



Disaster and Social System: A Study on Community Resilience in a Coastal Region of Bangladesh

This Thesis submitted to the University of Dhaka for the Degree of
Master of Philosophy.

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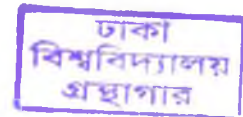
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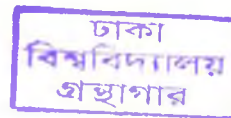
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Declaration

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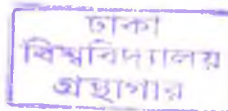


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To
Shaju, Mukta, Moti, Maya, Pushpa & Roddur

Abstract

Disasters “. . . are overt manifestations of latent social vulnerabilities, basically of weaknesses in social structures or social systems.” Quarantelli (2005) (p. 345). In this research paper, I explore how a better understanding of the linkages between disaster and Social system can help to enhance resilience of these linked systems in coastal areas. By resilience, we mean the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structure and functions.

ACRONYMS

ADAB	Association of Development Agencies in Bangladesh
ADB	Asian Development Bank
ADP	Annual Development Plan/Program
ADPC	Asian Disaster Preparedness Centre, Thailand
ADRC	Asian Disaster Reduction Centre, Japan
ADRRN	Asian Disaster Reduction and Response Network
AEGDM	Asian Experts Group on Disaster Management
AFD	Armed Forces Division
AGMP	Agriculture Meteorology Program, WMO
AIDS	Acquired Immune Deficiency Syndrome
ALITE	Augmented Logistic Intervention Team for Emergencies
ARPDM	ASEAN Regional Program on Disaster Management
ART	Alternative Risk Transfer
ASEAN	Association of South East Asian Nations
AUDMP	Asian Urban Disaster Mitigation Program, ADPC, Thailand
AUSAID	Australian Government Aid
AusDIN	Australian Disaster Information Network
BANBEIS	Bangladesh Bureau of Educational Information and Statistics Bangladesh
BBC	British Broadcasting Corporation
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Centre for Advanced Studies
BCC	Behavioural Change Communication
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BCHEPR	Bangladesh Center for Health Emergency Preparedness and
BDPC	Bangladesh Disaster Preparedness Centre
BDRCS	Bangladesh Red Crescent Society
BenfieldHRC	Benfield Hazard Research Centre, University College London,
BFE	Brahmaputra Flood Embankment
BFWMS	Bangladesh Flood and Water Management Strategy
BIDS	Bangladesh Institute of Development Studies
BIMSTEC	Bengal Initiative for Multi-sector Technical and Economic
BIWTA	Bangladesh Inland Water Transport Authority
BMA	Bangladesh Medical Association
BMD	Bangladesh Meteorological Department
BNCC	Bangladesh National Cadet Corps
BPDB	Bangladesh Power Development Board
BPKS	Bangladesh Pratibondhi Kollan Somity
BR	Bangladesh Railway
BRAC	Bangladesh Rural Advancement Committee
BRE	Brahmaputra Right Embankment
BUET	Bangladesh University and Technology
BUP	Bangladesh Unnoyon Parishad
BWDB	Bangladesh Water Development Board
BWP	Bangladesh Water Partnership
CA	Change Agents

CARE	Cooperation for Assistance and Relief Everywhere
CAs	Change Agents
CAT	Catastrophe Bonds
CATEX	Catastrophic Risk Exchange
CBDM	Community Based Disaster Management
CBO	Community Based Organization
CCA	Common Country Assessment
CCP	Cluster Cities Project
CDM	Clean Development Mechanism
CDMP	Comprehensive Disaster Management Program
CEGIS	Centre for Environmental Geographic Information Services
CEP	Coastal Embankment Project
CEPR	European Centre for Risk Management
CFAB	Climate Forecasting Application in Bangladesh
CFIS	Community based Flood Information System
CGIAR	Consultative Group for Agricultural Research
CGMW	Commission for the Geographical Map of the World
CHARM	Comprehensive Hazard and Risk Management Program
CIDA	Canadian International Development Agency
CIRDAP	Centre for Integrated Rural Development for Asia and the Pacific,
CIS	Commonwealth of Independent State
CMEPC	Civil Military Emergency Planning Council
CNC	Community Nutrition Centres
CNDR	Corporate Network for Disaster Reduction
CNN	Cable News Network
COEN	Committee for National Emergency
COP	Conference of Parties
CPD	Centre for Policy Dialogue
CPP	Cyclone Preparedness Program
CRA	Community Risk Assessment
CS	Civil Surgeon
CSC	Coastal Service Centre, NOAA, USA
CSD	Commission for Sustainable Development
CSDC	Countries in Special Development Situations
CSDDWS	Committee for Speedy Dissemination of Disaster Related Warning
CTGC	Disaster Management Technical Council
D&SCRN	Disaster and Social Crises Research Network
DAB	Doctors Associations of Bangladesh
DAE	Department of Agriculture Extension
DANA	Damage and Need Assessment
DANIDA	Danish International Development Agency
DAP	Detail Area Plan
DCC	Dhaka City Corporation
DDMC	District Disaster Management Committee
DEM	Digital Elevation Model
DEPI	Division for Environment Policy Implementation, UNEP
DEWA	Division for Early Warning and Assessment, UNEP
DFIB	Distributed Flood Information Base
DFID	Department for International Development, United Kingdom
DHA	Department of Humanitarian Affairs

DHI	Danish Hydraulic Institute
DIAB	Dubai International Award for best Practices to Improve the Living Environment
DIB	Distributed Information Base
DIFP	Dhaka Integrated Flood Protection
DIFPP	Dhaka Integrated Flood Protection Project
DIPECHO	Disaster Preparedness, European Community Humanitarian Office
DIT	Dhaka Improvement Trust
DMAIUDP	Dhaka Metropolitan Area Integrated Urban Development Project
DMB	Disaster Management Bureau (DMB), Bangladesh
DMCPT	Disaster Management and Crisis Prevention Team
DMDP	Dhaka Metropolitan Development Planning
DMIC	Disaster Management Information Center, Bangladesh
DMIS	Disaster Management Information System
DMT	Disaster Management Team
DNA	Designated National Authority
DND	Derma Narayangonj Dam
DoE	Directorate of Environment
DoF	Department of Fisheries
DoF	Department of Food
DPE	Department of Primary Education
DPHE	Department of Public Health Engineering
DPPI	Disaster Preparedness and Prevention Initiative
DPT	Diphtheria Pertussis Tetanus
DRBA	Disaster Recovery Business Alliance
DRI	Disaster Risk Index
DRR	Directorate of Relief and Rehabilitation, Bangladesh
DRR	Directorate of Relief and Rehabilitation
DRRO	District Relief and Rehabilitation Officer
DRRP	Disaster Reduction and Recovery Programme, UNDP
DTCB	Dhaka Transport Coordination Board
DTW	Deep Tube Well
DWS	Disaster Warning System
ECHO	European Community Humanitarian Office
ECNEC	Executive committee of National Economic Council
EGIS	Environmental and GIS Support Project
EIA	Environmental Impact Assessment
EMIN	Environmental Monitoring Information Network
ENSO	El-Nino Southern Oscillation
EOC	Emergency Operation Center
EPR	Emergency Preparedness and Response
ERD	Economic Relations Division
ERS	Early Response System
FAP	Flood Action Plan
FCD	Flood Control and Drainage
FCDI	Flood Control Drainage and Irrigation
FEJB	Forum of Environmental Journalists of Bangladesh
FF	Flood Forecast
FFWC	Flood Forecasting and Warning Centre
FFWS	Flood Forecasting and Warning System

FGD	Focus Group Discussion
FMD	Foot and Mouth Disease
FMM	Flood Management Model
FMRSP	Flood Management Research Support Project
FNB	Federation of NGOs in Bangladesh
FP	Facilitating Partner
FP	Family Planning
FPCO	Flood Plan Coordination Organization
FPOCG	Focal Point Operational Coordination Group
FRS	Flood Response System
FRSS	Fisheries Resources Survey System
FSMF	Fish Seed Multiplication Farm
FY	Financial Year
GBM	Ganges-Brahmaputra-Meghna
GC	Governing Council
GDP	Gross Domestic Product
GEF	Global Environment Facility
GF	Global Fund
GHG	Greenhouse Gas
GI	Galvanized Iron
GIS	Geographical Information System
GLIDE	Global unique Disaster Identifier
GMS	Geo-stationary Metrological Satellite
GO	Government Organization
GoB	Government of Bangladesh
GPS	Global Telecommunication System
GR	Gratuitous Relief
HBRI	the Housing and Building Research Institute
HFL	Highest Flood Level
HIES	Household Income and Expenditure Survey
HR	Human Resources
HRD	Human Resources Development
HW	High Water
ICDDR	International Centre for Diarrhoeal Diseases Research, Bangladesh
ICG	International Consultancy Group
ICID	International Commission on Irrigation and Drainage
ICT	Information and Communication Technology
IDEAL	Intensive District Approach to Education for All
IDNDR	International Decade for Natural Disaster Reduction / International
IDRC	International Development Research Centre
IEDCR	Institute of Epidemiology, Diseases Control and Research
IFCDR	Institute of Flood Control and Drainage Research (now IWFM)
IFPRI	International Food Policy research Institute
IFRCRS	International Federation of Red Cross Societies
IGA	Income Generating Activity
IIFC	Infrastructure Investment Facilitation Centre
IK	Indigenous Knowledge
ILRI	International Livestock Research Institute
IMD	Indian Metrological Department
IMDMCC	Inter-ministerial Disaster Management Coordination Committee

IPCC	Intergovernmental Panel for Climate Change
IPH	Institute of Public Health
IPHN	Institute of Public Health Nutrition
IPRSP	Interim Poverty Reduction Strategy Paper
IR	Inception Report
ISDR	International Strategy for Disaster Reduction
ISP	Internet Service Provider
IT	Information Technology
IUGG	International Union of Geophysics and Geodesy
IWM	Institute of Water Modelling, Bangladesh
IWRM	Integrated Water Resources Management
JICA	Japan International Cooperation Agency
JRC	Joint River Commission
KSS	Krishak Samabaye Samity
KV	Kilo-volt
LDC	Least Development Country
LDRRAP	Local Disaster Risk Reduction Action Plan
LG	Local Government
LGD	Local Government Division
LGED	Local Government Engineering Department
LGI	Local Government Institute
LGO	Local Government Organization
LGRD	Local Government and Rural Development
LGRD & C	Local Government, Rural Development and Cooperatives
LLP	Low Lift Pump
LSD	Least Square Difference/ Local Supply Department
LW	Low Water
M&PDC	Malaria & Parasitic Disease Control
MCM	Million Cubic Meter
MDGs	Millennium Development Goals
MDMR	Ministry of Disaster Management and Relief
MIDAS	Micro-Industries Development and Assistance Service
MIS	Management Information System
MISM	Management Information System and Monitoring
MLGRD	& C Ministry of Local Government, Rural Development and
MoA	Ministry of Agriculture
MOD	Ministry of Defence
MODS	Maintenance, Operations, Distribution and Services
MoEF	Ministry of Environment and Forest
MoEMR	Ministry of Energy of Mineral Resources
MoFDM	Ministry of Food and Disaster Management
MoFL	Ministry of Fisheries and Livestock
MOHFW	Ministry of Health and Family Welfare
MOPME	Ministry of Primary and Mass Education
MOU	Memorandum of Understanding
MOWCA	Ministry of Women and Children Affairs
MoWR	Ministry of Water Resources
MP	Member of Parliament
MPO	Master Plan Organization
MSL	Mean Sea Level

MSMEs	Micro, Small and Medium Enterprises
MT	Metric Ton
NAM	Non Aligned Movement
NAPA	National Adaptation Plan/ Program of Action
NCA	Net Cultivable Area
NCB	Nationalized Commercial Bank
NCS	National Conservation Strategy
NDMC	National Disaster Management Council
NDPD	National Day for Disaster Preparedness
NDSC	National Diseases Surveillance Centre
NE	North East
NFL	Normal Flood Level
NGO	Non-Governmental Organization
NGOCC	NGO Co-ordination Committee
NIPSOM	National Institute of Preventive and Social Medicine
NMCC	National Metrological Communication Centre
NNP	National Nutrition Program
NOAA	National Oceanic and Atmospheric Administration
NORP	National Oral Rehydration Projects
NPDM	National Plan for Disaster Management
NTU	Natural Temperature Unit
NW	North West
NWMP	National Water Management Plan
NWMPP	National Water Management Plan Project
NWP	National Water Plan
NWP	National Water Policy
NWRC	National Water Research Centre
NWRD	National Water Resources Database
O&M	Operation and Maintenance
ODA	Overseas Development Agency
OMS	Open Market Sale
OPV	Oral Polio Vaccine
ORS	Oral Rehydration Solution
PAP	Public Awareness program
PAPR	Partnership Agreement on Poverty Reduction
PBSs	Palli Biddut Samities
PCP	Project Concept Paper
PEAP	Poverty Eradication Strategic Action Plan
PEP	Production and Employment Programme
PFDS	Public Food Distribution System
PIC	Project Implementation Committee
PLA	Participatory Learning Action
PM	Prime Minister
PMIS	Program Management Information System
PMOE	Participatory Monitoring an Ongoing Evolution
PNGO	Partner of Non Governmental Organization
PP	Project Proforma
PPR	Public Procurement Regulation
PPWS&H	Physical Planning, Water Supply and Housing
PRA	Participatory Rural Appraisal

PRSP	Poverty Reduction Strategy Paper
PSF	Pond Sand Filter
PSPMP	Primary School Performance Monitoring Project
PVCA	Participatory Vulnerability and Capacity Assessment
PWD	Public Works Department
QPF	Quantitative Precipitation Forecast
R&D	Research and Development
RADAR	Radio Detection and Ranging
RD	Rural Development
RD&I	Rural Development Institutions
REB	Rural Electrification Board Response
RHD	Roads & Highways Department
RIC	Resource Integration Centre
RMG	Ready Made Garments
RS	Remote Sensing
RWP	Rural Works Programme
SAARC	South Asian Association for Regional Cooperation
SACMO	Sub-Assistant Medical Officer
SADC	Swiss Agency for Development and Cooperation
SADIS	Satellite Display System
SDC	Swiss Agency for Development and Cooperation
SEI	Socio-Economic Infrastructural Division
SFNTC	Social Forestry Nurseries and Training Centres
SFPC	Social Forestry Plantation Centres
SIDA	Swedish International Development Agency Signals
SMRC	SAARC Metrological Research Centre
SMS	Short Message Service
SOD	Standing Order on Disaster
SOD	Standing Orders on Disasters
SOP	Standing Operating Procedure
SPARRSO	Space Research and Remote Sensing Organisation
SSB	Special Security Bench
SSDP	Support to the Strengthening of Disaster Preparedness
STD	Subscribes Trunk Dialling
SWMC	Surface Water and Modelling Centre (now IWM)
SWSMP	Surface Water Simulation Modelling Program
T&T	Telegraph and Telephone
TBA	Traditional Birth Attendance
TCCA	Thana Central Cooperative Association
TIP	Thana Irrigation Program
TOR	Term of Reference
TR	Test Relief
TT	Tetanus Toxiod
TTC	Thana Training Centre
TTDC	Thana Training and Development Centres
UDD	Urban Development Directorate
UDMC	Union Disaster Management Committee
UHF	Ultra High Frequency
ULO	Upazila Livestock Officer
UNCED	United Nations Conference on Environment and Development

UNCHD	United Nations Conference on Human Development
UNCHS	United Nations Centre for Human settlements-Habitat
UNDP	United Nations Development Program
UNDRO	United Nations Disaster Relief Co-ordinator
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific Cultural Organisation
UNFCCC	United Nations Framework Convention of Climate Change
UNFPA	United Nations Population Fund
UNICEF	United Nations Children Emergency Funds United Kingdom
UNO	Upazila Nirbahi Officer
UP	Union Parishad
UP-DMC	Upazila Disaster Management Committee
UPI	Unit for Policy Implementation
UPL	University Press Limited
USAID	United States Agency for International Development
USD	US Currency
UzDMC	Upazila Disaster Management Committee
VCA	Vulnerability and Capacity Assessment
VDP	Village Defence Party
VGD	Vulnerable Group Development
VGF	Vulnerable Group Feeding
WAP	Wireless Application Protocol
WAPDA	Water and Power Development Authority
WARPO	Water Resource Planning Organisation
WASA	Water and Sewerage Authority
WB	World Bank
WCED	World Commission on Environment and Development
WDPC	Word Disaster Preparedness Committee
WFP	World Food Program
WHO	World Health Organization
WMO	World Metrological Organization
WPS	Water Purifying Solution
WPT	Water Purifying Tablet
WPW	Works Progamme Wing
WRP	Water Resources Planning
WRS	Water Resources System
WSS	Water Supply and Sanitation
ZIA	Zia International Airport

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Chapter 1:

1.1 Introduction:

The People's Republic of Bangladesh is situated in the southern part of Asia and bordered on the west, north, and east by India, on the south-east by Myanmar, and on the south by the Bay of Bengal.¹ It is a low-lying deltaic country formed by the Ganges, the Brahmaputra and the Meghna rivers. It is a land of about 136.7 million (SVRS, 2004, BBS) people within its 147,570 sq. Km (Agriculture Statistics WinWing, BBS 2004-2005) territory. More than 310 rivers and tributaries have made this country a land of rivers. Diversified cultural heritage, archaeological sites and the natural beauty of the country have made this land attractive. The country has the world's longest unbroken sandy beach of 120km, sloping gently down to the blue waters of the Bay of Bengal.²

Since Bangladesh achieved Independence in 1971, GDP has more than tripled in real terms, food production has increased three-fold, the population growth rate has declined from around 2.9% per annum in 1974 to 1.4% in 2006 and the country is now largely food secure. Over the last 20 years, growth has accelerated and the country is on track to become a middle income country by 2020. In four out of the last five years the economy has grown at over 6%. Between 1991 and 2005, the percentage of people living in poverty declined from 59% to 40% and the country's Human Development Index improved from 0.347 in 1975 to 0.547 in 2005. Child mortality has fallen substantially and gender parity in primary education has been achieved.³

Around 52% percent of the civilian labour force of the country is engaged in agriculture and 14% is engaged in industry. Monthly per capita income in 2010 is TK. 2,553 i.e. yearly Tk 30,636 or US\$418 (HIES, BBS, 2010). Since independence in 1971, Bangladesh has achieved substantial improvements in some social indicators like a decrease in infant and maternal mortality as well as illiteracy, and an increase in life expectancy, access to safe water and sanitation. However, approximately 31.5% (HIES, BBS, 2010) of the population still continue to live below the poverty line (BBS, 2010).⁴

¹ (Asian Disaster Preparedness Center (ADPC), January 2007)

² (Disaster Management Bureau, Disaster Management and Relief Division, April 2010)

³ (Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, September 2009)

⁴ (Bangladesh Bureau of Statistics. June, 2011)

Despite these successes, more than 50 million of our people still live in poverty. Many of these people live in remote or ecologically fragile parts of the country, such as river islands (Char) and cyclone-prone coastal belts, which are especially vulnerable to natural disasters. In the recently released draft, the Government of Bangladesh reaffirmed its commitment to the MDG targets, including halving poverty and hunger by the year 2015, through a strategy of pro-poor growth and climate resilient development.⁵

The geographical location, land characteristics, multiplicity of

Table 1 Impact of various disasters in Bangladesh (1904-2006)

rivers and the monsoon climate render Bangladesh highly vulnerable to natural hazards. The coastal morphology of Bangladesh influences the impact of natural hazards on the area. Especially in the south western area, natural hazards increase the vulnerability of the coastal dwellers and slow down the process of social and economic development. Significant country features include:

Disaster	No. of Events	Total Killed	Total Affected
Drought	5	18	25,002,000
Earthquake	6	34	19,125
Epidemic	28	403,102	2,757,519
Extreme temperature	17	2,041	87,000
Famine	1	1,900,000	0
Flood	69	50,103	324,470,717
Wave/Surge	2	3	12,010
Wind storm	146	614,143	63,911,270

Source: EM-DAT: The OFDA/CRED International Disaster Database (www.em-dat.net).

- A vast network of rivers and channels
- An enormous discharge of water heavily laden with sediments
- A large number of islands in between the channels
- A shallow northern Bay of Bengal and funnelling to the coastal area of Bangladesh
- Strong tidal and wind action

Natural and human induced hazards such as floods, cyclones, droughts, tidal surges, tornadoes, earthquakes, river erosion, fire, infrastructure collapse, high arsenic contents of ground water, water logging, water and soil salinity, epidemic, and various forms of pollution are frequent occurrences.

⁵ (Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, September 2009)

Climate change adds a new dimension to community risk and vulnerability. Although the magnitude of these changes may appear to be small, they could substantially increase the frequency and intensity of existing climatic events (floods, droughts, cyclones etc). Current indications are that not only will floods and cyclones become more severe; they will also start to occur outside of their “established seasons”. Events, such as drought, may not have previously occurred in some areas and may now be experienced.⁶

1.2 Statement of the problem and setting of the objectives:

According to the Bangladesh, PRSP⁷ in comparison to over 30 years ago it describes Bangladesh as “out of the shadow of famine”. Having said that it also says that aggregate poverty remains high and pockets of extreme poverty persists with Inequality as a rising concern. Add to this a country that is prone to disasters coupled with climate change as was faced 274 events under 8 types of disasters since 1904 to 2006 and in 2007 the first and second top most important disasters in the world alarming that by 2050, an 89 cm increase in the sea level would eat up roughly 20% of Bangladesh’s landmass, displacing more than 20 million people.

The question of impacts of disasters is, to what degree and what kind of disasters? Short term cyclones and floods versus climate change long term disasters of rising water and displacing land and people. We need to re-examine Disaster response and risk management in development in light of a new reality that threatens the community resilience.

Programming, within the fields of Development and Disaster Mitigation has traditionally been separate. Early response and disaster mitigation agencies / institutions have in the past lacked the luxury of being able to plan projects years in advance and instead must act with very little lead time when an emergency such as foods, Cyclones, drought and famine occurs. Recognizing hazards as generally consistent recurring events with some degree of predictability rather than as random surprises has allowed agencies to plan for mitigation and intervention not just after the event, but before and during.

⁶ (Disaster Management Bureau, Disaster Management and Relief Division, April 2010)

⁷ Bangladesh is going to reintroduce the five-year development plan from the next fiscal replacing the Poverty Reduction Strategy Papers (PRSP) aiming to meet basic need of the nation, officials said.
http://www.businessnews-bd.com/index.php?option=com_content&view=article&id=1101%3Asixth-five-year-development-plan-to-be-introduced-from-fy11&Itemid=81

New Reality thinking understands that it is necessary to understand the underlying causal structures of social system that create the conditions which allow the mixture of Hazards and risk to become an emergency. Once these are understood, pre-disaster mitigation through and as the core activity of recovery and

Top 10 Natural Disasters in Bangladesh
 for the period 1900 to 2011
sorted by numbers of killed:

Disaster	Date	No Killed
Drought	April 26, 1905	1900000
Epidemic	April 1, 1905	393000
Storm	November 12, 1970	300000
Storm	April 29, 1991	138866
Storm	October 1, 1942	61000
Storm	November 5, 1965	36000
Flood	July 1, 1974	28700
Storm	May 28, 1963	22000
Storm	May 24, 1985	15000
Storm	June 1, 1965	12047

Created on: Apr-1-2011. - Data version: v12.07

Source: "EM-DAT: The OFDA/CRED International Disaster Database
 www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium"

development can be initiated for making sustainable community resilience. Then the of Disaster Risk Reduction can be established which is holistic, serving to build up not just food supplies, but capacities which then serve to buffer these communities and households during times of stress and hazards.⁸

The word 'society' might mean the largest social system⁹. Social vulnerability to disasters and outcomes of any particular extreme event are influenced by build-up or erosion of resilience both before and after disasters occur. Resilient social systems incorporate diverse mechanisms for living with, and learning from, change and unexpected shocks. Disaster management requires multilevel governance systems that can enhance the capacity to cope with uncertainty and surprise by mobilizing diverse sources of resilience.

Human populations are concentrated along coasts, and consequently coastal ecosystems are some of the most impacted and altered worldwide. These areas are also sensitive to many hazards and risks, from floods to disease epidemics. Here, we explore how a better understanding of the linkages between ecosystems and human societies can help to reduce vulnerability and enhance resilience of these linked systems in coastal areas. By resilience,

⁸ (Islam K. S., 2009)

⁹ (Zetterberg, 1965)



we mean the capacity of linked social-ecological systems to absorb recurrent disturbances such as hurricanes or floods so as to retain essential structures, processes, and feedbacks. Resilience reflects the degree to which a complex adaptive system is capable of self-organization (versus lack of organization or organization forced by external factors) and the degree to which the system can build capacity for learning and adaptation.¹⁰

Part of this capacity lies in the regenerative ability of ecosystems and their capability in the face of change to continue to deliver resources and ecosystem services that are essential for human livelihoods and societal development. The concept of resilience is a profound shift in traditional perspectives, which attempt to control changes in systems that are assumed to be stable, to a more realistic viewpoint aimed at sustaining and enhancing the capacity of social-ecological systems to adapt to uncertainty and surprise.

II. Objective:

Broader objectives:

- To examine how community resilience defend social system from disasters.

Specific objective:

- To understand how disasters disrupt the social system.
- To know how community resilience faces disasters in its social system.

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1.3 Chapter arrangement:

In the first chapter, Research work Introduction, Statement of the problem and setting of the objectives-Hypothesis & Objective, Conceptual framework and Operational definition, Theoretical framework, Review of literature, Knowledge gap, Scope of research will be explained.

In second chapter, Research methodology, limitations of research: & expected Outcome try to be explained.

In third chapter, Disaster and Climate Change issues and scenario of Bangladesh will be explained and in the forth Social system topic will be explained.

¹⁰ (<http://www.sciencemag.org/content/309/5737/1036.full>)

In the fifth chapter, Community resilience and in sixth chapter the history of Moheshkhali and its vulnerability will try to be explained.

In the seventh chapter, the research findings and the conclusion will be placed.

1.4 Conceptual framework and operational definition:

Disaster:

A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

Comment: Disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation¹¹.

Here, the researcher randomly selected cyclone, storm surge hazard as the most frequent disasters in the coastal region of Bangladesh.

Social System:

The word 'society' might mean the largest social system.¹² The prerequisites for a social system are two or more people in interaction directed toward attaining a goal and guided by patterns of structured and shared Symbols and expectations. The social system as the basic unit of society in something of the same way that a cell is thought of as a basic unit in the make-up of an organism and an atom is thought of as the basic unit of matter.

Here, for this research work the social system of Moheshkhali Island will be explored.

Community Resilience:

'Resilience' is a complex multi-interpretable concept with contested definitions and relevance. Holling (1973) introduced the resilience concept into the ecological literature as a

¹¹ (http://www.unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf, 2011)

¹² (Zetterberg, 1965)

way to understand nonlinear dynamics¹³. According to The Resilience Alliance (2002) “Resilience in social systems has the added capacity of humans to anticipate and plan for the future”.

Here in this research work, the community Materbari Union of Moheshkhali Upazila will be considered as a community, here the definition of Alliance (2002) is considered.

Coastal region of Bangladesh:

The coast of Bangladesh is approximately 710 km long, as estimated by measuring the distance around the Bay of Bengal between Indian and Myanmar (Burma) borders. The landward distance of the delineated coastal zone from the shore is between 30 and 195 km whereas the exposed coast is between 37 and 57 km. The coastal zone is low-lying with 62% of the land have an elevation less than 3 metres and 86% less than 5 metres. The Bay of Bengal is a northern extended arm of the Indian Ocean. In the north of Bay of Bengal, “Swatch of No Ground”, a submarine canyon present at 25 km south of the western coastline of Bangladesh.

Records of the last 200 years show that at least 70 major cyclones hit the coastal belt of Bangladesh. The Noakhali-Chittagong coast 40 percent of the cyclones and The Chittagong-Cox’s Bazar coast received around 27 percent while Khulna-Sundarban and Barisal-Noakhali coast are relatively less vulnerable.¹⁴

Here, the researcher purposively selected Chittagong-Cox’s Bazar costal region as research area. Chittagong-Cox’s Bazar costal region is prone to cyclone, strom surge.

1.5 Theoretical framework:

Sociological Theory is law like proposition about society that can be supported by evidence like other science. To make a theory, Proposition have to make first. Propositions with two variates are acceptable as intermediary steps in theory construction even if they do not tell the whole story.

¹³ (Gunderson, 2002)

¹⁴ (Rahman M. , 2001)

Steps to construct theory:

a. Variates: Determinants and Results

At least two variates are required to make a proposition. Say for example, “The more knowledge he has, the higher and his prestige.”

Here; Knowledge=Determinants=Cause=Independent variable; and

Prestige=Results=Effect=Dependent Variable

In this research work, Disaster and social System: a study on community resilience in coastal region of Bangladesh

Here, Disaster= Determinants= Causes= Independent variable; and

Social System=Results=Effect=Dependent Variable

Because, If disaster is related to social system, and then the community resilience may protect to survive the people with high exposure in the coastal region of Bangladesh.

As., we get prestige from knowledge but no knowledge from prestige.

The first requirements of a proposition are that the determinants and results be precisely defined.

Say, for example, Max Weber’s “The Protestant Ethic and the Spirit of Capitalism” has one determinant i.e. the Protestant ethic and one result i.e. the spirit of capitalism. But it has these possibilities:

I. The **Protestant** Ethic and the Spirit of **Capitalism**: We study the frequency with which the Persons who are Protestants become capitalist and compare it with the frequency with Which persons who are Catholics become capitalists?

II. The Protestant **Ethic** and the Spirit of **Capitalism**: We look the ethical precepts in Protestantism which is more conducive to the emergence of capitalism than the corresponding precepts of Catholic ethics.

III. The **Protestant** Ethic and the **Spirit** of Capitalism: We look for a different spirit of entrepreneurship and hard work among Protestants compared with Catholics.

IV. The Protestant **Ethic** and the **Spirit** of Capitalism: Some ethical precepts in Protestantism lead to a particular spirit which is manifested as concern with one’s rank in the more visible aspects of stratification i.e., with achievements in the worlds of money, power, and science.

All four ways of interoperating the thesis are varying degrees present in Weber.

b. The Varieties of Linkage between Determinants and Results:

The topic of causal linkages is complicated, and it would carry us too far from the everyday problems of working theories in sociology to give it systematic presentation.

- 1.1) Reversible: if X, Then Y; and if Y, then X.
- 1.2) Irreversible: if X, Then Y; and if Y, then conclusion about X.
- 2.1) Deterministic: if X and always Y.
- 2.2) stochastic: if X, then probably Y.
- 3.1) Sequential: if X, then later Y.
- 3.2) Coextensive: if X, then also Y
- 4.1) sufficient: if X, then Y, regardless of anything else.
- 4.2) Contingent: if X, then Y , but only if Z
- 5.1) Necessary: if X and only if X, then, Y.
- 5.2) Substitutable: if X, then Y; but if Z, then also Y

Any proposition may now be characterised according to the above checklist of attributes. The above five attributes of a casual relation are well known any science. Max Weber's thesis about a relation between the Protestant ethic and the sprit of capitalism is the best interpretation as an irreversible, stochastic, sequential, contingent, and substitutable proposition.

I also try to follow Max Weber's theory construction.

c. Ordinary and Theoretical Proposition:

To present precisely defined determinants and results and specified relations between them are two ways of answering the question: what does this proposition mean? A third way of answering the same query phrases the answer in terms of informative value of the proposition. Proposition of low informative value are legion, and Proposition of high informative value deserve to be called theoretical propositions.

Inventory of Determinants:

All factors that factors affect certain phenomenon are systematically listed in an inventory of determinants.

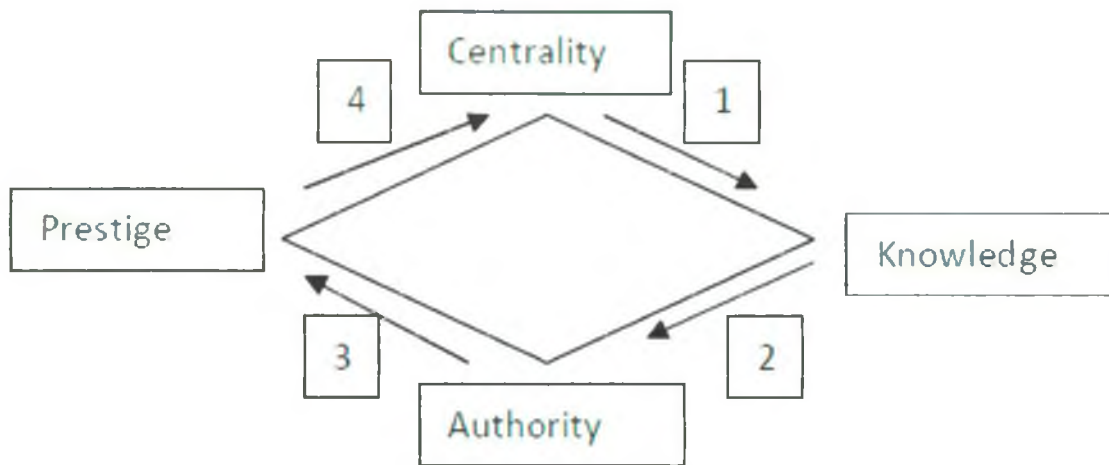
Inventory of Results:

A list of propositions in which the determinant is one and the same but the dependent variables are different is an inventory of results.

Chain Patterns of Propositions:

When we deal with two or more propositions in which a result in one appears as a determinant in another, we can order them as a chain.

Figure 1 Chain Patterns of Proposition



An illustration is furnished by Terence Hopkins, who has reviewed studies of small groups, focusing among other things, on four aspects. The studies make it reasonable to assume that we deal here with sequential propositions. One possible flow of determinants and results is the following:

- I. Persons who occupy central positions, that is , who interact with many other group members, tend to obtain better knowledge of their needs and attitudes;
- II. Persons who have better knowledge of the needs and attitudes of others can be more easily issue directives acceptable to others and thus tend to obtain higher authority;
- III. Persons of higher authority tend to receive more prestige;
- IV. Persons with prestige become sought-after interaction partners, and thus tend to obtain central positions in the group.

d. The conformation of a proposition:

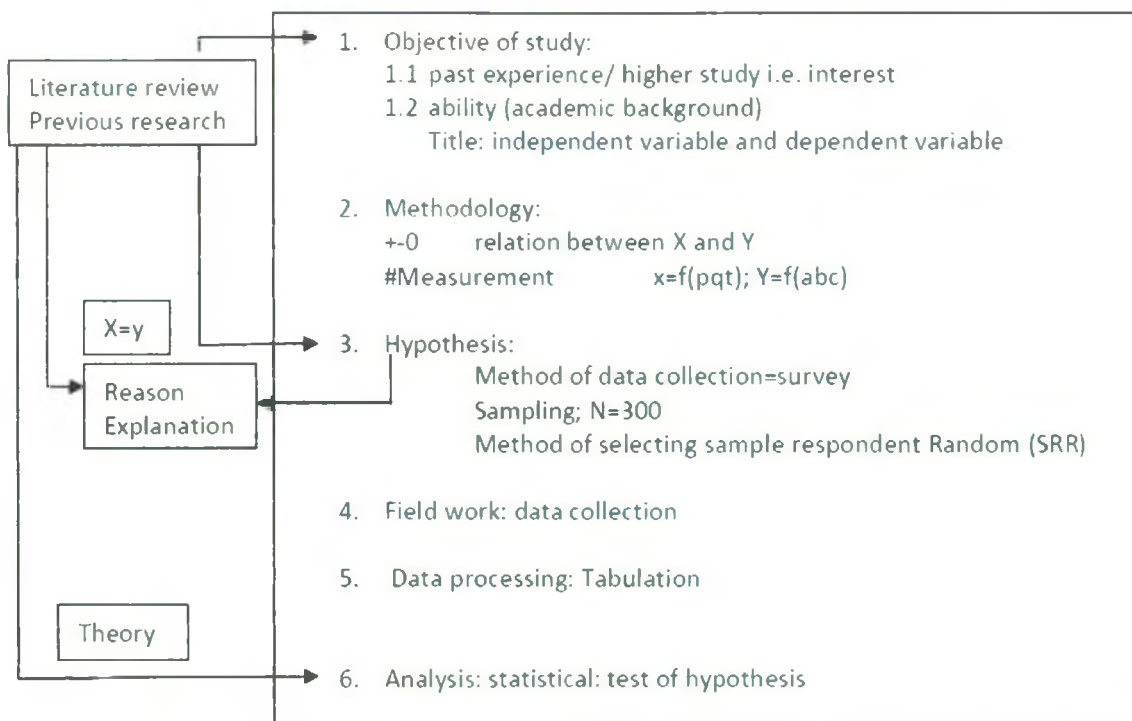
Propositions supported by evidence are called invariance, and propositions for which more evidence is needed are called hypotheses. These distinction cross-cuts our previous and between ordinary and theoretical propositions, and we get this important fourfold division:

Table 3 Four fold division

Empirical support	Low informative value	High informative value	
Wanting	Ordinary hypothesis	Theoretical hypothesis	Hypothesis
Sufficient	Ordinary invariance: finding	Theoretical invariance: Law	Invariance
	Ordinary Proposition	Theoretical Proposition	

e.Theoretical Framework:

Figure 2 Theoretical framework



It is the realization that there are great difficulties I testing a detached hypothesis compared with testing hypothesis integrated into a theory.

1.6 Review of literature:

Disaster and social system is interlinked. Beck defined it in a very modern sociological view. Here, in my study I try to follow his “risk calculus” concept to examine the proposition. Beck defined risk as ‘the modern approach to foresee and control the future consequences of human action’ which were the ‘unintended consequences of radicalized modernization’ (Beck, 1999, 3). Ulrich Beck’s *World Risk Society* (1999) was a sociological meditation on the interlinked forces of ‘globalization, individualization, gender revolution, underemployment, and global risks (as ecological crisis and the crash of global financial markets)’ (Beck, 2000, 2). Beck examined the ‘risk calculus’ concept, the power dynamics and sociology of risk (why groups profit from ‘manufactured uncertainty’), the ‘sub-politics’ of global dissent (anti-globalist and environmental campaigns), and how reflexive modernity uses conjecture in response to crises.¹⁵

Figure 3 Evaluation of society

Traditional Societies (Pre-Modern)	Early-Simple Modern Societies	Late or Reflexive Modernity
Institutions & Structures over agency		Agency primary over structure
Communal structures:	Collective Structures:	Agent primacy
<ul style="list-style-type: none"> • Concrete/particular structures shaped around relationship of "we" <ul style="list-style-type: none"> ◦ Extended family ◦ Church ◦ Village community • Vertically & horizontally integrated society • People embedded and formed communally within concrete, local spatiality, time material relationships 	<ul style="list-style-type: none"> • Abstract "we" • Atonomized individual • Social Classes • Vertically & horizontally integrated society • Spatiality, temporality and materiality transferred to collective structures • Functional departmentalization • Impersonal bureaucratization 	<ul style="list-style-type: none"> • Self as agent reflects on itself primarily an autonomous, self-monitoring of life • Structural reflexivity: agent reflects on social structures ('rules' and 'resources.') • Networks of flexibility • Educated classes required for advancing modernity • Communications / technology the new structure • Knowledge based • Client-centered-co-production
Shared meanings	Shared interests/needs/wants	Self-organized life-narratives
Disembedding Processes --->		Risk Society
Motor of social change are structures	---> Motor of social change - individualization / agency	

¹⁵ (<http://www.nextreformation.com/wp-admin/resources/risk-society.pdf>, 2011)

Professor Mahbuba Nasreen has made an sociological overview of disaster and social system from different engle. Here, in this section, the researcher adopted her litarature to review literature.

“Disaster research in Bangladesh is conducted from six major approaches: geographical approach, behavioural approach, structural approach, historico-structural approach, sociological approach and anthropological approach. Although geographical and sociological approaches have dominated the field of disaster research in developed societies, disaster research in Bangladesh mainly followed the geographical approach. It can be said that disaster research from sociological approach in Bangladesh is done only in rare occasions.

Past research on natural disasters (such as, famine, river bank erosion, floods or cyclones) in Bangladesh has followed the geographical approach of the Chicago-Colorado-Clark-Toronto School of Natural Hazard Studies associated with Kates, 1962, 1971, White, 1964, 1974 and Burton et al., 1978.^{16 17 18 19 20} Disaster response studies (Islam, 1974; Paul, 1984; Alam, 1990, 1991) deal with people's behaviour, such as their perception, attitudes, beliefs, values, response and personalities.^{21 22 23 24} These studies fall in the first school of thought (i.e. geographical approach) described by Alexander. They are concerned with discovering people's choices, behaviour and adjustments to disaster, for example, how people viewed the hazard and how they perceived alternative opportunities available to them in coping with the hazardous events. However, social impact of disaster is also mentioned in some of these studies.²⁵

A recent publication, following geographical approach (Ahsan and Khatun, eds., 2004) in disaster focused on gender aspects during disasters. Various disasters such as flood, cyclone, riverbank erosion, earthquake, arsenicosis, famine and others have been discussed from geographical perspective. However, although in some of the writings in the study impact of

¹⁶ (Kates, 1962)

¹⁷ (Kates, Natural Hazard in Human Ecological perspective: Hypotheses and Models' Economic Geography, 1971)

¹⁸ (White, Choice of Adjustment to Floods, 1964)

¹⁹ (White, Natural Hazards: Local, National, Global, 1974)

²⁰ (Burton, 1978)

²¹ (Islam, 1974)

²² (Paul, 1984)

²³ (Alam, 1990)

²⁴ (Alam, Survival: An Analysis of General Issues and Concerns with Emphasis on the Strategies to cope with Floods in Bangladesh, January 25-26, 1991)

²⁵ (Alexander, 1993)

disasters on people and coping with disasters have been emphasized, majority of them have only a geographical perspective.²⁶

Hossain et al (1987) examined, from behavioural approach, whether rural people in flood-free and flood-prone areas adopted different survival strategies or not and also focused on the responses of rural people in general, but not on women's responses.²⁷ Shaw (1989) highlighted the problems of poor women in a relief camp in Dhaka city. She noted how women bore the social burden of shame when living with strangers and drew attention to the difficulties women faced when trying to maintain *parda* during floods.²⁸ In his study on riverbank erosion and floods Rahman (1988) argued that people's ability to adjust to hazards should be viewed as an extension of social and natural systems already existing in society. He also pointed out that there are differences in people's reaction to riverbank erosion and flooding according to their socio-economic location. Alam's (1991) study focused on the survival strategies of rural people on the flood-prone and relatively flood-free villages. The author observed that some middle and poor income households sold or mortgaged their lands and other assets to avert hunger during floods.

The pioneering disaster research (Nasreen, 1995) based on sociological approach portrait a detailed picture of a disaster experienced by rural households. It focused on the pre, during and post disaster activities performed by men and women during floods. The author argues that disaster affect both women and men but the burden of flood coping falls heavily on women. During floods men in rural areas lose their place of work while women shoulder the responsibilities to maintain households' sustenance. Nasreen (1995, 1999) argued that although poor rural women have very few options open to them to overcome their problems, their roles in disasters are obviously not simple: they relate to a complete range of socio-economic activities. During floods women continue to be bearers of children and responsible for their socialization, collectors and providers of food, fuel, water, fodder, building materials and keepers of household belongings: they also represent a productive potential which was not recognised earlier. The study argues that it is women's strategies, developed over the last few years, those are vital in enabling the rural people to cope with disaster. Government and many other bodies dealing with disaster management mainly communicate with wealthier,

²⁶ (Ahsan, 2004)

²⁷ (Hossain, 1987)

²⁸ (Shaw, 1989)

influential landowners who do not represent or serve the interest of the poor or of women. Nor does it seem to have occurred to policy makers that women might be involved in activities different from men or experience disasters differently than men. Vast majority of the rural people is inextricably linked with the arsenic contaminated water for their daily survival. It is reported that most of these people neither had the idea of arsenic contamination, or the future impact of the catastrophe of *arsenicosis*. However, there has been very limited discussion on the socio-economic impact of *arsenicosis* in Bangladesh.

A sociological research (Nasreen, 2002) has been conducted on the problem of *arsenicosis* from a new environmental paradigm. It has been argued in the study that arsenic contamination in Bangladesh ground water is a widely recognized fact and that is causing suffering to millions. The author identified some of the social consequences related to *arsenicosis* such as social instability, superstition, ostracism, diminishing of working ability, increase of poverty, impact on women, disruption of social network and marital ties and causing death.

Hanchett (2003) argued that there is a gender side to the arsenic problem because women and men are affected in different ways. "Women who do know about the problem and wish to do something about it are faced with new demands on their time as they search for safer drinking/cooking water sources. Poor women also face insults – a problem they were able to avoid once they no longer needed to ask more affluent neighbours to share their safer wells".²⁹

1.6 Knowledge gap:

According to the Bangladesh, PRSP in comparison to over 30 years ago it describes Bangladesh as "out of the shadow of famine". Having said that it also says that aggregate poverty remains high and pockets of extreme poverty persists with Inequality as a rising concern. Add to this a country that is prone to disasters coupled with climate change as was faced 274 events under 8 types of disasters since 1904 to 2006 and in 2007 the first and second top most important disasters in the world³⁰ alarming that by 2050, an 89 cm increase

²⁹ (Nasreen, July 2004.)

³⁰ (www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium")

in the sea level would eat up roughly 20% of Bangladesh's landmass, displacing more than 20 million people³¹.

The question of impacts of disasters is, to what degree and what kind of disasters? Short term cyclones and floods versus climate change long term disasters of rising water and displacing land and people. We need to re-examine Disaster and social system in light of a new reality that threatens the community resilience.

New Reality thinking understands that it is necessary to understand the underlying causal structures that create the conditions which allow the mixture of Hazards and risk to become an emergency. Once these are understood, pre-disaster mitigation through and as the core activity of recovery and development can be initiated for making sustainable community resilience. Then the of Disaster Risk Reduction can be established which is holistic, serving to build up not just food supplies, but capacities which then serve to buffer these communities and households during times of stress and hazards.

1.7 Scope of research:

Disasters “. . . are overt manifestations of latent social vulnerabilities, basically of weaknesses in social structures or social systems.” Quarantelli (2005) (p. 345). In this research paper, I explore how a better understanding of the linkages between disaster and Social system can help to enhance resilience of these linked systems in coastal areas. By resilience, we mean the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structure and functions.

³¹ (Asian Disaster Preparedness Center (ADPC), January 2007)

Chapter-2

2.1 Research Methodology:

Area Selection: The researcher purposively selected the research area as the Chittagong-Cox's Bazar coastal region is one of the most cyclone hit region and Moheshkhali as an Island Upazila of Cox's Bazar district is relatively more vulnerable than other upazilas of Cox's Bazar. In spite of this, Materbari union which is itself an island of Moheshkhali upazila are prone to frequent cyclone and tidal surge; and also vulnerable as because of its dense population and lack of preparedness capacity which was proved in 1991 cyclone "Gorki".

These are some following causes to select Moheshkhali as research area:

- 1) The researcher is born and brought up in Chittagong coast, named Potenga, which was affected by Tropical cyclone on 29 April, 1991. He has been in the Cox's Bazar district for eight months as a Disaster Trainer with a partner organization of CARE Bangladesh named Resource Integration Centre (RIC) on 2003, travelled and conducted disaster related project (Disaster Management Project) activities like Disaster management training for disaster management committee of Union, Upazila and District level. He has travelled all the coastal area of Bangladesh, as he has been working in the disaster management field since 2003 with Bangladesh Disaster Preparedness centre (BDPC), International Federation of Red Cross and Red Crescent Societies (IFRC)-Bangladesh Delegation and United Nations Bangladesh. With all his extensive field experience, He found that Moheshkhali Upazila of Cox's Bazar district is the most disaster prone area and therefore selected Moheshkhali as his research area.
- 2) Out of a total 64, 19 coastal districts of the country, all lying on the coastal belt, namely: Bagherhat, Barguna, Barisal, Bhola, Chandpur, Chittagong, Cox's Bazar, Feni, Gopalganj, Jessore, Jhalokati, Khulna, Lakshmipur, Narail, Noakhali, Patuakhali, Pirojpur, Satkhira and Sariatpur, are most vulnerable to cyclone as well as water surge. Records of the last 200 years show that at least 70 major cyclones hit the coastal belt of Bangladesh. The Noakhali-Chittagong coast 40 percent of the cyclones and The Chittagong-Cox's Bazar coast received around 27 percent while Khulna-Sundarban and Barisal-Noakhali coast are relatively hit less.³²

³² (Rahman M. , 2001)

- 3) The researcher has visited all the unions of Moheshkhali on 2003, Prepare disaster management action Plan under a project of CARE Bangladesh³³. Since that time, he has been collecting relevant materials to conduct a research work. Finally, The researcher found that Materbari union, where he first entered on a very rainy day 22 June 2003 for conducting a cyclone simulation³⁴, select for his research area.

Research methodology:

Methodology is focused on participatory approach in line with the scope of work. The community vulnerability and risk assessment is conducted in a broad context encompassing specific human, social/cultural, economic, and environmental dimensions that relate to inequalities, gender relations and the disadvantaged. Participatory tools is adopted to ensure optimum participation of the communities at risk in the process of implementation

Both primary and secondary sources of information is explored to collect information. Primary information is collected through field visits, Focus Group Discussions (FGD), Informal Group Discussions (IGD), Key Informants Interviews (KII), Community Risk Assessment (CRA) while secondary information is collected through literature review, consultation with GO/NGOs working in the areas. Participation of 30% women is ensured in conducting the activities mentioned above.

2.2.What is CRA?

CRA (Community Risk Assessment)³⁵ is a participatory process for assessing hazards, vulnerabilities, risks, ability to cope, preparing coping strategies and finally preparing a risk reduction options implementation plan by the local community. CRA uses scientific information and predictions and participatory discourses to identify, analyse and evaluate risk environment of a particular community, reach consensus amongst the community on actions that are needed to manage the risk environment. The method recognizes that the vulnerability, loss, reduction or mitigation strategy and coping mechanism vary from community to community and group to group (women, person with disability, landless, farmers-fisher folks, etc) of a same community. So it ensures representation of professional, community and other groups and that their points of views are reflected. CRA encourages community participants to respect others' concerns.

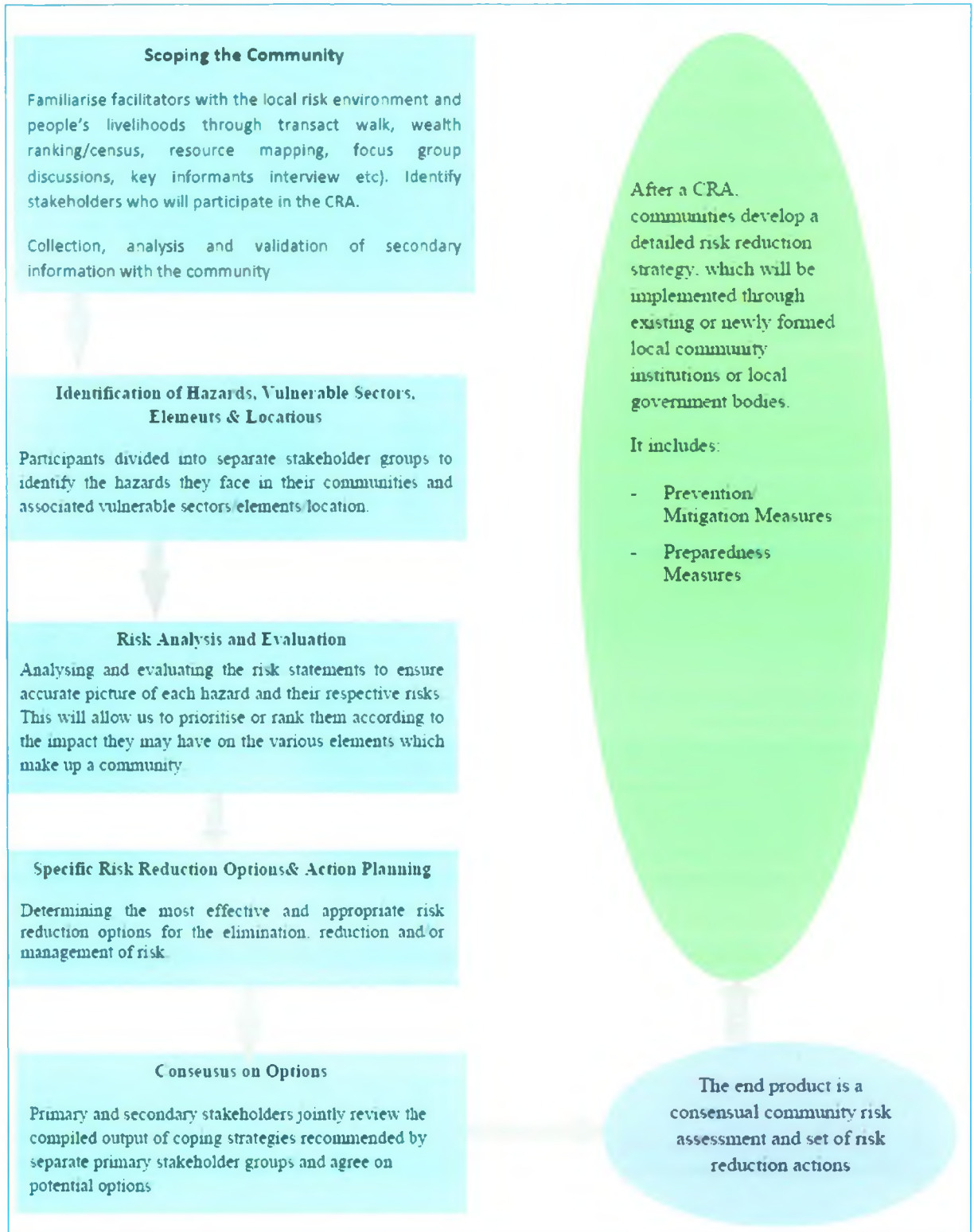
³³ (The Daily Ajker Desh Bidesh/Moheshkhali Representative, 17 July 2003)

³⁴ (The Daily AJKER DESH BIDESH/ Moheshkhali Representative, 22 June, 2003)

³⁵ (http://www.undp-adaptation.org/projects/websites/docs/CRA_Guidelines_English.pdf)

A flowchart below shows the CRA process sequentially.

Figure 4: Flow chart showing major steps of CRA



In the CRA processes the participating representatives will list down all hazards, identify all vulnerability aspects, causes and prepare consensual actions on risk reduction, coping and preparedness measures through analyzing each of the prioritized options. Risk reduction actions are then developed with the participation of all stakeholders' (both primary and secondary). The method requires active participation of stakeholders from different occupational groups and social classes giving an opportunity for their opinions and concerns to be discussed and recognized. The method can potentially reduce conflict among stakeholder groups and interests of individuals during project implementation and if the situation arises can assist the local people with resolving it. Through the process people understand the importance of their participation in all the steps starting from identification of hazards, deciding upon risk reduction options, coping and preparedness measures, preparing an outline work plan and in implementation. This enables them to feel a sense of ownership and play a more effective role during implementation of actions.

When is CRA used?

Rural people, especially the poor, landless, fisher-farmers, women and disabled are highly vulnerable to hazards. The increasing frequency of hazards and subsequent loss of lives and resources makes them more vulnerable. Considering all these factors, the need to practice wider participation in preparing risk reduction actions is inevitable, where all the stakeholders and their representatives participate in planning and implementation processes through consensus.

At present both non-government and government sector projects emphasise the participation of local stakeholders for hazard and vulnerability reduction in a sustainable manner. Government agencies in Bangladesh are central to any hazard response and risk reduction activities. There are also many national, international and UN organizations involved in hazard response and risk reduction initiatives, which aim to benefit the poor and other vulnerable groups. CRA is an appropriate method for all these organisations. CRA can ensure effective participation of vulnerable communities to achieve their risk reduction goals. CRA can be used at all levels to involve stakeholders from professional groups, agencies and departments and specialists from various disciplines, to prepare long-term risk reduction actions. It is expected that organizations involved in similar types of activities is benefited using CRA.

Who are the Participants of CRA?

Participation of both primary and secondary stakeholders of any locality is considered important and essential in CRA. Primary stakeholders are those who reside within the locality and are directly impacted by any hazards (e.g. women, disabled, farmers, and fishers, landless). Secondary stakeholders may not be directly impacted but are involved in providing support to them, and they may have some influence (e.g. administrative, legal) or be affected (either positively or negatively) by decisions made by primary stakeholders. Participation of secondary stakeholders in CRA is therefore very important. Types of participants might vary depending on the locality, occupational groups etc. and the objectives of conducting CRA.

The table below shows of primary and below page the secondary stakeholders in the context of Bangladesh.

Stakeholder	Impacted	Supportive
Primary Stakeholders	Fishers	Union Parishad
	Fish farmers	Union Disaster Management Committee (UDMC)
	Farmers (land owner and share croppers)	Upazila DMC
	Landless	Involved NGO staff
	Women	Local Forest Officer;
	Disables	Upazila Cooperative Officer;
	Adolescent, etc.	Money lenders, local elites;

<p>Secondary Stakeholders</p>	<p>UP Chair, members; Local Administration Public and Private service Providers Local Influential (policy/social – having influence on power structure) Member of Parliament, and Local institutional Network</p>	<p>Involved NGO staff Local Physicians Local CBOs and Networking Bodies etc. Scientific Organizations including Bangladesh Meteorological Department, Institute of Water Modelling (IWM), Center for Geographic Information Services (CEGIS), Climate Change Cell of Department of Environment, BUET, Dhaka University, and others.</p>
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Participating stakeholders’ types and numbers for CRA is depend on its goal and objectives and the social and physical boundary of the locality, extent of command area and other related factors.

What Resources are needed?

Time and other resources required to conduct CRA are not fixed. These can vary considerably depending on the objectives; hence this guide does not prescribe a structured timetable and resources.

The facilitators must have basic knowledge and some experience on PRA and have properly gone through this guide. Besides a clear idea of the locality, its livelihood options, local tone, conflicts, history of entitlement, physical situation of the resources, present hazard management initiatives, etc. will help the facilitators conduct a successful CRA.

In Bangladesh the dry winter season is suitable for conducting CRA, though the schedule should be synchronized with the farming system and local practices. Rice planting and harvesting times should be avoided. In rural settings of Bangladesh, schools, NGO offices, and UP offices can be used as venues.

Secondary data collection:

To cope and adapt with climate change (and variability), it is necessary to know the location, nature, intensity and magnitudes of hazards and then a comprehensive risk assessment shall enable designing and implementing action plans to reduce risks. Scientific information related to hazards necessary has been recorded in annex the researcher validate in one hand and enable the CRA team to refresh participants' experience of hazard trend in to their locality and develop RRAP addressing these risks.

Considering the above, the activities in this chapter are targeted to gather relevant primary information (also validating secondary information and maps from relevant sources e.g. DMIC) on the area, which will potentially help in action planning for managing the risk environment. Relevant data can also be gathered from the concerned offices (e.g. IWM, CEGIS, WARPO, BMD, SPARSO, GSB and DOE (CCC) etc.) using various data collection tools. However, it may not be necessary to collect all this information at this stage if the information is already available at project level or secondary sources. This might require considerable time depending on undertaking organization being locally institutionalized or ex-situ operations.

The commonly asked scientific secondary information, forms of information and possible sources are described in the following table.

Table 1: Scientific and modelling Information Required from Secondary sources

Information	Level of Detailing
Rainfall Trends over the seasons for last years	Union level, Upazila Level, District Level
River Bank Erosion Trend and Prediction	Union Level, Basin Level
Land Elevation	Union Level, Upazila Level, District Level
Groundwater table and quality of water information (including discharge and recharge rate)	Union Level, Upazila Level, District Level

Information	Level of Detailing
Water level/water extent /duration of last floods/	Union Level, Upazila Level, District Level
Drought trend and Prediction Information	Union Level, Upazila Level, District Level
Cyclonic surge predictions/ or past inundation	Union Level, Upazila Level, District Level
Information about hail storms trends and (prediction if possible)	Union Level, Upazila Level
Salinity Prone Areas and Degree of Salinity in Surface and Ground Water including Agri Land under salinity	Union Level, Upazila Level, District Level
Trends of the incidences of Tornados and if possible predictions	Union Level, Upazila Level, District Level
Number of continuous rain (more than 3 days) in past over the crucial season and predictions (if possible)	Union Level, Upazila Level, District Level
Trends of Heat Spell that affect (stress) livelihoods and projections (if possible)	Union Level, Upazila Level, District Level
Trends of Cold Wave that affect (stress) livelihoods and life and predictions (if possible)	Union Level, Upazila Level, District Level

After collection of the above mentioned scientific information, there is also need of some other secondary information to be collected from the local sources: Union Parishad, Upazila Parishad or other local sources. The common information to be collected before field activities of CRA is mentioned in the following table with possible sources.

Table 2: Socio-economic Information Required from Secondary sources

Information	Probable Sources
Location, Type and Area	Union Parishad, LGED
Population (Male/ Female)	Union Parishad, Upazila Statistics Office
Education (rate – primary, secondary)	Union Parishad, Upazila Primary Education Office
Health and Family Planning	Union Health Complex, Upazila Health and Family Planning Office
Communication (roads, bridge, culverts, sluice gates etc)	Union Parishad, LGED
River, Canal, Wetland (beels) etc.	Union Parishad, Bangladesh Water Development Board (office at district level)
Economic Activities (livelihood options)	Union Parishad, Local NGOs and Knowledgeable
Social – Religious Groups	Union Parishad
Institutions: educational, religious, government offices, UP, NGOs, local clubs, cultural institutions, flood/cyclone shelters	Union Parishad, Upazila social Welfare Office, Upazila Education Office
Common Places: hat – bazaar, playground	Union Parishad
Land use (commercial/business, settlement, infrastructure, forest, wetland, fish culture, cultivable/ non-cultivable, single cropped, double cropped, triple cropped etc)	Union Parishad, Upazila Land Office, Sub Assistant Land Officer, Upazila Agriculture Office, Sub Assistant Agriculture Officer, Upazila Fisheries officer, NGOs, Upazila Sub-Registrar Office
Soil Type	Union Parishad, Upazila Agriculture Office

Information	Probable Sources
Food and Agriculture	Upazila Agriculture Office, Upazila Food Office
Forestation	Union Parishad, Upazila Forest Office
Biodiversity	Union Parishad, NGOs, Forest Department
Water and Sanitation	Union Parishad, Tube well Supervisor, NGOs, Upazila DPHE Office, Sanitary Inspector
Poultry – Livestock	Union Parishad, Upazila Livestock Office
Fisheries	Union Parishad, Upazila Fisheries Officer
Electricity	Union Parishad, Polli Biddut Shomity
Union Map	Union Parishad, DMIC, Disaster Management Bureau

After collection and processing of the above mentioned information, a validation process of the information is started through a day long workshop with local people and union disaster management committees to get the feedback on the secondary information as the part of “*Scoping the Community*”.

After validation of the secondary information, the following Activities to be performed:

Transact Walk (Familiarization Tour, A few focus group discussion sessions, Participatory social mapping, Hazard Venn Diagram, Hazard mapping, Livelihoods Seasonal Calendar, Hazard Seasonal calendar, Key informants interviews, CRA Workshop:

Step-1: Hazard Identification

Step-2: Vulnerable Sector Identification

Step-3: Risk Statement and Prioritisation

Step-4: Risk Analysis and Evaluation

Step-5: First Plenary: Consensus on Risks

Step-6: Specific Risk Reduction Options

Step-7: Final Plenary: Consensus on Options

Figure 5 Daily Activity schedule for conducting CRA

Day and Time	Session	Description	Participants
Pre-CRA			
Ranging from a week to a month depending on local institutional capacity of conducting organization	Scoping the community	Tasks: Relevant secondary information (both scientific and socio-economic) collection and validation, Transact Walk, Focus Group Discussions, Social Mapping, Seasonal Calendar of Hazards and Livelihood Options, Hazard Mapping and Key Informants Interview	FGD, Social & Hazard Mapping, Seasonal Calendar: 8 – 10 persons from the union including UDMC, Knowledgeable, and Professionals etc.
1 to 10 days based on the individual PNGO's capacity	According to the PNGO's convenience	A draft report preparation based on the Pre- CRA findings	PNGO staff
01 Day: 06 hours session	Time agreed by the UDMC	Validation of the information collected from the different sources and means as the part of " Scoping the Community ".	24-36 members from Union/ Municipality/ City Corporation DMC
1-5 days depending on the PNGO's capacity	Before commencement of the CRA workshop	Finalization of the Pre-CRA report based on the validation session with the DMC members	PNGO staff

Preparation for the CRA workshop: Thorough review and analyze the Pre-CRA data and take preparation for CRA accordingly. This is very important for effective facilitation and

helping in preparation of Risk Statement.

A. Getting ready for CRA workshop; Task 1: Prepare a draft list of Hazard, Vulnerable Sectors, Elements and specific risk statement based on the Pre- CRA results.

B. Getting ready for CRA workshop; Task 2: Make four copies of hazard map (big size- easily visible to the CRA participants) based on the data found in the Pre- CRA.

CRA Workshop

<p>Day-1 (Ward 1/2/3) 9 am to 5 pm</p>	<p>Step – 1 & 2 Activity 1 - 3</p>	<p>Conduct three concurrent sessions in three venues at old three words by three facilitators' team.</p>	<p>2-3 participants from each of the socially disadvantaged group (disabled, women, farmer/ weavers/ fishers, landless) are a must. Include participants from each of the new words; equal number from each new word. Total participants should be in between 15-20.</p>
<p>Day-2 9 am to 5 pm</p>	<p>Step – 3 Activity 4 - 6</p>	<p>Conduct three concurrent sessions in three venues at old three words by three facilitators' team.</p>	<p>Same as Day – 1 Participants</p>
<p>Day-3 9 am to 5pm</p>	<p>Step – 4 Activity 7 - 8</p>	<p>Task # 07 would be carried out by the PNGO facilitators in consultation with the officials of relevant GO/NGO and local elderly and experienced persons.</p> <p>Task # 08 would be carried out by the PNGO facilitators in consultation with the respective GO/NGO department.</p>	<p>Facilitators, Field Officers and Assistants</p> <p>Facilitators, Field Officers and Assistants</p>
	<p>Compilation of findings of task 07 & 08</p>	<p>Prepare necessary posters and get ready for the final day session</p>	<p>Facilitators, Field Officers and Assistants</p>

Day- 4 9 am to 2 pm	Step - 4 Activity 9 <u>(Final Plenary)</u>	Fix all the posters prepared in Day 3 in the venue before the session starts. All the participants will observe the display out puts in small groups and then reach in to a consensus in the plenary after necessary corrections	Day 1 participants and 15-18 from secondary stakeholders (altogether around 25-38 participants).
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2.3 Connecting CRA to the cycle of disaster planning

From a disaster management perspective, CRA needs to become part of the disaster planning process. In theory, a CRA contribute essential data for action planning that leads into the implementation of risk reduction measures. When CRA is conducted without the expectation of disaster planning or the creation of safety measures it negatively raises local expectations that can not be fulfilled with consequent long-term community damage. The traditional Disaster Planning Cycle (illustrated in the diagram below) is a cyclical rather than linear process and involves six fundamental steps or stages:

Stage 1. Initiation of Disaster Planning

Stage 2. Risk Assessment- This is a three stage process with CRA being the second stage: (i)Hazard Mapping; (ii) CRAs for all key sectors; (iii) Loss Estimation Scenarios

Stage 3. Defining levels of Acceptable Risk- This is a political process where political leaders make decisions on the level of protection to plan for. These decisions are based on the data provided from Risk Assessment. (At this point in the Planning Cycle some societies may be forced to exit from further planning or implementation on grounds of cost)

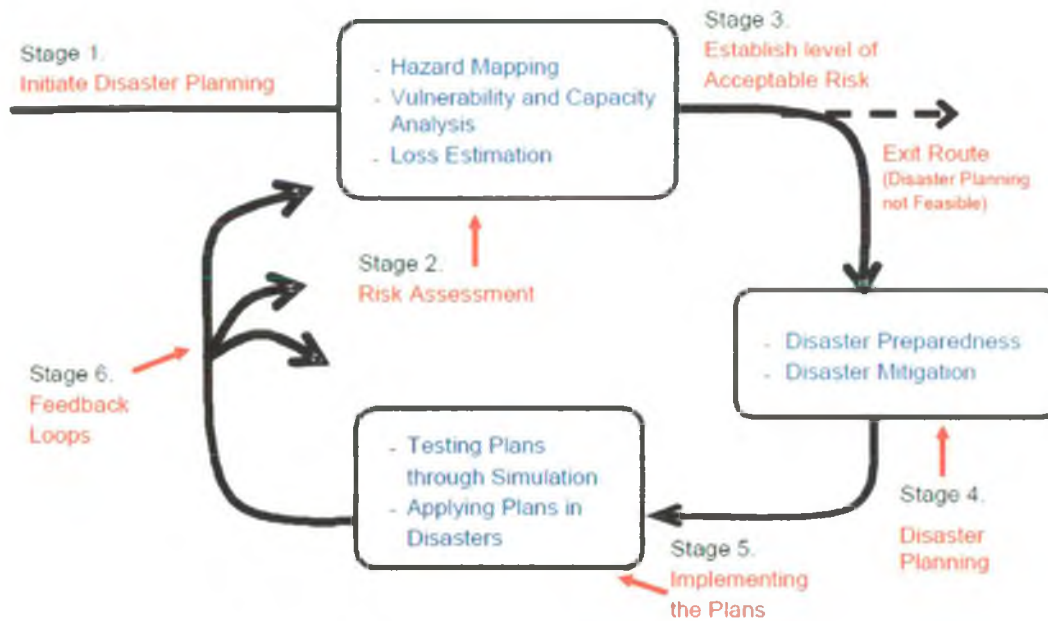
Stage 4. Planning Risk Reduction Measures and Disaster Plans- The planning process covers both structural (physical) and non structural elements (social/ administrative)

Stage 5. Implementing the Plans- This can be undertaken through the testing of disaster plans through simulation exercises or through their application in disaster situations.

Stage 6. Feedback Loops- As plans are tested or applied key lessons is fed back into stages 2, 3, 4 and 5 to continually improve the system of disaster planning.

Figure 6 the cycle of Disaster Planning

The Cycle of Disaster Planning:



2.4 Limitations of research:

As a researcher when I conduct some group discussion with the most vulnerable group representatives like, old aged people, major occupational group representatives i.e. fisher men, cultivator, Persons with disability, school children, adolescent, women, Union Parishad disaster Management Committee or Upazila Disaster Management Committee, Member of Cyclone Preparedness Programme (CPP); they raised their expectations and asked me to represent them to the respective level to solve some major problems immediately like embankment issues, fund problem of union Parishad, poverty problems.

People of my research area are working population living with hand to mouth. Therefore, it is hard to get their time for conducting such research work. As I have been with the community since June 2003, understand their language, jokes, culture and moreover build a good relationship from the community people to Union, Upazila, district and national policy level; they give me their valuable time.

Other than these, the low education rate, disrupt road communication, weather condition especially in the rainy season hampered the research work.

2.5 Expected Outcome:

This study is a valuable reference document for the policy makers to prepare development policy in the coastal area. Information sharing through this study will create a path for other researchers to conduct further study. It will find out the worst affected people of the study area and identify what is available at all levels to reduce the risks.

Chapter: 3

3.1 Disaster in coastal region

Some analytical write up like BEEL DAKATIA³⁶, Disaster: Issues and Gender Perspectives,³⁷ ENDOWED WISDOM³⁸, CLIMATE CHANGE ADAPTATION STRATEGIES FOR BANGLADESH,³⁹ Cyclone Sidr in Bangladesh- Damage, Loss and Needs Assessment For Disaster Recovery and Reconstruction,⁴⁰ Sustainability in Grass-Roots Initiatives Focused on Community Based Disaster Management⁴¹ and some historical write up of coastal district of Cox's Bazar like CHOKORJAR ETIHAS (History of Choker)⁴² and Glimpses of Cox's Bazar⁴³ gave sociological impression of this research work

An Anthropological research work conducted with the fishermen community in Moheshkhali with an objective to make a Socio-economic profile and indigenous fishing knowledge of the fisherman communities of the Moheshkhali Island.⁴⁴

A participatory risk analysis had been conducted to assess the risk of common disasters upon the people of Koyra impact zone of Sundarban Reserve Forest from the perspective of community people.⁴⁵

(The following section has been adopted from Nasreen, M (2005)⁴⁶

Defining Disaster

'Disaster' is defined differently by different people: to some 'disaster' is a summative concept' (Kreps, 1984) or a 'sponge world' (Qurantelli and Dynes, 1970). Some researchers mentioned disaster as a 'collective stress situation' (Barton, 1969) while others identified it with 'social crisis period' (Qurantelli and Dynes, 1977).

³⁶ (Rahman, 1995)

³⁷ (Society, July 23 & 24, 2000)

³⁸ (Comprehensive Disaster Management Programme, Dec 2009)

³⁹ (Department of Civil Engineering, BUET, Feb 2009)

⁴⁰ (The Government of Bangladesh & The International Development Community, April 2008)

⁴¹ (United Nations Centre for Regional Development, Disaster Management Hyogo Office, April 2003)

⁴² (Amin, June 2002)

⁴³ (Cox's Bazar Foundation, Sep 1995)

⁴⁴ (Uddin, April 2000)

⁴⁵ (Jagrata Juba Shangha (JJS), December 2004)

⁴⁶ (Nasreen, July 2004.)

Britton (1986) argued that “disasters can be more easily recognized than they can be defined”. Disaster is a severe, relatively sudden and unexpected disruption of normal structural arrangements within a social system over which the system has no firm control (Barton, 1974). A disaster may also be viewed as “a significant departure from normal experience for a particular time and place” (Turner, 1978). Disaster is also viewed as a mental construct imposed upon experience. This is because to understand disaster knowing the number of deaths, the value of property destroyed or the decrease in per capita income is not sufficient. The symbolic component requires knowledge of the sense of vulnerability, the adequacy of available explanation and the society’s imagery of death and destruction (Barkun, 1977).

Approaches to Sociology of Disaster

Although there is no coherent discussion in the sociological studies in the development of disaster research, attempts had been made to indicate some of the substantive trends in the development of sociology of disaster. Quarantelli and Dynes (1977) examined the sociological research of three decades on disaster and identified the following issues.⁴⁷ (Box 1)

Box 1: Trends in Disaster Research
Efforts at codification
The development of a social organizational, rather than a social and psychological emphasis
The emphasis on groups, rather than individuals, as the basic unit of analysis
The increasing emphasis on the pre-impact period as the source of post-impact changes
The developing focus on functional and dysfunctional long range consequences and the initial attempts at model building

Because disasters bring disruptions in the normal social life, create chaos, destroy social structure and contribute to replace social order, disaster research may be viewed as the study of ‘social pathology’ (Dynes, et al, 1978)⁴⁸. However, Fritz (1961) provided a sociological definition of disaster along with a rationale for which disaster should not be viewed as social pathology:

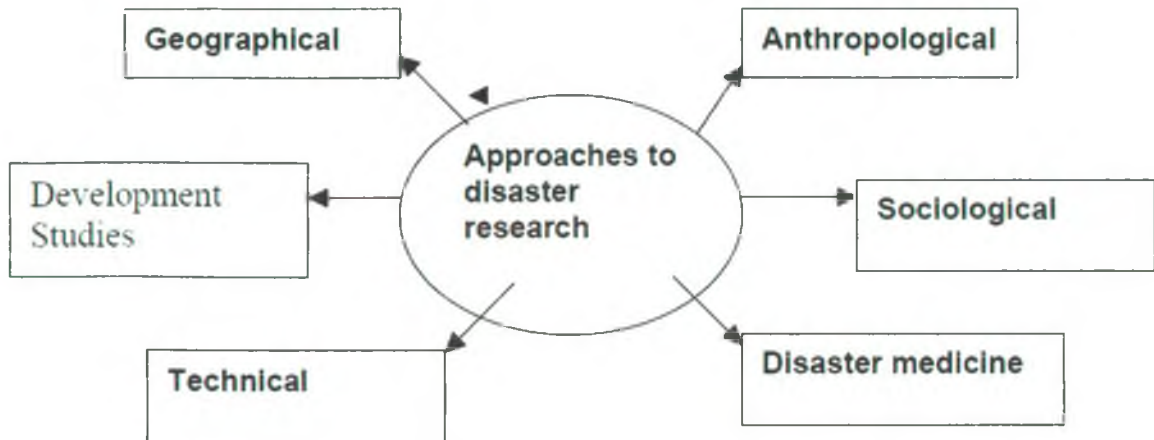
“Disasters provide a realistic laboratory for testing the integration, stamina, and recuperative Powers of large scale social systems. They provide the social scientists with advantages that cannot be matched in the study of human behaviour in more normal or stable conditions”.⁴⁹

⁴⁷ (Quarantelli, 1977)

⁴⁸ (Dynes, 1978)

⁴⁹ (Fritz, 1961)

Figure 1: Approaches to disaster research



After surveying the general literature on disaster, Alexander (1993) identified six schools of thought on natural hazards and disaster studies: the geographical approach, the anthropological approach, the sociological approach, the development studies approach, the disaster medicine approach and the technical approach. (Figure 1).⁵⁰

The geographical approach (pioneered by Barrows, 1923 and White, 1945) deals with the human ecological adaptation to the environment with special emphasis on the 'spatio-temporal' distribution of hazard impacts, vulnerability and people's choice and adjustment to natural hazards. Social science methods are widely used in this approach.^{51 52}

The anthropological approach (Oliver-Smith, 1979⁵³, 1986; Hansen and Oliver-Smith, 1982⁵⁴) emphasizes the role of disasters in guiding the socio-economic evolution of populations. Anthropologists adopting this approach search for reasons why communities in the 'Third World' fail to provide basic requirements for their people's survival. They also discuss the 'marginalization syndrome' caused by impoverishment of disadvantaged groups in 'Third World' countries. The sociological approach (Dynes, 1970; Quarantelli, 1978; Mileti, Drabek and Haas, 1975; Drabek and Boggs, 1968; Drabek, 1986) discusses vulnerability and the impact of disaster upon patterns of human behaviour and the effects of disaster upon

⁵⁰ (Alexander, 1993)

⁵¹ (Barrows, 1923)

⁵² (White, 1945)

⁵³ (Oliver-Smith, 1979)

⁵⁴ (Hansen, 1982)

community functions and organization. Oliver-Smith (1996) developed three general themes as the major trends in anthropological research in disaster: behavioural response approach, social change approach, and political economic/ environmental approach. Oliver-Smith argues that disaster in developing world occur at the interface of society, technology and environment and is fundamentally the outcomes of the interactions of these characteristics. He has also reported that although occurrence of disaster is frequent, theoretical work in disaster research is limited.

The development studies approach (Davis, 1978; Knott, 1987) discusses the problems of distributing aid and relief to 'Third World' countries and focuses on refugee management, health care and the avoidance of starvation. The disaster medicine and epidemiology approach (Beinin, 1985) focuses on the management of mass casualties. It also includes the treatment of severe physical trauma and their diseases which may occur after a disaster.

The technical approach (Bolt et al. 1977; El-Sabh and Murty, 1988) focuses on geophysical approaches to disaster such as studied in seismology, geomorphology and volcanology and seeks engineering solutions.

Among these approaches two disciplines, geography and sociology, have dominated the field of disaster research since the 1950s and have emphasised the environmental and behavioural aspects of disaster. Drabek's (1986) findings on existing sociological literature are the significant contributions to the conceptual typology of sociological disaster research. He identified different areas of concern in disaster research such as planning, warning, evacuation, emergency, restoration, reconstruction, perceptions and adjustments. He discussed sociology of disaster under four major headings: preparedness, response, recovery and mitigation. However, most of the approaches and sociological research on disaster have been formulated and conducted for the developed world (especially the USA). Their application to developing areas is problematic and very limited, as in the Bangladeshi cultural context. Moreover, there is almost no discussion of the gender response to disaster under any theoretical approach. In fact, only recently sociologists turned their attentions to the larger questions of social change related to disaster or the pre-impact conditions in disaster areas as sources of post-impact changes (Oliver-Smith, 1986).

3.2 Hazards, Vulnerability, Capacity and Disaster Risk reduction;

(This section adopted from UNISDR publication disaster terminology.)

It is told that all disasters are hazards but all hazards are not disasters. Because, hazard is A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. There are some hazards related terminologies such as: *Biological hazard; Geological hazard; Hydrometeorological hazard; Natural hazard; Socio-natural hazard; Technological hazard.*

Hydrometeorological hazard

Process or phenomenon of atmospheric, hydrological or oceanographic nature that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Socio-natural hazard

The phenomenon of increased occurrence of certain geophysical and Hydrometeorological hazard events, such as landslides, flooding, land subsidence and drought, that arise from the interaction of natural hazards with overexploited or degraded land and environmental resources.

Technological hazard

A hazard originating from technological or industrial conditions, including accidents, dangerous procedures, infrastructure failures or specific human activities, that may cause loss of life, injury, illness or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Geological hazard

Geological process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Natural hazard

Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Vulnerability

The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

Comment: There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors. Examples may include poor design and construction of buildings, inadequate protection of assets, lack of public information and awareness, limited official recognition of risks and preparedness measures, and disregard for wise environmental management. Vulnerability varies significantly within a community and over time. This definition identifies vulnerability as a characteristic of the element of interest (community, system or asset) which is independent of its exposure. However, in common use the word is often used more broadly to include the element's exposure.

Capacity

The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals.

Comment: Capacity may include infrastructure and physical means, institutions, societal coping abilities, as well as human knowledge, skills and collective attributes such as social relationships, leadership and management. Capacity also may be described as capability. Capacity assessment is a term for the process by which the capacity of a group is reviewed against desired goals, and the capacity gaps are identified for further action.

Risk

The combination of the probability of an event and its negative consequences.

Comment: This definition closely follows the definition of the ISO/IEC Guide 73. The word "risk" has two distinctive connotations: in popular usage the emphasis is usually placed on the concept of chance or possibility, such as in "the risk of an accident"; whereas in technical settings the emphasis is usually placed on the consequences, in terms of "potential losses" for some particular cause, place and period. It can be noted that people do not necessarily share the same perceptions of the significance and underlying causes of different risks.

Other risk-related terms in the Terminology: Acceptable risk; Corrective disaster risk management; Disaster risk; Disaster risk management; Disaster risk reduction; Disaster risk

reduction plans; Extensive risk; Intensive risk; Prospective disaster risk management; Residual risk; Risk assessment; Risk management; Risk transfer.

Risk assessment

A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.

Comment: Risk assessments (and associated risk mapping) include: a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios. This series of activities is sometimes known as a risk analysis process.

Risk management

The systematic approach and practice of managing uncertainty to minimize potential harm and loss.

Comment: Risk management comprises risk assessment and analysis, and the implementation of strategies and specific actions to control, reduce and transfer risks. It is widely practiced by organizations to minimise risk in investment decisions and to address operational risks such as those of business disruption, production failure, environmental damage, social impacts and damage from fire and natural hazards. Risk management is a core issue for sectors such as water supply, energy and agriculture whose production is directly affected by extremes of weather and climate.

Risk transfer

The process of formally or informally shifting the financial consequences of particular risks from one party to another whereby a household, community, enterprise or state authority will obtain resources from the other party after a disaster occurs, in exchange for ongoing or compensatory social or financial benefits provided to that other party.

Comment: Insurance is a well-known form of risk transfer, where coverage of a risk is obtained from an insurer in exchange for ongoing premiums paid to the insurer. Risk transfer

can occur informally within family and community networks where there are reciprocal expectations of mutual aid by means of gifts or credit, as well as formally where governments, insurers, multi-lateral banks and other large risk-bearing entities establish mechanisms to help cope with losses in major events. Such mechanisms include insurance and re-insurance contracts, catastrophe bonds, contingent credit facilities and reserve funds, where the costs are covered by premiums, investor contributions, interest rates and past savings, respectively.

Acceptable risk

The level of potential losses that a society or community considers acceptable given existing social, economic, political, cultural, technical and environmental conditions.

Comment: In engineering terms, acceptable risk is also used to assess and define the structural and non-structural measures that are needed in order to reduce possible harm to people, property, services and systems to a chosen tolerated level, according to codes or “accepted practice” which are based on known probabilities of hazards and other factors.

Disaster risk reduction

The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

Comment: A comprehensive approach to reduce disaster risks is set out in the United Nations-endorsed Hyogo Framework for Action, adopted in 2005, whose expected outcome is “The substantial reduction of disaster losses, in lives and the social, economic and environmental assets of communities and countries.” The International Strategy for Disaster Reduction (ISDR) system provides a vehicle for cooperation among Governments, organisations and civil society actors to assist in the implementation of the Framework. Note that while the term “disaster reduction” is sometimes used, the term “disaster risk reduction” provides a better recognition of the ongoing nature of disaster risks and the ongoing potential to reduce these risks.

Adaptation

The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Comment: This definition addresses the concerns of climate change and is sourced from the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC).

The broader concept of adaptation also applies to non-climatic factors such as soil erosion or surface subsidence. Adaptation can occur in autonomous fashion, for example through market changes, or as a result of intentional adaptation

Policies and plans. Many disaster risk reduction measures can directly contribute to better adaptation.

Climate change

(a) The Inter-governmental Panel on Climate Change (IPCC) defines climate change as: “a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land use”.

(b) The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”.

Comment: For disaster risk reduction purposes, either of these definitions may be suitable, depending on the particular context. The UNFCCC definition is the more restricted one as it excludes climate changes attributable to natural causes. The IPCC definition can be paraphrased for popular communications as “A change in the climate that persists for decades or longer, arising from either natural causes or human activity.”

Structural and non-structural measures

Structural measures: Any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard-resistance and resilience in structures or systems;

Non-structural measures: Any measure not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts, in particular through policies and laws, public awareness raising, training and education.⁵⁵

⁵⁵ (http://www.unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf, 2011)

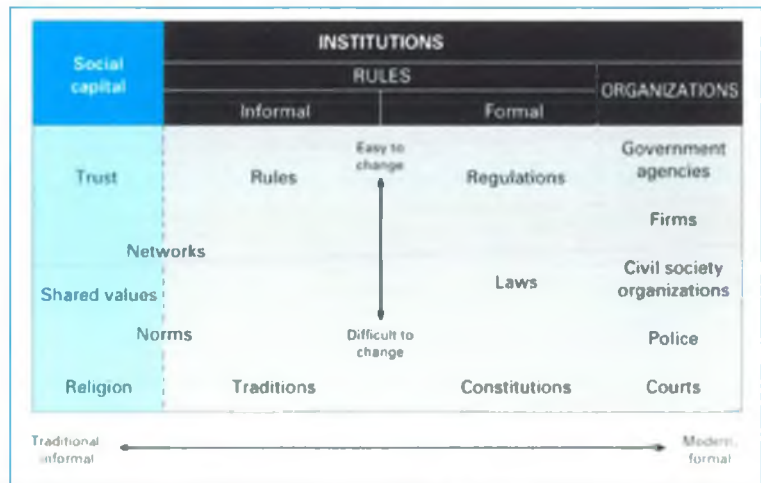
Chapter: 4

4. Social Systems

The prerequisites for a social system are two or more people in interaction directed toward attaining a goal and guided by patterns of structured and shared Symbols and expectations. The social system as the basic unit of society in something of the same way that a cell is thought of as a basic unit in the make-up of an organism and an atom is thought of as the basic unit of matter.

Institutions are the rules, organizations, and social norms that facilitate coordination of human action. On the informal end, they go from trust and other forms of social capital (including deeply rooted norms governing social behaviour) to informal mechanisms and networks for coordination. On the formal end, they include a country's codified

Figure 7 Social Norms, rules and Organizations for coordinating Human behaviour



rules and laws, and the procedures and organizations for making, modifying, interpreting, and enforcing the rules and laws (from the legislature to the central bank).

Because institutions govern behaviour, they are social assets (or liabilities, when bad or weak). So are the elements of social capital, such as trust and personal networks. The distinction between social capital and institutions can sometimes be blurred, and there are strong influences between the various social assets. For example, the exchange of goods and services may be based on personal networks and other forms of social capital in the village, but on formal institutions in the city. Similarly, general trustworthiness in a society can be strong either because of strong personal networks—or because of good laws and judicial systems that are generally accepted. In fact, as societies become more complex, trust in

individuals (based on knowledge of character and frequency of interpersonal contacts) is supplemented by trust in institutions (rules and organizations) when dealing with strangers.⁵⁶

Two very important dimensions of coordination are *others* and *future*. Markets are institutions with coordinating functions. A market coordinating the transactions of individuals and firms enables them to serve *others* and invest for the *future* (as when a baker builds an oven in response to greater demand). But markets need the support of other institutions to ensure confidence, control, and the right incentives. Economic agents face transaction costs, and institutions can coordinate to lower those costs. Traders may want to cheat each other—or to renege on their promises. But social capital and modern institutions—such as the rule of law and the enforcement of contracts—reduce this probability (a transaction cost), facilitating mutually beneficial transactions. Particular challenges for these other institutions are to commit to protect and nurture people and assets—and to serve dispersed interests.⁵⁷

⁵⁶ (Morgan, ed.1990)

⁵⁷ (Sen, 2002)

Chapter: 5

5. Community resilience:

'Resilience' is a complex multi-interpretable concept with contested definitions and relevance. Holling (1973) introduced the resilience concept into the ecological literature as a way to understand nonlinear dynamics⁵⁸. According to The Resilience Alliance (2002) "Resilience in social systems has the added capacity of humans to anticipate and plan for the future". They identify three defining characteristics:

- The amount of change the system can undergo and still retain the same controls on function and structure
- The degree to which the system is capable of self-organization
- The ability to build and increase the capacity for learning and adaptation⁵⁹

UN/ISDR (2004: 16-17) define resilience as: *'the capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structuring. This is determined by the degree to which the social system is capable of organising itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures'*.⁶⁰

This highlights the degree of anticipatory or proactive adaptation before the event occurs⁶¹. It also underlines the importance of learning from past events, the need to adapt to potential risk and the ability to deal with uncertainty. Also, it highlights the importance of people's capacities before a disrupting event. While UKCIP (2004: 3) defines resilience as: *'the ability of a system to recover from the effect of an extreme load that may of caused harm'*⁶²; this implies unlike the latter definition that damage can occur and the system is able to recover. This type of adaptation can be termed reactive; hence it takes place after the impacts of climate change have occurred.

Pelling's (2003:48) definition of resilience merges proactive and reactive resilience: *'the ability of an actor to cope with or adapt to hazard stress. It is a product of the degree of*

⁵⁸ (Gunderson, 2002)

⁵⁹ <http://www.resalliance.org/index.php/resilience>

⁶⁰ http://www.unisdr.org/eng/about_isdr/basic_docs/LwR2004/Annex_1_Terminology.pdf Page 5 access date 06 April'2011

⁶¹ (Levina, 2006)

⁶² (UKCIP, 2004)

*planned preparation undertaken in the light of a potential hazard, and of spontaneous or premeditated adjustments made in response to felt hazard, including relief and rescue*⁶³.

These definitions do not explain in detail what the outcomes of resilience are; what are these ‘acceptable levels’ of functioning and structuring? Does it mean an improvement in circumstances before the climate change event occurred, a similar level of vulnerability or a situation that is worse? This highlights a need for a robust understanding of people’s capacities in order to understand their ability to deal with a climate change event before it occurs.

Pelling’s definition introduces the terms ‘cope’ and ‘adapt’ in his interpretation of resilience. Within the climate change discourse ‘coping capacity’ and ‘adaptive capacity’ are often used interchangeably. Resilience includes both coping strategies and adaptive strategies. Coping refers to the actions and activities that take place within existing structures; often short-term strategies. While Adger (1996) argues that adapting frequently involves changing the framework within which coping takes place and involves a long term change in behaviour patterns. Coping strategies are more likely to emerge at the micro level, while adaptive strategies, which are related to social and cultural values, are long term processes, which are more likely to emerge at larger spatial scales. This distinction between coping and adapting highlights the variation in responses at different scales from the micro – macro. These responses do not exist at either ends of the spectrum of change; resilience is not a fixed state, it changes over time, for example coping mechanisms may develop into adaptive strategies over time.⁶⁴

It is necessary to distinguish between ‘adaptive’ or ‘coping’ capacity, which represents ‘potential’ rather than ‘actual’ adaptation. Thus, current stocks of adaptive capacity only reduces a system’s vulnerability to future climate change events or to climate change events that involve slow change over relatively long periods (e.g. salinity intrusion), which the system can adapt reactively. Hence, current levels of resilience to climate change are created from adaptive and coping capacity in the past, which determine current levels of vulnerability?

⁶³ (Pelling, 2003)

⁶⁴ (Adger, 1996)

Also, it is constructive to think about resilience as a layered concept: ranging from the individual to the household, ethnic group and even global level. It's important to highlight that resilience at one level of the system does not necessarily create resilience at other levels⁶⁵. For instance, if some people in a community have high levels of resilience, this may be a barrier or limit for other people in the community to adapt to stresses, for example the expansion of shrimp cultivation improved the income of the elite, but the resulting increase in salinity has led to a number of negative impacts for poorer households, such as declining agricultural productivity and the resultant income insecurity.

This demonstrates how the impacts of salinity caused by both climatic forces and non-climatic forces represented in the uneven power relations manifested in broader society has caused the poor to become increasingly vulnerable to climate induced stress. This highlights how resilience is socially differentiated and often involves tradeoffs, often for the most vulnerable. This differentiation can also extend down to the household level, for example the elderly have a decreased ability to engage in livelihood activities, which creates a reliance on familial and kinship networks, though due to sheer poverty and lack of material resources, the support these networks provide can be weak and can lead to destitution.⁶⁶

⁶⁵ (Glavovic, 5-7 December 2002.)

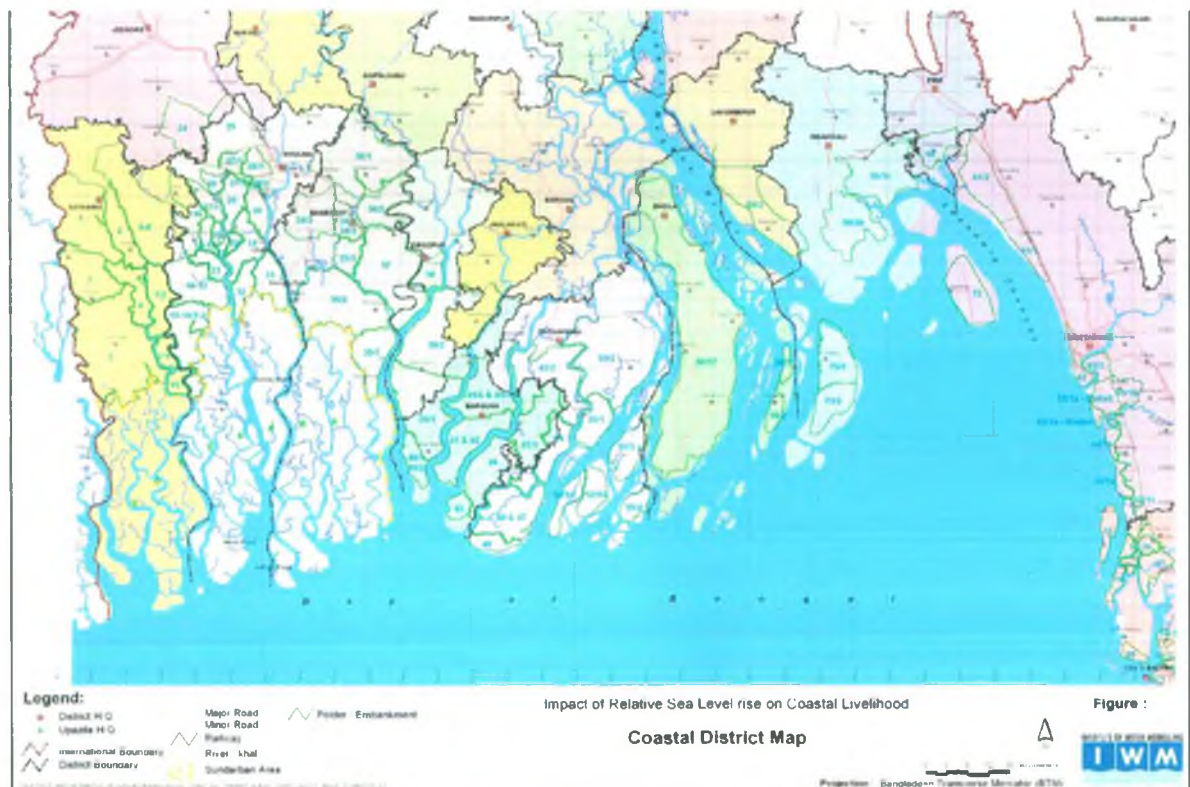
⁶⁶ (Jordan, 2009)

Chapter-6: The findings of the study

6.1 Coastal region of Bangladesh:

The coast of Bangladesh is approximately 710 km long, as estimated by measuring the distance around the Bay of Bengal between Indian and Myanmar (Burma) borders. The landward distance of the delineated coastal zone from the shore is between 30 and 195 km whereas the exposed coast is between 37 and 57 km. The coastal zone is low-lying with 62% of the land have an elevation less than 3 metres and 86% less than 5 metres. The Bay of Bengal is a northern extended arm of the Indian Ocean. In the north of Bay of Bengal, “Swatch of No Ground”, a submarine canyon present at 25 km south of the western coastline of Bangladesh.

Map 1 Coastal area of Bangladesh



The high degree of vulnerability of Bangladesh can be mainly attributed to extensive low-lying coastal area, high population density, frequent occurrence of cyclone and storm, high storm-surge, high rate of coastal environmental degradation on account of pollution and non-sustainable Development etc. Most of the people residing in coastal zones are directly dependent on the natural resource bases of coastal ecosystems. Climate change induced rise

in sea surface temperature, change in frequency, intensity or track of cyclone, and sea level rise may aggravate the potential risks to coastal zones.

On November 2006 under a UK Department of Environment Food and Rural Affairs (DEFRA) commissioned comprehensive study titled “Investigating the impact of relative sea level rise on coastal communities and their livelihoods in Bangladesh” suggested some adaptation options like be (1) strengthening of early warning system, (2) providing more safe haven facilities to the vulnerable population and livestock, (3) readjustment of embankment system including embankment height and drainage openings and (4) coastal forestation as green belt to reduce risk from SLR and cyclone surge.⁶⁷

I. Cyclone

A tropical STORM or atmospheric turbulence involving circular motion of winds occurs in Bangladesh as a NATURAL HAZARD. The tropics can be regarded as the region lying between 30°N latitude and 30°S latitude. All the tropical seas of the earth with the exception of the south Atlantic and southeast Pacific give birth to deadly atmospheric phenomena known as tropical cyclones. On an average, 80 tropical cyclones are formed every year all over the globe.

The term cyclone is derived from the Greek word 'kyklos' meaning coil of SNAKES. The British-Indian scientist and meteorologist HENRY PIDDINGTON coined the word 'Cyclone' to represent whirling storms expressing sufficiently the tendency to circular motion in his book *The Sailor's Horn-book for the Law of Storms*, published in 1848. Other meteorologists of the world immediately accepted the term and it is still current today. Satellite pictures of cyclones show that the nomenclature is very appropriate. Technically a cyclone is an area of low pressure where strong winds blow around a centre in an anticlockwise direction in the Northern Hemisphere and a clockwise direction in the Southern Hemisphere. Cyclones occurring in the tropical regions are called tropical cyclones and those occurring elsewhere are called extratropical cyclones.

Tropical cyclones are usually destructive and affect Bangladesh and its adjoining areas. Tropical storms are called hurricanes in the American continent, typhoons in the Far East and cyclones in the South Asian subcontinent. In the West, hurricanes are identified with human

⁶⁷ (Institute of Water Modelling (IWM) & Center for Environmental and Geographic Information Services (CEGIS), June 2007)

names such as Mitchel, Andrew, Carol, Dorothy and Eve. In the South Asian region no such nomenclature is in use. The term 'cyclone' is at times applied to a mid-latitude DEPRESSION but is now increasingly restricted to a tropical depression of the hurricane type, especially when it occurs in the INDIAN OCEAN. A cyclone is called *Tufan* in Bangla, from the Chinese 'Tai-fun'.

Bangladesh is part of the humid tropics, with the HIMALAYAS on the north and the funnel-shaped coast touching the BAY OF BENGAL on the south. This peculiar geography of Bangladesh brings not only the life-giving MONSOONS but also catastrophic cyclones, NOR'WESTERS, tornadoes and FLOODS. The Bay of Bengal is an ideal breeding ground for tropical cyclones. Cyclones are usually formed in the deep seas and hence their study has been very difficult. It is only with the advent of the Space age that weather satellites have provided valuable information about them. Direct studies of cyclones with aircraft reconnaissance are also being carried out by advanced countries. However, only a beginning has been made in Bangladesh towards the understanding of cyclones.

Classification Cyclones in Bangladesh are presently classified according to their intensity and the following nomenclature is in use: depression (winds upto 62 km/hr), cyclonic storm (winds from 63 to 87 km/hr), severe cyclonic storm (winds from 88 to 118 km/hr) and severe cyclonic storm of hurricane intensity (winds above 118 km/hr).

Formation A tropical cyclone needs more than 27°C sea temperature for its initial formation. Such a high surface temperature is necessary to produce a steep lapse rate for maintaining the vertical circulation in a cyclone. This condition is met throughout the year in regions of the Bay of Bengal where cyclones are formed, mostly near the Andamans. They usually occur at latitudes greater than 5°N or 5°S. It is thought that the Inter-tropical Convergence Zone has something to do with the formation of a cyclone. The Inter-tropical Convergence Zone is the region where winds from the two hemispheres meet near the equator, but its position varies with the SEASON. A cyclone derives its spinning motion from the Coriolis Force arising out of the earth's rotation. This force is virtually zero (0) at the equator. Hence, cyclones do not usually form at the equator. They are formed slightly north of the equator in the Northern Hemisphere, where they can acquire the necessary spin. It is probable that the easterly waves also play some part in the process of cyclone formation.

Among all the atmospheric disturbances, cyclones are the most destructive. The diameter of a cyclone may range from 300 km to 600 km. A cyclone is accompanied by winds with speeds

in excess of 118 km/hr, which flow toward the centre of a very strong low pressure. Pressure at the centre of the low may be 50-60 hPa (Hexa Pascal) less than in its outskirts. Cyclones are also accompanied by storm surges. Strong winds bring in enormous amounts of moisture and latent heat toward the centre of the low, which supply the necessary energy to the cyclone. The spiralling winds converge toward the centre of the low pressure where they rise at a tremendous speed.

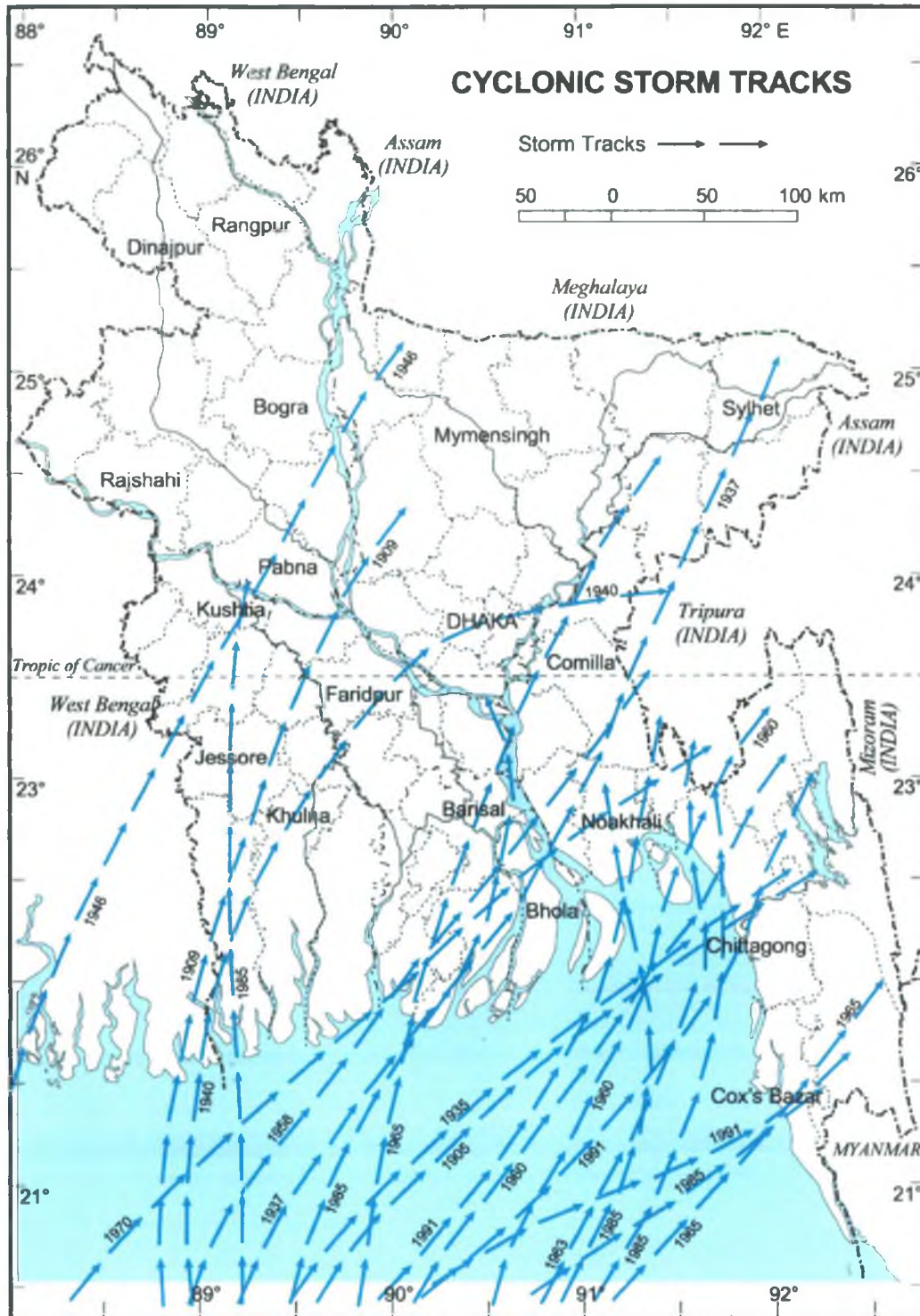
The most striking feature of a cyclone is its 'eye'. The eye can be seen clearly in satellite pictures in the case of a well-developed cyclone. The eye is small and almost circular; it coincides with the area of lowest pressure and has a diameter ranging from 8 km to 50 km. The eye is warmer than the rest of the storm area. The more violent the storm, the warmer the eye. The winds are very light in the eye, usually not more than 25 to 30 km/hr and rain is practically absent. In contrast, the strongest winds and the heaviest rain occur just outside this central eye.

Wind speed gradually diminishes as one moves away from the region of strongest wind. The main core of the cyclone is circular or nearly circular, having a diameter ranging from 100 km to 800 km. The main cyclone is often accompanied by a long tail having more than one band. The whole thing has a spiral structure, and looks like a comma. The tail may extend up to a few hundred kilometres. The tail usually crosses the land well before the main core of the cyclone and as a result the sky becomes overcast with clouds and rain often sets in before the onset of a cyclone. Such symptoms can serve as a warning for the possible approach of a cyclone.

The right-hand side of a travelling cyclone has more destructive power than its left-hand side. The duration of a cyclone, from the beginning to the end, may range from 7 to 10 days and it may produce 25 cm to 50 cm of rainfall. The life cycle of a cyclone ends soon after the cyclone reaches land ('landfall'), because it is cut off from its moisture source.

Cyclone track Cyclones in their initial stages move at a rate of 5 to 10 km/hr. In their final stage they may move at a rate of 20 to 30 km/hr or even up to 40 km/hr. Cyclones in the Bay of Bengal usually move northwest in the beginning and then curve eastwards. But this pattern is not uniform as seen from the tracks of various cyclones. Cyclones accompanied by heavy rains and sea swells are called storm surges. If this occurs during high tide, the storm surge is reinforced considerably and can rise as high as 12m. This deadly wall of water does most of the damage to life and property.

Map 2 Cyclone Storm Tracks



In cyclone forecasting, it is often assumed that a cyclone follows the direction of the upper atmospheric current. SPARRSO (Space Research and Remote Sensing Organisation) in collaboration with Dhaka University has undertaken an investigation of the problem and it has been found that there seems to be a steering current for every cyclone, but the level differs from cyclone to cyclone and there does not seem to be any relationship with the

intensity of the cyclone. Moreover, the upper atmospheric current is as variable as the track of the cyclone. SPARRSO has installed the model TYAN for predicting the track of a cyclone based on the climatology of the Bay of Bengal cyclones for the last one hundred years. The model has shown promising results in forecasting a cyclone's movement twenty-four hours ahead of landfall.

Storm surges In addition to the waves associated with winds, abrupt surges of water known as storm surges are associated with cyclones. They strike the coast nearly at the same time that the centre of the storm crosses the coast. In Bangladesh the maximum value of this storm surge has been reported to be as high as 13m. Most of the damage during a cyclone is done by the storm surges, which sometimes wash over entire OFFSHORE ISLANDS and large areas on the coast.

The most destructive element of a cyclone is its accompanying surge. There is little that can withstand a great mass of onrushing water often as high as 6m. In Bangladesh, cyclones occur in April-May and also in September-December. On an average, five severe cyclonic storms hit Bangladesh every year and the accompanying surge can reach as far as 200 km inland. Surge-heights increase with the increase of wind speed. Astronomical tides in combination with cyclonic surges lead to higher water levels and hence severe flooding.

Storm surges accompanying cyclones hitting Bangladesh have been noted to be 3m to 9m high. The 1970 cyclone (12-13 November) with a cyclonic surge of 6m to 10m and a wind speed of 222 km/h occurred during high tide causing an appalling natural disaster that claimed 0.5 million human lives. The cyclone of 29 April 1991 hit Chittagong, Cox's Bazar, Barisal, Noakhali, Patuakhali, Barguna and Khulna along with a TIDAL BORE (6.1m to 7.6m), killing 140,000 people.

Cyclones in the Bay of Bengal Because of the funnel shaped coast of the Bay of Bengal, Bangladesh very often becomes the landing ground of cyclones formed in the Bay of Bengal. The Bay cyclones also move towards the eastern coast of India, towards Myanmar and occasionally into Sri Lanka. But they cause the maximum damage when they come into Bangladesh, WEST BENGAL and Orissa of India. This is because of the low flat terrain, high density of POPULATION and poorly built houses. Most of the damage occur in the coastal regions of Khulna, Patuakhali, Barisal, Noakhali and Chittagong and the offshore islands of Bhola, Hatiya, Sandwip, Manpura, Kutubdia, Maheshkhali, Nijhum Dwip, Urir Char and other newly formed islands.

From 1981 to 1985, 174 severe cyclones (with wind speeds of more than 54 km/hr) formed in the Bay of Bengal. The month-wise occurrence is as follows: 1 in January, 1 in February, 1 in March, 9 in April, 32 in May, 6 in June, 8 in July, 4 in August, 14 in September, 31 in October, 47 in November and 20 in December. It is apparent from the above figures that severe cyclones occur mostly during pre-monsoon (April-May) and post-monsoon (September-December) periods and they are the ones which cause the most destruction.

II. Chronology of major cyclonic storms in Bangladesh

1584 Bakerganj (presently Barisal) and Patuakhali;	1971 (5-6 November) Chittagong coast; severe cyclonic storm;
1585 Mouth of the Meghna estuary;	1971 (28-30 November) Sundarban coast;
1797 (November) Chittagong; severe cyclonic storm;	1973 (6-9 December) Sundarban coast;
1822 (May) Barisal, Hatiya Island and Noakhali district;	1974 (13-15 August) Khulna;
1831 (October) Barisal;	1974 (24-28 November) Coastal belt from Cox's Bazar to Chittagong and offshore islands;
1872 (October) Cox's Bazar;	1975 (9-12 May) Bhola, Cox's Bazar and Khulna;
1876 (31 October) Meghna estuary and coasts of Chittagong,	1977 (9-12 May) Khulna, Noakhali, Patuakhali, Barisal, Chittagong and offshore islands;
1897 (24 October) Chittagong;	1983 (14-15 October) Offshore islands and <i>chars</i> of Chittagong and Noakhali;
1898 (May) Teknaf; cyclonic storm-waves; exact figures of damage not available.	1983 (5-9 November) Chittagong, Cox's Bazar coast
1904 (November) Sonadia; cyclonic storm; 143 killed and fishing fleet wrecked.	1985 (24-25 May) Chittagong, Cox's Bazar, Noakhali and their offshore islands (Sandwip, Hatiya, and Urirchar);
1909 (16 October) Khulna; cyclonic storm-waves; killed 698 people and 70,654 cattle.	1986 (8-9 November) Offshore island and <i>chars</i> of Chittagong, Barisal, Patuakhali and Noakhali;
1913 (October) Muktagachha upazila (Mymensingh); cyclonic storm; demolished many villages killing about 500 persons.	1988 (24-30 November) Jessore, Kushtia, Faridpur, offshore islands and <i>chars</i> of Barisal and Khulna;
1917 (24 September) Khulna; hurricane; 432 persons killed and 28,029 cattle lost.	
1941 (May) Eastern Meghna estuary; cyclonic storm with storm-wave; exact figures of the loss of lives and cattle are not	

<p>available.</p> <p>1942 (October) SUNDARBANS; severe cyclonic storm; number of human lives, exact figures of the loss of WILDLIFE and boats are not available.</p> <p>1948 (17-19 May) Between Chittagong and Noakhali; cyclonic storm; about 1,200 persons killed and 20,000 cattle lost.</p> <p>1958 (16-19 May) East and west Meghna estuary, east of Barisal, Noakhali; cyclonic storm along with surge; 870 persons killed, 14,500 cattle lost and standing crops destroyed.</p> <p>1958 (21-24 October) Chittagong coast; cyclonic storm; about 100,000 families lost their homes and government had to provide house-building loans.</p> <p>1960 (9-10 October) Eastern Meghna estuary (Noakhali, Bakerganj, Faridpur and Patuakhali);</p> <p>1960 (30-31 October) Chittagong, Noakhali, Bakerganj, Faridpur, Patuakhali and eastern Meghna estuary;</p> <p>1961 (9 May) Bagerhat and Khulna;</p> <p>1962 (26-30 October) Feni;</p> <p>1963 (28-29 May) Chittagong, Noakhali, Cox's Bazar and the offshore islands of Sandwip, Kutubdia, Hatiya and Maheshkhali</p> <p>1965 (11-12 May) Barisal and Bakerganj; most severe cyclonic storm,</p> <p>1965 (14-15 December) Cox's Bazar along with adjacent coastal area and Patuakhali;</p> <p>1966 (1 October) Sandwip, Bakerganj,</p>	<p>1991 (29 April) The Great Cyclone of 1991, crossed the Bangladesh coast during the night. It originated in the Pacific about 6,000 km away and took 20 days to reach the coast of Bangladesh. It had a dimension of more than the size of Bangladesh. The central overcast cloud had a diameter exceeding 600 km. The maximum wind speed observed at Sandwip was 225 km/hr. The wind speeds recorded at different places were as follows: Chittagong 160 km/hr, Khepupara (Kalapara) 180 km/hr, Kutubdia 180 km/hr, Cox's Bazar 185 km/hr, and Bhola 178 km/hr. The maximum wind speed estimated from NOAA-11 satellite picture obtained at 13:38 hours on 29 April was about 240 km/hr. The cyclone was detected as a depression (wind speed not exceeding 62 km/hr) on the 23rd April first in the satellite picture taken at SPARRSO from NOAA-11 and GMS-4 satellites. It turned into a cyclonic storm on 25 April. The cyclone in its initial stage moved slightly northwest and then north. From 28 April it started moving in a north-easterly direction and crossed the Bangladesh coast north of Chittagong port during the night of the 29th April. The cyclone started affecting the coastal islands like Nijhum Dwip, Manpura, Bhola and Sandwip from the evening of that day. The maximum storm surge height during this cyclone was estimated to be about 5 to 8m. The loss of life and property was colossal. The loss of</p>
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<p>Khulna, Chittagong, Noakhali and Comilla; 1969 (14 April) Demra (Dhaka district); 1970 (12-13 November) The most deadly and devastating cyclonic storm that caused the highest casualty in the history of Bangladesh. Chittagong was battered by hurricane winds. It also hit Barguna, Khepupara, Patuakhali, north of Char Burhanuddin, Char Tazumuddin and south of Maijdi, Haringhata and caused heavy loss of lives and damage to crops and property. Officially the death figure was put at 500,000 but it could be more. A total of 38,000 marine and 77,000 inland fishermen were affected by the cyclone. It was estimated that some 46,000 inland fishermen operating in the cyclone affected region lost their lives. More than 20,000 fishing boats were destroyed; the damage to property and crops was colossal. Over one million cattlehead were reported lost. More than 400,000 houses and 3,500 educational institutions were damaged. The maximum recorded wind speed of the 1970 cyclone was about 222 km/hr and the maximum storm surge height was about 10.6m and the cyclone occurred during high-tide.</p>	<p>property was estimated at about Tk 60 billion. The death toll was estimated at 150,000; cattlehead killed 70,000. 1991 (31 May to 2 June) Offshore islands and <i>chars</i> of Patuakhali, Barisal, Noakhali and Chittagong; 1994 (29 April 3 May) Offshore island and <i>chars</i> of Cox's Bazar; 1995 (21-25 November) Offshore island and <i>chars</i> of Cox's Bazar; 1997 (16-19 May) Offshore islands and <i>chars</i> of Chittagong, Cox's Bazar, Noakhali and Bhola; severe cyclonic storm (hurricane) with a wind speed of 225 km/hr, storm surge of 3.05m (similar strength to that of 1970 cyclone); only 126 people killed because of better disaster management measures taken by the government and the people. 1997 (25-27 September) Offshore islands and <i>chars</i> of Chittagong, Cox's Bazar, Noakhali and Bhola; 1998 (16-20 May) Offshore islands and <i>chars</i> of Chittagong, Cox's Bazar and Noakhali; 1998 (19-22 November) Offshore islands and <i>chars</i> of Khulna, Barisal and Patuakhali;</p>
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III. Weather satellites in cyclone warning

Bangladesh does not have satellite facilities of its own, but with the help of ground stations, it receives weather pictures from weather satellites launched by advanced countries. An APT (Automatic Picture Transmission) Ground Station for the reception of imagery from weather satellites was established in 1968 in Bangladesh (then East Pakistan). Recently SPARRSO

has established advanced receiving and analysing equipment with financial assistance from USAID under NASA's supervision. With the help of this equipment both low and high-resolution data from American NOAA-14 and NOAA-15 and Japanese GMS-5 satellites are received. The GMS satellites transmit data every hour. Data from NOAA satellites are obtained every six hours. An automatic grid, ie latitude, longitude and national boundaries are fitted in the picture with the help of the present equipment. Because of this equipment, no cyclone in the Bay of Bengal can escape notice.

Prevention The energy in a severe cyclone is equivalent to that of several thousand atom bombs of megaton strength and hence it is difficult even at this advanced stage of technology to try to modify a tropical cyclone. The United States has conducted experiments in the Atlantic by spraying silver iodide in the region of the maximum wind speed to minimise the wind speed. These experiments, though very promising, have remained inconclusive. Moreover, there is a chance that these cyclones could change their track and move towards another direction. Other methods which have been suggested for preventing the formation or reducing the severity of tropical cyclones is to cover the probable area of sea surface with a thin layer of oil or some chemical substance for reducing evaporation. However, the pollution effect of this gigantic effort needs to be considered before this experiment could be carried out.

Protection Cyclone is a natural phenomenon like an EARTHQUAKE or a volcanic eruption. Countries like Bangladesh have to learn to live with it. By strengthening the cyclone warning system and adopting protective and relief measures, the damage could be minimised. Bangladesh today has a comprehensive Cyclone Preparedness Programme (CPP) jointly operated by the Bangladesh Red Crescent Society and the Ministry of Disaster Management and Relief. It has a membership of about 32,000 devoted volunteers spread over 2,043 wards of 195 unions of the coastal belt of Bangladesh. In each ward the trained volunteers are ready to do the needful in the event of a cyclone. Each ward is provided with a transistor radio, a megaphone-cum-siren, a signal torchlight and first aid kit. Almost every upazila is provided with a wireless set, which keeps direct communication with Dhaka.

The entire government machinery including the army, the navy, the air force and the relevant ministries and organisations are required to discharge their duties in the event of a cyclone. There is a standing order pertaining to cyclones, which lay down actions by all during the various stages of the disaster.

Cyclone warning and preparedness measures have improved in Bangladesh in recent years. This has been amply demonstrated during the catastrophic cyclone that struck Bangladesh in 1997. Some 2,500 cyclone shelters have been built and a COASTAL GREENBELT project for AFFORESTATION of the coastal areas is also in progress. The improved cyclone warning system and mobilisation of people before the impending cyclones have been very effective in minimising the death toll.⁶⁸

6.2 Moheshkhali:

With an area of 362.18 sq k.m., Moheshkhali is situated between latitudes 21° 29'-21°45' and 91° 50'-91°58'.⁶⁹ Moheshkhali is under the administrative district of Cox's Bazar . It is bounded by CHAKARIA upazila on the north, COX'S BAZAR SADAR upazila and the Bay of Bengal on the south, CHAKARIA and Cox's



Bazar sadar upazilas on the east, KUTUBDIA upazila and the Bay of Bengal on the west. The eastern part of the upazila is separated from the mainland by the Maheshkhali channel. Main rivers are Bak-khali and Maheshkhali channel.⁷⁰

I. Moheshkhali : At a glance

<i>Information collected from Upazila and local journal.</i>		<i>Information collected from Banglapedia</i>	
Area and administrati ve structure:	<i>Area: 388.5 Sq k.m.</i> <i>Union: 8</i> <i>Pourosrava: 1</i> <i>Mouza: 31</i> <i>Village: 180</i>		<i>Established : 1982</i>
Population	<i>Ppopulation: 3,50,000</i>	Population	male 53.13%, female 46.87%;

⁶⁸ (http://www.banglapedia.org/httpdocs/HT/C_0397.HTM)

⁶⁹ (Progotishil Shahitto Shangshad, Moheshkahli, Coxsbazar, 15 August, 1997)

⁷⁰ (Moheshkhali Upazila administration, Moheshkhali, 2003)

	<p><i>Male: 1,80,000</i></p> <p><i>Female; 1,70,000</i></p> <p><i>Voter:</i></p> <p><i>Male: 90,000</i></p> <p><i>Female;80,000</i></p>		<p>Muslim 91.52%, Hindu 7.35%, Buddhist 1.12%, others 0.01%; ethnic nationals: Rakhain 515 families.</p> <p>Density: 4614 per sq km</p>
Education	<p><i>Literacy rate: 27.12%</i></p> <p><i>Colege: 3</i></p> <p><i>Mohila college: 1</i></p> <p><i>Private madrasha: 3</i></p> <p><i>Govt. Secondary Girls school: 1</i></p> <p><i>Private Secondary school: 10</i></p> <p><i>Private Junior school: 1</i></p> <p><i>Govt. Primary school: 10</i></p> <p><i>Registerd primary school: 47</i></p> <p><i>Un-registered primary school: 2</i></p> <p><i>Kindergurden: 6</i></p> <p><i>Abtadaye Madrasha: 8</i></p> <p><i>Sattelite school: 4</i></p> <p><i>Community school: 2</i></p>	Literacy and educational institutions	<p>Average literacy 27.2%; male 35.3%, female 18.2%. Educational institutions: college 3, government high school 1, non-government high school 15, madrasa 10, government primary school 47, non-government primary school 16, Old institutions: Maheshkhali Government Vernacular School (1923), Moheshkhali Model High School (1946). <i>Cultural organisations</i> Club 13, public library 1.</p>
Tourist area	<p><i>Archaeological heritage and relic ADINATH TEMPLE⁷¹</i></p>	<i>Main occupations</i>	<p>Agriculture 22.99%, forestry 1.25%, fishing 6.08%, sericulture 6.08%, agricultural</p>

⁷¹ *Archaeological heritage and relic ADINATH TEMPLE:*

Historical events Tradition goes that at one time a local peasant discovered a stone-image from the forest. He came to know in a dream that the stone-image belongs to a Hindu deity named Mahesh. The peasant thus built a temple and placed the image there. It is presumed that the island was named as Moheshkhali after the name of

	<p><i>Sonadia Dip</i></p> <p><i>Moheshkhali Jetty</i></p> <p><i>Sea beach</i></p> <p><i>Kayong hill</i></p>		<p>labourer 25.19%, wage labourer 7.17%, commerce 13.78%, service 2.57%, others 19.94%.</p>
Agriculture land	<p><i>Total agriculture land: 6,22,203,85 Hector</i></p> <p><i>Kash land:</i></p> <p><i>a. 16, 317,24 Hector</i></p> <p><i>b. 18,286,40 Hector (hill)</i></p> <p><i>Private land: 27,600,21 Hector</i></p> <p><i>Agricultural bloc: 14 Agricultural land: 20,390,00 hectors</i></p> <p><i>Land of Battle leafs : 1,008,00 hectares</i></p>	<p><i>Land use</i></p> <p><i>Cultivable</i></p>	<p>Land 5275. 36 hectares, salt production 2073.4 hectares, shrimp cultivation 2105.69 hectares, fallow land 1715.21 hectares.</p> <p><i>Land control</i> Among the peasants 66.62% are landless, 33.38% land owner.</p> <p><i>Value of land</i> The market value of the first grade arable land is Tk 6000 per 0.01 hectare.</p> <p><i>Main crops</i> Betel, paddy, betel nut.</p> <p><i>Extinct and nearly extinct crops</i> Pearl production.</p> <p><i>Main fruits</i> Mango, jackfruit, litchi, banana, papaya, coconut.</p>

the deity and the temple came to be known as Adinath Mandir. It is known from the report of the Portuguese traveller Caesar Frederick and as per opinion of Dr. Suniti Bhusan Kanungo that the island of Maheshkhali had its origin as a result of its being separated from the mainland by severe cyclone and tidal bore occurred in 1559.

<i>Communication facilities</i>	<i>Total road : 27 k.m. Pacca road: 25 k.m. Half pacca: 65,00 k.m. Kacha : 21200 k.m.</i>	<i>Communication facilities</i>	Roads: pucca 7 km, semi pucca 15 km and mud road 135 km. <i>Traditional transport</i> Bullock cart, coach, palanquin. These means of transport are either extinct or nearly extinct.
<i>Manufactories and Cottage industries</i>	<i>Ice factory: 10 Handloom: 178 Salt mill: 6 Cottage industry: 480</i>	<i>Manufactories and Cottage industries</i>	<i>Dairy, fishery, and poultry</i> Dairy 2, poultry 3, shrimp 277. Salt mill 6, flour mill 1, and ice mill 5. <i>Cottage industries</i> Weaving 178, other industries 480.
<i>Main agricultural products</i>	<i>Fish, Salt, battle leaf, dry fish, woods</i>	<i>Hats bazaars and fairs</i>	Hats and bazaars 15, fair 1 (Adinath Mela).
	<i>Earth killa: 4</i>	<i>Main exports</i>	Salt, betel, shrimp, sea-fish, dry fish.
<i>Service provider</i>	<i>Hospital: 1 Telephone exchange: 1 Electricity provider centre: 1 Post office: 5 Hat Bazar: 20 Public library: 1 Cultural centre: 1 Cooperative society: 21 Food storage: 4</i>	<i>NGO activities</i>	Operationally important NGOs are CARITAS, Christian Commission Development in Bangladesh, Prism Bangladesh.

	<p><i>Tahshil office:1</i></p> <p><i>Jal mohal:1</i></p> <p><i>Dry fish centre; 3</i></p> <p><i>Ponds:617</i></p> <p><i>Jetty: 2</i></p> <p><i>Child centre:1</i></p> <p><i>Youth centre: 18</i></p> <p><i>Old aged home: 19</i></p> <p><i>Livestock service centre: 1</i></p> <p><i>Community centre:5</i></p> <p><i>Red crescent society:1</i></p> <p><i>Cyclone shelter: 77</i></p> <p><i>Coastal community centre;</i> <i>4</i></p> <p><i>Bank:</i></p> <p><i>sonali bank: 1</i></p> <p><i>Pubali bank: 1</i></p> <p><i>Krishi Bank:5</i></p>		
Tex collected by the sub-registry office	<p>2002-2003: 33,25,121.50</p> <p><i>BDT</i></p> <p>2003-2004: 6,03,857.78</p> <p><i>BDT</i></p>	<i>Health centres</i>	Upazila health complex 1, satellite clinic 1, family planning centre 4
Source	(Upazila administration , Moheshkhali, 2003), (edited, March-May, 2002)	Source	. (http://www.banglapcdia.org/httpdocs/HT/M_0061.HTM)

6.3. Findings of the study:

I. Materbari:

The administrative name of the union is no.1 Materbari union. The union is 40 k.m. away from Cox's Bazar district head quarter and 33 k.m. from Moheshkhali Upazila office. It is bounded by the Bay of Bengal on the west, Badarkhali and Ujantia on the north, Dholghata on the south and Kuhalia River on the east. Two

Picture 2 Materbari Kuhalia River



side of the union is river and one side is the beach. By Engine boat, it takes 3 hours to reach in the union. Beside this, one can reach the union via Badarkhali by jeep. From the Upazila, it takes about 2 hours to reach by jeep. But, I went the union in 2003, there were on road connectivity directly by road because of the Badarkhali Bridge. One has to go either by engine boat from the Upazila which takes 3-4 hours and only two times in the day time or from the Upazila to Kalarmarchora union by Jeep and then by boat to the union which takes the same.⁷²

Picture 1 the Participants provided information in the CRA process

II. Stakeholder analysis:

The union is consisting of 9 wards as usual which can be divided by 3 broader wards. Here different type of occupational groups lived, mostly farmers, fisher man, petty business man. Beside this, vulnerable group people women, persons with disability, landless, child labour, and old



⁷² (Materbari Union Parishad, Materbari, 2009)

aged people lived; I consider the most occupational group and vulnerable group member as primary stakeholders; and member of Union disaster management committee, government service holder, NGO representatives, CPP and Red Crescent volunteers, community volunteers and elite persons as secondary stakeholders.⁷³

III. Community Risk Assessment period: October 2008- April 2011

IV. Socio-economic profile of Materbari: at a glance

(Source: KII-with the Union parishad Secretary, FGD and Transect walk)

Area:	10 sq. K.m.
Land	9625 Hector
Agricultural production	Paddy, vegetable, salt and shrimps. 75% land used for salt and shrimps cultivation
Natural resources	Char land, river, sea beach, plain land, Hill, Mangrove forest, fisheries, wild animals and birds.
Land	Cultivable land: 6500 Hector Non-cultivable land: 2000 Hector
Mangrove forest	75 Hector
River	1 (Kuhali 9 k.m.)
Canal	2 (about 12 k.m.)
Ponds	128, (118 small and 10 big)
Shrimps cultivation land	East side of the river on the union boarder, about 2.5 sq k.m. were occupied for Shrimps cultivation
Agricultural land	Cultivable land 6500 Hector and 2000 Hector un-cultivable land, 80% of the cultivable land can be cultivate in two seasons
Road Communication	Brick road 19 k.m., kacha road 11 k.m., earth embankment 2, sluice gate 8, among them 2 are not working, bridge 1, and culvert 25 where 10 have to repair.
Cyclone shelter	18
Education	Primary school-11, high school-2, senior madrasa 4, girls senior

⁷³ (Secratary, 2009)

institute	madrasha-1, forkani madrasha-1, Hafejia madrasha-19, Abtadayee Madrasha 3, and Kindergarten school 2
Health facility	Family planning centre 1, community clinic 2, Bangla-Gurman friendship cooperation operates 1 health centre, People has to depend on mostly village quack or medicine shop
Hatbazar	4 daily Bazar,
Government office	Materbari Union land office1, Polli Biddut Kandro-1, T & T office 1, Water board office-1, Basic office-1, Post office-1, Police box-1, CPP office -1, Forest office-1, Krishi Bank-1
NGO	6
Housing	40% Kacha , 45% C.I. sheed , 12 % roof C.I. sheet and earth build side wall, 3% brick build house
Population	About 50, 300, male 25,300, female 25,000. Birth rate 3.34% and death rate 0.89%, Muslim-48500, Hindu-1800, (1996)
Education	Literacy rate 89%, education rate 62%, child education rate 92%,
Hat	3
Religious and social centre	Mosque-45, tample-3, Muslim graveyard 27, Hindus grave yard-1, club -1
Occupation	Mainly agriculture. Produce paddy in two seasons, 80% of the population engaged with shrimp cultivation, People of sitepara and sciberdail live on fishing in the river and sea. Most of them have to work on wage or by contract basis. Female member and children of the fishing community live on preparing fishing net and for dry fish preparation. The farmer still depend on bullock and rain water for agricultural production.
Forestry	80% area of mangrove forest in the union becomes decreased due to shrimp cultivation, animal rearing and salt cultivation. Some trees like Coconut, Mango, Rain tree, Mahogany tree, jack fruit tree seen in the habitat area.
Bio-diversity	
Water and sanitation	Around every household has shallow tube well, last 20-30 years Salinity and iron contamination in the tube well has been increased, Around 4460 household has kacha latrine.
Livestock and	Cow-7000, goat-5000, ewe-200, chicken-66500.

poultry	
Social stratification	Socially people are stratified into 4 classes. (1) Poor and landless 44%, (2) lower middle class -40% (3) Middle class-14% (4) Rich class-02%
Occupation	Farmer-65% wage labourer-20% Petty business man-15% Service holder-10%
Social cohesion	Social cohesion exists in Muslim and Hindus communities.
Gender	Religiously people are conservative. Comparatively girl's children go to school than the male child. Adult girls and women wear BORKA.
Community based organization	Local Bazar committee, Union Parishad, Union Anser VDP committee, Village Government (GRAM SARKER), CPP committee, Youth club and political parties of the country like: Bangladesh National Party (BNP), Bangladesh Awami Leag, Jamat E Islami Bangladesh, Liberal Democratic Party, and Islamic Shashon Tontro Andolon. Bangladesh National Party (BNP), Bangladesh Awami Leag, Jamat E Islami Bangladesh are dominated party in this area.
Source	⁷⁴ (FGD and Transect walk, 2009)

V. Local perception of Materbari on Climate change
⁷⁵

Rain fall:

According to the local perception, the rain fall was normal in Materbari before tropical cyclone in 1991. After 1994, the rainfall



Picture 3 Muddy road in a rainy day

⁷⁴ (FGD, KII, Transect walk and Materbari Union Parishad, 2009)

⁷⁵ (FGD, KII, Transect walk and Materbari Union Parishad, 2009)

percentage has been changed. The percentage of rainfall become decreased in March and April but form May to June the density of rain become as much increased that creates flood. For this changed rainfall percentage, the agricultural production become hampered severely.

Ground water:

According to the local perception, after 1991 ground water become available under 60 to 120 feet but before that it was 350 to 400 feet. Due to shrimp cultivation in the habitat area, salinity contamination increased for the last 10 years.

Temperature:

According to the local perception, for the last 10-12 years, the average temperature has been increased March to November the temperature is unbearable.

VI. Current status of Disaster management in Materbari union⁷⁶: Safety net programme:

Test Relief (T.R.):

- On 2006-2007 fiscal years, 367 Household got 30 K.G. wheat/rice.
- On 2007-2008, 15 K.M. roads had been repaired through 19 schemes.
- During and after disaster, TR allocation in the union was not sufficient.



Picture 4 CRA Conduction with female participants

KABIKHA (Food for Work) project:

Project Implement office under Local Government utilize this fund to implement development project like road construction, canals dazing, structural development social and religious institution building,

- Beside this , union Parishad

⁷⁶ (Materbari Union Parishad, 2009)

member got some allocation to implement some development works in the union

- The allocation is not sufficient for the union.

KABITA (Money for Work) project:

- Local Government and Engineering Department use this fund to construct some structural development in the local government level like bridge, culvert and some structural works.
- The allocation is not sufficient for the union.

Vulnerable Group Feeding:

- In the union, 365 VGD card are allocated for women, each card holder get monthly 30 k.g. rice.

VII. Shelter Information of Materbari Union⁷⁷:

Table 4 List of Cyclone Shelters of Materbari Union [Total: 18]

Shelter Name	Union
Bandy shikdarpara ccdb cyclone shelter	Puran bazar gprs. Cum. Shelter
Hangshow Miyajipara Cyclone Shelter	Purba fuljan mura ccdb cyclone shelter
Maddah Sairar Dail Cyclone Shelter	Purba maize para ccdb cyclone shelter
Matarbari gprs. School com shelter	Rajghat Govt. P. Schol
Matarbari Naiapara Rest. P. School	Sairardil ccdb. Cyclone shelter
Naiapara Red Crescent Cyclone Shelter	Shairardail GPS
North Miyazipara (Miapara) Cyclone Shelter	Shardar Para Cyclone Shelter
North Rajghat Rest. Non Govt. P School cum shelter	South rajghat ccdb cyclone shelter
North shikder para cyclone shelter	South rajghat gprs scool cum shelter

⁷⁷ (<http://www.dmic.org.bd>, 2011)

VIII. Community Risk Assessment in Materbari Union:

Hazards identification⁷⁸:

Sl.	Hazards (Related to Disaster)	Sl.	Hazards (Not related to Disaster)
1.	Cyclone	1.	Road repair
2.	Tidal Surge	2.	Unsafe Latrin
3.	Water Congestion	3.	Assult women
4.	Salinity	4.	Dowry
5.	North-wester	5.	Child labour
6.	River erosion	6.	Plygamy
7.	Earthquake	7.	Fire
8.	Tornado	8.	Boat or road accident
9.	Flood- tide	9.	Droug addiction
10.	Rice related diseases	10.	Food price
		11.	Epidemic
		12.	Population growth
		13.	Shortage of cyclone shelter and lack of it facility
		14.	Lack of cyclone Early warning
		15.	Unsafe embankment
		16.	Illegal capture of land
		17.	Terrorism

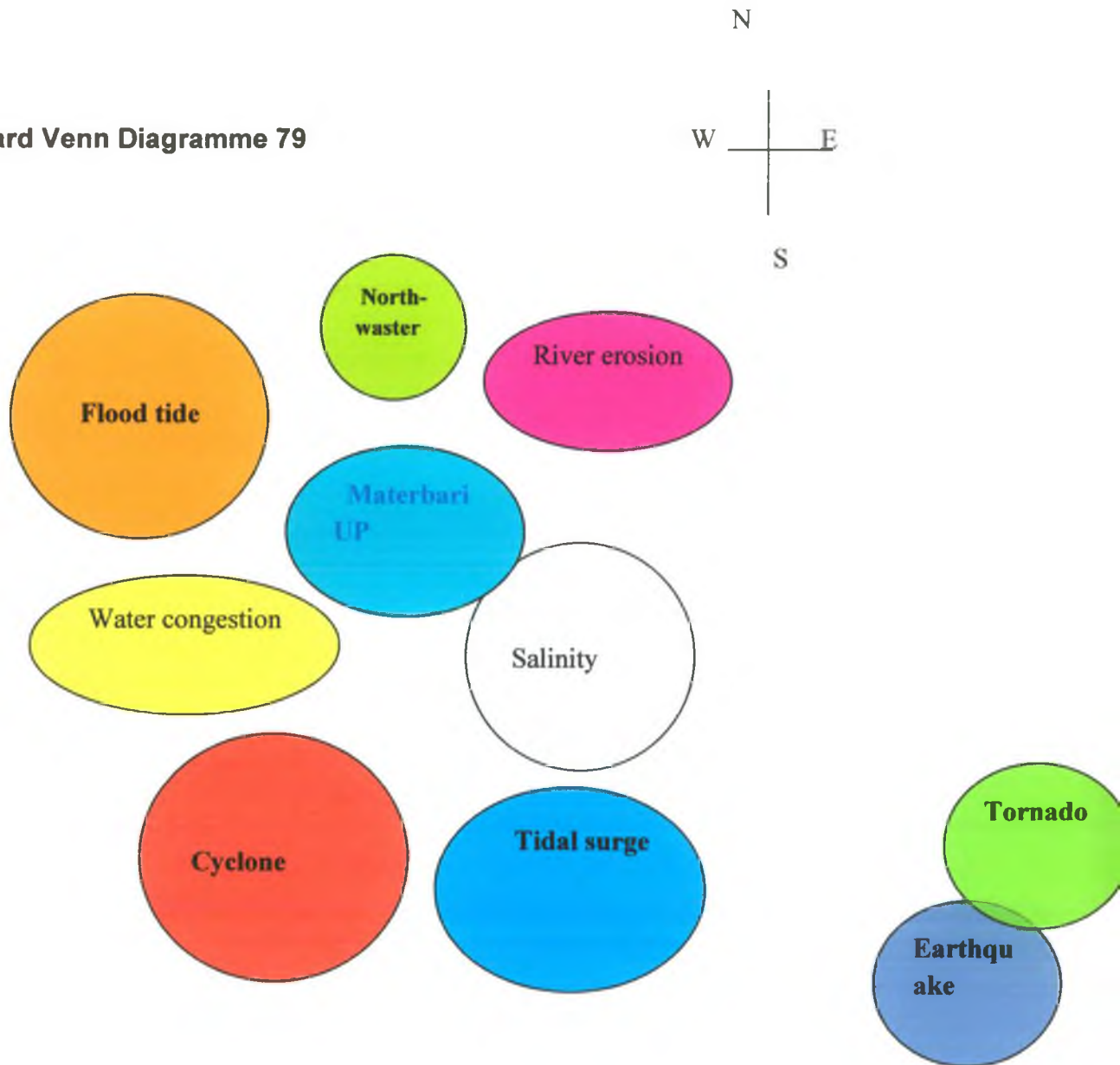
⁷⁸ (FGD with Primary stakeholder and validation workshop with UDMC, 2010)

IX. Hazard Venn Diagramme

The below venn diagramme shows the severity and intensity of the hazard of materbari union.

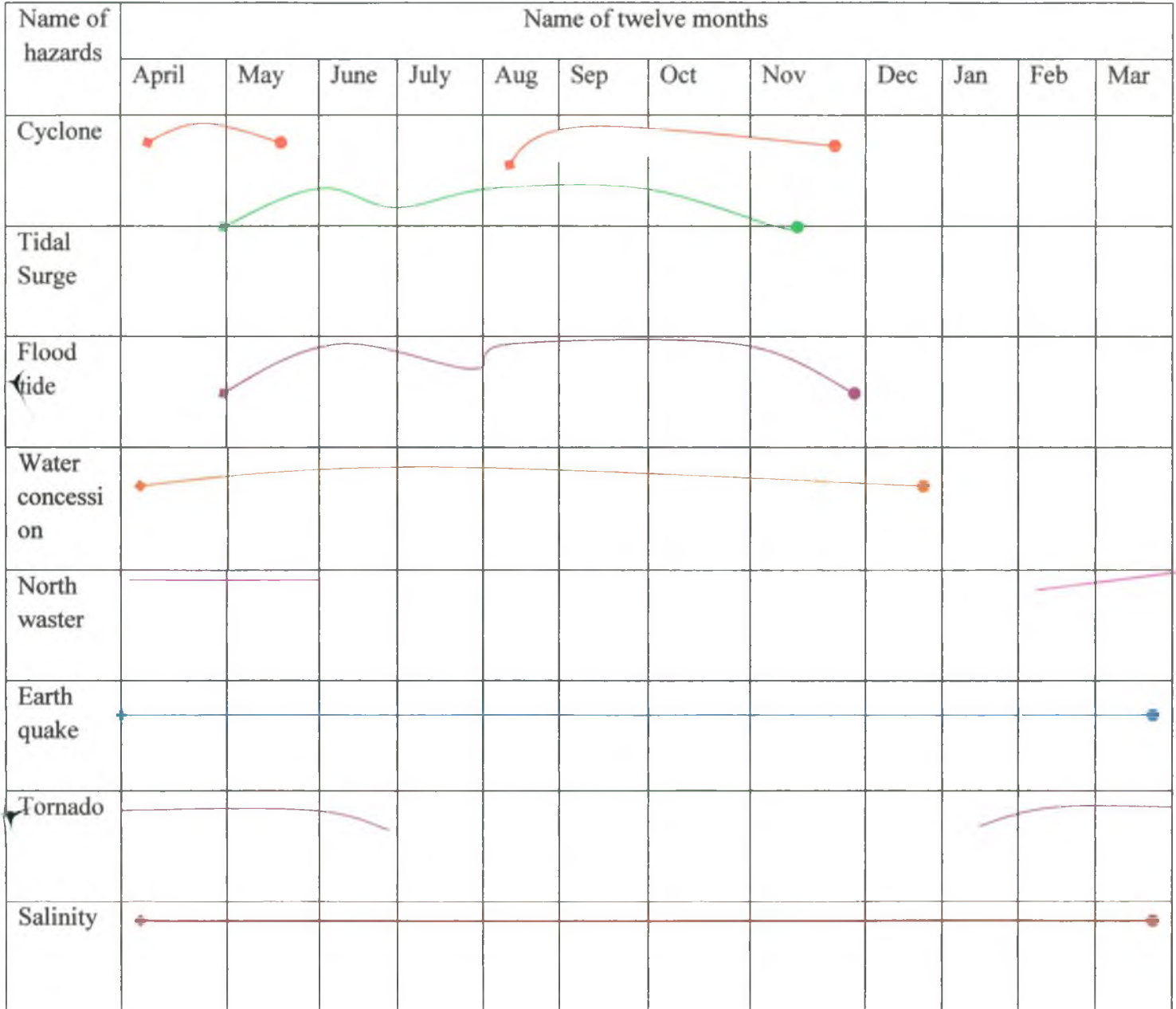
No. 1 Materbari Union

Hazard Venn Diagramme 79



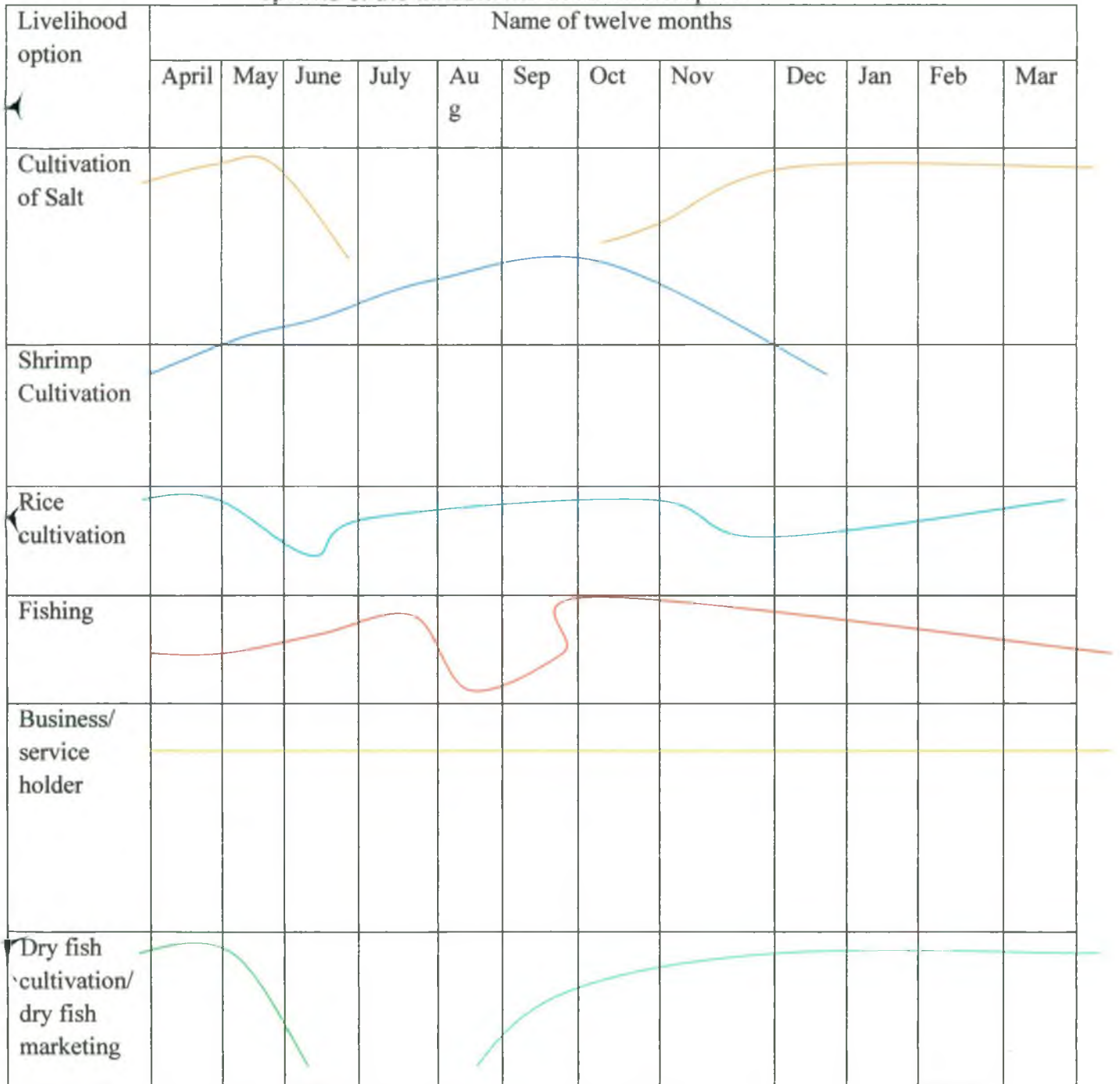
⁷⁹ (FGD with Primary stakeholder and validation workshop with UDMC, 2010)

X. Seasonal calendar⁸⁰: Cyclone , tidal surge and water congestion prolong longer period in the year.



⁸⁰ (FGD with Primary stakeholder and validation workshop with UDMC, 2010)

XI. Livelihood calendar: Due to mentioned hazard, the following livelihood options of the inhabitants become disrupted

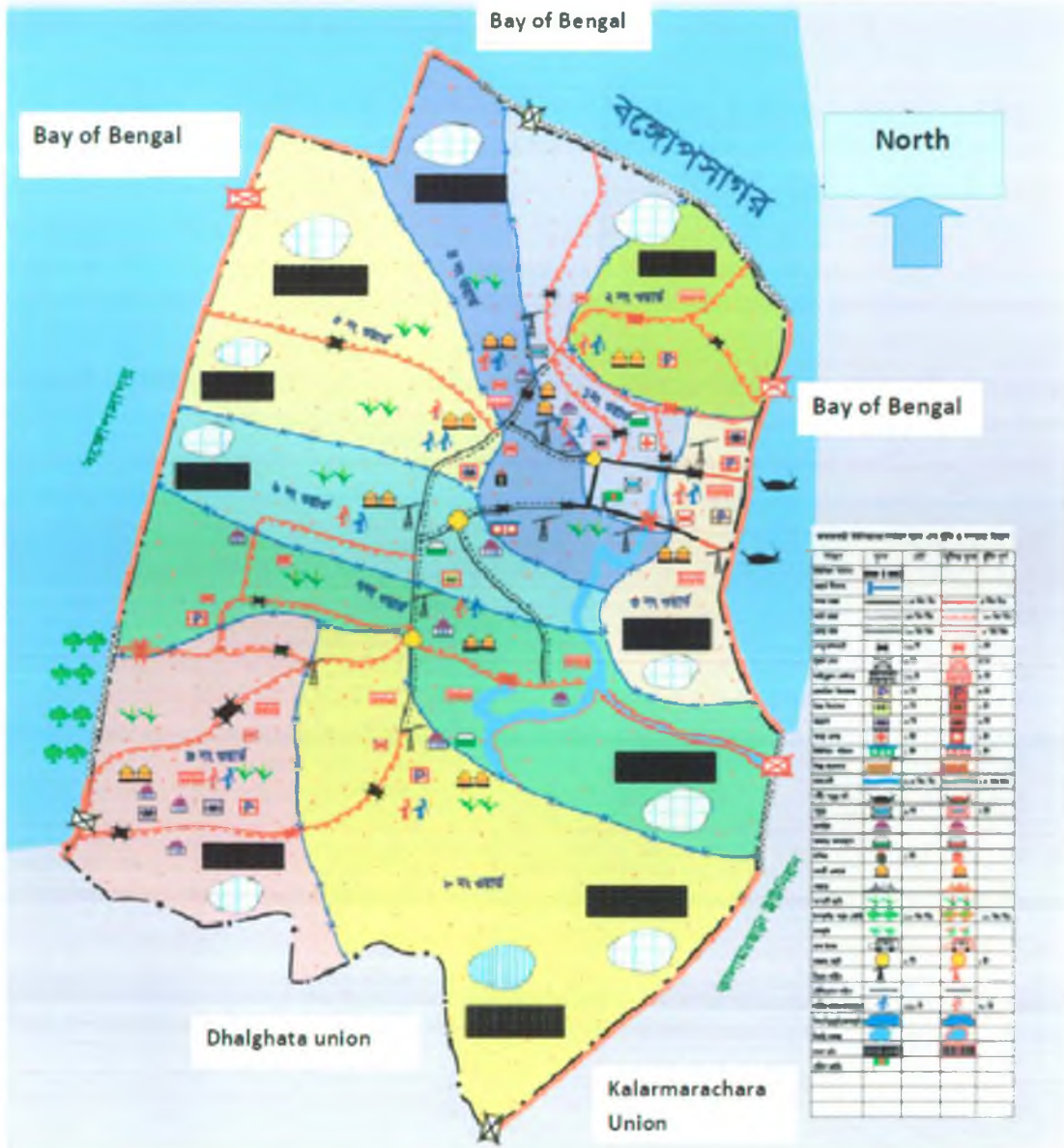


XII. Map 3 Hazard map Materbari

The following map shows that the union is severely prone to cyclone, tidal surge, and flood tide hazards

Hazard map

Materbari union, Moheshkhali Upazila, Cox's Bazar District



Legend of hazards

Cyclone affected area	
Cyclone and tidal bore affected area	
Flood affected area	
Sudden flood affected area	

General information of Materbari Union

Area (sq. mile)	12
Total Households	7,000
Total Population	60,000
Total vulnerable family	2,250
Main occupation	Agriculture, fishing, cultivation of salt
Education	45%
Trained volunteer	258

Annex 1: Vulnerable Sectors⁸¹

Hazards	Vulnerable Sectors										
	Life	Shelter	Livestock	Roads & Communication	Health	Education	Agriculture	Environment and trees	Business	Water and sanitation	Fisheries
Cyclone	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tidal Surge	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Water Congestion		✓		✓			✓	✓		✓	
Salinity	✓	✓	✓	✓			✓	✓	✓	✓	
North-waster	✓	✓	✓	✓				✓	✓		✓
River erosion	✓	✓	✓	✓			✓	✓			✓
Earthquake	✓	✓	✓	✓			✓	✓	✓	✓	
Tornado	✓	✓	✓	✓			✓	✓			✓
Flood-tide	✓	✓	✓	✓			✓	✓		✓	

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⁸¹ (FGD with Primary stakeholder and validation workshop with UDMC, 2010)

Annex 2: Vulnerable Community Elements⁸²

Hazards	Vulnerable sector	Community Elements
Cyclone	Life, Shelter, Livestock and poultry, Infrastructure and road communication, Health, Education, Shrimp cultivation, Agriculture, Salt, Environment, trees, Business, water and sanitation, Fisheries	-Sikderpara, Notunpara, Khondorabil, Baniakata, Bandisikderpara, Wapderpara, Rajghat. -Hindupara, Lallabghona, Monhajirpara, Miajirpara, Majhirpara, Bolirpara, -Noyapara, Moshtratali Shikderpara, Shayerpara, Shyerdail, Mogdail, Fhuljanmura, Baichpara, Majjpara, Sharderpara, Majherdail, Herpara, Hojmiajirpara
Tidal Surge	Do	-whole Rajghat, Khonderbil, North Shikderpara, Banyakata, portion of Tekpara, Notunpara -Tita majhirpara, Monhajirpara - Noyapara, Shairpara, Moshtratali Shikderpara, Shyerdail, Fhuljanmura,
Water Congestion	Life, Shelter, Livestock and poultry, Infrastructure and road communication, Agriculture, Salt, Environment, trees, Business, water and sanitation, Fisheries	-Rajghat CCDB Cyclone shelter, from non-government primary school to Bodiuddin's pond - on the southern part Rajghat Tek para, From Hospital to Ajijia Madrasha, -MonHajirpara, Miajirpara, Hindu para, Tita Majairpara -Noyapara, Moshtratali Shikderpara, Mogdail, Fhuljanmura, Saitpara

⁸² (FGD with Primary stakeholder and validation workshop with UDMC, 2010)

Salinity	Do	-Sikderpara, Notunpara, Khondorabil, Baniakata, Bandisikderpara, Wapderpara, Rajghat. -Tita majhirpara, Monhajirpara, Miajirpara, Hindu para
North-waster	Do	-Whole Materbari union (ward no. 1 are mostly vulnerable)
River erosion	Do	-Baniakata to BISIC office, East side of Rajghat, Khondrbill, Wapda para and east side of Baniyaghata to Tiakati .
Earthquake	Do	Whole union
Tornado	Do	-Sikderpara, Notunpara, Khondorabil, Baniakata, Bandisikderpara, Wapderpara, Rajghat. -Hindupara, Lallabghona, Monhajirpara, Miajirpara, Majhirpara, Bolirpara, -Noyapara, Moshratali Shikderpara, Shayerpara, Shyerdail, Mogdail, Fhuljannmura, Baichpara, Majipara, Shardepara, Majherdail, Herpara, Hojmiajirpara
Flood- tide	Do	-Whole Rajghat, _Liiallaghona, Titamajhirpara, -Noyapara, Saitpara, Nusratali Shikderpara, sirerdail, Fhuljannmura

Annex 3: Risk Statement associated with the Hazards⁸³

⁸³ (FGD with Primary stakeholder and validation workshop with UDMC, 2010)

Sector	Hazard	Risk Statement
Life	Cyclone	-15000 people may died out of 50,300 if there is occur like tropical cyclone of 1991
	Tidal Surge	-15000 people may died out of 50,300 if there is occur like tropical cyclone of 1991
	Water	-1832 children may died
	Congestion	-692 women and disable may be died due to the out of diseases
	Salinity	-1500 women and children may suffer form male nutrition
	Earthquake	-3100 people may died in Banighata, Khonderbil, whole Raj ghat if it occur like 1999 earthquake
	North-waster	-325 people may died if it occur like 2004 North-waster
	Tornado	-1400 people may died like every year Tornado
	Cyclone	-Out of 13000 core shelters 7000 may be damaged, loss 1500,00,000 BDT if it is like tropical cyclone of 1991
Core Shelter	Tidal Surge	-Out of 13000 core shelters 7000 may be damaged, loss 1500,00,000 BDT if it is like tropical cyclone of 1991
	River erosion	-400 core shelter may damage in Baniaghata, Khonderbill and whole Rajghat, loss 400,00,000 BDT
	Salinity	-6,500 core shelter may damage in Rajghat , North Shikderpara, Lillaghona and Saitpara area if it is continue like last 2 to 3 years Salinity problems, loss 65,00,000 BDT

	Earthquake	-6000 core shelter may damage if occur like 1999 Earthquake, Loss 600,00,000 BDT
	North-waster	-350 Core shelter may damage if it occur 2004 Northwester, Loss 50,00,000 BDT
	Tornado	-608 core shelter may damage if it occur like every year, loss 1,50,00, 000 BDT
Livestock and poultry	Cyclone	-1000 cows, 2500 goats, 9400 poultry may died if it occur like 1991 cyclone, loss 200,00,000 BDT
	Tidal Surge	-1000 cows, 2500 goats, 9400 poultry may died if it occur like 1991 cyclone, loss 200,00,000 BDT
	Salinity	-220 cows, 452 goats may face food shortage if it occurs like every year salinity problems, loss 10, 00,000 BDT.
	Flood tide	-500 cows, 762 goats may face food shortage in Noyapara, Moshratali Shikderpara, Shayerpara, Shyerdail, Mogdail, Fhuljanmura, Baichpara, Majipara, Sharderpara, Majherdail, Herpara, Hojmiajirpara if it occur like flood tide like 2007
Infrastructure and road communication	Cyclone	-9 k.m. road may washed away if it occur like 1991 cyclone, loss 2000, 00,000 BDT -28 mosque, 14 Madrasha, 3 k.g. school may washed away, loss 25,00,000 BDT - Ward no. 1-6 may disrupted severely, loss 500,00,000 BDT
	Tidal Surge	-23 k.m. area from sizer dail to Thakur char may severely disrupted , loss 2500,00,000 BDT
	Water Congestion	-20,180 people may disconnected if it continue like last five years water congestion problems, loss 7,00,000 BDT

	River erosion	-2 Bazar jetty and connected bridge may disrupted, loss 100,00,000 BDT -10,000 people may disconnected from main land, loss 10,00,000 BDT
	Earthquake	-2 Bazar jetty , connected bridge and 1 k.m. embankment may disrupted, loss 1000,00,000 BDT
Health	Cyclone	-1380 people may wounded if it occur like 1991 cyclone, loss 10,00,000 BDT
	Tidal Surge	-1380 people may wounded if it occur like 1991 cyclone, loss 10,00,000 BDT
	Flood-tide	-6470 people may affected diseases, and face male nutrition, Loss 100,00,000 BDT
	Water congestion	-4406 women and children may suffer from male nutrition
	Salinity	-35000 people may face food scarcity
Education	Cyclone	-10,300 student may apart from education, loss 300,00,000 BDT
	Tidal Surge	-30 % of infrastructural loss may occur
	Water Congestion	-4421 student education may post pond, loss 15,00,000 BDT
	Flood -tide	-6470 student education may disrupted if it occur like 2007 flood tide

Agriculture	Cyclone	-1172 Hecter paddy production may damage -4300 Hecter salt production may damage -4300 hector shrimp production may damage	
	Tidal Surge	Do	
	Flood -tide	-293 Hecter paddy production may damage -1075 Hecter salt production may damage -1100 hector shrimp production may damage	
	North-waster	-100 Hecter paddy production may damage -600 Hecter salt production may damage -28 shrimp her production may damage	
	Salinity	-500 hector paddy production may damage	
	Environment and Plantation	Cyclone	29,500 plant may damage, loss 800,00,000 BDT
		Tidal Surge	1500 plant may damage if it occur like tropical cyclone of 1991, loss 10,00,000 BDT
		Flood-tide	4300 plant may damage loss 86,00,000 BDT
		Salinity	loss 500,00,000 BDT

	River erosion	500 plant may damage loss 5,00,000 BDT
	North-waster	3390 plant may damage loss 152 0,00,000 BDT
	Tornado	3390 plant may damage loss 200 0,00,000 BDT
Drinking water and sanitation	Cyclone	-10800 people will suffer for safe drinking water, loss 50,00,000 BDT
	Tidal Surge	-30 % sanitation may disrupted, loss 2,00,000 BDT
	Water Congestion	-200 out of 1200 tube well may disrupted, loss 5,00,000 BDT
	Flood -tide	-1500 tube well may disrupted, loss 30,00,000 BDT
	Salinity	- 1200 tube well may disrupted, loss 30,00,000 BDT
Fisheries	Cyclone	-177 boat may damage, 400,00,000 BDT -940 fishing net may damage, 329,00,000 BDT -20 pond may damage, 80,00,000 BDT
	Water Congestion	-100 ponds production may loss, 100,00,000 BDT
	North-waster	--160 fishing net may damage, 128,00,000 BDT

Annex 4: Risk Assessment⁸⁴

Name of Hazards	Potential consequences	Consequence	Likelihood	Risk Rating	Acceptability
Cyclone / tidal surge	<p>-15000 people may died out of 50,300 if there is occur like tropical cyclone of 1991</p> <p>-Out of 13000 core shelters 7000 may be damaged, loss 1500,00,000 BDT if it is like tropical cyclone of 1991</p> <p>-1000 cows, 2500 goats, 9400 poultry may died if it occur like 1991 cyclone, loss 200,00,000 BDT</p> <p>-9 k.m. road may washed away if it occur like 1991 cyclone, loss 2000, 00,000 BDT</p> <p>-28 mosque, 14 madrasa, 3 k.g. school may washed away, loss 25,00,000 BDT</p> <p>- Ward no. 1-6 may disrupted severely, loss 500,00,000 BDT</p> <p>-23 k.m. area from sির দালি to Thakur char</p>	Shrimp her may washed away Food price	All most certain	High Risk	Unacceptable

⁸⁴ (FGD with Primary stakeholder and validation workshop with UDMC, 2010)

	<p>may severely disrupted , loss 2500,00,000 BDT</p> <p>-1380 people may wounded if it occur like 1991 cyclone, loss 10,00,000 BDT</p> <p>-1172 Hecter paddy production may damage</p> <p>-4300 Hecter salt , 4300 hector shrimp production may damage</p> <p>-10800 people will suffer for safe drinking water, loss 50,00,000 BDT</p> <p>-1501 plant may damage if it occur like tropical cyclone of 1991, loss 10,00,000 BDT 29,500 plant may damage, loss 800,00,000 BDT</p> <p>-177 boat may damage, 400,00,000 BDT, -940 fishing net may damage, 329,00,000 BDT</p> <p>-20 pond may damage, 80,00,000 BDT</p>				
<p>Water congestion</p>	<p>-692 women and disable may be died due to the out of diseases</p> <p>-1832 children may died -20,180 people may disconnected if it continue like last five years</p> <p>water congestion problems, loss 7,00,000 BDT - 4406 women and children may suffer from male nutrition -4421 student education may post</p>	<p>Water born disease may spread</p> <p>Salinity may spread</p> <p>Fruits plantation may disrupted</p> <p>Malnutrition may increase</p> <p>Occupational mobility may appear</p> <p>Food and water crises may severe</p> <p>livestock food scarcity may severe</p> <p>Environmental degradation may</p>	<p>All most certain</p>	<p>High Risk</p>	<p>Unacceptable</p>

	pond, loss 15,00,000 BDT	happen Edncation may hampered	All most certain	High Risk	Unacceptab le
Salinity	-1500 women and children may suffer form male nutrition	Water scarcity may severe Land degradation may happen Fruits plantation may disrupted Malnutrition may increase Food and water crises may severe livestock food scarcity may severe Environmental degradation may happen	Occupational mobility may appear Core shelter may damage	High Risk	Unacceptab le
	-6,500 core shelter may damage in Rajghat , North Shikderpara, Lillaghona and Saitpara area if it is continue like last 2 to 3 years Salinity problems, loss 65,00,000 BDT				
	-220 cows, 452 goats may face food shortage if it occurs like every year salinity problems, loss 10, 00,000 BDT.				
	-35000 people may face food scarcity				
	-500 hector paddy production may damage				
	- 1200 tube well may disrupted, loss 30,00,000 BDT	Salinity may happen Embankment may damage Agricultural production may damage. Water born disease may spread Salinity may spread Fruits plantation may disrupted Malnutrition may increase	All most certain	Medi um Risk	Unacceptab le
Flood- tide	-500 cows, 762 goats may face food shortage in Noyapara, Moshratali Shikderpara, Shayerpara, Shyerdail, Mogdail, Fhuljanmura, Baichpara, Majjpara, Sharderpara, Majherdail, Herpara, Hojmiajirpara if it occur like flood tide like 2008	Salinity may happen Embankment may damage Agricultural production may damage. Water born disease may spread Salinity may spread Fruits plantation may disrupted Malnutrition may increase	All most certain	Medi um Risk	Unacceptab le
	-6470 people may affected diseases, and face				

	<p>male nutrition, Loss 100,00,000 BDT,</p> <p>-6470 student education may disrupted if it occur like 2007 flood tide</p> <p>-1100 hector shrimp production may damage</p> <p>-1075 Hector salt production may damage</p> <p>-293 Hector paddy production may damage</p>	<p>Ocenational mobility may appear</p> <p>Food and water crises may severe livestock food scarcity may severe</p> <p>Environmental degradation may happen</p> <p>Education may hampered</p>			
River erosion	<p>-400 core shelter may damage in Baniaghata, Khonderbill and whole Rajghat, loss 400,00,000 BDT</p> <p>-2 Bazar jetty and connected bridge may disrupted, loss 100,00,000 BDT</p> <p>-10,000 people may disconnected from main land, loss 10,00,000 BDT -501 plant may damage loss 5,00,000 BDT</p>	<p>Embankment may damage</p> <p>Agricultural production may damage.</p> <p>Water born disease may spread</p> <p>Salinity may spread</p> <p>Fruits plantation may disrupted</p> <p>Malnutrition may increase</p> <p>Occupational mobility may appear</p> <p>Food and water crises may severe</p> <p>livestock food scarcity may severe</p> <p>Environmental degradation may happen</p> <p>Education may hampered</p> <p>Road, agricultural land and production may damage</p>	All most certain	Medium Risk	Unacceptable
Earth	<p>-3100 people may died in Banighata, Khonderbil, whole Raj ghat if it occur like 1999</p>	<p>Core shelter may damage</p> <p>Life may lose</p>	Unlikely	Low	Unacceptable

quake	earthquake	Infrastructure may damage		Risk	le
North-waster	-6000 core shelter may damage it occur like 1999 Earthquake, Loss 600,00,000 BDT,	Core shelter may damage Plantation may damage Fishing net, boat may damage Occupational mobility may occur	All most certain	High Risk	Unacceptab le
	-2 Bazar jetty , connected bridge and 1 k.m. embankment may disrupted, loss 1000,00,000 BDT				
	-350 Core shelter may damage if it occur 2004 Northwester, Loss 50,00,000 BDT				
	-100 Hector paddy production may damage				
	-600 Hector salt production may damage				
	-28 shrimp gher production may damage				
	3391 plant may damage loss 152 0,00,000 BDT				
-160 fishing net may damage, 128,00,000 BDT					
Tornad o	-1400 people may died like every year Tornado	Core shelter may damage Plantation may damage Fishing net, boat may damage Livestock may damage	Possible	Low Risk	acceptable
	-608 core shelter may damage if it occur like every year, loss 1,50,00, 000 BDT				
	-3391 plant may damage loss 200 0,00,000 BDT				

Annex: 5 Causal Analyses⁸⁵:

Name of Hazards	Potential consequences	Reason/Cause			Possible Options		
		Immediate	Intermediate	Ultimate	Immediate	Intermediate	Ultimate
Cyclone/ tidal surge	-15000 people may died out of 50,300 if there is occur like tropical cyclone of 1991	changing of Monsoon weather creates depression	Lack of Embankment lack of link road between embankment and cyclone shelter	Lack of embankment repairment plan (west side 4 k.m. (no. 3 Ward)	making sensitize dissemination of cyclone warning in local language	making sensitize environmental importance of mangrove forest dissemination of cyclone warning in local language	Build new cyclone shelter
	-Out of 13000 core shelters 7000 may be damaged, loss 1500,00,000 BDT if it is like tropical cyclone of 1991	Lack of sensitization	Lack of mangrove forest	(no. 3 Ward)	Repair cyclone shelter	Repair cyclone shelter	
	-1000 cows, 2500 goats, 9400 poultry may died if it occur like 1991 cyclone, loss 200,00,000 BDT		Lack of mangrove forest				
	-9 k.m. road may washed away if it occur like 1991 cyclone, loss 2000, 00,000 BDT		Lack of mangrove forest				
	-28 mosque, 14 Madrasha, 3 k.g. school may washed away, loss 25,00,000 BDT		Lack of mangrove forest				
	- Ward no. 1-6 may disrupted severely, loss 500,00,000 BDT		Lack of mangrove forest				
	-23 k.m. area from siring dal to Thakur char may severely disrupted , loss 2500,00,000 BDT		Lack of mangrove forest				

⁸⁵ (FGD with Primary stakeholder and validation workshop with UDMC, 2010)

<p>Water congestion</p>	<p>-1380 people may wounded if it occur like 1991 cyclone, loss 10,00,000 BDT</p> <p>-1172 Hecter paddy production may damage</p> <p>-4300 Hecter salt, 4300 hector shrimp production may damage</p> <p>-10800 people will suffer for safe drinking water, loss 50,00,000 BDT</p> <p>-1501 plant may damage if it occur like tropical cyclone of 1991, loss 10,00,000 BDT</p> <p>29,500 plant may damage, loss 800,00,000 BDT</p> <p>-177 boat may damage, 400,00,000 BDT, -940 fishing net may damage, 329,00,000 BDT</p> <p>-20 pond may damage, 80,00,000 BDT</p>	<p>Excessive rain</p> <p>Tidal water</p>	<p>lack of culvert in the connecting road</p> <p>Man made water congestion in the habitat area</p>	<p>Lack of sluice gate in the embankment</p>	<p>Arrange water drainage system</p>	<p>Connect canal with the embankment</p>	<p>Protect habitat area form the shrimp cultivation</p>
<p>Salinity</p>	<p>-692 women and disable may be died due to the out of diseases</p> <p>-1832 children may died -20,180 people may disconnected if it continue like last five years water congestion problems, loss 7,00,000 BDT</p> <p>-4406 women and children may suffer from male nutrition -4421 student education may post pond, loss 15,00,000 BDT</p> <p>-1500 women and children may suffer form male nutrition</p> <p>-6,500 core shelter may damage in Rajghat, North Shikderpara, Lillaghona and Saitpara area if it is continue like last 2 to 3 years</p> <p>Salinity problems, loss 65,00,000 BDT</p> <p>-220 cows, 452 goats may face food shortage if it occurs like every year salinity problems, loss</p>	<p>Store saline water for shrimp cultivation</p>	<p>Lack of awareness on salinity intrusion</p>	<p>Greedy ness to earn more in a short period of time</p>	<p>Protect habitat area form the shrimp cultivation</p>	<p>Create awareness on salinity intrusion</p>	<p>invent saline tolerant variety</p>

	10, 00,000 BDT.								
	-35000 people may face food scarcity								
	-500 hector paddy production may damage								
	- 1200 tube well may disrupted, loss 30,00,000 BDT								
Flood-tide	-500 cows, 762 goats may face food shortage in Noyapara, Moshtratali Shikderpara, Shayerpara, Shyerdail, Mogdail, Fhuljanmura, Baichpara, Majjpara, Sharderpara, Majherdail, Herpara, Hojmiajirpara if it occur like flood tide like 2008	River erosion	Broken Embankment No repairmen of embankment lack of water drainage system	lack of mangrove forest	Repair embankment	Create mangrove forest Build sluice gate and repair it on a regularly basis	take project to repair embankment		
	-6470 people may affected diseases, and face male nutrition, Loss 100,00,000 BDT,								
	-6470 student education may disrupted if it occur like 2007 flood tide								
	-1100 hector shrimp production may damage								
	-1075 Hector salt production may damage								
	-293 Hector paddy production may damage								
River erosion	-400 core shelter may damage in Baniaghata, Khonderbill and whole Rajghat, loss 400,00,000 BDT	Changing of river ways river siltation keeping boat beside the river bank	Leakage the embankment for shrimp cultivation Use BIHIDDY net for fishing	Damage mangrove forest	Keep boat in permanent boat station	Build/use sluice for damaging water form the shrimp cultivation land	Create mangrove forest in the char area		
	-2 Bazar jetty and connected bridge may disrupted, loss 100,00,000 BDT								
	-10,000 people may disconnected from main land, loss 10,00,000 BDT -501 plant may damage loss 5,00,000 BDT	Changing of geomorphol	Unplanned road, building , Bazar	Not followed the building	Modern equipment use to forecast the	Earth quake resilient building built	make the cyclone shelter		
Earth quake	-3100 people may died in Banighata, Khonderbil, whole Raj ghat if it occur like 1999 earthquake								

	-6000 core shelter may damage it occur like 1999 Earthquake, Loss 600,00,000 BDT, -2 Bazar jetty , connected bridge and 1 k.m. embankment may disrupted, loss 1000,00,000 BDT	ogy Lack of Awareness Lack of earth quake experience	construction	code	earthquake signal Create awareness on earthquake response	resilient to earth quake
North-waster	-350 Core shelter may damage if it occur 2004 Northwester, Loss 50,00,000 BDT	changing of Monsoon weather creates depression	Lack of plantation beside the shelter lack of mangrove forest lack of building cyclone resilient shelter		Retrenchment of plantation	create mangrove forest in the char area
	-100 Hecor paddy production may damage	Lack of sensitization				
	-600 Hecor salt production may damage	Lack of retrenchment of plantation				
	-28 shrimp gher production may damage	Excessive temperature lack of retrenchment of plantation	Lack of mangrove forest Lack of plantation beside the shelter		Retrenchment of plantation	tree plantation
	3391 plant may damage loss 152 0,00,000 BDT					
--160 fishing net may damage, 128,00,000 BDT						
Tornado	-1400 people may died like every year Tornado -608 core shelter may damage if it occur like every year, loss 1,50,00, 000 BDT -3391 plant may damage loss 200 0,00,000 BDT					

Annex: 6 Options Impact Analysis (STEPS)

Sl	Option	Purpose	Social/ Political	Technical/Economic	Environmental	Sustainability	Alternatives
1	Disseminate early warning of cyclone, tsunami and earthquake	To transfer life and property in the safe place	Death rate will decrease	need materials and economic assistance	Environment is protected	raise awareness regularly basis	
2	Create awareness on natural disaster	Do	reduce the loss of disaster	Training of the trainers training materials economic cause	Environment and biodiversity will protected	do	Incorporate disaster concept in the school materials
3	repair connecting road with cyclone shelter	build connecting road with the cyclone shelter make arrangement for women, children, old aged and persons with disability Create awareness on cyclone shelter management	Social security is maintained	Need help form the GO, NGOs	Normal life is maintained	Form local cyclone shelter management committee	

4	Repair old cyclone shelter	Create awareness on cyclone shelter management	do	do	do	Use cyclone shelter cum service provider like school, community hall etc	
5	Arrange facilities for women, children, persons with disability and old aged people in the cyclone shelter	make arrangement for women, children, old aged and persons with disability	ensure security and dignity of women	do	Environment is protected		
6	Build cyclone shelter	To protect life and property	People is protected from cyclone	Do	do	Form local cyclone shelter management committee	

7	Create mangrove forest	To protect life and property, char area, embankment	Risk of cyclone is less Social solidarity is increased	Need economical support for seeds and seedlings	Environment and biodiversity will protected	Form local mangrove forest management committee Prohibited the use of BHINGI net for fishing Prohibited grazing in the mangrove forest area	Build embankment
8	Repair embankment	to protect form cyclone , tidal surge and floodtide	Life slandered is maintained social security is enhanced	Need help form the GO, NGOs	Green belt is established	regular monitoring needed	
9	Use RCC pipe in the connecting road in the union	Reduce water congestion Agricultural production is increased to maintain water drainage system	human movement is easy Water congestion is reduced	Do	Tree plantation is increased	Regular monitoring needed by the union Parishad	
10	Build switch gate in the road to drainage water and connect the gate with cannel	Do	do	do	do	do	

11	Protect habitat area form shrimp cultivation	To reduce salinity and water congestion promote on agricultural production to enhance livestock food production	Protect people from salinity intrusion	make advocacy with WDB	Tree plantation is increased in the habitat	Regular monitoring needed by the union Parishad	
12	create awareness on salinity intrusion problems	do	do	Need support form MoFDM	do	do	
13	Invent saline resilient variety of crops and technology	to increase agricultural production to enhance livestock food production and seeds	Economy is developed	need support form IRRI and BRRI	Environment is protected	Training from agricultural research institute	Dhaka University Institutional Repository
14	Keep boat in the permanent place of the river bank	To protect embankment to reduce river erosion	river erosion is decreased	Need support from WBD and Local government	Tree plantation	Regular monitoring needed by the union Parishad	
15	create awareness on earth quake resilient housing design and technology	To ensure life and belongings	safety ness is enhanced	Need support from Geological survey of Bangladesh	Death rate is decreased	regular training and workshop Follow building code	
16	built earth quake resilient cyclone shelter	do	do	do	habitat is protected	do	

17	Set up deep tube well	to reduce scarcity of safe drinking water to reduce salinity	water born diseases is decreased	Need support form NGOs and Govt.	Environment is protected	regular repairmen
18	tree plantation in the habitat area	promote tree plantation	Environment is charming	need support from forest office	Nursery and bio diversity is promoted	raise awareness on regularly basis
19	Retrenchment of the plants	Retrenchment of tree	local need is solved	need support form agriculture department	Environment is protected	aware on north-waster
20	Built new roads and repair old roads	To maintain normal life	land owner may disagree to support	Need support form LGED and NGOs		Need regular monitoring

Chapter: 7 Major findings and conclusion

The following findings have been drawn through CRA in consultation with the participants- Primary stakeholders and the union disaster management committee.

7.1 Major findings:

- Indigenous Disaster Coping Capacity identified
- Communities Own Risk, Vulnerabilities and Capacities identified
- Because of geographical location of the community, inhabitants take disaster as a part of their life.
- The union is economically much affluent; Employment opportunity is available, like fishing, salt, shrimp, rice cultivation, boat man, rickshaw pulling etc.
- Community volunteerism like CPP are encouraged
- Most vulnerable groups are detached from the development planning
- Politics regulates the power structure
- Religious education make people dependent on luck
- Child marriage, Child labours and mother and infant mortality rate are noticeable due to luck dependency and lack of information knowledge on available service provider agencies.
- Most of the community people are much courageous and hard agriculture worker
- Union Parishad become less accountable due to non-election for the last 10 Years

Picture 5 Risk prioritization



7.2 Recommendations for < Policy makers i.e. Ministry of Food and Disaster Management (MoFDM)>

- Incorporate the LDRRAP into development planning
- Advocate the LDRRAP and operationalize it with the involvement of every stakeholders
- Translate Early Warning System in to local language and disseminate it in a quickest and easiest way.
- Increase lead time forecasting of cyclone
- Introduce insurance policy for the disaster prone area
- Allocate emergency contingency fund for the local government level
- Negotiate with the international community for technological and technical support as compensation from developed countries due to their carbon emission
- Organize or participate actively in the regional cooperation to advocate for Satellite information to produce lead time forecasting on cyclone , tsunami
- Make a strong lobbying with the international community to recognize the concept of “environmental persecution” and promote for making an international law to recognize “Environmental Refugee” as a basis for refugee status due to displacement for environmental reasons.

7.3 Recommendations for < Community Leaders i.e. chairman of Upazila and Union, Ward members, Change Agents>

- Improve sense of accountability , transparency and ensure participation of all stakeholder to operationalize the LDRRAP
- Up-date the LDRRAP and organize the community to take it as priority options to improve the community resilience
- Organize mock demonstration of cyclone, training and workshop
- Sensitize the vulnerable group people on early warning , available services in the community and maintain the cyclone shelter
- Create emergency fund, form cyclone shelter management committee, motivate community volunteerism
- Recommendations for < **Doner, Non-profit organizations**>
- Create mandate on Kyoto protocol

- Follow Sphere standard
- Maintain a good coordination to avoid duplication of development work
- Support the implementing agency through capacity building
- Monitor the project for better facilitation

7.4 Conclusion:

According to Germanwatch's index, Bangladesh is on the top of the list-countries most affected from extreme weather events (1990-2008).⁸⁶ Community resilience of coastal Bangladesh can not able to face it. Our lead time forecasting on cyclone need to be increased from 3 to 5 days. Bangladesh Meteorological Department (BMD) and Flood Forecasting Warning Centre (FFWC) forecast the early warning messages but lead time is very low i.e. 3 as Bangladesh has no satellite.

CRED coordinates a collaboration activity with UNDP focusing on national disaster data compilation initiatives in Asian region to prepare six Asian national disaster databases i.e. Bangladesh, Indonesia, Nepal, Philippines, Sri Lanka and Vietnam. The strengthening of disaster databases will eventually serve the global, international, and national humanitarian communities involved in disaster response planning and risk reduction.⁸⁷

Disaster doesn't have any boundary. Therefore we need to prepare locally, nationally and as well as regionally. It is very difficult to manage disaster impacts as individual nation but easier more comprehensively through a regional cooperation. The regional approach makes a convenient solution for regional, national and as well as local disaster risk reduction. Hyogo Framework of Action (HFA) and South Asian Association of Regional Cooperation (SAARC) can play a vital role for establishing such regional cooperation.

⁸⁶ (PINAKI ROY, The daily star, December 9, 2009)

⁸⁷ (Regina Below, September 2010)

List of individuals and committees consulted

Moheshkhali Upazila Disaster Management committee

Sl.	Name	Designation in the UzDMC
1	Upazila Nirbahi Officer, Moheshkhali, Cox'sBazar	Chairman
2	Chairman, Materbari Union, Moheshkhali , Cox'sBazar	Member
3	Chairman, Moheshkhali Pourashava, Moheshkhali,Cox'sBazar	Member
4	Chairman, Dhoghata Union,Moheshkhali , Cox'sBazar	Member
5	Chairman, Kalarmarchora Union,Moheshkhali , Cox'sBazar	Member
6	Chairman, Shaplapur Union,Moheshkhali , Cox'sBazar	Member
7	Chairman, Hoanok Union,Moheshkhali , Cox'sBazar	Member
8	Chairman, Boro Moheshkhali Union,Moheshkhali , Cox'sBazar	Member
9	Chairman, Chota Moheshkhali Union,Moheshkhali , Cox'sBazar	Member
10	Chairman, Kutubjum Union,Moheshkhali , Cox'sBazar	Member
11	Asst. Commissioner (Land)	Member
12	Upazila Agriculture Officer, Moheshkhali, Cox'sBazar	Member
13	Upazila Hcalth and Family Planning Officer, Moheshkhali, Cox'sBazar	Mcmber
14	Upazila Fisharies Officer, Moheshkhali, Cox'sBazar	Member
15	Upazila Livestock Officer, Moheshkhali, Cox'sBazar	Member
16	Upazila Education Officer, Moheshkhali, Cox'sBazar	Member
17	Upazila Engineer, Moheshkhali, Cox'sBazar	Member
18	Upazila Officer in Cahrge, Moheshkhali Thana, Cox'sBazar	Member
19	Upazila Secondary Education Officer, Moheshkhali, Cox'sBazar	Member
20	Upazila Women Affairs Officer, Moheshkhali, Cox'sBazar	Member
21	Upazila Food Controller, Moheshkhali, Cox'sBazar	Member
22	Upazila Social Welfare Officer, Moheshkhali, Cox'sBazar	Member
23	Upazila Youth Development Officer, Moheshkhali, Cox'sBazar	Member
24	Upazila Cooperative Officer, Moheshkhali, Cox'sBazar	Member
25	Upazila Anser. VDP Officer, Moheshkhali, Cox'sBazar	Member
26	Upazila Sub-assistant Officer, Moheshkhali, Cox'sBazar	Member
27	Upazila Junior Director, CPP, Moheshkhali, Cox'sBazar	Member
28	Chairman, Upazila Central Cooperative Society, Moheshkhali, Cox'sBazar	Member
29	Principal, Moheshkhali Degree College, Moheshkhali, Cox'sBazar	Member
30	Mr. Badiul Alam Showdagor, Chairman, Gorokghata Market Cooperative Society, Moheshkhali, Cox'sBazar	Member
31	Chairman, Moheshkhali Press Club, Moheshkhali, Cox'sBazar	Member
32	Mr. Khogandro Shill, Upazila Fredom fighter Shagshod, Moheshkhali, Cox'sBazar	Member
33	Ms. Nuri Akter, Member, Boro Moheshkhali Union Parishad & Member, Upazila Development Coordination Committee, Moheshkhali, Cox'sBazar	Member
34	Ms. Khadiza Begum, Member, Hoanok Union Parishad & Member, Upazila Development Coordination Committee, Moheshkhali, Cox'sBazar	Member
35	Ms. Monjura Begum, Member , Materbari Union Parishad & Member, Upazila Development Coordination Committee,	Member

	Moheshkhali, Cox'sBazar	
36	Programme Coordinator, Resource Integration Centre (RIC), Moheshkhali, Cox'sBazar	Member
37	Program Officer, Anondo, Moheshkhali, Cox'sBazar	Member
38	Branch Manager, Cost, Moheshkhali, Cox'sBazar	Co Opt Member
39	Mr. Muhammad Roshid, B.A. Ex.M.P. Moheshkhali, Cox'sBazar	Co Opt Member
40	Deputy General Manager, Cox's Bazar Polli Bidut Shomity, Jonal Office, Moheshkhali, Cox'sBazar	Co Opt Member
41	Upazila Supervisor, Islamic Foundation, Moheshkhali, Cox'sBazar	Co Opt Member
42	Upazila Project Implementation Officer, Moheshkhali, Cox'sBazar	Co Opt Member

List of Materbari Union Disaster Management Committee:

Sl.	Name	Designation	. Ward No.	Village	Mobile No
1	Nurul Islam (M.Com)	Chairman	2	North Raj Ghat	01720583344
2	Ruhul Kader	Member	1	Shikder Para	01713464425
3	Nurul Alam	Member	2	North Raj Ghat	01813254422
4	Jalal Ahmed	Member	3	Raj Ghat	01818605545
5	Abul Kashem	Member	4	Satghor Para	01720298546
6	Abdul Barek	Member	5	Miaji Para	01726067863
7	Mahbub Morshad	Member	6	Tiat Maji Para	01725270257
8	Kala Mia	Member	7	Maiz Para	01726817604
9	Mojammel Hopque	Member	8	Hongsho Miaji Para	01711275913
10	Hamed Hosain	Member	9	Sairar Dail	017126155876
11	Nurun Nahar Begum	Member	1,2&3	Shikder Para	01815411885
12	Monjura Begum	Member	4,5&6	Miaji Para	01715830403
13	Mostafa Perveen	Member	7,8&9	Mogdail	
14	Master Reja Khan	Member	1	Shikder Para	01726080935
15	Anowar Hossain	Member	8	Mogdail	01816019717
16	Hazi Mahbub Kamal	Member	1	Shikder Para	01720355988
17	Md. Iddirs	Member	1	Notun Para	0181236980
18	Babul Kishor Shill	Member		Puran Bazar	01725270314
19	Moklasur Rahman	Member		Maiz Para	
20	Bellal Hossain Bhuyan	Member	3	BISIC Officer, Rajghat	
21	Ahmad Hossain	Member Secretary			

List of participants meet in the ward level:

No. of Ward	Name	. Ward No.	Mobile No
1	Ruhul Kader	1	01713464425
	Nurun Nahar Begum	1,2&3	01815411885
	Hazi Mahbub Kamal	1	01720355988
	Md. Iddirs	1	0181236980
	Jamal Hossain	1	
	Am A Hannan		
2	Nurul Alam	2	01813254422
	Nurun Nahar Begum	1,2&3	01815411885
	Boshir Ahmad		
	Doulot Khan		
	Bahauddin		
3	Jalal Ahmed	3	01818605545
	Nurun Nahar Begum	1,2&3	01815411885
	Mir Kashem		
	Ladu Mia		
	Billal Hosain Mia		
4	Abul Kashem	4	01720298546
	Monjura Begum	4,5& 6	01715830403
	Sri Dulal Kanti Shil		
	Moklasur Rahman		
	Babul Kishor Shil		
5	Abdul Barek	5	01726067863
	Monjura Begum	4,5& 6	01715830403
	Astafajul Hoque		
	Abdul Malak		
	Jamalauddin		
6	Mahbub Morshad	6	01725270257
	Monjura Begum	4,5& 6	01715830403
	Kaisarul Islam		
	Kazi Nurul Alam		
	Nurun Nahar		
7	Kala Mia	7	01726817604
	Mostafa Perveen	7,8&9	
	Md. Karim		
	Nuru Rahman		
	Haji Salah Ahmad		
8	Mojammel Hopque	8	01711275913
	Mostafa Perveen	7,8&9	
	Akter Ahmad		
	Shana Akter		
	Abul Kashem		
9	Hamed Hosain	9	17126155876
	Johir Ahmad		
	Ronmala Khatun		
	Lutrfor Rahman		
	Dolil Mia		

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List of Photos of Materbari union

Communication road of Materbari





Village of Moheshkhali union



Union parishad of Moheshkhali

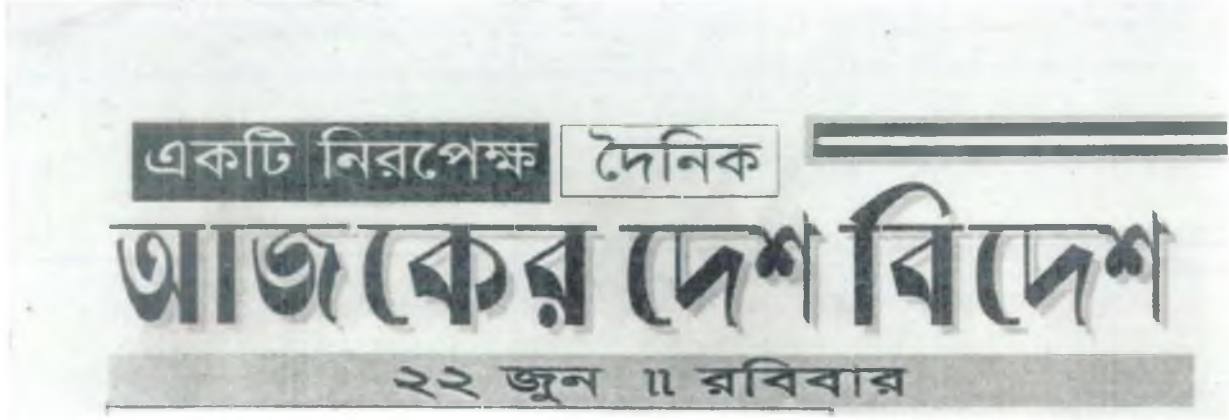


During CRA conduction in Materbari Union



Paper cutting from the local news paper

Here it is mentioned in the daily Ajker Desh Bidesh that Kazi Saiful Islam, Officer of Resource Integration Centre (RIC) –Moheshkhali, conducted day long simulation in Materbari on 22 June 2003.



মাতারবাড়ীতে রিক'এর দূর্যোগ বিষয়ক মহড়া অনুষ্ঠিত

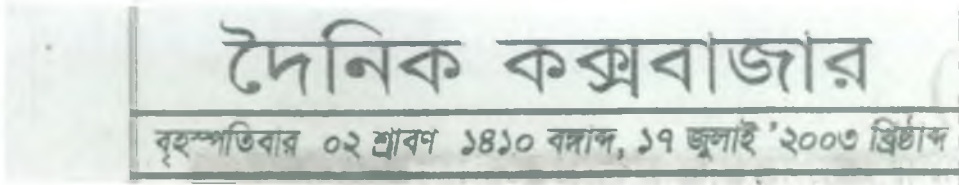
মহেশখালী প্রতিনিধি ॥
মহেশখালী উপজেলায় মাতারবাড়ী ইউনিয়ন পরিষদে গত ১৭ জুন সকাল ১১টায় রিসোর্স ইন্টিগ্রেশন সেন্টারের (রিক) উদ্যোগে দূর্যোগ ব্যবস্থাপনার এক মহড়া অনুষ্ঠান অনুষ্ঠিত হয়। এতে প্রধান অতিথি ছিলেন মহেশখালী উপজেলা রিক অফিসার মোঃ কাজী সাইফুল ইসলাম। চেয়ারম্যান নূরুল ইসলামের সভাপতিত্বে অনুষ্ঠিত সভায় বিশেষ অতিথি ছিলেন ইউনিয়নের সদস্যবৃন্দ রুহুল কাদের, জালাল আহমদ,

মোজাম্মেল হক, আবুল কাসেম, কালা মিয়া, হামিদ হোসেন, মাহবুব মোর্শেদ, আব্দুল বারেক, মোস্তফা পারভিন, নূরুন্নাহার, মনজুরা বেগম এবং মাষ্টার আনোয়ার হোসেন, মাতারবাড়ী উচ্চ বিদ্যালয়ে ভারপ্রাপ্ত প্রধান শিক্ষক রফিকুল ইসলাম সহ এলাকার গন্যমান্য ব্যক্তিবর্গ।

মহড়া অনুষ্ঠানে বক্তারা বলেন, দূর্যোগ ব্যবস্থাপনার উপরে এলাকার জনগণকে সচেতন করতে হবে। আমরা যদি সচেতন না হয় আগামীতে দূর্যোগের কবলে পড়ে অনেকে ক্ষয় ক্ষতির সম্মুখীন হবেন। তাই এলাকার জনগণকে একতা বদ্ধ হয়ে দূর্যোগ মোকাবেলার করার জন্য সচেতন হতে হবে।



Here it is mentioned in the daily Cox's Bazar that Kazi Saiful Islam, of Resource Integration Centre (RIC) –Moheshkhali, conducted day long simulation in Hoanok on 17 July 2003.



মহেশখালীর হোয়ানকে দিনব্যাপী দুর্যোগ বিষয়ক মহড়া অনুষ্ঠিত

কক্সবাজার রিপোর্ট
মহেশখালী উপজেলার হোয়ানক ইউনিয়ন পরিষদ মিলনায়তনে দুর্যোগ মোকাবেলা বিষয়ক দিনব্যাপী এক মহড়া গত ১০ জুলাই অনুষ্ঠিত হয়েছে। রিসোর্স ইন্টিগ্রেশন সেন্টার (রিক) মহেশখালী শাখার উদ্যোগে ও হোয়ানক ইউনিয়ন পরিষদের আয়োজনে দুর্যোগ বিষয়ক উক্ত মহড়ায় স্থানীয় মেম্বার, গন্যমান্য ব্যক্তিবর্গ গ্রামবাসী ও স্কুল কলেজের ছাত্র/ছাত্রীরা উপস্থিত ছিলেন।
মহড়া শেষে দুর্যোগকালীন ও দুর্যোগ পরবর্তী করণীয় সম্পর্কে অবহিত করণ সম্পর্কিত এক আলোচনা সভায় প্রধান আলোচক হিসাবে আলোচনায় অংশ নেন রিক

এর জেলা ম্যানেজার সাইফুল ইসলাম। অন্যান্যদের মধ্যে বক্তব্য রাখেন, মেম্বার আব্দুল মালেক, ফজলুল করিম, গোলাম কুদ্দুছ, রুহুল আমিন বাবুল, মোঃ কামাল, জোনার আলী, মহিলা সদস্য খদিজা বেগম ও আব্দুল মোনাফ। অনুষ্ঠানে স্বাগত বক্তব্যে ইউ.পি.সচিব আব্দুল হক বলেন, প্রাকৃতিক দুর্যোগে বঙ্গোপসাগর কূলের মানুষ গুলো জান মাল হারিয়ে চরমভাবে ক্ষতি গ্রস্ত হয়েছে। দুর্যোগ উপকূলীয় জনসাধারণ থেকে একগুণ কেড়ে নিলেও পরমুহর্তে তারা ১০ গুণ দিতে কসুর করেনা। তাই সম্ভাব্য ক্ষতি জেনেও নিজ বাসস্থান ত্যাগ করে উপকূল ছেড়ে যাওয়া তাদের পক্ষে সম্ভব নয়।