Adjusting to Floods on the Brahmaputra Plains, Assam, India*

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Key messages

- Indigenous communities living in flood-prone areas in eastern Assam have been responding to floods and other water-related stresses in unique ways, based on their traditional knowledge systems.
- With the intensity and frequency of the hazards increasing in recent times, their ways of coping and adapting have also changed and have sometimes become less effective.
- Cultural norms play a significant role in determining how these communities cope and adapt.
- In recent years, prolonged and extreme floods, intensified riverbank erosion, and siltation have severely challenged the capacity to respond and rendered agriculture (the prime source of livelihood) no longer viable in Matmora, and less productive in Majgaon.
- The communities need help to strengthen their adaptation capacities through intervention programmes aided by good governance.

Introduction

This study in the Brahmaputra Valley of Assam examines one of the most flood-prone valleys in India. Every year, floods, flash floods, riverbank erosion, and sand deposition on fields overwhelm the landscape. However, flash floods have become more devastating since the mid 1990s, especially on the northern bank of the Brahmaputra Valley.

Indigenous communities living on the riverbanks have developed traditional livelihood mechanisms seen in their dwellings, agriculture, livestock-rearing practices, and food storage. They have ways of foretelling floods and the weather, which have enabled them to cope and adapt.

Until two decades ago, farmers perceived short-duration floods as beneficial because the flood waters brought nutrient-bearing silt that helped enhance soil fertility along the riverbanks. Since then, the floods have become more intense and frequent. They submerge more areas for longer periods, causing damage to crops, and eventually rendering the soil unsuitable for any form of cultivation (Goswami and Das 2003). The communities are having to cope and adapt in new ways.

The Brahmaputra river and its tributaries drain the state of Assam in northeast India (population 26 million). The river originates from glaciers in southern Tibet (elevation 5,300 masl) and enters the Bay of Bengal after traversing 2,880 km through China, India, and Bangladesh. About one-third of the Indian part of the Brahmaputra Basin is in Assam. The Brahmaputra Valley within Assam consists mainly of vast alluvial floodplains covering an area of about 56,480 sq.km (altitude 34-130 masl).

Study sites

The team looked at two villages, Majgaon and Matmora, located in Dhemaji and Lakhimpur districts in the eastern part of Assam on the northern bank of the Brahmaputra River bordering Arunachal Pradesh (see Table 3). The five villages at these sites are home to three important indigenous communities: the Mishings in Matmora village and the Ahoms and Chutiyas in Majgaon. In Matmora, there are also several Assamese caste groups, including Brahmins and Koibarttas and a small population of Bihari people, who came to Assam from Uttar Pradesh 30 years ago.

* A documentary film '**Living with Floods**' on this case study is available on a separate DVD from ICIMOD.

Table 3: **The study sites in Assam**

	Village	Households	Community/caste group	Population (% covered)	Block/ District
Majgaon	Majgaon	68	Ahom, Chutiya, Baishya	283 (80%)	Bordoloni (Dhemaji)
Matmora	Bahpora	128	Koibartta, Brahmin Bihari	557 (50%)	Dhokuakhona (Lakhimpur)
	Opar Khamon	33	Mishing	147 (60%)	
	Khamon Birina	70	Mishing	336 (60%)	
	Tinigharia	22	Mishing	150 (40%)	

All the villages have experienced floods, especially since 1950 when a displacement in the bedrock occurred which made this area more flood prone and triggered an earthquake, and have made common attempts to cope and live with these stresses. However, there are also marked differences among these communities in the degrees of exposure and vulnerability to water hazards and in the way they adapt depending on each ethnic or caste group's culture, traditions, indigenous knowledge, and access to outside interventions.

People at both research sites reported changes in the local climate. In Majgaon, the summers have become warmer and longer. Increased rainfall intensity and frequency of heavy rain spells have led to more flash floods. Floods have become more furious and rivers now carry more sediment.

The microclimate has assumed the properties of an arid desert area, with groundwater going down and soil layers underneath losing moisture. According to the locals in Matmora, the climate has become hotter and more sultry, monsoon rains have become irregular and unpredictable, and heavy rains and storms more frequent. The village and nearby areas were devastated in 2007 when a major flood in the Jiyadhal River breached embankments.

Impacts of Water Stress and Hazards

Matmora

The annual cycles of water hazards combined with increasing impoverishment have reduced the communities of Matmora to disparate groups of the poor, displaced from their ancestral places and challenged with having to begin life anew each year.

The hazards have led to homelessness, landlessness, breakdown in agriculture, and loss of traditional livelihoods.

In the last two decades, the Brahmaputra River has engulfed parts of several embankments and more than ten villages – compelling people to shift to new areas or adopt semi-nomadic lifestyles. Increased spells of heavy rainfall have prolonged flood inundation, and the two recent big floods in 2007 and 2008 left 1-2 m deep layers of sand in more than 25 villages.

Matmora was an agriculturally prosperous area with self-sufficient farmers; the floods have reduced it to a sandy and barren landscape where agriculture has ceased to be the main source of livelihood. People have sought to become daily wage earners; fisher folk; carpenters; or small traders selling country liquor, milk, and other local produce. Many migrate to other places for menial labour in factories, industries, and service jobs. Some collect driftwood from the bed of the Brahmaputra River, risking their lives at times to sell the timber. Some have become skilled boat makers catering to the high demand for boats and using the timber from the rivers or trees in and around the village. Weaving has become an important income generating activity for the women, who also work as labourers in the construction of roads and the embankments.

The local scale migration, both temporary and permanent, has caused psychological trauma and social dislocation for many. Many young people who migrated in search of jobs have had to discontinue their education. This has drastically decreased the educated population in the area, once known for its contribution to social and literary fields.

Two types of chang-ghar (house on stilts of the Mishing community) in Matmora: left, the original design of bamboo and wood; centre, wealthier households invest in concrete to make higher stilts.

Majgaon

A chronically flood-prone area, Majgaon remains inundated for half the year. It has lost most of its vegetation and fruit trees from prolonged waterlogging, which has degraded the soil. The deposits of silt and debris brought by the 2007 floods have made areas in Majgaon a wasteland and seriously affected agriculture.

The deposits filled many wetlands, affecting fish production and fishing as a livelihood in these areas. Then again, continued silt deposition for decades has gradually converted some low-lying marshlands into plains, which are new farmland for the villagers.

Rice agriculture is still the primary source of livelihood, with people cultivating ahu (summer) and bao (deep water) paddies. However, about half the village population have found livelihoods outside the village as daily wage earners. Another 23% of households have taken up fishing and 14% liquor making. Other sources of income are livestock rearing, especially ducks and pigs. The community used to raise chickens until this became increasingly difficult in a flooded environment. During the monsoon, fish have become abundant in rivers, wetlands, and rice fields, making fishing an important seasonal livelihood source.

Responses to Water Stress and Hazards

The communities have responded to floods and associated hazards in diverse ways based mainly on their local knowledge and the skills acquired living in riparian environments. These responses have been aided to some extent by external interventions.

Housing and settlements

Mobile settlements – The Mishings of Matmora have traditionally been riverbank dwellers, making them better adapted in dealing with floods. They have always been flexible, moving to new places to cope with the river's changing course. The original villages have moved to new locations more than six times since establishment of the first embankment on the Brahmaputra in 1954. The villages moved as a community, retaining the village name and transplanting village institutions like the village school and the murang ghar (community hall) to the new setting each time.

Traditional Assamese houses are built on an elevated platform (left) with a separate granary built on stilts (right).

However since 1998, when the river waters engulfed four-fifths of the villages, this adaptation strategy is no longer working. Households have started moving on their own, independently of the village, breaking down age-old village institutions. Many ended up in nearby villages or on sections of the embankment that remained intact after the floods.

Chang-ghar housing – The Mishing live in traditional stilt houses called chang-ghar made of thatch. They build the houses on wood and bamboo stilts at an average height of 2-2.5 m (6-8 ft) above ground – in line with the highest flood level experienced in the area in recent times. The design of a chang-ghar provides ideal protection from floodwaters and allows for a variety of activities, such as livestock rearing and food storage. The more recent use of concrete materials for stilts or staircase has made the dwellings stronger against flood currents, but has reduced the dwellings' flexibility and made repair more costly.

Raised homesteads – Other communities, such as in Majgaon and Bahpora, live in houses with foundations elevated 0.5-1.2 m (2-4 ft) above the ground as a response to the floods. They are reluctant to live in stilt houses due to cultural biases associating this type of dwelling with ethnic groups such as the Mishings.

The height of the earthen or brick-and-concrete foundation of raised homesteads varies depending on the economic situation of the households and their decision on how much to invest in raising the homestead – higher platforms mean greater investment costs because more materials are used. The platforms are also used to shelter livestock. During floods, the households will take shelter temporarily by a roadside or in the nearest available concrete public building, such as a school.

Responses in agriculture

Mixed rice cultivation in Majgaon – Due to damage by floodwaters, the Majgaons no longer cultivate sali (wet season rice); instead, they plant bao (deep-water rice), which is adapted to water and resistant to floods. Farmers now mix indigenous varieties of summer rice (ahu) and deep-water rice to provide options in case the crop of one variety fails and to optimise the use of land. In a 'normal' year, when the floods are not so prolonged and virulent, both rice varieties survive. However, early flooding in April or May might damage the summer rice while the better-adapted bao will survive and ensure food security for these communities. Indigenous varieties of bao show considerable tolerance to flood waters.

Experiments in boro paddy – Boro (winter season rice) is a viable alternative variety suitable for perennially flooded areas. A group of farmers in Bahpora village (Matmora) are cultivating boro paddy in waterlogged areas with technical guidance from the district agriculture department. In the absence of irrigation facilities, investment in a pump set is necessary for off-season rice cultivation.

Agriculture on a river levee – In an effort to identify new land for cultivation in safer, higher elevation areas, villagers are starting to occupy land with grassy forests located on the river levee in the western part of the village. These areas used to be marshlands but bedrock displacement, triggering the 1950 earthquake, elevated them on both sides of the Na-Nadi River. Villagers flattened some of these areas to make fields for winter crops, such as mustard, black gram, lentil, cereal, cabbage, and even wet season rice.

Diversification from farm to non-farm livelihoods

To cope with the breakdown in traditional agriculture, farmers are diversifying to new sources of livelihood. However, they do not always successfully reduce their vulnerability.

Fishing – The subsistence activity of fishing is developing into a viable alternative livelihood despite the cultural norms of certain communities that discourage it. The villagers themselves, or fish traders, process and sell dried fish in the dry fish market of neighbouring Morigaon district. This profitable small enterprise has the involvement of cooperatives and well-established production and marketing channels. The proven benefits are motivating more and more people to engage in this enterprise.

Processing and sale of homemade traditional liquor – Traditional winemaking for domestic or home consumption is an age-old practice, but now some communities process and sell both traditional wine and the cheaper country liquors for income.

Employment in service and other jobs – The source of income most immediately available for people is menial labour in construction or agriculture in nearby areas and towns. The ongoing construction of the new embankment and installation of erosion protection structures in Matmora are providing temporary employment.

Young men migrate to other districts for service jobs and employment in the informal transport sector. Others get jobs in neighbouring states like Kerala and Nagaland. Most migrant youth do not settle permanently in these places of employment. The remittances they send help keep their families from poverty during the floods.

Indigenous crafts – Many women in these communities have traditional weaving skills to make mats for household use. The women are now earning a steady income from their woven products. They are improving their weaving quality and design by paying more attention to the requirements of the market for quality, good design, and quantity. The Mishing women are doing well in this activity.

Resale of agro and dairy products – Another livelihood activity with less risk is buying and reselling for a profit agricultural and dairy products, like rice, milk, curd, and gud (condensed sugar). This is giving rise to a new class of middlemen traders who were once primarily producers or farmers.

Factors Affecting Adaptation

A wide range of factors – social, governance, infrastructure, and environmental – enable or disable adaptation to the growing variability of water-induced hazards in Assam.

Social factors

Traditional knowledge base, skills, and capacities – The communities have a long history of living along the river and cultural linkages with water. This has equipped them with survival skills and the mental conditioning to be ready to start over after every disaster. Skills, such as swimming, and boat and raft making, have helped these communities to survive every flood or other water-related hazard that has come their way.

Experience has endowed the communities with the indigenous wisdom to observe changes in the weather that foretell the coming of rains and floods. There are are also folk beliefs regarding traditional medicine and healing, local skills and raw materials for housing construction, pig farming, wine-making, and food storage. Modern acquired knowledge has enriched some traditional practices.

Cultural norms, taboos – However, cultural perceptions can also hinder adaptation by these communities. Non-Mishing communities are reluctant to adopt the stilt house for dwellings and the traditional societies have reservations about income generating activities like fishing. For many years, these perceptions have hindered their capacity to adapt. These norms are not rigid, but it takes time to change people's behaviours and mindsets.

Support role of local institutions and social networks – Local institutions are serving as a stabilising factor in this turbulent environment and helping the communities to adjust to the stresses of floods and other water hazards. The Namghar, community prayer house fulfils the religious and spiritual needs of the Assamese caste groups of Majgaon and Bahpora. It guides people's behaviour through a set of norms for social harmony.

Amongst the Mishing community, the kebang (union of villagers) and the murang ghar (community hall) are local institutions that provide platforms to keep community social networks alive and strengthen personal relationships among community members. They are a forum for open discussion, collective decision-making, and settling problems and conflicts.

Social cohesion, amicable relationships, and, with the Mishing community, strong bonds of clanship motivate people to help each other during floods and distress. Those who have boats lend them to others in need; people provide shelter to those displaced. They accommodate and help each other while sharing shelters by the roadside or on an embankment, and lend money to those in need with nominal interest. This sense of community amidst disaster helps people survive better in times of need.

Women's self-help groups – Several self-help groups were functioning prior to 2007. They started early in the decade and flourished with diverse income generating activities until the major floods of 2008 and 2009 affected their enterprise activities. Many of the SHGs continue to offer micro and small lending activities that have provided cash for households and communities during floods and hard times.

Governance factors

Government policy and programmes – The construction of roads under the National Rural Employment Guarantee Act programme and the ongoing construction of a new embankment to plug the breaches in the old Matmora embankment have benefited people in times of flood. However, these programmes are not available to everyone and government policies and programmes leave much to be desired, especially in terms of empowering the communities in a sustainable way and building their capacities to cope with disaster through training.

The lack of proper policies and programmes has hindered adaptation in these areas. The programmes could provide for the construction and maintenance of embankments, flood insurance, flood plain zoning,

Traditionally, Assamese women weave their own clothes. Some are now selling their products as a result of the impacts of floods.

Young women using local boats during the floods in Assam.

restoration of degraded lands, innovative agriculture on degraded land, alternative livelihoods for people affected by floods, and routine relief and rehabilitation work. People stay in vulnerable places like embankments or close to riverbanks due to the lack of environmentally and culturally suitable rehabilitation and resettlement packages. The lack of reliable early warning systems has also hampered people's preparedness for floods.

Local politics and governance of embankments – Three consecutive major floods in Matmora from 2007-2009 were mainly the result of a failure to repair and maintain the embankment in a timely and technically sound manner. These events and the apparent assumption that floods will breach the embankments every rainy season could suggest that bad governance, corruption, and an unholy alliance between the contractors, politicians, and government departments are hindering proper maintenance.

External assistance and intervention – Relief and rehabilitation development agencies, local NGOs, and welfare organisations have helped the communities cope with the immediate effects of floods and return to normal life. Their assistance has provided food and water supply, plastic sheets, medicine, hygiene kits, and facilities for rehabilitation such as boats, raised seed bank, and high-rise platforms. NGOs have also helped to sensitise and train local communities to prepare for floods, which has been useful.

Infrastructure factors

Embankments and flood management structures – Embankments and structural measures serve as both enabling and disabling factors to adaptation. They protect people from floods and erosion over the immediate term and allow people to attend to their lives and livelihoods while finding ways to cope better with the changing nature of the floods. However, people can become too dependent on these structures, which limits their motivation to cope and adapt in other ways.

Communities become used to the protection of the embankment, which gives them a false sense of security and confidence to expand their settlement right up to the river bank. When the embankment collapses, the communities' sense of security collapses as well.

Lack of irrigation – The lack of public irrigation facilities in these areas is a major impediment to increasing agricultural productivity by limiting the communities' options for winter crops, especially the cultivation of boro rice. Thus, the capacity of the communities to cope with post-flood shortages of food is limited.

Environmental factors

Changed nature of disasters – Although people are used to riverine floods, the increased intensity and frequency of floods have made them more vulnerable. Erratic and irregular patterns in rainfall have created uncertaintly for rainfed agriculture. Floods due to regular breaches in embankments and the increased sediment load in floodwaters have caused widespread sand deposition, the scale and intensity of which are now beyond the known coping mechanisms of these communities.

Conclusions

The changing nature of water hazards in recent years has made people more vulnerable and rendered traditional adaptation practices less effective. Cultural traditions and perceptions can affect people's vulnerability and adaptation practices both positively and negatively. Both the poor and the rich are vulnerable in different ways.

Women suffer more during floods, which may confine them to their households on raised platforms with a heavy load of responsibility and work to manage drinking water, cooking, and tending their children and livestock. When women are in a boat to transport them somewhere, they must hold back nature's call due to the lack of toilet and bathroom facilities, and put their sanitation and hygiene on hold.

Self-help groups mostly women groups, need to be supported with financial subsidies to enable them to

resume the income generating activities which came to a halt after the floods of 2007. Micro-credit transactions also became irregular because members cannot afford to pay the deposits. Easier lending and repayment schemes could help them cope and adapt.

Promulgation of proper policies and implementation of existing relief and rehabilitation programmes can empower people and enhance their adaptive capacity.

Of the communities of Assam, the Mishings have been the best adapted to floods. However, they have also become the most vulnerable community due to the increasing intensity and frequency of the hazards, the proximity of the river, and their deepening poverty.

The community cohesion that used to be strong is being eroded now as the communities are being scattered to different places and forced to adapt on their own. Researchers and planners need to review indigenous adaptation practices and the changes. It would be relevant to examine whether the traditional coping capacity and adaptation strategies are still useful, and if they can continue to deal with the changing nature of the multiple water-induced disasters, and the social, economic, cultural, and political factors affecting society as a whole.

Traditional coping and adaptation mechanisms that have worked, such as the indigenous house design and early warning indicators, could be promoted through government policies and programmes, perhaps with incentives from the government and other institutions.

Recommendations

- Build the awareness, sensitivity, and capacity of communities to adapt to their changing environment and to develop alternative livelihoods.
- Support the communities to sustain and perpetuate selected local adaptation strategies, such as those mentioned in this report, that have been proven effective in enabling them to live better in hazard-prone areas.
- Train farmers in innovative agricultural techniques suitable for degraded lands.
- Promulgate suitable policies pertaining to embankments, flood insurance, and resettlement and rehabilitation, and implement these programmes in a timely fashion to be effective.

In Assam, some people have become permanent squatters on the embankments due to lack of other options.