

Brahmaputra River Erosion and Challenges to Majuli: Land Loss, Displacement and Cultural Survival

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Abstract:

Majuli, a river island in the Brahmaputra known for its neo-Vaishnavite monasteries (Satras), its Mising and other communities and its wetland ecology, has lost a large share of its area to bank erosion since the mid-twentieth century. This article synthesises geomorphological, demographic and policy literature to examine the causes and scale of that erosion, its social and cultural consequences, and the adequacy of the responses to it. It argues, first, that erosion at Majuli results from the interaction of a braided, sediment-laden and tectonically active river with a low-lying island; second, that public debate is hampered by irreconcilable estimates of the island's area, which range from roughly 480 to 875 km²; and third, that the most serious losses are cumulative and social: repeated displacement, land scarcity, weakened community networks and the relocation or closure of Satras. Using a human-security framework extended to include cultural security, the article concludes that protection works must be combined with reliable monitoring, resettlement policy, livelihood diversification and participatory governance.

Keywords: Brahmaputra, Majuli, riverbank erosion, displacement, livelihoods, human security, cultural heritage

1. Introduction

The Brahmaputra is one of the largest rivers of South Asia and, within Assam, one of the least stable. Its braided channels, heavy monsoon discharge and large sediment load rework the floodplain continually, and bank erosion is a recurrent hazard along the valley (Goswami; Sarma, "Fluvial Process").

Majuli is the most prominent casualty. Made India's first island district in 2016 ("Protecting Majuli"), it is known for the neo-Vaishnavite tradition of Srimanta Sankardeva, for the Satras and the performing arts, mask-making and boat-building associated with them, and for a rural population that numbered 167,304 in 2011 (Sahay and Roy). The river that made the island is now removing it: an area of about 1,255 km² in 1901 (Sarma and Phukan) has been reduced to a fraction of that figure, although estimates of what remains differ widely (Table 1).

Existing scholarship is strong on channel dynamics and on remote-sensing measurement of land loss (Sarma and Phukan; Kotoky et al.; Sankhua et al.; Das et al.). Work that links these measurements to livelihoods, governance and cultural continuity is less common, and the conflicting official figures for

the island's size are seldom treated as a problem in their own right. This article addresses that gap through three questions. What physical and human factors explain erosion at Majuli? What is known, and what is disputed, about the scale of loss? How does erosion affect livelihoods, communities and heritage, and how adequate are current responses?

2. Study Area and Research Design

Majuli lies in the upper Assam valley, bounded by the main Brahmaputra channel to the north and by the Kherkutia Xuti (Luhit) channel to the south (Sahay and Roy); the confluence of the Subansiri with the Brahmaputra has been identified as one of its critical erosion zones ("Majuli Erosion Study"). The island has no urban settlement, and agriculture and allied activities support almost all households (Sahay and Roy).

The study is a qualitative, desk-based synthesis. Its sources are peer-reviewed geomorphology and remote-sensing studies, census-based research, parliamentary and departmental statements as reported in the regional press, and a recent technical study by a central water-research agency. Sources were chosen for direct relevance to Majuli or to the Assam reach of the Brahmaputra. Figures are reported as the sources give them; no independent measurement was made. Because estimates of area differ in method, base year and delineation, they are compared rather than reconciled. The analysis is organised around a human-security framework (UNDP).

3. The Brahmaputra and the Formation of Majuli

In Assam the Brahmaputra is a sand-bed braided river that is more than 15 km wide in places. According to Sahay and Roy, its sediment load is second only to that of the Yellow River, and the basin receives an average of about 230 cm of rain a year. Channels shift across the valley floor and mid-channel bars appear, merge and disappear from one season to the next (Sarma, "Fluvial Process").

Majuli itself is a product of this instability. Sarma and Phukan reconstruct its origin as follows: an extreme flood around 1750 diverted part of the Brahmaputra's flow into the channel of the Dihing, and the land between the two rivers, once they rejoined, became the island. The first geographical report described it in 1792 as a cluster of fifteen large and many small islands, and official data gave its area as 1,255 km² in 1901. Morphotectonic analysis further relates the island's evolution to its subsurface setting (Lahiri and Sinha, "Morphotectonic Evolution"). Majuli is therefore neither a stable landmass nor a recent accident of geography; it is a feature whose margins have always been renegotiated by the river.

4. Causes of Erosion

4.1 Hydrological and Geomorphic Drivers

Intense monsoon discharge, a heavy sediment load and a braided planform combine to push the main current against different banks in different years. Kotoky et al. found extensive erosion along the Brahmaputra's banks between 1914 and 1975 but a dominant phase of deposition between 1975 and 1998, so erosion is episodic rather than uniformly progressive. At Majuli, Sarma and Phukan found that bank-line shift was uneven in time and space, with a maximum retreat of 0.48 km a year along the Brahmaputra's south bank. Floods and erosion are closely coupled: high water and strong currents undercut loose, silty banks, and eroded sediment is redeposited elsewhere as bars and new channels.

4.2 Tectonic Setting

The valley lies in a seismically active zone. Sahay and Roy date the acceleration of erosion at Majuli to the great earthquake of 1950. Lahiri and Sinha report that the channel belt of the upper Assam reach widened from an average of 9.74 km in 1915 to 14.03 km in 2005, and they attribute spatial variation in river behaviour to tectonic zonation ("Tectonic Controls"). A wider and more mobile channel belt exposes more bank to attack, which is consistent with the pattern observed at Majuli, although the causal chain has not been tested for the island specifically.

4.3 Land Use and Settlement Pressure

Human activity is better understood as a factor that raises exposure than as a demonstrated cause of bank retreat. Sahay and Roy report that forest and grassland declined between 1975 and 2000 as farmland and settlements expanded, and that scarcity of land has pushed housing onto riverbanks that are submerged by small streams during the rains. Direct attribution of erosion to land-use change remains poorly quantified for Majuli; fluvial and tectonic processes dominate the evidence.

4.4 Climate Variability

Climate change is often invoked as an aggravating factor, but whether floods are becoming more severe in the Ganges–Brahmaputra–Meghna basins has itself been debated (Mirza et al.). This article therefore treats climate as an uncertainty that could intensify existing hazards, not as an established cause of erosion at Majuli.

5. How Much Land Has Been Lost? Evidence and Contested Estimates

There is no dispute that Majuli has shrunk substantially. Sahay and Roy report that 107 of the island's 210 cadastral villages have been lost partially or wholly, and that the administration relocated 10,139 families between 1960 and July 2014. A Landsat-based study covering 1973 to 2021 estimated land degradation of about 81.56 km² (Das et al.), and a satellite-based study by the Central Water and Power Research Station covering a 120 km reach of the Brahmaputra along the island reported 75 km² of loss and 58 km² of deposition since 1986 ("Majuli Erosion Study").

The disagreement lies in the totals. The central government told Parliament that a Survey of India map showed 733.79 km², a figure dated 1914 in one report and 1940 in another, and that the area fell to 502.21 km² in 2004, a reduction of 31.58 per cent ("Majuli Island Shrunk"; "Protecting Majuli"). The same reply claimed a net gain of 22.08 km² by 2016, attributed to protection works by the Brahmaputra Board, while the district disaster plan put the area at 483 km² in 2014 ("Protecting Majuli"). Sahay and Roy note that the last land survey of the island was conducted in 1966 and that agencies quote areas from 522.73 to 875.00 km². Table 1 assembles these figures.

Table 1. Reported Area of Majuli by Source

Source	Area (km ²)	Year or note
Sarma and Phukan	1,255	1901 (official data)
Survey of India map, as reported to Parliament	733.79	1914 or 1940 (reports differ)
Government of India, Parliament reply	502.21	2004

Source	Area (km ²)	Year or note
Government of India, Parliament reply	524.29	2016 (after protection works)
District disaster plan, cited in "Protecting Majuli"	483	2014
Census of India, cited in Sahay and Roy	584.38	2011
Brahmaputra Board, cited in Sahay and Roy	522.73	2012 report
Revenue circle records, cited in Sahay and Roy	764.98	Year not stated
Sub-divisional plan, cited in Sahay and Roy	875.00	2010
Roy	629; 601; 487	1975; 2000; 2024

Source: compiled from the works cited in the table.

Such divergence is not merely technical. Erosion and deposition occur together, so a net figure conceals losses borne by particular villages; different delineations of the island (with or without seasonal sandbars, for example) give different totals; and a headline of "net gain" can weaken the case for continued protection funding even while families are displaced. Any credible response needs a single, published and regularly updated baseline.

6. Impacts of Erosion

6.1 Livelihoods and Displacement

Sahay and Roy describe a pattern of "shrinking space and expanding population": the island's population grew from 81,001 in 1951 to 167,304 in 2011 while its area fell by about two-thirds. With no urban economy to absorb them, families who lose land often become squatters or agricultural labourers working for a share of the crop, an arrangement that landowners can end at will. In many displaced households at least one member migrates in search of steadier income, typically in low-paid urban jobs. Displacement is thus rarely a single event; it is a downward sequence of lost land, insecure tenure and dependence on work off the island.

6.2 Infrastructure, Education and Social Networks

Erosion of roads, schools and public facilities, interrupted schooling for displaced children, and the scattering of kin and neighbourhood networks follow logically from the loss of villages, and they are widely reported. Systematic evidence on these effects is thin in the sources reviewed here, and household-level research on schooling, health and social capital among displaced families is a clear priority.

6.3 Ecology

Land-cover analysis by Sahay and Roy records a shift from forest, grassland and wetland towards sand and settlement over 1975–2015, with the wetland share of the island falling from 2.21 to 1.7 per

cent on their classification. Because Majuli's wetlands support fishing, agriculture and biodiversity, ecological degradation feeds back into livelihood insecurity. The biodiversity consequences of channel change, however, remain under-studied.

6.4 Cultural Heritage

Majuli was recognised as a cultural heritage site by the Government of Assam in 2006 (Sahay and Roy). Yet, according to the same authors, only twenty-two of its original sixty-five Satras survive on the island; larger institutions such as the Auniati Satra have relocated within Majuli (three times in fifty years), while smaller ones have closed or moved away. The threat is twofold. Physically, erosion damages or forces the relocation of institutions and buildings. Socially, displacement disperses the households through which songs, dances, mask-making, boat-building and religious practice are transmitted. Protecting heritage therefore means protecting communities, not only structures.

7. A Human-Security Perspective

The human-security concept, introduced in the UNDP's 1994 Human Development Report, shifts attention from the security of territory to the security of people from threats to survival, livelihood and dignity. It offers a useful frame for Majuli because the evidence above cuts across its categories. Economic and food security are undermined by the loss of cultivable land and the shift to insecure labour. Environmental security suffers with the degradation of wetlands and habitats. Personal and community security are weakened by repeated displacement and scattered social networks. The UNDP list does not name culture, but the Satra system at Majuli is at once a religious, educational, artistic and social institution, and I therefore add cultural security as a sixth dimension. The lens leads to a practical conclusion: embankments protect land, but only rehabilitation, tenure security, livelihoods and cultural support protect people.

8. Governance and Policy Responses

The Brahmaputra Board began protection works at Majuli in January 2004, and a proposal costing Rs 233.57 crore was approved to protect an 80-km vulnerable reach on the island's southern bank ("Majuli Island Shrunk"). Critics argue, however, that anti-erosion measures have remained piecemeal, that embankments have become the permanent address of erosion-hit families, and that official data are inconsistent ("Protecting Majuli"). Recent technical work shows that vulnerable reaches can be identified from satellite imagery ("Majuli Erosion Study"; Das et al.), which strengthens the case for a more systematic approach. Six measures follow from the evidence reviewed.

First, a single authoritative baseline for the island's area and bank-line position should be established and updated annually from satellite data, with methods and delineation published. Second, protection works should be reach-specific and designed from studies of flow, sediment movement and bank conditions, with vegetative and bio-engineering measures considered where they suit local conditions. Third, resettlement policy should give displaced families secure title to land, since squatting perpetuates vulnerability. Fourth, livelihoods should be diversified through fisheries, handicrafts, small enterprise and carefully managed tourism, so that households depend less on land that the river can remove. Fifth, Satras and other heritage assets should be documented and, where relocation is unavoidable, moved through consultation with the communities concerned. Sixth, local knowledge of the river's behaviour should be built into planning, early warning and monitoring. Coordination among

the departments responsible for water resources, disaster management, agriculture, environment and culture is a precondition for all six.

9. Limitations and Directions for Future Research

This study relies on secondary sources, and several of its figures come from press reports of official statements and from studies whose methods differ. It offers no primary measurement. Future work should combine multi-decadal bank-line analysis with household surveys and oral histories among displaced families, evaluate the effectiveness of specific protection structures, and assess the biodiversity and cultural costs of erosion in detail.

10. Conclusion

Erosion at Majuli is the outcome of a dynamic braided river, a tectonically active valley and an island whose margins have always been unstable. What is new is the scale of the social consequence: a shrinking land base supporting a growing population, repeated displacement, dependence on insecure labour and the gradual loss of the Satra institutions that anchor the island's identity. Contested official statistics make these problems harder to address. Sustainable protection of Majuli requires reliable data, technically sound and reach-specific engineering, secure rehabilitation, diversified livelihoods and the active participation of local people in decisions about their land and heritage. Protecting Majuli means protecting the communities, ecosystems and cultural traditions that have developed around the Brahmaputra, and not only its geography.

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