples* 10, 11-27.

Heron, John (1996). Co-operative inquiry: Research into the human condition. London: Sage.

Hossain, M. S., Lin, C. K., and Hussain, M. Z., (2001), "Goodbye Chakaria Sundarban: The Oldest Mangrove Forest", Society of Wetland Scientists Bulletin, 18(3):19–22.

Holling, C.S. (1973) Resilience and stability of ecological systems, *Annual Review of Ecology and Systematics*, 4, pp. 1–23.

IFRC (2010). Final Report, Bangladesh: Cyclone Aila, 30 June 2010

Islam MR, Ahmad M, Huq H, Osman MS (2006). "State of the coast 2006", Program Development Office for Integrated Coastal Zone Management Plan Project, Water Resources Planning Organization, Dhaka.

Ishtiaque, Asif, et al. (2017). "Robust-yet-Fragile Nature of Partly Engineered Social-Ecological Systems: A Case Study of Coastal Bangladesh." Ecology and Society, vol. 22, no. 3, 2017.

Kemmis, Stephen &McTaggart, Robin (2005). Participatory action research. Communicative action and the public sphere. In Norman K. Denzin &Yvonna S. Lincoln (Eds.), Handbook of qualitative research (3rd ed., pp.559-603). Thousand Oaks, CA: Sage.

Klein, R.J.T., Nicholls, R. J., Thomalla, F., 2003.Resiliencetonaturalhazards: how useful is this concept? Environmental Hazards 5(1–2),35–45.

Kreps, G. (1998). Disaster as systemic event and social catalyst, in Quarantelli, E.L. (ed.). *What is a Disaster*? Perspectives on the Question. London: Routledge.

Kafiluddin, AKM (2005). Human Health, Disease, and the Environment. 57/1, Lake Circus, Kalabagan, Dhaka 1205. Bangladesh.

Latif, A. (1989). 'Control of Flood in Bangladesh: Need for International Co-operation for the solution of the problem' in Mohiuddin Ahmad (ed) *Flood in Bangladesh*. Dhaka: Community development Library

Layder, D. (1993) New Strategies in Social Research, Cambridge: Polity Press

Laurent, Éloi, (2011), *Social-écologie*, Flammarion, Paris.

Laurent, Éloi, (2012), *Demokratisch - gerecht – nachhaltig, Die Perspektive der Sozial-Ökologie*, Rotpunktverlag.

Lewis, M.W. (1992). *Green Delusions: An Environmental Critique of the Radical Environmentalism,* Duke University Press, Durham, North Carolina.

Lewis, J. (1999). *Development in Disaster-Prone Places: Studies of Vulnerability*, London: Intermediate Technology Publications.

Lofland, J. And Lofland, L.H. (1995) Analysing Social Settings, 3rd edition, Belmont, CA: Wadsworth

Luke, S. (1977). *Power: A Radical View*, Macmillan, London.

Mann, M. (1984). *The autonomous power of the state: its origins, mechanisms and results*, Archives europeennes de Sociologie 25, 185-213.

Mallick, D. L, Rahman, A, &Alam, M. Juel ASM, Ahmad AN, Alam SS (2005). *Floods in Bangladesh: A Shift from Disaster Management towards Disaster Preparedness*. Institute of Development Studies Bulletin, 36(4), 53-70

Manyena, S.B., (2006). The concept of resilience was revisited. Disasters30 (4),433–450.

Maskrey, A.1989. *Disaster Mitigation: A Community-based Approach.* Oxfam, Oxford.

Mehedi, H. (2010). Climate-Induced Displacement Case Study on Cyclone AILA In the South West Coastal region of Bangladesh Khulna, Bangladesh: Humanity watch. 2010.

McEntire, D.A. (2003), "Causation of catastrophe: a lesson from Hurricane George", Journal of Emergency Management, Vol. 1 No. 2, pp. 22-9.

McEntire, D.A. and Fuller, C. (2002), "The need for a holistic theoretical approach: an examination from the El Nin˜ o disasters in Peru", Disaster Prevention and Management, Vol. 11 No. 2, pp. 128-40.

McEntire, D.A., Fuller, C., Johnston, C.W. and Weber, R. (2002), "A comparison of disaster paradigms: the search for a holistic policy guide", Public Administration Review, Vol. 62 No. 3, pp. 267-81

Mileti D. S. 2001.*Disasters by Design*. Washington D.C: Joseph Henry Press.

McAllister, I. (1993), Sustaining Relief with Development: Strategic Issues for the Red Cross and Red Crescent, Marinus Nijhoff Publishers, Boston, MA.

Mileti, D.S., Darlington, J.D., Passarini, E., Forest, B.C. and Myers, M.F. (1995), "Toward an integration of natural hazards and sustainability", Environmental Professional, Vol. 17 No. 2, pp. 117-26

Middleton, N., O'Keefe, P. and Mayo, S. (1993). *The Tears of the Crocodile: From Rio to Reality in the Developing World*, Pluto Press, London.

Morrow, B. H. and Enarson, E.: 1996, Hurricane Andrew through women's eyes: Issues and Recommendations, International Journal of Mass Emergencies and Disasters 14(1), 5–22.

MoFDM[124] (2005). Corporate Plan 2005-2009-Comprehensive Disaster Management: A Framework for Action. Dhaka: Government of Bangladesh; 2005

Moustakas, C. (1994). Phenomenological research methods. Thousand Oaks, CA: Sage

MoFDM (2007). Government of the People's Republic of Bangladesh.

MoDMR (2017). National Plan for Disaster Management (2016-2020), Building Resilience for Sustainable Human Development, published by the Government of the People's Republic of Bangladesh

Mucher, C. a., Steinnocher, K. T., Kressler, F. P., & Heunks, C. (2000). Land cover characterization and change detection for environmental monitoring of pan-Europe. *International Journal of Remote Sensing*, *21*(6-7), 1159–1181.

Nasreen, Mahbuba. (1995) Coping with Floods: The Experience of Rural Women in Bangladesh. Unpublished PhD. Dissertation. Massey University, New Zealand.

Nasreen, Mahbuba. (1999). 'Coping with Floods: Structural Measures or Survival Strategies?' in Imtiaz Ahmed (ed.) *Living with Floods: An Exercise in Alternatives*. Dhaka: The University Press Limited.

Newman L, Dale A. (2005). Network structure, diversity, and proactive resilience building: a response to Tompkins and Adger. *Ecol. Soc*. 10. http://www. ecologyandsociety.org/vol10/iss1/resp2/

O'Connor, J. (1994). Is sustainable capitalism possible? In: O'Connor, M. (Ed), *Is Capitalism Sustainable*? Guilford, New York.

O'Keefe, P. (1975). *African drought: a review*. Disaster Research Unit Occasional Paper 8. Bradford: University of Bradford

Oliver-Smith, Anthony (1986). 'Disaster Context and Causation: An Overview of Changing Perspective in Disaster Research' in Vinson H. Sutlive et al (eds). *Natural Disasters and Cultural Responses*. Williamsburg: Department of Anthropology, College of William, and Mary.

Oliver-Smith, A. (1996). Anthropological Research on Hazards and Disaster, *Annual Review of Anthropology*, Vol. 25. (1996)

Oliver-Smith and Hoffman, (1999). The *Angry Earth: Disaster in Anthropological Perspective,* Routledge, London.

Olsson P, Folke C. 2003. Adaptive co-management for building resilience in social-ecological systems. *Environ. Manag.*34:75–90

Oxfam (2013). *No accident. Resilience and the inequalities of Risk*. Oxfam international.

Painter, M., and W. Durham (1995). *The Social Causes of Environmental Destruction* in Latin America, Ann-Arbor: University of Michigan Press.

[124] MoFDM means the Ministry of Food and Disaster Management

Paul, Shankor and Islam Rezaul (2015). Ultra-poor char people's right to development and accessibility to public services: A Case of Bangladesh: *Habitat International*, *ELSEVIER*, journal homepage: www.elsevier.com/locate/habitatint

Paulson, Susan, Lisa L. Gezon, and Michael Watts. (2003). Locating the Political in Political Ecology: An Introduction, *Human Organization* 62(3): 205-217.

Pelling, M., (1998). *Social Power, Politics, and vulnerability in globalising societies: experiences from the urban South*, paper presented at the Workshop on Sustainability, Globalisation and Hazard, Middlesex University, 20-22 May.

Pelling, M., A. Özerdem and S. Barakat (2002) 'The macro-economic impact of disasters. Progress in Development Studies.2(4). pp. 283–305.

Peet, R. And Watts, M. (1993). Introduction: development theory and environment in an age of market triumphalism, *Economic Geography* 69, 227-53.

Peet, R. and Watts, M. (1996). *Liberation ecologies: environment, development and social movement*, London, and New York: Routledge.

Peluso, N.L. (1992) *Rich Forest, Poor People: Resource Control and Resistance in Java*, University of California Press, Berkely.

Peacock, W. G., Morrow, B. H., and Gladwin, H. (1997). *Hurricane Andrew: Ethnicity, Gender, and the Sociology of Disasters*, Routledge, New York.

Peacock, W. G., with Ragsdale, A. K.: 1997, Social systems, ecological networks, and disasters: Toward a socio-political ecology of disasters, In W. G. Peacock et al. (eds), Hurricane Andrew: Ethnicity, Gender, and the Sociology of Disasters, Routledge, New York.

Pickering, K.T. and Owen, L.A. (1994). *An Introduction to Global Environmental Issues*, Routledge, London.

Piclcett STA. (1993). An ecological perspective on population changes and land use. In: Jolly CL, Torrey BB, Eds. Population, and land use in developing countries: report of a workshop. Washington (DC j: National Academy Press. p 37-41,

Planning Commission Bangladesh. (2012) The Millennium Development Goals: Bangladesh Progress Report 2011. Dhaka: Planning Commission, GoB.

Quarantelli, E. (1998). Disaster Planning, Emergency Management, and Civil Protection: The Historical Development and Current Characteristics of Organized Efforts to Prevent and to Respond to Disasters. *DRC Preliminary Paper*.

Quarantelli E. L. (1989). Conceptualizing Disasters from a Sociological Perspective. *International Journal of Mass Emergencies and Disasters,* 7: 243-251.

Raymond L. Bryant (2016). Power, knowledge and political ecology in the third world: a review, Progress in Physical Geography: *Earth and Environment*, SAGE publishing, India.

Redclift, M. (1987). *Sustainable Development: Exploring the Contradiction*, Methuen, London.

Rocheleau, D., Thomas-Slayter, B. And Wangari, E. (eds) (1996). *Feminist Political Ecology: Global Issues and Local Experience*, Routledge, London.

Robins, P. (2002) Obstacles to a first world Political Ecology: Looking near without looking up. *Environment and Planning* A, 34, 1509-1513.

Jigyasu, Rohit (2002). Reducing Disaster Vulnerability Through Local Knowledge and Capacity: The Case of Earthquake-prone India and Nepal, Department of Town and Regional Planning, Norwegian University of Science and Technology, Norway.

Saha, B.K., (2010), Promoting Agrarian Reform in Rehman Sobhan (ed.) Challenging the Injustice of Poverty: Agendas for Inclusive Development in South Asia, Sage, Delhi.

Schmink, M. and Wood, C.H (1987). The 'political ecology' of Amazonia, in P.D. Little and M.M. Horowitz (eds), *Lands at Risk in the Third World: Local-level Perspectives*, Westview Press, Boulder, Colorado.

Shaw, R. and Okazaki, K. (2003). *Sustainability in grass-roots initiatives: focus on community-based disaster management*. Kobe, UNCRD.

Sen, A. (1981). *Poverty and Famines: An Essay on Entitlement and Deprivation*, Oxford: Clarendon Press

Smith, K. (1992). *Environmental Hazards*: Assessing Risk and Reducing Disaster. London: Routledge.

SRDI (2010). *Saline soils of Bangladesh. Soil Resource Development Institute*. SRMAF Project, Ministry of Agriculture, Dhaka, Bangladesh.

SRDI (2013). *Agricultural land availability in Bangladesh*, Soil Resource Development Institute (SRDI), Ministry of Agriculture, Government of the People's Republic of Bangladesh.

Stephenson, R.S., (1991). *Disasters and Development*, Disaster Management Training Programme, UNDP-UNDRO, Geneva.

Susman, P., O'Keefe, P .and Wisner, B. (1983). *Global disasters: a radical interpretation*. In Hewitt, K., editor, Interpretations of calamity from the viewpoint of human ecology, London: Allen & Unwin.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage publications.

Swift, J.J. (1989). '*Why are Rural People Vulnerable to Famine*?' IDS Bulletin 20.2: 8–15

S Yodmani (2001). *Disaster Risk Management and Vulnerability Reduction: Protecting the Poor*. Paper presented at The Asia and Pacific Forum on Poverty. Bangkok: Asian Disaster Preparedness Centre, 2001.

Szabo, S., D. Begum, S. Ahmad, Z. Matthews, and P.K. Streatfield. (2015). Scenarios of population change in the coastal Ganges Brahmaputra Delta (2011–2051). *Asia Pacific Population Journal* 30 (2): 51–72.

Szabo, S., E. Brondizio, F.G. Renaud, S. Hetrick, R.J. Nicholls, Z. Matthews, Z. Tessler, A. Tejedor, Z. Sebesvari, E. Foufoula-Georgiou, S. da Costa, and J.A. Dearing. (2016). *Population dynamics, delta vulnerability and environmental change: Comparison of the Mekong, Ganges–Brahmaputra and Amazon delta regions.* Sustainability Science 11 (4): 539–554.

Islam, Sheikih Tawhidul. (2006). Resource assessment of deciduous forests in Bangladesh, PhD E-Thesis. Durham (UK): University of Durham.

Islam, Sheikih Tawhidul. (2013). Baseline Study Report of the CBAS-SRF project, initiated by the World Vision in Bangladesh.

Tierney, Kathleen J. (1989). Improving Theory and Research on Hazard Mitigation: Political Economy and Organizational Perspectives. *International Journal of Mass Emergencies and Disasters* 7, no. 3 (1989): 367-96.

Timmerman P. (1981). *Vulnerability, Resilience, and the Collapse of society*. Rep. 1, Inst. Environ. Stud., Toronto, Canada.

T. Cannon (1994). Vulnerability Analysis and Natural Disasters. In: Varley A. (ed.) *Disasters, Development and Environment*. West Sussex, UK: Wiley.

Twigg, J. and Bhatt, M. (1988). *Understanding Vulnerability: South Asian Perspectives*. London, ITDG.

UNDRO. (1991). *Mitigation Natural Disasters; Phenomena, Effects, and Options*. Office of the United Nations Disaster Relief Coordinator, Geneva

UN/ISDR (2004) *Living with Risk*: A Global Review of Disaster Reduction Initiatives, 2004 version, Geneva: UN Publications.

UNISDR, (2005). *Hyogo Declaration.* Resolution adopted by delegates of the World Conference on Disaster Reduction, Kobe, Hyogo. Japan. 18-22 January. At http: i/www.unisdr.org/wcdr/.

UNISDR (2007). The Disaster Risk Reduction: *Global Review Report, 2007*

UNISDR (2007): *Hyogo Framework for Action 2005–2015*: Building the Resilience of Nations and Communities to Disasters, United Nations, Geneva, 24 pp.

UN-HABITAT (2010). *Land and natural disasters: guidance for practitioners*. United Nations Human Settlements Programme (UN-HABITAT)

UNISDR (2011): Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters: Mid-term Review 2010–2011, United Nations, Geneva.

UNISDR (2015). *Sendai framework for disaster risk reduction 2015-2030.* UNISDR, Geneva, Switzerland.

Varley, A. (1994). The Exceptional and the Everyday: Vulnerability Analysis in the International Decade for Natural Disaster Reduction. In A. Varley (ed.) *Disasters, Development and Environment*. Wiley, New York

Vayda, A.P. (1983). Progressive contextualization: methods for research in human ecology, *Human Ecology* 11, 265-81.

VAYDA, Andrew P.; WALTERS, Bradley B (1999). Against political ecology. *Human Ecology*, Vol. 27.

Van Manen, M. (1990). Researching lived experience: Human science for an action sensitive pedagogy. Albany: State University of New York Press.

Van Staveren M. F. van Tatenhove J. P. M. (2016). Hydraulic engineering in the social-ecological delta: understanding the interplay between social, ecological, and technological systems in the Dutch delta by means of 'delta trajectories. *Ecology and Society* 21(1). http://doi.org//10.5751/ES-08168-210108.

Watts, M. (1983) On the poverty of theory: natural hazards research in context, in K. Hewitt (ed.), *Interpretations of Calamity from the Viewpoint of Human Ecology*, Allen and Unwin, London.

Walleserstein, I. (1974) *The Modern World-System, Capitalist Agriculture and the origins of the European World Economy in the Sixteenth Century*, Academic Press, New York.

Watts, M.J., Bohle, H.-G. (1993): The Space of Vulnerability: The Causal Structure of Hunger and Famine. In: *Progress in Human Geography.* Vol. 17, No.1, pp. 43-67.

Weichselgartner, (2001). *Disaster mitigation: the concept of vulnerability revisited*, Disaster Prevention and Management, University of Cantabria, Santander, Spain, Vol. 10 Issue: 2, pp.85 – 95

Weischeselgarner.J and Bertens. J (2000). Natural Disasters: Acts of God, Nature or Society? On the Social Relation to Natural Hazards, in Andretta, M.A. (ed.), *Risk Analysis II*. Southampton: WIT Press.

Wolf, E. (1972). Ownership and Political Ecology, *Anthropological Quarterly* 45, 201-5.

White, G. F. (1945). *Human adjustment to floods*, Department of Geography Research Paper No. 29, Chicago: University of Chicago

Wisner, B. (1976) *Man-made famine in eastern Kenya: the interrelationship of environment and development*. IDS Discussion Paper 96. Brighton: IDS.

Wisner, B. (1978). *Does radical geography lack an approach to environmental relations*? Antipode 10, 84-95

Wisner, B. (2001) Some Root Causes of Disaster Vulnerability in Gujarat, http://www.anglia.ac.uk/geography/radix/gujarat.htm

Wisner, B., P. Blaikie, T. Cannon, and I. Davis (2004). *At-Risk: Natural Hazards, People's Vulnerability and Disasters,* 2nd Edition. London: Routledge.

Wisner, B. (2005): Invited keynote address at the SIDA & Stockholm University Research Conference, January12-14 2005, Nov. 2005.

Wilches-Chaux, G. (1993): La Vulnerabilidad Global. In: Maskrey, A. (Ed.): *Los Disasters no son Naturales*. La Red. Tercer Mundo Editores, Botoga.

Worster, D. (1995) *Rivers of Empire: Water, Aridity, and the Growth of the American West*, Pantheon, New York.

World Bank (2005). *A Global Risk Analysis*. Washington, DC, The World Bank and Columbia University, ISBN 0-8213-5930-4

Winchester, P. (1992). *Power, Choice and Vulnerability: A Case Study of Disaster Mismanagement in South India*, 1977-1988. London: James and James.

World Bank. (2006). Bangladesh: Country environmental analysis, volume II. Bangladesh Development Series Paper No. 12. Washington DC: The World Bank.

World Bank (2005). Natural Disaster Hotspot: A Global Risk Analysis, Disaster Risk Management Series No. 5

World Bank. (2012). The Sendai Report: Managing Disaster Risks for a Resilient Future. World Bank, GFDRR and Government of Japan. Washington, DC

Yin RK (2003) Case study research—design and methods, Applied social research method series SAGE publications, Thousand Oaks

Yin R (2009). How to do better case studies. In: Bickman L, Rog D (eds) The Sage handbook of applied social research methods. Sage Publications, Thousand Oaks

Yin, R. K. (1984). *Case study research: Design and methods.* Newbury Park, CA: Sage.

Zaman, M.Q. (1986) 'The Social and Political Context of Adjustment to Riverbank Erosion Hazard and Population Resettlement in Bangladesh' *Human Organization* 48(3):196-205.

Zhang, H., Zhuang, T., and Zeng, W. (2012). Impact of Household Endowments on Response Capacity of Farming Households to Natural Disasters. Int. *J. Disaster Risk Sci.* 3(4):218-226

Others:

- CRED Report, 2020, page-22)
- The Daily Ittefaq, 2 February 2005 Dhaka.
- The Dhaka Tribune dated April 30, 2017. 'Cyclone fatalities fall, economic losses on rising'.
- The Financial Express, dated May 04, 2019
- The Daily Star, dated May 20, 2020
- The Dhaka Tribune dated 12 August 2020
- The Financial Express, 22 March 2021: Bangladesh: The state of income inequality
- The Daily Star "Reducing the risk of disasters", 13 July 2013
- The Daily Star, dated Dec 4, 2010
- The Daily Star, dated: Mar 8, 2018
- UNDP (1998, 1999, 2000) Human Development Report, http://www.undp.org
- World Risk Report (2019). World RiskReport-2019_Online
- UNISDR (2011). The Global Assessment Report, 2011
- BBS (2011), Community Series, GoB
- BBS (2011), Population and Hushing Census (Satkhira and Khulna)
- *Global Climate* Risk *Index* (CRI) *2021*
- World Risk Report, 2015
- BBS (2014). Bangladesh Demographic and Health Survey, GoB, 2007-2014
- BBS (2008 and 2019), Agriculture census, GoB.

ANNEXURES

ANNEXURES

Annex I: Checklist for KII

I. Key issues/points of discussion

1) What changes do you observe in the landscape in your areas? What are the reasons behind these changes?
2) What are the issues/concerns that contribute to these changes? Do you think, these kinds of changes are creating imbalances in nature/ecology?
3) According to your observation, what are the drivers of this ecological change?
   - Natural drivers?
   - Social drivers?
   - Economic drivers?
   - Political drivers?
4) Who are mainly responsible to change the ecology in your areas? Why?
5) What are the possible impact of ecological change drivers on people and places? Who are mainly facing that impact?
6) Do you think that the ecological change processes are creating differential vulnerabilities and risks for the people? If yes, how?
7) Do you believe that the poor people are facing vulnerabilities and risk of disasters? If yes, how?
8) According to your observation, who are the influential people in local decisions, resource extractions and development? Is there any space for the poor in this case?
9) Why are the poor becoming the main losers in the existing social, economic, and political space?
10) What are the initiatives taken by the Government and others in addressing vulnerabilities and risks of the people in a disaster situation?
11) What are the gaps in these initiatives? How to reduce these gaps in addressing differential vulnerabilities and risk of disasters?

II. List of Key Informants:

SL	Name	Description	Location	Phone/email
1.	Madhab Chandra Dutta	Executive Director, SoDESH (local CSO)	Koyra and Shyamnagar	01711663801
2.	Gobinda Munda	Indigenous Youth Leader	Shyamnagar, Satkhira	01643648952

3.	Muktabiur Raihan	Executive Director, SAHAYA	Shyamnagar, Satkhira	01871119126
4.	Md sofikul islam	UP Chairman	Koyra, Khulna	01718-873858
5.	Md 251rishna kabir	Chairman of up	Koyra, Khulna	01712-640632
6.	Md al amin	teacher	Koyra, Khulna	01925-588410
7.	Md Soriful islam	teacher	Koyra, Khulna	01933-825049
8.	Nilima mondal	Member, UP	Koyra, Khulna	01909-713093
9.	Ziaur rahaman	Member, UP	Koyra, Khulna	01994-994060
10.	Md samad gazi	Member, UP	Koyra, Khulna	01949-206720
11.	Md Sheak al mamun	UP Chairman	Shyamnagar, Satkhira	01711-942922
12.	Md Abul kashem	UP Chairman	Shyamnagar, Satkhira	01711-295142
13	Md Golam Alogir	UP Chairman	Shyamnagar, Satkhira	01715-101991
14	Gopal munda	Village police	Shyamnagar, Satkhira	01740-972809
15	Monotosh	Village police	Shyamnagar, Satkhira	01925-670907
16	Basudev mondal	Businessman	Shyamnagar, Satkhira	01921-180716
17	Monindra mondal	Teacher	Shyamnagar, Satkhira	01720-549476
18	Md Krishn islam	Teacher	Shyamnagar, Satkhira	01740-561897
19	Md Ramjan ai	Political leader	Shyamnagar, Satkhira	01731-597804
20	Md Hanan Gazi	Political leader	Shyamnagar, Satkhira	01984-304532

Annex II: Checklist for FGD

Name of the Village (Area/location):
Union:
Upazila:
Date:

---

1) What are the major problems (i.e., social, economic, political, and environmental) that you are facing in your areas? Why these problems?
2) Do you face any forms of discriminations and inequalities? If yes, what are those? Who are mainly responsible for these?
3) Do you think the powerful people/social elite groups are dominating all local actions and decisions? Why/why not?
4) Do you face any forms of livelihood crisis? What are the reasons behind this crisis? Who are dominating to create this crisis?
5) What are the ways to resolve these livelihood crises?
6) Did you ever been displaced due to disasters? If yes, where were you replaced? Why?
7) Why a section of people lives in at-risk areas of disasters?
8) Who bears the suffering of disaster risks in your area? Why?
9) What are the causal grounds of lifelong vulnerabilities and sufferings of a particular group of people? Is it continued generation by generation? Why?
10) What are the major drivers of these vulnerabilities?
11) What is the nature of people's vulnerability in your area? Who are mainly vulnerable?
12) How do improve the coping capacity and ability of the people to face vulnerabilities and risk of disasters?

Annex-III: The Framework for PRA

1) Vulnerability mapping

Major steps:

- Ask the people to draw the map of the vulnerable people and place in their areas.
- Ask the people ''why these people and places are mostly vulnerable''?
- How do these people cope with vulnerabilities and the risk of disasters?
- Ask them to define the ways to reduce vulnerabilities and risks of the people?

2) *Scale Analysis*

Major steps:

- Ask the people, who are the powerful group in your area?
- Ask the people to give weight to Power Relations with:
  - Discriminations,
  - Consequence of Inequalities and
  - Local decision making.

- Ask the people ‘’why the powerful people/group are dominating in these areas?
- Ask the people ‘’how to create balance in power relations in the society’’?

3) *Cause-Effect Analysis*

Major steps:

- Ask the people, what are the causal grounds (human-induced and environmental) of salinity intrusion?
- Ask the people ‘’what are the effect of salinity intrusion on their lives and livelihoods?
- Define a set of the way forward to reduce the salinity intrusion.

Annex IV: Questionnaire for Perception Survey

আপনার মূল্যবান সময় হতে মাত্র ২০-৩০ মিনিট সময় ব্যয় করে গবেষণার প্রয়োজননে এই জরিপে অংশগ্রহন করার জন্য আপনাকে আহবান জানাচ্ছি। আপনার মূল্যবান মতামত আপনার এলাকার অসমতা ও বৈষম্যের বর্তমান চিত্র অনুধাবন করতে আমাদের সহযোগীতা করবে। উল্লেখ্য যে, জরিপে অংশগ্রহনকারীদের তথ্য গোপনীয় থাকবে।

প্রাথমিক তথ্য

ক. বয়স:

- ১৮-২৫ বছর
- ২৬-৩৫ বছর
- ৩৬-৪৫ বছর
- ৪৬-৫৫ বছর
- ৫৬-৬৫ বছর
- ৬৬+ বছর

খ. অবস্থান:

- শহর
- গ্রাম

গ. উপজেলা:

- শ্যামনগর, সাতক্ষিরা
- কয়রা, খুলনা

অর্থনৈতিক সূচক

১. আপনার বসবাস ও কৃষিকাজের জন্য কি নিজের জমি আছে?

- হ্যাঁ
- না

উত্তর হ্যা হলে, কি পরিমান (একর) জমি আছে?

- ০.০১ একর এর কম
- ০.০১-০.০৪ একর
- ০.০৫-০.৪৯ একর
- ০.৫০-১.৪৯ একর
- ১.৫০ এর বেশী

উত্তর না হলে, কোথায় থাকেন?

- সরকারী জায়গা/খাস জমিতে
- অন্যের জায়গায়/জমিতে

২. আপনার পরিবারে উপার্জনক্ষম সদস্য সংখ্যা কত?

- ৫ জন
- ২ জন
- ৩ জন
- কোন উপার্জনক্ষম সদস্য নাই/অন্যের সহযোগীতার উপর নির্ভরশীল

৩. আপনার পেশা কি?

- কৃষিকাজ
- চাকুরীজীবি
- ব্যবসা
- শ্রমিক
- গৃহিনী
- কর্মহীন/বেকার
- অন্যান্য।

নির্দিষ্ট করুন ➡

৪. আপনার পরিবারের মাসিক (গড়) আয় কত (টাকায়)?

- ১৫০০ টাকার নিচে
- ১৫০০-২৪৯৯ টাকা
- ২৫০০-৪৯৯৯ টাকা
- ৫০০০-৯৯৯৯ টাকা
- ১০,০০০ টাকার উর্ধ্বে।

৫. আপনার উপার্জনের অর্থ মূলত কোন কোন কাজে ব্যয় করতে হয়? (একাধিক উত্তর হতে পারে)

- দৈনন্দিন খাবার ও আনুষঙ্গিক কাজে
- জামা-কাপড়
- বাড়ীর আসবাবপত্র ও জ্বালানী উপকরন সংগ্রহ
- চিকিৎসা
- শিক্ষা
- সামাজিক আনুষঙ্গিকতা
- অন্যান্য (জরুরী প্রয়োজনে) ।

৬. আপনি কি মনে করেন যে আপনি আর্থিক ভাবে বৈষম্যের শিকার?

- হ্যাঁ
- না

উপরের উত্তর হ্যাঁ হলে, কি কি বিষয় আপনার আর্থিক বৈষম্যের জন্য দায়ী?

- পরিবারের দীর্ঘমেয়াদী দারিদ্রতা
- ভূমিহীনতা
- নিয়মিত কাজের সঙ্কট
- জরুরী আর্থিক সহযোগীতার অভাব
- স্থানীয় উন্নয়ন কার্যক্রমে অংশগ্রহনের সুযোগ না থাকা
- পরিবাওে সঞ্চয় পরিস্থিতি না থাকা
- অন্যান্য (যদি থাকে)।

৭. আপনার ধারনা অনুযায়ী, আপনার এলাকায় বসবাসকারী পরিবারগুলোর আর্থিক সক্ষমতা অনুযায়ী তাদের প্রভাব মূল্যায়িন করুন? (স্কেল: ১-৫; সবচেয়ে কম=১, কম=২, মাঝামাঝি=৩, বেশী=৪, সবচেয়ে বেশী=৫)

	১	২	৩	৪	৫
ধনী					
মধ্যবিত্ত					
দরিদ্র					
অতিদরিদ্র					

সামাজিক সূচক

৮. আপনার পরিবারের সাথে প্রতিবেশী কিংবা সমাজের অন্যান্যদের সাথে সম্পর্ক কেমন?

- খূব ভালো
- ভালো
- মোটামোটি
- ভালো না
- একদম ভালো না।

৯. আপনার মতে, কি কি বিষয় সামাজিক বৈষম্য/ঝুকির জন্য দায়ী?

- অসচতেনতা ও অজ্ঞতা
- পারিবারক ও সামাজিক অস্থিরতা, কলহ ও সংঘাত
- বাল্যবিবাহ
- নিরাপত্তাহীনতা, বিশেষ করে নারী ও কিশোরীদের
- দ্রুত জনসংখ্যা বৃদ্ধি
- পরিবারে নির্ভরশীল মানুষের আধিক্য/পরনির্ভরশীলতা
- ঘন ঘন প্রাকৃতিক দূর্যোগের কারনে বাস্তুচ্যুত (স্থানান্তরন) হওয়া
- স্থানীয় জনপুতনিধি ও প্রভাবশালীদেও আধিপত্য
- অন্যান্য (যাদ থাকে)।

১০. আপনার ধারনা অনুযায়ী, আপনার এলাকায় বসবাসকারী পরিবারগুলোর আর্থিক সক্ষমতা অনুযায়ী তাদের সামাজিক প্রভাব মূল্যায়ন করুন? (স্কেল: ১-৫; সবচেয়ে কম=১, কম=২, মাঝামাঝি=৩, বেশী=৪, সবচেয়ে বেশী=৫)

	১	২	৩	৪	৫
ধনী					
মধ্যবিত্ত					
দরিদ্র					
অতিদরিদ্র					

১১. আপনার মতে, আপনার এলাকায় সবচেয়ে সহযোগী সেবা প্রতিষ্ঠান কোনটি?

- বেসরকারী সেবা সংস্থা (এনজিও)
- স্থানীয় সরকার প্রতিষ্ঠান (ইউপি, উপজেলা পরিষদ)
- সরকারী সেবা প্রতিষ্ঠান
- অন্যান্য।

১২. আপনার মতে, স্থানীয় সিদ্ধান্ত গ্রহন প্রক্রিয়ায় কার আধিপত্য/প্রভাব বেশী?

- স্থানী প্রশাসন
- সরকারী সেবা প্রতিষ্ঠান (বিশেষত: পুলিশ, ভূমি অফিস)
- সরকার দলীয় নেতা ও কর্মী।
- স্থানীয় সরকার প্রতিনিধি
- নাগরিক সমাজ
- স্থানীয় ধনী ও ব্যবসায়ী
- স্থানীয় দরিদ্র ও অনগ্রসর জনগোষ্ঠী
- অন্যান্য।

১৩. আপনার ধারনা অনুযায়ী, আপনার এলাকায় বসবাসকারী পরিবারগুলোর আর্থিক সক্ষমতা অনুযায়ী তাদের রাজনৈতিক প্রভাব মূল্যায়ন করুন? (স্কেল: ১-৫; সবচেয়ে কম=১, কম=২, মাঝামাঝি=৩, বেশী=৪, সবচেয়ে বেশী=৫)

	১	২	৩	৪	৫
ধনী					
মধ্যবিত্ত					
দরিদ্র					
অতিদরিদ্র					

১৪. আপনার মতে, উপকূলীয় এলাকায় কি ধরনের ঘঁটনা/বিপদ আপনাদের জীবন ও জীবিকার উপর সবচেয়ে প্রভাব বিস্তার করছে?

- ঘূণীঝড়
- জলোচ্ছ্বাস
- লবনাক্ততা
- জলাবদ্ধতা
- জলবায়ূ পরিবর্তন
- দূর্যোগ পরিস্থিতিতে সময়োপযোগী সাড়া প্রদানে সীমাদ্ধতা
- অন্যান্য (যদি থাকে)

১৫. আপনার মতে, কি কি কারনে আপনার এলাকায় প্রায়শই দূর্যোগ পরিস্থিতি তৈরি হচ্ছে?

- প্রাকৃতিক ঘটনা/বিপদ সম্পর্কে সময়মতো তথ্য না পাওয়া
- মানুষের উদাসীনতা
- দরিদ্র ও বিপদাপন্ন পরিবারগুলোর জন্য প্রয়োজনীয়/সহায়ক ব্যবস্থা না থাকা
- প্রাতিষ্ঠানিক সীমাবদ্ধতা ও দূর্যোগে সাড়া প্রদানে দীর্ঘসূত্রীতা
- দূর্যোগ পরবর্তী পূনর্বাসন ও পূনর্গঠন কার্যক্রমে সীমাবদ্ধতা ও দীর্ঘসূত্রীতা
- দূর্যোগ পরিস্থিতি নিয়ন্ত্রনে দীর্ঘমেয়াদী/স্থায়িত্বশীল কার্যক্রম না থাকা
- অন্যান্য (যদি থাকে)

১৬. আপনার মতে, আপনার এলাকায় কারা সবচেয়ে বিপদাপন্নতা বা দূর্যোগ ঝুকির মধ্যে রয়েছে?

- বাঁধের বাইরে ও বাঁধ সংলগ্ন এলাকায় অবস্থানকারী পরিবার
- দরিদ্র পরিবারের নারী, শিশু ও বয়োবৃদ্ধ সদস্যরা
- আদিবাসী পরিবার/জনগোষ্ঠী
- সূন্দরবন নির্ভও নিম্ন আয়ের শ্রমজীবি পরিবার
- কৃষি ও ঘের শ্রমিক
- অনিয়মিত পেশায় নিয়োজিত শ্রমিক
- অন্যান্য (যদি থাকে)

১৭. দূর্যোগ পরিস্থিতির শিকার হয়ে আপনি/আপনার পরিবার কি কোন নতুন স্থান/জায়গায় স্থানান্তরিত হয়েছেন?

- হ্যাঁ
- না

১৮. আপনার ধারনা অনুযায়ী উপকূলীয় এলাকায় পরিবেশ/প্রতিবেশগত পরিবর্তনের জন্য কারা দায়ী?

- সরকারী সেবা প্রতিষ্ঠান
- বহুজাতিক প্রতিষ্ঠান
- বেসরকারী উন্নয়ন/সেবা প্রতিষ্ঠান
- স্থানীয় নেতা ও প্রভাবশালী ব্যবসায়ী
- অন্যান্য (যদি থাকে)।

নির্দিষ্ট করুন ➡

১৯. সরকারীভাবে আপনার এলাকায় দূর্যোগ বিষয়ে সম্ভাব্য ঝুকিপূর্ন পরিবারগুলোর জন্য কোন প্রাক-সতর্ক বার্তা দেওয়া হয়েছিল কি?

- হ্যাঁ
- না

২০. আপনার এলাকায় দূর্যোগের সম্ভাব্য ঝুকিপূর্ন পরিবারগুলোকে নিরাপদ আশ্রয়কেন্দ্রে সরিয়ে নিতে সরকারীভাবে কোন উদ্যোগ নেওয়া হয়েছিল কি?

- হ্যাঁ
- না
- জানিনা।

২১. আপনার এলাকায় দূর্যোগের ঝুকি কমানোর জন্য সরকারের কোন সুরক্ষা কর্মসূচী (রাস্তা, বাঁধ মেরামত ও পূনস্থাপন ইত্যাদি) লক্ষ্য করেছেন কি?

- হ্যাঁ
- না
- জানিনা।

২২. আপনার এলাকার নির্বাচিত জনপ্রতিনিধি (স্থানীয় সরকার ও সংসদ সদস্যসহ) দূর্যোগ আক্রান্ত এলাকা পরিদর্শন করেছিলেন কি?

- হ্যাঁ
- না
- জানিনা।

উত্তর হ্যাঁ হলে, তারা কি দূর্যোগ আক্রান্ত পরিবারগুলোর জন্য সহযোগীতা করেছিল?

- হ্যাঁ
- না
- জানিনা।

২৩. আপনি কি মনে করেন, নির্বাচিত জনপ্রতিনিধিদের (স্থানীয় সরকার ও সংসদ সদস্যসহ) দূর্যোগ আক্রান্ত এলাকা ও মানুষের উন্নয়ন কার্যক্রমে স্বচ্ছতা রয়েছে?

- হ্যাঁ
- না
- জানিনা।

২৪. আপনার মতে, দূর্যোগ পরিস্থিতি নিয়ন্ত্রনে কোন কোন ক্ষেত্রে রাজনৈতিক অঙ্গীকারের সংকট রয়েছে?

- দূর্যোগ পরিস্থিতিতে আক্রান্ত পরিবারগুলোর সুরক্ষা কার্যক্রমে
- দূর্যোগ প্রবন এলাকায় স্থায়ীত্বশীল বা দীর্ঘমেয়াদী পূনর্বাসন ও অবকাঠামোগত উন্নয়ন কার্যক্রমে
- ঝুকিপূর্ণ বা দূর্যোগ পরিস্থিতির শিকার মানুষের সেবা প্রদান কার্যক্রমে
- স্থানীয় সিদ্ধান্ত গ্রহন প্রক্রিয়ায় বিপদতাপন্ন ও ঝুকিপূর্ণ মানুষদের অংশগ্রহন নিশ্চিত করতে
- মানুষের সকল প্রকার বৈষম্য (অর্থনৈতিক, সামাজিক, রাজনৈতিক) কমানোর ক্ষেত্রে
- অন্যান্য (যদি থাকে)।

জরিপে অংশগ্রহন করার জন্য আপনাকে অনেক ধন্যবাদ।

Annex V: Key Organisations and Resource Persons

SL	Key Organisations	Resource Persons
1.	SoDESH (local CSO) located in Shyamnagar and Koyra	Madhab Chandra Dutta Email: sodeshsatkhira@gmail.com Tel: 01711663801
2.	SAHAYA (local CSO) located at Shyamnagar	Muktabiur Raihan Email: sahaya.org.bd@gmail.com Tel: 01871119126
3.	Institute of Remote Sensing and GIS, Jahangirnagar University, Savar-Dhaka	Krishna Proashad Mandol GIS Analyst Email: krishna.ju38@gmail.com Tel: 01710776567
4.	UNDP	Mahbubul Haque Data Analysis Expert, Human Rights Programme Email: mahbubul.haque@undp.org Tel: 01913984201
5.	BRAC	Biplob Mustafiz Head of Communication Email: biplobmostafiz@yahoo.com Tel: 01748746398
6.	Dept. of Anthropology, University of Dhaka	Farhana Begum, PhD Professor Department of Anthropology University of Dhaka Email: farhanabg@yahoo.com Tel: 01751633375
7.	Dept. of Anthropology, University of Dhaka	Dr Zobaida Nasreen Associate Professor Dept. of Anthropology University of Dhaka Email: zobaidanasreen@du.ac.bd. Tel: 01765461204