

University of Rajshahi

Rajshahi-6205

Bangladesh.

RUCL Institutional Repository

<http://rulrepository.ru.ac.bd>

Institute of Environmental Science (IES)

PhD Thesis

2020-05

Survival Strategies of the Environmental Refugees in Pabna District of Bangladesh

Amin, Md. Al

University of Rajshahi

<http://rulrepository.ru.ac.bd/handle/123456789/1032>

Copyright to the University of Rajshahi. All rights reserved. Downloaded from RUCL Institutional Repository.

Survival Strategies of the Environmental Refugees in Pabna District of Bangladesh



Ph.D. Dissertation

Researcher

Md. Al Amin

**Institute of Environmental Science (IES)
University of Rajshahi, Bangladesh**

June 2020

Survival Strategies of the Environmental Refugees in Pabna District of Bangladesh



Ph.D Dissertation

*A dissertation submitted to the Institute of Environmental Science (IES),
University of Rajshahi, Bangladesh in Partial fulfillment of the
requirements for the degree of Doctor of Philosophy in Geography and
Environmental Studies*

Submitted by

Md. Al Amin

Roll No. 14201

Reg.: 40767

Session : 2014-2015

Institute of Environmental Science (IES)

University of Rajshahi, Bangladesh.

**Institute of Environmental Science (IES)
University of Rajshahi, Bangladesh**

June 2020

Survival Strategies of the Environmental Refugees in Pabna District of Bangladesh



Ph.D Dissertation

Researcher

Md. Al Amin

Roll No. 14201

Reg.: 40767

Session : 2014-2015

Institute of Environmental Science (IES)

University of Rajshahi, Bangladesh.

Principal Supervisor

Golam Kibria Ferdous PhD

Professor

Department of Social Work

University of Rajshahi.

Co-Supervisor

Md. Abu Bakr Siddique Bhuiya

Rtd. Professor

Department of Social Work

University of Rajshahi.

Institute of Environmental Science (IES)

University of Rajshahi, Bangladesh

June 2020

Dedicated To

My Honorable Father

Eng. Late, Aftab Uddin



beloved

disable daughter

Rahiba Amin (Asa)

Declaration

I do hereby declare that this thesis entitled “**Survival Strategies of the Environmental Refugees in Pabna District of Bangladesh**” Submitted to the Institute of Environmental Science, University of Rajshahi, Bangladesh for the degree of Doctor of Philosophy is the result of my own study, under the supervision of Professor **Dr. Golam Kibria Ferdous** and Rtd. Professor **Md. Abu Bakr Siddique Bhuiya** Department of Social work, University Rajshahi, Bangladesh.

I further declare that previously this thesis has not been submitted in partially or fully for any degree or diploma either in this university or any other university or institute.

Researcher

Md. Al Amin

Roll No. 14201

Reg.: 40767

Session : 2014-2015

Institute of Environmental Science (IES)

University of Rajshahi, Bangladesh.

Golam Kibria Ferdous PhD

Professor

Department of Social Work

University of Rajshahi.

Cell: +880-1718-259102

Office: +880-721-711158

E-mail: ferdousswru@gmail.com



Md. Abu Bakr Siddique Bhuiya

Rtd. Professor

Department of Social Work

University of Rajshahi.

Cell: +880-1715-137775

Certificate

We do hereby recommend that the thesis entitled “**Survival Strategies of the Environmental Refugees in Pabna District of Bangladesh**” is an original research work submitted by Md. Al Amin for the award of the degree of Doctor of Philosophy in the Institute of Environmental Science (IES), University of Rajshahi, Bangladesh under our supervision.

Principal Supervisor

Co-Supervisor

Golam Kibria Ferdous PhD

Professor

Department of Social Work

University of Rajshahi.

Md. Abu Bakr Siddique Bhuiya

Rtd. Professor

Department of Social Work

University of Rajshahi.

Acknowledgment

First and foremost gratefulness is to almighty Allah for giving me strength, courage and patience to accomplish this study.

I wish to express sincere thanks and gratefulness to supervisors Professor **Dr. Golam Kibria Ferdous** and Rtd. Professor **Md. Abu Bakr Siddique Bhuiya** Department of social work, University of Rajshahi, Bangladesh for their thoughtful supervision, constructive guidance, stimulating suggestions, continuous encouragement and massive support to carry out the entire research and preparing this thesis.

I would like to express my gratitude to the Director of the Institute of Environmental Science who gave me advanced knowledge, good teaching and valuable advice on my research. I also wish to express my gratitude to all the faculty members of the Institute of Environmental Science, University of Rajshahi, Bangladesh for allowing me the opportunity to work on the study. My special thanks to Md. Sultan Ali, Secretary, Institute of Environmental Science, University of Rajshahi, Bangladesh for his cordial support during my research work.

I am highly thankful to Md. Abdus Samad Khan, Principal, Shahid M Mansur Ali College, Pabna, Bangladesh for granting me study leave for pursuing my higher studies.

I am grateful to all the members of governing bodies of Shahid M Mansur Ali College, Pabna, Bangladesh.

I am grateful to the authority of University Grant Commission of Bangladesh (UGC) for granting me a Ph.D fellowship for conducting this research. It was really helpful for conducting my research.

I am highly thankful to my beloved mother, writer, Begum Anawara Aftab, and sister Mrs. Romena Elahi, Library Bazar, D. C. Road, Pabna.

I am very thankful to my wife Mst. Shahanaz Pervin, Assistant Professor, Dept. of Geography and Environment, Shahid M Mansur Ali College, Pabna.

I am also thankful to S.M. Mahbub Alam, Nirbahi Sompadok, The Daily Sinsha, Pabna.

I am very grateful to Associate Professor Dr. Mohammad Nazmul Islam, Assistant Professor Dr. Mst. Shifat Rumana, Dr. Eng. Mrinal Kanti Shaha for giving their valuable time and co-operation during my research.

I am very grateful to Marine Eng. Md. Shah Alam, Md. Rashed Hossain Faruque, Md. Mohoshi ul Alam (Shuvo), Md. Asrafuzzaman, Abu Hena Mostafa Kamal (Bokul), Md. Shohel Ali, S.A. Junaed, Azijun Zannat Ava, Rahiba Amin Asa for giving valuable time and help during my research.

My special gratitude is extended to all those respondents who helped me by providing valuable information during the field survey.

At last my special appreciations to my all family members and friend circle for their cordial support to achieve my goals.

Md. Al Amin

Abstract

A study was conducted to depict the picture of river bank erosion caused by the Padma river alongside the Pabna sadar thana of the district since 2000-2009 and its impact on socio-economic condition of the displaced population. Initially the erosion in the study area was started during Pakistan period. The objectives of the study were to assess the impact of river bank erosion on the socio-economic condition and the survival strategies of the displaced population. Data were collected through a structured questionnaire. 150 respondents out of 223 displaced families were selected on a simple random basis. The study was conducted during the period of August 2016 to March 2018. Data were also collected from secondary sources to understand the erosion situation. The study was conducted following social survey method using statistical tools where necessary.

This study was done in the village named Raninagar of Dogachi union Pabna sadar thana. The study focuses on the existing socio-economic and environmental conditions of the victims. It also explored the survival strategies of the victims in coping with the precarious condition due to riverbank erosion. The environmental adaptation strategies of the victim families were indigenous in nature. In spite of strong requirements for their survival, the victims did not get adequate assistance either from institutional or non-institutional sources. Due to lack of adequate institutional support the victims could not organize their life in the changing environment. The study describes the physical environmental conditions of the study village with a special attention to natural disasters

of the region. It also explored the socio-demographic profile of the victims along with their economic condition before and after riverbank erosion.

At the micro level the study found out as to how the environmental and socio-economic variables influenced the victims' adaptation and their survival strategies to the changing situation.

A considerable proportion of the victims depended on their fate and prayed to Allah to save themselves from riverbank erosion, a good number of the victims were compelled to leave their original homestead and took shelter by the road side, on the embankment and on neighboring relative's land.

The victims resettled themselves in the new place initially with a poor housing and sanitation systems.

List of Abbreviation

AB	Abandoned Channel
AC	Active channel
AM	Anti Meridiem
ASA	Association of Social Advancement
BA	Bachelor of Arts
BBS	Bangladesh Bureau of Statistics
BNCC	Bangladesh National Cadet Core
BRAC	Bangladesh Rural Advancement Committee
BWDB	Bangladesh Water Development Board
CARE	Co-operative for American Relief Everywhere
CM	Centimeter
DDM	Department of Disaster Management
DM	Disaster Management
Fb	Flood basin
FGD	Focus Group Discussion
Fp	Flood plane
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GIS	Geographical Information System
GO	Government Organization
GOVT.	Government
ha	Hectare (1 ha = 2.47 acre`)
HSC	Higher Secondary Certificate
JSC	Junior School Certificate
J.L No	Jurisdiction List Number

Km	Kilometer
Lcb	Lateral channel bar
m	Meter
mm	Millimeter
MS	Master of Science
NASA	National Aeronautical Space Agency
NGO	Non-Government Organization
NI	Natural levee
PSC	primary School Certificate
Ph.D	Doctor of Philosophy
RBE	River Bank Erosion
SAARC	South Asian Association for Regional co-operation
SPSS	Statistical package for Social Science
Sq	Square
SSC	Secondary School Certificate
TK	Taka
TV	Television
UNO	Upazila Nirbahi Officer
VGD	Vulnerable Group Development
VGF	Vulnerable Group Feeding
WMO	World Metrological Organization

Content

Chapter-I: Background and Objectives of the study	1-5
1.1 Introduction and statement of the problem	1
1.2 objectives and justification.....	2
1.3 Scope of the study	4
1.4 Definition of the key concepts	4
Chapter-II: Review of Literature.....	6-17
2.1 Literature review	6
Chapter-III: Methodology of the study	18-28
3.1 Selection of the study area	18
3.2 Sampling procedure and sample size	18
3.3 Data collection and data processing.....	20
3.4 Presentation and Analysis of data	20
3.5 Case study method	20
Chapter-IV: History of Pabna district and river bank erosion ...	29-37
4.1 History of Pabna district and river bank erosion	29
4.2 The history of Padma river erosion and its zone.....	30
4.3 Causes of river bank erosion in Bangladesh.....	33
4.3.1 Natural causes	33
4.3.2 Human made causes	34
4.4 The riverbank erosion prone areas in Bangladesh	35
4.5 Intensity of river bank erosion in Pabna district	37

Chapter-V: Socio-Economic Background of the affected

people	38-61
5.1 Background of the study Population.....	38
5.2 Demographic and socio-economic status of the sampled population	39
5.2.1 Distribution of respondent by age, sex, marital status, family size, education.....	39
5.2.2 Economic condition of the respondents. Assets and liabilities before and after erosion.....	45
5.2.3 Present Landholdings, housing, health and sanitation condition of the respondents	52
5.2.4 At present use of fuel for cooking.....	58

Chapter-VI: Survival strategies of the victims

6.1 Shifting strategies.....	62
6.2 Properties and lives shifting.....	65
6.3 Homestead salvaging.....	65
6.4 Cutting Standing Crops and trees.....	66
6.5 Sale of properties.....	67
6.6 Adaptation strategy to fulfill the basic need	68
6.7 Faced challenges and consequences.....	69
6.8 Homestead and land loss	69
6.9 River bank erosion face by the respondent	69
6.10 To Decrease economic solvency	71
6.11 Dwelling environment.....	71
6.11.1 Community based responses	71
6.11.2 Necessary tools for dwelling situation	72
6.11.3 Dwelling shifting and early preparedness	73
6.11.4 Relocation planning and alternative livelihood	74
6.12 Coping policies in the new situation	75

Chapter-VII: Help received to face the problem.....76-87

7.1 Help received to face the problem 76

7.2 Faced Social problems 79

7.3 Primary shelter and Internal – external help 80

7.4 Maintaining livelihood internal - external
 help received 82

7.5 FGD Meetings 83

7.6 Some case studies..... 85

Chapter-VIII: Geographical and Geomorphological feature

of study area88-98

8.1 Geographical location of study area..... 88

8.2 Geomorphological feature of study area 88

8.2.1 Active channel..... 89

8.2.2 Abandoned channel 89

8.2.3 Natural levee 89

8.2.4 Floodplain..... 89

8.2.5 Flood basin 89

8.2.6 Lateral channel bar 89

8.3 Topographical Features of study area 90

8.4 Environmental Feature of the study area 90

8.4.1 Land use of the study area..... 90

8.4.2 Climate, temperature and rainfall..... 91

8.4.3 Vegetation of the study area..... 94

Chapter-IX: Environmental Impact Assessment (EIA)99-107

9.1 Environmental Impact Assessment.....	99
9.2 Environmental Parameters	100
9.3 Ecological Impact on the study area	100
9.3.1 Aquatic	100
9.3.2 Terrestrial.....	101
9.4 Physico-chemical	101
9.4.1 Land.....	101
9.4.2 Surface water.....	101
9.4.3 Groundwater.....	102
9.4.4 Atmosphere.....	102
9.5 Human Interest	102
9.5.1 Health	102
9.5.2 Aesthetic	102
9.5.3 Socio-Economic	103
9.6 Potential Impacts on Environment.....	103
9.6.1 Losses for Displacement of the study area.....	103
9.6.2 Land loss and land use pattern	104
9.6.3 Change of economical activities	105
9.6.4 Income loss.....	105
9.6.5 House structure loss	105
9.6.6 Crop loss.....	106
9.6.7 Security loss	106

Chapter-X: Some policy implications.....108-117

10.1 Local bodies, Thana administration and national policy.....	108
10.2 Development of National Policy	110
10.3 Prevention phase	112
10.3.1 Innovation of sustainable policy	112

10.3.2 Massive afforestation	112
10.3.3 International alliance	113
10.4 Awareness of people	113
10.5 System of early warning.....	113
10.6 Protection and salvation phase	114
10.6.1 Rescue Team	114
10.6.2 Evacuation announcement	114
10.6.3 Land for resettlement	114
10.6.4 Emergency ration	115
10.7 Rehabilitation policy	115
10.7.1 Plan for resettlement	115
10.7.2 Protection for severely affected victims.....	115
10.7.3 Health support and WATSAN	116
10.8 Livelihood and survival management phase.....	116
10.8.1 Coverage of social safety	116
10.8.2 Education of children	116
10.8.3 Self employment activities	117

Chapter-XI: Summery and Recommendation on the

entire study	118-122
Summary	118
Recommendations	120
Conclusion.....	122

Bibliography and annexure123-142

Appendics-I: Questionnaire..... 134

Appendix-II: Some Pictures about research on the study area 139

List of Table

Table-1: Distribution of the respondents by age group (Head of the family)	40
Table-2: Distribution of the respondents by sex.....	41
Table-3: Marital Status of the respondents.....	42
Table-4: Family size of the respondents.....	43
Table-5: Educational status of the respondents	44
Table-6: Occupational status before and after erosion.....	46
Table-7: Income-earnings of the respondents (Yearly basis) before and after erosion (average)	47
Table- 8: Average monthly income	48
Table-9: Expenditure (Yearly basis) on an average	49
Table-10: Deficit status (Yearly before and after erosion).....	50
Table- 11: Present deficit mitigation strategies of the respondents	51
Table-12: Land holding status before and after erosion.....	52
Table-13: Housing condition before and after erosion.....	53
Table-14: Health condition before and after river erosion	54
Table-15: Sanitation condition before and after erosion.....	55
Table-16: Drinking water supply before erosion.....	56
Table-17: Drinking water supply after erosion	57
Table-18: Present sanitary conduction of the respondents.....	58
Table-19: Distribution according to source of fuel	59
Table-20: Origin of migration	60
Table-21: Distribution according to pattern of migration	61
Table-22: Distribution according to land cultivation pattern	61
Table-23: Settlement strategies	63
Table-24: Occupational mobility before and after erosion	64
Table-25: Salvaging house structure	66
Table-26: Sale of properties	67

Table -27: Adaptation strategy to fulfill the basic need	68
Table-28: River bank erosion faced by the respondent.....	70
Table-29: Economic condition before and after displacement.....	71
Table-30: Help received after river erosion (Last five years)	77
Table-31: Kind of help received by the respondents.....	78
Table-32: For Primary shelter Internal- external help received	80
Table-33:For resettlement internal - external help and assistance	81
Table-34: For livelihood internal - external help received.....	82
Table-35: FGD Meeting with the respondents	83
Table-36: FGD Meeting with the respondents	84
Table-37: Annual Temperature of the study area.....	92
Table-38: Average Temperature of the study area	93

List of Map

Map-1: Physical Map of study area.....	21
Map-2: Map of the study area, village (Raninagar)	22
Map-3: Study Village: Raninagor	23

List of Diagram

Diagram-1: Distribution of the respondents by age group (Head of the family)	40
Diagram-2: Distribution of the respondents by sex.....	41
Diagram-3: Family size of the respondents.....	43
Diagram-4: Educational status of the respondents	44
Diagram-5: Occupational status Before and after erosion	46
Diagram-6: Average monthly income	48
Diagram-7: Land holding status before and after erosion.....	52
Diagram-8: Housing condition before and after erosion.....	53
Diagram-9: Health condition before and after river erosion	54
Diagram-10: Sanitation condition before and after erosion.....	55
Diagram-11: Drinking water supply before erosion.....	56
Diagram-12: Drinking water supply after erosion	57
Diagram-13: Origin of migration	60
Diagram-14: Settlement strategies.....	63
Diagram-15: River bank erosion faced by the respondent.....	70
Diagram-16: Help received after river erosion (Last five years)	77
Diagram-17: Help received by the respondents	78
Diagram-18: Environmental Parameters	100
Diagram-19: A policy model.....	111

List of Photo

Picture-1: The affected village Raninagar (during the dry season).....	24
Picture-2: The affected village Raninagar (during the dry season).....	25
Picture-3: Picture of River erosion (during the erosion period).....	26
Picture-4: Picture of River erosion (during the erosion period).....	27
Picture-5: Picture-5: NASA report, of land lost to Padma, The daily sun	28
Picture-6: House reconstruction types of a new land	73
Picture-7: Essential tools for reconstruction houses.....	73
Picture8: During the Dry season the river Padma	95
Picture9: Active channel of the river Padma.....	95
Picture-10: River cycle	96
Picture11: River zone	97
Picture-12: Corridor of river system.....	97
Picture-13: The importance of nutrient spiraling in rivers	98

Chapter-I

Background and Objectives of the study

1.1 Introduction and statement of the problem:

Bangladesh is prone to natural disasters. Every year a large number of people become victims of various types of disasters like cyclone, tornado, flood, draught, water logging and river bank erosion. Of them river bank erosion is a regular feature of this country. Bangladesh is surrounded by a lot of rivers with their tributaries. Of them, the mighty river Padma, Jamuna, Meghna, Brahmaputra and The Surma are the biggest rivers. Every year the banks of these rivers are being eroded due to flash flood and heavy rainfall. Village after village go under water leaving a lot of people homeless, landless and assetless. Once a man who had enough land and beautiful houses, became homeless due to river bank erosion. These people may be termed as environmental refugees.

The district of Pabna is surrounded by the mighty river Padma on the western and southern side while the river Jamuna on the eastern side. Every year these two big rivers erode their banks taking away village after village and making a large of families homeless. Besides, mosques, temples, schools, colleges also go in the river due to erosion. From a statement made by the WDB of Pabna District, 2500 families of Char Tarapur Union and 3000 families of Dogachi Union became homeless and landless because of the river bank erosion of the river Padma.

The Present study has been designed to identify the refugees of this environmental disaster and to find out the adaptation strategies along with the changes occurred in their life style and living standard.

1.2 objectives and justification:

Objectives:

The main objective of the study is to highlight the survival strategies of those people who become refugees due to river bank erosion. The purpose was to underscore the needs and challenges of these environmental refugees and to find out the solutions thereof. However, the specific objectives were as follows:

1. To assess the socio-economic background of the people of the study area who became victim of river bank erosion.
2. To understand the occupational mobility and income level of these refugees before and after river bank erosion.
3. To evaluate the adaptation strategies of the victim families in coping up with the new environment.
4. To make recommendations to the appropriate authority for taking effective measures against river bank erosion and for the rehabilitation of the affected people thereof.

Justification:

Bangladesh is a disaster prone country. It has been suffering due to evil effect of climate change. Beside other natural calamities, there has been a regular feature of river bank erosion due to flood, excessive rainfall and change of the course of rivers. Now-a-days it has emerged as one of the national problem. In addressing the problem, the nation should think and take necessary steps to minimize river bank erosion once for all. The present study has been designed to understand the needs and problems of the eroded population along with their struggle for existence of life and living.

Though expected, the county is not in a position to address the problem of river bank erosion all at a time. Nation shall have to be prepared to help the distressed people in a scientific way. For that necessary information on them is needed to be collected. The findings of the study will be of useful to the appropriate authority and workers who are working in the field of rehabilitation of the victims of river bank erosion. Furthermore, the findings of the research will be of helpful to appropriate policy formulation for stopping erosion and helping victims for proper rehabilitation.

1.3 Scope of the study:

The study was confined within the impact of river bank erosion as well as survival strategies of the environmental refugees especially of Raninagar village in Pabna district. It did not go to study the impact of other environmental disaster except river bank erosion. It covered family structure, size and income-earnings, mode of expenditure, conditions of health, housing, sanitations, education of the off springs, etc. along with the physical and socio, environmental situations of the victim families of the study area.

Primary data have been collected from the study field, the secondary data were collected from land office, district gazetteer, union council office, local elite and elderly population.

1.4 Definition of the key concepts:

Environment:

Environment is the sum total of biotic and abiotic components that influence life and living. Everything of this world from earth of ozone layer like wind, light, water, sound, soil, forest, hill, river, sea, man made structure, animal, trees, which surround us constitute as environment. According to RM. Maclver and C.H. Page “environment is divided into two parts i.e. one is outer and another one is inner.” Man tries to modify the outer environment to make it congenial for human habitation. It is of two types one is physical and another one is social “here I have considered the physical aspect of the nature as “environment”. Social environment is constituted taking man in his social milieu and Socio-economic perspectives.

Environment refers to the sum total of condition which surround man at a given point in space and time. CC park 1980.

Environment is the sum of living and nonliving components and events surrounding an organism. Goutam Paul. 1999.

Refugee:

A person who has been forced to leave his area or country in order to escape from persecution, due to natural disaster or manmade disaster is called as “refugee”. Generally speaking, a refugee is a displaced person who has been forced to leave or cross national boundaries and who cannot return home safely. Such a person is said to be known as refugee. But in this study “refugee” has been identified as a people who has been forced to leave due to the loss of their lands and shelters due to river bank erosion.

Survival strategies:

‘Strategy’ refers to a method or plan chosen by every biotic animal struggling for the existence of life. Here we have considered ‘Strategies’ as those efforts and plans of the people who have been forced to leave their place of origin along with their homestead assets.

Source: wikipedia.

Chapter-II

Review of Literature

2.1 Literature review:

Review of Literature is an important part of research work for getting a comprehensive understanding of the previous research works done in the relevant field. Thus, the researcher can find out the research gaps and identify the specific area where to hit. With reviewing the literature the researcher can be more specific in selecting the research topic more specifically.

Reports of the World Conference on Disaster Reeducation of (UNO) has pointed out an idea about the impact and consequences of the victims of environmental refugees all around the world. It has also mentioned the efforts of international community on their different initiatives which were taken by respective Governments, Non-Government and international agencies. (UNO-2005).

Hossain and Ferdousi (2004) reported that Bangladesh having an area of 1,44,000 sq.km. and a population of 160 million is a disaster prone country. Riverbank erosion in Bangladesh is a regular phenomena in terms of natural disaster which takes away thousand hectares of land every year.

Sarkar et. al. (2003) mentioned that Bangladesh consists mainly of riverine and deltaic deposits of three large and extremely dynamic rivers entering the country i.e. the Bramhaputra, Ganges and Meghna rivers.

Hutton and Haque (2003) discussed in their study that the constant threat of river bank erosion has contributed to a substantial disaster subculture in the riverine zones of Bangladesh.

Sarker and Thome (2003) incorporated information about riverbank erosion to depict the problems of impoverisation derived from two villages. The villages demonstrate extreme problem on land loss, damage of crops, livestock and ether assets. The study conducted on the basis of household survey contained information relating to socio-economic background of households, nature and magnitude of the problems caused by erosion and also the survival strategy of the displaced populations. It found that people undertake three types of strategies either in combination or independently. These were selling of assets, seeking alternative employment and also migrating to other areas.

Goodbred (1999) made another such studies. Goodbred tried to examine the causes of the changes in the land and rivers of the Ganges delta. Depending upon his field observations and studies of the secondary data sources he presented a qualitative appraisal of the data, where he tried to highlight the physical changes in the valley of the Ganges, historical evidence of the changes in the delta and the processes of encroachment of the alluvial morphological features of the whole of the Indo-Gangetic plain and its importance of mapping in geographical studies.

Amin (1999) focused on the settlement strategy of riverbank erosion displaces and argued for human resource development as a device for evolving a settlement strategy.

According to Brammer (1999), riverbank erosion is most serious on char land within and adjoining area of Teesta, Brahmaputra-Jamuna, Ganges and lower Meghna rivers, and in the Meghna estuary. The erosion occurs most rapidly during the rainy season, but the banks of the river slumping with regular through the dry season in places where rapid river flow regulars to undermine riverbanks.

Chowdhury et al, (1999) delineated and analyzed the type, nature and characteristics of human adjustment strategies to cope with the riverbank erosion hazard in the Jamuna floodplain. In Kazipur thana of Sirajganj District the two thirds of the areas were chars which constitute one of the worst areas affected by river bank erosion. A description in general terms of the possible range of human options and choices in adjustment and a conceptual framework were provided. Distinction was made between purposive and incidental adjustments and also various modes of adjustments to cope with 'the hazard that includes acceptance, reduction and changes. It has pointed out that the adjustment strategies at the community level were characteristically preventive, while, the individual level they were corrective.

Elahi *et al.*, (1991) discussed the problem of population displacement due to riverbank erosion caused by shifting of the Brahmaputra-Jamuna River. The paper also focused on the morphological behavior of the Jamuna River, together with its shifting tendencies based on Land sat images, large-scale maps, extensive field observation and anthropological investigation. The erosion had significant impact on differential population change on related human occupancy and bank line settlement of displaces. Elahi, tried to make a link among the flood hazard, riverbank erosion and population displacement. Although the shifting of river courses was related to hydrological process and the obvious result of which was the widespread flood and riverbank erosion bringing untold suffering for the people of the country. The study contained discussion on the nature and extent of riverbank erosion and population displacement in some selected areas.

Choudhury (1991), In Bangladesh due to river bank erosion and flash flood are displaced ever year. In Particular the river like the Jamuna has been continuously shifting form time immemorial and hence channel movement and hank erosion have become common phenomena. The meandering and braided rivers always run the risk or changing course thereby eroding the existing bank and making continuous attack on human settlements.

Karim, A. H. M. Zehadul (2014), A. H. M. Zehadul Karim conducted a study on “Flood and Riverbank Erosion Displacees: Their Indigenous Survival Strategies in Two Coastal Villages in Bangladesh”. He

mentioned that due to riverbank erosion and flood, the victims need to adapt with the changing environmental conditions, and consequently they need to adopt many socio-political, economic and cultural strategies in order to survive in the face of the plethora of problems. Displaces tried to take control over their environment through their multi-dimensional adaptation strategies. This study identified the different local policies and mechanisms which the victims adopt usually to cope up with the disaster effects of river erosion and flood in the coastal areas in the country.

Uddin, A.F.M Azim and Basak, Jayanta Kumar (2012), A study was done by A.F.M Azim Uddin and Jayanta Kumar Basak entitled "Effects of Riverbank Erosion on Livelihood" in the area of Lalcama Village in Sundarganj Upazila of Gaibandha District and Bishurigacha an Old Meghai village of Kazipur Upazila in Sirajganj District. The findings revealed that respondents of poor income group had less ability in spending money for food, educational expense and health care facilities.

Islam M. S. Et, Al, (2012), A joint work of M. S. Islam, T. Hasan, M. S. I. R. Chowdhury, M. H. Rahaman and T. R. Tusher Department of Environmental Science and Resource Management, Mawlana Bhashani Science and Technology University, Tangail, Bangladesh, conducted a study entitled "Coping Techniques of Local People during Flood and River Erosion in Char Areas of Bangladesh". They pointed out that floods and riverbank erosion in the deltaic region were not a small problem. The study found that flood and erosion have a disastrous impact on socio-economic condition of the victim families as well as on the worst

situation. The study was done in two char villages located in the middle of the country. The people faced the river erosion by means of a wide range of practices. In this research it was revealed that maximum homestead were built by C1 sheet, wood, jute stick and bamboo. The victims used various policies in reducing loss and in transfer their assets from flood and riverbank erosion to somewhere else. At last, the study concluded that although flood and river erosion in the country always create socio-economic and health hazards including environmental and infrastructural problems but government takes little or no attention to solve the problem faced by the affected people except giving temporary relief.

Rahman, M. A. and Rahman, M. M. (2011), Mohammad Arifur Rahman and Md. Munsur Rahman Conducted a study entitled "Impact of Livelihood Practices of The Char Dweller's on Economic Condition in Riverine Chars: A case Studie in Bangladesh." The study attempted to understand the livelihood patterns and survival strategies of the displacees. The study was conducted at char Konabari of Rajapur union under Belkuchi Upazila of Sirajgonj district and Dakshin Boro-char of Eklashpur union under Uttar Matlab, Chandpur district.

Islam M, Fakrul, and Rashid, A.N.M. Bazlur (2011), Md. Fakrul Islam and ANM Bazlur Rashid. conducted a research entitled "Riverbank Erosion Displacees in Bangladesh: Need for Institutional Response and Policy Intervention" According to them displacees of riverbank erosion failed to draw attention of the appropriate authorities. River erosion

victims do not get enough media coverage as like the victims of other disasters. So that, a silent catastrophe affects to these unfortunate group. Moreover, there is no any particular strategy or policy for the riverbank erosion victims neither of the government or of nongovernment agencies. They observed that most of the victims move to take shelter different government offices for getting relief. Because, the authorities of their original area could not assist them. The officials of resettled area had limited scope to assist them as they were not the victims of their own administrative area. As a result the victim families become most vulnerable to survive.

Government of the People's Republic of Bangladesh (2010), In the report of National Plan for Disaster Management 2010-2015, Disaster Management Bureau, Disaster, Management & Relief Division (April 2010) mentioned that about 1(one) million people and about 10,000 hectares of land is eroded by river bank erosion every year in our country (NWMP, 2001). Kurigram, Gaibandha, Jamalpur, Bogra, Sirajganj, Tangail, Pabna and Manikganj districts are the most river erosion prone area with the Jamuna and Padma basin. Other districts are Rajbari, Faridpur, Dhaka, Munshiganj, **Shariatpur** and Chandpur. A recent study of CEGIS (2005) shows that river erosion along the Padma River at the period of 1973 - 2004 was 29,390 hectares and with Jamuna River at the period of 1973 - 2004, 87,790 hectares.

Rahman, M.R. (2010), Another study was done by M.R. Rahman, Institute of Environmental Science, University of Rajshahi, on "Impact of Riverbank Erosion Hazard in the Jamuna Floodplain areas in our country" revealed the effects and consequences of hazards faced by the respondent families of river bank erosion.

Islam, M. Zulfiquar Ali (2009), Another study was conducted by Dr. M Zulfiquar Ali Islam of the Department of Sociology, University of Rajshahi on "Indigenous Adaptation Strategies of the Riverbank Erosion Displacees in Bangladesh: It was done on two northwestern villages - Khoksabari of sadar upazila and Natun Meghai of Kazipur upazila under Sirajganj district. A few percent of victim families from various adjoining eroded areas of Jamuna basin settled down in two study villages. The major findings of the study along with other things covered indigenous strategies which were taken by the victims for their existence. A considerable number of the displacees sold their valuable assets at the time of disaster for minimize their losses.

Taleb, Md Abu, Et, Al (2009), Md. Abu Taleb, Md. Humayun Kabir and Md. Muhibbullah, Department of geography and Environmental Studies, University of Chittagong and Department of Geography and Environment, University of Dhaka. Conducted a study on "Survival Strategies Among Erosion-Induced Displacees at Haimchar Upazila, Chandpur District, Bangladesh". They mentioned that during the last three decades about 35,605 peoples were the victim due to river bank erosion. Maximum victim families were living on embankment side. The

people were worried as to when their land would be eroded by the river. These victims were faced 3 times disaster at the last three decades. The survival strategies of the affected people were also discussed in this study.

Keya, Mahbuba Kaniz and Harun, S.M. Rafael (2007), Mahbuba Kaniz Keya and S.M. Rafael Harun conducted a study on "Riverbank Erosion Induced Stress and Coping Strategies of Displaced Women in Bangladesh". The study discussed to identify the ways by which displaced women used to cope up with their day to day problems. The results showed that these women used significantly different coping mechanisms compared to non-displaced ones.

Haque and Zaman (1989), Discussed the general impacts of erosion hazards in the lower Bharamaputra (Jamuna) floodplain of Bangladesh. By the disaster of river bank erosion were counted in the loss of land properties, change with occupation, and the impacts of social values and relationships. The basis of the analysis of impact was based on a survey studied on 547 randomly selected displaced homestead. It mention that a huge proportion of households who had main income was agriculture they became weaver, day labor following dislocation of this disaster. It was found that, some pragmatic measure should be taken to ameliorate this problem. They discussed the general impact of erosion disaster in the river Brahmaputra (Jamuna) floodplain of the country. Authors also focused on the nature of perception about hazards among floodplain

inhabitants and also on the indigenous adjustment strategies to cope with the hazard effects.

Khan *et. al.*, (1999), Reported that the riverbank erosion is a constant and age-old disaster that has rendered the formation of the char land of Bangladesh. Previously the population was a sizable one, but it has risen in number. River erosion is a regular process for which this type of natural disaster fails to draw an attention like another types of natural disaster like flood, tornados etc. But river bank erosion causes huge loss of properties and lives as any other. From to the GIS data the river erosion consumes about 8,700 hectares of arable land all the year round. About 10,00,000 peoples are affected by it in the period of 1998, 6,00,000 households, about 5,00,00,000 people were directly victim by the river erosion. The populations were tillers of the land, who had no capacity in retrieving their loss and thereby many of them had to migrate to the cities seeking for subsistence. They were considered as floating populations with no defined job or social status.

Rahman (1988), Described economic strategies for the survival of rural populations affected by riverbank erosion. The emphasis being on economic strategies, therefore, it differed from similar other studies. It emphasized the survival strategy of the rural population in the wider context of environment and society. The economic strategy was likely to be different due to difference in economic condition households, small, middle and rich peasantry were incorporated within the a model.

Bimol (1984), Described various responses to riverbank erosion hazard at individual, local and national levels. He draws attention on many dimensions of the human and institutional factors related to one another which create an array of direct cause accentuating levels of poverty and marginalization.

Nazmul *et.al.*, (2012), Riverbank erosion induced migration by the Char-dwellers in Bangladesh: Towards a better strategy, Asian journal of environmental and disaster management, vol.4, No. 3. Many the victims in the study field are forced to migrate with their houses due to the disaster of riverbank erosion. In the dwelling migration and displacement, they need fruitful management in various polices to reduce vulnerabilities and damages. The subject matter of this study is to explore best transfer strategy and essential conditions that enable it, and evaluate a adaption strategies in coping up with the new environmental situation.

Nazmul *et.al.*, (2018), Community-based responses to flood and river erosion hazards in the active Ganges floodplain of Bangladesh, Science and Technology in Disaster Risk Reduction in Asia. In the study the researcher state that to minimize their risks and the proportion of damage, they attempt to cope up with these natural disasters despite the fact which they have very low adaptive capacity. They have applied their own strategy to face their family form this disaster. With the chip local construction materials they cope up to make a new shelter, they used different indigenous technology and local skilled policy according their knowledge.

The above literature review were mostly depicted the historical background causes and consequences of the riverbank erosion in Bangladesh. Most of the studies were devoted to find out the damages done by erosion. So, there remains a gap of survival strategies of the affected people. I have chosen to fulfill the gaps as far as possible.

Chapter-III

Methodology of the study

3.1 Selection of the study area:

For identifying and selecting the study area, help was taken from the WDB of Pabna district. Maximum river bank eroded area was selected taking with the list of the victims. One big village was selected as a sample purposively. Out of 223 victim families of the village were identified, of them 150 families were selected following simple random basis. Data were collected from them through a structured questionnaire after duly been pre-tested and finalized.

3.2 Sampling procedure and sample size:

Sample size determination was one of the most important problems in planning a survey work. Sample size was needed for the estimates to be authentic figure to meet the objectives of the study. The sample size determination is significant for accuracy of research outcomes. Extra-large a sample involves huge cost, manpower, materials and time, whereas too small a sample overturns the results of the survey.

The study considered a small population, therefore, the sample size was determined using the following equation:

$$\text{Sample size, } n = \frac{Nn_0}{N+n_0}$$

$$\text{Where, } n_0 = \text{desired sample size} = \frac{z^2 pq}{d^2}$$

z = Assumed standard z – score usually set at 1.96, which corresponds to the 95% confidence level,

p = Assumed standard deviation estimated to have a particular characteristics, usually set at 0.5,

d = Allowable margin of error (confidence interval 0.05),

$q = 1 - p$ = for small population size,

N = Population size.

According to the law of Guilford & Fruchter 1971; 247.

Social survey method were followed to collect data from the study field. Besides, A structured questionnaire was prepared and pretested and finalized. Moreover local elites, social and political leaders were interviewed to get their opinion in solving the problem. Focused Group discussion was also arranged to understand the gravity of the situation. Finally, methodology of the study was finalized in consultation with the supervisor and experts in the line.

The study was conducted on 150 victimized families by river bank erosion of the study area. There are almost 223 families who were victimized by river bank erosion and the years. Among them 150 victimized families were selected after long inspection and discussion with the victim and leaders.

3.3 Data collection and data processing:

Primary data were collected from the selected victim families. Head of the family were the interviewed. Secondary sources were utilized. Information from relevant papers, articles, research studies, daily newspapers were also consulted.

Collected data were also reviewed, classified, tabulated and analyzed. Data have been presented in tables. These tables were prepared in order to show percentages. The data were also presented and analyzed in an orderly and systematic way. Some statistical techniques were also used and followed.

3.4 Presentation and Analysis of data:

Data have been presented through multivariate tables and pictures. Statistical techniques such as percentage, and test of signification have also been used to analyze the data. Data has been computerized and analyzed using various software techniques.

3.5 Case study method:

According to F.V. Young (1984;247), “case study is a method of exploring and analyzing the life of a social unit be that unit a person, a family, institution, culture-group, or even an entire community.

- It is technique of inquiry the magnitude of any research.
- Case study is analyzing the life of a social unit.
- Be that unit a person, a family or culture group.
- By case study only researcher and respondents can explain their problems.

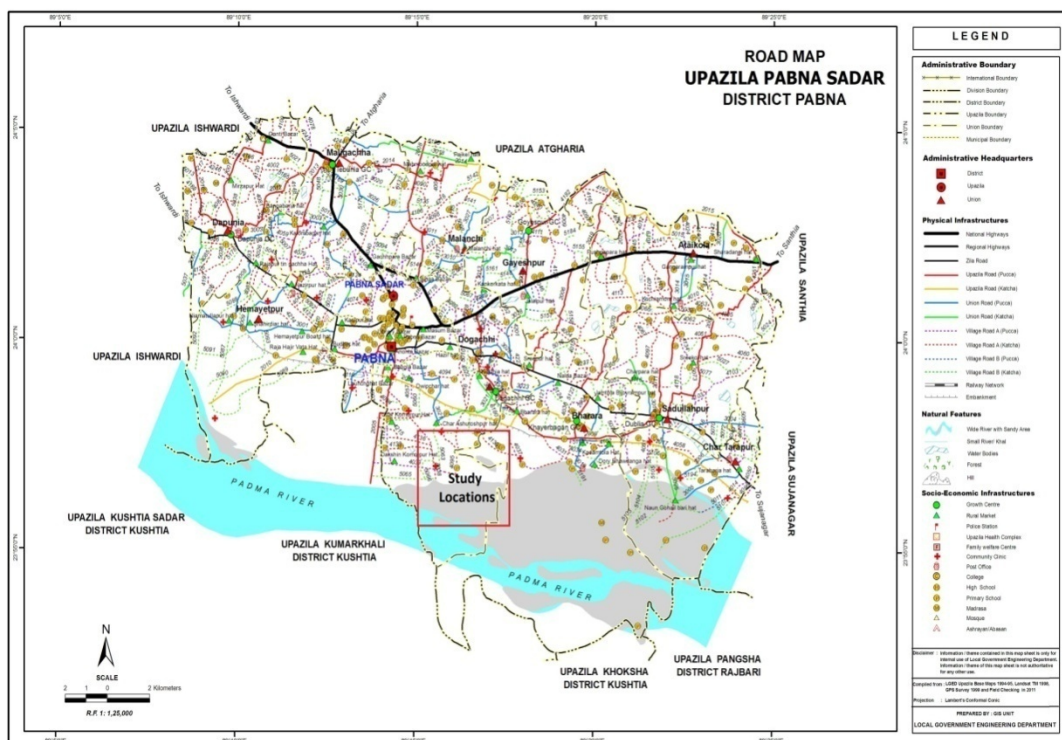
In this study some case study technique has been used and followed.

Map-1: Physical Map of study area



Source: Internet

Map-2: Map of the study area, village (Raninagar)



Source: Local government Engineering department Pabna.

Map-3: Study Village: Raninagor



Source: Google Arth, GIS.

Picture-1 : The affected village Raninagar (during the dry season)



Picture-2 : The affected village Raninagar (during the dry season)



Picture-3 : Picture of River erosion (during the erosion period)



Picture-4 : Picture of River erosion (during the erosion period)



Picture-5: NASA report, of land lost to Padma, The daily sun

daily sun

metropolis

66,000 hecets of land lost to Padma in 51 yrs

Says NASA report

More than 66,000 hectares (256 square miles) of land have been lost—roughly the area of Chicago, one of the biggest cities in the US—to erosion caused by the Padma River since 1967, reports UNB.

That is according to an August 2018 report published by the NASA Earth Observatory, the arm of the US space agency that is focused on the planet we live in.

The extreme erosion patterns of the Padma are known to have two main causes. First, it is a natural, free-flowing river with little bank protection, other than some occasional sandbags to protect buildings. Second, the bank sits on a large sand bed that can be eroded quickly.

Scientists measure erosion on the Padma River by noting differences in its width, depth, shape, and overall appearance on satellite images. The NASA report, "The Shape of Erosion", compares natural-color satellite images showing the changes to the shape and width of the Padma since 1988.

Each "twist and zigzag" is said to tell a different geologic story about the river. The images were acquired by NASA's Landsat satellites: the Thematic Mapper Plus on Landsat 5, the Enhanced Thematic Mapper Plus on Landsat 7, and the Operational Land Imager on Landsat 8. All images were acquired in January and February, during the dry season. Page 2 Col 6



Satellite image of NASA Earth Observatory.

Source: daily sun, Dhaka | Saturday | 15 September 2018

Chapter-IV

History of Pabna district and riverbank erosion

4.1 History of Pabna district and riverbank erosion:

The district of Pabna is situated on the north-western side of Bangladesh. It was established in 1832 as a district of this country. It is under the divisional of Rajshahi which is situated on the north-west of the district of Pabna.

Some historian says that the name of the district as Pundra over the name of the civilization of Poondrabordhon. Mahasthangarh was the capital city on that civilization. This oldest place is situated in neighboring Bogra district. But the hypothesis of Archologist cunninghom did not receive this view. In 1859 the major areas of the district was the part of indigo revolt. At the beginning of Yusuf shahi time in 1873 the serfs resisted executive demands of increased rents by feudal lords, that operated with N. Banerjee and Dwizendranath tagore, by developing an Agrarian league. It established at the time of 1879 by a particular judgship for the dstrict of Bogura and Pabna.

Some people imagine that in a certain period a small river Poboni had flown on this area. According the name of the small river the name of this district became Pabna.

Now Pabna has 9 upozillas, 8 municipalities, 72 unionporished and 1321 mouzas. The district of Pabna has 1540 villages. The district of Pabna is situated on the bank of the bigger river Padma on the western and southern side while the river Jamuna on the eastern side.

4.2 The history of Padma river erosion and its zone:

The river Ganges originates from the glacier Gangotri of the Himalayan Mountain. After the development of the river the Ganges flows in the country between India and Bangladesh. After flowing a large area in India it enters in Bangladesh at the thana Shibganj of Chapai Nababganj district. At the west side of the thana Shibganj, this river is classified into two branches, The name of the one is Bhagirathi and the other one is the Padma.

The river Bahgirathi flows southwards side. This is known to the people of India as the river Ganga at the period of British it was named Hooghly river. At the downstream near Goalando gath 2200 kilometers (1400 mi) from the source, the river Padma joined by the river Jamuna which is called the lower Brahmaputra. The flows of the river flows by the name Padma to Chadpur. The Meghna which is the widest river in our country joins into the river Padma near Chadpur. The combination of these two rivers, flows as a straight line to the southern region in Bangladesh in the Bay of Bengal of which is the part of Indian ocean.

Bangladesh is prone to natural disaster. The erosion of river is a regular feature in our country. This country is surrounded by a lot of rivers and their tributaries. River bank erosion is also an endemic and recurrent natural disaster in the country. It is known to all that all rivers have three courses. At the young stage river is small and it flows with steep slopes. With loss of energy. At this stage the erosion of river is downwards type.

When the river enters its mature stage it becomes braid, meander and sluggish in the river. The oscillation of the mighty river the Padma and the Jamuna occur a massive erosion in their middle course in river cycle.

A lot of families are affected by river erosion in every year. The banks of those river are being eroded due to flash flood, oscillation and heavy rainfall. Village after village go under water leaving a lot of families land less, asset less and home less. Once a person who had enough assets and lands and beautiful houses, become homeless and asset less due to river bank erosion. Actually these people are environmental refugees.

In Bangladesh 05% people of the total flood plain are directly victim due to river erosion. By the research of riverbank erosion of some researcher the erosion is taking place that out of 489 upozilas 94 upozilas are directly affected by erosion of river in our country. Some researcher comments that 56 upozilas with incidence of river bank erosion. But Now a days river erosion with flood hazards in nearly 105 upozilas reach as a regular feature of this natural disaster. Of those victim areas 35 upozilas are affected severely.

According the oscillation and course of rivers some areas face a large, scale river erosion with high frequency. Within a short time village after village go under water making a lot of people homeless and refugees due to this large scale river erosion. Some time the river assum different pattern as braided type. The river consists of various channels and separated with small lands in the flowing course. During the rainy season this impact plays a massive disaster to the banks of these rivers.

In Bangladesh during the rainy season due to massistive rainfall, flash flood, different courses of river and by the type of oscillation the sandy bank of the river erodes easily. As a result a huge portion of agricultural land, homestead land, farmland, standing crops and valuable standing trees had gone under the river. At the time the wideness of these river

increased day by day. The density of water increased with these sandy soil and different organic materials. When flash flood occurs in the victim zone. Both sides of the river overflows and the crops of the field go under the water. When excessive rainfall spread any place the river have to carry a large scale water presser. On the other side due to oscillation of the river the silty banks of the river erodes by the presser of water. On the other side, by course of rivers the sandy soil, organic and inorganic materials and other polluted materials flows in the river. With this materials the flow of river water make a high density mixture. At this middle course the river carry a heavy sediment and through the loded materials to the mouth of the river.

At the time of flowing the river has no systematic pattern of erosion. The intensity of erosion dependents on the variety of river and the supply of sediment and water. It also dependent on the types of Banks of the river. Like, sandy bank erodes easily. The mountain side bank cannot erodes. So the continental slop cannot grow the high land side.

The materials of bank of the river Ganges consists of sand and loosely. The corridor of the river is very active on the other side the materials of bank side is very susceptible for erosion. The process of erosion of the Ganges mainly depended on its limestone prone bank side. Near the Harding bridge of the district Pabna the river erodes along both sides. When the river reaches meandering phases maximum bank erosion occurs this time. Within the river corridor the active bend can also still migrate laterally.

The river Pabna are flowing traditionally with a meandering types. Some time it switching on to a braided type. For the increased and suspended

sediment the bar increasing rate are developing particularly the sand fractions and increase of loaded materials. Those causes can have accelerated the erosion of river for directing village to village to the finer flow to the river bank.

4.3 Causes of river bank erosion in Bangladesh:

Bangladesh is a riverine country. Every year various types of disasters like tornado, cyclone, flood, draught, water logging, river erosion heat our country. Of them river bank erosion is a recurrent and regular feature of this country. Causes of riverbank erosion is classified in to two types.

1. **Natural causes.**
2. **Human made causes.**

4.3.1 Natural causes:

1. Change the course of rivers:

The river usually changes its way by natural system. By the cause of earthquake the river may change its flow to certain massive riverbank erosion occurs at this period. At the time of new flow of the river total area goes under the river.

2. Deposit of sediment:

From the primary phase the river carries a lot of sediment with its flow. Day by day this huge sediment deposits on the river bed. For this the load capacity of river water may decrease in the river. So, both sides of the river bank carries the presser of river water. As a result the bank of erosion occurs naturally.

3. Oscillation:

When the river comes into middle stage of its life cycle. The river flows with carrying a high density sediment to the surrounding areas in the river. This high density waves of the river, erodes the bank.

4. Massive rainfall:

Due to massive rainfall the water level of the river increase and flows quickly. As a result erosion occurs naturally.

5. Nature of soil:

River bank erosion mainly depends on the nature of soil. The current of river cannot erode the hard rock or hard soil. Other side the silty or sandy banks of the river cannot stand against the current of the river. So, erosion occurs easily of the river bank.

6. Effect of flood:

During flood a huge water flows on the river. On the other hand the water of flood, stays a long time both side of the river bank and causes erosion.

4.3.2 Human made causes:

1. To cut trees on bank side:

The roots of different trees catches the soil as a fishing net. So, it is called that the root of trees are the natural nets to protect river bank erosion. By dint of root nets the wave of river cannot erode the banks easily.

2. Regular river drizzling:

During the flow of water with the deposits of sediment in the river bed, day by day deposits in river. The carrying capacity of water decreases day by day. To give up the sediment on the river bed. The drizzling is essential. Other wise it occurs the erosion of the river bank.

3. High water vehicle transportation:

For the transportation of water vehicle. It produce a heavy water wave that heats both sides of the river. As a result the bank of rivers erodes time to time.

4.4 The riverbank erosion prone areas in Bangladesh:

Bangladesh is known to riverine country. A lot of rivers are flowing as a fishing net in the country. The bay of Bengal is standing to the south side of the country. Last address of the maximum rivers are the bay of Bangal. Which is the bay of Indian Ocean. At the time of flowing to the south the banks of those rivers are being eroded. Village after village go under water leaving a lot of people homeless and refugees.

Name of the district	Affected areas of the district of Pabna
Pabna	The district of Pabna is situated by the side of the river Padma on the western and southern side while the river Jamuna on the eastern side. At the period of 2007 the Raninagar, Sodorajpur, Char Komorpur, Bharara,

	Bhaduradangi, Sagarkandi, Nazirgonj, Shara union, Ishordi of the district were the victim of river bank erosion. In 2007 the village of Raninagar, Sodorajpur, Char komorpur were the victim of river erosion.
Name of the district	Affected areas of the district of Sirajgonj
Sirajgonj	Every year the Kajipur of Sirajgonj district are the victim of the mighty river Jamuna. The home less people transfer their shelter in road side, embankment side and various government administrative zone.
Name of the district	Affected areas of the district of Rajbari
Rajbari	The mighty river Padma flows by the north side of Rajbari district. The another mighty river the Jamuna has joined with the river Padma. At the period of 2007 the village Char Dhunci and Char Silimpur of Mizanpur union of the district 50 acors of land had gone in the river. August 2007 two Fari ghat of Doulodia which the Goyalando upozila started river erosion. By river erosion these ghat destroy a lot of transportation and people were the victim of riverbank erosion of the river Padma.

Source: Rahman. M. Arifur 2018.

4.5 Intensity of river bank erosion in Pabna District:

The Padma River is known for heavy bank erosion, shifting channels, and sandbars that continually emerge in its course. The Mahanand is the main tributary of the river Padma. The Madhumati is the other main distributaries of the river Padma. In the upper course of Padma the Garai is another distributaries of this river. The water flow of the river Padma is controlled with seasons by the Barrage of Farakka, located a few kilometers upstream in West Bangal, India. A proportion of major rural and urban centers, with Rajshahi and Pabna, are situated along the river Padma. For the busy water flow and enough sources of fisheries the river Padma is famous.

The exact history in not found though there are many study conducted on river bank erosion. It is said from the history written by various researchers that the river erosion began from its birth. But sometimes it was seen acutely. Now it is out of control in Bangladesh especially in Pabna district.

The intensity of river erosion in the research area is very high. The banks of river of this area were very sandy and high level. When current of water flow erosion occurs this area easily. In the time of study respondents inform that somebody already migrate their house in 16 terms of his 85 years lifetime, period. Some respondents had resettled their houses two terms in a year. They had a terrible sanitation system. Sometimes found 500 meters of land were eroded by this river in a day.

Chapter-V

Socio-Economic Background of the affected people

5.1 Background of the study Population:

Most of the people used to maintain their livelihood by doing agricultural activities, like land cultivation, fishing, land labour and open dairy farm. Specially during rainy season they become dependent on fishing. Some victims also go to town area as migratory workers. After rainy season when the alluvial soil is found in the bank sides of the river the people cultivate oil seeds and pulse type crops.

The land use is mainly determined by the duration and depth of seasonal flooding by the availability of soil moisture in dry season. Rice is the principal crop throughout the area. Whenever, the land only shallowly flooded or water could be kept on the land by small bounds, farmers grow Chinese nut and Sun flower followed by Rabi crops. Where sufficient dry season moisture is available, a dry land crop is often grown after the main harvest. Dry land Rabi crop could not be grown in soils which remain wet for some weeks after the end of the rainy season. In the rainy season the Padma floodplain became deeply flooded, sudden rise of flood level and current of water prevent the cultivation of kharif crops in most of this area. However, local rice is grown because large sandy areas remain wet for most or all of the dry season. Rabi crops mainly included khesari, mustard seeds, teel, gram, sweet potatoes etc. Homestead sites are generally on the artificially raised mounds and intensively used for bananas, vegetables, fruit trees and nurseries.

5.2 Demographic and socio-economic status of the sampled population:

According to the population and Housing census 2011, The study area (Dogachhi Union) had a population of 64,809, of whom male were 33382 and Female 31427 and literacy rate were 42.49% and land of this area are 14229 (acre).

The village Raninagar has a Total household 223, Total population 968 among them male 478 and female 490.

source: population and Housing census, Bangladesh Bureau of statistics, 2011.

5.2.1 Distribution of respondent by age, sex, marital status, family size, education:

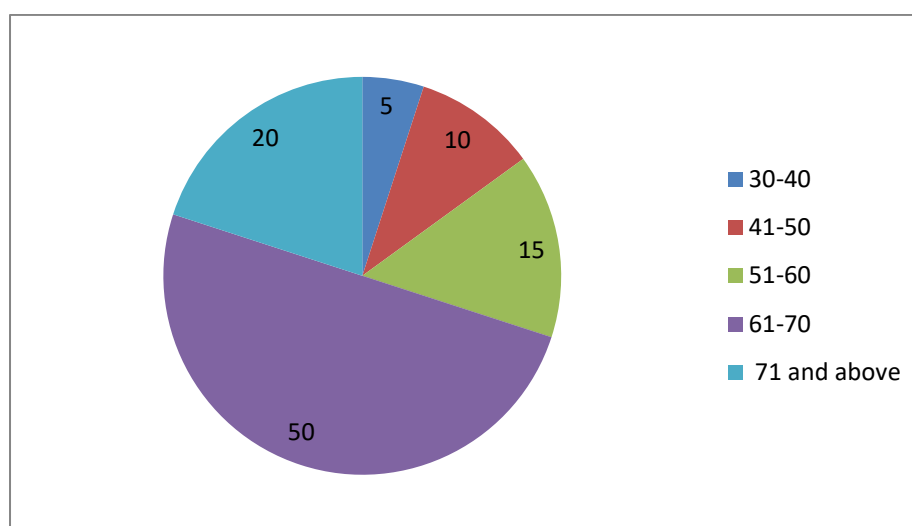
The age distribution of respondents can be found in the following table.

Distribution of the respondents by age group (Head of the family)

Table 1:

Age Limit	Number	P/c
30-40	07	4.67%
41-50	15	10%
51-60	23	15.33%
61-70	75	50%
71 and above	30	20%
	N=150	100%

Source: Field data



Digrame-1: Distribution of the respondents by age group (Head of the family)

The table shows that age limit of the respondents 4.67% are within the age limit of 30-40 of 10% from 41-50, 15.33% are between 51-60, similarly 50% are between 61-70 and 20% are 71 to above age living in the study area.

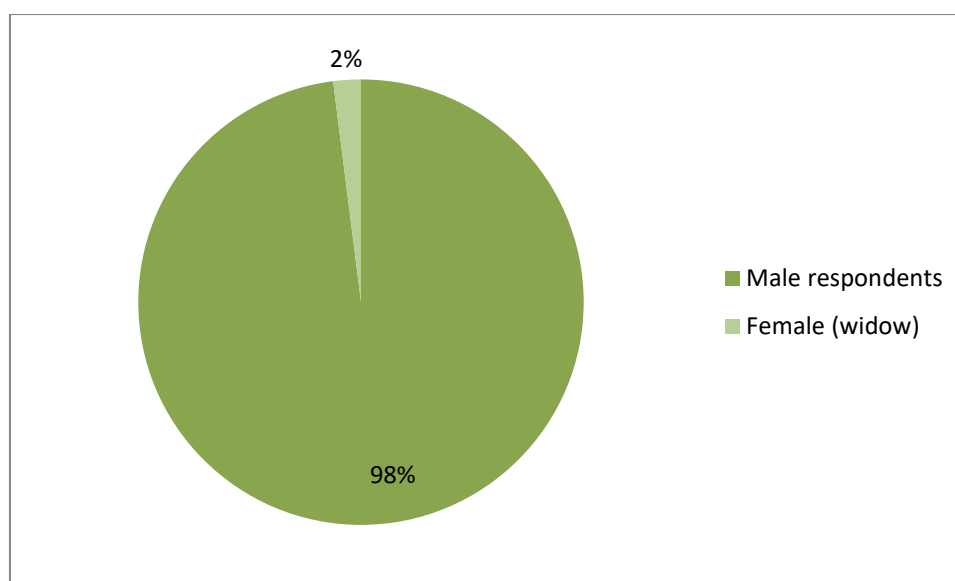
Comments: Maximum respondents were age limit of 61-70 years in the study area.

Distribution of the respondents by sex

Table 2

Male respondents	147	98%
Female (widow)	03	02%
	N= 150	100%

Source: Field data



Digrame-2: Distribution of the respondents by sex

The table shows that there are 98% male and 02% respondents female living in the study area.

Comments: Only 02% respondents were female and widow on the study area.

Marital Status of the respondents

Table-3

Married	147	98%
Unmarried	00	00%
Widow	03	02%
	N=150	100%

Source: Field data

The table shows that 98% respondents were married and 00% respondents were unmarried and 02% were widow.

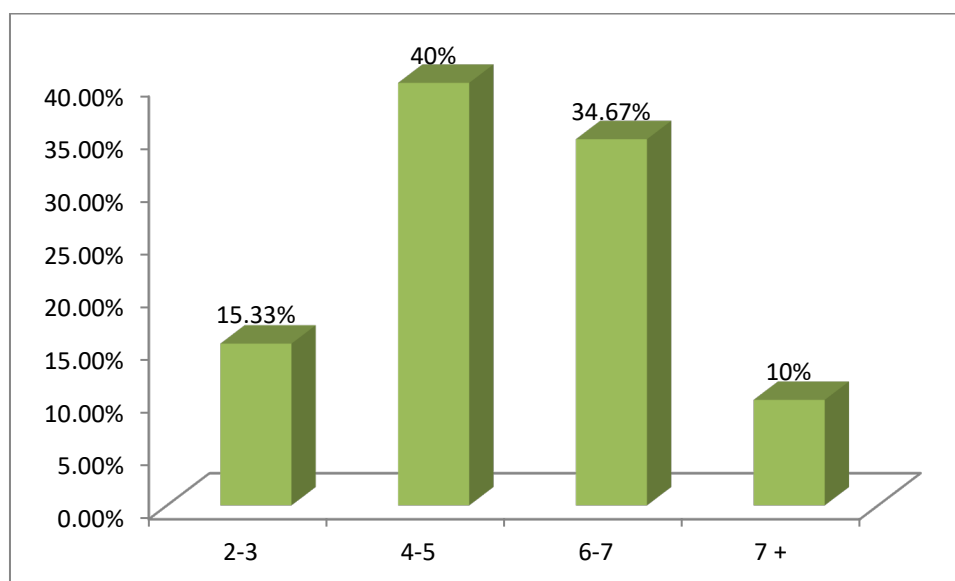
Comments: All respondents of the study field were married and 02% were widow.

Family size of the respondents

Table-4

No of family members	Number	PC%
02-03	23	15.33%
04-05	60	40%
06-07	52	34.67%
7 +	15	10%
Total	N=150	100%

Source: Field data



Digrame-3: Family size of the respondents

The table shows that 15.33% families have 02-03 members, 40% having 04-05 members, 34.67% having 06-07 members and 10% having 7+ members in the study area. Most of them having joint family system. Some of the respondents having more then one wife.

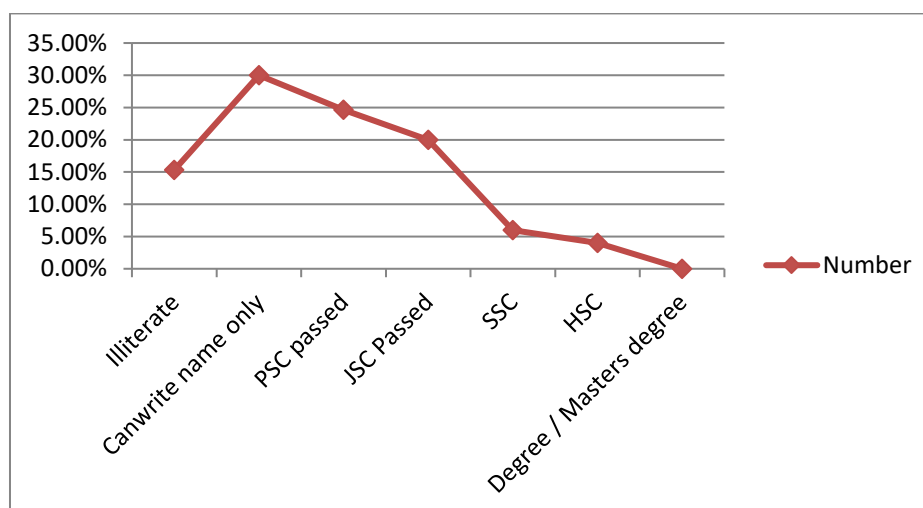
Comments: Only 10% respondents has more than 7 members in their family.

Educational status of the respondents

Table 5

Level of education	Number	PC %
Illiterate	23	15.33%
Can write name only	45	30%
PSC passed	37	24.67%
JSC Passed	30	20%
SSC	09	06%
HSC	06	04%
Degree / Masters degree	00	00%
Total	N=150	100%

Source: Field data



Digrame-4: Educational status of the respondents

The table shows that 15.33% respondents are quite illiterate and 30% can write their name only, 24.67% passed PSC and JSC 20%, SSC 06% HSC, 04% only. There is no degree or master degree holders were found in the study area.

Comments: Maximum respondents can write their name only.

5.2.2 Economic condition of the respondents. Assets and liabilities before and after erosion:

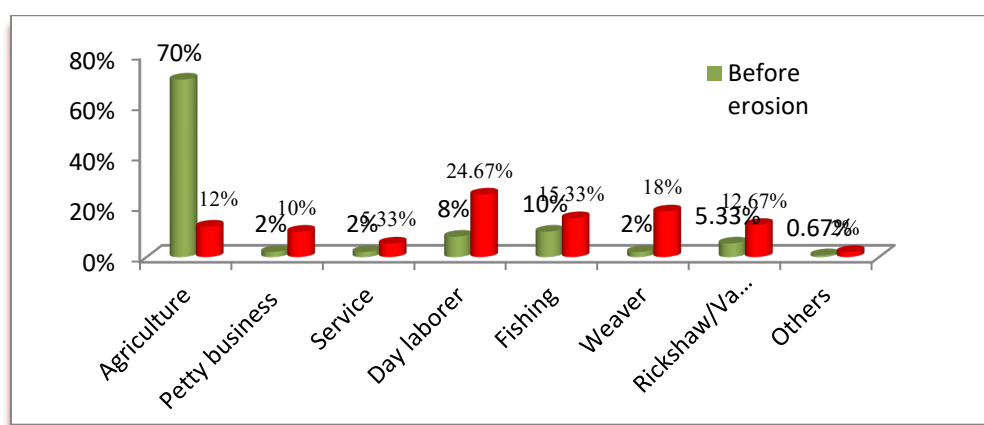
Socio-economic background plays a vital role in human life. It is known to all that the man who is economically and socially well off, can enjoy life as to their expectation. But, who lags behind, suffers in every sphere of life. The researcher wanted to differentiate between pre and post river erosion period status of the respondents so that it becomes easy to understand the changing pattern of their life style. In this chapter, the occupational, earning and expenditure condition of the victim families can be identified and analyzed.

Occupational status Before and after erosion

Table-6

Name of occupation	Before erosion		After erosion	
	Number	PC%	Number	PC%
Agriculture	105	70%	18	12%
Petty business	03	02%	15	10%
Service	03	02%	08	5.33%
Day laborer	12	08%	37	24.67%
Fishing	15	10%	23	15.33%
Weaver	03	02%	27	18%
Rickshaw/Van puller	08	5.33%	19	12.67%
Others	01	0.67%	03	02%
Total	N-150	100%	N-150	100%

Source: Field data



Digrame-5: Occupational status Before and after erosion

The table shows that 70% respondents were found engaged in doing agricultural activities before erosion, 02% were engaged in business, 02% also service, 08% day laborer, 10% fishing, 02% weaver, 5.33% rickshaw/van puller and 0.67% were engaged in other activities under the study area.

After erosion there is change in profession, i.e 12% respondents were found in doing agricultural activities after erosion, 10% were in petty business, 5.33% also service, 24.67% day laborer, 15.33% fishing, 18% weaver, 12.67% rickshaw/van puller and 02% were engaged in other activities under the study area.

Comments: Before erosion 70% respondents were farmer after erosion maximum changed in to day labour, weaver and fishing.

Income-earnings of the respondents (Yearly basis) Before and after erosion (average)

Table-7

Name of income sources	Amount of income	Before erosion		After erosion	
		Number of respondent	P/C	Number of respondent	P/C
Land source	60,000/- 70,000/-	105	70%	45	30%
Pond	80,000/- 90,000/-	04	2.67%	00	00%
Garden	-----	00	00%	00	00%
Service	1,10,000/- 1,20,000/-	03	02%	08	5.33%
Day labor	1,00,000/- 1,10,000/-	12	08%	37	24.67%
Fishing	90,000/- 1,00,000/-	15	10%	23	15.33%
Petty business	80,000/- 1,00,000/-	03	02%	15	10%
Others (Riksha / van / Private car /Auto driver)	70,000/- 80,000/-	08	5.33%	22	14.67%
Total		N-150	100%	N-150	100%

Source: Field data

The table shows that 70% respondents had 60,000/- - 70,000/- income from land property before erosion. 03% 80,000/- - 90,000/- from pond, 2.67% 1,10,000/- - 1,20,000/- from service, 08% 1,00,000/-1,10,000/- from day labor, 10% 90,000/-1,00,000/-fishing, 02% 80,000/- - 1,10,000/- Petty Business and, 5.33% 70,000/- - 80,000/- other sources under the study area before erosion. But a after erosion the figure changed as 30%, 00%, 00%, 5.33%, 24.67%, 15.33%, 10%, 14.67% respectively.

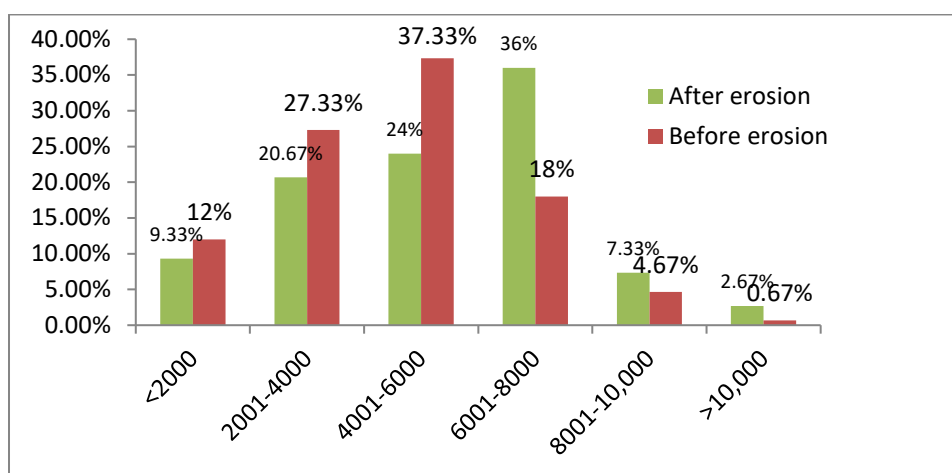
Comments: Before river erosion income earning of the victims were good.

Average monthly income

Table – 8

Monthly income in TK	Before erosion		After erosion	
	respondents	P/C	respondents	P/C
<2000	14	9.33%	18	12%
2001-4000	31	20.67%	41	27.33%
4001-6000	36	24%	56	37.33%
6001-8000	54	36%	27	18%
8001-10,000	11	7.33%	07	4.67%
>10,000	04	2.67%	01	0.67%
	N – 150	100%	N – 150	100%

Source: Field data



Digrame-6: Average monthly income

The table shows that 9.33% respondents had <2000/-, 20.67% had 2001/- 4000/-, 24% respondents had 4001/- - 6000/-, 36% had 6001/- - 8000/-, 7.33% had 8001/- - 10,000/- and 2.67% had above 10,000/- TK monthly income before river bank erosion on the study area. On the other hand 12% respondents had <2000/-, 27.33% had 2001/- 4000/-, 37.33% respondents had 4001/- - 6000/-, 18% had 6001/- - 8000/-, 4.67% had 8001/- - 10,000/- and 0.67% had above 10,000/- TK monthly income after river bank erosion on the study area.

Comments: Before river erosion average monthly income were good.

Expenditure (Yearly basis) on an average

Table-9

Heads of the expenditure	Monthly average expenditure	
	Before erosion	After erosion
Food	30,000/-	23,000/-
Clothes	6,000/-	4,500/-
Shelter	14,000/-	11,000/-
Health	4,800/-	5,600/-
Education	9,000/-	6,500/-
Others	3,500/-	2,800
Total	67,300/-	53,400/-

Source: Field data

The table shows that on an average expenditure for food was found 30,000/- yearly per head before erosion and after erosion it was found 23,000/-. It was found that total expenditure before erosion was 67,300/- and after erosion it was 53,400/- every year.

Comments: After riverbank erosion average expenditure of the victims were decreasing.

Deficit status (Yearly before and after erosion)

Table-10

Deficit amount	Before erosion		After erosion	
	Number of respondents	P/C	Number of respondents	P/C
1500/-2000/-	39	26%	45	30%
2000/-3000/-	30	20%	38	25.33%
3000/-4000/-	54	36%	60	40%
4000/-5000/- and above	27	18%	07	4.67%
	N-150	100%	N-150	100%

Source: Field data

The table shows that 26% respondents whose yearly deficit was 1500/-2000/-, 20% had 2000/-3000/-, 36% had 3000/-4000/- and 18% had found yearly deficit 4000/-5000/- and above before erosion. After erosion 30% respondents had yearly deficit 1500/-2000/-, 25.33% had 2000/-3000/-, 40% had 3000/-4000/- and 4.67% had 4000/-5000/- and above under the study area. It is also seen that the amount of deficit was increased after erosion of the respondents.

Comments: But now after erosion deficit status of the respondents is decreasing.

Present deficit mitigation strategies of the respondents

Table - 11

Sources	Number (After erosion)	P/C
Bank loan	04	2.67%
NGO loan	96	64%
Local people	23	15.33%
Relatives	27	18%
	N – 150	100%

Source: Field data

The table shows that 2.67% respondents mitigate deficit taking loan from bank, 64% from NGO's, 15.33% from local people and 18% from relatives under the study area.

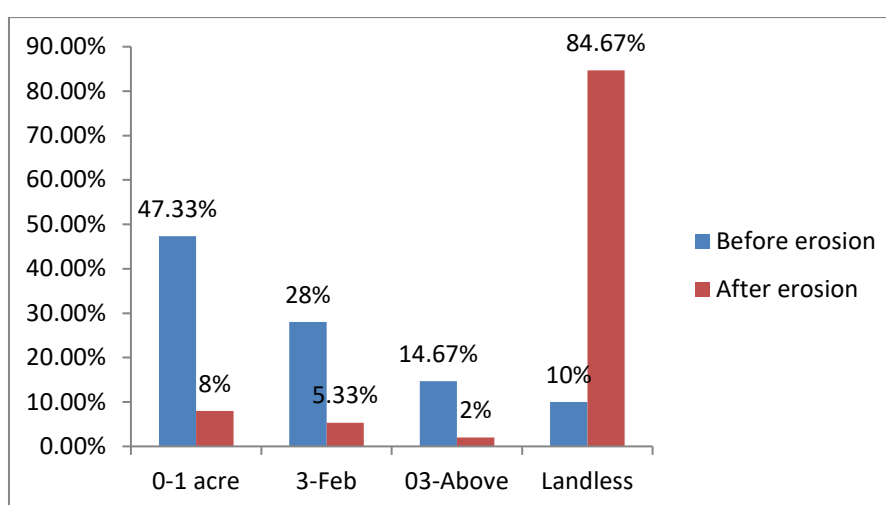
Comments: After riverbank erosion present deficit mitigation strategies of the maximum victims were loan from NGO

5.2.3 Present Landholdings, housing, health and sanitation status of the respondents:

Land holding status before and after erosion
Table-12

Range	Before erosion	PC%	After erosion	PC%
0-1 acre	71	47.33%	12	08%
02-03	42	28%	08	5.33%
03-Above	22	14.67%	03	02%
Landless	15	10%	127	84.67%
	N-150	100%	N-100	100%

Source: Field data



Digrame-7: Land holding status before and after erosion

The table shows that 47.33% respondents had 0-1 acre of cultivable land before river erosion but 08% after river erosion. The landlessness range has increased after river erosion. We also see that 14.67% respondents had 03- above acres of land but after river erosion it has decreased 02%. and landless was 10% and 84.67% before and after riverbank erosion respectively.

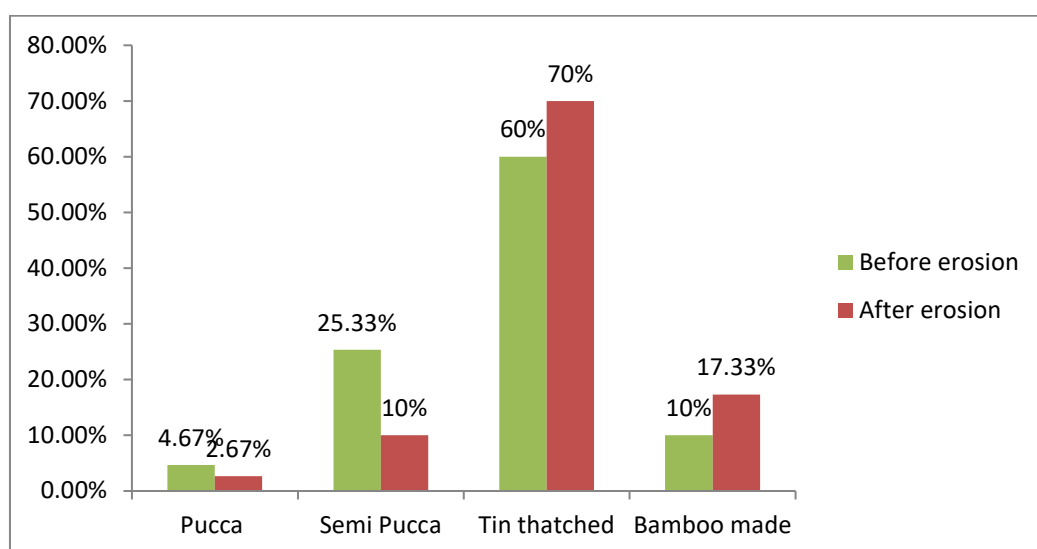
Comments: After river bank erosion 84.67% respondents become landless.

Housing condition before and after erosion

Table-13

Range	Before erosion	PC%	After erosion	PC%
Pucca	07	4.67%	04	2.67%
Semi Pucca	38	25.33%	15	10%
Tin thatched	90	60%	105	70%
Bamboo made	15	10%	26	17.33%
	N-150	100%	N-150	100%

Source: Field data



Digrame-8: Housing condition before and after erosion

The table shows that 4.67% respondents lived in Pucca house, 25.33% lived in semi pucca house, 60% lived in Tin thatched and 10% were lived in Bamboo made house before river bank erosion. On the other side 2.67% people lived in pucca house, 10% lived in semi pucca house, 70% lived in Tin thatched house and 17.33% people lived in Bamboo made house after river bank erosion.

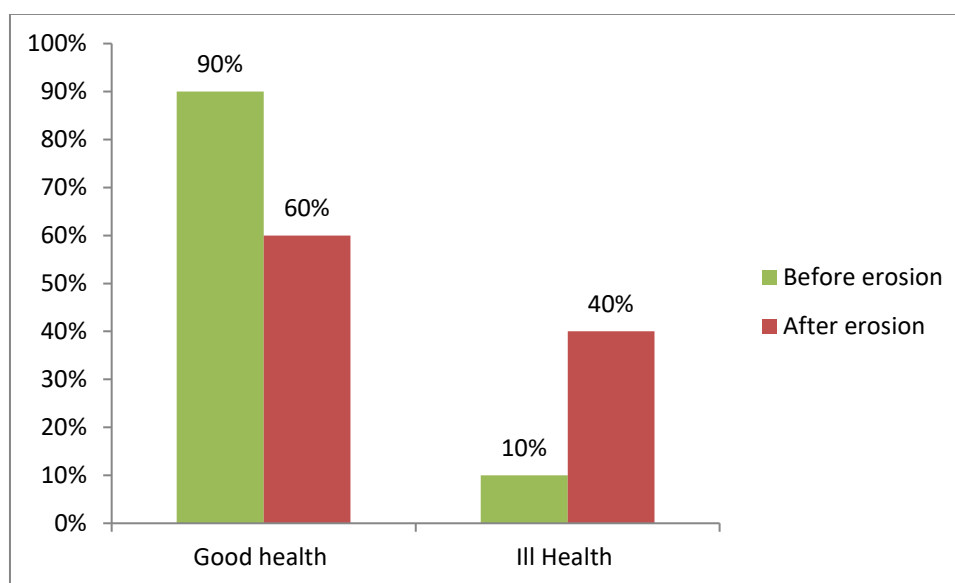
Comments: After erosion 70% respondents lived in tinshed house.

Health condition before and after river erosion

Table-14

Range	Before erosion		After erosion	
	Respondent	PC%	Respondent	PC%
Good health	135	90%	90	60%
Ill Health	15	10%	60	40%
	N-150	100%	N-150	100%

Source: Field data



Digrame-9: Health condition before and after river erosion

The table shows that 90% respondents were in good health and 10% were ill before river bank erosion. On the other side 60% respondents having good health and 40% has ill health after river bank erosion.

Comments: After erosion health condition were bad. (Especially the weavers are suffering chest problem)

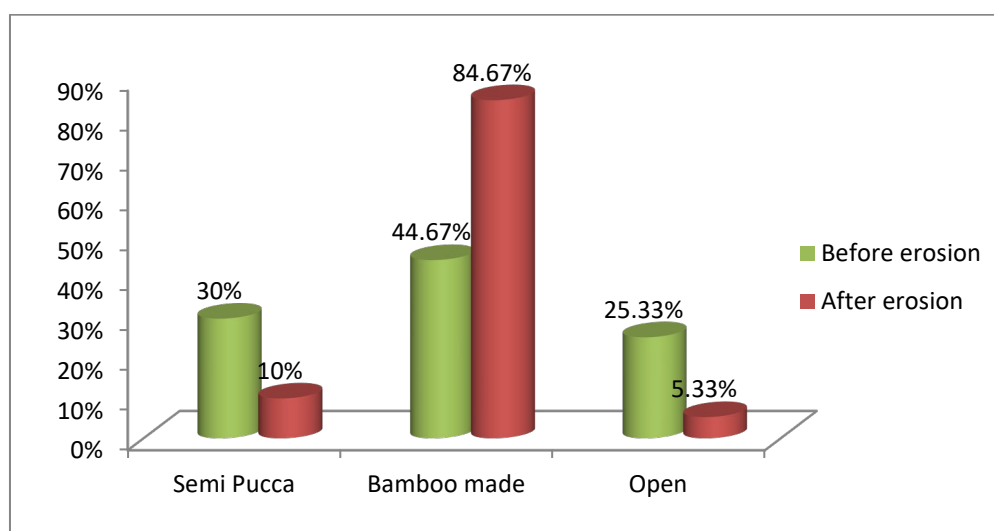
Sanitation condition before and after erosion

Latrine:

Table-15

Range	Before erosion		After erosion	
	Respondent	PC%	Respondent	PC%
Semi Pucca	45	30%	15	10%
Bamboo made	67	44.67%	127	84.67%
Open	38	25.33%	08	5.33%
	N-150	100%	N-150	100%

Source: Field data



Digrame-10: Sanitation condition before and after erosion

The table shows that 30% respondents used semi pucca latrine, 44.67% used Bamboo made latrine and 25.33% used open sanitary system before erosion and now 10% used semi pucca latrine, but 84.67% respondents use bamboo made latrine under the study area. Only 5.33% people also use open sanitary system now a days.

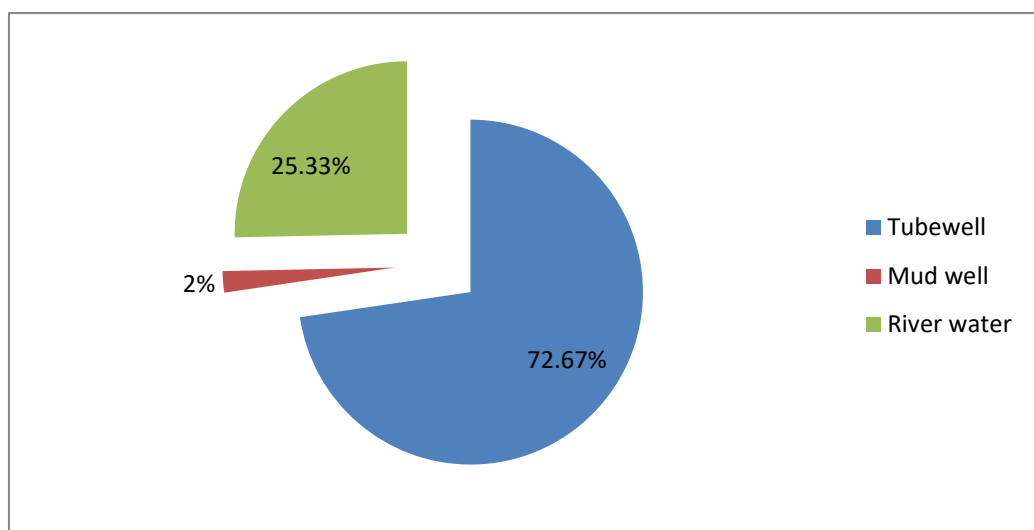
Comments: After river band erosion maximum victims use bamboo made latrine.

Drinking water supply before erosion

Table-16

Before erosion	No. of respondent	P/C
Tubewell	109	72.67%
Mud well	03	02%
River water	38	25.33%
	N – 150	100%

Source: Field data



Digrame-11: Drinking water supply before erosion

The table shows that 72.67% respondent used tubewell water before erosion and 25.33% used river water only 02% respondent used mud well as a source of drinking water.

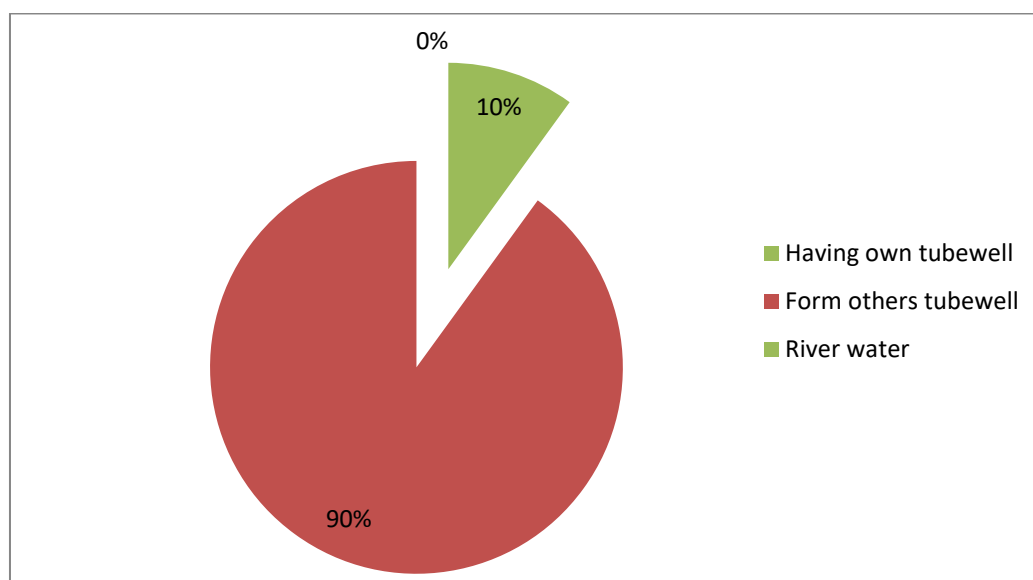
Comments: Before riverbank erosion 02% respondents used mud water.

Drinking water supply after erosion

Table-17

After erosion	No. of respondent	P/C
Having own tubewell	15	10%
Form others tubewell	135	90%
River water	0	0%
	N – 150	100%

Source: Field data



Digrame-12: Drinking water supply after erosion

The table shows that 90% respondent used from other's house tubewell water after erosion and 10% respondent has own tubewell no respondent used river water. Totally 100% respondents use tube well for drinking water.

Comments: After riverbank erosion 100% victim families use tubewell water for drinking.

Present sanitary conduction of the respondents

Table-18

Use of Latrine	No. of respondents	P/C
Kacha (Bamboo Made)	75	50%
Semi Pucca (Tin shade)	15	10%
Full Pucca	07	4.67%
Slab latrine	45	30%
Having no latrine (Use Outside home)	08	5.33%
	N – 150	100%

Source: Field data

The table shows that 50%kacha, 10% semi pucca, 4.67% full pucca, 30% slab latrine, 5.33% having no latrine.

Comments: After erosion 5.33% victims use open latrine outside of the house.

5.2.4 At present use of fuel for cooking:

On the basis of source of fuel for cooking, the victim families were classified into eight types.

Distribution according to source of fuel

Table-19

Source of Fuel	Frequency of respondent	Percent
Woods or timber	18	12%
Leaves	14	9.33%
Cow dung	00	00%
Wood and cow dung	12	08%
Leaves and Cow dung	34	22.67%
Leaves and wood	47	31.33%
Wood, leaves and cow dung	25	16.67%
Kerosene	00	00%
Total	N- 150	100%

Source: Field data

Table shows that maximum (31.33%) of the respondents used leaves and woods as fuel for their cooking purpose. No victim families used kerosene for their poverty and low income and nationally 2.32% rural population used kerosene (BBS 2001). The table also reveals that no respondents used cow dung as their only source of fuel instead of this; they used cow dung combined with wood and leaves about 16.67%. Twelve percent (12%) of the victim families used timber or woods as their source of fuel for cooking which is smaller than that of the national rural level 57.63% (BBS, 2001). The study field eight percent (08%) of the respondents used wood and cow dung as their fuel source and nine percent (9%) of the victim families used only leaves. Seventeen percent (16.67%) of the victim families used wood, leaves and cow dung as the source of fuel for cooking and 22.67% used leaves and cow dung.

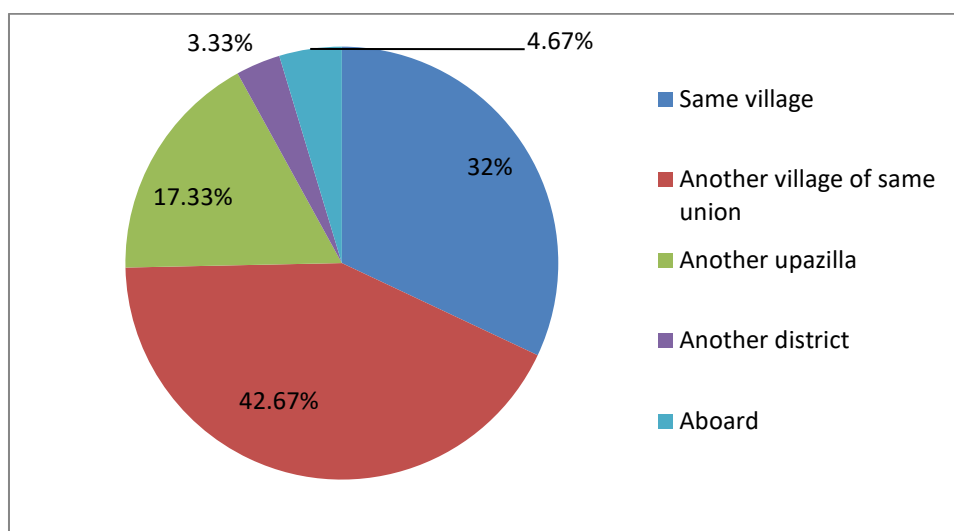
Comments: No respondents used kerosene for cooking. Maximum used leaves and dry cow dung.

Origin of migration

Table-20

Types of migration	No of respondent	Percent
Same village	48	32%
Another village of same union	64	42.67%
Another upazilla	26	17.33%
Another district	05	3.33%
Aboard	07	4.67%
Total	N-150	100%

Source: Field data



Digrame-13: Origin of migration

The table shows that 32% respondents migrate to same village, 42.67% another village of same union, 17.33% another upazilla, 3.33% another district, 4.67% migrate in aboard.

Comments: Only 4.67% respondents migrated in aboard for job.

Distribution according to pattern of migration

Table-21

Types of migration	No of respondent	Percent
Permanently	54	36%
Temporarily	96	64%
Total	N-150	100%

Source: Field data

The table shows that 36% respondents migrate their housestead permanently and 64% migrate are temporary.

Distribution according to land cultivation pattern

Table-22

Types of land cultivation	No of respondent	Percent
Own land	22	14.67%
Share cropper	41	27.33%
No cultivation	87	58%
Total	N-150	100%

Source: Field data

The table shows that 14.67% respondents cultivated their own land, 27.33% share cropper and 58% had no cultivated land.

Comments: Maximum victims had no own cultivated land.

Chapter - VI

Survival strategies of the victims

6.1 Shifting strategies:

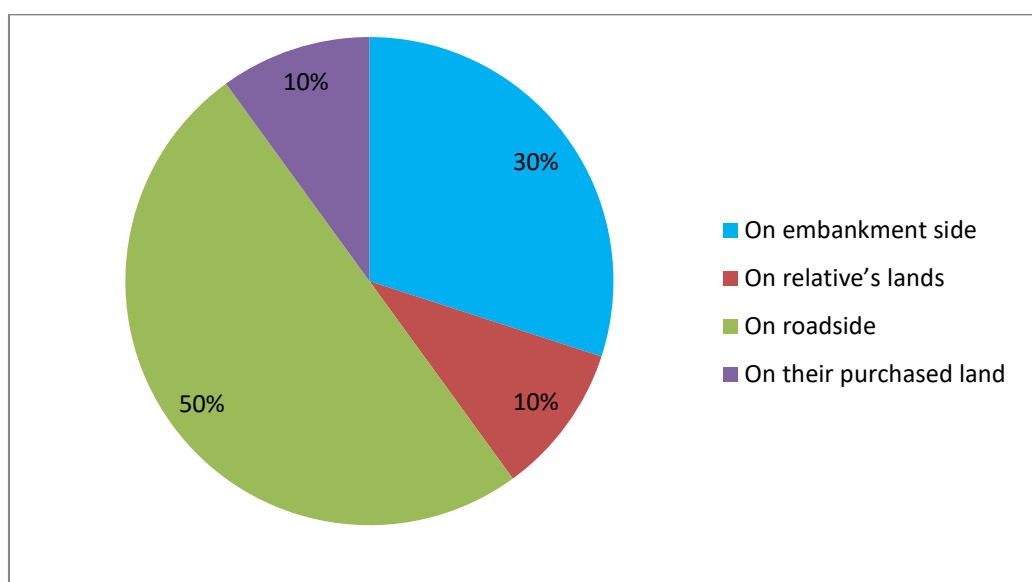
When the river bank erosion started during mid sixties first of all they could not imagine how long it will continue. When one after another the homesteads started going to the river they shifted to the backward side of their homesteads. When that settlement became at stake they started moving to further backward. Thus, when the entire village were at stare, they further moved towards distant villages and settled to their friends and relatives houses taking with their small assets along with their cattle, house structures etc. Some of them took shelter to embanks, and by the side of the high roads and on khas lands. The following table shows their settlement strategies.

Settlement strategies

Table-23

Types of land	No. of respondents	P/c
On embankment side	45	30%
On relative's lands	15	10%
On roadside	75	50%
On their purchased land	15	10%
	N-150	100%

Source: Field data



Digrame-14: Settlement strategies

The above table shows that maximum victims shifted scatteredly to embankment and on roadside. Some went to distant areas and only 10% could afford to purchase a piece of land selling their temporary assets including cattle.

Comments: Maximum respondents shifted on Embankment and road side after erosion.

Income strategies: Occupational mobility before and after erosion

Table-24

Occupation	Before erosion		After erosion	
	Respondents	P/c	Respondents	P/c
Agricultural farming	105	70%	18	12%
Para-Agriculture	14	9.33%	22	14.67%
Fishing	15	10%	23	15.33%
Rickshaw / Van pullers	07	4.67%	20	13.33%
Handloom industries	03	02%	27	18%
Garment industries	00	00%	11	7.33%
Shop stewarding	03	02%	07	4.67%
Petty business	03	02%	15	10%
Aboard	00	00%	07	4.67%
	N-150	100%	N-150	100%

Source: Field data

The table shows that before the river erosion most of the respondents (70%) were involved in agricultural activities excepting a few who did petty business, petty service outside their village. But after erosion they had to change their original profession and were to involve in different type of activities for their livelihood. Interestingly, they did not know how to do all other activities except their original economic activities. They had to struggle for their existence. But a few of them when outside their original place to distant places including outside the country far their livelihood. It was found that 4.67% respondents went abroad taking jobs after erosion.

Comments: Before erosion maximum victims were farmer but after erosion. They changed into weaver, ricksha/van puller and fishing.

6.2 Properties and lives shifting:

At the period of erosion shifting of essential properties and life was essential need for their temporary shelter. When this disaster attacked uncountable sorrows come down in the life of the victim families. All the families of the study area were bound to transfer their homestead. But they had to face an unimaginable condition to find out the temporary shelter. Maximum victim families sold their livestock cattle and valuable standing trees at very low cost, maximum victim family took shelter in nearest road side and embankment side with a helpless situation. Some also took shelter in neighboring home for a few days. Some also migrated to another unions.

6.3 Homestead salvaging:

Though the maximum displacees were very poor in the study area. At the period of erosion they had to migrate to their native area by force. They had applied their own efforts to reduce the cost to transfer the temporary shelter. They managed local essential tools like hand saw, screw driver, hammer, kodai, khonta, dao and axe and tried to re-settle in a temporary shelter by themselves with the help of their family members. At the time of critical period only they had to take commercial house builder of the village.

Salvaging house structure

Table-25

Nature of Salvage	No. of respondents	P/c
Fully salvaged	91	60.67%
Partially salvaged	47	31.33%
Could not salvage	12	8%
	N-150	100%

Source: Field data.

Most of the structural pattern of homestead of the victim families were salvageable. 60.67% of the victim family shifted their houses to the safer places. 31.33% victim families partially shifted their own houses because those families could use brick for wall only 8% built kacha and mixed type houses which could not be transferred for sudden river erosion.

6.4 Cutting Standing Crops and trees:

The study shows that 94% of the victim families cut their standing trees and saved it from the attack of riverbank erosion, Among them 51% sold those trees for procuring money to meet the needs of resettlement. Another 43% preserve them for use in their resettlement. Rest 6% of the victims families could not cut or sold their trees because it was engulfed by erosion quickly. Out of 150 victim families 47% had standing crops on their own place. Out of which 25% could save their crops. 16% of corps were immature. Rest of all respondents could not salvage their cultivated crops due to sudden attract of riverbank erosion.

6.5 Sale of properties:

Maximum percentage of the respondents sold their properties in the time of disaster to reduce the loss. They adopted this policy for collect money for surviving their life.

Sale of properties

Table-26

Items	No. of respondents	P/c
Stored crops	39	26%
Livestock	27	18%
Furniture	23	15.33%
Ornaments	18	12%
Eroded land's title	12	8%
Remaining land	09	6%
Irrigation equipment	06	4%
Other Valuable Assets	16	10.67%
	N-150	100%

Source: Field data.

The study shows that 26% of the victim families could sell their stored crops, Livestock 18%, furniture 15.33%, Ornaments 12%, remaining land 6%, irrigation equipment 04% and other valuable asset 10.67%. 8% of the displaces were forced to sell their land engulfed by riverbank erosion.

Comments: Maximum victim families could sell their stored crops, livestock, furniture were forced to sell for surviving.

6.6 Adaptation strategy to fulfill the basic need:

The study shows that monthly income of the victim families was Tk. 5400 before river erosion which reduced to Tk. 4600. Other side, maximum victims become occupation less for the loss of their regular occupation. To face the loss of the disaster and to maintain their livelihood through a hard ship.

Adaptation strategy to fulfill the basic need

Table -27

Adopted Strategies	No. of respondents	P/c
Having new occupation	68	45.33%
Selling livestock assets	14	9.33%
Help from Relatives	27	18%
NGOs loan	16	10.67%
Adolescent employment	11	7.33%
From savings	03	02%
Bank loan	04	2.67%
Went abroad	07	4.67%
	N-150	100%

Source: Field data

The study shows that 45.33% of the victim families adopted in new occupation for maintaining their livelihood. 9.33% of the victim families sold their various assets and livestock to fulfill their basic needs, 18% of the victim families received help from relatives 10.67% took loan from NGO, 7.33% of the victim respondents engaged with their young members at work before finish of their education. 02% spent money from savings, 2.67% took loan from schedule banks and 4.67% went abroad to develop their life strategy.

Comments: Maximum victims having new occupation for fulfilling the basic needs.

6.7 Faced challenges and consequences:

River bank erosion is very cruel and silent disaster. By river bank erosion village after village go under water leaving a lot of people homeless, landless and assetless. It also washed away house structure, crops farm land within a short time. So, the victim families faced the challenges and consequences in their life al the year round.

6.8 Homestead and land loss:

River bank erosion is very harmful than other disasters. Once a man who had enough land and beautiful living places, within a short time he lost every things. The rich person faced a high scale damage in their life. The river erosion wasted away all kinds of assets, damaged communication networks also. So, the homestead and land loss occured by this natural disaster throughout the whole life.

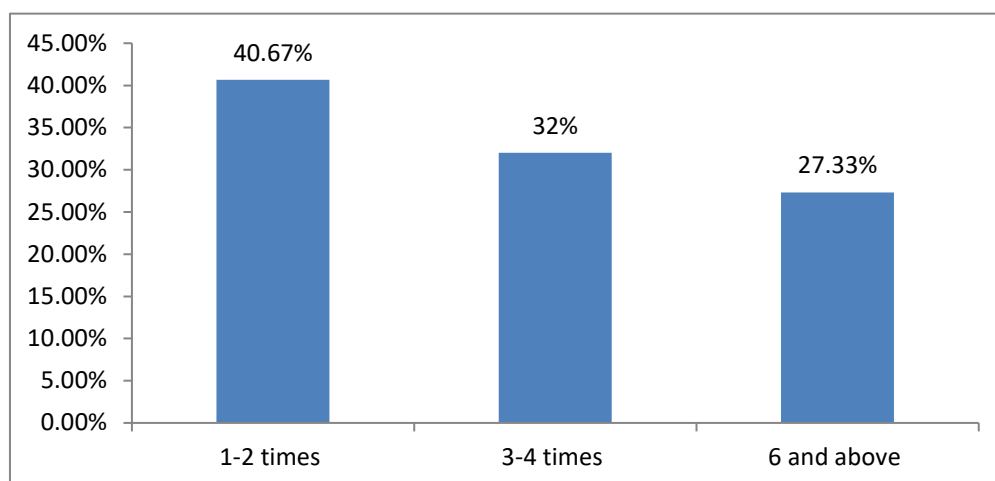
6.9 River bank erosion face by the respondent:

The victims of the river bank erosion shifted from their original houses several times. But the condition of each respondent is different from another. The following table shows the time line of facing the river erosion though out their life time.

River bank erosion face by the respondent

Table-28

Time line	No. of respondents faced erosion	P/C
1-2 times	61	40.67%
3-4 times	48	32%
5 and above	41	27.33%
Total	N-150	100%



Digrame-15: River bank erosion face by the respondent

The above table shows that maximum respondent (40.67%) faced 1-2 times river bank erosion throughout their life time similarly 32% faced 3-4 times and 27.33% faced 5 to above times during their life time.

Comments: Maximum percent respondents faced 1-2 times riverbank erosion.

6.10 To Decrease economic solvency:

The economic condition of the victims had decreased after erosion which has shown in the following table;

Economic condition before and after displacement

Table-29

Solvency level	Before		After	
	Number	Percentage	Number	Percentage
Solvent	92	61.33%	32	21.33%
Insolvent	52	34.67%	91	60.67%
Below poverty line	06	04%	27	18%
	N-150	100%	N-150	100%

Source: Field data

The table shows that before erosion 61.33% respondents had solvent, 34.67% had insolvent and 04% had below poverty line. On the other hand after erosion 21.33% had solvent, 60.67% had insolvent and 18% had below poverty line on the study area.

Comments: Before erosion maximum respondents were solvent.

6.11 Dwelling environment:

6.11.1 Community based responses:

Livelihood pattern of the victim families are totally dependent on intensity of river erosion and accretion cycle of temporary place. During rainy season the eroded places washed away fully or partly. Near other places sometime found another new land. The victim family as well as try to stay their homestead as possible at the time of erosion. But when the situation become a dangerous position, at the last time they migrated their

family to safer place. The victims who become homeless, landless and assetless they cannot manage a new place for their temporary settlement. They moves to different roadside, embankment side and relative land. At the time of large scale erosion when washes away their homestead land. The total villagers have to migrate their own place to a distant area for temporary shelter. They manage these disaster prone situation with each other together. It was found that the community based responses was strong among the victim of the villagers.

6.11.2 Necessary tools for dwelling situation:

At the period of riverbank erosion, carpentry and different essential tools are needed to emergency response. When the victims migrate to another place for their resettlement. Some time the victim families got support from their neighboring rich person or relatives. For the resettlement or temporary shelter, carpentry is essential. To face the needs of temporary shelter, some tools are crying need to the victim families and carpenter. That are screwdrivers, hand saws, spades, hammers, claw hammers, soil chopper, etc. These local and familiar tools are highly demanded to make their shelter. To maintain their livelihood and house hold agriculture the tools kodal, khonta, kachi, plass, dawo are also essential for the victim families.



Picture-6: House reconstruction types of a new land.



Picture7: Essential tools for reconstruction houses.

6.11.3 Dwelling shifting and early preparedness:

At the period of river erosion skill manpower, essential labours, tools and homestead shifting policy was the crying need to the victim families. The victim families moved to their essential dwelling materials gather in the

nearly safe land with the help of relatives and villagers. At that time village leaders and political figures also tried to help to migrate their sufferings by providing temporary shelter as a social responsibility. In the study field during the period of erosion the political and social leaders organized a local rescue team, with the young and elites for facing the disastrous situation within their own capacity. They arranged minimum food for the victims for some days. When the villagers knew that the erosion of river is very near as a early preparation. They tried to safe their valuable standing trees, cultivated crops and homestead materials with this local rescue team. The member of the team applied their capacity all day and night round towards dwelling and shipment of the victim families.

6.11.4 Relocation planning and alternative livelihood:

After the erosion of the river bank the victim families fallen into unimaginable sorrow. Maximum victim families lost their homestead loss partly or fully of their cultivated land loss in the study field. So, they planned all at a time to re-settle their location. So, they tried to manage a safe living place for their shelter. Some time they soled their valuable materials low cost to purchase a land. Even they had tried to positioned a suitable roadside place and embankment side location for their shelter.

For their alternative livelihood they had to manage a temporary work policy in nearest town, another union or another upozilla. After erosion the victim families always tried to work in any position to maintain their livelihood. The practices of all victim families were not same. Some were the experienced with agricultures, some were at home in fishing, some

were good day labours. So, they had to struggle to survived in the new occupational activities. So, after a long suffering the victim families survived with alternative livelihood.

6.12 Coping policies in the new situation:

The adaptation policy of the victim people were separate to others. In copping up with the new environmental situation they had to try vary hard all the year round. To adjust these worst situation, they had to adopt various policy which were not easy in their life.

Chapter-VII

Help received to face the problem

7.1 Help received to face the problem:

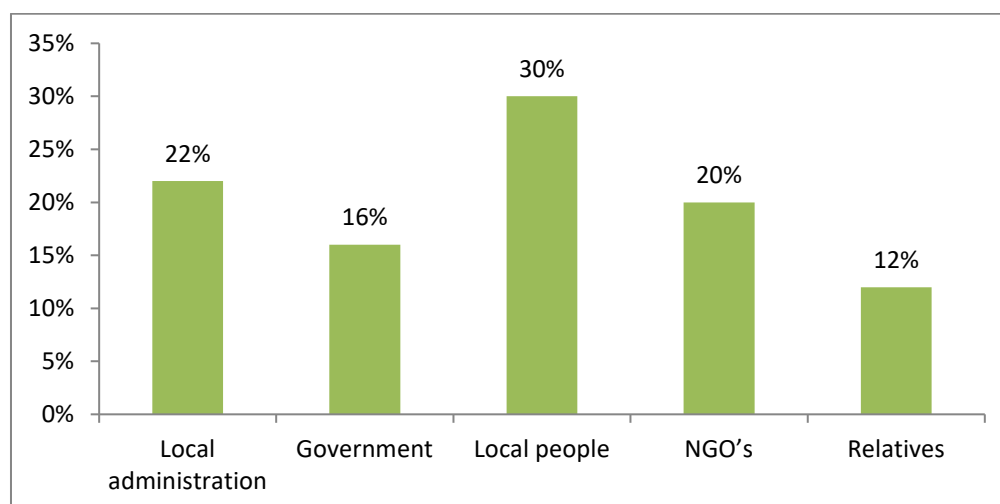
It is the responsibility of deputy commissioner of the respected district to extend primary help and relief to the victims of any natural disaster or any unpleasant incident occurred. Relief and assistance provided by the district relief section to river bank erosion victims or any other victim when they face any uncurl circumstances occur. But such kind of disaster do not get sufficient priority by deputy commissioner because of lack of fund or to remain in other important official activities. Here, the main duty is entrusted to relief and rehabilitation department. When flood or tornado occurs in any area they are to run fast, taking all other governmental depts. But the victims of river bank erosion get less emphasis like all other disasters. The following table gives the picture of help received by the victims of river bank erosion in the study area.

Help received after river erosion (Last five years)

Table-30

Sources of help	Number	P/C
Local administration	33	22%
Government	24	16%
Local people	45	30%
NGO's	30	20%
Relatives	18	12%
Total	N – 150	100%

Source: Field data



Digrame-16: Help received after river erosion (Last five years)

The table shows that 12% respondents got help from relatives of the study area. The table shows that 16% respondents got help from Govt. and 22% respondents got help from local administration of the study area. The table shows that 20% respondents got help from different NGO's of the study area.

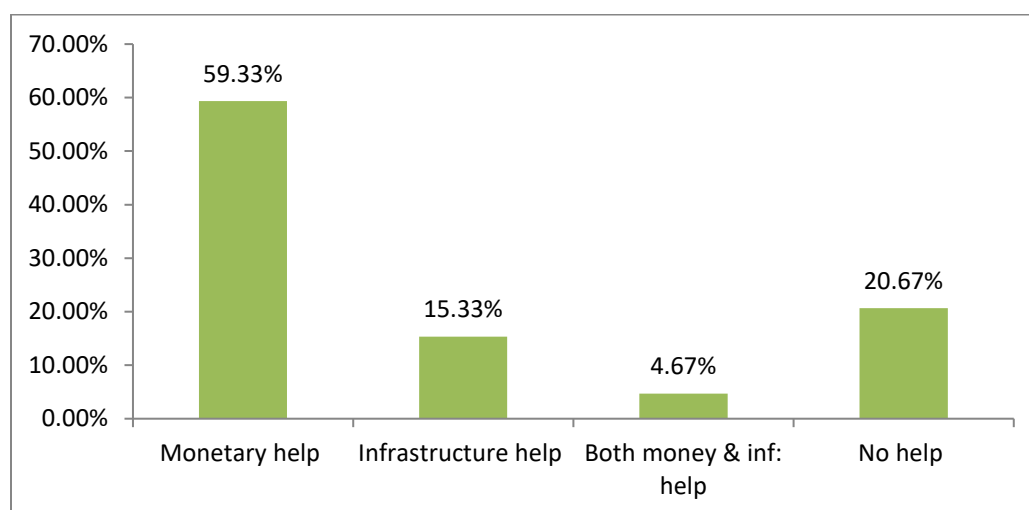
Comments: Only a few percent victims received help from relatives last five year.

Kind of help received by the respondents

Table-31

Type of help	Frequency of respondents	Percent
Monetary help	89	59.33%
Infrastructure help	23	15.33%
Both monetary & Infrastructure help	07	4.67%
No help	31	20.67%
Total	N-150	100%

Source: Field data



Digrame-17: Help received by the respondents

Data presented in table stated that monetary help was received by 59.33% of the respondents from the government and non-government organization and only 15.33% of the respondents received infrastructure help. 4.67% of the respondents received both monetary and infrastructure help and 20.67% of the respondents received no help from the government and non-government organization in the study area.

Comments: 20.67% victims received little or no help from the government.

7.2 Faced Social problems:

After erosion the victims faced very hardship condition in their life. At the time of riverbank erosion the victims tried to face situation the other together. A few landless desperate respondents were involve in river robbing. In winter season they arrange cultural activities like Wazmahfil, Palagan, Boyati gun to forget their misery.

The weavers are suffering in chest problem. They are trying to change their profession. Maximum brickfield labours are suffering asthama disease. During the dry season villagers suffers from dust pollution. Though maximum respondents has on own tube well but all of them use tube well water for drinking from distant tubewell. For treatment they depend on quacks and community clinics.

7.3 Primary shelter and Internal – external help:

At the time of erosion when the victim families fallen into risk they tried to transfer their asset to a safe area from their original homestead. The victim families received different help from various sources.

For Primary shelter Internal- external help received

Table-32

	Have taken shelter with the help of	Number	Percentage
Internal 68%	Own source	75	50%
	Help of Relatives'	27	18%
External 32%	Help other than relative	34	22.67%
	Help of Government agencies	06	04%
	Help of Union porishad	08	5.33%
		N-150	100%

Source: Field data

To face the first river erosion salvaging lives assets of the respondents by themselves or with the help of relatives. From the field survey it was shown that 68% of the victim household resettled their house depending on their own economical capacity and rest 32% received help from external sources.

Comments: For primary shelter the maximum victims overcoming the first hazard faced by own sources.

For resettlement internal - external help and assistance

Table-33

Source		Number	Percentage
Internal 68%	Previous Saving	15	10%
	Land sale	25	16.67%
	Asset sale	21	14%
	Borrowing money from relatives	41	27.33%
External 32%	Loan from individual	07	4.67%
	Loan from Cooperative society	02	1.33%
	Loan from NGO	29	19.33%
	Loan from Bank	04	2.67%
	Government relief	06	04%
		N-150	100%

Source: Field data

The table shows that for the resettlement the respondents got help 68% from internal source and 32% external help for different purpose to made house.

Comments: For resettlement maximum victims sold land, assets and by previous solving.

7.4 Maintaining livelihood internal - external help received:

In this study it was found that victims received help from external sources for solving their worst situation for fulfilling their crying needs from both internal and external sources.

For livelihood internal - external help received

Table-34

Purpose	Internal	External	Total
Primary shelter	68%	32%	100%
Resettlement	68%	32%	100%
Survival	74%	26%	100%

Source: Field data

The table shows that for primary shelter 68% respondents received help from internal source and 32% external source, for resettlement 68% had internal help and 32% got external help and for survival 74% had internal source and 26% had external source.

7.5 FGD Meetings:

FGD Meeting with the respondents

Table-35

Meeting	Participant	Topic	opinion
Meeting no-1	Local union councilor, Local village leaders, Imam of mosque, Weavers, village doctor, labours and shopkeepers. 09.04.2018	Health, Hygiene and Sanitation purpose of the respondents. 27	The weavers are suffering from chest problem. They are trying to change their profession. Maximum brickfield labours are suffering from asthma disease. During the dry season villagers suffer from dust pollution. Though maximum respondents has on own tube well but all use tube well water for drinking. For treatment purpose they totally depend on village doctor.
Meeting no-2	Local councilor, local elites, political leader, school teacher and general respondents. 16.04.2018	Social relationship and co-operation about respondents. 18	After erosion as well as they are living in very hardship condition in their life. At the time of riverbank erosion or other disaster they overcome that situation each other together. A few landless respondents are involved in river robbing. In winter season they arrange cultural activities like Wazmahfil, Palagan, Boyati gun.

FGD Meeting with the respondents

Table-36

<p>Meeting no-3</p>	<p>Local councilor, elder persons, widow, fisherman and social leaders. 23.04.2018</p>	<p>Land, income-earnings and environment of the respondents. 23</p>	<p>Landless respondents desire a piece of kash land for survival of their life. They also desire goat, sheep, to rear for income from government. They are interested to social forestation by as govt-public partnership from.</p>
<p>Meeting no-4</p>	<p>Social leaders, local political leaders, petty businessmen, agricultural labour 30.04.2018</p>	<p>Survival strategy during riverbank erosion of the respondents. 21</p>	<p>At the time of erosion they had to leave the area with their own efforts to a safer place mainly on road side, embankment or relative's land. They cut their standing trees and crops with the help of villagers together with their indigenous process.</p>

7.6 Some case studies:

Some Important case studies of the victims of River bank erosion of the study area.

Case studies No-1

Name: M. Afazuddin, Age: 75 years,

Fathers name: late Sefat ullah Pramanik,

Vill: Char Rani Nagore,

Occupation: Agri-farmer.

I am a poor man of the village Rani Nagore. Beging victime of the river erosion at the age of 7. I had to loss the homestead first. At the age of 10, I went to the river with my senior family members for fishing. That was a source of income for our livelihood. I faced river bank erosion several times and had to shift household 11 times while I was 36 years my family shifted homestead to sadirajpur village 2nd half miles away from our village. I was then married.

During the last 36 years my occupation was fishing in the Padma river and selling those in the nearby bazar. During off season, I worked as a day labourer.

Before land erosion I was a land lord. I had 12 acre landed property. we had a joint family. Total no. of family members was 15. Our family was an affluent family. We used to live in peace house. But after permanent shifting we became poorer. Now, I live in a mud house.

My house is located by the road side slope. Presently, it is a tin-shed semi pucca house. We could not build a semi pucca latrine. We rear cow and goat. Now I am a bit better in respect of life and living. My past memory gives me pain and sorrow.

Case studies No-2

Name: Bonder Ali Sarker Age: 85 Year,

Father's: Late Abed Ali Sardar.

Vill: Rani Nagore,

I observed river erosion five times. I was 20 years old during first erosion. I had 25 bighas landed properties during the period of first erosion. All the landed properties went to the river due to river bank erosion. I shifted from my original house after erosion to a village 2 miles away from my previous house. That house also went into river. Now, I live in the end point of Raninagore village. I built a semi pucca house. I have 1.5 bighas of cultivable land an sandy land of 10 bighas. My sons are all working and earning a poor income. My economic condition was good enough before erosion and after erosion all the people became scattered and fallen into miseris including myself. But some of the families became well-to-do by doing business and taking job elsewhere.

Case studies No-3

Name: Ohid Sardar

Age: 70 Year,

Father: Late Babar Ali Sardar.

Vill: Rani Nagore,

I am an old man of 70 years. I was born in the village Raninagar, Under the padma Sadar Upazilla of the district Pabna. My father late Babar Ali Sardar, was a solvent farmer and I had 10 acres of fertile land. I was the eldest son of my parents. I had 3 brothers and four sisters. I started my education in the Madrasha of my village. After primary level of education I joined with my father in agricultural activities. I married in a nearby village at the age of 21 years. I was living a pleasant life along with my two sons and five daughters. With my adequate income which was earned from agriculture land. Every year I could save some money after meeting my family needs. I was known to the villagers as a solvent and successful farmer.

Misfortune came down on my life due to river bank erosion. I faced five time river bank erosion in my life. First time of erosion I lost 60% of my cultivated and non cultivated land due to massive erosion of mighty river Padma in the following. The mighty river Padma engulfed all of my remaining land including my homestead in the previous years. Then I took shelter in the slope of nearby WDB Embankment. First three months I took help from my relatives and well wishers. I started a petty business at Ashutospur hat. I straggle hard to survive. It was very difficult for me to maintain my family with that low income. I shifted to Pabna town to find a job. Then I worked in Square Pharmaceuticals company as a labour with my son. Now I am living on the north side of the village Raninagor.

Chapter VIII

Geographical and Geomorphological feature of study area

8.1 Geographical location of study area:

Pabna Sadar Upazila area 443.90 sq km, located in between 23°53' and 24°05' north latitudes and in between 89°09' and 89°25' east longitudes. It is bounded by atgharia and ishwardi upazilas on the north, kumarkhali and pangsha upazilas on the south, santhia and sujanagar upazilas on the east, Ishwardi upazila on the west side of district.

8.2 Geomorphological feature of study area:

Geomorphological location regarded to be graphical inventories of a landscape showing landforms and surface as well as subsurface materials. The geomorphological maps provide important information applied in land use planning. On the other side slope is one of the major geomorphological factors. For the development of soil and distribution of vegetation its effect directly but it also control environmental and economical patterns as the model of utilization.

The study area does not have any official records on river erosion prompting and mapping this study. The study field consists of abandon channels, lateral channel bars, flood basins, natural levees, flood plains and active channels. The surface deposit of the field is new flood plain deposits of sediment of the river. The new flood plain deposits of sediment are staying mainly by the Ganges river system and their

numerous tributaries and other branches of river. The new flood plain deposit of sediment consists of alluvial soil which is the mixture of sand, medium grain, fine grain, silt and clay in the river water.

8.2.1 Active channel:

In the river corridor the flowing of water which flows all the year round is called active channel.

8.2.2 Abandoned channel:

In the river the narrow depression without water or with water are known to abandoned channel.

8.2.3 Natural levee:

The wedge shaped ridge in river deposit. Which stands irregular with liner shaped and sandy deposit is called natural levee.

8.2.4 Flood plain:

The alluvial or sandy land which stands the borderline side of the river banks is called flood plain.

8.2.5 Flood basin:

In the river the poorly drained system which slopping critically in the stream with depression is called flood basin.

8.2.6 Lateral channel bar:

The sand bar in the river bed which formed in the channel is called lateral channel bar.

8.3 Topographical Features of study area:

Naturally Rani Nagar is a remote area from the Pabna town. 1/5th portion of land area standings from northern side of the mighty river Padma. Actually this is a char area. During the rainy season 60% land of this area goes under water. At the dry season a medium water flows as the main stream of the river Padma. A lot of sand deposits are standing on the heart of the river Padma. Alluvial soil is vary rare. Sands deposits are standing as the lands of this study area. The banks of the river Padma of this study area is very high and sandy.

8.4 Environmental Feature of the study area:

8.4.1 Land use of the study area:

The use of land was mainly determined by the duration period and depth of seasonal flooding by the availability of soil moisture in dry season. Rice was the principal crop throughout the area. Whenever the land only shallowly flooded or water could be kept on the land by small bounds, farmers grow Chinese nut and Sun flower followed by Rabi crops. Where sufficient dry season moisture was available, a dry land crop was often grown after the main harvest. Dry land Rabi crop could not be grown in soils which remained wet for some weeks after the end of the rainy season. Where flooding became too deep for transplanted paddy. In the rainy season the Padma floodplain became deeply flooded, early rise of flood level and the wave of water prevented the produce of kharif crops in most of this area. However, local rice was grown lump sump because large sandy areas remained wet for most or all of the dry season. Rabi crops mainly included khesari, mustard, til, gram, sweet potatoes etc.

Homestead sites were generally on the artificially raised mounds and intensively used for bananas, vegetables, fruit trees and rice nurseries.

8.4.2 Climate, temperature and rainfall:

The climatic condition of the study area was not different from Rajshahi district. There was no local arrangement for recording temperature and rainfall in the study area. The neighboring meteorological center is located in Rajshahi district, which keeps records of temperature, rainfall and humidity. The conditions might well be assumed to be more or less the same as the average climatic conditions of the Rajshahi district. A picture of the monthly average temperature, rainfall and humidity of the Pabna district.

Annual Temperature of the study area

Table-37

	Avg. Temperature (°C)	Avg. Temperature (°F)	Precipitation / Rainfall (mm)
January	18.4	65.1	19
February	21.2	70.2	18
March	26	78.8	34
April	29.7	85.5	56
May	29.9	85.8	159
June	29.1	84.4	300
July	28.8	83.8	260
August	29.1	84.4	294
September	29.2	84.6	242
October	27.6	81.7	201
November	23.3	73.9	17
December	19.6	67.3	3

Source: <https://en.climate-data.org/>

Average Temperature of the study area

Table-38

	Jan	Feb	Mar	Ap	May	June	July	Au	Sep	Oct	Nov	Dec
Avg. Temperature (°C)	18.4	21.2	26	29.7	29.9	29.1	28.8	29.1	29.2	27.6	23.3	19.6
Min. Temperature (°C)	11.6	13.9	18.5	22.8	24.6	25.6	25.9	26.4	26.2	23.6	17.5	12.9
Max. Temperature (°C)	25.3	28.5	33.6	36.7	35.2	32.7	31.7	31.8	32.2	31.6	29.1	26.4
Avg. Temperature (°F)	65.1	70.2	78.8	85.5	85.8	84.4	83.8	84.4	84.6	81.7	73.9	67.3
Min. Temperature (°F)	52.9	57.0	65.3	73.0	76.3	78.1	78.6	79.5	79.2	74.5	63.5	55.2
Max. Temperature (°F)	77.5	83.3	92.5	98.1	95.4	90.9	89.1	89.2	90.0	88.9	84.4	79.5
Precipitation / Rainfall (mm)	19	18	34	56	159	300	260	294	242	201	17	3

Source: <https://en.climate-data.org/>

8.4.3 Vegetation of the study area:

Most of the study area is not for cultivation, but natural 'vegetation remained only in few small areas. Scattered Mahogoni, Babla, Simul trees are mainly found there. Shrub and bamboo occupied minors in the scattered her and there. Short grasses, partly used for grazing in the dry season, were locally found in basins of the Padma floodplain. The alluvium occurring on the part of the active floodplain was either barren or supported a few tufts of short grass. Most of the study area was used for a single crop of Chinese nuts, Bangi, Sweet pumpkin , cultivation. Minor areas were seedbeds or grazing fallow. After the rainy season in a few alluvial soil the people cultivate Festive pulses, Sunflower, Roasted pulses etc.

Picture-8: During the Dry season the river Padma



Picture-9: Active channel of the river Padma

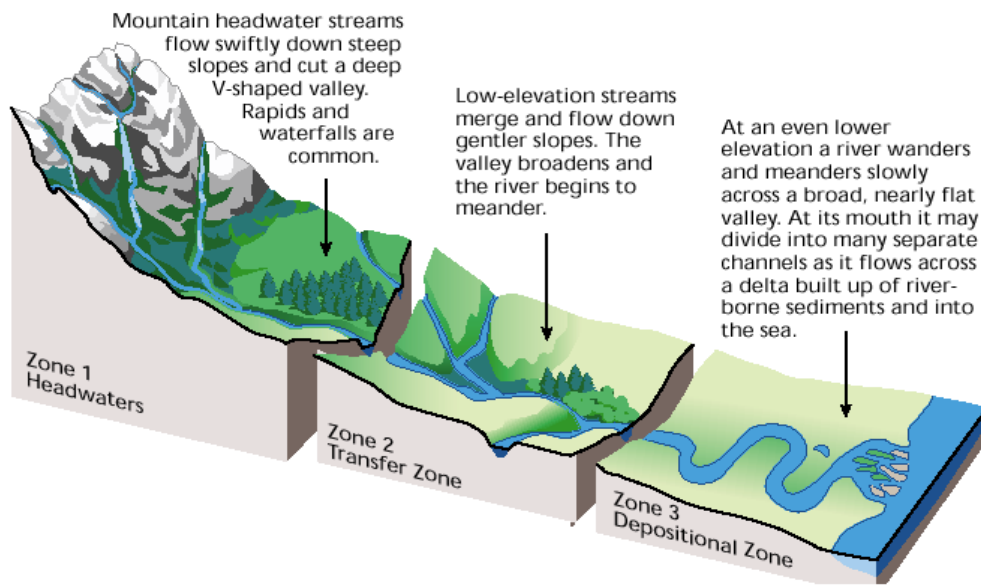


Source: Britannica - Encyclopedia Britannica

Picture-10: River cycle

Source: Dr. David Coates.

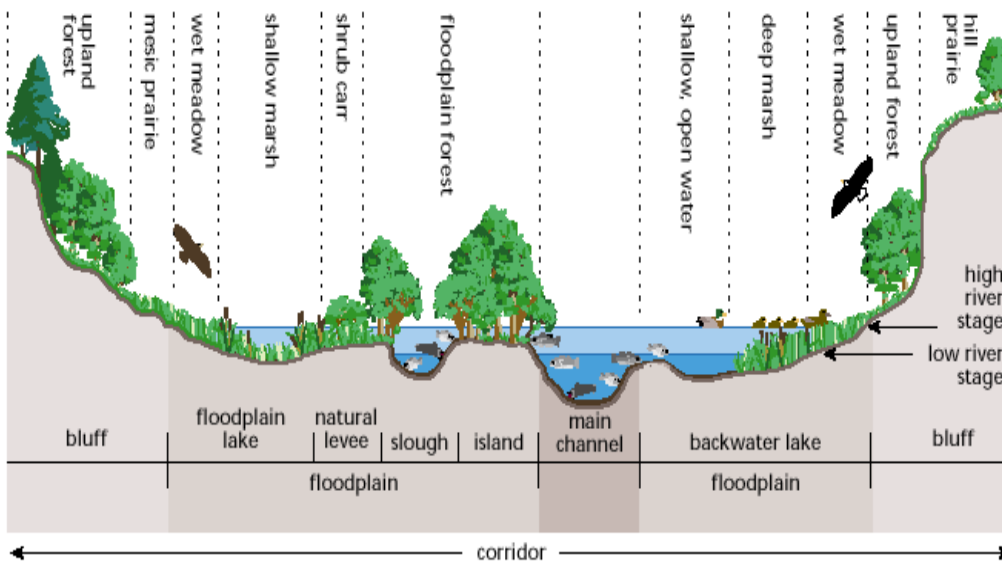
Picture-11: River zone



Source: Dr. David Coates.

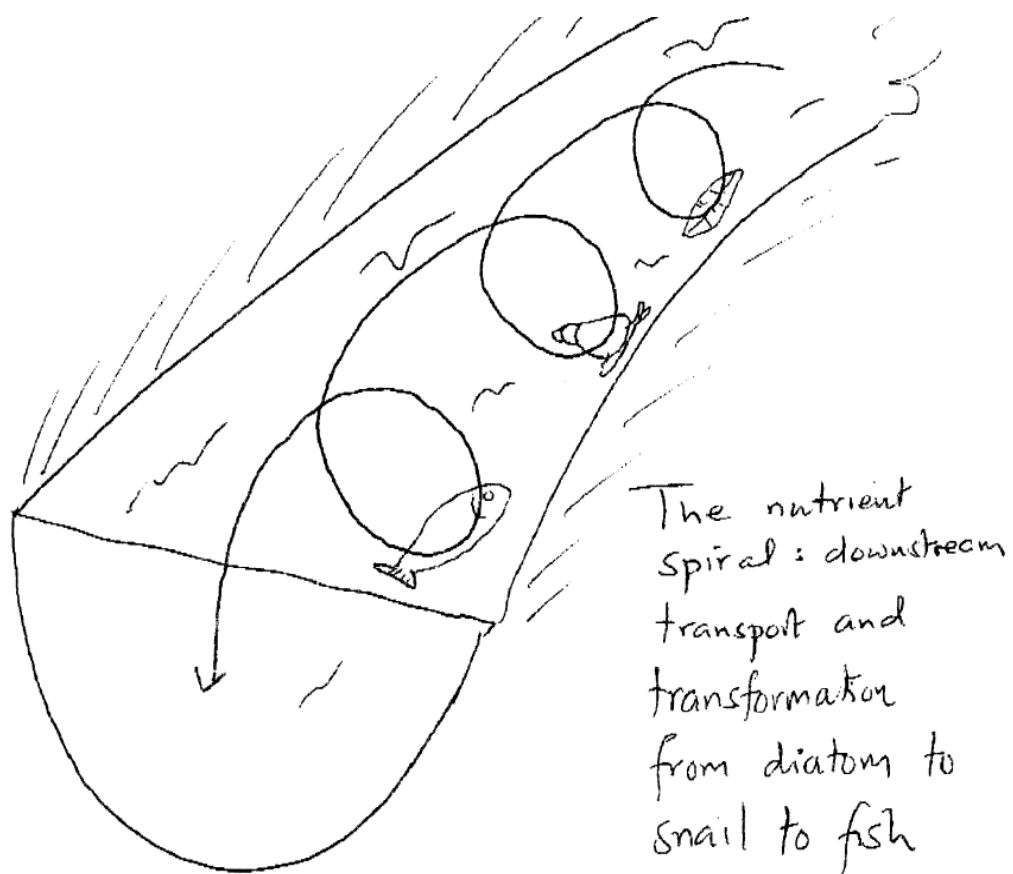
In the study area Raninagar are in the zone 2 Transfer Zone.

Picture-12: Corridor of river system



Source: Dr. David Coates.

Picture-13: The importance of nutrient spiraling in rivers



Source: Dr. David Coates, *Wetlands: People, Land, Water and Fish*, 2002, Dhaka.

Chapter IX

Environmental Impact Assessment (EIA)

9.1 Environmental Impact Assessment:

The primary purpose of EIA is to encourage consideration of the environment in planning and decision making and finally to arrive at actions that are more environmentally compatible.

An environmental impact assessment (EIA) is an assessment of the possible positive or negative impact that a proposed project may have on the environment, together consisting of the environmental, social and economic aspects.

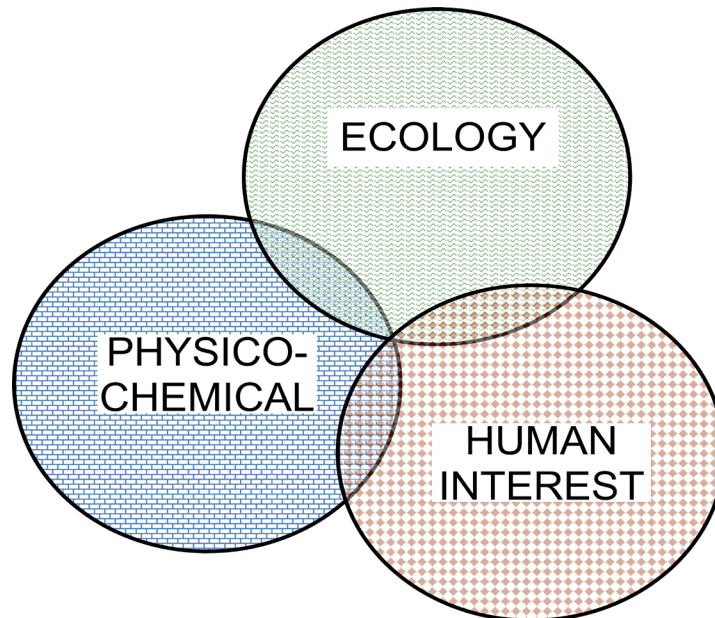
The International Association for impact Assessment defines EIA as, “The process of identifying, predicting, evaluating and mitigating the biophysical, social and other relevant effects of development proposals prior to major decisions being taken or commitment made”.

Source: wikipedia

9.2 Environmental Parameters:

- Components of environment can be grouped into major components.

Diagram-18: Environmental Parameters



Source: Dr. David Coates

9.3 Ecological Impact on the study area:

9.3.1 Aquatic:

Fisheries: Fisheries are breeding natural ways in the river but dry season it was hampered.

Eutrophication: Eutrophication is alarming condition.

Aquatic Weeds: Aquatic weeds are decreasing day by day after erosion.

Species diversity: Species diversity also decreasing due to sandy soil.

Endangered species: Endangered species is dangerous condition their.

9.3.2 Terrestrial:

Forest: There is no forest in the study area. Only local people plant for their own needs.

Wildlife: Some small bushes are there.

Species diversity: Species diversity is treated position in the study area.

Endangered species: Endangered species is also standing endangered position there.

9.4 Physico-chemical:

9.4.1 Land:

Erosion and Siltation: Erosion and siltation condition is very high on the study area.

Backwater Effect: Backwater effect is very poor due to sandy river bed.

Bank stability: Bank stability is very poor there.

Drainage: Only natural drainage systems are staying in the study field.

Soil characteristics: Soil characteristics is desert prone type.

9.4.2 Surface water:

Regional Hydrology: During the rainy season hydrological condition is unbalanced as a result flood affects much.

Silt Load: A huge portion of silt transports by the river current.

Water Pollution: Water with polythene and solid waste are polluted day by day.

9.4.3 Groundwater:

Regional Hydrology: Regional Hydrology are also medium condition.

Recharge: Recharge also medium condition.

Water table: During dry season water table go under level.

Water Pollution: Water Pollution as well as their.

9.4.4 Atmosphere:

Air pollution: Air pollution is normal on the study area.

Dust Pollution: Dust Pollution is very high.

Noise Pollution: Noise Pollution is normal their.

9.5 Human Interest:

9.5.1 Health:

Diseases: Chest and Asma diseases are increasing day by day after erosion.

Sanitation: Open sanitation also decrease but bamboo made sanitation are maximum their.

Nutrients: Nutrition condition is very poor.

9.5.2 Aesthetic:

Landscape: Landscape is desert prone type their.

Recreation: Recreation condition is as well as.

9.5.3 Socio-Economic:

Land Loss: Land Loss is very high in the study area.

Crop Production: Crop Production is very low.

Aquaculture: Aquaculture is a few.

Irrigation: Irrigation is based on rain.

Navigation: Navigation is very poor mainly dry season.

Flood Control: Flood Control is very alarming condition.

Transport: Transport is only ricksha, van and foot walk.

Re-settlement: Maximum re-settlement is embankment and road side.

Employment: Maximum respondents are change in day labour and worker.

Agro-industrial: Their is no agro-industry in the study field.

9.6 Potential Impacts on Environment:

A change in system exerts certain influence on many different environmental parameters resulting a net positive or negative impact on the environment.

9.6.1 Losses for displacement of the study area:

The erosion of river is must harmful environmental disaster that cannot be compared than another catastrophe like other disaster tornodo, flood, draught, cyclone, water logging, earth quake. The people do not lose their homestead land. Some time house or other structural assets also go to the

victim due to disaster. But homestead and cultivated land always stand on the earth. But by impact of river erosion the victim families loss their all assets. Within a short time they loss their occupational activities also. Only the death case is very rare in this disaster. The loss by river erosion is unimaginable for some victims. It affects the rich much more than the poor. Some losses cannot be compared with money. Some assets of the victim which is the result of their struggle for all the life round. After erosion naturally the victim of the study field have lost homestead, cultivated land, farmland other side they become refugees. It is bound of question that they can regain their loss.

9.6.2 Land loss and land use pattern:

There is no systematic nature of river erosion. The hard soil cannot erodes easily. But the sandy land cannot face the wave of river. In the study field maximum land were very silty. There were no tree or other bushes on the bank side. The roots of trees can protect erosion as a natural fishing net. But absence of the tree, the land of the study field eroded easily. The victims of the study area were lost of their land partly or totally. At the period of erosion they overcome this hazard with their local strategy. By their own capacity they meet their problems and essential needs. Due to the erosion they setup to the new safer places. They desire some invisible help to Allah dearly. They have to manage the local land owners to search for the homestead place and temporary occupation.

9.6.3 Change of economical activities:

The victims by riverbank erosion had lost their income capacity and also loss expenditure opportunity. In this research it was found that a large number of people lost their occupation directly and were living a hard ship life. A few victims also changed their economical condition with positive phases. They migrated to aboard and another districts. A big portion of victims changed their profession as weavers and daily worker from agricultural work. Some are searching new sources of income to maintain lively hood.

9.6.4 Income loss:

After disaster the victims families lost the continue income to maintain their family. This sudden brake of their economical condition made some people desperate psychological impact on their life. It was found that some land loss person were involved in the river robbing and hijacking to other districts.

9.6.5 House structure loss:

In Bangladesh the villagers make their house with simple type with local materials. Maximum house of the study field were made by local labours with own labour of the victims. CI tin, chatai, bamboo and jute stick were used mainly as a materials. Some time they use brick on the floor for the protection of thief. A few person were made their house by brick and concrete materials. The roof of the house mainly CI tin. The study shows that due to the bank erosion the victim families were faced their

homestead more than one time also. Some of the victim families tried to shifted their moveable house structure towards a safe zone. At the period of erosion the victims families try to overcome the situation together each other.

9.6.6 Crop loss:

At the time of riverbank erosion the victim families loss their homestead with their cultivated land and farm land. A large number of valuable standing trees and cultivated crops had gone due to this disaster. In this disaster the land lord and rich respondents faced more loss then the poor victims. In the study field on the char land the farmers cultivated chiness nut, til, kashari, and different crops. Especially when river water go down on the alluvial soil, they cultivated these crops. These were the main source of their economy. Day by day they waited for this crops. But due to natural disaster some time they were not harvested this crops. But due to riverbank erosion their hope totally failed with disaster.

9.6.7 Security loss:

By river erosion the victim families faced the security problem. The person who are economically develop in their life they can faced any problem easily. After disaster they loss their income capacity and leading a helpless life. Some victims were also to faced dangerous position in their life. Mainly they cannot afford food. Another needs like treatment and security were the bound of question for them. At the new place the

victim have to face thief. The women and girls faced harassment, Bite of different animals like dog, snake, fox. Some times children and disable person may be missing out from this disaster. So, it can be said that after riverbank erosion the victim families faced security problem than before riverbank erosion.

Chapter-X

Some policy implications

10.1 Local bodies, Thana administration and national policy:

It is common in Bangladesh that the victims of riverbank erosion do not get proper attention by the authorities, like the victims of fire, cyclone, flood, tronado, earthaquake, draught get priority in the list of disasters. Riverbank erosion is a slow process and scattered incidences. So the displacees of river erosion fail to draw the attention of the proper authorities. River bank erosion gets little or poor coverage. For this a silent hazard is going on all the year round. In our country there is no particular policy or strategy for the victim of riverbank erosion, nether by local, nor to Non-government or Government sectors.

Bangladesh government has issued general principles for distribution of relief materials and assistances to the victims of river bank erosion.

In the year 2007 The ministry of Flood and Disaster Management issued four important circular. Here directing some guidelines for distribution of general relief, allotment of cash, CI sheets etc. The resettlement of the victim families, the cyclone/fire/flood/riverbank erosion/tidal bore/earthquake etc. The displacees of riverbank erosion did not get priority.

They victim families do not get normal relief like other disasters, if a person dies, his family gets some money as assistance from the government. In this disaster of riverbank erosion, death is very rare. At the period of disaster each family is given 20kgs of rice once as

assistance from the government fund. With a six members of family it can maintains only ten days.

For reconstruction of damage house 3,000/- three thousands taka is given to every victim families. Now a days it is very poor amount for the migration of total homestead. On the other hand there is a problem to identify the victim people. For cyclone prone areas the government built different temporary shelters for the victims and their livestock assets.

In Bangladesh there is no any temporary rescue shelter for the victim of riverbank erosion. On the other side there is no warning policy or early forecasting system about the riverbank erosion.

Actually this disaster is very different than other disasters. If fire, flood, draught, cyclone, tidal surge occurs in any where. The people suffer very much but they cannot loss their homestead and cultivated land. The damage of crops, livestock, homestead trees can make up in future life. But by riverbank erosion the victims loss their all valuable assets like cultivated land, homestead, standing trees, crops and pera-agriculture garden. It affects the rich much more then the poor people.

After erosion the displacees are forced to leave their own area by their own initiative to a safer zone. In maximum time this landless and helpless victim families cannot get chance for purchase a piece of land. It was found that maximum victims move to a temporary shelter in different road side, to school or madrasha, or near embankment side. Sometime some victims had to take shelter to distant government administrative zones. So, the authority cannot find out their new address. So the official authority cannot assist them.

For this reason these environmental victims become most vulnerable than other environmental refugees.

To meet up the vulnerability and improve the situation of the victim of river bank erosion, some policies can be framed. These are as follows

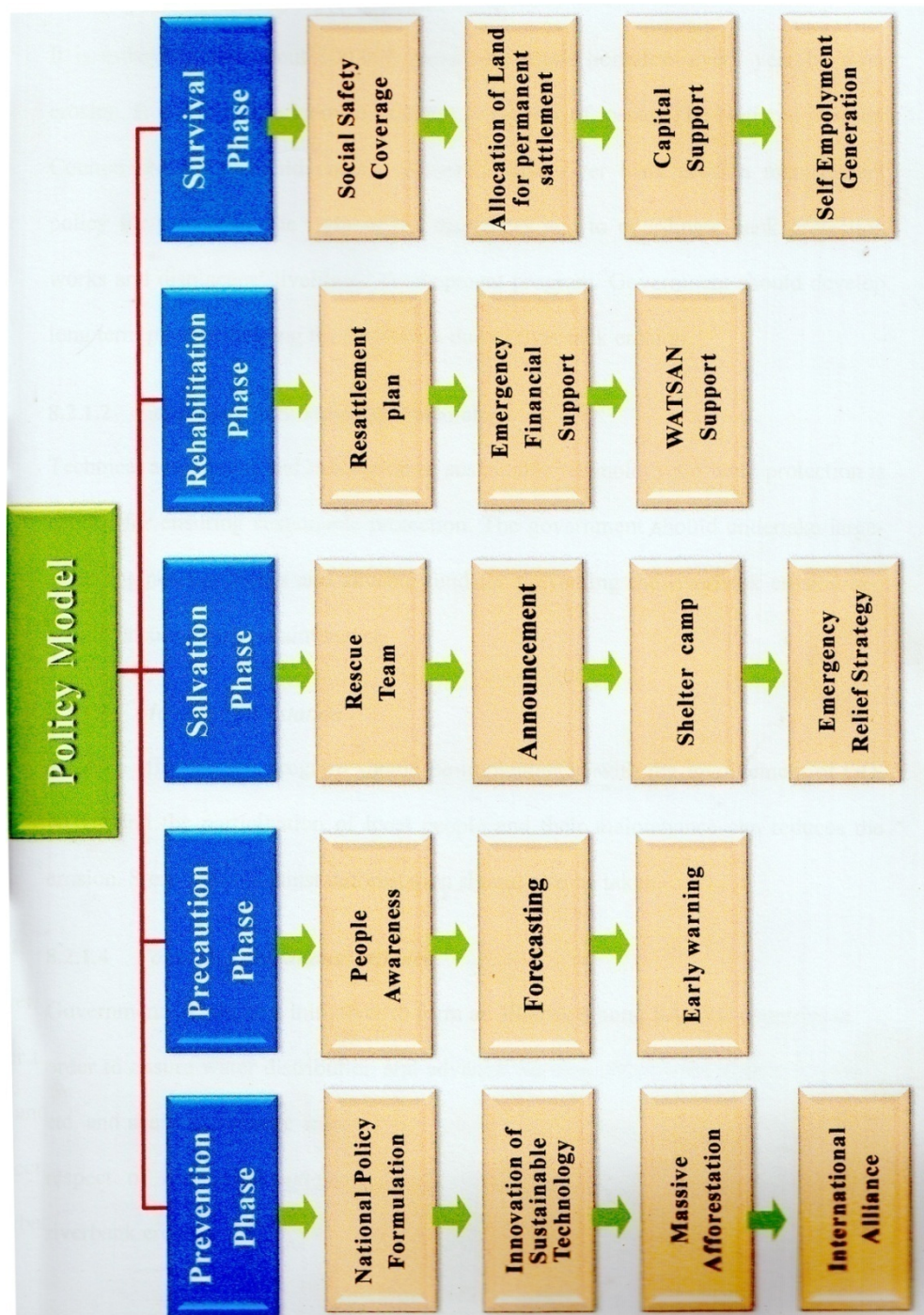
10.2 Development of National Policy:

A huge number of people become landless and homeless every year due to riverbank erosion. It is a harmful disaster considering the loss of homestead, cultivated land, standing crops and trees. The National Disaster Council (NDMC) should apply a fruitful policy for the protection of these victims of river bank erosion.

Bangladesh is the country of six seasons. The Bay of Bengal is standing south side of the country. Which is the part of Indian ocean. Other side the Mountain Himalaya are standing on the north portion of this zone. The climate of this country is tropical seasonal climate zone. So, different natural disasters hit this country in different seasons. During rainy season riverbank erosion hits this country. At that period of flood also joins with these victim families. So an uncountable catastrophe flows over the life of victims of river erosion.

On one side maximum villagers of Bangladesh are very poor. They maintain their life with hard ship condition excepts a few land lord person. The villagers are totally dependent on their agricultural activities. If any natural disaster hits any area that zone suffers a lot. But when this exceptional natural disaster riverbank erosion hits any zone. So, the economical impact of these victims were under level. So the government of Bangladesh should have to take fruitful and sustainable strategy for these environmental refugees. The following chart may be a guideline for that.

A Policy Model



Source: Mosharof Hossain, 2016

10.3 Prevention phage:

This phage is very important for all type of victims. Because any kinds of disaster cannot be stopped fully. Its impact only be reduced. The erosion of river is a continuous process of nature. Specially, the sandy banks erodes easily. So the inhabitant of that disaster prone area must have to take some preventive measure to save the life and properties. So preventive measures may be taken well ahead.

10.3.1 Innovation of sustainable policy:

To ensure the sustainable riverbank erosion protection. Modern technical and sustainable technology may be applied. Modern sustainable innovation policy can play an important role against this disaster. The government of Bangladesh should have to take a sustainable engineering work to protect river erosion.

10.3.2 Massive afforestation:

We know that one forth portion forestation is very friendly for a country. In our country the forestation is decreasing day by day. We should ensure a large scale forestation implementation policy with the participation of local victims, NGO's and GO. Regular maintenance and stern action can reduce the deforestation. massive afforestation can save the environment. By this way we can reduce the erosion of river.

10.3.3 International alliance:

International alliance is very important factor for any nation. The well wisher of any country can take a positive role in the field of economic, political, educational and environmental change. So, the government of Bangladesh should have to take an initiative to make an international alliance with SAARC and other neighboring countries.

10.4 Awareness of People:

Awareness is very essential to face any hazard or disaster. Discussion, consultation and consequences of weather report can increase the awareness of the victim families. Different training on natural disaster by government institutions or any other NGO can play an important role, to reduce the risk and can take protection strategies to face the disaster.

10.5 System of early warning:

By using technologically advanced policy and forecasting through satellite on early warning can ensure the victims to take quick preparation to face the hazard, and can reduce the loss of assets, livestock, crops etc. At the critical moment the local people can take early initiatives to safe themselves together. So, proper monitoring system and early warning policy will be help to the victim of riverbank erosion.

10.6 Protection and salvation phase:

In the study it was found that protection and salvation phase is most important to face the problems. It is true that Allah helps him who helps himself. At the period of disaster the victims always try to protect their own family and try fully or partly shift to a new place.

10.6.1 Rescue Team:

During the critical moment to face any natural disaster the rescue team can be useful. So a rescue team is very essential with logistic support by the government. This team can reach to them rapidly and can salvage property their life and livestock assets during critical situation.

10.6.2 Evacuation announcement:

Announcement is the process to reach the information to the disaster prone people. By this way people get chance to take preparation to face the dangerous situation. It can help the people to reduce their loss to a minimum scale.

10.6.3 Land for resettlement:

After disaster the victims become very helpless. Among them a lot of people are landless and assetless. So, to rebuild the house structure, government can allocate some land for the displacees. and also allocate have to support and monetary help to re build their shelter.

10.6.4 Emergency ration:

After disaster the victim families faced different crisis. Food, medicine, shelter become essential for them. So, authorities should provide food and medicine through the rationing system. These helpless people desire that local elites and government will provide food and help in those critical period. So, food rationing is essential to the victim families.

10.7 Rehabilitation policy:

Temporary shelter cannot secure life. So the victim families need rehabilitation fully. It is an essential need of the victims of river bank erosion.

10.7.1 Plan for resettlement:

It is known to all that permanent shelter can secure life. So the victim families of riverbank erosion try to resettle themselves to a reliable place according their capacity. For this purpose government and local administration should provide a comprehensive policy to resettle the victim families by distributing khas lands.

10.7.2 Protection for severely affected victims:

The severely affected victims need various supports like housing materials, financial and homestead land. They desire different GO, NGO and other international organizations will come forward to extended some assistance to the victim families.

10.7.3 Health support and WATSAN:

After disaster the victim families suffer from different health hazard. So the government of Bangladesh should provide these victim families health care free of cost. They should supply low cost sanitary latrine and pollution free drinking water facilities. This supports will be helpful to the victims.

10.8 Livelihood and survival management phase:

Generally the villagers maintain their livelihood with their own capacity by their agriculture based incomes. Due to the disaster of riverbank erosion they have to face an unimaginable suffering. So, they may be given long-term basis loan.

10.8.1 Coverage of social safety:

After disaster the victim families face a very hard ship situation. Government should extend a social security network to these victim families like widow allowance, disability pension for disable person, VGF, VGD card and stipend for students. It will be very helpful to the victim families.

10.8.2 Education of children:

At the period of riverbank erosion the children of victim families suffer from educational problem. By riverbank erosion, are damaged school, college, Madrasha and communications networks. So, the authority should take steps to ensure of study for the children of the victim

families. For this purpose satellite schooling system have to be arranged and built up.

10.8.3 Self employment activities:

It is common that after erosion victim respondents loss their income opportunity capacity. Sometimes they hope the government, local government and other organization will provide some economical activities during this crisis moment. So, the government should have to arrange skill development training for the victims so that they can find a sustainable job. On the other hand government can send these victims to the foreign labour market for new job with appropriate training.

Chapter-XI

Summery and Recommendation on the entire study

Summary:

The study emphasizes the importance and need for looking into the phenomena of riverbank erosion, course shifting tendency of river erosion displacement and its impact on socio-economic condition at local and national level.

A field survey was conducted at Pabna district to know the causes and effect of riverbank erosion and its impact on population displacement and its impact on socio-economic conditions.

Land degradation due to river bank erosion is a recurrent problem in Bangladesh. It has a devastating impact on the socio economic condition in the study area. The main purpose of the research work was to depict the status of land degradation due to river bank erosion in Pabna district since a certain period caused by the Padma river and its impact on the socio economic condition of the displaced population of the study area. This is why data for the study were collected by interviewing from 150 randomly selected displaced populations from the village Raninagar. Secondary data were also collected to describe the erosion status.

The another side of the study was to look into the survival strategies of the victims of riverbank erosion of the study population on the Pabna district.

Most of the respondents (40.67%) were migrated from their original house 1-2 times in their life time. Rest (59.33%) of the respondents changed their house up to 3 to over 6 times in their life time.

Before erosion 70% respondents were involved agricultural activities after erosion it was 12%. only

It was found that after erosion 84.67% respondents had land less before erosion it was 10% in the study area.

42.67% respondents migrate another village to same union and only 4.67% migrated aboard.

Before erosion 90% respondents were good health. After erosion it was 60%.

It was found that their social relationship were very strong. When river eroded. They overcome that situation together through adopting indigenous strategies now the victims. Shifted household on embankment 30% on road side 50%, relatives land 10% and purchase land 10%.

Though the sanitation facility in the study area was not good but the drinking water supply was better. Personal initiative, government and NGO participation has improved the source of drinking water condition in the study area but could not improve the latrine facility due to mobility of the respondents. (10%) of the respondents used own tube well as their source of drinking water on the other hand 90% respondents use drinking water from others tube well. It is very positive signal to health and hygienic environment that 100% respondent use tube well for drinking water now.

The annual incomes of the respondents were lower than that of the national average that might indicate that the socioeconomic status of the respondents in the study area was lower than a typical social community of Bangladesh.

River bank erosion is a recurrent problem in Bangladesh. It has a devastating impact on the socio economic condition of the study area. The main purpose of the research work was to depict the status of river bank erosion victims of Pabna district and their survival strategies collected by interviewing through questionnaire from 150 randomly selected & displaced populations from village Raninagar Dogachi union, Pabna Sadar upazila Pabna.

Recommendations:

It is true that river bank erosion or any natural disaster cannot be stopped fully but proper management system can reduce magnitude of the problem. In the study area people become economically vulnerable due to river bank erosion. To overcome this situation people applied their indigenous knowledge, GOs and NGOs took a minor step. But still now people are within poverty trap. For recovery from the damage of river bank erosion sustainable river bank erosion management system have to be applied. Based on the research outcome this study has suggested some recommendations to develop sustainable adaptation strategy from river bank erosion.

1. Government should take steps to send these refugees to foreign labor market free of cost or taking lump-sum of refundable money

from them. Appropriate training facilities may be arranged for them.

2. Govt. should take steps so that children of the victimized families can get opportunity to go to school, college, and university on priority basis and complete their education free of cost.
3. Social afforestation program have to stated taking the help of victim families.
4. Proper policy for deforestation have to be taken.
5. A well planned family planning system to ensure their health, hygiene and awareness about diseases be formed by govt.
6. To make them self-reliant through petty business or small cottage, industries to be established through government and non-government organizations.
7. To build emergency fund to fight against the river bank erosion hazard during crisis moment by allocating money from the national budget.
8. Last of all, to increase public awareness, information relating to bank erosion should widely be published through various mass media.

Conclusion:

Bangladesh is prone to many disasters including river bank erosion. It is a regular catastrophe all around the year. Especially, in rainy season and during flash flood and afterwards people of the erosion areas fall into untold sufferings. Since, it is a poor country the government cannot allocate as much money as required for draizing the river or administer the river bank erosion. Many of the rivers are now silted which require massive draizing. The rivers of the country mostly the major rivers like the Padma, Jamuna, Brahmaputra come from upstream of Himalayan belt through China, Nepal, Bhutan and India. Every year the rivers are affected with flash flood bring about mud and silt from the upstream.

There is a dearth of appropriate policy neither from the government of the country or from international community. Due to climate change, Bangladesh is the worst sufferer though they are not responsible for the evil effect of climate change.

As far as possible govt. of Bangladesh is trying hard to mitigate the evil effect of climate change. However, more attention may be given to mitigate the sufferings of all victims of climate change including the victim of river bank erosion. Appropriate policy and advance warring systems be developed and action plan may be taken for the rehabilitation of the victims of river bank erosion.

To decrease the damage of riverbank erosion and developing the people's life standard GOs and NGOs must come forward in this regard.

Bibliography and annexure

- Abedin M. Zainul., 2005. A Handbook of Research (Second Revised Edition). Book Syndicate, Dhaka.
- Abrar, C.R., Azad, S.N., 2004. Coping With Displacement: Riverbank Erosion in North-West Bangladesh. North Bengal Institute: Refugee and Migratory Movements Research Unit, RDRS Bangladesh, Dhaka.
- Ackerman. E. A., 1945: Geographic Training. Wartime Research and Immediate Professional Objectives. Annals AAG, 35. pp. 121-143.
- Alam K. Asraful , 2015. Fundamental Physical Geography 1st edition. Perfect Publication 37 Banglabazar Dhaka.
- Alam K. Asraful, 2014. Encyclopedia of Geography & Environment, 2nd edition, perfect publication 37 Banglabazar Dhaka. pp-271-272.
- Alam K. Asraful, 2016. Modern Geomorphology, 1st edition, perfect publication, Dhaka.
- Alam, Asraful , 2014. Climatology 1st edition, Perfect Publication, Dhaka.
- Alam, S.M. 1991. *“Survival”*: *An Analysis of General Issues and Concerns with Emphasis on the Strategies to cope with Floods in Bangladesh*. A paper presented at the Seminar on Environment and Natural Resources Management in Bangladesh, organized by Bangladesh Sociology Association, Dhaka, January 25-26.
- Alam. Shah Manzoor 1948 A Survey of Research in Geographic: 1972-75. Indian Council of Social Science Research. New Delhi.

- Anuchin. V.A. 1957: The Nature of Geographical Environment and the Appearance of Indeterminism in Soviet Geography. *Voprosy Geografic* 41-52.
- Appleyard. D., 1970 *Styles and Methods of Structuring a city in Environment and Behaviour*. vol. 2, pp. 100-118.
- Aydinalp, C. and Fitzpatrick, E.A. 2005. *The land degradation problem and its effects on ecology in the densely populated region of Turkey*. Department of Soil Science, Faculty of Agriculture, Uludag University, Turkey. *Ekologia-Bratislava*. 23 (30): 298-304.
- Azam, M.S. 2007. River bank erosion in Chilmari upazila under Kurigram District and its Impact on the socio-economic Condition of the Displaced Population. M.S. Thesis, Department of Environmental Science, Bangladesh Agricultural University, Mymensingh.
- B.B. Hosett and Kumar. 1998. *Environmental Impact Assessment and Management*. Daya Publishing House, Delhi-110035.
- BBS, 2001. *Statistical Year Book of Bangladesh*. Bangladesh Bur. Stat. Statistical Division. Ministry of Planning. Govt. the People's Republic of Bangladesh.
- BBS, 2004. *Statistical Year Book of Bangladesh*. Bangladesh (Bur. Stat. Statistical Division. Ministry of Planning. Govt. the People's Republic of Bangladesh.
- BBS, 2008. *Statistical Year Book of Bangladesh*. Bangladesh Bur. Stat. Statistical Division. Ministry of Planning. Govt. the People's Republic of Bangladesh.

- Bennett. R.J. & R.J. Chorley. 1978: Environmental Systems: Philosophy. Analysis. and control. London. Methuen.
- Berry. Brian J.L., 1978: Geographical Theories of Social change. In B.J.L. Berry (ed.). The Nature of change in Geographical Ideas. Northern Illinois University Press, pp. 17-36.
- Bhuiya M. Bahadur Hossain, 2017. Revised edition. Introduction to physical Geography. R.C Pall, Grantha Kutir 26, Banglabazar, Dhaka. pp-222-238.
- Bimol, K. 1984. Perception of and Agricultural Adjustment to Floods in the Jamuna Flood plain, Human Ecology, 12 (4): 3-19.
- Bowen. Margarita, 1934, Geography in Relation to the social sciences, New York, Carles & Scribner.
- Brammer, H. 1999. Agricultural Disaster Management in Bangladesh. The Univ. Press, Dhaka.
- Bridges, E.M. and Oldeman, L.R. 2005. Global Assessment of Human-induced soil Degradation. Arid Soil Research and Rehabilitation, International Soil Reference and Information Centre. 13: 4, 3 19-325.
- Burton, I., Robert, W. and White, F. 1978. The Environment as Hazard. New York: OxfordUniversity.
- Climate change and disaster Management, 2nd edition. Sojon Prokasoni Nilkhet, Dhaka. p-327-339.
- Carlstein. T., 1980. Time. Resources. Society and Ecology. Dept. of Geography Royal University of Lund. Lund.
- Chisholm. M., 1962. Rural Settlement and Landuse, London. Hutchinson.

- Chowdhury, E. 1991. Human Responses to Riverbank Erosion Hazard in Bangladesh: Some Lessons from Indigenous Adjustment Strategies, pp.191-217.
- Coates, Dr. David. 2002, Wetlands: People, Land, Water and Fish, Dhaka.
- Coppock, J.K., 1970, Geographers and Conservation, Area, vol. 2, pp. 24-26.
- Cormier, Alam, 1993, Uncommon Sense: The Heretical Nature of Science, Oxford University Press.
- Curry, L., 1967, Quantitative Geography, The Canadian Geographer. 11, pp. 265-74.
- Darwin, C.R., 1859, On the origin of Species by Means of Natural Selection or the preservation of Favoured Races in the Struggle of life, London. John Murray.
- Davis, I. 1978. *Shelter after disaster*. Headington, Oxford: Oxford Polytechnic Press.
- Dhondyal, S. P. (n.d.). Research Methodology in Social Sciences. Meerut: Friends Publications.
- Disasters: The J. *Disaster Study, Manag.* 13(4): 301-314.
- Dr. Alam Khurshed, Samaj Gobeshana Paddati, 5th edition-2003, Minerva publications, 38/3, Bangla Bazar, Dhaka. pp-346-347.
- Elahi, K.L., Ahmed, K.S. and Mafizuddin, M. 1991. *Riverbank Erosion, Flood and Population Displacement in Bangladesh, Riverbank Erosion Impact Study*, Jahangirnagar University. Savar, Dhaka, Bangladesh.

- Elahi, K.M., 1991. Impacts of Riverbank Erosion and Flood in Bangladesh: An Introduction: Riverbank Erosion, Flood and Population Displacement in Bangladesh. River Erosion Impact Study (REIS), Jahangirnagar University, p. 10.
- Elhance, D.N. (1971). Fundamentals of Statistics. 12th ed. Allahbad: Kitab Mahal.
- English, J., Srivastava, J.P. and Alderman, H. 2000. *Population growth inevitable lead to land degradation. Agriculture and environmental challenges: proceedings of the Thirteenth agricultural Sector Symposium*, pp. 45-58.
- Greenberg, C. 1986. *The Adaptation Process of River Erosion Displaces in an Urban Environment: A case study of Squatters in Serajgang, Bangladesh*. Univ. of Manitoba, Canada.
- Guy, P.R. 1981. River bank erosion in the mid- Zambezi valley, downstream of Lake Kariba. *Biol, Conservation*, pp. 199-212.
- Hanson, D.L., Steenhuis, T.S., Walter, M.F. and Boll, J. 2005. *Effects of soil degradation and management practices on the surface water dynamics in the Talgua River Watershed in Honduras*. Department of Biological and Environmental Engineering, Cornell University, Riley-Robb Hall, Ithaca, New York, USA, 15 (4): 367-381.
- Haque, C. E. 1989. Human adjustments to riverbank erosion hazard in the Jamuna floodplain, Bangladesh. *Human-Ecology*, 16(4): 421-437.
- Haque, C. E. 1992. *Effects of natural hazard-induced displacement upon household income in rural Bangladesh*. Dept. Geography, Brandon Univ., Manitoba, Canada. *Asian-Profile*, 20(5): 427-439.

- Haque, C.E. 1997. *Hazards in a Fickle Environment: Bangladesh*. Kluwer Academic Publishers.
- Haque, C.E. and Zaman, M.Q. 1989. “*Coping With Riverbank Erosion Hazard and Displacement in Bangladesh*”: Survival Strategies and Adjustments.
- Hooke, J.M. 2003. *River meander behavior and instability: a framework for analysis*. Transactions of the Institute of British Geographers, NS 28, pp.738-253.
- Hossain, et al, S. 2004. Assessment for role of GIS Based Natural Disaster Database in Environmental Management and Planning activity in Bangladesh. Environ. Informatics Archives, 2: 855-863.
- Islam Johirul, Nahar, Bodnun, Kobir Humayan, Jahan Sarmin, 2018. Environmental Geography, 3rd edition, Shojon prokashani, Dhaka. pp-21-36.
- Islam, M. Fakrul, Rashid, A.N.M. Bazlur. 2011. Riverbank Erosion Displaces in Bangladesh. Bangladesh Journal of Bioethics, 2011; 2(2): pp- 4-19.
- Islam, M. N. 1986. Alternative Adjustment to Natural Hazards; Implication for Bangladesh, Presidential Address at 11th Annual Bangladesh Science Conference, Rajshahi, Bangladesh
- Islam, M. Nazmul, 2006. Bank erosion hazards of the Padma river at Zanjira-Socio-Economic impacts, Indian Journal of Power and river valley development.
- Islam, M. Nazmul, 2012. Riverbank erosion induced migration by the char-dwellers in Bangladesh: Towards a better strategy, Asian

Journal of Environment and disaster Management, Research Publishing Services, vol. 4, No. 3, pp- 243-267.

- Islam, M. Nazmul, 2018. Community-based responses to flood and river erosion hazards in the active Ganges floodplain of Bangladesh, Science and Technology in Disaster Risk Reduction in Asia, DOI: <http://dx.doi.org/10.1016B978-0-12-812711-7,00018-3>.
- Islam, M.N., Islam, M.Z., Akter, S.T., 2006. Bank erosion hazards of the Padma river at Zanjira—socioeconomic impacts. Indian J. Power River Valley Develop. 56 (3&4), 123_130.
- Kates, R.W. 1971. Natural Hazard in Human Ecological perspective: Hypotheses and Models. Economic Geography, 47: 438-45 1.
- Khan, N.I., Islam, A., Ritchie, J.C., Walling, D.E. and Peters, N. E., 2003. Quantification of erosion patterns in the Brahmaputra-JamunaRiver using geographical information system and remote sensing techniques. Dept. Geography & Environ., Univ. Dhaka, Bangladesh. Application of geographic information systems and remote sensing for quantifying patterns of erosion and water quality. Hydrological-Processes, 17(5): 959-966.
- Khan, T.A., Mirjahan, M., Saleh, A.F.M., Rahman, R., Baten, K.A., Matin, N. and Ibrahim, M.A. 1999. EIP Projects: *An Assessment. Planning and Management of Water Resources*. The Univ. Press Ltd., Dhaka, Bangladesh, Chapter 3, pp.33-55.
- Kheri, M.B., Shaban, A., Khawlie, M. and Girard, M.C. 2003. *Impact of human activities on water-induced soil erosion in the mountainous coastal region of Lebanon*. Conseil national de la recherche scientifique, Beyrouth, Lebanon. Secheresse, 12(3): 157-165.

- Kobir Hefjul, 2016. World Regional Geography, 1st edition, Delta Publications 37/1 Banglabazar Dhaka. pp-42-45.
- Larry W. Canter. 1996. Environmental Impact Assessment. Mc Graw-Hill, Inc. New York.
- M. Z. Mamun and ATM. N. Amin, *Densification: A Strategic Plan to Mitigate Riverbank Erosion Disaster in Bangladesh*, (The University Press Limited, Dhaka, 1999).
- Mahmud K. Hasan, 2018. Text book of GIS and Remote sensing, 1st edition, shojan porkashani, Dhaka. pp- 295-297.
- Mesbah, U. S., The Mobility Characteristics of Displaces: A Case Study from River Bank Erosion Hazard Area: River Bank Erosion, *Flood and Population Displacement, River Erosion Impact Studies (REIS)*, (Jahangirnagar University, 160–169, 1991).
- Miller, Delbert C. (1970). Hand Book of Research Design and Social Measurement. 2nd ed. New York: David Mckay Company, Inc.
- Philips, Bernard S. (1976). Social Research Strategy and Tactics. 3rd ed. New York: Macmillan Publishing. Co., Inc.
- Philips, Estelle M. and Pugh. D.S., (1993). How to Get A Ph.D. –A Hand book for students and Thier Supervisors. 2nd ed. New Delhi: UBS Publishers' Distributors Ltd.
- Prosser, I.P., Hughes, A.O. and Rutherford, I.D. 2000. *Bank erosion of an incised upland channel by sub-aerial processes*: Tasmania, Australia. Earth Surface Processes and Landforms, 25, pp. 85-101.
- Qadir, S.A. (1987). Social Science Research in Bangladesh. Dhaka: NILG.

- Quiggin, J., Chisholm, A. and Dumsday, R.G. 1987. *Land degradation: behavioural causes. CRES, Australian National Univ., Australia.*
Land-degradation. Problems and Policies, pp. 203-212.
- Rahman Arifur, 2017. Introduction to Geography & Environment, 1st edition, Kabir publication 38/3 Banglabazar Dhaka. pp-328-342.
- Rahman Arifur, Kabir M. Enamul, 2019. Climatology, 2nd edition, Kobir Publication 38/3 Banglabazar Dhaka.
- Rahman M. Arifur 2018. Physical Geography 1st edition. Kobir publications 37/3 Banglabazar Dhaka. pp 305-328.
- Rahman M. Arifur, 2018. Climate change and disaster management, 2nd edition, shojon prokashani Nilkhate, Dhaka. pp-327-340.
- Rahman, M.M. 1988. *Vulnerability syndrome and the question of peasant adjustment to riverbank erosion and flooding in Bangladesh.* A paper presented at the international symposium on the Impact of Riverbank Erosion, Flood Hazard and the Problem of Population Displacement, Dhaka. April 11-13.
- Reich, J. 2004. *Flood management in Baden Wurttemberg.* Wasser Wirtschaft Hydrologie, Wasserbau, Boden, Okologic. 94 (9): 13-15.
- REIS, (1985) Riverbank Erosion Study, Janangirnagar University, Bangladesh and University of Manitoba, Canada.
- Richard, K.S. 1994. Real Geomorphology revisited. Earth Surface Process and Land form., 19:277-281.

Rouf Kaji Abdur, Mahmud K. Abul, Roy Biswasjit, 2019. Geography of disaster 1st edition, Sujaneshu prokashani 34, Banglabazar, Dhaka. pp- 277-287.

Rumi Syed Rafiqul Alam, 2014. Bangladesh: Praktik O Sampad Bhugal, 1st edition. Uttoron ofset Printing press Grater Rood Rajshahi. pp. 136-145.

Sanders, D.W. 1997. International activities in assessing and monitoring soil degradation. Land and water Development Division, Rome. American Journal of Alternative Agriculture. 7 1 7-24.

Sarker, M. H and Thorne, C. R 2003. Morphological Evolution of the Brahmaputra-Padma Lower Meghna Braided System. Published in Pipe. Conference Braided Rivers, Univ. Birmingham, UK.

Shah D.M. Firoj, Kobir Anamul, Kamaruzzman, Yesmin Akida, 2018. Geomorphology 1st edition, Kobir publication 38/3 Banglabazar Dhaka. pp-150-152.

UNDP.2004. United Nations Development Program Report, Professor's Current Affairs, September. Dhaka: Professor's Publications.

Westing, A.H. 1994. *Population, desertification and migration. Environmental Conservation*. Westing Associates in Environment, Security and Education, Putney, USA. 21 (2): 110-114.

বাংলাদেশ পানি উন্নয়ন বোর্ড (২০১১)

বাংলাদেশের নদী, ২য় সংস্করণ, আগস্ট ২০১১

বাংলাদেশ নদী গবেষণা ইনস্টিটিউট (২০০৩)

বাংলাদেশের সীমান্ত নদী, ফরিদপুর, জুলাই ২০০৩.

ড. অশোক বিশ্বাস (২০১১).

বাংলাদেশের নদী কোষ, গতিধারা,, ৩৮/২-ক, বাংলাবাজার, ঢাকা ২০১১.

The Daily Sun 15 September 2018.

The Daily Sinsha, 21 April 2014.

Local Government Engineering Department (LGED) Pabna.

Britanica Encyelopedia

wikipedia

Internet

<https://en.climate-data.org/>

APPENDICES-I

Appendix: English version of interview schedule

**Institute of Environmental Science IES, Rajshahi University,
Bangladesh**

Questionnaire for Ph.D Research

Survival Strategies of the Environmental Refugees of Pabna District in Bangladesh

- | | |
|--|--|
| 1. Name of respondent: | Age: |
| Father's name: | Alive/Dead |
| Mother's name: | Alive/Dead |
| 2. Present address: | Village: Post Office: |
| | Thana: District: |
| 3. Previous address: (Before river bank erosion) | |
| Village: | Post Office: |
| Thana: | District: |
| 4. Marital status: | <input type="checkbox"/> Married <input type="checkbox"/> Unmarried: |
| | <input type="checkbox"/> Divorcee: <input type="checkbox"/> Widow: |
| 5. Religion: | <input type="checkbox"/> Islam <input type="checkbox"/> Hindus <input type="checkbox"/> Others |
| 6. Education: | <input type="checkbox"/> Illiterate <input type="checkbox"/> Can write name only |
| | <input type="checkbox"/> Up to primary <input type="checkbox"/> Junior certificate |
| | <input type="checkbox"/> SSC <input type="checkbox"/> HSC |
| | <input type="checkbox"/> Above |

7. Number of family member:

Name of member	Relation	Age	Qualification	Occupation

8. Description of property

Present	Before erosion
Land property (if any) amount:	
Households (if any) amount:	
Cattle (if any) amount:	
Furniture (if any) amount:	
Cash money (if any) amount:	
Other (if any) amount:	

9. Occupation:

Present occupation	Before erosion
Agriculture	
Business	
Service	
Day laborer	
Fisherman	
Weaver	
Rickshaw/van puller	
Other	

10. Income-earnings of respondents (Monthly/Yearly)

Present income	Quantity	Before erosion	Quantity
From land (if any)			
Pond (if any)			
Garden (if any)			
Service (if any)			
Day laborer (if any)			
Fishing (if any)			
Other (if any)			
Total			

11. Sectors of expenditure (Family)

Present expenditure	Quantity	Before erosion	Quantity
Food subsidy			
Clothes			
Housing			
Education			
Treatment			
Other			
Total			

12. Surplus information (if any):

Have you any surplus after expenditure? Monthly/Yearly:

Yes No

If yes, mention quantity: Monthly Tk Yearly Tk

13. What do you do with surplus money?

Deposit in bank Give loan

Purchase cattle Other

14. If any deficit: Yes No

If yes, how much deficit? Before erosion monthly tk Yearly tk

After erosion monthly tk Yearly tk

15. How do you mitigate deficit? By loan By help

From relative Other

16. Have taken loan? Yes No

If yes, which sources? Government NGO From person

17. If any help received after erosion? Yes No

18. If yes, Government Non-govt.

Both From person

19. Amount of total help: -----

20. How many terms?-----

21. If any relative reside in foreign country? Yes No

If yes, how is your relationship with him?-----

22. If he gives any help to you? Yes No

If yes, Quantity:----- Monthly tk Yearly tk

23. Total no of migration in life time times

24. Choice of place for further migration:

- Road side
- Embankment side
- Relatives land
- Perches land

25. Help received from the government/non-government organization at the time of erosion/disaster

- Monetary help
- Infrastructure help
- Both types of help
- No help

26. Source of drinking water :

- Tube-well
- Well
- Ditch/pond
- River
- Others

27. Have own tube well : Yes No

28. Sanitation facility :

- Sanitary latrine
- Kacha latrine
- Open place
- Others

29. Source of fuel for cooking :

- Wood
- Leaves
- Cow dung

30. Types of dwelling house hold :

Used materials	Type of housing construction		No. of households
	Fence	Roof	
Bamboo			
Leavers			
Straw/jute stick			
Tin/CI sheet			
Others			

31. Land cultivation :

- Own land
- Share cropper
- No cultivation

32. Opinion of respondents:-----

Appendix-II

Some Pictures about research on the study area



Bank of the river Padma



At the dry season the river Padma



River side vegetable cultivation



Picture during data collection



Picture during FGD Meeting



South-west side of the village in dry season



Bank of river during dry season



South side of the village (Raninagar)



Nature of petty business



South-east side of the village



Road side settlement of van puller



Embankment side settlement



Fuel processing on the study area



Fuel stick of cow dung processing



Collection of fuel



Protection of fuel for cooking



Nature of kitchen



Nature of Bath place



Road side goat farming



Type of Latrine



Local policy of vegetable Protection



Settlement of relative house



Drying cloth on road side



Source of drinking water