

## DEDICATION

Dedicated to the memory of the  
people who lost their lives in  
the terrible floods of the  
Tista.

## DECLARATION

The undersigned declare that the thesis entitled '**HUMAN AND RIVER INTERACTIONS IN RIPARIAN VILLAGES ALONG THE TISTA RIVER OF JALPAIGURI AND KOCH BIHAR DISTRICT, WEST BENGAL**' being submitted by myself (Rajib Mitra) to the Department of Geography & Applied Geography, University of North Bengal, Raja Rammohunpur, P.O. NBU, District Darjeeling, PIN 734013, West Bengal, is entirely authentic and has not been published partially or in full for any other diploma or degree of an academic institution except few parts peer-reviewed journals to partially fulfil the need of publication.

The work of other authors or other organisations that used it has been adequately recognised in this research at pertinent locations with due credit where it is due. The published works have also been courteously used, whether directly or indirectly. There is very little probability of this happening, but if it does, it must be appropriately acknowledged to the author(s), organisation, or agency in question. The approach is to achieve originality and uniqueness in every aspect of the research by gathering evidence from secondary data sources, household survey, fieldwork, and interviews.

*Rajib Mitra.*

(RAJIB MITRA)

Date: 16.08.2023

Place: Raja Rammohunpur, Darjeeling.



समाचो बन्धः सयित्तिः समाची

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**CERTIFICATE**

This is to certify that **Rajib Mitra**, a Research Scholar of the Department of Geography & Applied Geography, University of North Bengal, Raja Rammohunpur has carried out this research work entitled "**Human and River Interactions in Riparian Villages along the Tista River of Jalpaiguri and Koch Bihar District, West Bengal**" under my supervision which is being submitted to the University of North Bengal for the award of Doctor of Philosophy in Geography & Applied Geography under the faculty of science.

This thesis is based on the original work done by the researcher. He has fulfilled all the requirements as per the regulation of the University for submission of the Ph. D Thesis.

This thesis as a whole or any part of it has not been submitted to any other University/ Institution for any other degree.

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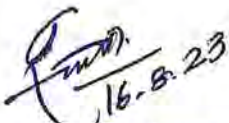
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HUMAN AND RIVER INTERACTIONS IN RIPARIAN VILLAGES ALONG THE TISTA RIVER OF JALPAIGURI AND KOCH BIHAR DISTRICT, WEST BENGAL A THESIS SUBMITTED TO THE UNIVERSITY OF NORTH BENGAL FOR THE AWARD OF DOCTOR OF PHILOSOPHY IN GEOGRAPHY AND APPLIED GEOGRAPHY Submitted by RAJIB MITRA Under the Supervision of Professor D. K. MANDAL, Ph. D DEPARTMENT OF GEOGRAPHY AND APPLIED GEOGRAPHY UNIVERSITY OF NORTH BENGAL, RAJA RAMMOHUNPUR, DARJEELING, WEST BENGAL, INDIA 2023

13 CHAPTER I: INTRODUCTION 1.1 Introduction Interactions between human and river is a mutual process in the natural system of the Earth. Human-Resource symbiosis is a common phenomenon in a river basin (Dasgupta, 2013). Human beings are the most important creation of the Earth and have started their journey with the first interaction with nature. With the passage of time, interaction has been increasing and reaching higher levels in its scope and extent. The interaction processes have different directions and aspects of reality. There is mutual adjustment between humans and the environment as their relationship is coevolution and coadaptative type (Lill et al., 2006). River water has multiple uses in society. The river water can be used as a source of water supply for drinking, industrial, municipal and irrigation purposes, recreational activities, fishing, navigation and it has some aesthetic value. River provides various facilities to the people who are settled along it. Rivers have an influence on the customs, ideas and social behaviour of a particular person or society (Wantzen et al., 2016). A particular community of people worshipped rivers as God viz., 'Tista Burir Puja' is celebrated by both the Rajbhanshi and Bengali communities to worship the Tista River, which constitutes the lifeline of Jalpaiguri District (Attractions of Jalpaiguri, 2018). The earliest recorded river valley civilisation of the world was found in Mesopotamia, starting to form around 4000 BCE in the basin of the Tigris and Euphrates of the Middle East (Kuiper, 2011). Others were the Egyptian civilisation of the Nile River, the Indus Valley civilisation of the Indus River, Huang-Ho River civilisations of the Yellow River. These civilisations are denoted as a hydraulic empire or hydraulic despotism by Karl August Wittfogel in his book 'Oriental Despotism' (1957), as rivers play a major role in the growth of the civilisations. It can be said that human beings depend on the river economically, morally, emotionally, ecologically, politically, etc. Interdependencies of humans and rivers in the natural environment is a worldwide concept and various authors worked on it like Birkholz (2009) on the Kant River, Strydom (2009) on the Buffalo and Hartenbos and Klein Brak Rivers, Nijenhuis (2012) on the Mekong River, Dasgupta (2013) on the Matla River, Nayak and Panda (2016) on the Brahmaputra River. The interdependencies can stay at complex patterns in a river basin (Nijenhuis, 2012). The river creates some imprints of its existence on the socio-economic life of the people. The presence of the river in any region is a vital physical component which facilitates the developmental processes of that region. The

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## PREFACE

The complex interrelationship between people and rivers has been the focus of interest and research for millennia. Rivers are more than just bodies of water; they are arteries that shape the landscapes they pass through and deliver essential materials for the development and nourishment of people. The relationships between people and rivers have changed over time as communities have settled along their banks and depended on their streams for transportation, irrigation, and different commercial endeavours.

The current study is an issue of fluvial geomorphology and has the title "*Human and River Interactions in Riparian Villages Along the Tista River of Jalpaiguri and Koch Bihar District, West Bengal*". The Tista River occupies a distinctive place among the innumerable rivers that have had a profound impact on human civilization. The Tista River, which flows through the riparian regions of northern India, has witnessed a wide range of human activity and has been essential to the lives of those who live along its banks. Riparian environments along the Tista River have contributed to trade and communication as well as providing ideal territory for agriculture.

This thesis explores the intricate and dynamic relationships that exist along the riparian villages in the Jalpaiguri and Koch Bihar District of the Tista River. It aims to investigate the relationship's many facets, such as its social, cultural, economic, and environmental components. We may learn a great deal about how people have adapted to and influenced this natural resource by investigating the historical, topographical, and ecological features of the Tista River. We can comprehend the particular difficulties and chances given by the river and its associated ecosystems by studying this particular area. This thesis also seeks to provide light on the methods used by regional communities to maximize the positive effects of the Tista River while minimizing any negative effects that might arise.

Regarding sustainable development and environmental preservation, it is crucial to comprehend how people and rivers interact in Tista River riparian villages. The delicate ecosystems of these riparian villages face substantial pressures from rapid urbanization, population expansion, and vulnerabilities of the riverine hazards (viz., floods, bank erosion and river channel shifts). We may create successful policies and management strategies that strike a balance between the development and the preservation of this priceless natural

resource by understanding the historical backdrop, current dynamics, and future prospects of interactions between humans and rivers.

This thesis represents the result of a protracted investigation that included field research, interviews, data analysis, and literature evaluation. It integrates knowledge from a number of fields, including fluvial geomorphology, hydrology, anthropology, and environmental science, to offer a thorough picture of the intricate interactions between people and the Tista River. It is believed that the results of this study will add to the body of information already known about river systems and how they interact with human cultures, promoting wise choices and sustainable behaviour.

I sincerely believe that this thesis will be a useful tool for academics, decision-makers, environmentalists, and anybody else interested in better understanding and encouraging the coexistence of people and rivers in riparian zones. We may work towards a future where environmental preservation and human development go hand in hand, safeguarding the welfare of both the present and future generations by acknowledging the value of the Tista River and the different people that depend on its waters.

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## LIST OF TABLES

| Table No. | Description of the Table   | Page No. |
|-----------|--|----------|
| 1.1       | Calculation of sample size based on Cochran's method (1963)  | 13       |
| 1.2       | Assessment of the human interferences on the Tista River   | 15       |
| 2.1       | Different elevation classes with their range and area of extent of the study area                                  | 31       |
| 2.2       | Different slope classes with their range and area of extent of the study area                                      | 33       |
| 2.3       | Different TRI classes with their range and area of extent of the study area  | 35       |
| 2.4       | Different lithological units with their area of extent of the study area   | 35       |
| 2.5       | Different geomorphological units with their area of extent of the study area                                       | 37       |
| 2.6       | Different rainfall classes with their range and area of extent of the study area                                   | 40       |
| 2.7       | Distribution of area of different average maximum and minimum temperature (°C) classes of the study area.          | 41       |
| 2.8       | Different soil classes with their area of extent of the study area   | 41       |
| 2.9       | Different NDVI classes with their area of extent of the study area   | 43       |
| 2.10      | Distribution of different religions (in percentage) in the Jalpaiguri and Koch Bihar District                      | 51       |
| 2.11      | Distribution of workers (main and marginal) in different categories of economic activity in the riparian villages  | 53       |
| 2.12      | Establishment of some important railways in this region during the colonial era                                    | 56       |
| 2.13      | LULC classes and their distribution in the study area (2021)   | 61       |
| 3.1       | Livelihood assets with their categories  | 66       |
| 3.2       | Livelihood dimensions and considered variables   | 68       |
| 3.3       | Distribution of the respondent inhabitants in different categories (based on occupational structure) in the sample | 69       |
| 3.4       | Reasons of the inhabitants for living in the riparian village of the Tista River                                   | 71       |
| 3.5       | Length of time the respondent and their family resided in the riparian villages of the Tista River                 | 72       |
| 3.6       | Distance of house of the respondents from the Tista River (in m)   | 73       |
| 3.7       | Uses of the Tista River water for religious and festivals purposes   | 79       |
| 3.8       | Descriptive statistics of annual income (in rupees) of the respondents   | 82       |
| 3.9       | Gini Coefficient values of the annual income of the respondent inhabitants in different categories                 | 84       |
| 3.10      | Per capita income of the surveyed district, state and country (2019-20)  | 85       |
| 3.11      | Deviation of annual income from per capita income of district, state, country                                      | 86       |
| 3.12      | Working and dependent members in the respondent's household  | 89       |
| 3.13      | Number of livestock of the inhabitants   | 90       |
| 3.14      | Availability of government economic assistance schemes in the households   | 91       |
| 3.15      | Government focus on this region due to natural resources and economic potentiality                                 | 91       |
| 3.16      | Development of eco-tourism hub positively affect their household's income  | 92       |
| 3.17      | District-wise distribution of ultimate irrigation potential under the Tista Barrage Project, Gajaldoba             | 92       |
| 3.18      | Irrigation facility provided by Tista-Mahananda Link Canal (2021)  | 93       |
| 3.19      | Irrigation facility provided by Tista-Jaldhaka Main Canal in 2021  | 95       |
| 3.20      | Total agricultural land covered by TMLC and TJMC   | 96       |
| 3.21      | Different types of fishing nets (Jaal) used by the riparian fishermen  | 97       |
| 3.22      | SEM fitness test   | 109      |

|      |   |     |
|------|---|-----|
| 4.1  | Historical Occurrences of Floods along the riparian areas of Tista River, West Bengal   | 117 |
| 4.2  | Records on bank erosion in the study area induced by floods   | 117 |
| 4.3  | Selection of literatures on conditioning parameters to delineate flood susceptibility zones   | 118 |
| 4.4  | Saaty's scale of relative importance  | 127 |
| 4.5  | Pairwise comparison matrix for flood susceptibility zonation  | 127 |
| 4.6  | Normalized vector for flood susceptibility zonation   | 128 |
| 4.7  | Consistency check of aggregated for flood susceptibility assessment   | 129 |
| 4.8  | Weight of the selected flood susceptibility parameters and their sub-parameters   | 130 |
| 4.9  | Area of flood susceptibility  | 132 |
| 4.10 | Right and left bank line shifting statistics of the Tista River (1993 - 2023)   | 136 |
| 4.11 | Variables considered for determining the bank erosion-prone sites   | 142 |
| 4.12 | Bank erosion-prone sites  | 142 |
| 5.1  | Red and yellow warning levels of the Tista River at different sites   | 155 |
| 5.2  | Year-wise (2018-2021) flood warning signals in Tista River during monsoon   | 156 |
| 5.3  | Block-wise flood damages by Tista River since 2018 to 2021  | 158 |
| 5.4  | Riparian Gram Panchayat/Village-wise damages by Tista River (2021)  | 158 |
| 5.5  | Riparian villages show negative tendency in population growth rate due to the effects of riverine hazards   | 160 |
| 5.6  | Categorisation of the contributing factors based on the IPCC (Intergovernmental Panel on Climate Change) vulnerability definition for calculation of the LVI-IPCC | 162 |
| 5.7  | Maximum, minimum and average indexed score of major component SDP with considered sub-components  | 164 |
| 5.8  | Maximum, minimum and average indexed score of major component LS with considered sub-components   | 165 |
| 5.9  | Maximum, minimum and average indexed score of major component SS with considered sub-components   | 167 |
| 5.10 | Maximum, minimum and average indexed score of major component HC with considered sub-components   | 167 |
| 5.11 | Maximum, minimum and average indexed score of major component FS with considered sub-components   | 169 |
| 5.12 | Maximum, minimum and average indexed score of major component WS with considered sub components   | 171 |
| 5.13 | Maximum, minimum and average indexed score of major component FH with considered sub-components   | 172 |
| 5.14 | Maximum, minimum and average indexed score of major component RBE with considered sub-components  | 174 |
| 5.15 | Maximum, minimum and average indexed score of major component RCS with considered sub-components  | 176 |
| 5.16 | Maximum, minimum and average indexed score of major component CV with considered sub-components   | 176 |
| 5.17 | Basis of classification of livelihood vulnerability level (LVI approach)  | 178 |
| 5.18 | Livelihood vulnerability index value, vulnerability class and vulnerability level of the surveyed riparian villages   | 179 |
| 5.19 | Maximum, minimum and average indexed score of adaptive capacity, sensitivity and exposure   | 181 |
| 5.20 | Basis of classification of livelihood vulnerability level (LVI - IPCC approach)   | 184 |
| 5.21 | Values of Index Dimension of LVI based on LVI-IPCC framework of surveyed riparian villages along the Tista River  | 184 |
| 5.22 | Vulnerability of the study area   | 186 |
| 5.23 | Correlation matrix between different major components with LVI and LVI-IPCC   | 186 |

|      |   |     |
|------|---|-----|
| 5.24 | F test for studying the significance of the observed variables  | 188 |
| 6.1  | Riparian villages of Jalpaiguri District show positive tendency in population growth rate and increasing population pressure on lands | 196 |
| 6.2  | Riparian villages of Koch Bihar District show positive tendency in population growth rate and increasing population pressure on lands | 197 |
| 6.3  | Detailed description of the data used in the study  | 200 |
| 6.4  | Area statistics of LULC classes of the year 1991, 2001, 2011 and 2021   | 201 |
| 6.5  | LULC change detection (1991-2021) analysis of the study area  | 203 |
| 6.6  | Accuracy assessment of classified LULC maps of 1991, 2001, 2011 and 2021  | 204 |
| 6.7  | Potential sites of river bed materials extraction   | 208 |
| 6.8  | Sediment load comparison between pre and post-monsoon periods for the Tista River in Jalpaiguri and Koch Bihar District               | 210 |
| 6.9  | Annual deposition of river bed minerals of Tista River  | 210 |
| 6.10 | Site-wise human activities, colour and intensity of water of the Tista River  | 228 |
| 6.11 | Scoring of the sections with naturalness based on different elements  | 231 |
| 6.12 | Scoring of the sections with human interventions based on different elements  | 232 |
| 6.13 | Habitat quality assessment of the survey sites  | 234 |
| 6.14 | Habitat modification assessment of the survey sites   | 235 |
| 6.15 | Shannon-Wiener diversity index of attribute types within the studied reaches of the Tista River                                       | 237 |
| 6.16 | Paired samples statistics   | 238 |
| 6.17 | Paired Sample t Test  | 238 |
| 6.18 | Paired samples statistics   | 239 |
| 6.19 | Paired Sample t Test  | 239 |
| 7.1  | Several concepts and theories interrelated with the perceptions variables   | 247 |
| 7.2  | Reliability test of the formulated constructs as set in the quantitative section and illustrated with Cronbach's alpha values         | 248 |
| 7.3  | Number of respondents on the perception of communities' association with the linear nature of the Tista River                         | 250 |
| 7.4  | Number of respondents on perception concerning the availability of information on Tista River   | 252 |
| 7.5  | Number of respondents on understanding the benefits (goods and services) and perception connection to use aspects of the Tista River  | 255 |
| 7.6  | Number of respondents on perception concerning the significance or value of the Tista River   | 256 |
| 7.7  | Number of respondents on perception concerning the health of the Tista River  | 258 |
| 7.8  | Perception of human interferences on the Tista River  | 260 |
| 7.9  | Perception on conservation and management of the Tista River and its water resources  | 263 |
| 7.10 | Understanding the inhabitants' opinion on participation in Tista River management activities  | 267 |
| 7.11 | Paired Samples Statistics   | 270 |
| 7.12 | Paired Sample t Test  | 270 |

## LIST OF FIGURES

| Figure No. | Description of the Figure  | Page No. |
|------------|--|----------|
| 1.1        | Location Map of the Study Area (a) India, (b) West Bengal and (c) Community Development (CD) Block-wise selected riparian villages | 4        |
| 1.2        | Selected riparian villages of the Tista River from Rajganj and Mal Block   | 5        |
| 1.3        | Selected riparian villages of the Tista River from Jalpaiguri Sadar and Maynaguri Block  | 6        |
| 1.4        | Selected riparian villages of the Tista River from Haldibari Block   | 7        |
| 1.5        | Selected riparian villages of the Tista River from Mekhliganj Block  | 8        |
| 2.1        | Elevation map of the study area  | 32       |
| 2.2        | Slope map of the study area  | 33       |
| 2.3        | Terrain Ruggedness Index map of the study area   | 34       |
| 2.4        | Lithological map of the study area   | 36       |
| 2.5        | Geomorphological map of the study  | 37       |
| 2.6        | Annual long-term (1986-2020) rainfall map of the study area  | 39       |
| 2.7        | Average temperature of the study area (2011-2020) (a) Maximum and (b) Minimum  | 40       |
| 2.8        | Soil map of the study area   | 42       |
| 2.9        | NDVI map of the study area   | 43       |
| 2.10       | Riparian village-wise spatial distribution of population   | 44       |
| 2.11       | Riparian village-wise spatial distribution of households   | 46       |
| 2.12       | Riparian village-wise spatial distribution of sex ratio  | 47       |
| 2.13       | Riparian village-wise spatial distribution of (a) SC population and (b) ST population (Percentage)                                 | 48       |
| 2.14       | Riparian village-wise spatial distribution of Literacy Rate (Percentage)   | 49       |
| 2.15       | Riparian village-wise spatial distribution of (a) Male literacy rate and (b) Female literacy rate (Percentage)                     | 50       |
| 2.16       | Riparian village-wise spatial distribution of the working population (Percentage)  | 51       |
| 2.17       | Riparian village-wise spatial distribution of (a) Main and (b) Marginal working population (Percentage)                            | 52       |
| 2.18       | Riparian village-wise spatial distribution of net sown area (Percentage)   | 54       |
| 2.19       | Riparian village-wise spatial distribution of irrigated land area (Percentage) to the total net sown area                          | 55       |
| 2.20       | (a) Transport network map and (b) Road density map of the study area   | 57       |
| 2.21       | Location of the health centres in the study area   | 58       |
| 2.22       | Riparian villages portrayed distances from the nearest banks   | 59       |
| 2.23       | Riparian villages show the availability of agricultural marketing society  | 60       |
| 2.24       | LULC map of the study area for the year 2021   | 62       |
| 3.1        | A conceptual framework to represent the connection between water-energy-food from livelihood Perspective                           | 67       |
| 3.2        | Distribution of respondents based on their reasons for choosing the present occupation   | 70       |
| 3.3        | Age-sex structure of the respondents of the study area   | 74       |
| 3.4        | Age-sex pyramid of the respondent's households in the study area   | 74       |
| 3.5        | Educational attainment of the respondents of the study area  | 75       |
| 3.6        | Gender-wise disparities of the respondents of the study area   | 77       |
| 3.7        | Caste-wise disparities of the respondents of the study area  | 77       |

|      |  |     |
|------|--|-----|
| 3.8  | Religious orientations of the respondents of the study area  | 78  |
| 3.9  | Radar chart represent the income diversity of the respondents in the study area  | 83  |
| 3.10 | Lorenz Curve of the distribution of annual income for (a) Farmers, (b) Agricultural Labourers, (c) Fishermen, (d) Boatmen, (e) Mining Dwellers and (f) Tista River based commercial activity dwellers (TCAD)   | 84  |
| 3.11 | Lorenz Curve of the distribution of annual income for (a) Other Occupation Dependent Inhabitants (OODI) and (b) Total surveyed respondents   | 85  |
| 3.12 | Deviation of income of the (a) Farmers and (b) Agricultural Labourers  | 86  |
| 3.13 | Deviation of income of the (a) Fishermen, (b) Boatmen and (c) Mining Dwellers  | 87  |
| 3.14 | Deviation of income of the (a) Tista River based commercial activity dwellers (TCAD) (b) Other Occupation Dependent Inhabitants (OODI)   | 88  |
| 3.15 | Area of landholdings of the riparian inhabitants   | 89  |
| 3.16 | Tista Barrage Project and its command area in respect of the study area  | 96  |
| 3.17 | Responses of the inhabitants (in percentage) on different physical dimensions of livelihood: (a) Irrigation facility, (b) Uses of farm equipment, (c) Transport facility, (d) Communication networks, (e) Uses of HYV seeds and (f) Uses of indigenous seeds   | 99  |
| 3.18 | Responses of the inhabitants (in percentage) on different physical dimensions of livelihood: (a) Uses of fertilisers and manures, (b) Uses of pesticides, (c) Banking facilities and (d) Agricultural marketing society facility   | 101 |
| 3.19 | Responses of the inhabitants (in percentage) on different risk dimensions of livelihood: (a) Low product price, (b) Labour shortage, (c) Capital limitation, (d) Transformation of agricultural land, (e) Crop diseases and (f) Availability of preservation practices   | 104 |
| 3.20 | Responses of the inhabitants (in percentage) on different risk dimensions of livelihood: (a) Seasonal flow of the Tista River affected income, (b) Flood induced by Tista effects on income, (c) Bank erosion induced by Tista effects on income and (d) River channel shifts induced by Tista effects on income   | 105 |
| 3.21 | Responses of the inhabitants (in percentage) on different environmental dimensions of livelihood: (a) Uses the river water for household purposes, (b) Uses of eco-friendly practices, (c) Participation in economic resource management, (d) Attend training for economic resource management skills/programme, (e) Waste disposed on the river and (f) Involvement in environment conservation practices | 106 |
| 3.22 | Structural equation modelling demonstrates the interdependencies of livelihood dimensions of the riparian inhabitants  | 108 |
| 4.1  | Drainage network map of North Bengal with special emphasis on Tista River (a) Drainage network map by J. Rennell (1794) and (b) Drainage network map by A. Arrowsmith (1804)   | 115 |
| 4.2  | Drainage network map of North Bengal with special emphasis on Tista River (a) Drainage network map by J. Arrowsmith (1832) and (b) Drainage network map from Google Earth (2022)   | 116 |
| 4.3  | Flood susceptibility parameters: (a) Elevation, (b) Slope, (c) Relative Slope Position and (d) Plan Curvature  | 120 |
| 4.4  | Flood susceptibility parameters: (a) Topographic Ruggedness Index, (b) Topographic Position Index, (c) Valley Depth and (d) Convergence Index  | 122 |
| 4.5  | Flood susceptibility parameters: (a) Average Annual Rainfall, (b) Topographic Wetness Index, (c) Normalized Difference Vegetation Index (NDVI) and (d) Distance to River   | 124 |
| 4.6  | Flood susceptibility parameters: (a) Lithology, (b) Geomorphology and (c) Land use land cover  | 125 |
| 4.7  | Flood susceptibility model of the study area using the AHP method  | 132 |
| 4.8  | Validation of Flood susceptibility model of the study area by ROC-AUC  | 133 |
| 4.9  | Tista River channel shifting since 1993-2003, (a) and (b) indicate the major segments of the channel shifting  | 134 |

|      |   |     |
|------|---|-----|
| 4.10 | Tista River channel shifting since 2013-2023, (a) and (b) indicate the major segments of the channel shifting   | 135 |
| 4.11 | Tista River bank line shifting since 1993-2023, (a) Right bank and (b) Left bank, (S1) and (S2) indicates the major segments of the left and right bank line shifting   | 138 |
| 4.12 | Positive and negative bank line shifting (a) Right bank and (b) Left bank   | 139 |
| 4.13 | Historical Channel Migration Zone (HCMZ) of the Tista River since 1993 to 2013  | 140 |
| 4.14 | (a), (b), (c) and (d) Bank erosion-prone sites along the Tista River in Jalpaiguri and Koch Bihar District  | 143 |
| 4.15 | (a) Land loss due to active channel shifting since 1993 to 2023 at Domohani village in Jalpaiguri District, (b) River bank erosion at the left bank of the Tista River at Domohani area, (c) and (d) Flood scenario in August, 2015 at Domohani and its surrounding villages  | 144 |
| 4.16 | (a) Land loss due to active channel shifting since 1993 to 2023 at Purba Sangapara village in Jalpaiguri District, (b) Land loss due to active channel shifting since 1993 to 2023 at Basusuba village in Jalpaiguri District, (c) River bank erosion at the left bank of the Tista River at Purba Sangapara area in 2022, and (d) River bank erosion at the left bank of the Tista River at Basusuba area in 2022  | 145 |
| 4.17 | (a) Land loss due to active channel shifting since 1993 to 2023 at Nijtaraf (Paschim) village in Koch Bihar District, (b) Land loss due to active channel shifting since 1993 to 2023 at Dakshin Fulkardabri Kharkharia village in Koch Bihar District, (c) River bank erosion at the left bank of the Tista River at Nijtaraf (Paschim) in 2022, and (d) River bank erosion at the left bank of the Tista River at Dakshin Fulkardabri Kharkharia area in 2022 | 146 |
| 5.1  | Methodological flow chart of livelihood vulnerability evaluation for the study area   | 161 |
| 5.2  | Spatial distribution of surveyed riparian villages based on indexed values of socio-demographic profile   | 163 |
| 5.3  | Spatial distribution of surveyed riparian villages based on indexed values of livelihood strategies   | 165 |
| 5.4  | Spatial distribution of surveyed riparian villages based on indexed values of social safety   | 166 |
| 5.5  | Spatial distribution of surveyed riparian villages based on indexed values of health condition  | 168 |
| 5.6  | Spatial distribution of surveyed riparian villages based on indexed values of food support  | 169 |
| 5.7  | Spatial distribution of surveyed riparian villages based on indexed values of water support   | 170 |
| 5.8  | Spatial distribution of surveyed riparian villages based on indexed values of flood hazard  | 172 |
| 5.9  | Spatial distribution of surveyed riparian villages based on indexed values of river bank erosion  | 173 |
| 5.10 | Spatial distribution of surveyed riparian villages based on indexed values of river channel shifts  | 175 |
| 5.11 | Spatial distribution of surveyed riparian villages based on indexed values of climatic variation  | 177 |
| 5.12 | Spatial distribution of surveyed riparian villages based on livelihood vulnerability index values   | 178 |
| 5.13 | Spatial distribution of surveyed riparian villages based on indexed values adaptive capacity  | 181 |
| 5.14 | Spatial distribution of surveyed riparian villages based on indexed values sensitivity  | 182 |
| 5.15 | Spatial distribution of surveyed riparian villages based on indexed values exposure   | 183 |
| 5.16 | Relationship between different riverine hazards indexed score and livelihood vulnerability index  | 187 |
| 5.17 | Means plot of the observed variables (a) Indexed score of LVI and flood hazards, (a) (b) Indexed score of LVI and river bank erosion and (c) (a) Indexed score of LVI and river course shifts   | 189 |

|      |  |     |
|------|--|-----|
| 6.1  | Decadal population growth rate (2001-2011) scenario in the riparian villages   | 198 |
| 6.2  | Population growth of the riparian villages since 2001 to 2011  | 199 |
| 6.3  | LULC scenarios of the study area for the year (a) 1991 and (b) 2001  | 201 |
| 6.4  | LULC scenarios of the study area for the year (a) 2011 and (b) 2021  | 202 |
| 6.5  | Distribution of various LULC classes during 1991-2021 in the study area  | 202 |
| 6.6  | (a) and (b) Transformation of agricultural lands into wetlands by the riparian inhabitants near Rangdhamali and Barapatina Nutanbus, (c) and (d) transformation of agricultural lands into built up areas, (e) and (f) construction of bridges and barrage, canals in the study area     | 205 |
| 6.7  | Groundwater level map of the study area: (a) Pre monsoonal, (b) Monsoonal and (c) Post monsoonal   | 207 |
| 6.8  | River bed materials extraction sites of the Tista River  | 208 |
| 6.9  | Tista Barrage Project at Gajaldoba of Jalpaiguri District  | 211 |
| 6.10 | (a) Sedimentation rate of the Tista River, (b) and (c) Extension of the charlands due to reduction in sediment transport capacity of the Tista River since 1993 to 2023  | 212 |
| 6.11 | Embankments and spars along the right bank of the Tista River  | 215 |
| 6.12 | Survey site map of the study area  | 217 |
| 6.13 | Site-wise different water quality parameter assessment (a) Nitrate (mg/l), (b) Fecal coliform (MPN/1000ml), (c) Turbidity (NTU), (d) Total suspended solids (mg/l), (e) Fluoride (mg/l), (f) Phosphate (mg/l), (g) Potassium (mg/l) and (h) Sulphate (mg/l)                              | 221 |
| 6.14 | Site-wise different water quality parameter assessment (a) Total alkalinity (mg/l), (b) Total dissolved solids (mg/l), (c) pH, (d) Temperature (0C), (e) Boron (mg/l), (f) Calcium (mg/l), (g) Chloride (mg/l) and (h) COD (mg/l)  | 224 |
| 6.15 | Site-wise different water quality parameter assessment (a) Dissolved oxygen (mg/l), (b) Conductivity ( $\mu$ s/cm), (c) Total hardness as CaCo <sub>3</sub> , (d) Total coliform (MPN/1000ml), (e) Magnesium (mg/l), (f) Sodium (mg/l), (g) Total fixed solids (mg/l) and (h) BOD (mg/l) | 227 |
| 6.16 | Location of the river habitat survey sections in the study area  | 229 |
| 6.17 | Flowchart of the RHS approach for the present study  | 230 |
| 6.18 | Sections with naturalness (a) Section A and (b) Section B  | 232 |
| 6.19 | Sections with human interventions (a) Gajaldoba Tista Barrage, (b) Section near Jalpaiguri Tista bridge, (c) Section near Jalpaiguri town and (d) Section near Joyee bridge  | 233 |
| 6.20 | Spatial mapping of the (a) Habitat quality and (b) Habitat modification of the survey sites of the Tista River   | 236 |
| 6.21 | Mann-Whitney U test (a) Between naturalness sections and (b) Between human intervention sections   | 238 |
| 7.1  | Diagrammatic Representation of Gestalt Laws of Perceptual Organization: (a) Law of Similarity, (b) Law of Proximity, (c) Law of Continuity, (d) Law of Pragnanz or Law of Good Figure, (e) Law of Closure, (f) Law of Common Region  | 242 |
| 7.2  | A diagram-based presentation of the perception process   | 243 |
| 7.3  | A schematic presentation of the MARS model of individual behavior  | 244 |
| 7.4  | Schematic depiction of the factors that influence perception   | 245 |
| 7.5  | Inhabitants' perception of communities' association with the linear nature of the Tista River  | 252 |
| 7.6  | Inhabitants' perception concerning the availability of information on the Tista River  | 254 |
| 7.7  | Inhabitants' perception of understanding the benefits (goods and services) and connection to use aspects of the Tista River  | 256 |
| 7.8  | Inhabitants' perception of the significance or value of the Tista River  | 258 |
| 7.9  | Inhabitants' perception of the health of the Tista River   | 259 |
| 7.10 | Inhabitants' perception of human interferences on Tista River  | 262 |

|      |   |     |
|------|---|-----|
| 7.11 | Inhabitants' perception of conservation and management of the Tista River and its water resources | 266 |
| 7.12 | Inhabitants' opinion on participation in Tista River management activities                        | 268 |

## LIST OF PLATES

| Plate No. | Description of the Plate  | Page No. |
|-----------|---|----------|
| 3.1       | Field photographs demonstrated (a) and (b) Agricultural fields; (c) and (d) Several types of fishing nets; (e), (f), (g) and (h) Boating activities; (i), (j) and (k) Collection of wood carried by the river; (l) Tista River based commercial activities.   | 80       |
| 3.2       | (a) and (b) During the visit of the office of the Executive Engineer, Teesta Barrage Circle, Siliguri, Irrigation & Waterways Directorate, Government of West Bengal, for obtaining information on the Tista Barrage Project.   | 95       |
| 3.3       | Field photographs depicted (a), (b) and (c) Risk of crop damages due to floods; (d) Water supply in the Tista Jaldhaka Main Canal has not been provided most of the time of the year; (e), (f), (g), (h) and (i) Risk of losses of the agricultural lands due to river bank erosion.  | 103      |
| 5.1       | Field photographs depicted (a), (b) and (c) Flood situation at Domohani in August-2015; (d), (e), (f), (g), (h) and (i) Waterlogging in the agricultural fields, unmetalled road, school and houses during the monsoonal season of the study area in 2020.  | 153      |
| 5.2       | Field photographs depicted (a) and water level of the Tista River during the flood near Domohani; (b), (c) and (d) Waterlogging in the houses; (e) and (f) Roads were completely destroyed due to flood; (g), (h), and (i) Waterlogging in the agricultural fields; (j) and (k) Riparian villagers were taking shelter in the embankments during the flood and (l) Interviews with the people affected by floods during 2021. | 154      |
| 6.1       | Field photographs illustrated human interferences on Tista River (a) Tista Barrage at Gajaldoba; (b) Construction of barrage of Tista Jaldhaka Main Canal, (c) and (d) Bridge and embankment; (e) and (f) Tista Char used as a picnic spot near Gajaldoba and Jalpaiguri.   | 195      |
| 6.2       | Field photographs of human interferences on the river (a) Foundation stone of the strengthening of Mandalghat-Bibiganj embankment at Boalmari Nandanpur; (b) Embankment Road at Mandalghat; (c), (d) and (e) Embankments along the Tista River.   | 216      |
| 7.1       | (a)-(j) Photographs taken during the time of perception survey of the riparian respondent inhabitants concerning the Tista River.   | 249      |

## LIST OF APPENDICES

| <b>Table No.</b> | <b>Description of the Table</b>   | <b>Page No.</b> |
|------------------|---|-----------------|
| A.1              | Riparian village-wise percentage of area under different types of land use (based on Census 2011).  | 299             |
| B.1              | Description of the major components and their sub-components of Livelihood Vulnerability Index (LVI).   | 301             |
| B.2              | Indexed values of major components of the surveyed riparian villages along the Tista River.   | 304             |
| C.1              | Season-wise water quality data of the of the Tista River at two different sites.  | 307             |
| D.1              | Respondent inhabitants-wise computed composite index of respondents' awareness (CIRS) and composite index of respondents' living standards (CIRLS).   | 308             |
| E.1              | Questionnaire on Livelihood Dimensions, Vulnerability of the Riparian Inhabitants along the Tista River and their Perception Concerning the Tista River in Jalpaiguri and Koch Bihar District, West Bengal. | 312             |

## ABBREVIATIONS

|  |   |
|--|---|
| <b>GSI</b> - Geological Survey of India                                      | <b>CRU TS</b> - Climatic Research Unit gridded Time Series        |
| <b>CartoDem</b> - Cartosat-1 Digital Elevation Model                         | <b>FAO</b> - Food and Agricultural Organization                   |
| <b>NBSS &amp; LUP</b> - National Bureau of Soil Survey and Land Use Planning | <b>ICAR</b> - Indian Council of Agricultural Research             |
| <b>USGS</b> - United States Geological Survey                                | <b>OLI/TIRS</b> - Operational Land Imager/Thermal Infrared Sensor |
| <b>SOI</b> - Survey of India   | <b>SDG</b> - Sustainable Development Goal                         |
| <b>IMD</b> - India Meteorological Department                                 | <b>GDP</b> - Gross Domestic Product                               |
| <b>NDVI</b> - Normalized Difference Vegetation Index                         | <b>NSA</b> - Net Sown Area  |
| <b>AHP</b> - Analytical Hierarchy Process                                    | <b>AMS</b> - Agricultural Marketing Societies                     |
| <b>LVI</b> - Livelihood Vulnerability Index                                  | <b>APMC</b> - Agricultural Produce Market Committee               |
| <b>IPCC</b> - Intergovernmental Panel on Climate Change                      | <b>LULC</b> - Land Use and Land Cover                             |
| <b>RHS</b> - River Habitation Survey   | <b>BCE</b> - Before Christ  |
| <b>masl</b> - Metre Above Sea Level  | <b>TPI</b> - Topographic Position Index                           |
| <b>CD</b> - Community Development  | <b>TWI</b> - Topographic Wetness Index                            |
| <b>km</b> - Kilometre  | $\lambda$ - Lambda  |
| <b>m</b> - Metre   | $\sigma$ - Standard Deviation                                     |
| <b>sq</b> - Square   | <b>mg/l</b> - Milligrams Per Litre                                |
| <b>cm</b> - Centimetre   | <b>MPN</b> - Most Probable Number                                 |
| <b>mm</b> - Millimetre   | <b>ml</b> - Millilitre  |
| <b>mbgl</b> - Metres Below Ground Level                                      | <b>NTU</b> - Nephelometric Turbidity Unit                         |
| <b>TRI</b> - Terrain Ruggedness Index  | <b>BDL</b> - Below Desired Level                                  |
| <b>NetCDF</b> - Network Common Data Form                                     | <b>ROC</b> - Receiver Operating Characteristic                    |
| $^{\circ}$ - Degree  | <b>AUC</b> - Area Under ROC Curve                                 |
| <b>C</b> - Celsius   | <b>mNDWI</b> - Modified Normalized Difference Water Index         |
| <b>GIS</b> - Geographic Information System                                   | <b>ANOVA</b> - Analysis of variance                               |