CASE STUDIES

CLIMATE ADAPTIVE PRACTICES GRASSROOTS INITIATIVES

Development Alternatives

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Population	As per 2011 census, total population of Assam was 31,169,272. It Ranks 15th in terms of population in India.[1]
Climate	With the "Tropical Monsoon Rainforest Climate", Assam's temperate (summer max. at 95–100 °F or 35–38 °C and winter min. at 43–46 °F or 6–8 °C) and experiences heavy rainfall and high humidity.[2,3] The climate is characterised by heavy monsoon downpours reducing summer temperatures and affecting foggy nights and mornings in winters, frequent during the afternoons.
Climate Vulnerabilities	Changing weather pattern, rising temperature, cloud bursts, flash floods, floods.
Average Annual Rainfall	2203 millimetre[4]
Economy	Assam's economy is based on agriculture and oil. Assam produces a significant part of the total tea production of the world. Assam produces more than half of India's petroleum.

[1] *2011 Census of India.*

[2] *Singh, R. L. (1993), India, A Regional Geography, Varanasi, India: National Geographical Society of India.*

[3] *Guwahati's landscape to change with satellite towns, BRT systems". The Assam Tribune. Retrieved 4 August2013.*

[4] *District-wise monthly rainfall data from 2004-2010 for the whole of India by Indian Meteorological department from www.indiaportal.org*

Assam is a state of India in the north-eastern region. Located south of the eastern Himalayas, Assam comprises the Brahmaputra Valley and the Barak river valleys along with the Karbi Anglong and the North Cachar Hills. Like the rest of the northeast region of India, Assam is extremely vulnerable to climate change. The 20th century has observed a warming trend of 0.51°C in India with accelerated warming observed from 1970 onwards. The region has experienced increase in the annual mean maximum temperatures, with increase at the rate of +0.11°C per decade and annual mean temperatures at a rate of 0.04°C per decade in the region. Assam has a high reliance on agriculture that is likely to only increase given its growing population. Changing weather patterns and rising temperatures leave farmers vulnerable to crop losses. Additional precipitation increases the risk of crop flooding. Climate change will also negatively impact the water resources sector by increasing freshwater scarcity, which is already a problem for Assam in the summer[1].

[1] *http://www.nicra-icar.in/nicrarevised/images/State%20Action%20Plan/Assam-SAPCC.pdf*

Techquipped for Floods

Key Messages:

- Flexible flood management planning (FFMP) is a comprehensive, participatory process preparing vulnerable communities for effective flood management saving lives and livelihoods.
- A comprehensive disaster risk reduction strategy coupling warning system with critical infrastructure and environmental buffers is important. Hence, appropriate investment in all three areas is the best approach to achieve substantial benefits.
- Flood Early Warning System (FEWS) feeding information to Disaster Response Agencies facilitate timely and effective action.

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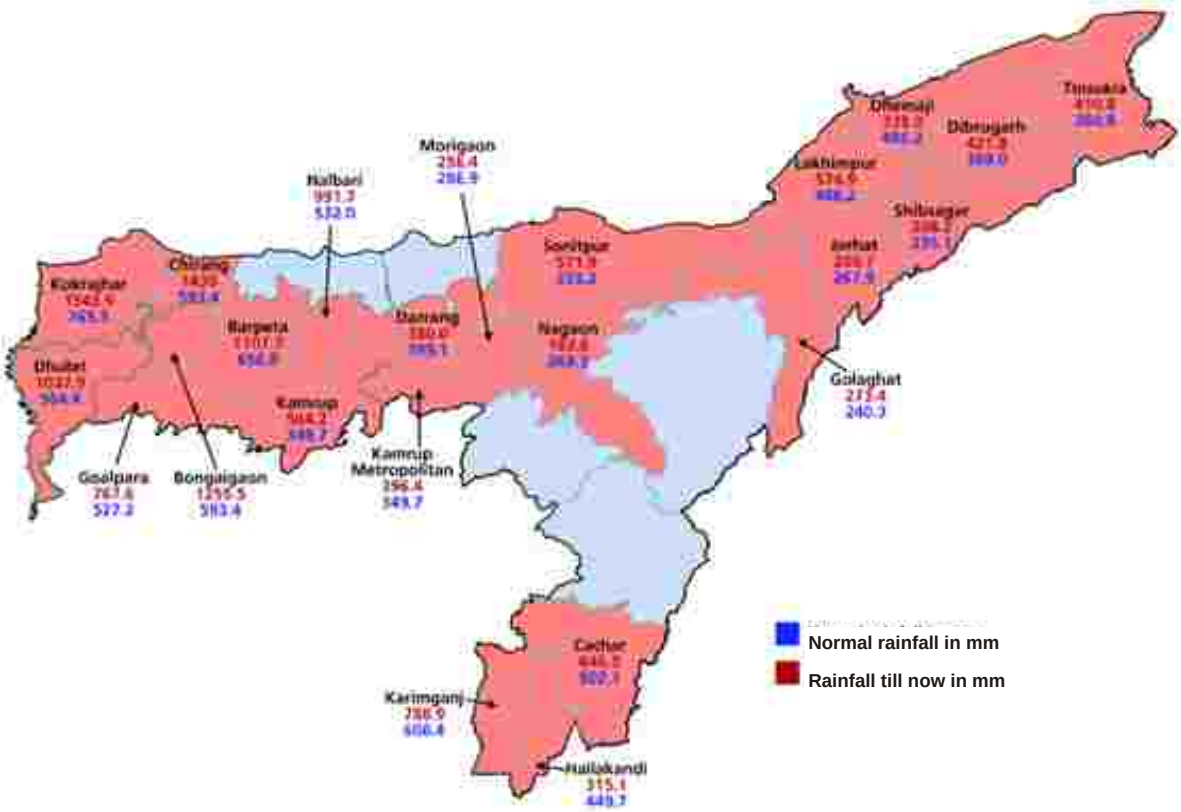
1. Context

1.1. Need:

Floods, flash floods, river-bank erosion and sand-casting (deposition of large amounts of sand by flood water) are the most frequent water-induced hazards in the eastern Brahmaputra basin in Assam. Such hazards affect all aspects of land, lives, and livelihoods of communities living in the region to a significant degree. Moreover, annual cycles of hazards cripple people's resilience and intensify the poverty spiral. Thousands of hectares of fertile land in hundreds of villages; have been lost to the river, due to frequent shifting in the river course and erosion of river banks. The impacts of climate change on the Himalayan region further increases incidences of landslides and cloudbursts, and flash floods affecting the hydrological regime of large rivers like the Brahmaputra.

Climate change is considered a major driving force, triggering alternation in the regional and local weather and climate systems. The impacts of climate change on the Himalayan region are rising temperatures, recession of glaciers, extreme rain events, increased incidences of landslides and cloudbursts, and flash floods triggered by landslide which affect the hydrological regime of large rivers like the Brahmaputra. The gargantuan river sustains millions of people, scores of ethnic cultures and supports diverse ecosystems in the eastern Himalayan region.

Flash floods have been causing considerable loss of life and property in lowland communities, particularly during the monsoon season. Although floods in small



Flood affected districts of Assam

rivers and tributaries can be extremely disastrous, they do not receive enough attention from government and other concerned agencies. Two districts that are the areas of intervention – Lakhimpur and Dhemaji are notorious for being flood-prone, as they lie in the river basins of Jiadhal and Singora.

The communities living in these areas have developed mechanisms over time that have become ingrained in their lifestyles and traditions – for example, housing, agriculture, livestock rearing, food storage, and weather and flood predictions. These mechanisms had helped them cope with and adapt to the immediate and long-term impacts of such hazards for quite some time. But as climate scientists are observing rising temperatures in the region, decreasing rainfall and recent drought-like situations in the past two decades, it is evident that the climate of the region is changing faster than the communities can adapt. The traditional coping and adaptation practices of the riparian communities living in these areas and practices that had developed in response to normal climatic variations have been rendered less effective against the increasing scale and intensity of the changing hazards.

2. Objectives

ICIMOD and Aaranyak have together piloted this project to use community-based *flood early warning systems* (FEWS) and *flexible flood management planning* (FFMP) to help manage flood risk and uncertainty as part of the Himalayan Climate Change Adaptation Programme (HICAP). These tools for flood risk management have been piloted in the Jiadhal and Singora river basins of the eastern Brahmaputra in Assam. The objectives of the project were to:

- Manage flood or flash flood risk by providing early warning to downstream communities.

- Enhance cooperation between upstream and downstream communities through flood information sharing.
- Enhance adaptive capacities and resilience of communities to withstand adverse effects of floods and flash floods.
- Form a local institutional arrangement to increase effectiveness of community-based FEWS *(flood early warning systems).*

"Flexible flood management planning (FFMP) is a comprehensive, participatory process preparing vulnerable communities for effective flood management saving lives and livelihoods"

3. Approach

Flexible flood management planning (FFMP) is a comprehensive, participatory process used to prepare a flood management plan for vulnerable communities. The process also explores uncertainties as a co-learning experience between communities, researchers, policy makers and institutions on the ground in the context of social and environmental change including climate change.

The FFMP was piloted in four villages: Dihiri and KechhuKhana Koch Gaon in the Jiadhal river basin; and Soroni and Borsola in Singora river basin. The four main steps performed under the FFMP were:

- Participatory flood mapping (also known as social flood hazard mapping); participants prepared a flood hazard map with the help of a trained facilitator.
- Community driven monitoring: A six month long activity in which local community members regularly monitored and recorded flood events and weather conditions, particularly temperature and rainfall. Participants received training on how to monitor and record flood and weather conditions in advance.
- Participatory envisioning: An exercise in which local communities anticipate plausible future environmental scenarios based on their own experiences. Using these scenarios, participants identify major drivers of change. Community perceptions identified upstream deforestation and population pressures on food security, lack of good governance as major drivers of change increasing flood risk. After identifying the drivers, participants are given future climate projections, which they use to envision how climate change will affect major drivers of change and prepare two future scenarios. Well-trained facilitators, including individuals to take notes are required to perform this exercise.
- Preparation of a flood management plan: The final step in the FFMP and is prepared on the basis of the data and information obtained from the previous three steps. This activity enables local community members to learn how to plan; as a key step in building their adaptive capacity. Facilitators and note takers play a vital role in this step.

4. Key Stakeholders

In this pilot project, the vulnerable communities from all four villages were the main stakeholders The nature of the project was such that the role of communities was

vital in the planning process, operations and execution of the warning systems. The real time data logging and information dissemination system was heavily dependent on villagers, nodal point people and the project operators communicating with each other.

Aaranyak's network and the district government's networks were engaged for the process of participatory mapping, including the following key stakeholders:

- Local governance and district administration.
- District Disaster Management Authority, Lakhimpur.
- District Disaster Management Authority, Dhemaji.
- University of Pennsylvania, USA.

5. Key Components

Flexible Flood Management Planning (FFMP)

To perform the FFMP, training on participatory flood mapping and community based monitoring was conducted for field facilitators followed by envisioning training, field exercises and a flexible flood management planning exercise.

As a result of the participatory envisioning, several factors contributing to loss of life and property due to floods were identified. The community was aware of several flood mitigation systems that could be useful in their situations. In infrastructural developments, suggestion were made for embankments, sluice gates, high structures etc. In pre-flood systems, early warnings system was a suggestion.

Following that suggestion, the team saw an opportunity to test out FEWS in some sites in the area of intervention.

Flood Early Warning System (FEWS)

The Wireless flood early warning system (FEWS) is a low-tech, cost-effective and user friendly system. It consists of two units: a transmitter and a receiver – both of which were installed upstream. The transmitter was installed along the riverbank and the receiver was installed at a house near the river.

Technology of FEWS

A flood sensor attached to the transmitter detects rising water levels. Critical floods levels are set with the help of the local community. When the water reaches a critical level, a signal is wirelessly transmitted to the receiver. The flood warning is then, disseminated via mobile phones to vulnerable communities and concerned agencies. The flow of information then proceeds simultaneously in two parallel chains to reach both the village and the nearby government officials.

The effectiveness of wireless FEWS is dependent on the selection of proper sites for the installation of both the units. It is necessary to provide training to local community members on the installation and operation of the system, as well as troubleshooting.

Five sets of early warning systems were installed in Jiadhal and Singora rivers in 2013. The first set was installed at Sagarpur village in Lakhimpur district in June 2013. Two days later, the system provided a flood warning system that was successfully communicated to communities downstream. All the equipment performed well during the 2013 flood season. The system is such that the village electrician can also run the technology. Moreover, it is crucial to institutionalise the roles and responsibilities of different stakeholders and develop an efficient communication and dissemination mechanism between upstream and downstream operators.

6. Outcomes and Impacts

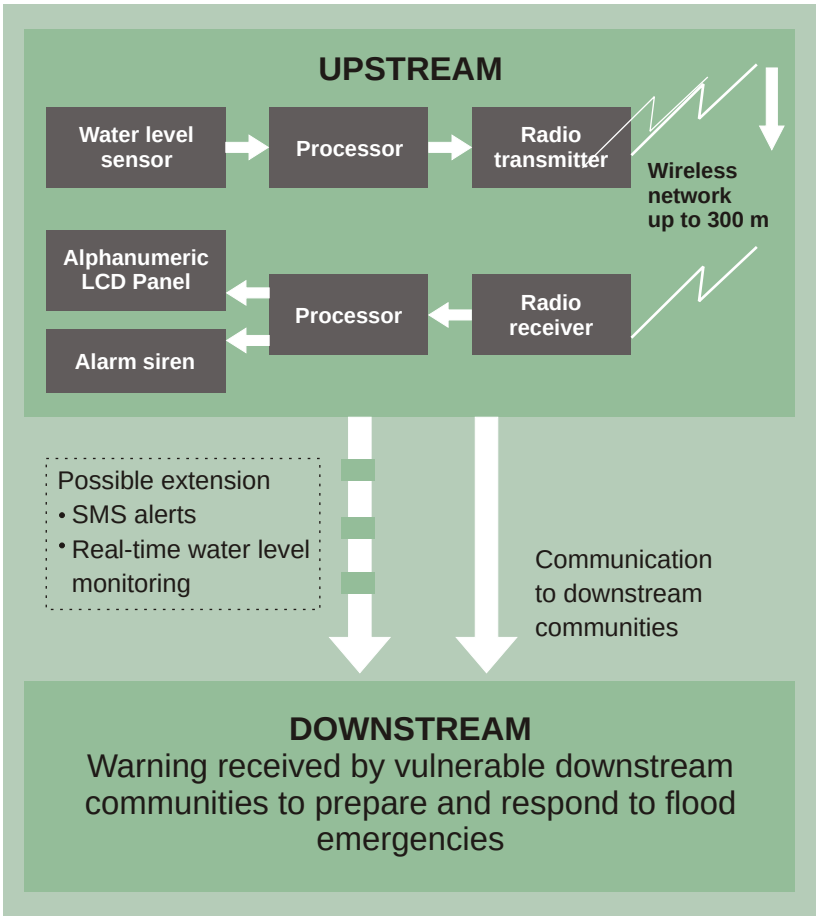
The direct impact of this pilot project has been on 20-25,000 people living downstream in 40 villages. They now have a lead time of 1.5-2 hours to prepare for the impending floods, and evacuate, if necessary. In Dihiri in the Jiadhal river basin, assets including livestock worth approximately 3,300 USD were saved during the flood season of 2013. With a lead time of 2 hours, simultaneous measures were taken, where some community members were plugging in breaches, reinforcing the embankments etc., and other members were moving people and livestock to higher ground.

In addition, local authorities have knowledge of the impending floods and can facilitate faster response to the problems of food and water. Local authorities can position equipment for emergency response and aid agencies can mobilise sooner.

Priority given to planning and management: During this process, lives of women, children and elderly people were saved. They were sent to safe zones – higher road, railroad, higher building, school buildings etc. Livestock were also taken to safe places next. Reactions to the information were based on what kind of warning was received.

The information transfer systems have been streamlined and made more efficient promoting upstream and downstream cooperation. FEWS installed in one village upstream has the capacity to save thousands of lives in 20 villages downstream.

Spatial planning was done for these structures and the map created in conjunction with the community was handed over the district level planners.



Flow of information in FEWS

Public Platform to highlight broad-ranging climate change actions are achieving heavy results on the ground. Strengthened motivation, spurred innovation; catalysed further change towards a low emission high resilience future.

7. Lessons Learnt

- Methodology and instrumentation of FEWS have been improved every season with learning from the previous season. Currently, information is disseminated through voice calls from one operator to several nodal people in each village, to project operators and district administrators. The technology developers are working now to have a built in system to send an sms warning at Levels 1, 2 and 3.
- Dissemination of the information, either through voice calls or sms, is dependent on a functional telecommunications network. This may create problems in events of freak cloudbursts, as networks are often down. An alternate is to have access to radio frequencies used by the military to increase the reliability of the information communication system.
- Greater involvement of various stakeholders in an overall disaster risk reduction strategy such as local CSO, NGO and district officials.

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FEWS Transmitter

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Community involvement plays a key factor in FEWS