HYDRO-GEOMORPHOLOGICAL DYNAMICS AND SOCIO-ECOLOGICAL VULNERABILITIES OF RECURRENT FLOODS IN MORIGAON DISTRICT, ASSAM

Pradip Chandra Kalita, Prof. Dhrubajyoti Saharia
Associated Professor
Department of Geography
Pragjyotish College, Gauhati University
tirthankar389@gmail.com, himasrisarma524@gmail.com

***Abstract*—Morigaon district is repeatedly affected by annual floods and severe riverbank erosion driven mainly by the Brahmaputra and its tributaries. Flooding disrupts livelihoods, damages crops and infrastructure, forces repeated displacement of riverine (char) communities and exacerbates public-health risks. This review synthesizes published studies, government reports, and situation updates to characterize flood drivers and spatio-temporal patterns in Morigaon, summarize impacts on people, economy and environment, evaluate past/ongoing mitigation and disaster-management responses, and identify gaps and pragmatic recommendations for building resilience locally. Key findings highlight the combined role of large river dynamics (Bankline shift and siltation), monsoon variability, and anthropogenic drivers (land-use change, inadequate embankments), while pointing to the urgent need for integrated, community-centred adaptation and improved early-warning and relocation planning.**

***Index Terms*—Flood hazard, Riverbank erosion, Brahmaputra River**

I. Introduction

Assam has historically seen floods and riverbank erosion, but in recent decades, the impact of disasters has grown dramatically, which is also having an impact on the state's growth. Because of its location within the Brahmaputra River Basin, Assam endures annual flooding, making it one of the states most affected by seasonal floods. Floods have historically been an imminent threat in this area, made worse by erratic monsoon rainfall, glacial melt, and human activities like river system expansion and deforestation. Morigaon district, situated in central Assam, is one of the most flood-prone places in the state, with annual floods wreaking havoc on communities, agriculture, and local businesses. In addition, the riverbed has had numerous interventions over time, including the construction of embankments and dams. There were also no efforts to investigate or chart the floodplain correctly. This has caused a significant interruption in the river's natural flow, resulting in an immense amount of devastation. Climate change, combined with the expansion of infrastructure such as highways and airports, is causing floods to become more intense. These and other construction projects may be sited in flood-risk locations, yet they have inadequate drainage, with

their hard, rather than porous, surfaces boosting run-off. Over the last six decades, successive administrations in Assam have invested money on embankment construction to alleviate the consequences of flooding.

The Brahmaputra River, which runs alongside Morigaon, is a significant supply of water resources and a potential source of flooding. Nearly every year, especially during the monsoon season (June to September), the area is flooded by the river and its tributaries. Morigaon's terrain, which includes low-lying floodplains and varying river systems, renders the region extremely vulnerable to flooding. Furthermore, climate change, increased rainfall, and glacier retreat all contribute to the increasing frequency and severity of floods, putting many populations at risk. According to local accounts, more than 70% of the district's land is prone to flooding, which has an impact on agriculture, infrastructure, and public health. Out of all the districts that are particularly vulnerable to flooding, Morigaon district occupies a unique position. The Laharighat, Mayong, and Bhuragaon revenue circles formerly included these impacted areas. The district has a major erosion problem because no proper anti-erosion measures based on geo-hydrological models have been implemented thus far. Most of the district's plains are flood plains along the Brahmaputra River. Since the last four decades, erosion caused by the River Brahmaputra has damaged 94 revenue villages, with several being fully wiped out or substantially degraded (Nath and Medhi,2021).

Study area: Morigaon district

II. Geographical and Socio-Economic Profile

Morigaon lies in central Assam, south of the Brahmaputra main channel. The district includes low-lying floodplains, river islands (chars), and alluvial tracts used for intensive smallholder agriculture. Many communities depend on paddy cultivation, small fisheries, and seasonal labour; char inhabitants are especially economically marginal and exposed to bank erosion cycles. Population density, dependence on riverine resources, and limited formal shelter options increase vulnerability to repeated flooding and erosion. Morigaon district is an administrative district in the state of Assam in India. The district headquarters is located at Morigaon. The ancient place of occult Mayong is located in this district as well as Pobitora Wildlife Sanctuary.

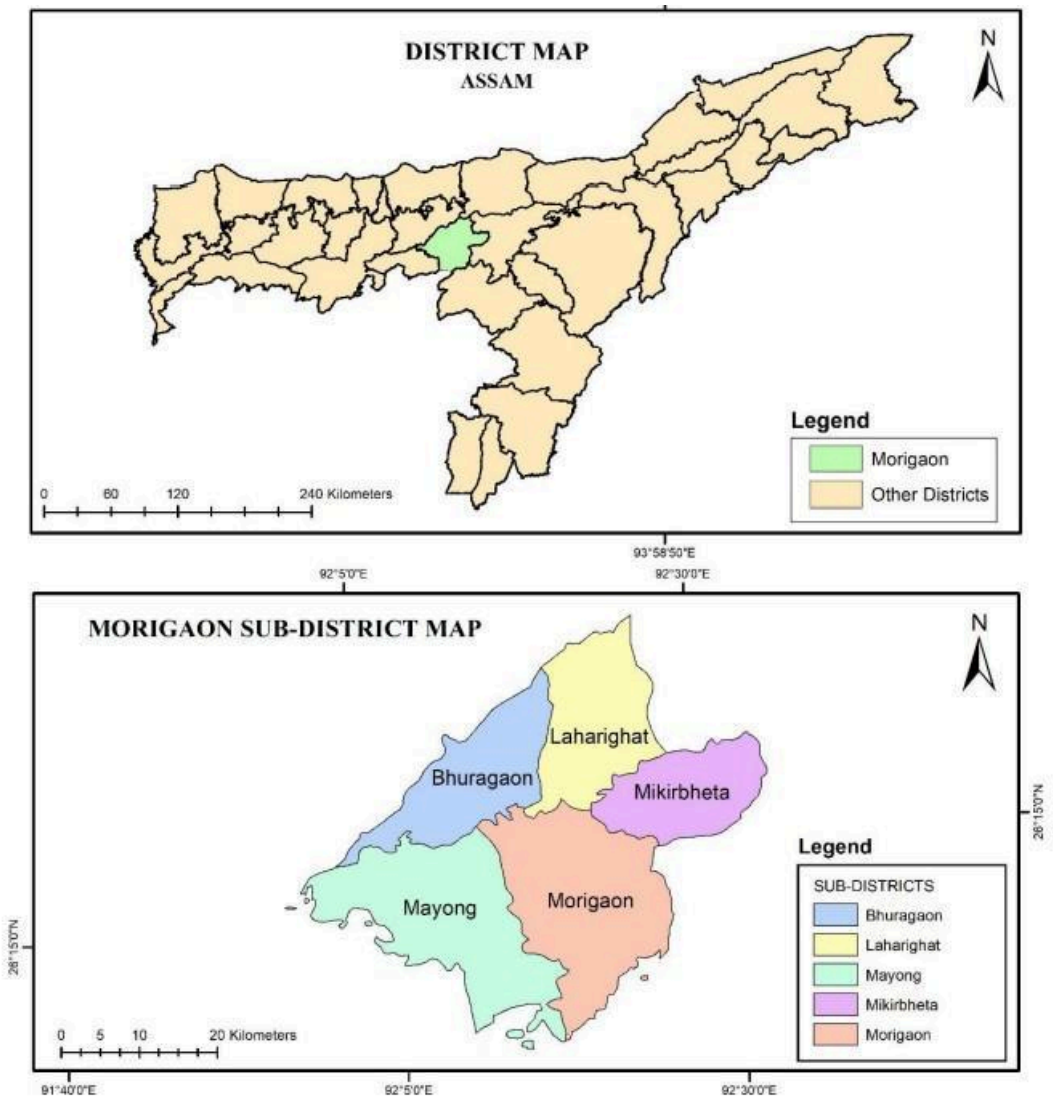

Figure 1: Location of the study area

III. Significance of the study

People in flood-prone areas adopted several indigenous flood risk reduction techniques, such as shelter, food stores, animal shelters, sanitation, transportation systems, etc., to protect themselves from flood-related suffering. Short-term and ad hoc remedies have now been shown to be insufficient and unable to address the state's recurrent flood problem because neither the central government nor the state government of Assam have offered sufficient steps or methods for reducing flood. Therefore, there is an urgent need to develop some long-term, practical tactics to lessen these constantly growing issues by implementing certain local techniques. The social, economic, and environmental circumstances of a location influence the indigenous approaches' methodology and technology.

Objectives

The principal objectives of the study are-

1. To evaluate geo-environmental settings of the Brahmaputra valley related to flood problems.
2. To delineate flood inundation areas in time and space during the recorded history in Assam.
3. To examine the ethnic bases of the population in the flood-prone areas of Morigaon district and to evaluate their traditional technology with respect to human shelter, sanitary system, food stores, water supply, livestock shelter, health-care facility: cropping pattern, cropping system, irrigation system etc.

IV. Description

Morigaon District is one of the smallest districts in Assam, covering an area of 1450.02 sq. km, which is about 1.85% of the state's total land area. It was established on September 29, 1989. The district is bordered by the mighty Brahmaputra River to the north, Karbi Anglong District to the south, Nagaon District to the east, and Kamrup District to the west. Geographically, it extends from 26° 15' N latitude to 26° 5' N latitude and 92° E longitude to 93° 5' E longitude. The Brahmaputra River, a prominent transboundary river in South Asia, has a complicated geological and geomorphological history. It starts at the Angsi Glacier on the TibetanPlateauand runs through China (where it is known as the Yarlung Tsangpo), India, and Bangladesh before merging into the Bay of Bengal. Its evolution is closely linked to the region's geological and climatic history. The Brahmaputra River basin is one of the world's tenth largest rivers and the largest braided sand-bed river, as well as one of the most unusual and remarkable riversystems. The Brahmaputra River basin, noted for its biodiversity and enormous potential for irrigation, livelihood possibilities, hydropower generation, and navigation, is critical in maintaining riparian countries' water-centric lifestyles and livelihoods. (Barua et al.,2025) The shifting of the Brahmaputra River bankline in Assam's Morigaon district has beena majorsource of concern due of its catastrophic effects on soil erosion, relocation, andlossoflivelihoods. Large tracts of land have been eroded, and thousands of people have had torelocateas a result of the Brahmaputra river’s extremely dynamic and irregular meanderingpatternsover the years. Natural hydrological processes, significant monsoonal rainfall, sediment deposition, deforestation, and human activities like sand mining and embankment construction are the main causes of the river's changing channel. There has been significant erosioninanumber of Morigaon villages, including Mayong, Bhuragaon, Laharighat.

Assam, located in the northeastern region of India, faces recurring floods due to its unique geographical and climatic conditions. The state is crisscrossed by the mighty BrahmaputraRiver and its tributaries, which often overflow during the monsoon season. Heavy rainfall, deforestation, and soil erosion exacerbate the situation, leading to widespread inundation, displacement of people, loss

of agricultural lands, and damage to infrastructure. The low-lying topography and siltation of riverbeds further contribute to the intensity and frequency of floods. Changes in rainfall patterns, increased intensity of rainfall events could be contributingtomorefrequent and severe floods. Deforestation, urbanization, and other land use changes can alter water flow patterns and increase flood risk. Natural changes in river courses, erosion, and sedimentation can influence flood behavior. Communities across the nation have createdandimplemented a range of flood prevention strategies over time, fusing conventional methods with innovative technologies. These steps are intended to reduce the likelihood of flooding, safeguard people and property, and manage water resources responsibly.

Flooding results from river enlargement and heavy rainfall that produces runoff that exceeds the capacity of current drainage infrastructure. Flooding is a natural environmental issue that can be controlled rather than eliminated due to its characteristics and the effects of human activity. Different communities from all over the world have adopted their own specific mechanisms to adapt the consequences of flood hazards. During flood, communities of Nigeria which has settled nearby the riparian areas struggle to safer areas despite the negative effects of flooding due to fear of losingone'scultural heritage and brotherhood. Therefore, Nigerian coastal communities have spent decades developing and implementing traditional knowledge in flood control and management to overcome the difficulties caused by flooding. Levees, bunds, and weirs are few examples of local defences which are utilised by communities. Communities along the shore use coping mechanisms such as planting crops that mature early, harvesting them before floods arrive, moving to higher ground, and creating water ways. In addition, local bridges, rock embankments, and concrete embankments are being built to safeguard settlements and shorelines. Furthermore, people living along the coast have effectively studied floods using the traits of plants and animals.

Changing Pattern of Traditional Technology in AssamwithSpecial Reference to Morigaon District Particularly in flood-prone areas like Morigaon district, modernisation, climate change, and socioeconomic changes have drastically changed conventional technological practices inrecent years. Some traditional methods have been modified, fusing indigenous knowledge with new developments. Farmers used to utilise rain-fed irrigation methods, native seed varieties, and organic manure. However, conventional farming practices have been replaced or altered as a result of growing climate uncertainties, particularly floods and unpredictable monsoons. In Morigaon, there arises a shift from traditional rice varieties to hybrid crops. Farmers are increasingly choosing hybrid high-yielding rice varieties backed by government agricultural programs, which has led to a fall in indigenous flood-resistant rice varieties like "BaoDhaan"(deepwater rice). Moreover, traditional

ploughing techniques have been declining in recent years. Tractors and power tillers have virtually replaced bullock-drawn wooden ploughs, eliminating the need for labour. Using Contemporary Irrigation like electric and diesel-powered pumps have displaced traditional "Dong" irrigation, which used to be widespread in the steep regions of Morigaon and involved bamboo pipe water routes. This hasimprovedwatersupply but increased expenses. With the help of the government and contemporary technology, Morigaon farmers have brought back and updated the "Dhap Chash" (floating farming) system in response to the rise in flooding. In order to increase the flood resistance, some renovated stilt houses now use iron poles rather than bamboo. Traditionally, villagers have always controlled floods with bamboo, banana trunks, and earthen barriers; however, geo-bags, sand-filled embankments, and concrete flood walls are now more often used in Morigaon.

Problems and prospects associated with indigenous methods and techniques Indigenous flood mitigation systems and approaches are strongly founded in local knowledge, practices, and resource availability, providing cost-effective and adaptable solutions adapted to unique locations. However, these approaches face a variety of problems and opportunities. On the brightside, indigenous practices like bamboo-based embankments, local tree planting for erosion prevention, and the construction of temporary shelters have proven efficient in providing immediate relief while also assuring adaptability to future floods. Communities frequently display resilience by rotating crops, producing flood-resistant cultivars, and taking advantage of natural floodplain fertility to support agriculture, as referred to in SipajharDevelopment Block, where traditional practices coexist with natural flood dynamics (Nath2020).

V. Summary and Conclusion

Flood hazards are an imminent threat to ecosystems, property, and human life, especially in areas that frequently experience severe weather. Societies have made great strides in lowering flood-related damages since the introduction of contemporary flood mitigation strategies, such as sophisticated drainage systems, early warning systems, embankments, and flood forecasts. However, the significance of indigenous mechanisms is still inevitable, even withthesetechnological improvements. Particularly in rural and isolated places where modern infrastructure might not be available, indigenous knowledge and traditional practices which have been gathered over many generations, offer localised, flexible, and frequently sustainable alternatives for flood hazard mitigation.

Financial and technical support should also be provided to indigenous communities for the revival and modernization of their flood adaptation strategies without compromising their heritage.

Encouraging community-led initiatives, such as participatory flood mapping and localized warning systems based on indigenous early-warning indicators, can significantly enhance disaster preparedness and response. In conclusion, while modern flood adaptation techniques offer crucial technological solutions, indigenous mechanisms remain indispensable due to their deep-rooted ecological understanding, community-driven nature, and sustainable approach. Rather than viewing traditional knowledge as outdated, it should be recognized as a 53 valuable resource that complements contemporary strategies, offering cost-effectiveandlocally adaptable solutions to flood hazards. Governments, researchers, and policymakers must foster an inclusive approach that bridges the gap between indigenous and modern flood-adaptation techniques, ensuring a resilient and adaptive future for vulnerable communities. By prioritizing indigenous wisdom alongside scientific advancements, societies can create a balanced and sustainable flood hazard mitigation strategy that is not only technologically sound but also culturally and environmentally attuned to the needs of affected populations.

References

[1] Singh S. 2004 Physical geography, Prayag Publication, Allahabad, pp317-320

[2] Bhagawati A.K., Bora A.K., Kar B.K. 2002 Geography of Assam, Rajesh Publication, pp-36-46

[3] Goswami D. C. 2003 Flood problems of Assam: Causes and remedies in: Sabhapanditeds. Flood problem of Assam, pp. 8-15

[4] Kates RW 1962: Hazard and choice perception in floodplain management, University of Chicago, Dept. Of Geography. Research paper no -78. pp-157

[5] Singh S-1992: Geomorphology and remote sensing in environmental management, scientific Publishers Jodhpur, pp-214-221

[6] Goswami DC 1985: Brahmaputra River, Assam: Physiography, Basin denudation and channel aggradations, water resources research, Amer. Geophysics Union, Vol 21 no.7, pp 959- 978