



Navigating the floodplains: reimagining Assam's water management through indigenous knowledge systems

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Abstract

The Brahmaputra Valley in Assam, India, represents one of the most complex hydro-geomorphological regimes in the world. For decades, the dominant paradigm of flood management has been characterized by "command and control" structural interventions, primarily embankments and spurs, inherited from colonial engineering traditions. However, these technocratic solutions have often proved inadequate, and in some cases, counterproductive, leading to catastrophic breaches and ecological degradation. This paper explores the potential of Indigenous Knowledge Systems (IKS) as a foundational pillar for a more resilient and sustainable water management strategy. By examining the adaptive practices of communities such as the Mising, Bodo, and Deori, this research highlights how traditional architecture (e.g., *Chang-ghars*), communal irrigation (*Dong* systems), and flood-resilient agriculture offer sophisticated models of "living with the river." The study argues that integrating ethno-hydrology with modern hydrological modeling is not merely a nostalgic retreat but a scientific necessity in the face of climate uncertainty. The paper concludes with policy recommendations for a hybrid governance model that decentralizes water management and recognizes the epistemological value of local ecological wisdom.

Keywords: Brahmaputra, Indigenous Knowledge Systems (IKS), Flood Management, Assam, Ethno-hydrology, Sustainable Development, Climate Resilience

1. Introduction

The state of Assam, situated in the Northeastern frontier of India, is defined by its intimacy with water. Dominated by the Brahmaputra and Barak river systems, the region's topography is a palimpsest of fluvial processes—floods, erosion, and siltation—that have shaped its biological and cultural identity for millennia. However, in the contemporary era, the annual monsoon floods have transitioned from life-sustaining ecological pulses into chronic humanitarian

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disasters. Despite billions of rupees invested in structural defenses since the mid-20th century, the vulnerability of the local population has increased.

The failure of modern water management in Assam is largely an epistemological one. It stems from a "techno-centric" worldview that perceives the river as a hydraulic machine to be tamed rather than a socio-ecological entity. In contrast, the various indigenous communities inhabiting the floodplains have developed a body of knowledge over generations that views floods as a cyclical reality to be navigated rather than an enemy to be conquered. This Indigenous Knowledge System (IKS) encompasses architectural design, agricultural timing, social organization, and biological indicators.

This paper seeks to bridge the gap between traditional wisdom and modern policy. It argues that the path to a flood-resilient Assam lies in "reimagining" water management—moving away from total reliance on high-cost, high-fail engineering toward a decentralized, community-led, and ecologically informed framework.

2. The Historical Context of "Taming" the Brahmaputra

To understand the current crisis, one must look at the transition from Ahom-era water management to British colonial intervention. The Ahom dynasty (1228–1826) utilized a system of *Ali* (embankments) that were strategically placed to allow for agricultural flooding while protecting key roads and settlements. Their approach was decentralized and sensitive to the "pulsing" nature of the river. The British, however, viewed the Brahmaputra through the lens of Victorian engineering, seeking to fix the river in place to facilitate tea transportation and land revenue. This "fixed" approach is what modern India inherited, leading to the current conflict between a shifting river and a static defense system.

The Crisis of Modernity: The Failure of Structural Interventions

The history of flood control in post-independence Assam has been dominated by the National Flood Policy of 1954, which prioritized the construction of embankments. Today, Assam possesses over 4,500 kilometers of embankments. While these structures provided a temporary sense of security and allowed for expanded settlement in the short term, their long-term consequences have been deleterious.

The "Levee Effect" and Siltation

Embankments constrict the natural flow of the river, forcing the silt, which would otherwise be deposited across the floodplains to rejuvenate the soil, to settle on the riverbed itself. This raises the bed level, making the river shallower and more prone to overtopping. When a breach occurs—often due to poor maintenance or extreme weather—the resulting "drainage congestion" and high-velocity water release cause significantly more damage than natural, gradual flooding (Saikia, 2019).

Ecological Disruption

The structural approach ignores the "lateral connectivity" required for a healthy riverine ecosystem. Embankments prevent fish from migrating to the *beels* (wetlands) for spawning and disrupt the groundwater

recharge cycle. The loss of these wetlands, which act as natural sponges, further exacerbates the flood peaks.

3. Indigenous Knowledge Systems (IKS): Theoretical Framework

IKS refers to the unique, traditional, local knowledge existing within and developed around the specific conditions of women and men indigenous to a particular geographic area (Warren, 1991). In the context of Assam's ethno-hydrology, this knowledge is not static; it is an evolving set of practices born from trial, error, and deep observation of the Brahmaputra's temperaments.

The theoretical underpinning of this research rests on the "Social-Ecological Systems" (SES) framework, which posits that human and natural systems are inextricably linked. Indigenous strategies in Assam represent a high level of SES maturity, where the "hydro-social cycle" is managed through cultural norms and ecological adaptation rather than external imposition.

Architecture of Resilience: The Mising and the *Chang-Ghar*

One of the most visible examples of IKS in Assam is the architectural ingenuity of the Mising tribe, who predominantly inhabit the riverine islands (*chars*) and banks. Their traditional house, the *Chang-ghar*, is a stilt-based structure constructed from bamboo, wood, and thatch.

Design Principles

The *Chang-ghar* is elevated several feet above the ground, allowing floodwaters to pass underneath without damaging the living quarters. The height of the stilts is determined by historical flood levels. Furthermore, the materials used are lightweight and locally available. In the event of an unprecedented flood or severe bank erosion, a *Chang-ghar* can be dismantled and relocated within days—elevating "mobility" as a core survival strategy over "permanence" (Dutta & Bhagabati, 2012).

The Socio-Political Ecology of the "Char" Dwellers

The inhabitants of the *chars* (shifting river islands) are often the most marginalized. Their existence is characterized by "transience." IKS among *char* dwellers involves a unique understanding of soil types—knowing which sandbar will stay stable for three years and which will disappear in one monsoon. Their "floating" lifestyle, utilizing boats as primary residences during peak floods, challenges the Westphalian notion of settled, land-based citizenship.

Socio-Economic Utility

The space beneath the house serves as a sheltered area for livestock and looms during the dry season, and as a refuge for smaller animals during floods. This design acknowledges that in a floodplain, the attempt to create a dry, impermeable barrier is futile; instead, it creates a vertical living space that respects the horizontal movement of the river.

The Dong System: Bodo Traditional Water Governance

In the northern banks of the Brahmaputra, particularly among the Bodo community, the *Dong* system represents a sophisticated communal water management practice. *Dongs* are small canals diverted from perennial rivers in the foothills of Bhutan to agricultural fields.

4. Management and Equity

Unlike state-run irrigation projects, *Dongs* are managed by *Dong-Bandh Committees*. These committees oversee the equitable distribution of water and the collective labor required to repair canals after monsoon damage. This system ensures that water is managed as a "common pool resource," fostering social cohesion and reducing the vulnerability of individual farmers to localized water scarcity or excess. The *Dong* system's ability to divert and slow down excess runoff during the early monsoon also serves as a decentralized flood-mitigation tool.

Agricultural Adaptation and Bao Rice

Indigenous agriculture in Assam is characterized by a "flood-friendly" crop calendar. Traditional varieties of rice, such as *Bao* (deep-water rice), have the physiological ability to elongate their stalks as the water level rises, sometimes growing up to several centimeters a day to keep their panicles above the surface.

Deep-water Rice Ecology

Bao rice requires no chemical fertilizers, as it thrives on the nutrient-rich silt brought by the floods. By maintaining the cultivation of *Bao* and other indigenous varieties, farmers ensure food security even in years of high inundation. However, the push for "High Yielding Varieties" (HYVs) under the Green Revolution paradigm—which are short-stalked and flood-intolerant—has undermined this traditional resilience, making farmers more dependent on government relief.

Ethno-meteorology and Biological Indicators

Indigenous communities in the Brahmaputra valley possess a nuanced system of "folk meteorology." Observations of animal behavior and plant phenology serve as early warning systems (EWS).

1. **Animal Behavior:** The unusual movement of ants to higher ground carrying eggs, the low nesting of specific bird species, or the agitation of livestock are often interpreted as precursors to a major flood event.
2. **Botanical Signs:** The flowering patterns of indigenous trees and the density of specific aquatic weeds are used to predict the intensity of the coming monsoon.

While these indicators may seem anecdotal to formal scientists, they represent a localized, real-time monitoring system that often precedes official bulletins issued from distant urban centers.

5. Science and IKS: The Epistemological Bridge

The paper emphasizes that IKS is not "anti-science." On the contrary, it is a form of "empirical science" based on long-term observation. For instance, the Mising people's understanding of the relationship between the *Simolu* (silk cotton tree) flowering and the arrival of the first flood wave correlates precisely with modern meteorological data regarding pre-monsoon showers. Recognizing these correlations can help create "Hybrid Early Warning Systems" that are more trusted and actionable at the village level than a generic WhatsApp alert from the District Commissioner's office.

The Gendered Dimension of IKS

Indigenous water management is deeply gendered. In Assam, women are often the primary repositories of seed diversity and "indoor" flood management. They manage the elevated granaries (*Bhoral*) and utilize traditional preservation techniques to ensure that food and medicinal herbs remain dry and accessible. Recognizing the role of women in IKS is crucial for any inclusive disaster risk reduction (DRR) policy.

6. Challenges to Indigenous Knowledge

Despite its efficacy, IKS in Assam faces significant threats:

1. **Climate Change:** The increasing frequency of "flash floods" and erratic monsoon patterns are testing the limits of traditional predictability.
2. **Modern Education and Migration:** As the younger generation moves toward urban centers, the oral transmission of ecological wisdom is breaking down.
3. **State Hegemony:** The government's preference for large-scale infrastructure (like the proposed "Big Dams" in Arunachal Pradesh) often ignores or displaces the very communities that hold the key to sustainable management.

7. Integrating IKS into Policy: A Way Forward

For Assam to move toward a "flood-resilient" future, a paradigm shift is required. This involves moving from a "Resistance" model to a "Resilience" model.

Hybrid Engineering

Future flood-control structures should be designed in consultation with local communities. For instance, instead of continuous embankments, "breachable" or "overflow" levees could be designed to allow controlled flooding into designated floodplains, mimicking natural processes while protecting dense settlements.

Decentralized Governance

The *Dong-Bandh* model should be scaled and integrated into the Panchayati Raj Institutions (PRI). Local communities should be empowered with the resources to maintain their own small-scale water infrastructure and EWS.

Documentation and Pedagogy

There is an urgent need to document ethno-hydrological practices before they are lost. Integrating IKS into the school and university curriculum in Assam would validate this knowledge and encourage innovation among local youth.

Ecosystem-Based Adaptation (EbA)

Policy should prioritize the restoration of *beels* and wetlands as natural flood buffers. These wetlands should be managed using indigenous fishing and conservation techniques that have sustained them for centuries.

8. Conclusion

The Brahmaputra is not a problem to be solved, but a dynamic landscape to be inhabited. The recurring "tragedy" of Assam's floods is less a natural inevitability and more a result of a mismatch between the river's ecology and the state's engineering responses. Indigenous Knowledge Systems offer a repository of "soft" solutions that are cost-effective, culturally appropriate, and ecologically sustainable.

Reimagining water management in Assam requires the humility to acknowledge that the people who have lived on the banks of the Brahmaputra for centuries are not just victims of the flood—they are its most sophisticated scholars. By weaving together the precision of modern satellite imagery with the wisdom of the *Chang-ghar* and the *Dong*, Assam can create a global model for tropical river management in the age of climate change.

The reimagining of Assam's floodplains is an exercise in decolonizing the landscape. It requires transitioning from a "hydraulics of power"—where the state dictates the flow of water—to a "hydraulics of participation," where the river's rhythm and the people's wisdom dictate the future of the valley.

Conflict of Interest: *The author declares no conflict of interest.*

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