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Exploring the Socio-ecological Vulnerability and Livelihood Insecurities of the Riverbank Erosion-affected *Char*land Displacees in Bangladesh

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Abstract

Riverbank erosion in Bangladesh's *char*land areas creates persistent cycles of land loss, displacement, and livelihood insecurity, making these landscapes some of the most vulnerable socio-ecological setting in the country. There are a number of researches on climate-induced hazards but the specific driving forces of socio-ecological vulnerability in erosion-affected *char*lands remain insufficiently examined. The present research investigates how displacement, livelihood fragility, socio-ecological, and economic constraints shape vulnerability of the riverbank erosion-affected displacees in Vangi Dangi village. The research attempts to (i) explore the responsible agro-ecological and hydro-climatic factors of socio-ecological vulnerability, (ii) assess how displacement influences social and economic well-being, and (iii) analyze the livelihood insecurities that materialize from recurrent riverbank erosion. Both qualitative and quantitative procedures are used on data collected from the total study population, all 122 households in Vangi Dangi village who are experienced riverbank erosion at least once in their lifetime under Decreer Char Union of Faridpur Sadar Upazila of Faridpur District in Bangladesh. In collecting data on the study village, FGDs (Focus Group Discussions) and case studies are also utilized to capture lived experiences of mobility, asset loss, and adaptation challenges. The findings of this study reveals that the *char*land dwellers face repeated land degradation (100%) that forced them frequent displacement (100%), which cause disruption of their Income generating Activities (IGAs). In addition, erosion affects their total livelihood based on agriculture (93.44%), pastoral (63.93%), wage labor (61.48%), and fishing (35.25%) that also responsible for their food insecurity, unsafe drinking water, economic insecurity and their total livelihood. It will recommend policy formulation using ICTs to ensure livelihood securities, reduce socio-ecological vulnerability, and promote sustainable development.

***Keywords**:* Agro-ecological Forces, Socio-ecological Vulnerability, Livelihood, *Char*land, Riverbank Erosion Displacees

1. Introduction

The physical and geographical attributes have rendered Bangladesh susceptible to frequent environmental dangers and natural calamities. The recurrent climate extreme, Riverbank erosion is negatively influencing impoverished, marginalized communities and their livelihoods in *char*land inhabitant, as the *char*lands of Bangladesh exhibit a high susceptibility to erosion attack (Roland et al., 2025; Saikia & Mahanta, 2023; Islam &

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Rashid, 2017). The displacees, who rely heavily on agriculture and pastoral livelihoods, often abandon their original locations due to persistent riverbank erosion, which engenders socio-ecological vulnerability and livelihood insecurities in *char*land habitats (Islam et al., 2022; Podder et al., 2021; Hossain, 2019). This persistent unpredictability compels these inhabitants to adjust in changing environments at significant socio-economic expense (Williams et al., 2019).

The socio-ecological vulnerability of the *char*land displacees*,* their socio-economic fragility and the consequences of erosion-induced displacement are not only environmental but also multidimensional. In addition, the deterioration of natural resources directly affects the survival of *char*land inhabitants who are largely dependent on agriculture, cattle rearing, or small-scale fishing (Banik et al., 2020; Rahman et al., 2019; Roy & Hossain, 2019). The households lose their homestead lands, property, both tangible and intangible livelihood essentials that create immediate food insecurity, financial loss, and social and economic sufferings (Islam et al., 2022). Institutional initiatives are essential for the affected displacees in resilience (Krichen et al., 2024) but the inadequate stakeholders' cooperation, insufficient living arrangement, frequent attack, inaccessible livelihood essentials make the *char*land displacees more vulnerable due to their vulnerable socio-ecological settings (Al-Fazari & Kasim, 2020).

Due to lack of GOs (Government Organizations) and NGOs (Non-government Organizations) supports and contributions, they have to face poor access to education, health, purewater, sanitation, and shelter services after displacement. The women, children and elderly are considered as one of the most vulnerable groups as displacees in *char*land because of their physical, social, economic, and ecological vulnerability (Karunarathna, 2022). Besides, they experience in access to livelihood assets and increased risks of exploitation. In addition, children are deprived of quality education, health care services, and recreational facilities due to displacement because their living standards are disrupted and they have to engage in different odd substantial activities or IGAs for their familial survival strategies (Edström, 2007).

The present research primarily trying to explore the socio-ecological vulnerability that exists in *char*land ecosystem by analyzing the influential factors such as: (i) agro-ecological drivers or factors— land use, climate variability, sunlight, vegetation cover and geographical features; (ii) hydro-climatic factors—flood, riverbank erosion, drought, rainfall, high storms mostly '*Kalbaishahkhi'.* These socio-ecological factors of vulnerability make the *char*land displacees displacement and livelihood insecurities. This study also highlights that how these socio-ecological factors are highly responsible for creating *charl*and dwellers vulnerability. This study intends to reveal that how the causal dimensions of socio-ecological vulnerability intertwines between post-erosion displacement and socio-economic livelihood insecurities. By linking these dimensions, the study emphasizes that post-erosion displacement is both an environmental and socio-economic challenge, necessitating integrated strategies for disaster risk management, land security, and sustainable livelihood support.

2. Review of Literature and Research Gap

From global context, the South-East Asia region is particularly prone to natural disasters both in terms of the absolute number of disasters and of populations affected (Islam & Khan, 2018 & Onwutuebe, 2019). It is greatly exposed to climate impacts (Islam et al., 2022; Rahman and Gain, 2020 & Roy et al., 2019), several countries in the region are home to highly vulnerable population groups including the desperately poor and the marginalized. Riverbank erosion in Bangladesh has long been recognized as one of the most severe environmental hazards affecting millions of people living in riverine and *char*land areas (Islam et al., 2022, Podder et al., 2022 & Haloy and Das, 2025). Asia experienced the highest proportion of population displacement due to erosion in 2011, with 89.12% of the population being shifted (Das et al., 2014 & Haque 2018) , as an instance, the territory of Assam destroyed 12.6 thousand hectares of land in 2014, forcing 77,800 people to evacuate their dwellings (Dekaraja & Mahanta, 2021). Since August 22, 2024, several areas in Bangladesh have experienced catastrophic flooding as a result of heavy rains and water released from upstream sources. The access to resources in *char*lands, decision-making power of women, and social capital for *char*land dwellers are often destabilized during and after erosions events (Pande, 2022; Chowdhury, 2021; Li and Zhou, 2021; Ghosh et al., 2020; Onwutuebe, 2019 & Ni Aolain, 2010). Md. Sadequr Rahman and Animesh Gain upheld the negative impact of riverbank erosion on people and their livelihood with their economic, social and psychological distress which is increasing over the time. Lack of institutional support, government interventions, the psychosocial interventions, modern technological sustenance, vulnerable assets of livelihood which is very meager to survive create barriers in confronting with precarious habitat also in resilience. It is also to be noted that the effect of climate change on people may differ depending on their geographical location, livelihood and socioeconomic status in addition Due to lower socio-economic status, *char* dwellers are thought to be among the poorest and most vulnerable groups (Mrinal Saikia & Ratul Mahanta, 2024; Pfister et al., 2017 & Islam and Hossain, 2014).

However, none of the reviewed studies have paid attention on the socio-ecological factors of vulnerability and livelihood insecurities of the *char*land displacees in Bangladesh at a time. On the contrary, a number of studies have given special attention on the different livelihood issues of disaster affected *char*land women, children but not focused on the total *char*land displacees' vulnerability at the same time. Some scholar's prime concern has been paid to riverbank erosion affected households not to the *char*land dwellers' livelihood or, *char*land women or their vulnerability exceptionally. Simultaneously agro-ecological and hydro-climatic factors or driving forces of vulnerability of the riverbank erosion affected *char*land dwellers have acknowledged limited attention at aforementioned studies. However, existing studies predominantly focus on the economic and environmental impacts of riverbank erosion. Despite most of the literature on riverbank erosion and displacement, there is a notable gap in understanding the multidimensional and nature of socio-ecological vulnerability among *char*land displacees. Existing research seldom integrates environmental and livelihood frameworks to explain how displacement influences social and economic well-being. This study addresses this gap by exploring the responsible agro-ecological and hydro-climatic factors of socio-ecological

vulnerability in *char*lands, highlighting their adaptive responses and resilience building processes within complex socio-ecological systems.

2.1 Comparison and Distinction between Ecological and Socio-ecological Vulnerability

Ecological vulnerability denotes the sensitivity of natural systems (Bhatia, 2023; Dordevic et al., 2022) where the indicators are rivers, soils, vegetation/forests, biodiversity to environmental degradations like annual floods, riverbank erosion, drought, salinity, agro-ecological or hydro-climatic changes (Georgescu & Băncescu, 2025; Bhatia, 2023; Berrouet et al., 2018; Beroya-Eitner, 2016; Turley & Ford, 2009; Forbes et al., 2004). It also highlights the ecosystem coverage and ability to respond, without necessarily considering human society (Jordaan et al., 2019, Pastor, 2018) for example the soil of *char*lands are highly vulnerable to riverbank erosion due to its fragile sediment structure and shifting of river channels (Hossain, 2019; Hong et al., 2016; Pfister, 2022). On the contrary, the socio-ecological vulnerability examines the complex interaction between the environmental/ecological systems and human communities (Steinmann et al., 2024; Yeonsoo, 2016) that is recognizing the changes which impacts on the social well-being and socio-economic structure of a society (Georgescu & Băncescu, 2025; Joseph, 2025; Afrin et al., 2024; Berrouet et al., 2018; Pastor, 2018; Pandey et al., 2015). It integrates the ecological vulnerability or risks and human, social, economic, institutional, and cultural factors that shape people's ability to cope with the degraded situations and adapt to precarious ecosystems with existing vulnerable assets. The key differences are as mapped out:

Dimensions	**Ecological Vulnerability**		**Socio-ecological Vulnerability**
	Findings	**Relevant Scholarly Literatures Reviewed**	**Present Study**
Key Emphasis	The sensitivity of natural systems (rivers, soil, biodiversity)	Steinmann et al., 2024; Bhatia, 2023; Razanatsoa & Gillson, 2022; Dordevic et al., 2022; Pfister, 2022; Berrouet et al., 2018; Beroya-Eitner, 2016; Turley & Ford, 2009;	Interface between inhabitants (respondents) and environment
Primary Drivers	Biophysical processes	Islam et al., 2025; Joseph, 2025; He et al., 2024; Pal & Talukdar, 2018; Beroya-Eitner, 2016; Suzuki & Iwasa, 2009; Forbes et al., 2004	Biophysical, social, economic, institutional processes
Methodical Lens	Environmental science	Zhao et al., 2024; Tereshchenko & Melnyk, 2017; Pryshliak, 202; Solovjova, 2019; Raufirad et al., 2018	Interdisciplinary lens
Role of Human	Absent	Bhatia, 2023; Pfister, 2022; Yang et al., 2020; Raufirad et al., 2018; Beroya-Eitner, 2016	Centered on coping, adaptation, resilience and rehabilitation strategies of the respondents
Outcome	Ecosystem degradation	Islam et al., 2025; Georgescu & Băncescu, 2025; Gong et al., 2025; Zhao et al., 2024; Razanatsoa & Gillson, 2022; Huong Giang, 2019; Suzuki & Iwasa, 2009	Loss of livelihood, displacement, resilience of the respondents

In the context of this study, this vulnerability hints loss of cultivable land, displacement, livelihood insecurity, gender burdens, financial insolvency, scarcity of daily necessities, and the breakdown of social relationships (Islam et al., 2025; Joseph, 2025; Razanatsoa & Gillson, 2022; Pastor, 2018). As a result, affected households become more dependent, socially and economically vulnerable.

3. Conceptual Clarifications

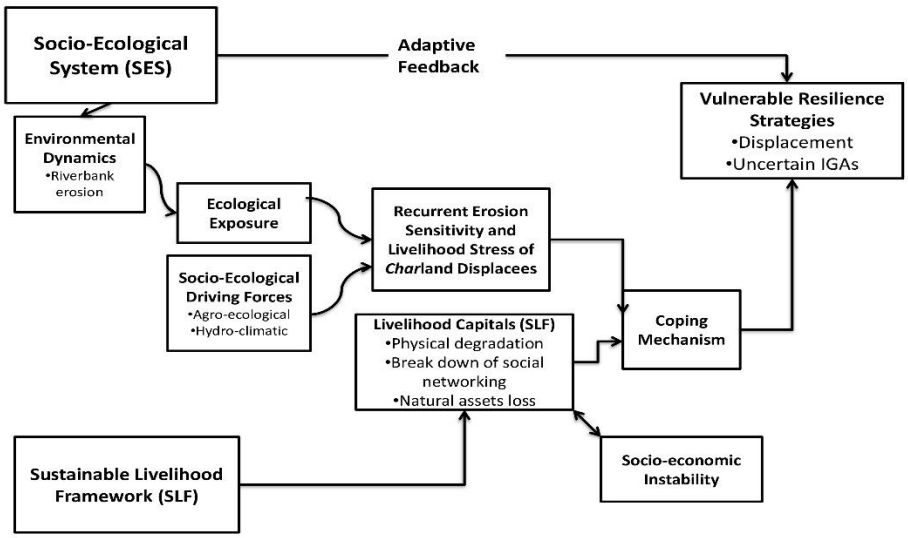
Vulnerability is referred as the lack of capacity to withstand a threat or to react effectively following the occurrence of riverbank erosion. It involves the analysis of erosion risks and assets of disadvantaged *char*land dwellers, such as women, children and elderly in *char*land ecosystem. In this study, the term socio-ecological vulnerability refers to the extent to which human and environmental systems are at risk from environmental hazards and stresses that are influenced by both the natural processes (riverbank erosion) and by factors such as socio-economic status, poverty, inequality, poor governance, limited access to basic needs, and weak social networks. In this study of *char*land areas, socio-ecological vulnerability is increased when river dynamics cause and increase homelessness, landlessness, displacement, and such alarming situation is not supported by gender roles, and adequate institutional supports. These factors heighten vulnerability and limit long-term resilience of the study population. The another term, agro-ecological forces of vulnerability is defined here as an environmental and agricultural factors such as use of land, climate variability, and geological features that exemplify and highlight the adaptive limitations of *char*land dwellers who are highly vulnerable and dependent on agriculture based livelihood and natural ecosystem. The term livelihood involves securing basic needs like food, shelter, and income through economic activities, social networks, and skills, often fragile due to environmental disruptions in *char*land displacees. The term, *Char*land is explained here as a riverine landform formed by sediment deposition, usually inside the basins of major rivers. In addition to the term riverbank erosion displacement has been referred in this study as the forced relocation of *char*land dwellers due to permanent land loss, often resulting in displacement to new areas like *char*s, embankments, or urban slums, often leaving households with little security and poverty.

4. Theoretical Foundation

In this study, the theoretical foundation draws on the Socio-Ecological System (SES) Theory and Sustainable Livelihood Framework (SLF) to explain how riverbank erosion shapes the responsible multidimensional agro-ecological and hydro-climatic factors of vulnerability and livelihood insecurities among *char*land displacees in Bangladesh. SES theory (Berkers and Folke, 1998) explains, “the interconnectedness and dynamic interactions between human societies and ecological systems for sustainability.” In addition, Berkes and Folke (1998) delineate SES as interlinked systems of human and nature “that are structured by reciprocal feedbacks between ecological dynamics and human actions, and must therefore be studied as integrated, co-evolving systems rather than as separate domains.” On the contrary, Chambers and Conway (1992) emphasize SLF as a livelihood “comprise the capabilities, assets, and activities required for a means of living,” and “can cope with and recover from stresses and shocks.” Together, these

theory and framework illustrate the dynamic interactions between ecological processes where agro-ecological and hydro-climatic factors influence livelihood, social structures, and livelihood capacities that define their daily survival functioning in *char*land ecosystem. From the view point of SES theory, the study *char*land is unstable in riverbank erosion where vulnerability emerges from disruptions within the coupled system, where ecological disturbances (loss of land, soil degradation, instability) affect the displacees' well-being and livelihood security. The following figure showing the integration of SES and SLF to deliver a comprehensive theoretical lens in conceptualizing *char*land displacces' socio-ecological vulnerability and livelihood insecurities:

Figure 1: *Theoretical Framework on Socio-ecological Vulnerability and Livelihood Insecurities*



Based on Berkes and Folke (1998) and Chambers and Conway (1992)

The SES theory also highlights the feedback loops and non-liner change, which is significant for understanding erosion and displacement perpetuate cycles of risk and marginality for *char*land displacees. The SLF interlinks riverbank erosion to *char*land displacces' livelihood structure by illustrating the losses of land after displacement, lack of IGAs facilities, and inaccessibility of social capitals that responsible for creating vulnerability. In relation to this fact this obvious, that erosion severally degrade land, education, health care, community networks, while livelihoods of *char*land displacees become threaten because of weak institutional support. The integration of SES and SLF provides a comprehensive theoretical lens by interpreting SES's structural and ecological drivers of vulnerability. Besides, by SLF this study tries to highlight the responses of displacees *char*land dwellers, their livelihood confrontation, and vulnerable adaptive resilience capacities. Through the theoretical framework (see Fig. 1) it is relevant that *char*land vulnerability can be interpreted as a product of environmental exposure generated by socio-ecological instability where socio-economic sensitivity is responsible for their existing capital deficits and marginality.

5. Methodological Investigation

5.1. Study Area and Location: A Synopsis

This study adopts a qualitative research design supported by selective quantitative insights to examine environmental vulnerability and livelihood impacts among *char*land dwellers affected by riverbank erosion. In south-central Bangladesh, Vangi Dangi is a medium-sized *char*land village in Decreer Char Union, which is a part of the Faridpur district's Faridpur Sadar Upazila (Fig.2: Map 1 & Fig.3: Map 2). The research region is acknowledged as one of the riverbank erosion prone sites in Faridpur district thus the study village is selected as study locale.

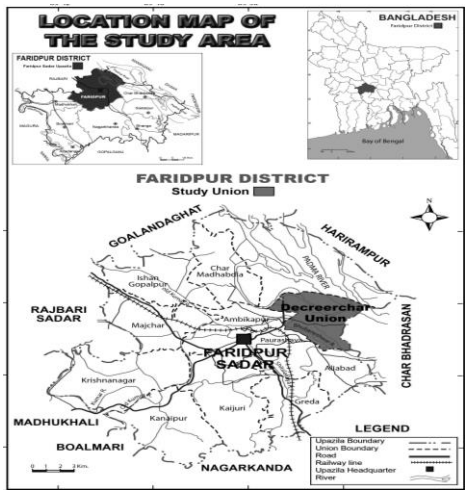


Figure 2: *Map 1 (Location Map of the Study Area*)

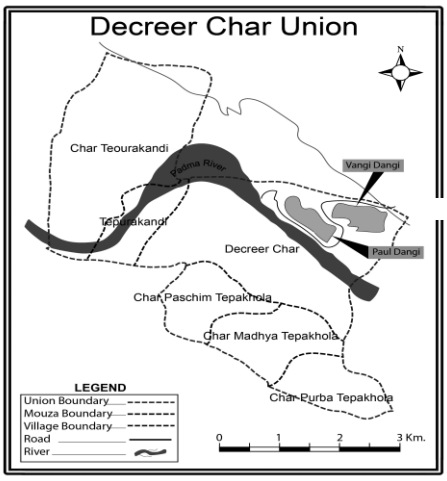


Figure 3: *Map 2 (Decreer Char Union Showing Study Village—Vangi Dangi)*

5.2. Sampling Procedures and Unit of Analysis

In this study, a purposive sampling method is utilized to choose study area for interviews and distribution of questionnaires. The criterion for choosing households within the study villages was the presence of a household head (HH). The paper is primarily based the data gathered through direct interviewing with 122 displacee *char*land dwellers from all of the riverbank erosion displacee households (122) at Vangi Dangi who are affected by riverbank erosion at least once in their lifetime. All the erosion-affected households (122) in the present study are considered as the appropriate primary unit of analysis. The respondents are directly interviewed to represent these units. In this present study, it has been tried to take interview in a family of both male and female members and their children in their respective aspects. When both are not available, any responsible member of the households is considered as a unit of analysis. As the unit of analysis, these affected *char*land dwellers are strikingly appropriate for the purpose of this study.

5.3. Data Collection and Instruments

A Mixed-methods strategy has applied in integrating both qualitative and quantitative methods. A pilot survey was conducted before implementation on 40 households to

assess the suitability of the data collection instrument. The findings from the pilot survey were used to develop the data collection instrument. Field survey was then carried out using semi-structured questionnaires, filed visits, literature review, and expert opinions. Quantitative data were gathered from a questionnaire survey of 122 households from Vangi Dangi village where qualitative data triangulation and information is got together through FGDs, depth interviews, KIIs (Key Informal Interviews) and case studies. The FGDs include 6-12 participants and 2-3 research team members, focusing on essential issues. KIIs are conducted with local leaders and individuals from government (GOs) and non-government organizations (NGOs), addressing concerns about disasters and climate change's impact on *char* areas' inhabitants. The data collection activities through questionnaire and interviewing of social survey, case studies, and FGDs were took place from 7 November 2024 to 12 January 2025. In addition, the informal interviews with various stakeholders were conducted from 9 February to 16 March. The Secondary data from GOs and NGOs reports, and scholarly studies enhanced the field evidence, especially on erosion patterns and demographic impacts.

5.4. Data Management and Analysis

The study followed Colaizzi's (1978) descriptive phenomenological approach to analyze the respondent's lived experienced. Upon completion of the interviews, verbatim transcripts were created from the audio recordings to ensure participant responses were transcribed exactly as spoken in Bengali, and later translated into English to ensure accuracy (Sandelowski et al. 2009). The transcripts were then reviewed multiple times for consistency and completeness (Silverman, 2021).

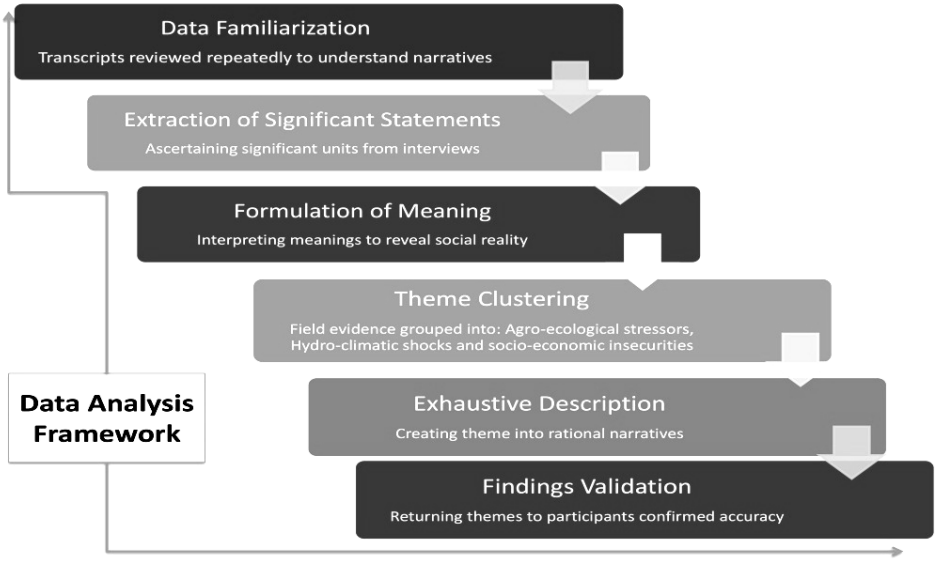


Figure 4: *Data Analysis Framework*

Based on Colaizzis' Descriptive Approach (1978) researcher has formed this figure

By following Colaizzi's descriptive approach, the process started with the first step (data familiarization), by which all transcripts of respondents were repeatedly reviewed to achieve in-depth understanding of erosion-induced vulnerabilities and livelihood destructions (Fig. 4). In addition, the second step, extraction of significant statements has been taken to explore the key expressions that try to capture the social reality and lived experiences of the *char*land displacees's livelihood. Through the third step, formulation of meanings statements illustrates the socio-ecological evidences. The derived meanings, fourth steps of approach are then organized into broader theme cluster such as agro-ecological forces, hydro-climatic shocks, and livelihood insecurities (Fig. 4). The fifth step, exhaustive description is produced into a comprehensible narrative that replicates the difficulties of displacee *char*land dwellers' livelihood insecurities. The last and final step, validation of findings then conducted by repetitive interpretations to participants to confirm accuracy and enhance the integrity and constancy of the study outcomes. This methodical approach helps this study to ensure a severe, translucent, and participant-informed investigation (Fig. 4).

On the contrary, survey responses have been analyzed in descriptive statistical methods—frequencies and percentages to reveal the socio-demographic profile, influential indicators, displacement status and livelihood insecurities. Besides, graphs, tables, figures and charts are produced to interpret patterns and relationships for clearer illustration. The findings of quantitative approach are analyzed to show the relation to research objectives, theoretical frameworks (SES and SLF), and field realities. Results are also integrated with qualitative insights where mixed-methods triangulation is used.

6. Results and Discussions

6.1. Socio-Demographic Profile of *Char*land Dwellers

The socio-demographic characteristics of study *char*land dwellers provide critical insights into their heightened environmental vulnerability to riverbank erosion and displacement (Maxmen 2020, & McLean 2011). Factors such as household structure, education, occupation, gender relations, health conditions, and land tenure collectively shape how they cope with environmental and socio-economic stress. Understanding the socio-demographic profile of *char*land dwellers is essential to grasp the multifaceted nature of their vulnerability (Williams and Webb 2022; Kadir & Naher 2023)

6.1.1. Socio-demographic Status of the Charland Dwellers

As shown in table 1, the socio-demographic status of this *char*land community highlights their livelihood status, age and sex ratio, occupational status, level of education and overall livelihood patterns. The results of this study reveals that the 1st majority 44.26 percent (n= 54 of 122) are in 34-43 age category and among them 92.62 percent (n=113 of 122) are male as their sexual analysis (Table 1a). The religious status of this study dwellers are found as Islam (Table 1a).

Table 1a: *Socio-demographic Status of the Charland Dwellers*

Indicators for Measuring Socio-demographic Status		Riverbank Erosion Affected *Char*land Dwellers N=122		
		n	**%**	**Majority**
Age	Less than 13	4	3.28	6th
	14-23	9	7.38	5th
	24-33	21	17.21	2nd
	34-43	54	44.26	1st
	44-53	14	11.48	3rd
	54-63	11	9.02	4th
	More than 64	9	7.38	5th
Sex (Household Head)	Male	113	92.62	1st
	Female	9	7.38	2nd
Religion	Islam	114	93.44	1st
	Hindu	8	6.56	2nd
Level of Educational	Illiterate	18	14.75	3rd
	Literate	31	25.41	2nd
	Primary	58	47.54	1st
	Secondary	12	9.84	4th
	Higher Secondary	2	1.64	5th
	Graduation	1	0.82	6th
Family Size (Number of Members)	Small (≤1-4)	106	86.89	1st
	Medium (5-9)	14	11.48	2nd
	Large (≥10)	2	1.64	3rd

Source: Field Survey in 2025

Table 1b: *Occupational Diversifications of the Charland Dwellers*

Indicators for Measuring Socio-demographic Status		Riverbank Erosion Affected *Char*land Dwellers N=122		
		n	**%**	**Majority**
Occupational Diversity*	Agriculture	114	93.44	1st
	Pastoral	78	63.93	2nd
	Day Labor	75	61.48	3rd
	Fishing	43	35.25	4th
	Nut Shelling	12	9.84	5th
	Shopkeeper	11	9.02	6th
	Tailoring	7	5.74	7th
	Maid Servant	5	4.1	8th
	House Management	2	1.64	9th
	Painting	1	0.82	10th

Multiple Responses Considered

Source: Field Survey in 2025

From field reality, it is relevant that the disappointing fact has been found at their educational status because the first majority 47.54 percent of the respondents has secured their primary education only where no post-graduation level of education has been identified because of their *char* cultural backwardness (*cf*. Singha & Pal, 2021). In addition, 86.89 percent of the respondents are found to be living in a small family, with one to four members (Table 1a).

6.1.2. Occupational Diversifications of the Charland Dwellers

From the abovementioned table 1b this study analysis reveals the poor socio-economic and occupational status of the study *char*land dwellers. The highest proportion of the study respondents are engaged in agriculture based economy (93.44%, n=114 of 122) and pastoral (63.93%, n=78 of 122). These findings also indicate a poor income group population of the study village (Table 1b). The *char*land dwellers repeatedly affected by erosion attack and they have to lose their cultivable and homestead land that negatively influences on their occupational status. Occupational diversity is common but stressor for the continuation of their livelihood.

6.1.3. Land Ownership Status of the Charland Dwellers

Landownership status of the study village also highlights their socio-economic and ecological vulnerability by showing the study results where the highest proportion 82.79 percent (n=101 of 122) are landless. Besides, only 17.21 percent have found who have their own land (n=21 of 122) and among them a very few of the respondents (10.66%, n= 13 of 122) are found as marginal (Table 2).

Table 2: *Land Ownership Status of the Charland Dwellers*

Landownership (in acre)		**Ownership Patterns of *Char*land dwellers N=122**									
		Self		**Rent**		***Khas***		**Relatives**		**Total**	
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Landless											
With Homestead		29	29.29	0		0		0		29	23.77
Without Homestead		0		6	6.06	64	64.64	2	2.02	72	59.02
	Total	29		6		64		2		**101**	82.79
Landowner											
Rich	>7.50	1	4.76	0		0		0		1	0.82
Middle	>2.50 to ≤7.50	2	9.52	0		0		0		2	1.64
Poor	>1.00 to ≤2.50	5	23.81	0		0		0		5	4.10
Marginal	≤1.00	13	61.90	0		0		0		13	10.66
	Total	21		0		0		0		**21**	17.21
Grand Total										**122**	100

Source: Field Survey in 2025

From field reality, this is very authentic that the unequal distribution of land clearly reveals this structural poverty, land tenure insecurity and limited access to productive capitals among the affected diplacees (Table 2). This condition also highlights their socio-ecological vulnerability in the context of their land ownership status.

6.1.4. Housing Materials Used by Char Households

The field data attest that the *char*land dwellers usually use thatch (14.75%, n=18 of 122), corrugated iron sheets (CISs; 76.23%, n=93 of 122; highest proportion), bamboo branches (7.38%) for their roof materials in building housing structure (Table 3). These types of structure are not only socio-ecologically vulnerable but also indicate their economic constraints and socio, physical vulnerability, which are shaped by their cyclical poverty, structural and environmental uncertainty.

The another part of this housing structure is the wall materials where most of the households' living arrangements are made with mud, thatch, CIS, bamboo branches, wood, and both bricks and CIS. The study finds that highest majority 98.36 percent n=120 of 122 of the respondents are living in non-concrete house and only a few 1.64 percent (n=02 of 122) of the respondents' homestead have found semi-concrete.

Table 3: *Housing Materials Used by Char Households (Roof)*

Housing Materials		Patterns of Residence				Total	
		Non-concrete		Semi-concrete			
		n	%	n	%	n	%
Roof	Thatch	18	14.75			**18**	**14.75**
	CIS	93	76.23	2	1.64	**95**	**77.87**
	Bamboo Branches	9	7.38			**9**	**7.38**
	Total	**120**	98.36	**2**	**1.64**	**122**	**100.00**

Source: Field Survey in 2025

Table 3b: *Housing Materials Used by Char Households (Wall)*

Housing Materials		Patterns of Residence				Total	
		Non-concrete		Semi-concrete			
		n	%	n	%	n	%
Wall	Mud	**7**	5.74			**7**	**5.74**
	Thatch	11	9.02			**11**	**9.02**
	CIS	92	75.41			**92**	**75.41**
	Bamboo Branches	9	7.38			**9**	**7.38**
	Both Bricks and CIS			2	1.64	**2**	**1.64**
	Wood	1	0.82			**1**	**0.82**
	Total	**120**	**98.36**	**2**	**1.64**	**122**	**100.00**

Source: Field Survey in 2025

This structure is clearly symbolizing their material poverty and environmental fragility because sometimes they have to displace hither to thither without any warning due to erosion attack that is why they have to shift their livelihood essentials and housing materials in a very short time for another new shiftiest. Thus, these materials are movable; they use these for their survival in *char*land precarious habitat. The disappointing fact and reality is that the dominance of non-concrete housing materials represents their socio-economic deprivation within erosion-prone social settings (Table 3a and 3b).

6.1.5. Lighting Inaccessibility and Social Deprivation

The lighting inaccessibility also highlights their social deprivation because the affordability of energy use for every sector and community are essential for achieving sustainable development goals (SDGs). Nevertheless, the filed data attest the fact that the riverbank erosion affected *char*land dwellers have to rely on solar panel (31.97%, n= 39 of 122) due to lack of electricity grid in this study area as their primary source of lighting in dark condition.

Table 4: *Vulnerable Lighting Arrangements in the Dark for Dwelling Houses*

Ownership and Sources of Light		**Riverbank Erosion-affected *Charland* Dwellers N=122**			
		Electricity	**Solar Panel**	**Kerosene**	**Candle**
Own	n	32	39	122	43
	%	26.23	31.97	100	35.25
Relatives	n				
	%				
Local Govt.	n		11		
	%		9.016		
Neighbor	n				
	%				
House Owner	n				
	%				
Land Owner	n				
	%				
Total	**n**		**50**	**122**	**43**
	%		40.98	100	35.25

Source: Field Survey in 2025

The inadequate electricity supply in this 21st cencury indicates their institutional or infrastructural backwardness and social exclusion for the affected community. However, the reality is too hard to accept that this fragile environment, formation of *char* and socio-ecological settings are also responsible for the absence of electricity.

Case 1

Belaiyet Kazi (65), a displacee *char*land dweller, a farmer is living in Pal Dangi village. His displacement status is fifth. His family consists of six (6) members. They are also deprived of using electricity supply for their daily functioning. His monthly income is

only ten thousands taka in BDT, which is also insufficient for using solar panel for his residence's lighting. That is why they largely depend on kerosene, candles or sometimes indigenous fueling. Due to inaccessibility of proper lighting arrangements are hindering his children's education, their agricultural activities, women's daily functioning including tailoring and cooking at night.

7. Influential Driving Forces of Socio-ecological Vulnerability and *Char*land Dweller's Livelihood Insecurities

The socio-ecological vulnerability and recurrent riverbank erosion cause frequent displacement from their place of origin to other *char* or others that is responsible for their livelihood insecurities in confronting with *char*land precarious habitat. (Islam, 2017 & Podder et al., 2022). The present study is analyzing two main driving forces and measurable indicators of socio-ecological vulnerability to explore their livelihood insecurities namely agro-ecological factors and hydro-climatic forces.

7.1. Agro-Ecological Factors

From field visit, it is significant that agro-ecological resources are frequently disrupted by riverbank erosion although they utilize the resources available in their *char*land environment, their livelihoods remain unstable and unsustainable, lacking the necessary resilience to withstand and recover from the stresses and shocks induced by riverbank erosion displacement (Simane, Zaitchik, and Foltz 2014). This *char*t illustrates the agro-ecological vulnerability of *char*land inhabitants in the study village by assessing indicators of their current vulnerable assets, including land, vegetation cover, climate variability, sunlight, and their unstable geological *char*acteristics (Chart 1a and 1b), which are exceedingly responsible for disrupting their livelihood after the riverbank erosion attack.

Chart 1a: *Agro-Ecological Factors of Vulnerability (Land Use, Climate Variability and Sunlight)*

Factor	Measurable Indicators	*Char*land Dweller's Vulnerability
Agro Ecological	Land use	• Loss of agricultural land due to riverbank erosion • Disruption of homestead land • Loss of land ownership resulting from displacement • Vulnerable fishing pond
	Climate Variability	• Climate induced risk and dislocation • High frequency and intensity cause annual flood and riverbank erosion • The extent to which climate introduces risks
	Sunlight	• Vulnerable source of lighting facilities for Vangi Dangi • High dependency in cultivation

Source: Field Survey in 2025

7.1.1. Land Use

Land use instability constitutes a primary agro-ecological vulnerability that impact on their total livelihood. The continual loss of homestead areas and agricultural land due to recurrent riverbank erosion undermines the foundation of agrarian livelihoods of the study

*char*land dwellers. As evacuated households forfeit their legal entitlement to inundated parcels, the deprivation of arable land jeopardizes food production and undermines land ownership rights. Moreover, the depletion of fishing ponds, often crucial for sustenance and supplementary income in continuing their livleihood, exacerbates the family economy and heightens dependence on unstable wage work (for more, see chart 1a).

7.1.2. Climate Variability

Climate variability adds another major dimension to agro-ecological vulnerability. Climate-induced dislocation is recurrent, as extreme hydrological events cause both temporary and permanent displacement. In addition, climate induced risk and dislocation reduce agricultural productivity.

The extent to which climate factors introduce risks is especially through prolonged monsoon flooding and dry-season drought that creates an environment of perpetual uncertainty (for more, see Chart 1a).

7.1.3. Sunlight

Sunlight availability and energy access also influence the agro-ecological vulnerability of the study *char*land dwellers. In the study village, there is no access to the national electricity grid. Consequently, solar panels serve as the only source of lighting and limited electrification. However, the dependence on solar energy, while environmentally friendly, is highly vulnerable to seasonal fluctuations, cloud cover, and the affordability of solar equipment. This limited energy access both agriculture activities such as irrigation pumping and crop dry and household well-being thereby constraining livelihood diversification and productivity (for more, see Chart 1a).

Chart 1b: *Agro-Ecological Factors of Vulnerability (Vegetation Cover and Geological Features)*

Factor	Measurable Indicators	***Char*land Dweller's Vulnerability**
Agro Ecological	Vegetation cover	• Insufficient vegetation cover • Uprooted big trees due to erosion that also create vulnerability to resist erosion • Degradation of forestry due to recurrent riverbank erosion • Loss of necessary trees • Degradation of cattle feed
	Geological features	• Create complex landscape for riverbank erosion risk • Geographical isolations work as sites of exported erosion risk • Create unique challenge for adaptation • Create less diversified socioeconomic • *Char*land as a islet generate risk for riverbank erosion

Source: Field Survey in 2025

7.1.4. Vegetation Cover

Vegetation cover and forestry degradation further exacerbate environmental vulnerability of the s study *char*land dwellers. The insufficient presence of vegetation and the recurrent

uprooting of large trees due to erosion reduce the natural buffer capacity of the landscape at *char*land habitat. Trees serve as protective barriers that stabilize riverbanks and provide essential ecosystem services such as shade, fuel-wood, and cattle fodder but their loss not only accelerates soil erosion but also diminishes biodiversity and increase dependence on external feed for livestock that negatively affect their livelihoods. The degradation of forestry resources and the absence of adequate reforestation programs weaken both ecological resilience and community adaptive capacity (for more, see Chart 1b).

7.1.5. Geological Features

In this study, the geological and geomorphological features increase *char*land's environmental vulnerability, which is prone to erosion (Longobardi & Formisano, 2025). The geological adversities limit their educational access, adequate food stuff, health care facilities and other essentials related to continue their livelihood. In addition, another factors such as climatic variability, insufficient vegetation cover and precarious geological formations cause complexities in creating vulnerability by influencing the environmental sustainability and human security (Chart 1b).

7.2. Hydro-climatic Factors

The hydro-climatic factors analyses are vital for explaining the annual degradation of land due to erosion attack in precarious ecosystems of the study area because it operates at multifarious scales from minute to extensive. This study finds five essential and measurable indicators that exist in the both study *char*land villages such as flood, riverbank erosion, drought, *Kalbaishakhi* storm and heavy rainfall at the months of *Asharh-Shraban*, which are considered to construct the hydro-climatic dimensions to reveal the hydro-climatic factors of vulnerability (Chart 2a, 2b, 2c and 2d). Besides, these indicators are also responsible for the loss of household animals and the inadequate water and sanitation systems of the *char*land inhabitants (Chart 2a, b, c, d).

Chart 2a: *Factors of Vulnerability: Hydro-climatic (Flood)*

Factor	Measurable Indicators	*Char*land Dweller's Vulnerability
Flood	1. Frequency and intensity of flooding events 2. Extent of inundated area 3. Duration of waterlogging	• High Impact on food security and daily livelihoods • Submerge living residences and cultivable lands • Induced displacement and migration (temporal or permanent) • Loss of livestock • insufficient water and poor sanitation system • Lack of shelter for temporary communal settlement • Loss of safety net for women, elderly and children • Crisis of safe drinking water

Source: Field Survey in 2025

7.2.1. Factors of Vulnerability: Hydro-climatic (Flood)

Flood is a frequent hazards due to their socio-ecological settings in this study area which disrupts total livelihoods and living conditions repeatedly. Floods are also responsible for submerged their homestead land, cultivable lands, livestock loss, assets loss and temporary displacement (Chart 2a). The frequency and intensity of flooding events together create *char*land dweller's vulnerability because this situation has high impact on their food security and daily livelihoods, which also responsible for submerge their living residences that cause their temporary shifting from their places of origin (Chart 2a).

Besides socio-ecological induced displacement makes them dependent on GOs and NGOs aid system, which is not sufficient for their resilience (Chart 2a). Due to socio-ecological degradation, the loss of safety nets for women, children and elderly; insufficient water and poor sanitation system highlights their poor infrastructural conditions, environmental instability, institutional constraints and vulnerable resilience mechanisms (Chart 2a).

7.2.3. Factors of Vulnerability: Hydro-climatic (Riverbank Erosion)

Riverbank erosion is also severely responsible for destroying homestead and cultivable land, leading to frequent displacement and livelihood loss (Saikia et. al., 2023 and Akter, 2013). It disrupts social stability, causes scholl dropouts, and creates food insecurity (Chart 2b). Limited access to government and NGOs support worsens their condition, intensifying socio-economic hardship and overall environmental vulnerability.

Chart 2b: *Factors of Vulnerability: Hydro-climatic (Riverbank Erosion)*

Factor	Measurable Indicators	*Char*land Dweller's Vulnerability
Riverbank Erosion	1. Rate and frequency of erosion 2. Area of land lost annually 3. Number of households displace	• Disruption of normal socio-economic functioning • Depletion of homestead and cultivable land • Forced displacement and relocation • School drop out of children due to displacement • Food insecurity and crisis in daily subsistence • Limited access to NGOs and GOs aid

Source: Field Survey in 2025

7.2.4. Factors of Vulnerability: Hydro-climatic (Drought and Rainfall)

Drought and irregular rainfall intensify hydro-climatic vulnerability in the study *char*land where prolonged dry periods damage crops, reduce soil fertility, and create severe drinking water scarcity(for more, see Chart 2c). Vegetation cover loss and pest outbreaks further threaten their livelihoods (*cf.* Abbass et al. 2022 and Grzesiak et al. 2009). Conversely, excessive or erratic rainfall causes recurrent flooding and riverbank erosion at study precarious *char*land, destroying homestead and farmland.

Chart 2c: *Factors of Vulnerability: Hydro-climatic (Drought and Rainfall)*

Factors	Measurable Indicators	*Char*land Dweller's Vulnerability
Drought	1. Frequency and duration of prolonged dry periods 2. Decline in average annual rainfall 3. Reduction in soil moisture and groundwater levels	• Significant crop damage and decline in agricultural productivity • Acute scarcity of safe drinking water • Death of essential trees and vegetation cover • Increased incidence of pest and insect impacting crops and health
Rainfall	1. Intensity, duration, and irregular distribution of rainfall 2. Increased frequency of extreme precipitation events	• Heavy rainfall triggers flood, riverbank erosion annually • Temporary loss of homestead land , cultivable lands and other essential equipment leading to displacement and livelihood insecurity

Source: Field Survey in 2025

These climatic extremes disrupt livelihoods, heighten food insecurity, and deepen the socio-economic vulnerability of *char*land dwellers at Vangi Dangi village.

7.2.5. Factors of Vulnerability: Hydro-climatic (Storms and Extreme Weather)

Frequent storms and extreme weather events increase the vulnerability of *char*land dwellers at Vangi Dangi village by damaging homes, assets, and local infrastructure. Such climatic disturbances disrupt livelihoods and weaken community networks, leading to loss of social stability and resilience (for more, see Chart 2d).

Chart 2d: *Factors of Vulnerability: Hydro-climatic (Storms and Extreme Weather Events)*

Factor	Measurable Indicators	*Char*land Dweller's Vulnerability
Storms and Extreme Weather Events	1. Frequency and intensity of storms 2. Duration and spatial extent of climatic shocks 3. Seasonal recurrence and unpredictability of weather patterns	• Structural collapse of dwellings and communal infrastructure, intensifying material deprivation • Disintegration of household and community networks, leading to social disorganization and weaken collective resilience • Disruption of livelihood systems, mobility, and income-generating activities • Heightened social and economic insecurity, particularly among marginalized and resource-poor groups • Increased dependency on external assistance and erosion of adaptive capacity

Source: Field Survey in 2025

Livelihood interruptions, reduced mobility, and declining income sources intensify economic hardship. Marginalized groups particularly women, children and the poor experience greater dependency and limited coping capacities that is worsening their overall socio-economic insecurity day by day and for this reason their socio-economic deprivation is also becoming a continuous process in confronting their livelihoods.

8. Displacement Status and Spatial Dynamics of Vulnerability

This research characterizes spatial vulnerability as the spatial context, taking into account various parameters related to riverbank erosion displacement that affect the functioning of vulnerable *char* dwellers during and post erosion of riverbanks. This study sharply demonstrates that threats from riverbank erosion, combined with economic and social vulnerabilities, compel the *char*land dwellers of study village to migrate in neighboring *char*s (Table 5). The study reveals the fact that among 122 *char*land dwellers, 46.72% experience displacement once, primarily from Vangi Dangi (22.81%), while 22.95% faced it twice and 13.93% thrice. Recurrent displacements, particularly in areas like Haziganj and *Char* Bahirdia, underscore the dwellers heightened environmental vulnerability to riverbank erosion and climate-induced hazards.

Table 5: *Displacement Status and Places of Origin*

Displacement Status		Respondent *Char*land Dweller's Places of Origin N=122													
		Vangi Dangi	Balia Ghat	Mominkhar Hat	Vuia Dangi	Krishnapur	Munshiganj	*Char* Tepakhola Mridha Dangi	Rahim Matobbar Dangi	Hazi Uzir Mahmuder Dangi	Haziganj	*Char*Bahirdia	Vajon Dangi	Byapari Dangi	**Total**
Once	n	13	1	2	4		1	3		2		2	7	1	**36**
	%	22.81	20	15.38	100		16.67	60		100		20	77.78	25	**29.51**
Twice	n	4	2	5		1	3	1	3		1	4	2	2	**28**
	%	3.28	1.64	4.10		0.82	2.46	0.82	2.46		0.82	3.28	1.64	1.64	**22.95**
Thrice	N	12		2			2							1	**17**
	%	9.84		1.64			1.64							0.82	**13.93**
Fourth	N	9	2					1				3			**15**
	%	7.38	1.64					0.82				2.46			**12.30**
Fifth	n	4		3		1									**8**
	%	3.28		2.46		0.82									**6.56**
Sixth	n	7		1					1						**9**
	%	5.74		0.82					0.82						**7.38**
Seventh	n	4										1			**5**
	%	3.28										0.82			**4.10**
Eighth	n	2													**2**
	%	1.64													**1.64**
Total	n	**57**	**5**	**13**	**4**	**2**	**6**	**5**	**4**	**2**	**1**	**10**	**9**	**4**	**122**
	%	**46.72**	**4.10**	**10.66**	**3.28**	**1.64**	**4.92**	**4.10**	**3.28**	**1.64**	**0.82**	**8.20**	**7.38**	**3.28**	**100**

Source: Field Survey in 2025

Case 1

Asma Aktar (36) is a riverbank erosion affected *char*land women at Vangi Dangi village. Her family consists of five members along with three children who are girls-child. She has displaced her residences three times in her life. Due to recurrent riverbank erosion displacement, she along with others female members of her family have to displace their residences more than thrice from their origin due to environmental vulnerability. Unhygienic sanitary system, limited freedom of girls movement, break down of social structure and social relations are the common

vulnerabilities that they have to face. They have to face socio-economic deprivation due to limited and inaccessibility of education, health and recreational facilities.

9. Socio-Economic Deprivation and Livelihood Insecurities in *Char*land

The riverbank erosion-induced displacement scrupulously influences the socio-economic stability (Podder et. al., 2021 and Islam et. al., 2022) of *char*land dwellers at Vangi Dangi village. Due to annual and frequent riverbank erosion, the loss of homestead and cultivable land, and assets disturbs livelihoods and break everyday resilience. From field data, it is very disappointing that displacement leads to unemployment, food insecurity, and dependency on GOs and NGOs aid (Chart 3).

Chart 3: *Dimensions of Vulnerability and Connection between Socio-ecological Settings and Livelihood Insecurities*

Dimensions	Nature of Impact	Duration of Impact after Displacement	Affected Groups	Consequences Lead to Livelihood Insecurities
Loss of homestead and cultivable land	Physical and economic	Long-term	Entire households	Homelessness, food insecurity, decline in agricultural productivity, and economic instability
Forced displacement and relocation	Social and psychological	Long-term	Displaced households, elderly and women	Breakdown of community networks, identity loss, and psychological trauma
Destruction of physical assets (houses, livestock, tools)	Economic	Short-to medium-term	Farmers and low income households	Asset depletion, reduced income-generating capacities, and dependency on aid
Disruption of agricultural and fishing activities	Livelihood-based	Medium- to long-term	Farmers and fishers	Loss of employment opportunities, decline in income, and livelihood insecurity
Limited access to education and healthcare	Institutional and social	Long-term	Elderly, children, women and challenged persons	Increased illiteracy, poor health outcomes, and reduced social mobility
Insecure land tenure and ownership	Structural	Long-term	Landless, displaced households, women, children, elderly	Persistent poverty, exclusion from rehabilitation and development programs
Poor infrastructure and market inaccessibility	Economic and spatial	Medium-term	Traders and small entrepreneurs	Reduced trade opportunities, isolation, and limited livelihood diversification
Gender inequalities in displacement context	Social and cultural	Long-term	Women and adolescence girls	Increased vulnerability to exploitation, reduced economic participation, and social insecurity

Source: Field Survey in 2025

Inadequate admittance to education, healthcare, and markets further constrains their rescue facilities and social flexibility. In addition, it is relevant that apprehensive land tenure prolongs poverty, while gender disparities intensify women's vulnerability and economic marginalization. Together, these factors create determined socio-economic scarcity and hinder sustainable livelihood reinstatement in erosion-affected study *char*land (for more, see Chart 3). In relation to this fact, it produces multidimensional vulnerability, strengthening fundamental disparity, livelihood insecurity and social segregation. Displacement-induced deprivation disseminates marginality, dwindling community resilience and lengthening class, gender, and latitudinal differences within *char*land.

10. Conclusion

The socio-ecological vulnerability of the displacee *char*land dwellers divulges a robust connection between riverbank erosion displacement and socio-economic insecurities. The *char*land dwellers' displacement from their place of origin to another both in temporary or permanently is drawing the socio-ecological impediments of the *char*land ecosystem and represents the cycles of poverty and structural constrains. Recurrent erosion attack, frequent displacement and loss of tangible and intangible livelihood essentials disrupt livelihood securities of the affected dwellers. Consequently, environmental degradation and instability rise for the inaccessibility of institutional supports both from GOs and from NGOs program to rehabilitate the affected community in recovering. These hazardous situations are emphasizing the immediate needs for sustainable livelihood strategies and indigenous interventions to improve resilience among the erosion affected *char*land dwellers. Riverbank erosion is considered as the most common and recurrent disaster in the study village of Vangi Dangi. Without organizational supports, the erosion-affected households have to face the adversity in mitigating the disaster attacks every year.

Riverbank erosion is considered as the most common and recurrent disaster in the study village of Vangi Dangi and without organizational supports, the erosion-affected households have to face the adversity in mitigating the disaster attacks every year. Some recommendations may be espoused to address the livelihood confrontation situation of the erosion-affected *char*land dwellers in Vangi Dangi have to face intermittently. For eradicating vulnerability and strengthening resilience, the government should formulate and undertake preparedness plan and mitigation measures for respective disaster risk reduction in time by enhancing financial and resource allocations in disasters risk reduction activities. The BWDB, GOs and NGOs should construct required large-scale engineering structures (e.g., embankment, dam, shelter center) to reduce physical vulnerability of the *char*-dwellers. They should be engaged in the local and national economy by broadening and strengthening economic and other productive livelihood opportunities. The vulnerable, poor, and marginalized *char*-dwellers of Vangi Dangi village need to be enabled in association with their indigenous knowledge, skills, and capacities to effectively sustain their erosion-affected indigenous *char*land livelihood.

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