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Assessing Flood Impacts of Diroi River on its Riverine Area in Sivasagar District, Assam: A Comprehensive Study

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Abstract: ***Floods are recurring natural disasters in the Diroi River basin, Sivasagar district, Assam, posing significant threats to local communities, infrastructure, and ecosystems. This study aims to assess the impacts of floods in the Diroi River basin, focusing on the social, economic, and environmental dimensions. Primary data of the study were collected through an open-ended questionnaire. The sample size of the study is 227. A mixed-method approach that combines socio-economic surveys, this research evaluates flood risk, vulnerability, and resilience in the region. Pearson's corelation matrix has been used to analyse the impact of flood on the socio-economic development of the study area. Q-GIS is used to prepare the study area map. Findings highlight the severity of flood impacts on agricultural livelihoods, infrastructure, and human settlements. The study also identifies key factors influencing flood vulnerability, including land use changes, inadequate flood management infrastructure, and socio-economic disparities. The results of this assessment can inform flood risk management strategies, policy interventions, and community-based initiatives to enhance resilience and reduce flood-related losses in the Diroi River basin.***

Keywords: flood assessment, vulnerability, socio-economic impact, risk management, Diroi River

1. Introduction

Floods are among the most recurrent and devastating natural disasters in Assam, a state crisscrossed by a complex network of rivers and tributaries. The Diroi River, a significant tributary in the Sivasagar district, contributes both to the agricultural sustenance and the recurring flood challenges faced by the region. In recent decades, increasing monsoonal variability, sedimentation, deforestation in upstream areas, and human encroachments have amplified the frequency and intensity of flood events along the Diroi River. These floods not only lead to extensive damage to crops, property, and infrastructure but also disrupt livelihoods, education, and public health systems, particularly in vulnerable rural communities.

Sivasagar district, with its rich historical heritage and agrarian economy, experiences seasonal inundation that affects thousands of households annually. The Diroi River, though relatively modest in size compared to the Brahmaputra and its major tributaries, plays a disproportionately large role in local flood dynamics. Understanding the nature, causes, and consequences of flooding in the Diroi basin is essential for effective disaster management and sustainable regional development.

This study aims to analyse the impact of flooding caused by the Diroi River in Sivasagar district, focusing on the socio-economic consequences, environmental degradation, and existing mitigation measures. By drawing on both field data and historical flood records, the paper seeks to contribute to a more informed approach to flood risk reduction and resilience-building in one of Assam's most flood-prone districts. Various villages are inundated every year due to floods. Based on purposive sampling, four villages were selected as sample villages for the household survey, and households were selected by adopting simple random sampling.

2. Significance of the Study

The significance of this study lies in its comprehensive assessment of the flood impacts of the Diroi River on its riverine area in Sivasagar District, Assam. The research provides valuable insights into the physical, social, and economic consequences of flooding, highlighting the vulnerability of the local community and the need for effective flood management strategies. By identifying the key factors contributing to flood severity and the areas most affected, this study informs policymakers, disaster managers, and stakeholders about targeted interventions and mitigation measures. The findings of this research can be used to develop evidence-based policies and plans to reduce the risk and impact of floods, ultimately contributing to sustainable development and resilience in the region. Furthermore, the study's methodology and results can serve as a model for similar flood-prone areas, making it a significant contribution to the field of disaster management and hydrology.

3. Research Questions

1) What are the primary socio-economic impacts of flooding on the communities living near the Diroi riverine area, and how do these impacts vary across different demographic groups?
2) How do the frequency and severity of floods in the Diroi riverine area affect the livelihoods of local residents, including their income, employment, and access to basic services?
3) What are the institutional and policy frameworks in place for flood management in the Diroi riverine area, and how can these frameworks be strengthened to reduce flood vulnerability?
4) What are the most effective structural and non-structural measures that can be implemented to mitigate the flood vulnerability of the Diroi riverine area, and how can these

measures be prioritised and integrated into existing development plans?

4. Objectives

1) To analyse the Impact of the flood on the socio-economic condition near the Diroi riverine area.
2) To suggest suitable strategies to mitigate the flood vulnerability of the Diroi riverine area.

5. Study area

The area of the present study comprises four villages near the Diroi River.

Location: The Diroi River is situated in the Sivasagar district, Assam, India, within the Brahmaputra River valley.

Topography: The topography of the study area is plain. There are no plateaus, and a mountain area is found within this range.

Climate: The region experiences a tropical monsoon climate with high rainfall and humidity. Winters are mild, while summers are hot and humid.

Hydrology: The Brahmaputra River and its tributaries, including the Diroi River, play a crucial role in shaping the region's physiography. The river system is prone to flooding, which can have significant impacts on the local population and economy.

Soil: Soil near the Diroi River is likely alluvial soil, which is commonly found in river valleys and deltas.

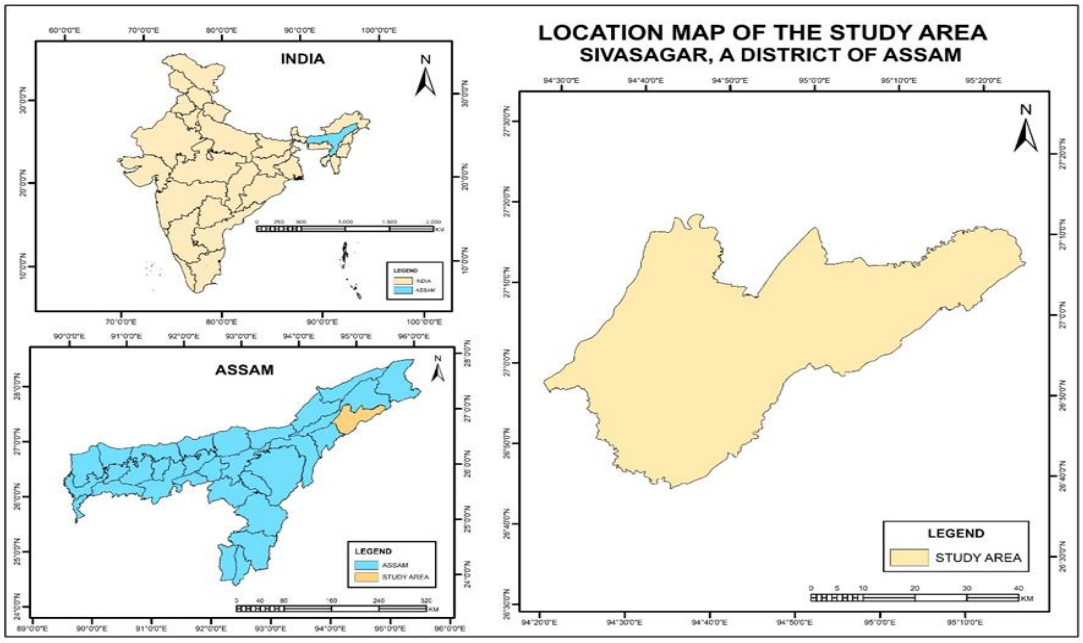

Figure 1: Map of the study area

6. Literature Review

The Diroi River, a tributary of the Brahmaputra River, flows through the Sivasagar district of Assam, India, and has been a recurrent source of flooding in the region. The riverine area of the Diroi has been experiencing frequent floods, causing significant damage to infrastructure, agriculture, and human settlements (Bhattacharya, 2018). The impact of these floods on the socio-economic condition of the local population has been substantial, with loss of livelihood, displacement, and trauma being common consequences (Das, 2020).

Studies have shown that floods in the Brahmaputra valley, including the Diroi River, are primarily caused by a combination of natural and anthropogenic factors, including heavy rainfall, siltation, and deforestation (Saikia, 2019). The construction of embankments and other flood control measures has been found to be ineffective in mitigating the impact of floods, often exacerbating the problem by altering the natural flow of the river (Baruah, 2020).

The socio-economic impacts of flooding in the Diroi riverine area are multifaceted. A study by the National Disaster Management Authority (NDMA, 2018) found that floods in the region led to significant loss of livelihood, particularly among the agricultural community, with crop damage and loss of livestock being common. The study also highlighted the vulnerability of marginalised communities, including women and children, who are disproportionately affected by floods.

Research has also focused on identifying strategies to mitigate the impact of floods in the Diroi riverine area. A study by the Assam State Disaster Management Authority (ASDMA, 2020) emphasised the need for a multi-hazard approach to disaster management, including flood risk management, climate change adaptation, and sustainable livelihoods. The study recommended the implementation of structural measures, such as flood-resistant infrastructure, and non-structural measures, such as flood forecasting and early warning systems.

The importance of community-based approaches to flood management has also been highlighted in the literature. A study by the International Journal of Disaster Risk Reduction (IJDRR, 2020) found that community-led initiatives, such as flood preparedness committees, can play a crucial role in reducing flood vulnerability and enhancing resilience.

The literature review highlights the significant impact of floods on the socio-economic condition of the communities living near the Diroi riverine area. The review also emphasises the need for a comprehensive approach to flood management, including structural and non-structural measures, community-based initiatives, and sustainable livelihoods.

7. Methodology

This study has been conducted by adopting a mixed-methods approach. Data were gathered through primary and secondary sources. Primary data were gathered based on an open-ended questionnaire. The secondary data were collected from various published articles, journals, papers, and the internet.

Sample villages were selected using purposive sampling, and household surveys were conducted using simple random sampling.

Table 1: Showing Household-level Survey.

Villages	Number of HHs	Surveyed HHs	% Of surveyed HHs
Borapial Habi	150	45	30
Patia Gaon	298	90	30
Chandbecha	176	53	30
Charal Pathar	127	39	30
Total	751	227	

According to Table 1, the total number of households in the four sample villages is 752, and the number of surveyed households is 227. Data were gathered and analysed based on two dimensions, followed by an open-ended questionnaire. Collected information and data based on the sub-dimensions were scored according to a self-designed scale, 1-5.

8. Results and Discussion

Objective1: "Impact of the Flood on the Socio-Economic Condition near the Diroi Riverine Area" is discussed in Table 2. The floodwaters of the Diroi River have had a profound impact on the socio-economic fabric of the communities living in its riverine area. The relentless inundation of agricultural lands, homesteads, and livelihoods has pushed many families into a state of economic distress and vulnerability. Our study reveals that the flood has led to significant loss of livelihood, displacement, and trauma among the affected populations. The following sections present the findings of our research, highlighting the specific ways in which the flood has affected the socio-economic condition of the people living near the Diroi River.

Table 2: Showing dimensions of impact assessment.

Dimensions	
Social	Economic
Sub -dimensions	
Social	Displacement and Homelessness
	Loss of Livelihood
	Poor living Conditions in Relief Camps
	Increased Vulnerability of Marginalised Communities
	Impact on Education
	Health Risk
	Food Insecurity
Economic	Loss of Agricultural Production
	Damage to Infrastructure
	Increased Poverty
	Disruption of Industries
	Reduced Investment

To identify the impact of the flood from the River Diroi in the riverine area, a statistical analysis is applied, which involves a correlation matrix using JAMOVI, based on the summarised scoring data collected through the mentioned sub-dimensions.

The Hypothesis of the study is:
H_0: There is no significant relation between the impact of flood and socio-economic conditions.
H_1: There is a significant relationship between the impact of flood and socio-economic conditions.

Descriptives		
	Social	Economic
N	227	227
Mean	25.7	23.7
Median	28	24
Mode	28	30
Sum	5838	5388
Standard deviation	6.58	7.59
Minimum	7	6
Maximum	35	30

Table 3: Descriptive Statistics of the scored value on impact assessment

Correlation Matrix			
	Social	Economic	
Social	Pearson's r	—	
	df	—	
	p-value	—	
	95% CI Upper	—	
	95% CI Lower	—	
	N	—	
Economic	Pearson's r	0.858***	—
	df		—
	p-value	<.001	—
	95% CI Upper	0.889	—
	95% CI Lower	0.82	—
	N	227	—

The impact of floods on the socioeconomic conditions in the Diroi riverine area is analysed based on scored data from household survey responses. A Spearman correlation matrix technique is applied to determine statistically significant relationships among the variables. From Table 4, it is found that Pearson's r = 0.858*: This indicates a strong positive correlation between the Social and Economic variables. The value of 0.858 is close to 1, suggesting a high degree of linear relationship.

p-value < .001: This means the correlation is statistically significant at a very high level ($p < 0.001$ is often denoted by *). It implies that the probability of observing this correlation (or more extreme) by chance is less than 0.1%.

95% CI Upper = 0.889, Lower = 0.820: The confidence interval suggests that we are 95% confident that the true population correlation lies between 0.820 and 0.889.
N = 227: The correlation is based on 227 observations/data points.
df = 225: Degrees of freedom for the correlation is calculated as N-2, which is 227-2 = 225.

It proves that there's a strong, statistically significant positive correlation between Social and Economic variables. If one variable changes, then the other also tends to move together.

The impacts of flood, as shown in Table 2, are found statistically significant, which showcases the present and future possibilities and scenarios of impact on the riverine area.

Hence, H_1: There is a significant relationship between the impact of flood and socio-economic conditions, is accepted, and H_0 =There is no significant relation between the impact of flood and socio-economic conditions, is rejected.

Objective 2: Suggest suitable strategies to mitigate the flood vulnerability of the Diroi Riverine area.

Objective1 established the trend and pattern of flood vulnerability in the area, underscoring the necessity for an in-depth examination of the issue. Based on the findings of this study, strategies to address flood vulnerability in this context would be reformulated and proposed.

1) Flood Barriers and Embankments: Construct or strengthen embankments along the Dero River to protect the area from overflow. Ensure proper maintenance and consider raising embankment heights based on historical flood data.
2) Improved Drainage Systems: Develop or upgrade drainage channels to efficiently manage excess water and reduce waterlogging in the area.
3) Elevated Structures: Build elevated homes, animal shelters, or critical infrastructure (like schools, healthcare centres) to minimise damage during floods.
4) Flood-Resistant Infrastructure: Incorporate flood-resistant design in construction projects, such as using raised platforms or water-resistant materials.
5) Community-Based Flood Management:
   - Establish a community flood management committee involving local residents.
   - Implement flood education programs for stakeholders.
   - Develop and practice village-level Emergency Response Plans.
6) Early Warning Systems: Set up an effective flood early warning system using real-time sensors, satellite data, or community observers to alert residents about impending floods.
7) Habitat Management and Restoration:
   - Restore and conserve wetlands or natural water bodies to help absorb excess floodwater.
   - Plant native vegetation to stabilise restoration efforts to protect wildlife habitats.
8) Land Use Planning: Encourage sustainable land use practices and avoid settlements in high-risk flood areas.
9) Awareness and Training: Conduct regular training and awareness programs for communities on flood preparedness, response, and evacuation procedures.
10) Incorporate Traditional Knowledge: Explore and integrate traditional flood management practices (like chang ghars or raised platforms) suitable for the local context.
11) Livelihood Support: Support alternative livelihood options for communities affected by floods to reduce dependency on flood-prone areas.
12) Strengthen Institutional Frameworks: Collaborate with agencies like the Flood and River Erosion Management Agency of Assam (FREMAA) for technical support, funding, and implementation of flood management projects.
13) Data-Driven Planning: Use historical flood data, satellite imagery, and risk assessments to plan mitigation strategies.
14) Government Initiatives: Align efforts with state policies focusing on wetland conservation, as emphasised by Assam's Chief Minister, to naturally mitigate urban and rural flooding.
15) Assess Local Vulnerabilities: Conduct a detailed vulnerability assessment specific to the Dero riverine area, considering factors like river morphology, population density, land use, and historical flood patterns.
16) Engage Local Authorities: Work closely with local authorities, experts, and communities to tailor strategies to the area's unique needs and challenges.

9. Conclusion

The flood of the Diroi River in Sivasagar district, Assam, likely had profound impacts on the riverine communities, infrastructure, and local ecosystems, consistent with broader flood trends observed in Assam. The floods potentially led to the displacement of populations, agricultural losses, damage to critical infrastructure, and economic disruptions, underscoring the vulnerability of the area to fluvial dynamics. Effective mitigation strategies, blending structural measures like embankment strengthening with non-structural approaches such as early warning systems and community preparedness, are essential to reduce future flood risks. A detailed assessment involving local stakeholders and experts is crucial to tailor interventions to the Diroi River's specific context, enhancing resilience and sustainability of the riverine area in Sivasagar district

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