

Development Profile In Flood Prone Areas



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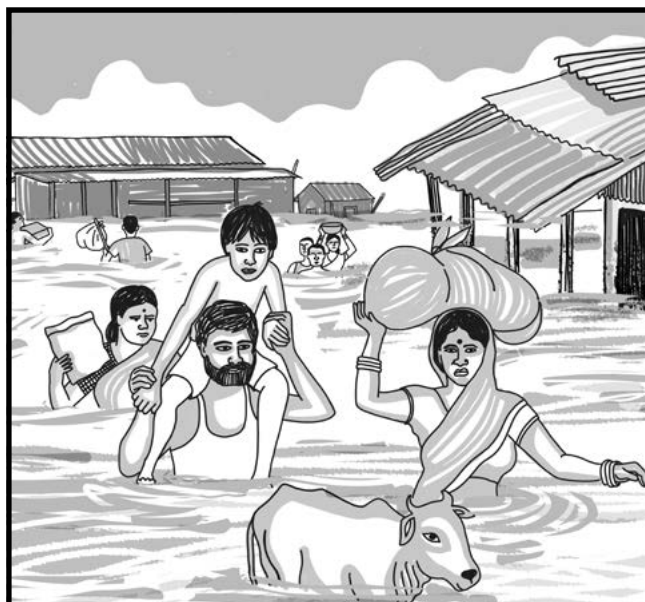
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Development Profile In Flood Prone Areas

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Executive Summary

Floods have an adverse effect on the Indian economy every year. On an average, every year around 7 million hectares of farm lands get affected by floods, around 3.2 million people are affected to varying degrees, and more than 1600 human lives and 89,000 cattle are lost due to floods. The annual damage to property amounts to Rs 18 billion and is rising each year. Much of the above damages occurs in a particular geographical region. The Ganga-Brahmaputra-Barak basin areas in the states of Assam, West Bengal, (North) Bihar and (Eastern) Uttar Pradesh, face the brunt of floods every year. Hence these areas may be termed as recurrent flood prone areas. These areas have high population density and rank low on human development index.

This report is an outcome of a study that was mounted to understand the nature of problems posed by floods to people living in recurrent flood prone areas, to underline the specific efforts that have been undertaken by communities and development interveners to cope with floods and to come up with a tentative list of possibly programmable activities which can be supported / implemented by the Trusts to help the flood affected communities.

This report consists of five articles. The first article, titled ***Flood and Development*** is the outcome of a field research undertaken in 72 villages spread over five regions within the recurrent flood prone area, namely Eastern Uttar Pradesh, North Bihar, North Bengal, Lower Assam, Upper Assam and Barak Valley. Based on multiple interviews and focus group discussions with the many people residing in these areas, we have traced out the myriad water related hazards faced by them. Though there is a tendency to club all these areas in one category, in reality, people living there face myriad water related hazards such as flash floods, *sailaab* kind of floods, water-logging resulting from drainage congestion or seepage and river bank erosion. The level of vulnerability and the resulting adverse impacts on a community are a function of the spatial location of the habitations vis-a-vis the river channel and the embankments as well as the social status of the community. In our article on *Flood and Development*, we argue that the adverse impacts of



water related hazards need to be seen through the following typology based on the spatial location of the habitation: inside embankment (between the most common water channel in the river and the embankment), outside embankment, on embankment and habitations on banks of rivers and streams which have no embankments. We have tried to see the impacts of water related hazards on people in these different location types by identifying the well-defined effects on agriculture, animal husbandry, education, health, water and sanitation and housing. The nature of hazard and the intensity of its impact on the above parameters differs across regions. Some specific impacts are however ubiquitous: shortening of the cropping season and crop failure, dismal status of (road) infrastructure, inadequacy of boats (an otherwise all-purpose mechanism for mobility), acute difficulty in obtaining safe drinking water during floods, security and privacy issues during the onslaught of floods arising from an overwhelming practice of open defecation, and the lack of access to education and health services during the floods, etc. The article further identifies a set of interventions possible (or already being tried out) in each of the regions studied which contribute to resilience building among the communities residing in the flood prone areas.

The second article titled, ***Floods and Vulnerable Communities***, focuses on the impact of the floods particularly on women and other vulnerable communities like the *mushahar* community in North Bihar and the immigrant community in Lower Assam. The study highlights the drudgery faced by the women during and post-floods and other problems specific to women: inability to maintain proper hygiene, absence of basic gynaecological care services, the burden of arranging the food, water and fuel for the family, etc. Vulnerable communities face near complete loss of livelihoods during floods and living hand-to-mouth as they do, further regress into high indebtedness.

Women among them routinely suffer the humiliation of facing the (money) lender, while the men migrate out of the village for labour work in distant places. As a result, the women tend to suffer from high psychological stress and suffer from high morbidity and sometimes mortality.

The final article in the main body of the report, ***Making Sense of Flood Prone Areas: An Overall Synthesis***, synthesises the findings obtained from the two original research work and the two workshop reports and lists down a menu of possible interventions that would contribute to resilience building among the population residing in the flood prone areas. In this, the article particularly focuses on “low hanging fruit” which would reduce vulnerability, enhance mobility and maximize productivity and result in resilience building among the flood prone population. Some of the possible interventions that the article highlights include provision of elevated platforms with proper drinking water and sanitation facility, provision of sanitary napkins for women during floods, elevated hand-pumps, raised toilets, floating schools, availability of boats, aggressive promotion of small pumps to facilitate irrigation in dry season; coupled

with promotion of creeper gardens and vegetable cultivations. The article moots the concept and need of “participatory embankment management.” We argue that resilience building can only happen if all these are taken up simultaneously and hence we recommend that Trusts take up resilience building work in a chosen cluster in one of the areas, perhaps in the Barak valley.

The fourth and the fifth articles, given in the Annexures are a short summary of the two workshops that were organised in Patna and Guwahati respectively. A number of organisations from Bihar, Uttar Pradesh, West Bengal and Assam were invited for a one-day consultation workshop. The tentative findings of the study were sounded on this group of practitioners. The practitioners also shared the possible interventions in some of these areas.

On an average, every year around 7 million hectares of farm lands get affected by floods, around 3.2 million people are affected to varying degrees, and more than 1600 human lives and 89,000 cattle are lost due to floods.



Flood and Development

*Findings from field research in West Bengal,
Bihar, Assam and U.P.*





Introduction

Floods and Losses in India

India has been consistently facing the brunt of floods. During 1953 -1980, on an average, every year around 8.2 million hectares of land and 27 million people were affected from floods. As a result, agriculture would routinely take a severe hit every year. During this period, on an average, 3.6 million Ha cropped area would get affected every year resulting in an annual crop value loss of Rs 2.23 billion. Apart from the losses in agriculture, flood water would also enter human habitation and damage houses. Every year around 1 million houses are damaged resulting in an annual average loss of Rs 0.4 billion. The deadliest impact of flood has been in terms of mortality – both human and cattle. During this 28-year period, more than 38,000 human lives and 2.8 million cattle were lost due to floods. The overall loss due to flood would run in billions of rupees every year and nearly two-thirds of the loss would be in the form of crop loss (GoI 1981). The effect of flood was not uniformly felt in urban and rural India, the latter faced the brunt of floods severely, and the biggest losers were the agriculturists¹. Despite the Governments undertaking multiple structural and non-structural interventions as part of flood management activity, floods continued to create havoc. Between 1953 and 2010, on an average every year the damage from flood would hover somewhere around INR 18 billion (GoI 2011).

Policy Initiatives by the Government of India

Government of India has undertaken several policy level initiatives to tackle the flood menace. In 1954, the Union Ministry for Planning, Irrigation and Power made two policy statements, namely, “Floods in India: Problems and Remedies” and “The Floods in the Country”. Subsequently, in December 1957, a high level committee on flood was formed and they submitted their report. As a follow-up to the above, in 1958 a policy statement on flood was made in the Parliament. In 1978 India witnessed a massive flood. Following it, the *Rashtriyā Barh Ayog* (RBA) was formed. In March 1980, the RBA submitted its report. Subsequently in 1981, the Planning

Commission prepared a report on the development of the chronically flood affected areas. Thereafter in 1983, an expert committee under R Rangachari was formed to probe the status of implementation of the recommendations made by the RBA. The Planning Commission in various Five Year Plans has looked into flood management. The latest in this is the Planning Commission Working Group on Flood Management for the Twelfth Five Year Plan (GoI 2011).

Flood Prone Areas in the Country: Assam, Bihar, Uttar Pradesh and West Bengal

Geographically, the Ganga-Brahmaputra-Meghna plains face the most intense and recurrent floods. The plains fall in the states of Assam, West Bengal, Bihar and Uttar Pradesh. These four states account for 17% of the country's geographical area (Census 2011). But around 52% of the all flood prone areas of the country lie in these states. (This estimate lies somewhere between 43% and 52% depending on whether one uses the Twelfth Five Year Plan's Working Group's figures or the *Rashtriyā Barh Ayog's* estimates (GoI 2011). Clearly, these states bear a disproportionate burden of floods.

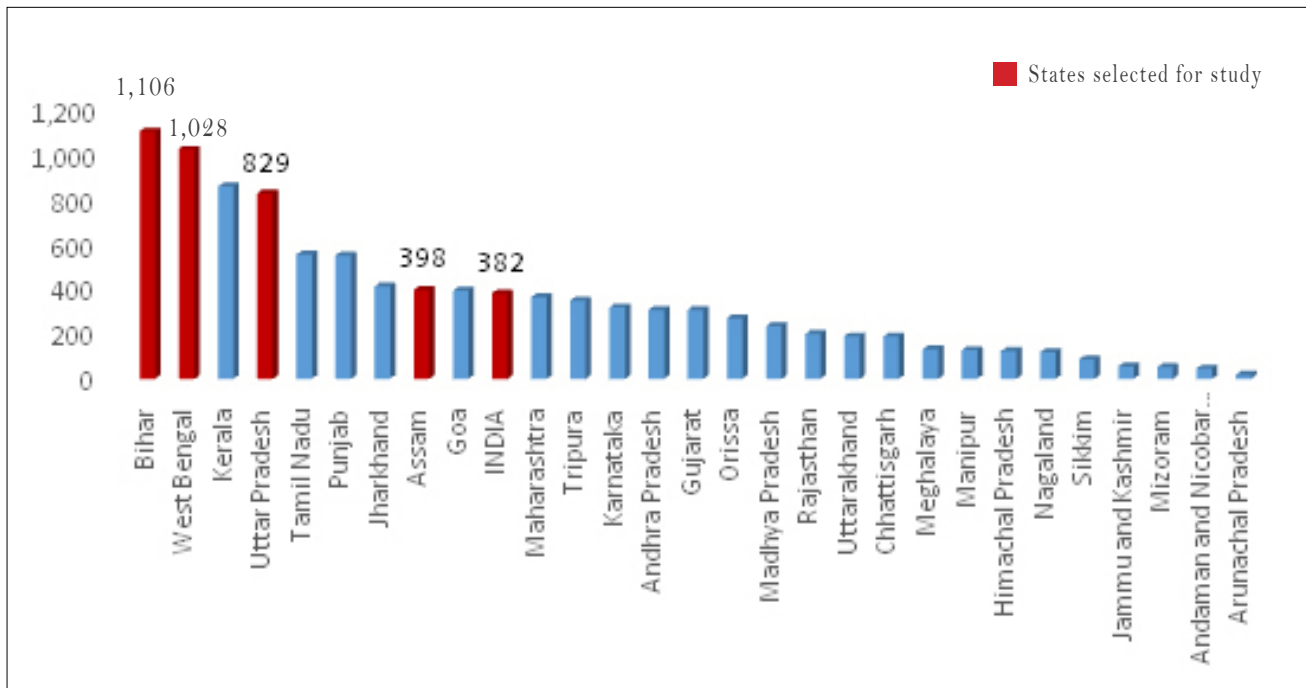
The importance of the four states to any discussion on floods becomes clearer when one computes the proportion of flood prone area within their total geographical area. While just 10% to 14% of the geographical area of India as a whole was designated as flood prone, for the above mentioned states, the same lies between 35% to 47% (again depending on whether one uses the RBA figures or the Twelfth Plan estimates). Historically, embankments have been the most important flood protection measure undertaken by the central and state government. Hence, the length of the embankment is a good proxy for identifying the most flood prone areas in the country. The total length of the embankment in India is 33,928 kilometres and around 60% of these embankments are located in the states of Assam, Bihar, Uttar Pradesh and West Bengal (GoI 2011).

Further, as seen in Chart 1, these four states are also densely populated indicating high pressure on land and other resources, including water resources (rivers in this case). Any natural hazard in these densely populated states easily translates into a severe disaster. These four states are also low in the Human Development Index (http://www.im4change.org/docs/340IHDR_Summary.pdf).

¹An analysis of data during 1953-2010 reflects strong correlation between (i) area affected and population affected ($r=0.87$) and (ii) between area affected and damage to cropped area ($r=0.94$). The strong association between damage to crop area and human lives lost ($r=0.53$) indicates that it was the rural population dependent on agriculture who faced the maximum adverse impact of floods (GoI 1981).



Chart 1: Population Density based on Census-2011



Methodology

The objective of our study was to understand the development profile of the flood prone regions in Uttar Pradesh, Bihar, West Bengal and Assam. The broad research design for our study is exploratory. In terms of the epistemological and ontological worldview we subscribed to a mix of pragmatic and advocacy worldview (Creswell 2008). The problem – development profile in the flood prone areas of Uttar Pradesh, Bihar, West Bengal and Assam – was at the centre while deciding on the broad research strategy. In order to understand this problem and to advocate for change – livelihood enhancement among the flood affected population – we decided to rely on primary field research, through which qualitative and quantitative data was collected, and substantiate it with secondary data wherever required. So broadly, our research strategy followed concurrent mixed-method approach (Creswell 2008).

During our field research, qualitative and quantitative data was collected using a mix of methods, namely, observation and photo documentation, semi-structured and unstructured personal interviews, and focus group discussions. Given the paucity of time and the fact that we were undertaking an exploratory research, we decided to take village, and not households, as our unit of analysis.

Given the vast geographical area comprising these four states, we had to choose certain locations in each of these states where we would do our field research. We do not prescribe to the post-positivist worldview

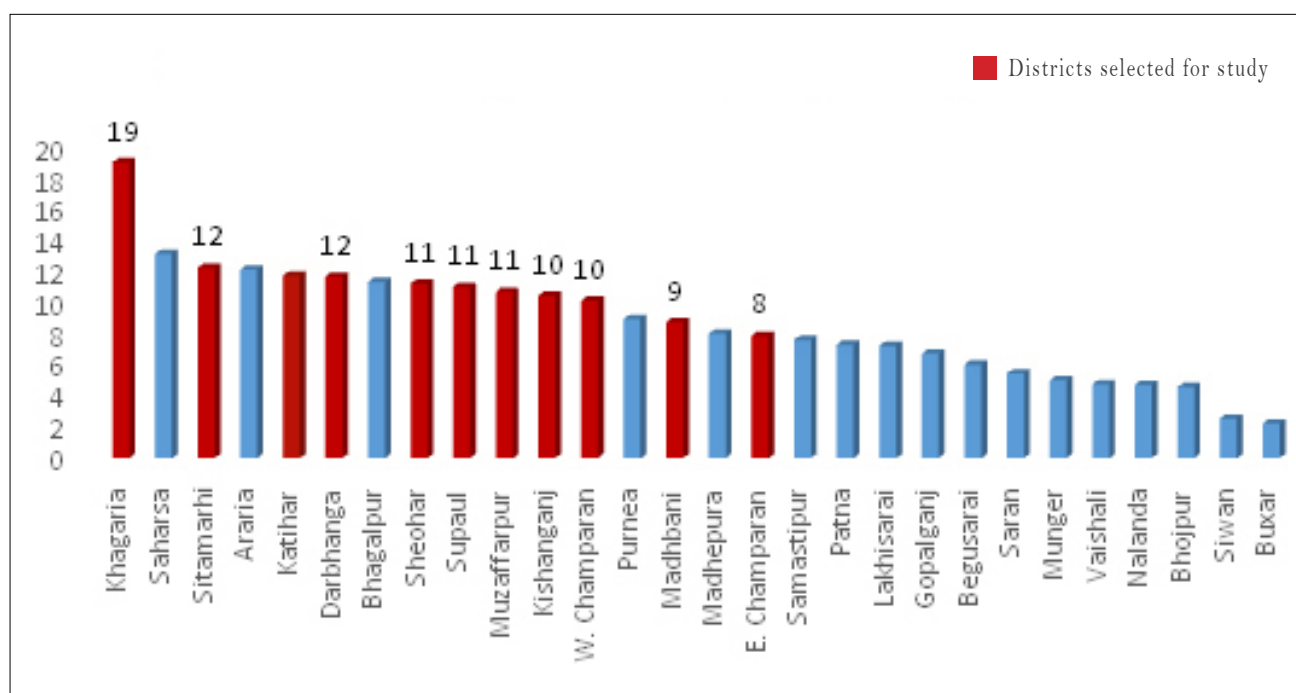
(Creswell 2008) and hence scientific sampling and ensuring the sample areas represent the entire population was never an effort. Rather we decided to do purposive sampling. Our purpose was to reach the flood prone districts and villages and to talk with the population residing in those areas. For this, we decided to take a mix of heuristics (past experience of our project leader about areas in these districts) and referral or snow-ball sampling (Patton 1990). We identified certain river basins and districts which we knew were flood prone, based on our past work, our own experience or by speaking to with key informants. There we contacted partner organisations of the Tata Trusts or other non-governmental organisations (NGOs). We detailed them about our study and requested them to take us to flood prone villages. We relied on the local expertise and experience of these organisations for selecting the villages. We also conducted focus group discussions of civil society organisations working in these study districts. The focus group discussion was either preceded or followed up with field visits to villages.

We also made use of review of secondary data accessed from government sources. For example, in Bihar, time-series data on block-wise flood frequency is available for a period of 24 years, 1987-2010 (BSDMA undated). Similarly the Assam State Disaster Management Authority (ASDMA) has prepared a document titled Flood Atlas of Assam where vulnerability zonation of area within each district based on the frequency of flood was prepared (ASDMA



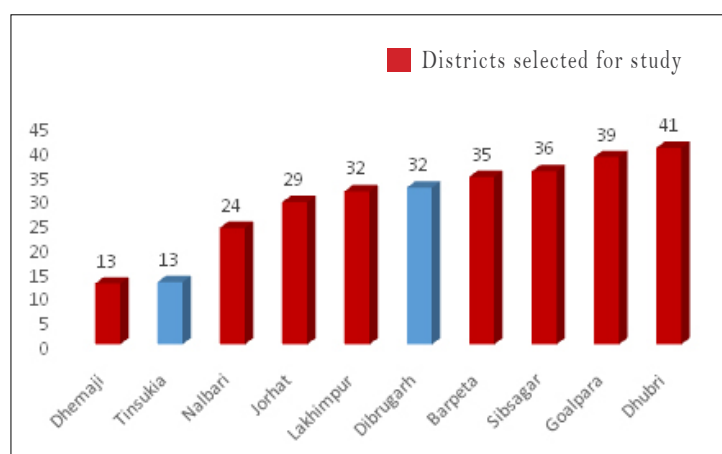


Chart 2: Average flood frequency in Bihar during 1987-2010 (BSDMA website)



2014). We have used the data on flood frequency in both these states to triangulate our choice of districts. As seen in Chart 2, the bars painted in red were chosen for field work and we found that most of our chosen districts are also the districts where flood frequency is at least one-in-three-years. Similarly the bars in red in Chart 3 depicts the districts that were chosen for fieldwork in Lower and Upper Assam.

Chart 3: Area flooded atleast once in every two years in Assam (in%)

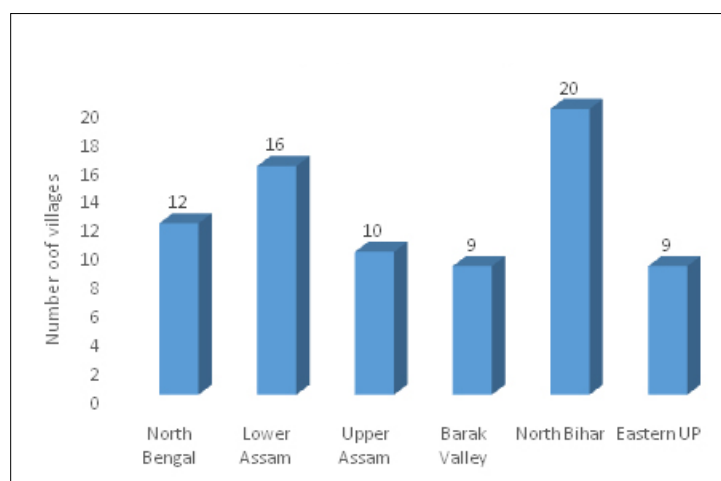


Source: Assam State Disaster Management Agency, 2014

The study has covered the districts of Dhubri, Goalpara, Barpeta and Nalbari, Dhemaji, Lakhimpur, Sibsaagar, Jorhat, Cachar, Haikandi and Karimganj in Assam; Coochbehar and Alipurduar in West Bengal; West Champaran, East Champaran, Sheohar, Sitamarhi, Mauzaffarpur, Madhubani, Darbhanga,

Supaul, Khagaria and Kishanganj in Bihar; and Deoria, Gorakhpur and Kushinagar in Uttar Pradesh. The details of number of villages in each region is mentioned in Chart 4.

Chart 4: Number of Villages Studied



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Bihar

*A village in Supaul,
located inside the
Embankment*

Background of the Study

The study in Bihar covered a total of 20 villages spread over 9 districts. These districts include East Champaran, West Champaran, Seohar, Sitamarhi, Madhubani, Muzaffarpur, Supaul, Khagaria and Kishanganj. All these districts lie on the north of the river Ganges and hence this region is often in common parlance referred to as North Bihar. The number of villages chosen in each district were not uniform: they varied from one (in Muzaffarpur, Madhubani) to four (in Kishanganj) per district (Refer to Table 1). The choice of villages in Bihar were a mixture of snow-ball, key informant and convenience sampling.

Table-1: District-wise Distribution of study villages

District	Number of villages
East Champaran	3
Khagaria	2
Kisanganj	4
Madhubani	1
Muzaffarpur	1
Sheohar	2
Sitamarhi	2
Supaul	2
West Champaran	3
Total	20

Typologies of Villages based on Spatial Location: Graded Vulnerability

The spatial location of a village vis-a-vis the river and the structural protection measures – the embankments – would define how vulnerable it is to flood related hazards (flooding, water-logging and river bank erosion). The villages which are located on river banks with no embankments tend to be most vulnerable to seasonal flooding and river bank erosion. The villages which are located between two or more rivers (or tributaries) tend to be vulnerable to flooding and waterlogging from either or all of the rivers. In many cases, while the nearby river is not in spate, the backwaters from the larger river may increase the water level in the tributary and flood the adjoining region. In our study, we came across three villages which were located between two rivers, and were prone to flooding and bank erosion.

The state of Bihar has a long history of embankments. While on some rivers, and on some stretches, embankments have been recently constructed, on rivers like Kosi, embankments, atleast on certain stretches, are more than half a century old. Just as the (lack of) maintenance of the canal systems have been subjected to debate in India, the same has been experienced for the embankments in the state of Bihar. The discourse on embankments tends to be polarised. It generates a lot of heat in the public discourse, particularly among the civil society and activists who

have been working on floods and in the flood prone areas in the state. The establishment has always relied on structural measures like embankment construction as a flood protection measure, apart from river engineering. But the civil society in Bihar has argued against embankment on multiple grounds:

1. Flood is a natural phenomenon and people in North Bihar lived and thrived with flood. The water would spill on the adjoining flood plain and in due course of time as the water level in the stream channel reduced, the water would recede and go back to the channel, leaving fine particles, the silt, on the land, thus enhancing the fertility of the soil. This natural phenomenon has been hampered through embankment construction.
2. The embankment reduces the space for the river to spread its flood water beyond them, as a result the area within the embankments experiences enhanced speed and force of the flood water. The silt carried by the river during floods and deposited in the flood plain now gets deposited only within the embankments. As a result, there is a gradual raising of the river bed. The force of the water and its height (as a result of raised bed) makes the habitation within the embankment, if any, extremely vulnerable to floods and the embankments vulnerable to breaches. In Bihar, there are lots of villages which continue to remain inside the embankment, as they were not satisfied with the compensation that the government provided for relocation. These villages then become extremely vulnerable to flood and erosion.
3. The embankment, like canals, require continuous maintenance and repair. In the absence of this, the embankments become prone to breaches. Lack of maintenance could result in a breach (like the breach on Kosi in 2008) and when an embankment breaches, a high wall of water from a higher topography (higher because of raised bed) gushes in to the low
- lying neighbouring areas, causing massive loss of life and property. Since the embankments are earthen embankments, they become vulnerable to damage from rodents. Sometimes the breach is not an outcome of lack of proper maintenance or rat attack but is an act of deliberate human action: the inhabitants residing inside the embankment, might deliberately breach the embankment in order to reduce the height of flood water and flood damage to them. It has been found in some areas (not only in Bihar, but also in Assam and Uttar Pradesh) that the villages which are located outside the embankment would organise night patrols during the monsoon months, when the river is at spate, to guard the embankment and stop any such deliberate breach.
4. The areas which are located outside the embankment, though located at “safe” areas tend to face myriad problems: (i) the rise of the river bed and the gradual weakening of the embankment keep the neighbouring areas in constant angst of possible breach and hence a disaster, particularly during the monsoons, (ii) the embankments create a barrier to natural drainage as it obstructs the rainwater from reaching the rivers, resulting in waterlogging. This phenomenon of waterlogging then could inundate the homestead and agricultural land, affecting agriculture, reducing the cropping window for the farmer and resulting in artificial bodies of stagnant water, (iii) in some areas, there would be seepage through the earthen embankments and the continuous seepage would result in waterlogging in large tracts of land neighbouring the embankments, (iv) and in case of North Bihar where most of the rivers run north-west to south-east, a tract could be encircled by embankments of adjacent rivers, thus completely cutting off the drainage. It is not unusual in such a case, to have large tracts of land remaining waterlogged for most part of the year.

Among our study villages, around one-third were located inside the embankment, a little less were located outside the embankment, one-third had no embankment and in one case, the habitation was located on top of the embankment (Refer to Table 2).

Table-2: Typology of villages based on their spatial location

Inside the Embankment	6
Outside the Embankment	5
On the Embankment	1
No Embankment	6



A village in Muzaffarpur, located on top of an embankment



Around 45% of our studied villages had faced a severe flood incident at some point of time which had caused them to relocate as the original land had washed into the river (due to river bank erosion and change of the river course). Some of the villages subsequently got relocated on the top of the nearby embankment, some got relocated to land outside the embankment; villages which had no embankment just relocated to higher ground – only waiting to relocate again once the river catches up and erodes the land further. Thus depending on where these villages could get relocated, they continued to experience different levels of vulnerability.

North Bihar is criss-crossed by multiple rivers. The major rivers include Gandak, Burhi Gandak, Kamla, Adhwara groups of rivers, Bagmati, Kosi and Mahananda. Each of the studied villages were close to one of the above mentioned rivers. Three villages were actually between two rivers. The high vulnerability to floods and bank erosion is evident from the fact that most of the villages were located very close to the river, the average distance of the river from the villages was around half a kilometre (560 metres). Thus, most of these villages, irrespective of whether it was inside or outside the embankment, were very closely situated vis-a-vis the river.

Flooding, Flood Months and Type of Flood

In majority of the villages flooding would start from the month of July-August and would continue till October-November (Refer Table 3). In the north-western districts of Sitamarhi, Seohar, East Champaran and West Champaran, flooding starts from August. In the north-eastern districts of Madhubani, Supaul, Khagaria and Kishanganj, the respondents reported that flooding usually starts around July. In Supaul and Kishanganj, the two districts bordering Nepal, the first bouts of flood might start as early as in June.

We found that on an average, the floodwater would enter a village around six times in a season and the

total period of inundation would be around 65 days. However the length of the inundation period varies depending on whether the flood is of flash flood kind or of a *sailaab* kind of flood. In case of the latter, flood water would recede very slowly. Because of drainage congestion, there would be waterlogging, which would prolong the period of submergence. So in some of the villages, water would drain out in 2-3 days, while in others waterlogging could cause many patches of land



Erosion alongside the banks of Kosi river

to remain submerged for 4-6 months, if not more. In this regard, our data on submergence, based on the report of the respondents, showed that districts like Supaul, Khagaria, Madhubani mostly faced the *sailaab* kind of flood, which coupled with waterlogging elongated the period of submergence. In districts like Kishanganj, Seohar and Sitamarhi there would be a high number of flood events but water would tend to go down quickly. In West Champaran a mix of both type of floods can be inferred from the data.

Table 3: Flood months

Flood starts in the month of	The last bout of flood comes in		
Months	Number of villages	Months	Number of villages
May	1	August	1
June	6	September	4
July	3	October	7
August	10	November	7
-	-	January	1





Waterlogging caused due to seepage and drainage congestion in habitations in Supaul

During Floods: Coping and Relocation

In around 75% of the villages, the respondents said that they would have to relocate to another place during the flood to move to higher grounds. In only five of our study villages, we found that people did not have to relocate because either the village was (re) located on upland, or there would be places in the village which were upland and where people could temporarily shift, or people would raise their houses by filling the soil or they would cope with floods just by continuing to stay in their house in the village in spite of the flood making a temporary bed by putting one bed on top of the other.

On an average, around 80% of the households have to relocate to higher grounds. In terms of choice of higher grounds, an overwhelming majority would go on top of the nearby embankment. While some would take shelter in government buildings, such as school and panchayat bhavan, some others would go to railway line, roads or high grounds within the village area. Such areas of high ground are on an average, one kilometre from the village and the relocatees tend to stay for around two months in these locations. In all the studied villages, the people informed that the relocation process was self-initiated and that the government relief and rescue would be too little and too late.

In 11 out of the 14 villages, on which we have data, the relocation would take place only after the flood water enters the village and the water level starts rising. In the remaining three villages, the respondents reported that they relocate before the water enters

the village. Here the role of traditional indigenous knowledge gains importance: the village elders in some of these villages, based on the colour and flow of the water, would predict the possibility of flood and warn others, after which people would start planning their relocation.

According to the respondents, in times of urgent relocation, it is there children and the livestock that they think of first. In some stances, however, the livestock and essentials have to be left behind, and the villagers somehow manage to save their life with their children. In some areas, the respondents reported to have had the time to plan their relocation with household essentials.

In eight out of 20 villages that we studied, some people (around 10%-20%) would relocate to the roof-top of their houses in case of floods – rather than moving to the embankment. But these would be people who belong to the higher caste and had a pucca house. For them, protecting the house and property, which would otherwise be subject to theft, was the main reason of staying back in the village, rather than joining the others to the embankment. Also, being mostly from a higher caste, they would prefer to continue staying in their premises rather than sharing a public space with a heterogeneous community.

The respondents often emphasised the importance of owning boats in the flood prone areas. Boats increased mobility, facilitated sanitation and ensured access to government services through enhanced mobility. During our study, we found that around 60% of our study villages had boats. In some of



these villages, boat making is a prominent livelihood; sometimes people would collectively purchase boats, given its expense. Sometimes the access to boat is facilitated by certain castes, like the *mallah* caste, who earn their livelihood by ferrying people on their boats. In one studied village, the Circle Officer of the District Disaster Management Agency provided a boat to a village.

Floods and Agriculture

Land is the most important asset that a rural household might possess. The same holds true for the flood prone villages. In our studied villages, average landholding was found to be around 1.15 acres (if we include the three outliers the average landholding goes up to 2.8 acres). But land distribution is skewed and in some of the villages, the respondents reported that most of the land would be owned by a few (mostly higher caste) people in the village. The landlessness, an important component of being low on asset (and hence low on power), was found to be high among the studied villages. On an average, around 44% of the households in the villages were reported as landless.

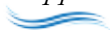
The cause of landlessness could be multiple in these

flood prone villages. Certain communities like the *harijans* and *mushahars* were found not to own any land. Sometimes they would be resettled on some upland where wage/agriculture labour become their sole livelihood activity. An important locale specific reason of landlessness in the flood prone areas is river bank erosion and change of river course. During our field research, the respondents reported that because of landlessness and skewed landholding distribution, many people would be sharecroppers and would cultivate land on *batai* basis.

One specific character of landholding in the flood prone areas is that the absolute size of landholding masks the more important question on the nature of the land or the cultivable potential of the land. This difference between mere ownership of land and the cultivable potential emanates from the adverse impacts that floods, waterlogging to some extent river bank erosion have on the population. The flood water may not just bring fine silt particles but can bring large sand particles, which then get deposited on the farm land rendering it uncultivable. It was reported in one particular village that though people may have 20 acres of land, the land is uncultivable because of sand



Cultivation undertaken on land inside an embankment during non-flood months in Madhubani



deposition. Similarly, waterlogging of farmlands for an extended period of time, sometimes for most part of the year, as seen in the districts of Supaul, Madhubani, Darbhanga, tends to reduce the cropping season and the cropping pattern available for the landowner. Some tracts of waterlogged land might sometimes remain fallow around the year.

Given that flood and waterlogging tend to reduce the cropping cycle, maximum utilisation of the land in the dry months becomes important. This means access to assured water becomes a necessity for summer cropping. Hence access to irrigation becomes important. The studied villages had access to irrigation (around 90% of land had assured irrigation), entirely dependent on groundwater through shallow tube wells powered by diesel engines. A thriving water market exist in most of these villages, whereby people who don't have tubewells or pumpsets, rent it on a rate of around Rs150 per hour. The rate is high compared to electric pumps, and hence it has been argued that the lack of access to cheap energy is a major cause of economic scarcity plaguing north Bihar. Even this expensive source of irrigation falls short of the water requirement due to the sandy nature of the soil.

Wheat (cultivated in all the 16 villages out of 20 where some agriculture was practiced), followed by paddy (13 villages), pulses (8 villages), maize (8 villages) and mustard (8 villages) are the dominant crops of the area. We had argued earlier that while the districts of Supaul, Madhubani, Khagaria and Kishanganj are more prone to *sailaab* kind of floods and waterlogging, districts in north western Bihar, that is, Seohar, Sitamarhi and East Champaran seem to suffer more from flash flood and the flood water would recede quickly. The only district where both types of flood was observed was in West Champaran. This inference also gets reflected in the cropping pattern, cropping intensity and crop diversity. It can be hypothesised that in areas witnessing *sailaab* with the resultant waterlogging for long months, farmers get fewer months to practice agriculture, compared to areas that witness flash floods. Here it must be mentioned that the flash flood could also bring lot of sand on the soil and could be more destructive in terms of loss of life and property.

The crop data collected during our field research shows that crop diversity is much higher in Seohar, Sitamarhi and East Champaran, where there would be three or four different seasonal crops, such as paddy, wheat, mustard, maize, and sometimes, sugarcane and vegetables. Diversity is lower in Madhubani, Supaul,

Khagaria and Kishanganj, where predominantly there would be one crop, wheat or maize. Paddy is widely cultivated in the villages from Sitamarhi, Sheohar, East Champaran and in some pockets in Kishanganj. We also found that while cropping would start from October-November, in some extreme cases, it could be as delayed as February; this was witnessed Supaul and Khagaria. In Sitamarhi, Seohar and East Champaran, cropping would start from June-July onwards. This means that the latter set of districts had a longer cropping calendar than the former set of districts.

In two-thirds of our study villages, people reported changing their cropping patterns to cope with the natural hazards like flood, river bank erosion and waterlogging. Observed changes are: reduction of two or three season crops to one season crop (mostly the kharif would get affected and the rabi would start late), reduction in vegetable cultivation and replacement with maize, sometimes cultivation of maize crop during rabi. It was found that in order to make the best use of the available cropping period, people would cultivate crops like cucumber and some other vegetables on the river bed, and green manure crops like dhaincha on wastelands (rendered so due to sand deposition). In some studied villages, people would cultivate hybrid varieties of crops with the help of local non-governmental organisations. In some of the villages, people stopped maize cultivation due to animal (Nilgai) attack. Among the existing food crops, floods reduces the yield of paddy and wheat (because of late sowing) by 40%-50%.

Floods and Animal Husbandry

Animal husbandry is often an important livelihood for a rural household. During our field research we tried to find out the dominant animal husbandry activities pursued in the flood prone villages and the impact that natural hazards like floods have on such activities. Predominantly our focus was on goat rearing, poultry and dairy. We found that on an average around 60% of the households would have small ruminants like goats, around 31% engage in poultry and around 40% of the households would engage in dairy activities. Further the proportion of buffaloes was higher in the villages in Seohar, Sitamarhi and East Champaran, while proportion of cows was slightly higher in the districts of Supaul, Khagaria and Kishanganj.

In areas more prone to *sailaab*, waterlogging and erosion, that is in the districts of Supaul, Khagaria, Madhubani and parts of Kishanganj, lesser proportion of people are engaged in animal husbandry



Children taking goats to a nearby char land for grazing

compared to the districts of Seohar, Sitamarhi and East Champaran. It was seen that around 30% of the households in the first set of districts and around 80% households in second set of districts were engaged in goat rearing. Similarly, the figures stood at 20% vis-a-vis 24% for poultry and 25% vis-a-vis 49% for dairy. Table 4 takes into consideration all the villages from Kishanganj).

Table 4: Animal Husbandry Practices (% of households sets of districts)

	Goat rearing	Poultry	Dairy
Set I: Madhubani, Supaul, Khagaria and Kishanganj	45	36	35
Set II: Sitamarhi, Seohar and E. Champaran	75	25	45

The difference between the two sets can be attributed to the loss of livestock, and hence the loss in terms of income, that results of floods and erosion. The floods tend to have myriad adverse impact on livestock: it may result in enhanced mortality as the gushing

water might wash away the cattle, increased morbidity through various diseases, reduce the area available for grazing and foraging, and in case of crop failure, reduced crop residue and fodder. Thus, in 17 out of the 20 studied villages, people complained about loss of livestock from flood and in 16 villages, people complained of reduced income from animal husbandry due to floods. In many of the studied villages, the respondents complained that as a result of floods, milk production would reduce by nearly 55%.



Cattle in Bihar's flood prone areas are mostly of desi breed



Floods, Housing and Mobility

In the study villages in Seohar and Sitamarhi, households had elevated their houses by soil filling to cope with floods. Sometimes the people would use government schemes like Indira AwasYojana to dig out soil from the neighbouring areas in order to elevate their houses. However, mobility during the floods continued to remain a problem. During floods, limited number of boats, are the only mechanism for transportation. Transporting sick people to nearby hospitals becomes extremely difficult. (We have witnessed cases where sick people would be carried on a charpoy by four people and via boat-van-trekker). Mortality during transit is not uncommon.

Water Supply, Sanitation and Health in Flood Prone Areas

In most of the study villages we found that handpumps are the only source for drinking water. In some villages (like one in Kishanganj) water would be supplied by the government through public standposts, but water supply was not reliable. As a result, even in such cases the villagers still depend on the handpump. There is a general perception in the area that water from handpump, that is, groundwater, is good for health. At



A patient being carried on a charpoy to a boat

practice of rainwater harvesting and use the same for drinking purpose.

Dismal status of sanitation facility is common across the entire region. (The other common issue being the dismal state of roads). Open defecation is a predominant practice in all the studied villages for both men and women. The situation deteriorates during the flooding months. During floods the situation becomes particularly agonising for the women in the village. It was reported that during the floods, women would use makeshift toilets made out of bamboo and banana stems. Sometimes they would hire a boat, and take the boat into the mid-waters where the women folk would relieve themselves. As expected, from the prevalent water and sanitation practice, in all the studied villages the respondents reported an increase in the incidence of disease during and post-floods.

High dependence on flood waters for domestic use including drinking, shallow handpumps, coupled with the prevalence of open defecation, throws up a public health menace, manifested in terms of high incidence of morbidity and mortality, during and post-flood months. Among various water-borne diseases, dominant are diarrhoea, typhoid and cholera. Vector-borne ailments like malaria are also very common. People suffer from multiple skin diseases due to prolonged exposure to flood water, as it carries animal carcass emitting toxic chemicals, apart from human and animal excreta. Children are prone to diseases like diarrhoea, malaria, typhoid, pneumonia and skin infections (Refer Table 5). Another common problem that the people face during floods is increased incidence of snake bites.



Handpumps are unhygienic even during non-flood months

the same time, we have witnessed handpumps located in areas where one would expect contamination from humans and animals. Moreover during floods, handpumps located in the lowland would get submerged and people then either end up drinking flood water or shift to hand pumps in upland areas of the village or, fetch water from outside. In very few villages, some NGOs have been able to inculcate the



Table 5: Types and prevalence of diseases during floods

For adults		For Children	
Name	Frequency (number of times reported)	Name	Frequency (number of times reported)
Diarrhoea	20	Diarrhoea	20
Malaria	10	Malaria	5
Skin Diseases	7	Skin Diseases	6
Snake bite	4	Typhoid	2
Typhoid	2	Pneumonia	3
Cholera	1	*****	*****
Cough & Cold	10	*****	*****

Given the high incidence of diseases, access to health services and centres become crucial to restrict morbidity and mortality. But access to health services is one big constraint experienced by the flood affected population. In only four out of twenty villages, the respondents reported that they got some emergency health services from government agencies like the health department and the District Disaster Management Agency. On an average the distance of the hospital from the village would be around 12 kilometres. But this measure of distance in the flood prone areas are inadequate indicators inexplaining the harrowing experience people have to go through in order to access health services. Often the Primary Health Centres (PHCs) do not have adequate facility and people have to depend on informal (*jholachap*,

quacks) doctors. The remoteness of the villages and the dismal conditions of roads which at times non-existent further create constraints in case a patient has to be taken to the block or district hospital. Often patients would be carried on a *charpoy* to a boat and then carried further to a place from where there will be van service to take the patient to the hospital. Thus it is not unusual to hear about mortality during transit.

Education in Flood Prone Areas

All of the studied villages had primary schools but the schools would close down during the floods. Out of the 18 villages on which we have data on education, in 13 villages the respondents reported that the school would be shut during the floods. This was so as the teachers mostly come from outside the village. During



Boats are often the only mode of transport





This school has been operationalised immediately after floods

floods, the access to the school becomes difficult and hence they simply do not come to teach. At a meeting with civil society organisations in Madhubani, it was revealed that a posting in the Kosi region is considered a lucrative posting for the teachers as they avail of “flood vacation” apart from the normal vacations. Sometimes schools are closed down because they are located in the lowland (in one occasion in Kishanganj we came across a two-storied *pucca* school building constructed on the river bed) and gets flooded. When they are located on upland they often become sites for relief camps. Thus, by the account of some respondents, the schools might remain closed for up to four or five months in a year.

Migration in Flood Prone Areas

In a natural hazard prone area, migration can be a livelihood diversification as well as a coping strategy. In rural Bihar, where family size is large, per capita landholding is low, and over and above that, the return from land is low due to floods, waterlogging and river bank erosion, migration is expected to be a widely practiced phenomenon. In all the studied villages 80%-90% of the households have at least one member who works in Delhi, Mumbai, Punjab, Kolkata, Kerala and so on and stays out of the village for 6-7 months a year.

Life in flood prone areas is characterized by a low level equilibrium manifested by subsistence living, setbacks via crop and livestock losses, and in some cases, through loss of life. In such a scenario, it can be argued that saving in assets like land and house, and

continuous adjustment to floods and erosion, is fuelled by remittances. Remittances tend to be the insurance, based on which the life-livelihood cycle in the flood prone area runs. We observe that the importance of remittances is so high that one could argue that one way to improve the life and livelihood of the people in the flood prone North Bihar is to make migration smoother and to design an efficient mechanism for smooth transfer of remittances.

Possible Interventions: Building Resilience

During our field research we explored through discussions with the respondents on different activities that could be promoted to minimise the adverse impacts faced from floods, waterlogging and river bank erosion. The respondents in our studied villages suggested myriad interventions. These interventions can be broadly classified under the following headings: reducing vulnerability, improving connectivity and improving productivity. The combination of the three is expected to contribute to building resilience in the life and livelihood of the people residing in the flood prone areas.

The interventions suggested under reducing vulnerability are expected to reduce the possibility of getting exposed to a natural hazard. In the event of a natural hazard taking place, the community would be able to cope with it thus stopping the hazard from turning into a disaster. One intervention that was suggested by people was embankment management. We argue that embankments that are already constructed are here to stay, but their operation, maintenance and management need to improve. We could follow a participatory model in line with the participatory models followed in case of canals and water supply systems. Hence we propose Participatory Embankment Management (PEM). Under PEM people would have management rights on stretches of the embankment. They will have right to plant and periodically harvest certain trees on these embankments for strengthening them.

In areas where there are no embankment, people have asked for embankment construction. To strengthen the river banks and to restrict bank erosion, the respondents also argued for certain kind of bank strengthening activities - like using porcupines².

²Porcupines are structural measures undertaken for strengthening the river banks. They have been found to be quite cost effective method for river training. Porcupines are pole-like projected structures, projecting in different direction and located longitudinal to the river bank. The structure resembles a porcupine. It is used to reduce water velocity, to trap sediments, intercept and break the circular flows that develops during floods and the structure can fill up holes developed on the river bank and bed with the trapped sediment. Porcupines can be made of bamboo, wood or concrete. The life cycle of bamboo, wood is lesser than the reinforced cement. Sometimes the bamboo/wood porcupines are filled with vegetation to form a green wall. A similar self-constructed structure was observed in a village which was located on the banks of Kosi in the Supaul district (<http://lib.icimod.org/record/27710/files/Chapter%206%20Physical%20Methods.pdf>).



Apart from these measures, the people also articulated the requirement of raised platforms in the village, where they could go in case of floods. It is important to ensure proper water and sanitation facility in such elevated platforms, as also a separate cattle shed for keeping livestock. Another level of intervention is at the household level: the respondents requested the need for houses on raised platform, such that the house does not get inundated in flood and they do not need to leave their houses (unless of course, it's a once-in-twenty five years kind of flood). Some respondents, who continued to stay inside the embankment, and are highly vulnerable to flood and river bank erosion, argued for a resettlement and rehabilitation policy whereby they are offered agricultural and homestead land in areas beyond the embankment.

One cross-cutting observation that runs through all the study villages is the remoteness of the villages and the pathetic state of roads and the frequently observed non-existence of bridges. Smaller bridges over river channels which criss-cross the villages are particularly important in this region. The remoteness creates a big challenge for the people to access any developmental service of the state – be it health or education. Lack of connectivity also constrains income enhancement, as access to markets becomes a big constraint. At the village level, lack of public infrastructure like boats, electricity and sanitation system affects the health and well-being of the community.

To address these issues, the respondents articulated four specific interventions that would improve connectivity and have an impact on health and well-being of the community. They are: (i) improving the roads and building small bridges that connect villages to the bigger roads, (ii) providing electricity: in case grid connectivity is a problem, electricity can be provided through off-grid solar panels, (iii) improve sanitation facilities: the dismal condition of sanitation across all the studied villages, have adverse impacts on the health, particularly for women and children; (iv) availability of boats in adequate numbers which would enhance the mobility of the people during floods.

The third set of interventions aims at improving productivity through making maximum utilisation of available resources. The three important resources with the people in rural setup are: natural resources (land), physical resources and human resources. The second and the third enable the individual/group to make maximum use of the first resource.

In the flood prone areas in North Bihar, landholding

is small and even within that some land remains out of cultivation for a significant part of the year on account of waterlogging. To make use of such land, one intervention suggested addressing the problem of drainage congestion by draining out water from the inundated lands. In case de-waterlogging is not possible because of physical constraints, we argue, that efforts need to be directed to make these pools of water productive. The ICAR institutes in Bihar have tried out agro-forestry models surrounding this waterlogged land involving a combination of *makhana* and fisheries with side bunds and plantation on the bund. Such initiatives could be piloted and promoted. But these activities are dependent on the depth of water level and the duration of waterlogging. Hence in future, a detailed micro-level district river basin based planning on these is required.

One major problem that the agriculture in Bihar, and cultivation practices in flood prone areas in particular suffer from is the access to assured and cheap irrigation. Irrigation is an important physical resource is required to intensify agriculture and cultivate productively. The need is far more in the flood prone areas as a long part of the crop year is lost in many of these villages on account of flooding and waterlogging. In order to compensate the loss, the farmers have to intensify cropping in the dry season for which access to irrigation, and electricity (instead of expensive diesel), is important. The only caveat here is the increased dependence on groundwater, which is harmful in the long-run, either through depletion of the water table or from geogenic contamination like arsenic. Some of the respondents have also argued for increasing the use of river beds for vegetable cultivation which would then contribute to increased income and nutritional security.

Education contributes to human skills and in the long-run is an important resource for livelihood prosperity, but education is an immediate casualty from floods. To address this problem, a model of floating schools could be designed in the extremely flood prone villages. Such models of solar powered floating schools are already prevalent in the flood prone areas in Bangladesh (<https://www.wise-qatar.org/solar-powered-floating-schools-bangladesh>).





This village is affected by erosion alongside the river bank

Eastern Uttar Pradesh

Background of the Study

The study in Eastern Uttar Pradesh (UP) took place in nine villages spread over three districts, namely, Deoria, Gorakhpur and Kushinagar. In Deoria, three villages were studied from Rudrapur revenue block; in Gorakhpur, we studied two villages each from JangalKaudia and Badhalganj blocks; and in Kushinagar one village each from Khadda and Hata block in Kushinagar was studied. The size of the study villages varied widely – the number households ranged between 200 and 3200. Most of these villages were heterogeneous in terms of their caste composition. In only two of the nine studied villages, the habitation had one or two caste groups, all the remaining villages had four or five caste groups.

Typologies of Villages based on Spatial Location

The study villages were located either on larger rivers like Rapti, Gandak, and Ghagraor on smaller tributaries like Gurra, Rohin and Kuanao. Most of the study villages were located very close to the rivers. On an average, the nearest river would be little more than half a kilometer away in these villages. Their location

exposed them to flooding, waterlogging and river bank erosion.

The level and kind of vulnerability that the villages tend to experience from natural hazards like floods and river bank erosion is strongly linked to the spatial location of the village. The villages located closer to the river banks tend to be more prone to floods, villages which are on the banks of the rivers tend to be more prone to river bank erosion, and villages between two rivers – in the *doab* area – are highly vulnerable to floods from rising water levels in the adjoining river or from the backwaters of the larger river when the latter is at spate.

Embankments tend to have differential – sometimes contradictory – impacts in terms of enhancing or reducing vulnerability in the life and livelihoods of the population in the riparian areas. As noted in case of Bihar, impact of an embankment is different for a village which continues to remain within the embankment vis-a-vis a village outside the embankment and located in the “safe” area.

Among the nine villages that were studied, three were located in the *doab* area. These villages were



located on a smaller tributary joining the larger river in a few kilometres. None of these villages had any embankment and hence they are prone to flooding and waterlogging. The flooding usually would take place once the tributary is in spate and the water spills over the river bank to the adjoining area. In due course of time, the water level in the river channel comes down, and the flood water drains out of the flooded area gradually. But by that time the larger river may be in spate and this process of recession gets hampered. The backwaters from the larger river then floods the tributary and does not allow the flood water to get drained out. As a result there is a prolonged period of flooding and waterlogging. The situation further deteriorates if there is drainage congestion or if there is a gradual rising in the river bed in the larger river, which is often the case when the rivers are embanked.

In one of the study villages, originally located on the river bank, people resettled themselves on top of a nearby embankment. In the original location, the village would suffer a lot of damage from flash floods from the adjoining river Rohin, which originates from Nepal and floods with every high precipitation in the mountains. One of the study villages which remained within the embankment was prone to river bank erosion and floods, and as a result a continuous exodus of people from the village was witnessed. Three among the studied villages were located outside the embankment. In one of these three, people continued to go back to the original settlement where they had agricultural land inside the embankment, and practiced agriculture in the non-flood months.

In four villages, the habitation was forced to shift from an earlier location because they were extremely vulnerable to hazards like bank erosion, which would render people homeless and landless. In one of these villages, the habitation was inside the embankment and would be prone to flood as well as river bank erosion. It was reported that nearly half of the village land got washed away as a result of river bank erosion. As a result, some of the households were forced to resettle on the other bank of the river, while some went to the land adjacent to the adjoining highway. In another village, originally located between the river Rohin and the embankment, the inhabitants have settled permanently on the embankment since 2001. In another village, originally lying inside an embankment, the government provided the villagers with land to stay but no agricultural land. Their old agricultural land would lie within the embankment. As a result, the people continued to stay in the old village

inside the embankment in the non-flood months, in order to practice agriculture. They would move outside the embankment in the flood months. In the fourth village, the original habitation was on the banks of river Gandak, on the western side of the railway line. In 1998, an embankment was constructed adjacent to the railway line. As a result of this construction the village got resettled to the eastern side of railway line. This was the only village out of the four where vulnerability to floods reduced with relocation.

Flooding, Flood Months and Type of Floods

Usually flooding would start in the month of July-August and continue till October-November. Waterlogging, often an outcome of drainage congestion, was reported to be a major problem in the area. Most of the study villages reported to be in waterlogged condition for three to four months in a year. In some areas, water would recede in a matter of seven to ten days, but these areas are also prone to flash floods, often a consequence of high intensity precipitation in the upstream Nepal Himalayas.



Flooded habitations





A portion of this house located on the river bank has been eroded by the river

During Floods: Coping and Relocation

The respondents often referred to the major flood in 1998 and 2001 when most of the people (80% of the households) from these villages had to leave their village and resettle in the nearby areas. During floods people leave their houses and often temporarily relocate to the nearby embankment; this pattern was found in five of the study villages. One village, which was inside the embankment, moved out to the “safe” area beyond the embankment. Apart from the embankment, people also moved to nearby places located on higher grounds, including other habitations and the nearby highway.

Most of the places where people would relocate were less than a kilometre from their villages, and depending on the period of flooding and waterlogging, the affected population would continue to stay in these places. We found that some people might continue to stay on the relocated land for months together. Usually people started relocating as the flood waters entered the village and the water level kept rising.

In all but one of the studied villages, the respondents reported that relocation to higher grounds was largely a self-initiated and self-managed process.

However, communities from different castes would help each other in relocation. In one of the studied villages, the *nishad* and the *mallah* community traditionally owned boats and their livelihoods were dependent on the rivers. These people, though lower in the caste hierarchy in a caste-ridden Uttar Pradesh village, would take the leading role in relocating people to higher grounds, and in return of this service would usually get some grains from the villagers. Usually during relocation the elders would carry their children and livestock with them. In seven of our studied villages, the villagers shared that some of them would continue to stay in the village despite floods.

In villages with *pucca* houses, around 45% of the households continued to stay back despite floods but moved to the rooftops. Sometimes this is temporary: the family continues to stay on the roof-top till they get a boat to move to higher grounds; in some other times they would stay for a longer period of time (or for the entire flooding period). The reason of staying back in the village and shifting to the roof was to safeguard the family belongings in the house.

Out of the nine studied villages in eastern Uttar Pradesh, only three villages had boats and these too,



very few in number. The lack of adequate number of boats, crucial for transportation and access to various facilities, especially during the flood months, added a further layer of vulnerability in these villages.

Floods and Agriculture

Agriculture was the prime livelihood option for people in the studied villages. Most of the households were either owner cultivators or sharecroppers. The latter were either landless or had been effectively reduced to a landless status when the land was lost to the river as a result of river bank erosion or due to the changing course of the river, or when the land became uncultivable because of flooding/waterlogging and ensuing sand deposition.

According to the respondents, maize (in 8 villages) and paddy (in 7 villages) were the dominant crops in Kharif, while wheat (in 9 villages) and mustard (in 5 villages) were the dominant crops in Rabi. Summer cultivation was found to be low, and wherever people practiced summer cultivation on small patches of land, they would mainly engage in vegetable cultivation.

Flooding and waterlogging adversely affected agriculture in the area. This happened mainly through

two processes: first, the flood water carried sand particles and as a result sand deposition brought in by the flood waters (and not silt) on agricultural land would render some land uncultivable for years. In the study villages, we found that around 30% of the agricultural land might have become uncultivable as a result of these problems. Second, the agricultural land was vulnerable to getting washed away into the river as a result of river bank erosion. Given the importance of land in the life and livelihoods of the rural populace, river bank erosion had severe adverse impacts on the affected people. In some of the studied villages, we found that large tracts of land, sometimes half of the habitation, went inside the river, rendering people landless, homeless and helpless.

Sometimes planned human action also imposed an element of vulnerability in the life of the people in the flood prone areas: In one of the studied villages, sand mining from the river bed was reported to accentuate the process of bank erosion. In some villages, we found that embankment construction caused people to relocate to an area designated “safe”, but the displaced population did not get adequate compensation and as a result, remained landless and sometimes homeless.



Multi-tier cropping in the flood plains





Sand tolerant agriculture in the flood plains

As a result of natural hazards, livelihood intensification gets constrained and migration becomes both a livelihood diversification and a coping strategy. During our field research, we also came across some pilot interventions on sand-tolerant agriculture promoted by some non-governmental organisations. These interventions are important as they allow the flood affected agriculturists to adapt to the vulnerable situation that they face. These need to be promoted and scaled up aggressively.

In many villages people adapted to the natural hazards and the resulting adverse impact on agriculture by bringing a change in the cropping pattern: in some villages, paddy got replaced with gram and in some other village, people cultivated vegetables in small patches instead of large scale potato cultivation. As a result of floods and river bank erosion, the asset base and the livelihood strategies available for the inhabitants got affected, and hence an increase in landlessness and indebtedness was reported by many respondents.

Floods and Animal Husbandry

Apart from agriculture, animal husbandry was a

widely practiced livelihood activity in the study villages. Within animal husbandry, dairy was found to be dominant. On an average, around 70% of the households are engaged in dairy. The other important activity was goat rearing and around 13% of the households were engaged in this activity.

Livestock, like land, was found to be susceptible to adverse impacts from floods. The floods affected the livestock population in two ways: (i) direct loss of animal and cattle in floods as the force of flood water might wash away the livestock population, (ii) during the flood and post-flood months, the animals are susceptible to various diseases which often resulted in livestock mortality.

The loss of livestock adversely impacted the owners and sometimes discouraged them to take up animal husbandry as a livelihood activity. In seven of the nine studied villages, the respondents' reported that animal loss would take place due to floods and that such losses adversely affected the income from animal husbandry. According to some of the respondents, milk production reduced by half as getting fodder for the cattle was difficult and hence the income from dairy often reduced drastically.



Health and Education in Flood Prone Areas

In all the villages, the respondents reported an increase of diseases during the flood months. The diseases were either water borne diseases such as diarrhoea, or skin diseases which resulted from long-term exposure to polluted and often toxic flood water. In the studied villages, average distance that people had to travel to reach a treatment centre was around 13 kilometres. But access to health services is a big challenge in most of these villages. This was largely because the villages were remotely located with dismal road condition. The number of boats, an important mechanism of transportation during floods, was also inadequate in the area.

component of moral hazard on the part of the teachers also works, and on pretence of inaccessibility, teachers tend to deliberately skip attendance.

- In some villages where the children had to travel kilometres to a neighbouring village to attend school, access to the school for the student could also be difficult, even if the school is located on an upland.

Migration in Flood Prone Areas

In Eastern Uttar Pradesh, like in most other flood prone areas, where the life and livelihood is increasingly vulnerable to natural hazards, migration



This school located on lowland gets routinely submerged during floods

In seven of the nine studied villages, the village had a primary school. But in all these villages the respondents reported that the school remained closed in the flood months. The closure of schools during floods are cause by following:

- The schools, if located on upland, become a relief camp
- If not located on upland, the access to schools becomes challenging for the teachers who would come from outside the village. Sometimes a

is both a process of livelihood diversification and a coping strategy. In the studied villages in eastern Uttar Pradesh, migration is a prevalent practiced. In the nine studied villages, more than 80% of the households would have one or two members of their family who have migrated to far off places like Delhi, Mumbai and Hyderabad in search of livelihoods. The duration of the migration was found to be around three to four months. We believe that like in Bihar, even in eastern Uttar Pradesh, migration might be the only fuel that



runs the subsistence and vulnerable economy that characterises the flood prone areas.

Possible Interventions: Building Resilience

The respondents in the nine studied villages reported myriad problems that they face as a result of flooding, waterlogging and river bank erosion. These problems manifested in terms of enhanced vulnerability that constrained the affected population to access and productively use their assets or resources and to pursue a livelihood strategy that would result in a desired livelihood outcome (and achieve their aspirations).

In order to reduce the problems they face, a number of possible interventions were suggested. We can broadly club these interventions into three broad conceptual headings: reducing vulnerability, better connectivity and enhancing productivity (through livelihood diversification or intensification). It is expected that a simultaneous fulfilment of all the three will contribute to building resilience in the life and livelihood of the population residing in the flood prone areas.

Under reducing vulnerability the interventions include:

- Protecting the villages from river bank erosion through bank strengthening activities.
- Regular repair and maintenance of embankments – here we would like to argue once again the importance of PEM (details can be found in the chapter on Bihar)
- Protection of crops against animal attack through innovative fencing.
- Curtailing sand mining; otherwise it accentuates the erosion process.

The interventions that were found to improve the otherwise dismal status of connectivity include:

- Better road facility for better communication.
- Improved access/ownership to boats in the village, which would then help the affected families to increase their mobility, access development services and even pursue certain livelihood strategy.

The interventions that would enhance productivity through better utilisation of the resources include:

- Strengthening dairy farming, a dominant livelihood strategy found in the studied villages
- Setting up of a maize processing unit.
- Design livelihood interventions that would create employment.



Upper Assam

*Approach to a house
built on stilts*

Background of the Study

The study in upper Assam covered 10 villages in four districts: Dhemaji, Lakhimpur, Sibsagar and Jorhat. On an average, the villages had around 395 households, but the number varied widely within the studied villages. While some villages in Sibsagar district had less than 100 household, one village in Lakhimpur and one in Jorhat had 1500 and 600 household respectively. In four of these villages, the entire community belonged to the Mishingtribe and in two other villages they were the majority population. The caste Hindus were majority in three villages. Only one village had a predominant (nearly entirely) minority population. The social demographics in Upper Assam is different from Lower Assam where many of the studied villages in Dhubri, Barpeta and Nalbari had a dominant minority population.

Typologies of Villages based on Spatial Location

In terms of the settlement of the habitation, two villages were located between the embankment and the river, three villages were located outside the embankment and the remaining five villages had no embankment. Since 2000, around five out of the studied 10 villages have been relocated on account

of river bank erosion. In the study villages, the three major rivers were Subansiri, Siang and Brahmaputra. Apart from these there were smaller tributaries like Sili, Dimo and Singra. On an average, these villages are 550 metres away from the nearest river bank. Such close proximity of the villages with the river makes them extremely vulnerable to the floods and river bank erosion.

Flooding, Flood Months and Type of Flood

In the north-eastern district of Dhemaji, floods would start as early as in April and flood may continue till September. In the adjoining western district of Lakhimpur, the first bout of flood would come in July-August and might continue as late as October. In Sibsagar and Jorhat, located on the southern bank of the river, the flood months usually starts from June-July and continue till September, sometimes till October. Flood water would enter some villages at least five times during the flood months, while in some other villages, this would be so frequent that the villagers would lose count.

Once the flood water enters a village, it might continue to spread slowly and remain spread over a long period of time. Sometimes if the flood is akin

to a flash flood, the water may go down rapidly once the water level in the river channel reduces. In four study villages, the flood water inundates the village for an extended period of three months. In four other villages, flood water would remain in the village for 10-15 days, before starting to recede. Given the enormity and the intensity of the flood menace, the villagers relocate to high grounds.

During Floods: Coping and Relocation

In one of the villages, the habitation relocated on the top of the embankment. This was a village in the Dhakuakhana area of Lakhimpur district. In 2007, the village was completely washed away from the floods in Brahmaputra. According to the respondents, the embankment was less than half a kilometre and so when the flood water entered the village, the entire village (ran and) settled on the embankment. The villagers described that the force of the flood water was tremendous and the roar of the gushing water sounded like a bomb when it hit the villages. Given the paucity of time, the villagers could not save their property from the floods – everything got washed away. The people barely managed to get to the embankment and save their lives. Since then the habitation has continued to be located on the top of the embankment.

Among the remaining nine villages, in five,

the people temporarily relocate to the nearby embankments, in two villages the people would relocate to nearby schools and in the remaining two villages, people would usually shift to the nearby highway, located on a higher elevation. None of these relocation points were too close to the habitation. On an average, they were located within a distance of three kilometres from the habitations. The distance that families had to travel before they could relocate themselves to a temporary relief camp varied across the villages. While in some villages people had to relocate to the road or to a school adjacent or even within the village, in some other villages, relocation and relief camps in schools and on embankments were found to be some 8-10 kilometres away. It was reported that the people could stay in the temporary relief camps for a period of 45-50 days.

In most of the villages the relocation is self-initiated; relocation would take place once the flood water entered the village. In six of the 10 villages that we studied, the people have mentioned that the Circle officer from the District Disaster Management Agency did come to visit them, but after they had relocated and set-up a relief camp on their own. Sometimes (like in one village in Dhemaji), the local non-governmental organisation played key role in the relocation and relief process.



People depend on boats for transportation



Once the flood water enters the village absolute chaos reigns. The force at which flood water enters gives very little lead time to the flood affected population to relocate to relief camps on higher ground. In some of the studied villages, the respondents barely managed to save themselves by moving to higher grounds as soon as possible. Sometimes the people could not even wait for day break and had to relocate during the night to save their lives. In some other villages, the respondents just had enough time to rescue their children, and move to the relief camps. In some of the villages dominated by the Mishing community, where the houses were located on a higher elevation, the people had enough time to carry their children and the essentials, but had to leave their livestock back in the village. While in other flood prone areas, the respondents had some time to carry their livestock with them to the relief camps/temporary higher grounds, the flood menace in the villages of Upper Assam was so severe that the people barely managed to save themselves and were forced to leave the livestock behind.

Boats are an essential multi-purpose resource among the people in the flood prone areas. They are the most important for transportation during floods, often they are the only mode of transportation during rescue and crucial for accessing health and other developmental

services. In eight out of 10 villages, the respondents reported that there were boats in the village. At the very least, there would be two to three boats in the entire village. However in one village in the Jorhat district, given the flood menace all households had boats, while in some other villages around 20% of the households had boats.

Floods and Agriculture

In flood prone areas it is not just the absolute quantum of land that matters, it is the quality of the land or more specifically, the cultivable potential of the land. Landlessness in hazard prone areas could be an outcome of social processes (where some caste groups are historically deprived of land ownership or have lost land on account of debt) or – more importantly – an outcome of natural processes like river bank erosion or changing of courses of the rivers. The cultivable potential of the land depends on the magnitude of the adverse impact of floods (which would often bring sand deposits on agricultural land rendering them uncultivable for years) and waterlogging (by effectively reducing the cropping window available for a farmer).

In two villages, one in Dhakhuakhana and one in Majuli, the entire agricultural land had been lost due to floods. In these villages the entire population is now landless. In the remaining eight villages, the proportion



Waterlogging of agricultural land



of landless households varied between 60% to a low 15%. The average landholding in the villages is around 4 bighas (1.2 acres or less than a hectare). Thus most of the farmers in the studied villages were marginal farmers.

Given the handkerchief nature of the landholding, intensification of land use (agriculture) becomes a necessary requirement for income maximisation from the available land. The necessity of agriculture intensification, which necessarily implies cultivation

as smallholder rainfed agriculture by using residual soil moisture. This model of agriculture constrains any possibility of intensification.

The dominant crop in the area is paddy: *saali* paddy and *ahu* paddy are the dominant crops. In some villages flood-tolerant *bao* paddy and *boro* paddy is also cultivated. The average yield of *ahu* is around 5.8 maund/bigha, for *bao* it is around 10-12 maund/bigha, and for *saali* paddy the yield is around 14 maund/bigha. The yield of *boro* paddy is much higher at



of more than one crop or as many crops as possible in a year, is further heightened in the flood prone areas because agriculture is often prone to losses during certain times of the year on account of flooding and waterlogging. But agriculture intensification is subject to availability of inputs like labour and irrigation. Thus access to irrigation is an important prerequisite for strengthening agri-based livelihoods in flood prone areas.

Out of the ten studied villages, two villages do not have any agriculture land. Among the remaining eight villages, around five villages have no access to irrigation facility, two villages have around one-tenth of the land under irrigation and only one village has around half of its land under irrigation coverage. Thus the agriculture practiced in the area can safely be termed

around 20-25 maund/bigha, but it is cultivated only in villages which has some irrigation facility. Apart from paddy, the villagers also cultivated mustard, pulses and vegetables in patches. The respondents reported that the cropping cycle got affected from floods – floods would sometime reduce the yield of the crop (because of late sowing) and sometimes would result in complete crop failure. As a result, in three villages the villagers reported a change in the cropping pattern in recent years as an adaptation strategy. In these villages, there has been an increase in mustard cultivation instead of paddy. In one of the village where the entire agricultural land went into the river, the villagers have resorted to river bed cultivation of watermelon, and tried out sugarcane cultivation – but none were successful.



Cattle population is mostly of desi breed

Floods and Animal Husbandry

Apart from agriculture, animal husbandry is another prominent livelihood activity in rural areas. During the course of our field research we explored the prominence of this activity in the flood prone villages and its vulnerability to the natural hazards like flood, erosion and waterlogging that characterised most of the villages. In most of the villages, people reported the practice of goat rearing; 38% of the households were engaged in goat rearing. In seven out of the ten studied villages people were engaged in poultry farming. In all the villages, people had cattle – on an average, eight out every ten person were engaged in dairy activity. In five out of ten studied villages, in villages dominated by the Mishing community, piggery was an important livelihood activity. In couple of villages, dominated by Muslim population, fisheries was prevalent.

Thus goat rearing, dairy and piggery were a dominant livelihood activity in the area. At the same time, these were also vulnerable to natural hazards which resulted in loss of production and sometimes mortality of animals. In all the studied villages, the respondents reported loss of animal and adverse

effect of floods on income generation from animal husbandry. It was reported that often the flood is so intense that it washes the livestock away. The livestock was also prone to various water borne diseases and given the dismal state of animal husbandry departments in the area, morbidity often translated into mortality.



Piggery is common in Upper Assam

In terms of effect on income generation, while a household engaged in goat rearing could earn around Rs 5000 per year, his income was reported to be reduced by 50-80% due to floods. Similarly, the average income from piggery was around Rs 14000 which would reduce by 60-70% due to floods. The average income from poultry was found to be around Rs 3500 per year and the same would reduce by 50-70% due to the flood menace. Milk production also went down. In some of the flood affected villages where both agriculture and animal husbandry has been adversely affected due to floods, people have started moving into wage labour and have started migrating. This trend is applicable for the both male and female population in these villages.

Health and Education in Flood Prone Areas

The people, young and old, were prone to diseases which were either waterborne or resulted from a long exposure to contaminated flood water. In all the studied villages, people complained about the onset of waterborne diseases like diarrhoea and dysentery during and post-flood. Also the exposure to contaminated flood water resulted in skin diseases. The children were more prone to cough and cold. In such cases easy access to medical services becomes a necessity.



A patient being carried on a push cart

In six out of the ten studied villages, the respondents said that they got some emergency medical facility from the government. In eight villages, the respondents reported provision of emergency health services from non governmental agencies. But the lack of access to



Road conditions in some flood prone areas



government health facilities was a big challenge faced by the villagers. Most of the villages reported long commute to access government health services. On an average the Primary Health Centres were roughly eight kilometres away from these villages. Given the dismal status of physical infrastructure and the remote location of these villages, travelling eight kilometres for a sick person would be an ordeal.

In all the villages there were schools within the village boundary. But with the advent of floods the schools closed down because either the students were not able to come to the school or because the schools were transformed into rescue and relief camps. In one village in Dhakuakhana in Lakhimpur district, the entire village got resettled on the embankment, and the school too shifted to the embankment, and operated with temporary tarpaulin structure for four years. The problem in these villages was that once the kids stopped going to school for some months, they would get engaged in some labour job and subsequently many actually stopped going to school altogether. Thus the drop-out rates increased and often young people prematurely joined the unorganised labour force.

Floods and Migration

The villages faced myriad problems as a result of floods: in some villages, access to drinking water was difficult, particularly during the flood months; in some people faced difficulty in practicing agriculture and faced agricultural labour shortage; in some cases the major problem was severe loss of property which remained uncompensated or inadequately compensated by the government; in some cases, floods turned landholders into landless labourers; and in areas where land erosion was high people hardly had any other option but to migrate.

These problems magnified given the dismal state of communication, the resulting remoteness which then constrained the access to development services offered by the government. Despite these problems, the prevalence of migration among the flood affected studied villages in Upper Assam was lower than other flood prone areas like Lower Assam and Bihar. In Upper Assam villages, one in every two household would have at least one member who has migrated to far-flung areas such as Kerala, Mumbai, Chennai, Haryana, Hyderabad and Bangalore. In some of the villages, people would work as labour in the neighbouring state of Arunachal Pradesh, where a lot of construction work is being undertaken. One in every six households would migrate out of the villages

because of the loss faced due the floods and erosion. This proportion is much lower than the neighbouring state of Bihar and even less than the districts in Lower Assam.

While both Lower Assam and Upper Assam faced the brunt of floods, the extent of migration is lower in the districts of Upper Assam than in the districts of Lower Assam. The reason could be demographic disadvantage, in terms of higher population density, that the districts in Lower Assam faces compared to the Upper Assam districts. The districts in Lower Assam have larger family size and hence low per capita landholding and high pressure on land. As a result, sole dependence on agriculture is not enough to eke the livelihood of the land scarce but labour abundant households. As a result, high migration from Lower Assam districts acts both as a livelihood diversification and as a coping strategy. This demographical phenomenon is absent in Upper Assam districts. Also in districts of Upper Assam, the Mishing community has for ages lived with flood. The people in these districts have other non-farm livelihoods options like piggery, goat rearing, poultry, weaving and timber collection, which coupled with lower demographic pressure ensures that the people continue to maintain a low level livelihood equilibrium without resorting to migration.

Possible Interventions and Building Resilience

The respondents from the studied villages have highlighted the multiple problems faced due to floods, which influences their livelihood strategies, often constraining them from living a prosperous life. During the course of the field study, they have also drawn attention to the possible activities that could be taken up to address the problems and constraints. These activities can be divided into the following broad domains: enhancing connectivity (road and power supply), reducing vulnerability (construction and strengthening of embankments) and enhancing productivity (agriculture, irrigation pump sets and better marketing linkage). Conceptually, we would argue that the simultaneous fulfilment of all the three would contribute to resilience building in the life and livelihoods of the flood prone population.

One crosscutting reality that pervades all the flood prone areas – Bihar, Assam, (north?) Bengal and Uttar Pradesh – is the remoteness experienced by the flood prone villages. Commuting to these villages, even in the non-flood season, is a challenge. Often one has to take help of boats or two-wheelers, and sometimes





Elevated Hand Pump: Not very common in Upper Assam

walking is the only way to these villages. The road situation is pathetic and small streams crisscrossing the villages have no bridges over them. As a result, during the flood months these villages resemble islands encircled by swirling water. Communication further deteriorates during the flood months and access to government services, particularly health and education, become extremely difficult. No wonder that in most of the studied villages in Upper Assam, the respondents would talk about the improvement of roads and the requirement of bridges.

The spatial location of the villages – close to the river bank, on flood plains with no protective walls/embankment, beside a leaky embankment, inside an embankment (between the river and the embankment) – exposes them to varied degree of vulnerability to floods. In order to reduce vulnerability, in six out of ten villages, the respondents have either asked for construction of new embankments or have argued for a rehabilitation/strengthening of the existing embankments. Given the impact of embankments in other areas, for example in Bihar, these suggestions, shared by the respondents, need to be taken with caution. But in vast stretches where embankments already exists some form of Participatory Embankment Management (PEM) might be useful.

In most of these villages people would relocate to high grounds during floods. In the absence of highlands in the vicinity, paucity of separate spaces for livestock and humans in relief camps, and lack

of proper sanitation facility in the relief camps, the relocatees are vulnerable to material losses and health deterioration. To reduce this vulnerability, the respondents asked for high grounds close to their habitation, access to health, nutrition and sanitation (separate for women) services and provision of separate spaces for livestock in those high grounds. These high grounds in the form of raised platforms need to be constructed, perhaps using soil and rubble from river banks and waterlogged lands.

Productivity enhancement could only be achieved by ensuring optimal utilisation of the scarce resources that the people owned or accessed. To augment the value to the ongoing farm and non-farm livelihood strategies – by intensification or by diversification – the respondents highlighted the need to:

- Enhance their access to land which was otherwise subjected to erosion through compensation against the land loss,
- Provision of irrigation pumpsets with which agriculture could be intensified in the non-flood months,
- Promotion of sand-based agriculture on lands where there is sand deposition as a result of floods.
- Provision of boats to increase the mobility of the flood affected population
- Support and strengthening the marketing of produce from traditional non-farm activities like weaving, a practice common among the Mishing women.



Barak Valley

*Makeshift toilets
in the Haor area*

Background of the Study

The study in the Barak valley covered nine villages spread over the three districts that comprised the Barak valley: Cachar, Hailakandi, and Karimganj. These villages were located in Kalain and Silchar blocks in Cachar district, Lowairpoa block in Karimganj district and Algapur development block in Hailakandi district. On an average, the size of the study villages was around 400 households. Demographically most of these villages were dominated either by the Bengali speaking Muslims or Bengali speaking Hindus.

Typology of Habitations based on Spatial Locations

In two of the eight villages, a part of the village was located inside the embankment while the other part was located outside the embankment. The embankment was constructed beside the Barak river and the region was popularly referred as *Barakpaar*. The area was close to the Silchar town in the Cachar district. The other six villages were located outside the embankment. Most of these villages were located very close to the river banks: on an average, the river would flow 500 metres away from the habitation. In only one village the affected habitation was some 2 kilometres

away from the river. Given such close proximity of the habitation to the river, both category of villages – the ones inside and the ones outside the embankment, were vulnerable to natural hazards like flooding, bank erosion and waterlogging.

Haors in the Barak Valley Area

The *haors* are low lying wetlands abundantly found in the districts of Hailakandi, North Cachar and Karimganj districts. The *haors* could be crisscrossed by tributaries of a larger river. Despite being prone to flooding and waterlogging (the latter an outcome of poor drainage), the *haors* are also sites of human habitation. The people in *haors* comprise of both the older inhabitants of Assam and the refugee population which settled in the area during the partition of the country in the 1940s. During the course of our study in the Barak valley we visited the Bakri *haor* in the Hailakandi district, the Khelma area in the North Cachar district and the Sadhur Kutir in the Karimganj district.

Flooding, Flood Months and Type of Floods

The flooding could start as early as in the month

of May and the last bout of flood and resulting waterlogging of lands could continue till the month of October. In the villages from the Barakpaar area that are situated on the banks of Barak and in parts of Khelma lowlands there could be around six events of floods while in the villages in Hailakandi there would be one or two events of floods. The flooding and waterlogging could take place due to various combinations: breach of embankments, dysfunctional regulators and subsequent drainage congestion. According to the respondents in the villages in the *Barakpaar* region of Cachar and in Hailakandi, the submergence period could last from ten days to two weeks. In the Khelma region in Cachar and in parts of Bakri *haor* region in Hailakandi the submergence would last for months together.

In order to facilitate drainage and flood protection, way back in the 1960s, the Government of Assam constructed sluice gates and embankments. But over the years, due to lack of maintenance, these have weakened and have continued to remain in a state of disrepair. As a result when the river is in spate these embankments are prone to breaches and the regulators (sluice gates) fail to regulate the inflow/outflow of water. As a result, extensive area in the *haors* gets inundated during monsoon. Given that these are low lying lands, drainage is anyway a slow process which further faces congestion because of damaged regulators or road construction within the *haors*. In some of the *haors* where the elevation of the road has increased in recent years, the road would act as an embankment and a site for temporary relocation/relief camps during floods.

Relocation and Coping during Floods

In four out of the nine study villages in the Barak valley, the respondents reported that they would relocate from the village to higher grounds during the event of flood. They would go to the nearest high grounds in such cases: embankments, school, and hospitals or nearby market areas, where they would stay for a period of one-three weeks. Some respondents also reported moving to their relatives' residence during the flooding of their habitation. In order to reduce the risk of the house getting flooded ensuing property and animal loss, some of the respondents reported undertaking innovative adaptation measures like constructing the house on elevated land, increasing the height of the bed and storage of animal fodder at a higher elevation inside the house.

The habitations within the *haors* are most vulnerable

to flooding. We found that the inhabitants have undertaken myriad adaptation measures in terms of location of houses, choice of livelihood activities and transportation. Some of the houses were located at a higher elevation. These houses belong to people who migrated from Bangladesh in the 1940s during partition. These people, from their past experiences of staying in the floodplains of Bangladesh knew how to adapt their life with the persistent vulnerability. One such adaptation measure was to locate the house on higher elevation to ensure that the flood waters do not enter the house. The people individually or collectively own boats, the most efficient mode of transportation during the flood months and would undertake fishing in the waterlogged areas as a dominant livelihood activity.

Floods, Agriculture and Fisheries

Landlessness was found to be high in the studied villages. In five (out of a total of nine) villages, on an average, one-third of the households were found to be landless. The proportion of landlessness went up to 50-60% of the households in the two villages from the *Barakpaar* area of Cachar. As a result the people from those villages depended on myriad service activities in the nearby Silchar town.

The agriculture in the Barak valley can be characterised as smallholder agriculture where most of the landholders have handkerchief landholding. Average landholding size is around 1-1.5 acres. Given that some of the cropping year is wasted on account of flooding and waterlogging, an enhancement of agriculture based livelihood is only possible if these small parcels are subjected to intensive agriculture in the non-flooding months. But to promote intensification, a critical input would be access to cheap irrigation source. This is one input which was found to be most lacking in all the villages visited in Barak valley.

In most of the villages, some having a size of 350-400 households, one would find only one bore wells (Shallow Tubewells) and at the maximum six to eight pump sets. The pump sets were diesel powered and were used to lift water from the homestead ponds, streams and river. Access to irrigation was scarce and expensive. The pump rents were charged on an hourly basis and the rate hovered around Rs 150-200 per hour. Such high irrigation cost made irrigated cropping such as *boropaddy* cultivation, over a small patch of land, uneconomic despite the much higher yield than the largely rainfed crop like *saali* paady. The yield of



The level of this house has been raised through earth filling. Machaan cultivation being undertaken in the backyard and irrigated by the dug well.

saali paddy depended on the soil type: in sandy soil the yield was found to be low, around 8-10 maund/bigha while the productivity doubled in loamy soil. The normal productivity of *boro* paddy was around 15-20 maund/bigha. It was reported by the respondents that both the paddy varieties were susceptible to flooding, untimely rainfall and hailstorms, in which case, the yield may reduce by half and sometimes result in total crop failure.

One dominant livelihood activity witnessed in the villages in Barak valley was fisheries. Given the wide prevalence of low lying waterlogged land in the region, the *haors* and the *beels*, a large chunk of the population used the waterlogged lands to practice fisheries. The usual approach in case of fisheries in the *haor* was to create some bunds in the lowest lying areas and practice culture fisheries. During the field research we also came across villages in the Hailkandi district where most of the population would be engaged in culture fisheries. Here fisheries were practiced in small ponds on their homestead land. Though fishery has been a traditional livelihood activity in the region, production is vulnerable to floods. Fingerlings are washed away during floods.

Floods and Animal Husbandry

Among various animal husbandry activities, poultry was found to be widely practiced in the villages. In

some villages around 90% of the households practiced dairy. But according to the respondents the cattle holding came down over the years as there was an increase in cattle disease and mortality post-flood, and arranging fodder for the cattle was a challenge. Like in other parts of Assam, even in Barak valley the respondents complained about the dismal state of the animal husbandry department. During floods, the cattle also had to be relocated to higher grounds. Sometimes the people relocated their cattle to the nearby high grounds (like roads) and some of the times they brought their cattle to their relative's place during floods.

In this context one of the respondent in the Khelma area in the Cachar district reported that cattle mortality was also witnessed once the cattle were relocated to a different area during flood months. This happened as the cattle could not digest the grass in the relocated area. This respondent had made arrangement to store animal fodder within the house for the entire flood season, such that the cattle need not be relocated and stall feeding could be promoted. But despite these measures, cattle mortality could not be avoided. Since the last few years, this respondent has moved out of dairy completely. For similar reasons, goat rearing is also not a dominant livelihood activity in the area.



Water, Sanitation and Health in Flood Prone Areas

The water supply situation varied between the villages in the *Barakpaar* area and those in the Hailakandi district. The infrastructure and management is different in these two sets of villages. In the former, the source of water supply was the Barak river, from which community based drinking water schemes have been initiated as part of the decentralised management of the water supply systems. The coverage and the management of such a decentralised model was of varying performance. In one of these villages the coverage of taps (provided by the Public Health and Engineering Department) was around 50%. In the other village there were multiple water supply schemes, each were to be run by the Village Water Supply (VWS) Committee. But the VWS committee in one scheme was struggling to remain functional as the scheme itself was out of service for some time with no repair and maintenance activity.

According to the people these decentralised schemes were often a source for corruption and hence were often over-designed. So a scheme, on paper, would be sanctioned for 300 households, but to cater to 200-300 households one would need to install a 10 Horse Power (HP) motor to lift water, while only 5 HP motor would finally get installed. As a result, the scheme at its best would cater to half the number of designed households. The VWS also struggled to collect revenue against water supply and in proper maintenance of the system. Presence of a strong leadership in the VWS improved their performance in a few villages, but during our study, no such strong leadership was witnessed. Since the schemes were not functioning, effectively the people lifted water from the Barak river. The situation was more dismal in the villages in Hailakandi. In a village of 375-500 households it was reported that the village had only three or four hand pumps. Hence the villagers lifted water for drinking purposes from the homestead pond, in which they also practice fisheries.

Sanitation situation varied within the studied villages. While the respondents from the villages from the *Barakpaar* reported very low incidence of open defecation, the respondents from the villages in Hailakandi reported around 50% of the households to practice open defecation. Similar dismal situation was reported in the villages from the Khelma area in the Cachar district.

In the villages in Hailakandi and in Khelma, where sanitation and drinking water was a problem, the respondents reported increase in the incidence

of diseases in the flood and post-flood period. The common disease in the area include dysentery, diarrhoea, skin disease and malaria. In terms of access to health services during flood months, it was found that in most of the villages the nearest health centre was around eight kilometres from the village, access to which is a constraint during the flood months. In contrast, the two villages from the *Barakpaar* area had a medical centre within the village, but these medical centres did not have any medicine and hence the people had to go the neighbouring Silchar town for the same.

Education in Flood Prone Areas

Most of the studied villages had a dominant minority population. These villages had a madrasa and a lower primary school in the village. The nearest high school was somewhere between 2-12 kilometres away from the study villages. Given the proximity of the area to the Silchar town, the general education status was high in the Barakpaar villages compared to those in Hailakandi, Karimganj and in the Khelma area of Cachar. According to one respondent, who was also a senior teacher in an Upper Primary school, lack of adequate teachers and proper infrastructure were responsible for the deteriorating quality of education.

Migration in Flood Prone Areas

Given the vulnerability due to flood, subsistence nature of agriculture and limited scope of animal husbandry, migration becomes a coping mechanism in flood prone areas of the country. The incidence of migration varied within the studied villages. In the *Barakpaar* area, in one of the villages only around 10% of the households had some member who undertook long distance migration. But in the adjoining village, around 80% of the household migrated to the neighbouring state of Mizoram, but only few households undertook long distance migration. Given the proximity of the area to the Silchar town, most of the household were engaged in myriad services in the town. On the other hand, in one of the villages in Hailakandi, long distance migration was more than 80% while it was around 33-35% in the neighbouring village. In both these villages, people would migrate for a period of six months to one year. In the villages in the Khelma area of Cachar district, inhabited predominantly by the Bengali Hindu population, long distance migration was found to be low. In one village which had around 450 households, it was reported that only 8-10 people would go to nearby quarries for some work.



The case of Bakri *Haor* in Hailakandi district

Bakri *Haor* is located in the Algapur block in Hailakandi district. The *haor* area is divided into 12 parts (distinct habitations, Part-1 to Part-12) and parts of the *haor* falls under the jurisdiction of four panchayats. The total number of households in the *haor* is around 1857. Among the various parts, Part-4 of the *haor* remains completely inundated round the year and hence is devoid of any habitation. The *haor* is bifurcated by a road. The road was originally constructed in 1989 and converted to a paved road in 2013. According to the respondents, as a result of the paving of the elevation of the road has reduced.

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The *haor* is located beside the river Katakhal and there is an embankment between the *haor* and the river. But the breach in the embankment is not uncommon. The breaking down of the sluice gate, constructed to regulate the flow of water in and out of the *haor* further complicates the problem. As a result during the months of May-June-July, when the river is in spate, the area would be repeatedly flooded. During this time there would be two or three incidences of flooding and each time the flood water continued to cause waterlogging for a month to month-and-a-half. Subsequently, as the water level in the river channel goes down, the water gets drained out from the *haor* very slowly owing to the natural low lying topography coupled with drainage congestion.

While the increase in the flow in the river channel in certain months of the year and the resultant spillage in the adjoining flood plains is a natural phenomenon, the delay in receding of the flood water is more an outcome of a management failure. The reason behind the slow receding of water from these low lying land of the *haor* is the state of disrepair of the sluice gate. The importance of the sluice gate is realised when one looks into the overall fluvial-drainage pattern in and around the *haor*.

The distance between the adjoining river Katakhal and the Part-10 of the Bakri *haor* is around three kilometres. Around four kilometres downstream, the river Katakhal confluent with the larger river Barak. So when the river Barak is in spate, the backwaters moves up in the river Katakhal which might be already in spate. As a result of the combined flow there is a breach in the embankment, or the water would move into the *haor* through dysfunctional regulators and inundate extensive area. Further, there are two smaller streams which passes through the *haor*: the river Jaleshwar and river Fala. The distance between the river Jaleshwar and the Part-3 of the *haor* is around 3 kilometers and from Part-10 the distance is around 10 kilometres. The river Fala passes through the Part-10 of the *haor*. The river Jaleshwar drains into Barak, but the sluice gate on Jaleshwar which regulates the water flow is dysfunctional. As a result when Barak is at spate, the backwaters inundates extensive part of the *haor*.

Because of the proximity of multiple river systems, and dysfunctional and weakened protective and regulatory infrastructure, the Part-6, 7, 10 of Bakri *haor* are extremely vulnerable to floods. As a result, inhabitants from those areas have been forced to undertake certain coping measures. One such measure is individual or collective ownership of boats – the most efficient mode of transportation within the area. One adaptation measure that people in the *haor* have undertaken is to create temporary bunds around the land which are on lowest elevation and to practice fishery. Often such land would be leased out to individuals or cooperatives for fisheries. Increasing the elevation of the houses by soil filling is another adaptation mechanism.

The location of the houses on higher elevation (sometimes done artificially) is another adaptive measures. Sometimes the inhabitants cope with the flood water entering their houses by putting multiple charpoys on top of one another and locating the bed on higher elevation (like a *machan*). In this way, they manage to protect the household items when flood water enters the houses.

As part of the agriculture practice, the people in this area, as in other parts of the state, cultivate *saali* paddy but productivity remains vulnerable to flooding [from 15-16 maund/bigha the productivity can go down to 6-7 maund/bigha]. Similarly the *boro* paddy is also vulnerable to early monsoon floods and hailstorm during the late summer months and as a result the yield may decline from 20-22 maund/bigha to 6-7 maund/bigha. The rabi cultivation is very low in the area. Given the susceptibility of agriculture to flooding and waterlogging, the inhabitants in the area have taken to fisheries as a dominant livelihood option. Given limited scope of agriculture and animal husbandry within the *haor*, wage labour becomes both a diversification and a coping strategy. It was reported that around 80% of the households would have atleast one individual who would be travelling to nearby Silchar for daily wage labour. Some people also undertake long distance migration to far flung areas like Bangalore.

Since 2006-07 there are ten drinking water schemes in Part-6&7 which are run by the PHED, Government of Assam.



Water is supplied through handpumps and stand-posts. But a respondent complained that the duration of PHED water supply was infrequent, usually once in every two days, and the handpumps remain dysfunctional for extended periods of time. Hence the inhabitants in Part- 6, 7 & 10 of the *haor* would often source water directly from the *haor* for drinking and domestic purpose. One of the respondents from some other part of the *haor* shared that, “whenever we visit those areas [6, 7 & 10], we carry our own water bottles with us”.

There is one lower primary school and one madrasa in the *haor*. For the rest, the children have to travel for 1-5 kilometers from the *haor*. But given the challenges that the people would face in their life and livelihoods from floods, education often become a casualty. It was reported that out of the 453 households residing in the worst affected Part- 6, 7 & 10 part of the *haor*, around 10% households would have a person who has passed the tenth standard and only 2% households would have a person who has passed higher secondary and 2% households would have a graduate member.

The case of *Beel* in SadhurKutir in Karimganj

The major rivers in the district of Karimganj are Longai, Kushiara and Singla. According to one of the respondents, the propensity for recurrent flooding, a feature of the Longai river, has gone down in the recent years. In the last seven-eight years, he argued, the water in the river channel has reduced. One reason cited for the same was the construction of a dam on the Longai river for a 10 megawatts hydropower project in the upstream state of Mizoram. Another reason cited was the drying up of the springs which would otherwise feed the Longai river. Thus it was argued by couple of respondents that the floods in the Karimganj district are largely an outcome of drainage congestion and waterlogging – a phenomenon witnessed in the Sadhur Kutir village.

The Sadhur Kutir village is located in the Lowairpoa block in Karimganj district. The village has a large low-lying wetland, a *beel*, spread over a large area somewhere around 3000 bighas (990 acres). The submergence of such a large tract of land can be attributed to the water released from upstream, the slow rate of drainage from a naturally low lying area, and most importantly, the entering of backwaters of river Longai into the *beel*. In the immediate upstream of the *beel*, there are tea gardens; the irrigation water laced with chemical fertilizers and pesticides from these tea gardens also drains into the *beel*. A small river Kankra passes through this *beel* and drains into river Longai. The backwaters were able to enter the *beel* because one of the two sluice gates, constructed to regulate the flow of water, was defunct for last four-five years. As a result, during the monsoon season the *beel* had seven-eight feet deep water. Given these circumstances, around 60% of the people had boats.

There were around 250 households in this village and of them around 200 households depended on this *beel* for their livelihoods, the rest were into construction doing masonry work. The villagers practice fishery in the *beel* during monsoon season. While some of the respondents complained that the high chemical content of the water had a detrimental effect on the fish production in the *beel*, the total fish production from the *beel* between July and October was around 30 Quintals. The fish was sold to the nearby fish markets. According to some respondents any intervention towards promotion of improved fisheries practices, like stopping of catching of fingerlings, could still increase the fish production manifolds. According to these respondents, such an intervention would then contribute to the food security, nutritional enhancement and increase income.

Around 35% of the households in the village were landless. These people would often lease in land, either in the form of 50:50 crop share for paddy and by paying cash on a per acre basis if they cultivate vegetables on lease. Given the waterlogged situation for most part of the year, only 8-10 households did *saali* paddy. During winter-summer the people in the village did cultivate *boro* paddy (1.5 T/acre), harvesting the canal water that drains out from the upstream tea gardens. But the backwaters of the river sometimes submerges the *boro* paddy crop.

As far as livestock is concerned all the households had cattle, desi breed, and nearly 50% of the households had goats. As a large chunk of land remains under water, the land for foraging is limited. Additionally, goats were found to be susceptible to disease during the flooding and waterlogging months. Veterinary service from the government is limited, and private service providers are expensive. As a result, in the recent years the proportion of households with goats has reduced by 25-30%.

The village had one tubewell, ten open wells and four handpumps but no PHED water supply. In terms of education the village had a lower primary school. For the rest the children have to move some five-ten kilometres from the village. The education status was low and it was reported by the respondents that out of the 280 households in the village, only around 20 households would have a standard ten passed candidate, around 12 households would have a higher secondary pass and only four households had graduates in their family. According to one of the respondents, who was a school teacher, the drop-out from the school was high as the children are engaged in various economic activities like catching fish, cattle rearing and child labour.



Disaster mitigation... increases the self reliance of people who are at risk – in other words, it is empowering.

Ian Davis

While natural disasters capture headlines and national attention short-term, the work of recovery and rebuilding is long-term.

Sylvia Mathews Burwell



*There also is
the plight that comes from
natural disasters; these
natural disasters could be
alleviated or dealt with; we
only need some time to do
it.*

Bhumibol Adulyadej

*Yet does not one
in a heap of ruins
stretch out his
hand, Or in his
disaster therefore
cry out for help?*

Psalms 57:1



Lower Assam

Background of the Study Area

The study in Lower Assam focused on four districts, namely Dhubri, Goalpara, Barpeta and Nalbari. We studied four villages in Dhubri, five villages in Goalpara, four villages in Barpeta and three villages in Nalbari. On an average, these villages would have some 550 households (there was considerable variation in the size of the village from a low 70 to a high 1000 in the region). In Dhubri and Barpeta, the villages were bigger in terms of the number of households and most people belong to the minority population. In Goalpara, the villages were small and most of the households in those villages were Garo or Koch Rajbanshi. In Nalbari the villages had a mixed population comprising of the Bodo community and caste Hindus. Minority population villages consisted of Bengali speaking Muslims (also colloquially referred as *Bhatia*) and Assamese speaking Muslims (also colloquially referred as *Ujani*).

Flooding, Flood months and Nature of Floods

According to the District Disaster Management Authority in Lower Assam, flood usually start

sometime in mid-May and can continue till mid-October. Some of the rivers in Lower Assam, like Manas, Beki, Gadadhar, Gangadhar, which are the northern tributaries of the Brahmaputra originate from the Bhutan hills. High precipitation in the Bhutan hills increases the water level in the stream channels and beyond a certain capacity, the water spills over and inundates the adjoining flood plains. Usually flooding is most likely in the three months, June, July and August. On the other hand, the community perception is that flood in Lower Assam usually starts from the month of June and could continue till October. The community did not expect an early flood, as was the case in 2015, and as a result a lot of standing crop was lost. In lowland areas with drainage congestion, and in areas located between two rivers, where the flooding is caused by either rivers, flood water might not drain out for months resulting in a prolonged period of inundation.

The districts in Lower Assam were affected by both flash floods and normal *sailaab* kind of flood. The flash floods come unexpected and is manifested by a sudden increase in the water level, mostly due to high intensity

rainfall in the catchment area or due to a cloud burst. As a result, large volume of water comes gushing in, spills over the banks, breaches embankment and floods large areas. The velocity of the water is high. Often the volume and velocity of water gets further accentuated by sudden release of water from upstream reservoirs. During our field research in the Goalpara district, the villagers spoke frequently of the flash flood in 2014 that took place in the Jhinhiram river and caused a massive damage in these villages.

During our study, we enquired about number of flooding events and the average duration of inundation/waterlogging for each of these events. It is expected that areas affected by flash flood would have relatively lesser number of flooding event and the spilled water would recede back to the stream channel quicker than in the case of *sailaab* where the flood would spread gradually and might take a longer time to recede. The inundation time was also expected to be correlated with the drainage congestion which would



Sailaab kind of flood

Floods are gradual, that is, there is a gradual increase in the water level in the river channel up to the Highest Flood Level (HFL) and the Danger Level (DL) and finally the water spills over the river bank. It then floods the adjoining area and hits the embankment constructed to prevent the flood water from spreading. If there are vulnerable points in the embankments then those sections might not withstand the pressure of the river water, the embankment breaches and a high wall of water gushes in to the surrounding areas. As the river beds gets silted, the bed rises, the effective storage and carrying capacity of the channel reduces, and spillage takes place even with lesser volume of water. According to one District Disaster Management Officer, flash floods causes more destruction compared to the normal floods. The former causes higher casualty and causes more damage to property.

then result in waterlogging for days and even months. In the flood-prone areas where the habitations are located at a higher elevation than the agriculture land, the floods might inundate the agriculture land for a longer time compared to the village. Sometimes the villages might not be submerged while the agriculture land might remain submerged for a prolonged period of time.

In Dhubri district the villagers faced 3-4 events of floods and a submergence period that varied from 3-4 days to a couple of months. This variation was a function of the location and the topography of the village vis-a-vis the river. The community has developed an intricate knowledge based on their experience and was fairly confident in telling that “*du kishthoyegechee teen bar hobo*” (two instalments are over, three more to go).



Some parts of Lower Assam in the Goalpara district, experienced flash floods in 2004 and in 2014 from the river Jhinhiram. The upper reaches of the river Jhinhiram lies in the hilly tract of Meghalaya and the river flows to the plains in the Goalpara district. In September 2014, according to the respondents, there was high intensity rainfall in Meghalaya, and hence the Meghalaya government released water from the reservoir into Jhinhiram. This sudden release of water from the reservoir along with rain water, resulted in a large volume of water coming down to Goalpara with high velocity, spilled the banks in Goalpara and resulted in loss of human life and livestock and also caused severe damage to property.

In Barpeta district, the people living in Mandiya block experienced around 5-6 events of floods and the land remained submerged for a period of two to fifteen days. In one village located on the bank of Brahmaputra, flooding would take place at least twice a month, while the agriculture fields could remain submerged for months (on one occasion we were told for six months). The prolonged period of submergence is often an outcome of drainage congestion.

The drainage congestion further is an outcome of several factors:

1. The village or the agriculture land could be located on lowland, either naturally or because the bed of the river had risen due to siltation.
2. If the land is between two rivers (*doab*) then the backwaters of the larger river can keep the area inundated for a long period of time. The smaller tributary might fail to confluence with the larger

river if the river bed has increased and hence the backwaters may inundate the adjoining land.

3. Developmental activities like construction of embankment, roads and railway lines could run across drainage lines without provisions for cross-drainage.



The fury of river bank erosion in Barpeta



4. The cross-drainage provided through pipes or through gated regulators might not be operated properly, might be dysfunctional and subsequently not repaired or might be plain inadequate compared to the volume of water to be drained out.

During the course of the fieldwork in Lower Assam



we found that many of the above factors, particularly 2, 3 & 4 caused waterlogging for a prolonged period. As a result, the cropping season got shortened and cultivable land remained fallow. In Dhubri we came across large stretches of land of upto 700 bighas that remained waterlogged for 11 months. In Goalpara, even in the case of flash flood, submergence was prolonged because the drainage outlet was inadequate. In Nalbari district we came across villages, located between rivers where drainage congestion was resulting in large chunks of land remaining waterlogged. These villages were located on lowland and were surrounded by two rivers: Pagladiya and Boroliya. It was reported that in the neighbouring 8-10 villages a total of around 3000-4000 bighas land remained fallow just because of waterlogging.

River bank erosion, a natural phenomenon, often has an adverse impact on life and livelihood of the people adjoining area. There is a dispute in whether it can be officially called a “natural disaster”, given its non-episodic but continuous nature. Nevertheless, it is an environmental hazard and at a massive scale. During the course of our fieldwork in Lower Assam we found severe impact of river bank erosion on the life and livelihood of the population.

In Dhubri district, in Char-Durahati village in Dhubri subdivision around 2000 bigha of land had been washed away into the river as a result of river bank erosion. As a result of this around 400/500 households have been displaced. It was reported by the respondents that there are cases where a house has been broken eight times by the river and new construction had to take place each time. In Barpeta district, the adversity caused by river bank erosion appeared to be more severe and vast. In Mandiya block, we came across a village right on the banks of the river Brahmaputra, SatrakumaraKonaraChatra which could be very well be termed as a “ghost village” – full of remnants of what used to be a village once upon a time. The respondents reported that in 2012 flood and river bank erosion claimed five villages. We were further informed that 17 villages in the Manikpur panchayat have been lost to the river completely as a result of river bank erosion. In Sompara village in Barpeta district, the respondents reported that river bank erosion was taking place on the eastern bank of river Beki and as a result, on an average, around four bighas of land is getting eroded every year. The respondents further informed that the bank erosion was taking place over the entire length of 50 km from where Beki leaves Bhutan till its confluence with the

Brahmaputra.

Social Structure and Vulnerability

The effect of flood, waterlogging and bank erosion may not be homogenously distributed among the population. Different sections of the society could be differentially exposed to the hazards and could experience varying degree of impact. The difference could be dependent to some extent on social hierarchy and the position of a particular community in this hierarchy. It could also be a function of certain practices of the community (for example, preference to stay close to the river) and access to resources (most important among them is land but also other resources like social networks).

During the course of our fieldwork in Lower Assam we came across various communities: the minority population in Dhubri and Barpeta, Garo and Rajbanshi tribe in Goalpara and the Yadavs in Nalbari. Enroute to Dhubri, informal discussion with a minority girl (refer to Box 1 in this section for more details) gave us crucial information on the social divide within the minority population – between the *Ujani* and the *Bhatia* community. The *Bhatia* community is often looked down upon by the *Ujanis*. The latter sees the former as hardworking yet money-minded who would spend their cash on buying and selling land (*mati*, refer to Box 1 for more details). Based on our observation it seems that the *Bhatia* community might be cash rich, might also be land rich, but given the big family size they still struggle to make a decent living. This community though relatively cash rich to the *Bhatias* would fare dismally low in the human development indicators.

The *Bhatia* community is a basket case of how vulnerability, could be a mix of a natural and a social context. Given their precarious position in the state politics (*Bhatias* are perceived as Bangladeshis who have illegally entered in Assam), the community choose to stay in the remote *Char* areas in Dhubri, or right on the bank – or sometimes right on – the river Brahmaputra, as was witnessed in Goalpara town. A part of this choice could also be because of greater familiarity with the waters than the land (one wonders if that's the reason why they see land more as a commercial resource to be transacted, rather than an emotional resource to be preserved and passed on to the generations). But these areas are bereft of most, if any, development services and are extremely prone to natural hazards like floods and erosion. Thus the *bhatias* are most vulnerable to natural hazards. In



general, both in Dhubri and Barpeta, we found that the minority population was residing very close to the river and they continued to do so in spite of frequent floods, river bank erosion, and in spite of the fact that the agricultural land was not cultivable on account of sand deposition.

Box 1: Relationship between Bengali speaking Muslims and Assamese speaking Muslim: Understanding from a 14-year old girl

On our journey to Dhubri, somewhere close to Bilasipara town our car broke down. We moved into the adjoining village, and gradually started interacting with a girl (later we came to know she was around 14 years old). She told us that the Bengali speaking Muslims who primarily reside in the *char* areas are colloquially known as *Bhatia* and the Assamese speaking Muslims are known as *Ujani*. There were 200 *Bhatia* families and 150 *Ujani* families in the village. She came from a mixed lineage - her father was a *Bhatia* and mother (who was physically handicapped) was an *Ujani*. Her father stays in the *char* area and comes to the village everyday via boat to sell milk. She and her mother live with her maternal uncle and her mother owns a shop in the village. According to her, the women if married in a *Bhatia* family have to toil round the clock. She also told us that usually the girls are married off early but she does not want to get married before she passes her tenth standard examinations. She did not want to get married to a *Bhatia* as they tend to “*khatiyekhatiye mere fele*” (do so much work that the wife would die out of fatigue). She further said that the *Bhatias* spend all their income in buying and selling land but their living conditions are poor as they do not spend on housing and sanitation. She took us into the village and showed us how the *Bhatia* houses were different from the *Ujani* houses. The hostility between the *Ujani* and the *Bhatias* also got reflected in their culinary choices. The girl told us that there were two hotels in the market one on either side of the highway. One is a *Bhatia* hotel and the other an *Ujani* hotel. She strongly recommended the *Ujani* hotel as we would find more options there, and said that the other hotel would only have “*bhatlankaaarpeyaz*” (rice, chilly and onion).

In Goalpara district, we could see how spatial location, of living in the hilly tract vis-a-vis the

plains, was exposing two different communities to a differentiated degree of vulnerability to floods. The Garos lived on the hills and their agricultural land—particularly the paddy growing land—was located close to the river. Given the nature of their habitation and the landholding, they face limited impact from floods. The impact that they faced was restricted to the submergence of their paddy fields. The Rajbanshi community, located few kilometres apart, resides in the plains. Much of their habitation and agriculture land is close to the river. The flood and waterlogging problems had a larger effect on their life and livelihoods. The Garo community and the Rajbanshi community both were dependent on the livestock as a source of livelihood. But while the Garo community could keep their livestock close to their habitation on the hills, the Rajbanshi community had to keep their livestock in the plain land close to their habitation. On advent of flood there is hardly any loss in the livestock among the Garo community, while in two villages dominated by the Rajbanshi community, the respondents reported death of livestock from the 2014 flash flood and complained about lack of a safe place for animal shelter.

Floods and Agriculture

The traditional cropping pattern in Lower Assam includes *saali* paddy (from July to December), *Irri* paddy (*Chinese boro*, from Feb-June), and jute (from March-August). Apart from these, in some areas people have started growing potato, mustard, and chilly. There is a culture of homestead cultivation of vegetables, mostly for self-consumption, though we have come across villages where vegetables are also sold. The floods, waterlogging and bank erosion were having myriad impact on agriculture:

- In some heavily flood-affected areas, like in Mandiya block in Barpeta district, people would cultivate paddy varieties only through broadcasting method. The costs were less, and loss from flood would be less, but the yield was very low, around 4 maund/bigha.
- The average yield of *saali* paddy hovers around 12 maund/bigha while the yield of *irri* paddy is around 23 maund/bigha. Both of these are susceptible to flood and waterlogging. In many villages the cultivation of *saali* paddy is not practiced on account of flood and waterlogging. In case the crop does not fail completely from flooding and waterlogging, the yield get reduced. The yield of *saali* paddy reduces by half (in one village we found



the reduction from 15 maund/bigha to 8.5 maund / bigha; in another village from 12 maund//bigha to 6 maund/bigha).

- In two of our study villages, we found that the agricultural land has become uncultivable due to sand deposition.
- In some villages, land would be uncultivable because of inundation for a long period of time, and in some other places the cropping season have shortened due to flooding and waterlogging.
- With the unexpected advent of flood, the cultivators aim to quickly harvest standing crops and minimise their loss. As a result, the demand for agricultural labour increases, and labour cost rises and hence the agricultural surplus goes down. During our fieldwork in Mandiya block in Barpeta district, we could see vast stretches of standing jute crop, destroyed by the first bout of flood.
- Increased adoption of new and commercially lucrative crops like potato was constrained by the lack of reliable seeds, storage and marketing facility. The dismal road situation that prevented heavy vehicles like trucks to move into the village added to the constraint.

The loss faced by the farmers during the flood months could perhaps be reduced or covered by rabi and summer crop cultivation. But given that the

land would be fit for cultivation quite late in the rabi season, the bulk of the cultivation will have to take place in the dry summer months. In these months intensive agriculture is possible subject to availability of cheap irrigation. In the districts of Dhubri, Goalpara, Barpeta and Nalbari in Lower Assam, we found groundwater—through diesel powered Shallow Tubewells (STWs)—to be the predominant source of irrigation.

On an average a village may have upto 100 STWs. The number of STWs were not uniformly distributed among all, some could have 5-10 borings while some had none. Most of the data in our fieldwork was collected at the village level, so the reason behind this inter-household dispersion is beyond the scope of our study. We also found that number of pumpsets were lower than the number of STWs in Dhubri and Barpeta (and to some extent in Goalpara). Thus in nine out of the twelve villages in these three districts we found the existence of pump rental market. We expected the rental arrangements to fall under one of the following category:

- (i) Hourly rate (Rs/Hr)
- (ii) Area based fixed pricing (Rs X/bigha)
- (iii) Fixed crop share (X unit of crop Y/bigha)
- (iv) Variable crop share (half or one-third of the



Loss of crop after the first bout of flooding



produce).

Hourly rates would approximate volumetric pricing; area based fixed pricing and fixed crop share is crop- and water-use neutral, and hence, approximates a flat tariff system; and in variable crop share, the pump owner would share the risk (and reward) of crop production along with the renter. We hypothesise that in natural hazard prone area we would hardly witness any variable cost contract. Among the twelve study villages, eight reported fixed crop share, six reported area based fixed pricing and only three villages reported rental arrangements at an hourly rate. The crop share was somewhere between one to three maund of paddy per bigha, while the area based pricing was reported to be somewhere around Rs 1200/bigha.

Only in Nalbari, the respondents reported rural electrification and hence we found electrically operated water extraction devices. But even here the respondents reported irregularity of power supply and hence the village had both diesel and electric pumpsets. The electric pumpsets were rented out at Rs 1000/bigha while the diesel pumpsets were rented out at an exorbitant rate of Rs 3000-4000/bigha.

Floods and Animal Husbandry

Livestock is an important asset to the rural household. Animal husbandry is an important off-farm livelihood activity which contributes to food security, essential

nutrition intake and contributes to the income of the household. In time of stress, they also act as liquid asset which could be sold in lieu of cash. During our field research we explored the nature of livestock ownership and animal husbandry activities followed by the people in the flood-affected areas. We also tried to explore the challenges they face due to floods.

In Lower Assam, on an average, around 75% of the households in a village practice dairy farming and around 87% of the population practice goat rearing. Given that Lower Assam has predominantly Muslim population, we did not find piggery as a dominant livelihood activity. In Barpeta district, only one in three households would practice animal husbandry. The reason behind the decline can be primarily attributed to the floods and river bank erosion. In these areas availability of green fodder and dry fodder for the cattle was a big challenge for the owners. To address this scarcity, the people moved to the *char* area, where they either grew grass or they collected wild grass. Lack of grazing land was another problem, and children – like in Bihar – would take the smaller ruminants to the *char* for grazing purpose.

Post-flood there is deterioration in health among the livestock. According to the respondents, veterinary services were very poor. They would travel quite a distance to take their livestock to the veterinary centre – only to find that the veterinary doctor is missing



Collecting grass for fodder from remote char areas



in the Centre. Many of our respondents, particularly in Dhubri and Goalpara reported mortality in cattle population. While in Dhubri this mortality was more in the post-flood months, in Goalpara the mortality resulted because of the flash floods.

In Nalbari district, in two of the three villages, the respondents reported practicing dairy farming as one of the dominant occupations, but they suffered from lack of knowledge in scientific practices. Both these villages went for Artificial Insemination (AI) program, but according to them, the AI program did not result in a desired outcome.

In terms of importance, livestock perhaps rank next only to children. In the event of flood if the flood affected population is relocating to high grounds, they would definitely carry their livestock with them. Finding a safe high ground for animal shelter was expressed as a concern by some of the affected people in Goalpara district.

(Dismal) Status of Infrastructure

For infrastructure, our focus was to understand two important aspects of physical infrastructure: roads and electricity. The status of road in any given area would define its extent of remoteness. The remoteness of an area in turn has serious implication on the overall human and economic development. It would define the access to basic services like health and education and would define the scope of different economic activities such as access to the market. Similarly, rural electrification also has important implication on overall rural development. Electricity for domestic use has an impact on education and quality of life. In an area with access to electricity, people would get a cheaper source



Dismal status of road infrastructure in Barpeta



of irrigation.

In the course of our fieldwork in Lower Assam, one general trend across the villages in all the four districts is the dismal road condition. In Dhubri and Barpeta, the road condition of the main arterial road deteriorates drastically as one moves out from the town to the villages. In the Agomoni block in Dhubri where the road conditions were better, the living standards were better. In Barpeta, certain areas do not have motorable roads and in some areas the road itself did not exist. Goalpara and Barpeta districts are criss-crossed by numerous stream channels and construction of bridges across these narrow and deep stream



channels has become important. During the course of our travel, we came across many such channels where the only mode of crossing the channel was via small hand rowed or motor boats. There were also a number of temporary bamboo or cane-made bridges on which one would have to walk gingerly to cross those stream channels. These bridges would be temporary and often breaks down once or twice a year. We also came across concrete bridges in Dhubri districts which were on the verge of breaking down in the absence of proper maintenance. In several places in the Balijona block in Goalpara, the road was not conducive for a two-wheeler and the only way to reach those places was by walking. The dismal infrastructure further increased the remoteness of these already far-off villages and made access to basic public services like health and education for the people of these villages extremely difficult.

Water, Sanitation and Health in the Flood Prone Areas

Access to drinking water and sanitation have serious implication on public health. This connection is perhaps nowhere more important than in the flood prone areas of the country. Lack of access to safe drinking water particularly during the flood period, and dismal status of sanitation conjointly would define the kind of public health challenge that one is looking at in the flood-prone areas.

In the thirteen villages (on which we have broad village level figures on sanitation facility), we find that on an average sanitation coverage is around 7%. Thus less than one in 10 household would have a sanitary toilet. Out of these villages, around ten have sanitation coverage close to zero. Most of houses in those villages either had *kachha* toilet or practiced open defecation or both.

Handpumps were the most common source for drinking water supply. During floods most of the villages reported depending on these handpumps as a source for drinking water. In case the handpumps get submerged in flood water, people reported drinking water directly from the river. In Dhubri, Barpeta and Nalbari handpumps were the source of drinking water supply, while in Goalpara dug wells were the prominent source. In very village, we found handpumps located on higher grounds from which the people would fetch water during floods.

If one brings in the information on (poor, rather pathetic) status of sanitation together with the information on the prevalent practices pertaining to

drinking water, one could hypothesise with a fair level of confidence that in most of these villages there would be high incidence of disease during- and post-flood period. In eight out of nine villages on which we have data, the respondents reported an increase in diseases in the post-flood period. The most common diseases were diarrhoea, jaundice and malaria. In some of the villages, mortality from such diseases were also reported. Subsequently, we enquired about where they would go for the treatment of these diseases.

Access to health services was extremely difficult from these remote villages. In Barpeta, we came to know that for certain villages, first, the patient would have to be brought to a roadway via a boat (because there was no road connection to the village); then, the person would be boarded on a push-cart to take the person from the bank to the nearest road/embankment; and from there a motor van would take the patient to the nearest hospital/PHC. During this treacherous transit, morbidity would sometimes translate into mortality. During the course of our fieldwork we actually witnessed a case of child mortality taking place during this long transit. Even after this long and treacherous journey to the hospital/PHC, the availability of doctors and hospital-bed was not guaranteed. Respondents complained that in absence of a doctor, sometimes the nurse and sometimes the *chowkidaar* would run the health centre. Sometimes the patients have to lie down in the corridors of the hospital, due to lack of beds as the prevalence of disease during and post-flood might cause patients to outnumber the beds in the health centre.

Migration in Flood Prone Areas

Migration is a major coping strategy in the flood prone areas. People move out of their village in search of jobs as the natural resources become gradually useless to be put to any productive use. Also remittances by migrant workers contribute to the well-being of the household in advent of crop failure and loss of land from erosion. The income from migration is also used to provide for liquid capital used to purchase essential inputs for farm and non-farm livelihoods in the non-flood season. So it is not uncommon to find that migrant workers adjust their migration days with the cultivation practices followed in their home region. During our fieldwork in Lower Assam we found that around 90% of the households would have one or two young males between the age group 20-40 migrate out of the area in search of job. They would go to far-flung areas like Kerala, Rajasthan, Jammu and Kashmir, Chennai, Bangalore and also to nearby places like Guwahati and Meghalaya.





*River erosion across one bank
and deposition on the other*

North Bengal — The Districts of Coochbehar and Alipurduar

Background of the Study

A field research was undertaken in nine villages in the Coochbehar district. These villages were under the jurisdiction of seven Gram Panchayats namely, Mahamari, Salbari, Nakkati, Balabhut, Belguri, Kuchlibari and Mistrop. Apart from these, we also visited one peri-urban habitation: Madanmohanpara, which is located on the outskirts of the Tufanganj town, to understand the vulnerability of peri-urban areas to natural hazards like floods and bank erosion (details in Box 1 in this section).

In the neighbouring Alipurduar district (a newly formed district carved out from the Jalpaiguri district), we studied three villages: Dakshin Shibkata, Jaipur and Deorali line-Khoklabasti. All the three villages are located on the foothills of the Bhutan hills. The Deorali line-Khoklabasti was few kilometres away from Bhutan.

While the demography in the villages in the Coochbehar district was dominated by caste Hindus and minority population, the villages in Alipurduar were dominated by tribal population (Santhal, Oraon, who are originally from the present-day Jharkhand, resettled in the tea gardens of Alipurduar by the British). In terms of topography, villages in Alipurduar were located on the foothills of the Bhutan Hills. In Coochbehar, which is south of Alipurduar, most of the

villages were located on the flood plains of the multiple rivers that came down from the Bhutan hills.

Typologies of Villages based on Spatial Location

None of the villages (including the one in the peri-urban area) were located inside an embankment. The peri-urban habitation (Madanmohanpara) was found to be located on an embankment. In six of the study villages, there were no embankments and three villages were protected by an embankment. In all these three villages the embankments were constructed in recent years. Five of the ten studied villages were located between two rivers, or located between two channels of the same river. In case of the latter, one of the channel would remain dormant around the year and only come to life during the monsoon season. So effectively these villages would become islands, *char*, during the monsoon months. One village, Balabhut-Khatarpar in Balabhut GP, was located in the immediate downstream of the confluence of four rivers. The rivers in the district of Coochbehar were Teesta, Mansai, Raidak, Gadhadhar, Torsa and Kaljaani – all part of the Teesta-Brahmaputra river basin. On an average, the number of households in these villages would be around 400. In eight of the ten villages the population was dominated by Muslims.



In the district of Alipurduar, out of the three study villages, two did not have any embankment. One of these, the Dakshin Shibkata village is located between two rivers which are the tributaries of the river Gadhadhar. Some parts of the village is located on low lying areas and are naturally prone to waterlogging (resulting from high precipitation). The other village without an embankment, Deorali line-Khoklabasti was located on a slightly undulating terrain at the bottom of the Bhutan hills. The border of Bhutan from



Bamboo-based porcupine have failed to restrict bank erosion in some locations

this village was around five kilometers. This village is located adjacent to a stream that came down from the Bhutan hills, the stream finally meets the river Torsa some kilometres downstream. Though the village did not usually experience flooding, the agricultural land adjacent to the river was subjected to occasional flooding, as most of these streams would carry large volume of water which often spill over the stream channels. The village Jaipur lies on the banks of the

river Jayanti. In 2012, the government of West Bengal constructed a one-kilometer long embankment to protect the village against floods. But the embankment is already broken at places. Beyond the embankment there is a SarbaSiksha Kendra school, agricultural land and very few houses and then an all-purpose road. This height of the road has been increased post 1993-flood and as of now the road acts as a second layer of embankment for most part of the habitation in the village. The SSK, agricultural land and some houses that lie between the road and the newly constructed embankment were prone to flooding and waterlogging.

The spatial location of the village restricted the access to various development services from the state, prominently health, education, water supply (and market) especially during the flood months. As a result, the population would be vulnerable to hazards like floods and erosion, but once the hazard became the reality, it would quickly turn into a disaster. This phenomenon become stark in *chit* Borolaukutir, and with respect to the villages in the Gaddarpar area.

The *chit* Borolaukutir is a small patch of land consisting of just seven households. The land is surrounded by Assam on all sides and crisscrossed by multiple channels of the rivers Gangadhar and Raidak. The only way to reach this village from the mainland is on a boat. The other two *chits* that surrounds it are Banyaguri and Belguri, which are in Assam. Altogether there are some 50 households on the *char*. In Borolaukutir, people did not have any land. During the Left Front government they were given land in these remote areas bordering Assam. The *chit* Borolaukutir used to have a larger area. Over the years, a chunk of the land has been subjected to river bank erosion. According to the

respondents, around 1000 bighas of land have been subject to river bank erosion. As a result of remoteness and the area's islandic status, access to government services—health, education, drinking water and electricity—is difficult. The people living in this *char* are hence highly vulnerable to natural hazards like floods and erosion.

The entire area of Gaddarpar is flood prone and the area falls under the administrative jurisdiction



of the four gram panchayats. In each of the gram panchayats, the habitations from the Gaddarpar area is few compared to the overall area of the gram panchayat. According to the respondents, since the entire Gaddarpar area falls under multiple panchayat jurisdiction and not under a single gram panchayat, the problem faced by the people in the Gaddarpar area does not get resonated at the gram panchayat or at the higher administrative level. As a result, the villages in the Gaddarpar area continues to face problems from floods.

Flooding, Flood Months and Nature of Floods

In the district of Coochbehar, the first bout of flood comes sometime in the month of July and the last bout of flood may continue to come till October⁴. In some areas the first bout of flood might start from June. Usually there would be four to five flood events during the entire period. Only in some areas in the Mekliganj subdivision, in the villages which are located on the banks of river Teesta, around three to four flood events per month were reported. In areas where drainage congestion was not a problem, the water level would go down within two or three days. But in areas where there is a problem of waterlogging, like in Madhya Dadhiyal and Madhya Balabhut-Khatarpar villages, the water would recede in ten days and sometimes it might take a month and half for the flood water to drain out of the submerged area.

In the district of Alipurduar there would be flash floods, where high precipitation in the Bhutan hills suddenly increases the water in the stream channel and once this small rivers reaches the plain areas, the bed become shallower and broader, and spills the water on its banks flooding adjoining areas. The same is true even for villages on the bank of the river Jayanti, a larger river flowing through the Alipurduar district. Usually the rivers are in spate during the months of July, August and September. The inundation period is less and the water starts receding in couple of days. In some villages the water recedes in a matter of few hours. In two of the three villages, the effect of floods was either restricted to only the agricultural land adjoining the stream channels or that part of land (that had some habitation, agricultural land and a school) in between a new, yet leaky embankment and a road (acting as a second embankment).

Floods and Agriculture

Agriculture is the main livelihood of the people in the flood prone areas of Coochbehar with more than 80% of the population in the study villages engaged in agriculture. Not all of them are owner cultivators. According to the respondents, around a quarter of the households were landless. Most of them would lease-in land and practice sharecropping. On an average, the land holding size would be hovering around 4.5 bighas (1.5 acres, less than 1 hectare). Thus, the agricultural



Lack of proper drainage in flood plains results in waterlogging

⁴As we write this report, the district Coochbehar is already facing the brunt of flooding.



practices in the area can be categorised as smallholder agriculture.

Generally in order to maximise income from the handkerchief holdings, the cultivators have to intensify agriculture. In this process of intensification, there are two general constraints and one geographic-specific hurdle that needs to be crossed. One general constraint is the access to human labour round the year. This might not be a big constraint in a landscarce, labourabundant households. The other constraint is access to irrigation, which is a necessary input if one has to extend agriculture in the dry months when the precipitation and the residual soil moisture might not be enough to fulfil the evapo-transpiration requirement of the crop. In the flood prone areas, agriculture might not be possible in some months of the year and the farmers might be forced to operate within a narrower cropping window. Hence, in the flood prone areas it becomes all the more important to extend cropping to the dry months of the year because a part of the cropping season, the kharif months, might be lost due to floods and ensuing waterlogging. Thus access to cheap and reliable irrigation becomes important. In this matter, Coochbehar performs better than most other flood prone districts.

In Coochbehar district, on an average, around 40% of the households had shallow tube wells (STW) and around 16% of the households had pump sets. The inter-village variation, in terms of number of STWs in a village, was found to be high. While in some of the villages nearly every household would have a STW, in some villages — remote and extremely flood prone areas — only 5-10% households would have STWs. Compared to STW ownership, fewer people owned pumpsets, the range was between 10-25%. In eight out of ten villages we found the existence of pump rental markets. In most of the villages, the rental was on an hourly basis, around Rs 150 per hour. In couple of villages, the rental was on an area basis, around Rs 1500 per bigha. Though during our travel to flood prone villages, we came across electrically operated pumpsets which showed proliferation of rural electrification for agriculture, but in our studied villages most of the pumpsets were powered by diesel. Only in two villages, we found electrically operated pumpsets and here the pump rental was based on area (Rs/bigha) for the electric pumpsets while diesel pump set owners charged an hourly rate.

Despite the floods, the major crop in the area is *aman* paddy. The yield of *aman* paddy was around 9-10 maund/bigha. The crop was vulnerable to

flooding, in which case the yield was reported to reduce by 50%. In only one village, where drainage and waterlogging was a problem, the farmers stopped taking *aman* paddy. Among the studied villages, *boro* paddy, the “silver bullet” behind the agrarian dynamism of Bengal, wherever cultivated, gave a higher yield of around 18-19 maund/bigha. But among the flood prone villages, *boro* paddy was restricted to people who had pump sets and had agricultural land close to the river bank or between the river and the embankment. Apart from the two major paddy crops, other crops like maize, mustard and jute was found to be cultivated sporadically in some of the villages. In some of the flood prone villages, the farmers cultivated watermelon and vegetables on the river bed. In some of the villages, it was reported that the sand brought in by the flood waters would deposit on the field and adversely affect cultivation.

In the neighbouring Alipurduar district, in the three study villages, landlessness varied between 23-50%. But people continue to practice agriculture as sharecroppers by leasing-in land. The agriculture in the area, like in Coochbehar, could be classified as smallholder agriculture as the average land was found to be around 3 bighas (less than 1 hectare). Like in the villages of Coochbehar, the farmers here cultivated *aman* paddy, pulses, maize and very few people would cultivate *boro* paddy. The average yield of *aman* paddy was somewhere around 7 maund/bigha and the yield would reduce by half in case the crop got affected by the floods. Though the *boro* paddy had a higher yield (around 14 maund/bigha), only few farmers could take it up. According to the respondents, the reason for low adoption of *boro* paddy was limited access to cheap irrigation source. The agriculture diversification noticed in the Coochbehar district was not observed in the studied villages in Alipurduar, though the former was much more prone to floods, waterlogging and bank erosion. We argue that the difference lies in the differential access to irrigation (or to broaden it further, access to water supply during summer months in the flood prone areas). The studied villages on a proportionate basis had lesser number of STWs and pump sets. The pump rental market existed on the basis of only hourly rates of around Rs 200 per hour. The importance of irrigation was high as the soil was sandy (or was getting sandy because of periodic floods) and would have low water retention capacity, thus demanding frequent irrigation. But the farmers were not be able to provide frequent irrigation because of the high irrigation cost and hence they altered



their cropping patterns. They stopped cultivating jute, a traditional but water intensive crop, and the respondents reported that they would rather practice low input subsistence agriculture.

Compared to the villages in the flood prone areas in Lower Assam and the Barak valley, the villages in Coochbehar show greater crop diversification. There are multiple reasons: First, unlike other areas, the land in Coochbehar was not under submergence for a prolonged period of time in spite of multiple flood events. In one of the studied village in Coochbehar district, where waterlogging occurred due to drainage congestion, the cropping season got reduced and agriculture was adversely affected. The second reason behind greater crop diversification was access to irrigation, diesel pump sets and more recently electric pump sets. In two of our studied villages, we came across these irrigation methods which allowed the farmers to increase cropping intensity by intensifying agriculture in the non-flood months. Hence the practice of vegetable cultivation, water melon, tobacco and potato cultivation was seen in some of the studied villages. The third reason—quite contrary to the experience in Bihar and Assam—was the presence of embankments. The embankments, constructed recently, have been able to give some protection to the agricultural land from recurring floods. But given the lessons that we have learned from other areas, it is yet to be seen whether these embankments would continue to have a positive impact in the long-run.

Floods and Animal Husbandry

In the flood prone villages in the district of Coochbehar, goat rearing and dairy farming are prominent activities. In seven of the eight studied villages on which data on livestock is available, more than three-quarters of the households have cattle – all *desi* breed. In three out of the four villages in which we have data on goats, we found that nearly every household has a goat. In one village, where flooding and waterlogging had reduced the cropping season, the respondents reported a decline in the cattle holding. In that village less than one-fifth of the households had cattle. The proportion of households owning goat also dwindled in the same village.

Animal husbandry activities got adversely affected due to floods and waterlogging, as there was a higher incidence of disease among cattle population during and post-floods. In such cases the adverse impact could be reduced if people have access to veterinary services. But the respondents complained that veterinary service

is difficult to obtain (dismal veterinary service was a general complaint) and often doctors had to be given a “private call” whereby the service becomes very expensive. In some of the flood prone areas close to the international border, illegal cattle trade and theft, and conflict with the Border Security Force in taking their cattle to the *char* land very close to the international border, are some of the problems faced by the people, which also capped the cattle population.

In the three studied villages in Alipurduar, animal husbandry was a mix of dairy, goat rearing, piggery and poultry. Cattle was mostly of *desi* variety and nearly all the households had cattle. Less than half the households had goat. According to the respondents the goat were more prone to diseases from floods. Respondents shared that during monsoons, the rivers carry dolomites from the Bhutan hills and the flood waters deposit this dolomite on the grassland. The goat forages on the dolomite-laden grasses which then result in morbidity and mortality. The tribal population in the studied villages also engaged in piggeries. Poultry and piggery contributed to income enhancement. These animals were also prone to diseases. The veterinary services, as seen in the neighbouring Coochbehar district, was in a dismal state and often, the only way that the villagers could access the veterinary services was by private means, which would then be a costly proposition.

Water Sanitation and Health in Flood Prone Areas

In five (of the nine studied) villages in Coochbehar, the people predominantly depended on hand pumps as a source of drinking water. In these villages, more than 70% of the households (sometimes all the households) had hand pumps. Most of these hand pumps had a bore depth of 30-50 feet and the respondents complained of high iron content in the water. During the floods people would either depend on the hand pumps which were located on higher grounds, or would continue to depend on the existing hand pumps and in some of the villages, people would directly drink river water. In the four villages in the Mekliganj subdivision located on the banks of the Teesta, the villages traditionally depended on dug wells and they continued to do so. In some of these villages there has been a proliferation of hand pumps in the recent years.

Among the eight villages, on which we have information on sanitation, in six villages at least half of the population practiced open defecation. In some of these villages around 90% of the household



practiced open defecation. Among the four villages located on the banks of river Teesta, we observed a different sanitation situation. The two villages on the left bank were protected by an embankment, were more accessible via motorable road, and had easier access to development activities of the government.



A newly constructed embankment protects villages from the mighty Teesta, while villages on other bank remain vulnerable



The sanitation situation was also better in these villages than the right bank villages. The two remote villages on the right bank of the river Teesta were exposed to frequent flooding, and became quite inaccessible during floods.

With poor sanitation and increased dependence on contaminated flood water, the flood prone villages usually stare at an adverse public health situation in the post-flood months. Quite expectedly in at least

four flood-prone villages, the respondents reported an increase in diseases in the flood and post-flood months. Most of these diseases were water borne diseases such as diarrhoea and jaundice, and vector borne ailments such as malaria and dengue.

While to an extent, irrigation solved some problems

on the agriculture front, the biggest problem due to floods is the physical inaccessibility brought in by dismal road conditions and lack of bridges to cross numerous river channels that would often encircle these flood prone villages. During floods, road connectivity becomes problematic and needs to be supplemented, if not substituted by boats. It was found that the distance of a Primary Health Centre (PHC) was somewhere between six to nineteen kilometres. Given the remoteness of these villages, even a six kilometres journey would take long as one has to arrange for small boats to carry the patients. Subsequently, even if one reaches a PHC, availability of a doctor and medicine (or both) remained uncertain. As a result, not only was the morbidity found to be

high but often the morbidity translated into mortality.

In the villages in Alipurduar district, most of the people would depend on hand pumps as a source for drinking water. Only in one village, Deorali-line Khoklabasti, located on an undulating terrain and very close to Bhutan, the respondents complained of water scarcity in the non-flood months. In order to get a secure source of water supply, the village has invested in three Deep Tubewells (DTWs). Using an electrified





Boats are the common mode of transport

pump set, groundwater is extracted from these DTWs. Subsequently, groundwater is supplied to households through multiple pipelines. On an average, six families would depend on each pipeline. An amount of Rs 150 per month is collected from the beneficiaries to run the scheme. In terms of sanitation facility, a significant proportion of the population, 60% and 40% households in two villages respectively, practiced open defecation.

Like in other flood prone areas, access to medical services was found to be a constraint in the villages in Alipurduar. On an average, the PHC from the studied villages would be around 2.5 kilometres, but the access becomes difficult as people have to cross multiple rivers which are insipate. The only mechanism for transportation would be boats, some of which are temporary, made out of banana leaves. The respondents reported cases of child birth and mortality (including by accidents) during the transit.

Education in Flood Prone Areas

In Coochbehar, in six out of the nine study villages, there was a primary (or a lower primary) school within the village boundary. In the remaining villages, access to the primary education was a problem. In one of these three villages, located downstream of the confluence of four rivers, the school was reported to remain closed for a month. In the *chit* area, where accessibility was a constraint even during non-monsoon months, access to education facility was a constraint. The worst scenario was reported from the right bank villages on the bank of river Teesta in the Mekliganj area. The villages were in remote locations and hence the teacher would attend the school only twice or thrice during the flood months. In another village, for three months of the year, the young children from the right bank village had to come down to the left bank village and stay in the village with the families of friends and relatives, in order to access the school which was located on the embankment that



Road conditions in flood prone villages in North Bengal



protected the left bank village.

In two of the three studied villages in the district of Alipurduar, there was a primary school within the village and access to schools by the students was not a problem. But the presence of the teachers, who would have to come to those schools from outside, was found to be irregular. In some other village, while the habitation was protected by a road, the school, which was between a broken embankment and the road, would get flooded periodically.

Migration and Floods

Given the general lack of access of developmental services in the flood prone areas and limited possibility of on-farm employment, subsistence agriculture, off-farm employment and the general remoteness of the area with dismal communication service, one would expect high out-migration. Based on the data obtained in five villages on migration in Coochbehar, around 63% of households had at least one member—most often a young male member—who worked in the nearby towns or big cities like Guwahati and Kolkata or travelled to far flung areas of Mumbai, Kerala, Delhi, Rajasthan, for a period of five to seven months in a year.

In Alipurduar, given the proximity of the villages with the Alipurduar town, around 50% of the households went to Alipurduar for eking their livelihoods. But long distance migration was also prevalent in the area. It was reported that around six girls from one village had gone out of the village in search of jobs. Given the economic backwardness in the area, trafficking was not uncommon in these villages. In another village, located on the Bhutan border, people would depend on the labour work in factories in Bhutan.

Possible Interventions

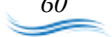
During the course of field research, we interacted with numerous people to understand the range of interventions that would be able to address the myriad problems from hazards like flood, waterlogging and erosion.

One cluster of interventions could be conceptually clubbed as improving connectivity. In the flood prone areas of Coochbehar and Alipurduar, like in other flood prone areas, the biggest constraint is the lack of communication. The dismal conditions of the roads and the non-existence or broken state of bridges on numerous small streams that crisscross the villages, constrain the access to various development

and support services of the state. These include healthcare, education, water supply and access to the market. As a result, with the advent of a hazard like flood, waterlogging and erosion, the people become vulnerable to adverse impacts and the hazard turns into a disaster. In case of the recurrent floods, this happens frequently. To a certain extent the potential of enhancing productivity, through optimal utilisation of the available resource, is also dependent on communication. One important mechanism to improve communication in these areas is to make available adequate number of boats, as the boats are often the only mechanism through which people can move during the flood months.

The second cluster of interventions is aimed towards reducing the vulnerability that the people in the flood prone areas face. In areas which are extremely flood prone and are so remote that relocating during floods also becomes a problem, the respondents have expressed the requirement of raised platforms, with proper water supply and sanitation facility (separate for females) and a separate place to keep the livestock. In some areas, waterlogging and drainage congestion had an adverse impact on the livelihoods. In such areas de-waterlogging of lands, repair and enhancement of the capacity of the regulators (to drain out the water) could make the hitherto uncultivable land cultivable. The river bank strengthening activities to retard river bank erosion undertaken under diverse government programs have been criticised by some respondents on the grounds of corruption. Need for some interventions on this front in partnership with the government was also articulated by some respondents.

The third cluster of interventions comes under enhancing productivity. Within this, two specific interventions would be important in the area. It has been observed that lack of fodder for the livestock has an impact on livestock holding and hence income from the livestock. So certain fodder crops, which could grow irrespective of occurrence or non-occurrence of floods needs to be promoted. In Coochbehar, people had access to irrigation and electric pumps for irrigation have started making inroads. But in Alipurduar, access to cheap irrigation constrained the productive potential of the land during the non-flood (non-monsoon) months. Education is an important resource, often termed as human capital. In flood prone areas in Coochbehar and Alipurduar, in high flood prone areas, one could experiment with floating schools, as practiced in the flood prone areas of Bangladesh.



Floods, livelihoods and development in a peri-urban area: A case of Madanmohan para

The Madanmohan para is located on the outskirts of the Tufanganj, a sub-division town within Coochbehar district. It used to be a *char* in the earlier times but over a period of time the area got integrated with the neighbouring town. The habitation still comes under the panchayat administration (and not under the Tufanganj Municipality). The inhabitants prefer to shed off the older identity of “people from the *char*” because of its inferior connotation and prefer to be seen as townfolk or at least as a peri-urban population.

The habitation consists of around 125 families. The settlement is homogenous in terms of religious composition with Hindus households. Around 20% of the houses in Madanmohan para are *pucca* houses while the rest are *kachha* houses. The general education status was found to be high in this area with every household reporting to have an intermediate pass person in the family, and at least half of the families would have a higher secondary pass person and 25% of the households would have a graduate in their family.

The habitation, originally a *char* formed by silt deposition of the river, was situated virtually on the river bank. The nearest river was Raidak, which flowed some 600 metres away from the farthest point in the habitation. Thus the habitation was settled within the flood zone of the river. House and road construction caused drainage line congestion. Though the village does not face the brunt of river bank erosion, some nearby areas within the gram panchayat within which Madanmohan para lies, suffer from high river bank erosion. According to the respondents, every year around 3-4 bighas of land within the gram panchayat was lost into the river as a result of bank erosion.

The dependence on agriculture as a source of livelihood was limited: less than 10% of the households had agricultural land. The livestock holding in the area is also low: around 20% of the households reported to have cattle—all *desi* breed. Given the paucity of agricultural land, and hence animal fodder, people had to buy fodder and grass from the market for their cattle stock.

The area suffered from floods every year during the three months of July, August and September. Last year there were three incidents of floods. Once flooded, the area remained waterlogged for the next four to five days. According to the respondents, waterlogging in the area was accentuated by unplanned construction, often across the natural drainage lines, and because of enhanced elevation of the road without any provision for cross-drainage. The village has an embankment, and construction went up to the embankment. According to the respondents, the embankment was weak and in some places it could barely bear the weight of construction. The drainage congestion got worse when the people from the habitation tried to close the mouth of the river with a temporary embankment in order to restrict the inflow of the water from the river Raidak.

Damage caused by waterlogging and the reasons for drainage congestion were known to everyone. But no corrective measures have been taken. While the political and economic reasons behind these still remains unknown, no one raised the issue as they were keen to maintain social harmony in the village.

During floods, the people, along with their livestock would relocate to the school located on higher elevation and on the outskirts (around 800 meters) of the village. Some of the people would continue to stay in their house and cope with the floods by temporarily lifting the bed to a higher elevation (like a *machaan*). In recent years, a flood shelter has been constructed in the market area, located on the boundary of the village. On the advent of floods, the people would relocate there to take shelter. Sometimes, during floods, the area is provisioned with boats from the panchayat or from the neighbouring municipal corporation.

For drinking water, the area depended mostly on government standposts and hand pumps. There were four standposts in the village and 80% of the household would depend on hand pump for drinking water. Out of the 125 households, only 15-20 had access to tap water supply. The water supply in the stand posts and the taps were infrequent and erratic: sometimes water supply would be available for one hour, sometimes only for 35-40 minutes and sometimes for 3-3.5 hours per day. Consequently, there would be long queues in front of public standposts. Sometimes people stood in the queue and yet were not able to get water within this short period of time. Most of the households had to depend on hand pumps. The hand pumps were reported to have shallow depth (20-50 feet) and the respondents complained about high iron content in the water. The incidence of disease in the post-flood months increased. Given its location, the village/habitation thankfully had access to the sub-divisional hospital located in Tufanganj.

Given the location of the habitation on the outskirts of Tufanganj, nearly every household in the village would depend on the labour work in the town to eke their livelihood. At the same time, migration was high: nearly every household had one young person who worked in distant places such as Kerala, Bihar and Punjab.

Floods and Vulnerable Communities





Introduction

The exposure to and the impact from various water related hazards—floods, waterlogging and river bank erosion—are not uniform to all the residents from the flood prone areas. Certain sections of the community are more vulnerable than others. Different sections of the society could be differentially exposed to the hazards and could experience varying degree of impact. The difference could be dependent to some extent on social hierarchy and the position of a particular community in this hierarchy. It could be a function of certain practices of the community (for example, preference to stay close to the river) and access to resources (most important among them is land but also other resources like social networks). In this article, we focus on the impact of floods on a social group—women in the flood prone areas—and two communities—the Mushahar community in North Bihar and the Bengali speaking Muslim community in Lower Assam—residing in the flood prone areas.

To collect the information the researchers undertook a concurrent mix-method research design and undertook focus group discussions (FGDs), mixed group and women-only FGDs, in seven districts (Dhemaji, Goalpara, Dhubri, Nalbari, Barpeta, Jorhat and Lakhimpur) in Lower Assam and four districts (West Champaran, Darbhanga, Madhubani and Khagaria) in North Bihar. The villages in these districts were chosen using a mixture of snowball, referral and purposive sampling (Patton 1990).

Spatial Location

The habitation in the studied villages were located close to the river, lying one to three kilometers away from the village. In terms of settlement vis-a-vis embankment, the studied villages were located on both sides of the embankment. The vulnerability towards water related hazards (flood, erosion and waterlogging) were a function of the spatial location of these villages vis-a-vis the embankment. The villages located *inside* the embankment (between the river and the embankment) suffered from bank erosion and in some areas, the agricultural land became uncultivable because of the sand-casting resulting from recurrent floods. In either cases, forced migration (alternatively one can see this as multiple displacement) becomes the only coping strategy and the families become environmental refugees.

In some of the study villages in Bihar where the habitation was located *inside* the embankment, the people were adversely affected by the floods every year.

These villages were dominated by the people from Mushahar caste, the caste located at the bottom of the social hierarchy and often termed as *mahadalitin* Bihar. In some of the villages in Upper Assam, dominated by the Mishing tribe, though the habitation was located outside the embankment, in “safe” areas, the people suffered from waterlogging resulting from the seepage of the Brahmaputra water through the earthen embankments.

Socio-economic Situation of the Women

The literacy rate among women in the villages was low (<20%). The overall literacy rate was slightly higher in Assam vis-a-vis Bihar. In Assam most of the respondents atleast went to a school (the only exception was a Mishing village in Dhakuakhana).

In general, the women would usually work as an agricultural labour in their own villages and also in the nearby villages. They also engaged in cattle/goat rearing and fuelwood collection. In Upper Assam, the women are also engaged in weaving. During the FGDs it was shared that usually weaving would be the first activity that the women in the household would undertake once they come back to their home from the rescue-relief camps post-flood.

The major source of borrowing in the studied villages were from the moneylenders, at an annual interest rate of 36-60%. Money would be borrowed to finance the cost of education of the children, to bridge over non-receipt of remittances on time, construction/renovation of houses post-flood and to buy necessary inputs for agriculture. In the non-flood months, since the men in the family would migrate in search of better livelihood opportunities, the responsibility of managing the home fell on the women. They therefore had to engage in household and productive activities, and meet financial obligations including the repayment of the interest and principal amount to the moneylender and looki for fresh loans.

Among various household activities, gathering fuelwood for cooking is an important responsibility of the women in the household. The research team did not come across users of clean fuel like LPG or smoke-free *chullahin* any of the study villages. According to the respondents, during floods and immediately after floods there is severe scarcity of fuel. The women have no other option but to buy fuel at high cost.

Problems Faced by the Women during and post-flood

Though women are expected to engage in myriad





Women travel far to collect fodder

domestic and productive work, their mobility gets constrained during floods. The major reason being dismal status of road infrastructure and more importantly, the non-availability of boats. Consequently, the women had to shell out a lot of money to move out of the village. In the absence of boat, women are forced to stay back in the village, sometimes for days together, facing scarcity of food. According to some women, in the absence of electricity, the evenings in the flood inundated villages becomes a harrowing experience for them. In some villages, where there were elevated platforms (like in Bettiah) and schools, the women along with their children could take shelter in these shelters.

The second problem that the women face during floods is lack of safe drinking water. Usually they would depend on the hand pumps for drinking water. When the hand pumps get submerged under flood water, the women would travel farther to collect water from the few hand pumps located on the high grounds within the village. Some of the respondents reported drinking flood water when left with no alternative. Even post-floods when the family are back from the relief camp to their village, they face severe water crisis,

until the hand pumps are cleaned and repaired. In some places in Bihar and Assam, women would use sand and coal filters to purify water in post-floods. In some villages in Assam, the researcher found that the Anganwaadi workers in some villages advocated for boiling water before drinking to remove the bacterial impurities from the water. In some villages in Bihar, Megh Pyne Abhiyan, a non-governmental organisation working in North Bihar, has promoted harvesting of rainwater for drinking and domestic uses.

The third problem that the women face particularly during flood is access to proper food for her family (the problem intensifies for pregnant women). For days together, due to lack of mobility emanating from the absence of adequate number of boats, they have to depend on relief food items. These usually comprise of things like crushed coarse millet and salt. Sometimes, even if the relief items include pulses, oil, potato and sugar, cooking in the relief camps become a difficult proposition, predominantly due to lack of fuel. Once back in the village, post-flood, the women also struggle to arrange for food for their children as most of the food items in the village by then would have been lost in floods. As a coping strategy, the women tend



to save some cash with them to buy food during (and immediately after) floods. They also prepare cow dung cakes for fuel which they try to save by storing them in elevated platforms in their houses.

The fourth, and perhaps the most important, problem that the women face during and post-flood is the lack of medical care, particularly gynaecological treatment. The women reported limited access to medical care facility, and near absence of any pre- and post-natal health care facility. The pregnant women in the village undergo tremendous physical and mental fretfulness and discomfort. The respondents reported cases where the pregnant women would deliver in the relief camp and in some case, in boats while undertaking a torturous journey to the nearby health centre. Cases of mortality of child and mother were also reported by the respondents. For the pregnant women, life during and post-floods becomes a great ordeal, denied of nutritious food, safe drinking water, and limited access to medical care, and burdened thereafter with the expectation of resuming a normal life.

The fifth, and a related problem is the lack of hygiene and sanitation. During floods, women have to continue open defecation in their villages or have to take boats to the middle of the river already in spate, to complete the ablutions. There are not

enough temporary toilets for the women. As a result often during the floods, the women have no privacy. There are safety risks associated with defecating in the river during floods, or after sunset. The respondents reported incidences of deaths of mother and child in Darbhanga district resulting from getting carried away by the current in the river while defecating in the river. Due to lack (or unaffordability) of sanitary napkins, the women continue to use cloth during the menstruation period. The cloth does not dry due to continuous overcast conditions during the flood months and continuous application of wet cloth results in skin infections, uterine diseases, blood loss and anaemic health conditions.

Another problem that the women face during flood months is the general safety and security for her and her family, particularly the children. They perceive themselves as responsible for providing safety and security for their family. In absence of proper safety and security, which may result from the lack of privacy and location of shelters being prone to accidents, the women tend to suffer from psychological stress.

Impact of the Problems on Women

Limited economic opportunities in the flood prone areas result in limited income generation, and lack of access to formal finance institutions, results in



Women returning from agricultural fields



increased indebtedness, multiple borrowing and eventually a debt trap situation. Exploitative treatment from the moneylender is common. In the absence of male members of the family who migrate for work, it is the women who have to face the moneylender. It is the women in the family who then have to take the burden of doing all tasks including borrowing and repayment

of the loans. This takes quite a toll on the women.

The women in the flood prone areas lack proper nutrition, suffers from lack of proper sanitation and hygiene, and over and above, have to take the burden to doing multiple household and remunerative work, and bear the physiological burden to protect the family (in absence of male members who might have migrated



A child fills water from a standpost



Women engaged in miscellaneous activities



for work). These result in psychological stress (which then manifest in terms of aggressive and short-tempered behaviour), deterioration of health among women (often manifested by high morbidity among women resulting from iron deficiency) and mortality.

Often men do not realise the impact of such severe psychosocial stress on women. The governmental organisations realise the stress and impacts, however, hardly any action is taken to better the situation.

Other Vulnerable Communities

The Mushahar community in Bihar is one of the most backward communities in the country and comes under the state classification of *mahadalit*. Our study in Madhubani, West Champaran and Khagaria district in North Bihar show that the community is mostly landless and often lack habitation land. They tend to have their huts in land owned by the landlords, against free (bonded) labour on the landlord's agricultural land. Or else they squat on government land in inhospitable terrain like river bed and canal bed. Given their landlessness and near illiteracy, agricultural labour is their dominant occupation. Given the location of the habitation, the community is extremely vulnerable to floods and waterlogging and are prone to suffer from losses of whatever little asset they have as a result of flood and inundation. Their cash saving is abysmal and they depend on agricultural labour or other casual labour in the countryside to eke their livelihoods. During the flood months (and post-flood months), in case the agricultural land goes out of cultivation, they have limited possibility of earning a livelihood. As a result, they face a lot of challenge to survive in those months. They are completely dependent on the relief material or are forced to take loans at high interest rates from the moneylender (who in some cases are also their landlord). Given their lack of various assets, the community practices multiple borrowing and is perpetually caught in a debt trap. In recent years, the young population have started migrating in search of agricultural labour in different states in order to cope



Dismal state of sanitation – common across the flood prone region

with such adversity.

The districts in Lower Assam have a sizeable minority population. There exist a social divide within the minority population residing in this area—between the Assamese speaking Muslims (*Ujani*) and the Bengali speaking Muslims (*Bhatia*) community. The *Bhatia* community is often looked down upon by the *Ujanis*. The latter sees the former as hardworking yet money-minded, who would spend their cash on buying and selling land. Based on our observation, it seems that the *Bhatia* community might be relatively cash-rich and might also be land rich, but given large family size, they struggle to have a decent living. This community though cash-rich would fare dismally low in the human development indicators.

The *Bhatia* community, given their precarious position in the state politics (they are perceived as Bangladeshis who are illegally living in Assam), choose to stay in the remote *char* areas in Dhubri, or on the bank or sometimes right on the river Brahmaputra, as was witnessed in Goalpara town. A part of this choice of place could also be because of their familiarity with the waters more than the land (one would conjecture if that is why they see land more as a commercial resource to be transacted rather than as an emotional resource to be preserved and passed on to the generations). But these areas are bereft of most development services and are extremely prone to natural hazards like floods and erosion. Thus, the *Bhatias* are most vulnerable to natural hazards.



Making Sense of Flood Prone Areas

An Overall Synthesis





In this chapter we try to sum up our overall understanding about the situation of the flood prone areas in the Ganga-Brahmaputra-Barak basins and interpret the information to move towards suggestions about action for a philanthropy to consider. The reality is complex and hence a degree of simplification is a must if one is to make sense of the complex reality. Hence the chapter needs to be understood as providing a basis for more detailed and focused work in case the Trusts decide to take up the issues connected with development of flood prone areas in programming rather than offering cut and dry, and peremptory conclusions. First, we look at the context of the flood prone areas, in terms of their physical attributes, as well as social and economic dimensions. Second, we offer our understanding about the nature of problems posed by floods. These problems can be seen as arising out of a combination of natural conditions and anthropogenic factors. Third, we look at the ways in which the affected people and some organizations working with them have tried to cope with these problems. Finally, we discuss what interventions and action can be designed if the Trusts desire to engage with these areas and people.

Context of Flood Prone Areas

It is important to realize that while flood is the most important common infirmity from which these regions and people living in them suffer, neither the regions nor the people are homogeneous in any significant dimension. We continue to look at the regions and the societies there in six classes: Eastern Uttar Pradesh, North Bihar, North Bengal, Lower Assam, Upper Assam and Barak Valley (Refer Table 1 for detailed data).

In general, Eastern Uttar Pradesh and Bihar flood plains in the Gangetic basin are highly populous, have moderate “intervening terai” in Nepal which distances them from the point at which the rivers join the plains, are dominated by multi-caste Hindu societies, have virtually no industrial or commercial interests invested in them, and are fairly well covered with raised road and rail networks which exacerbate the drainage situation. Barring the district of Khagaria which is located at the most unfortunate geographic location where the mighty Ganga and several of its major tributaries meet, in most other locations the nature of floods is relatively moderate. Forests are present only

to a small to moderate extent in these regions as well as in the catchments that give them the flood waters. The regions have very fertile soils, have reasonably long crop calendars and are buffalo dominated as far as animal holding is concerned.

As we move further East, the North Bengal flood plains, through which the Ganga, Teesta and Mahandanda, and their tributaries flow, experience sharper gradient from the mountains, have very little or no “intervening terai”, and hence face the brunt of the floods and have a shade better forest cover within as well as in catchments. These regions are inhabited by multi-caste Hindu, tribal population working in the tea gardens, and immigrant Bangla Muslim people. These regions have moderately long crop calendars. The calendar length is restricted by temperature regime which is not conducive to paddy, the main crop of the region.

Further East, the lower Assam region exhibits greater diversity. This region experiences very rapid fall of rivers coming from Bhutan and relatively smaller gradients in the South Banks of Brahmaputra which are drained by rivers coming down from Meghalaya hills. This region gets more rainfall. The population density varies across districts here from a high of 1170 in Dhubri to a low of 400 in Kokrajhar. The region is politically a tinder-box.

It houses the Bodo tribals in its North, Rabhas in South and multi-caste Hindu as well as immigrant Bangla communities. All communities have been at strife with each other, and with the State, for the last 40 years. The crop calendar is much shorter here due to prolonged duration of *sailaab* in places like Dhubri and temperature regime and absence of irrigation in the Bodo regions. While petroleum and tea interests are present here, the region in general is much more humming with small enterprises: fisheries, handlooms, areca nut, sericulture, handlooms, etc.

Moving further East, the Upper Assam region experiences the fury of the mighty Brahmaputra or Subansiri first, as no terai separates their fall in the region. The region has dominant tea and petroleum investment interests. River tribes such as Mishing and Sonwal live here along with the caste Hindu people and older generations of very small Assamese Muslim population. The crop calendars tend to be short in this area. Population density is relatively low: varying between around 400 in Dibrugarh to a low of 212 in

The chapter needs to be understood as providing a basis for more detailed and focused work in case the Trusts decide to take up the issues connected with development of flood prone areas in programming rather than offering cut and dry, and peremptory conclusions.





Table 1: Contexts of Flood prone Area

Aspect	Eastern UP	North Bihar	North Bengal	Lower Assam	Upper Assam	Barak Valley
Drop in altitude	2000 metres in about 200 km	2000 metres in 250 km	More than 2000 metres in 100 -150 km	2000 metres in 100 km	2500 metres in 200 km	1000 metres in 100km
Presence of terai upstream	Narrow stretch in Nepal	30-40 km wide stretch in Nepal	None	None	none	Na
Extent of embankment	Limited	Extensive over major rivers	Limited	Extensive	Extensive	Extensive
Forest cover of catchment	Modest	Limited	Modest	Substantial	Substantial	Negligible
Rainfall in catchment	1000-1200 mm	1200-1500 mm	1500-2000 mm	Over 2000 mm	Over 2000 mm	1500 mm
Population density	1220 (Deoria)	1279 (Madhubani)	833 (Coochbehar)	763 (Nalbari)	212 (Dhemaji)	673 (Karimganj)
Social composition	Multi-caste Hindu Prevalence of feudal society	Multi-caste Hindu. Muslims dominate in Eastern parts. prevalence of feudal society	Multi-caste Hindu and Muslim	Boro,Rabha, Tea Tribals, Bangla	River tribes, Tea tribes, Hindu multi-caste. Highly feudal society	Muslims and Hindus of Bangla origin.
Commercial interests if any	None	None	Tea and Hydropower	Limited Tea and Petroleum	Tea and Petroleum	Tea
Special features	Law and order an issue	Strong Law and order and governance issues	No major issues	Hotbed of Bodo, ULFA, Rabha and other insurgency	Insurgency an issue	No major issue

Dhemaji. The region is fed by catchments in Arunachal Pradesh that has decent forest cover. The rainfall here is much higher at over 2000 mm. The Barak valley houses mainly the migrants, from Bangladesh, has a much higher population density, negligible forest cover in catchments, limited commercial interests and moderate rainfall of around 1500 mm.

Problems caused by Floods

Flood arise naturally when the quantity of water flowing through a river channel exceeds its carrying capacity. This is bound to happen in the situation of high gradient over short distances particularly when the highland catchments receive torrential rains. This can also happen when water has to be released from the dams located at the bottom of those areas. However the problems caused by flood arise as a consequence of both the natural conditions such as the above and the modifications in the topography and water drainage systems due to human action. Embankments prevent or discourage rivers from

changing course. But as the rivers in the Himalayan region are laden with sediment, they cause huge siltation downstream and the embanked riverbeds rise above, not only their original levels but well above the level of riparian tracts. Subsequently, a breach in embankments causes havoc as tall walls of water rush down the plains devouring all that comes in her way. Such situations of difference in river bed elevations inside and outside the embankment result in large amount of seepage of water from embanked riverbeds onto the areas outside causing permanent waterlogged areas as can be seen in Supaul. Raised roads and rail lines in the absence of cross-drainage also disrupt the watercourses and cause drainage congestion. This in turn leads to waterlogging.

The problems faced by people in the region result from the above factors and also from the quality of prevailing administration. These problems manifest in the areas of livelihoods, health, education, transport and communication, etc. The broad contours of these problems are summed up in Table 2 which follows.





Table 2: Nature of Problems Caused by Floods

Aspect	Eastern UP	North Bihar	North Bengal	Lower Assam	Upper Assam	Barak Valley
River bank erosion	Major problem across districts	Significant problem	Significant problem	Major problem	Major problem	Major problem
Sand cast	Major problem	limited	limited	Major problem	Limited	Limited
Shifting of river course	limited	Major problem	Major problem	Major problem	Major problem	Limited
Duration of sailab	Maximum 1 month	up to 5 months in Khagaria	Limited to 2-3 weeks	Up to 4-5 months	Up to 2-3 months	
Loss of land	Major issue	Major issue	limited	Major issue	Major issue	Limited
PROBLEMS CAUSED BY FLOODS IN CONJUNCTION WITH ANTHROPOGENIC FACTORS						
Extent of raised roads, rail lines etc	Quite high	Very high	modest	Modest	Limited	Limited
Extent of water-logging	high	Very high	Modest	High,	High, a lot of beels	High, <i>haor and beels naturally low lying lands</i>
Road connectivity	decent	Decent except in flood times	Decent except in flood times	Problematic, Major deficiency	Major deficiency	Problematic
Closure of schools	limited	Fairly long	limited	Long periods	Long periods	Moderately long
Extent of available healthcare	poor	Very poor	Modest poor	Very poor	Very poor	Poor
Drinking water issues	An issue	Major issue	Limited issue	Major issue	Major issue mainly due to GW iron and arsenic	Limited In some areas a major issue
Sanitation	Very bad condition	Very bad condition	Bad conditions	Managed well but Bad in Dhubri, Goalpara and Barpeta	Poor during floods	Bad condition
Length of available crop calendar	8-9 months	6-8 months	6-8 months	6 months	4-5 months	6-8 months
Type of animal husbandry	Large animals	Large animals	mixed	Small ruminant	Small ruminant + pigs	Small ruminant
Extent of man-animal conflict	Very high, with neelgai	Limited	Limited to peri-forest areas	Limited	None	None

An overarching issue pertains to coping with floods. While hydrological significance and political economy issues pertaining to embankments continue to be discussed ad infinitum, they exist and have modified the eco-system irrevocably. The issue is how to deal with the new topography. Embankments become highest point of elevation and hence draw people to them during floods. To create shelter, people dig

holes to fix poles in them. They are also commonly used as roads and one observes vehicular traffic on them. These vehicles cause vibrations and also holes. Animals continue to pass through. The embankments, essentially earthen structures, are also prone to rodent attack. As a result of all these, embankments become weak and need to be strengthened time and again. Then there are occasional but deliberate breaches





made in them when one class of people, living inside the embankment, seek to reduce their vulnerability to flood by sending it gushing to the other side of the embankment. All these features result in the system becoming suboptimal. *Given these problems, and given the reality that embankments will continue to exist in the foreseeable future, there is a requirement of paradigmatic change on how embankments are managed: there is a case of Participatory Embankment Management towards shared goals.* Should this come about, resilience of the communities in the riparian areas of embanked rivers stands to improve.

It needs to be noted that the nature of livelihoods problem is shaped by some key factors: population density, nature of flood problems, crop calendar available, proximity to forests, man-animal conflicts and access to market. Since the combination of these factors vary across the regions, the nature of livelihoods problems varies across them. In Eastern Uttar Pradesh for example, man-animal conflicts pose a major problem during the available crop calendar as the menace of the neelgai, a protected large herbivore is increasing each year. Controlling this menace has no specific relation to floods. Large and under-utilized water bodies in *beels* and *haors* in the Barak valley region of Assam offer not so much a problem as an opportunity to expand (fisheries based) livelihoods there. Solutions in Bihar are difficult to come by because of high population density and the resultant resource competition; if one were able to recover the waterlogged areas, it would certainly add to income opportunities. Where de-waterlogging is not possible, there is also the possibility of systematic exploitation of such waterlogged areas through the promotion of a combined makhana-fish regime. The key issue here would be to manage the community action since both these are prone to poaching and presence of lawless musclemen does not augur too well for community action of the poor dalits.

The problems in the area of housing also have differing complexion. While pressure on land makes any community level solution to shelter and housing very difficult, if not impossible, to practice in Bihar and Uttar Pradesh, such solutions are eminently possible in Assam. Raised platforms can be considered wherever land availability so permits. Platforms need to be built using earth from the feeder river and channels.

The level to which these are to be raised depends on community experience: they should be high enough to remain above the highest flood levels experienced. On such high platforms, communities can take shelters during flood along with their animals. The size of these platforms depends upon the village population. Even now people take shelter on the embankments, roads or rail lines, which are the highest surfaces in the local terrain. The advantage of creating raised platforms is that one can conceivably create structures for toilets and bathrooms for women (and men), as well as construct raised hand pumps for safer drinking water. There are several such raised platforms in lower and upper Assam where NGOs such as the Gramya Bikash Manch have been active. Another interesting possibility is to disseminate the method and life pattern of stilted housing of the Mishing in Dhemaji or of the Bengali refugees in Barak valley and North Bengal. If people were able to construct stilted houses in existing locales, dislocation and consequent problems can be reduced.

The problems most commonly experienced pertain to drinking water, sanitation, access to health facilities and connectivity. Fortunately, all permit similar solutions across the board in the whole tract.

The multitude of problems experienced by the people is also a function of the spatial location of the habitation vis-a-vis the river and the embankment (refer Table 3). The habitations located on the river bank, either because they continue to stay within the embankment or because the rivers have no embankment, continue to experience the brunt of river changing courses, river bank erosion and flash floods. As one moves from Eastern Uttar Pradesh to the Barak valley, the magnitude of these problems vary. The problem of river bank erosion is very high in Eastern Uttar Pradesh, eastern part of North Bihar (over the river Mahananda), moderate in West Bengal, very high again in some of the districts in Lower Assam (located on the Northern tributaries on Brahmaputra like Beki and Gadadhar), some districts in Upper Assam (Majuli, for instance) and on the main stem of the river Barak in the Cachar district. The problem of sand deposition is high in the villages located adjoining the river, particularly in Eastern Uttar Pradesh and in Lower Assam. Within the districts of North Bihar, the north western districts located on the Gandak

It needs to be noted that the nature of livelihoods problem is shaped by some key factors: population density, nature of flood problems, crop calendar available, proximity to forests, man-animal conflicts and access to market.





Table 3 Habitations and their flood related problems

	Location of the habitation			
Severity of the problem posed by	Inside embankments	On embankments	Outside but close to embankments	In riparian areas of un-bundled rivers and streams
Flash, destructive floods	Serious	Limited	Yes, quite serious	Possible but relatively less frequent
Sand-cast on farmlands	Possible	Limited	Yes, very possible	Limited
River bank erosion	Can be serious	Limited	Limited	Yes, serious
River changing course	Serious	Limited	Yes, serious	Yes, serious
Damage to standing crops	Yes, serious	Limited	Yes, serious	Yes, possible
Being marooned for a long time	Yes, serious	Yes, serious	Yes, possible	Limited
Breakdown in communication	Yes, serious	Yes, serious	Limited	Limited
Discontinuity in schooling	Yes	Yes	Yes	Limited
Sailab lasting for a long time	Limited	Limited	Yes	Yes
Water-logging	Limited	Limited	Yes	Yes
Loss of income from animal husbandry	Yes	Yes	Yes	Limited
Drinking water, sanitation	Yes	Yes	Yes	Yes
Housing	Yes	Yes	Yes	Yes

and Burhi Gandak basin suffer more from flash floods while in the north central districts located on the Kosi and Bagmati basin, the problem of *sailaab* kind of floods and waterlogging due to drainage congestion and seepage, (particularly in the villages located outside yet proximate to the embankment) increases. As a result, the standing crop loss and the extent of fallow land is more in these north central districts of Madhubani, Darbhanga, Supaul and Khagaria.

There are some issues cut across the entire flood prone region and affect most of the districts irrespective of the location of the habitation. One important issue is the poor state of the communication facility because of which access to education and health services suffer. This lack of access to health service become still more important when one realises that the overall sanitation facility in most of the villages, irrespective of the location, is dismal with open defaecation emerging as the dominant practice. The lack of access then manifests in terms of increased morbidity and mortality.

Local Solutions for Pressing Problems

The solutions as designed by local people which we observed are summed up in Table 4. It would be misleading to say that such solutions are practiced on a large scale. But there would have been no need for a systematic interventions were they so practiced!

For housing, as discussed above, it the possibility of raised platforms. We also have the possibility of popularizing stilted housing.

With regard to safe drinking water, the most practicable solutions appears to be installation of raised hand pumps. The pumps are to be raised to a level such that the spouts do not get submerged under flood waters. This enables people to draw relatively clean and safe water and also ensures that flood water does not get mixed with subsoil water through the pipe of the hand pumps. This would be a community solution. Megh Pyne Abhiyan, a non-government organisation working in the flood prone districts of North Bihar, has been promoting rain water harvesting for drinking, and this too deserves attention.

Sanitation poses a genuine and tough challenge. Not only are safe and private spaces for ablution needed, particularly for women and children, the question of harmless disposal of human waste also cries for an answer when every square inch has been inundated. These problems are well addressed by the solution of raised toilets, either built on the raised shelters as noted above or just in isolation. The human waste disposal happens in a usual manner. Non-government organisations like Megh Pyne Abhiyan have been promoting *phyadamansauchalaya* in some of these villages.





Table 4: Local Solutions for pressing problems noted during field work

Aspect	Eastern UP	North Bihar	North Bengal	Lower Assam	Upper Assam	Barak Valley
Housing	None	None, make-shift shelters on embankments	Stilted houses	Raised platform for shelters	Stilted houses	Stilted house among some people
Sanitation	None	None, some talk of “mobile toilets”	None	Raised toilets	Raised toilets	None
Drinking water	None	Rainwater harvesting promoted by Megh-pyne	None	Raised hand-pumps	Raised hand pumps	None
Staying connected	None	Make shift bridges	None	Boats,	Boats	Boats
Survival during flood period: food and water	Food is mostly <i>sattu</i> , water from rivers	Food is <i>sattu</i> . Water a problem	None	None	None	None
Schooling	No solution	No solution	No solution, People rely on relatives	None except relocation of schools	None	None
Fuel supply	None	None	None	Prior preparation	None	
Fodder supply	None	None	None	None	Prior preparation	None

So far as access to health facilities is concerned, people seem to adopt a two-pronged approach. The first is to stock necessary supply of medicines against most commonly occurring ailments (during floods) within the communities themselves. The second is to enhance access by providing boats. An attempt to build mobile clinics on large boats had been made by some organisations in Assam.

Possible Interventions

The overarching goal guiding the list of possible interventions is resilience building among communities residing in the flood prone areas. We argue that resilience building is an outcome of a combination of interventions which focus on reducing the vulnerability, improving access to (various developmental) services and improving productivity through optimal use of the resources (Figure 1).

Table 5 on the facing page sums up our tentative suggestions for an agenda for intervention in the flood plains. The agenda comprises of the points noted above. The specific constellation of action items would vary by the locale. The Trusts also need to evaluate the relative merit of intervening in just one theme across the entire flood prone regions or focussing on a specific

well identified region and practice a whole range of solutions to contribute to its increased resilience. We are of the later view. For this purpose, we not only have to choose a mix of solutions that are appropriate to the region in question, but also have to assess the possibility of implementing such solutions given the extant social conditions of the region.

If the intention is to reach out to as many of the flood affected people as one can, then one would need to be clear about which solutions can be scaled. To facilitate the choice of interventions that have maximum reach and utility, Table 6 attempts to examine each solution to see where all it makes sense.

The above assessment is based on our current understanding from our field work. To fine tune this, focused efforts will be needed. These perhaps may not be the most popular measures. These are essentially resilience building measures – they would reduce vulnerability, enhance connectivity and maximise productivity. These measures are not relief measures and hence certainly are not the measures chosen by the state and other relief agencies. The latter simply distribute relief materials comprising food, tarpaulin and clothes; while these things soak money, they do not contribute to resilience building.





Table 5: Action Possibilities

Aspect	Eastern UP	North Bihar	North Bengal	Lower Assam	Upper Assam	Barak Valley
Housing	Introduce raised platforms where land is available	Introduce raised platforms where land is available; popularize stilted housing	Introduce raised platforms where land is available. popularize stilted housing	Raised platforms, also popularize stilted housing	Raised platforms	Raised platforms
Drinking water	Raised hand-pumps	Raised hand-pumps	Raised hand-pumps	Raised hand-pumps	Raised hand-pumps	Raised hand-pumps,
Sanitation	Raised toilets where land is available	Raised toilets for women	Raised toilets	Raised toilets	Raised toilets	Raised toilets
Connectivity	Boats to be made available	Boats to be made available	Boats to be made available	Boats to made available	Boats to made available	Boats to be made available
Diet enhance-ment	Bound-ary plantations and short duration veg-etables	Raised creeper beds	Raised creeper beds, vegetable cultivation	Intensify homesteads; vegetables, support piggery	Intensify homesteads, support piggery	Intensify home-steads, support fisheries
Agriculture related	Neelgai related measures	Recovery of water-logged lands, agroforestry (makhana and fisheries)		Introduce more second season crops, creepers on arecanut, recovery of waterlogged lands	Short dura-tion rabi crops needed, creepers on arecanut	
Irrigation related		Introduce solar irrigation	Introduce solar irrigation	Small pumps to be popular-ized	Introduce Solar irrigation	Solar based irrigation, small pumps
Animal hus-bandry related	Dairy interventions	Dairy interventions		Vaccination of goat	Vaccination of goat, piggery	Vaccination of goat
Fishing related		Introduce fishery on wetlands		Introduce cage fisheries	Introduce cage fisheries	Introduce cage fisheries

We believe that the optimal thing would be for the Trusts to zero in to an area which is both significant and compact enough to be manageable, understand the nature of its problems, and offer a package of measures such as the above so that one creates a model of a flood resilient cluster. Since one is talking of a cluster, issues such as quality of governance, fragmentation in the community, presence of musclemen or likely interference from insurgents, etc also needs to be taken into account. **Given all these factors, we tentatively recommend that the Trusts take up resilience building work comprising most of the steps in table 5 in a chosen cluster in the Barak valley.**

Figure 1: Building Resilience

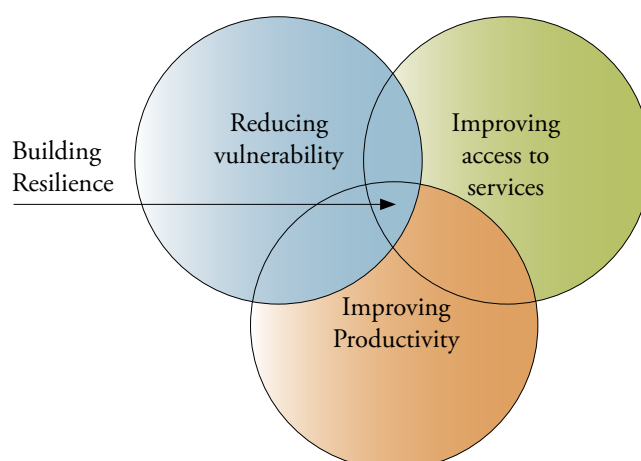




Table 6: The entries in cells represent the degree of appropriateness of the concerned solution to the region.

Aspect	Eastern UP	North Bihar	North Bengal	Lower Assam	Upper Assam	Barak Valley
Raised platform for shelter	Low	Medium	High	High	High	High
Stilted housing	Very low	Higher in Khagaria area, low elsewhere	Very High	High	High	High
Raised hand pumps	Very high	Very high	Very high	Very high	Very high	Very high
Raised toilets, particularly for women	Very high	Very high	Very high	Very high	Very high	Very high
Stocking medicines and things like sanitary napkins	High	High	High	High	High	High
Providing boats and bamboo rafts	Medium	High	Medium	Very high	Very high	High
Recovery of waterlogged lands	Medium	High	Low	High	Medium	Medium
Fish cum makhana cultivation	Low	High	Low	High	High	Low
Boat schools	Low	High in Khagaria	Low	High	High	Low
Cage fishery in wetlands	Low	Low	low	High	High	High
Small solar powered pumps for rabi	High	Very high	High	High	Medium	High
Raised creeper gardens	Very high	Very high	High	Medium	Medium	Medium
Vaccination of small ruminants	Low	Low	High	Very high	Very high	Very high
Bamboo plantations to improve soil resilience	High	High	High	Low	Low	Low
Participatory embankment management			High	Very high	Very high	Very high





Appendix 1: Workshop Report— Patna, Bihar

Date: 17th March, 2016

Venue: Bandana Guest House, Pataliputra Colony, Patna-13

Participants:

The workshop was attended by 37 people. The participants included representatives from various non-governmental organisations, currently working in various districts in eastern Uttar Pradesh and North Bihar, and researchers from academic institutes like the A. N. Sinha Institute and the Tata Institute of Social Sciences.

Description:

The workshop began with an introductory talk by Prof. Sanjiv Phansalkar of the Tata Trusts. In his talk Prof. Phansalkar introduced the context and rationale behind the flood prone area study taken up by the Trusts. Against this larger canvas, three presentations based on the ongoing study were made by the study team. Each presentation was followed by discussions where the participants commented on the presentation.

The presentations were:

1. Development Profile in Flood-Prone Areas in the Ganga-Brahmaputra Basin—A Study on Eastern Uttar Pradesh by Vivek Kher

In response to this presentation, the following comments were made:

- In eastern Uttar Pradesh, the proportion of buffaloes in livestock is high but the low milk production is partially due to lack of availability of fodder. In this respect, access to vaccination for livestock in the pre- and post-flood months is important to reduce mortality and production loss.
- Initiatives undertaken by some non-governmental organisations like promotion of sand based agriculture, could get some mention in the ongoing study.
- The flood prone areas suffer from water scarcity conditions in the non-flood months. In some of the areas, the water table is lowered and consequently, there is a scarcity of water for domestic and agricultural use. The agriculture in those months would resemble rain-fed situation. These elements of scarcity amidst – what is perceived otherwise as plenty – has to be recognised.
- The flood prone areas consist of various land types/zones like *doab*, *diaras*, *majhar*. These different land types throw up different levels of vulnerability to floods and hence also emanate varied consequences. The study had classified the habitations in the flood prone areas into various typology – a similar effort could be made in identifying a typology of



Participants of a sub-group engaged in discussions at the Patna Workshop



consequences.

- Migration is an ever-pervasive phenomenon in the flood prone areas in eastern Uttar Pradesh and Bihar. It has diverse impacts on the society. The positive role played by the migrants in bringing a behavioural change in their villages was highlighted by one of the participants. The migrants appreciate the importance of rainwater harvesting for drinking and domestic use. As a result, they have played an important role in breaking the (false) notion in their villages that using rainwater for drinking purpose would result in disease such as goitre. In some cases they bring back what they have learned elsewhere to the field. A migrant who worked as an agricultural labour in Punjab returned to Bihar and used the skills that he had learned in Punjab in his agricultural field.
- One of the participant sought clarification on the methodology followed in the study—the sampling plan and the efficacy of the recall method followed during the focus group discussions in the studied villages. The team leader for the study, Prof. Phansalkar, explained the rationale of choosing the particular methodology. He explained that any study usually passes through a phase of trigger to a phase of characterisation, and finally to hypothesis testing/interventions-evaluations. As of now, the study is still between the trigger and characterisation, which led to choosing this particular methodology. Another team member informed that instead of stratified sampling, a combination of snowball sampling and convenient sampling was followed. This was because the nature of the study was exploratory with the objective of providing a detailed characterisation of the developmental problems faced in the flood prone areas at the end of its first phase.

2. Impact of Flood on Women in Bihar and Assam by Mayuri Hazarika

In response to this presentation, the following comments were made:

- It will be important to categorise the consequences of flood on the life and livelihood of women into pre-flood, during-flood and post-flood situations.
- It will be important to trace the impact of migration on the life and livelihood of women. One of the participants shared that as a result of migration it is often the women in the household who is left behind to bear the consequences of migration.
- Some of the participants shared that the plight of

women due to flood and erosion which resulted in an increased incidence of child marriage and trafficking.

- One of the participants pointed to the requirement of conducting a research on the impact of flood on the security of women.
- One participant highlighted the linkage between (lack of) nutrition among women, and floods. It was further emphasised that the focus should also be on the 0–6 month-old children as most often, both the mother and the child suffer from nutrition deficiency.
- A comment was made that in absence of the male members in the household (due to migration), female in the household play an important role in farming, particularly in the post-flood months.
- One of the participants highlighted the importance of looking at government schemes and their efficacy through the lens of gender.

3. Flood and Development: Observations and Impressions based on the Fieldwork in Uttar Pradesh, West Bengal, Bihar and Assam by Nirmalya Choudhury

In response to this presentation, the following comments were made:

- One of the participants from Khagaria pointed to the age-old practice of bonded labour that continues to exist in some flood affected areas. While the landowner tends to move out of the agricultural land that is adversely affected by floods, the labour is forced to stay back. This then affects the life and livelihood of the labourer.
- Some of the participants highlighted the work that they are already undertaking to address the dismal drinking water and sanitation system that exist in the flood prone areas. Various models of eco-sanitation systems (locally renamed as *phydamansouchalaya*) and rain water harvesting systems were being successfully piloted in some of the villages. In some cases, the demand has been raised by the female folk in the village. Given the prevalence of geogenic contamination in the flood prone areas, some of these organisations have also worked on reviving dug wells as a source for domestic water usage.
- Some of the participants shared that given the diversity and the geographical vastness of the flood prone areas, this initiative in the subsequent phase should look into undertaking long-term studies but in focussed geographical locations.





Participants at the Patna Workshop

- Some of the respondents highlighted the importance of promoting flood tolerant agriculture, sand based agriculture, cultivating seasonal fruits and vegetables on land within the embankment, and setting-up partnerships with various ICAR institutes in the region. Others pointed to the need to revive traditional agriculture practices in flood prone areas, and emphasised the importance of promoting traditional knowledge to live with floods.
- The study team particularly drew attention of the participants on the fact that despite operating at a subsistence level and facing repeated natural hazards and disaster, the flood prone areas— thankfully— did not report extreme manifestation of agrarian distress as is observed in various drought prone areas of Maharashtra, Punjab, Andhra Pradesh and Telangana, to name a few, and if largescale migration and the resulting remittance could be attributed as a reason for this relief. The participants were of the view that migration played an important role, but at the same time, migration has been an age-old phenomenon⁵ and that people in Bihar had self-confidence and had mastered the art of living in hostile conditions (*jeenekikaala log jaantehain*).

Subsequently, the participants formed small groups and discussed the following four topics: (i) flood and education, (ii) women and floods, (iii) health in the flood prone areas, and (iv) livelihoods in floodprone areas. The broad objective of the exercise was to

suggest how the Tata Trusts could address the various challenges pertaining to health, education, livelihoods and gender in the flood prone areas.

The following are the points that were mentioned by respective groups.

Group 1: Women and Floods

- The focus should be on building social empowerment through formation and strengthening of institutions for collective actions such as Self Help Groups, Federation, Producer Groups, Farmers Club, etc.
- There is a need of awareness building at various levels.
- The focus should also be on economic empowerment by promoting saving and credit within the women groups and through promotion of multi-sectoral income generation activities among women like agriculture, livestock, village based nonfarm forest produce, etc.
- Due importance should be given on skill building for income generation, institution management and facilitation.

Group 2: Health and Floods

- Strengthening personal hygiene through provision for toilet, bathing spaces and safe drinking water.
- Ensure safe child birth, secure the healthcare for mother and child and betterment of health of young girls.
- Improve access to health services and veterinary

⁵For example, large scale migration of people from Bihar to far-off lands like Mauritius and the Caribbean islands.



services

- Provision of fresh and nutritious food to enhance nutritional security.
- Ensure access to fodder and water for livestock

Group 3: Flood and Education

The group articulated that the following provisions and strategies were required to achieve a singular objective: continuation of education in the flood prone areas

- Enhance school safety by building capacity of children and teachers to cope with disasters/floods and by increasing health and hygiene practices among children.
- Awareness building among parents towards education.
- Capacity enhancement of school education committees for making appropriate arrangements during any disaster/flood.
- To prepare volunteers to arrange and facilitate an alternate area for schooling during floods.
- To sensitise communities towards needs of children by providing book banks and other resources.
- To advocate with the administration at the panchayat, district and state level, to ensure that proper building codes/ location/ material are used for the construction of schools, to arrange for bridge course for drop-out children, to ensure that extra classes are undertaken for students for the days that they lose schooling due to floods and to restore the education system [post-flood⁶] on a priority basis.

Group 4: Livelihoods in flood-prone areas

- Promotion of a cropping strategy that takes into consideration riverbed cultivation (current practices are restricted to cucurbits and vegetables), explore the possibility of flood tolerant agriculture, explore the possibility of a cash crop between the Kharif and Rabi crops and practice intensive agriculture like summer paddy wherever possible in water logged areas.
- Promotion of solar irrigation systems.
- Provision of fodder and vaccination for the livestock; strengthen the milk value chain.
- Skill enhancement of the people migrating outside for work to strengthen their bargaining/negotiation capacity.
- Ensure credit facilitation through appropriate institutions.
- Promotion of local [non-farm] crafts like bamboo, banana fibre and mats.

- The Tata Trusts should explore possibility of collaboration with the state government on the Pokhra Yojana (in Bihar with 90% Government subsidy) and in using the Mahatma Gandhi National Rural Employment Guarantee Act for cleaning and de-silting of drainage systems.

In the last session of the workshop, Eklavya Prasad of Megh Pune Abhijan commented on the above presentation, followed by Prof. Rajeshwar Mishra and Prof. Pushpendra who shared their views on the development in flood prone areas.

Eklavya Prasad from Megh Pyne Abhijan commented that the list was too broad-based and given the local complexity and the geographical vastness of the flood prone areas, one needs to go deeper and get a more localised understanding of a problem to design solutions that are more locale-specific.

Prof. Mishra stressed that one needs to think deeper about why certain programs and interventions fail to yield the desired outcome. Prof. Mishra mentioned that while awareness building has been highlighted in the recommendation of various sub-groups, but one needs to deconstruct this “awareness building” and ensure that it does not remain a one-way flow of information to the community. He argued for an engagement with the community to ensure a two-way flow of information.

Prof. Pushpendra highlighted that while many of the problems always exist, most of them would intensify as a result of floods. He drew attention to the fact that often there is discrimination during the post-disaster relief activities. He advocated that the process of relief provision has to be sensitive towards discrimination. He argued that the Trust needs to have a long term policy for engaging in these flood prone areas and should take into consideration macro level issues that concern floods.

Prof. Phansalkar gave the concluding speech in which he articulated a conceptual understanding of how different interventions undertaken at various levels, requiring cooperation at various scales – individual, household, village, agro-climatic zones, inter-generational – could have different level of complexity. He argued that while deciding and prioritising diverse interventions in the flood prone areas, this conceptual understanding of graded complexity would be a useful tool. With this he thanked the host organisation and all the participants for taking part in the workshop. The workshop came to a close.

⁶Addition made by the author



Appendix 2: Workshop Report - Guwahati, Assam

Date: 19th March, 2016

Venue: Don Bosco Institute, Kharguli, Guwahati

Participants:

The Guwahati workshop was attended by 27 people. The participants were mostly from civil society organisations that are working in north Bengal (Coochbehar and Alipurduar districts), lower Assam (Barpeta, Goalpara, Dhubri and Nalbari districts), upper Assam (Dhemaji, Lakhimpur and Jorhat districts) and Barak valley (Cachar and Karimganj districts).

Description:

At the start of the workshop Prof. Sanjiv Phansalkar of the Tata Trust shared the rationale behind the decision to undertake a study on the flood prone areas.

This was followed by the following three presentations:

1. Flood and Development in selected districts in Upper Assam by Vivek Kher.

Comments after the presentation on upper Assam:

The study highlighted the fact that the villages studied in Upper Assam, despite floods and low farm income, reported low migration. Responding to this, one of the participants opined that migration from (Upper) Assam is still a recent phenomenon. Another

participant drew attention to a possible conjunction of the following causes behind the low migration figures in Upper Assam:

- Most of the districts in Upper Assam reports low population density because of which pressure on land is also low.
- Some land has been reclaimed and put into habitation, which further reduces the pressure on land.
- There is prevalence of short distance/daily migration from districts in Upper Assam to the neighbouring state of Arunachal Pradesh for daily construction labour.

Another participant shared that at least in the districts in the south bank of Brahmaputra there are non-farm livelihoods options like labour jobs with parastatals like ONGC and in the tea gardens. According to one participant, homesickness and limited scope of finding jobs outside were also reasons behind low migration. The discussion on migration concluded with a general observation that though historically the prevalence of migration from upper Assam was low, there is an increasing trend in the recent years.

The study had shared that the information on irrigation from upper Assam was low. The finding was further substantiated by the participants. It was reported that the irrigation coverage in the state was very low and that the irrigation department was one of the two most dysfunctional government department, animal husbandry being the other. According to another participant, given the dominance



Presentation of a study on Women and Floods during the Guwahati Workshop



of tea gardens in the districts on the south bank of Brahmaputra in Upper Assam, the practice of paddy cultivation was limited and hence the demand for irrigation was also low.

One participant pointed out a case of a village where pottery was the dominant livelihood practice, but with river bank erosion, availability of soil for pottery was steadily going down. As a result, the continuance of this traditional livelihood activity is threatened.

One of the participants commented that while the study was focussing on rural areas, floods also have adverse effect on the nearest urban centres. Thus, the study needs to also focus on urban areas.

2. Impact of Flood on Women in Bihar and Assam by Mayuri Hazarika.

Comments after the presentation on floods and gender

The thick description provided in the presentation was well appreciated by the participants. According to one of the participants, water hazards, break down of communication and gender would often get interlocked with each other. The participant narrated the case of a location in Lakhimpur district where because of a breach of embankment and erosion the road got affected and hence trucks had to queue up or stop at a particular location. The villages nearby saw an opportunity and opened liquor shops, and the young women from the adjoining area are made to stand near the shops to entice customers. As a result, there is an emerging challenge resulting from incidences of prostitution; health issues are also emerging.

It was further deliberated by the participants that while women safety and health issues in the flood prone areas, during and post-flood, was of high importance, lack of government action in this arena could perhaps be attributed to the low capital intensive nature of investment required to address the situation (as compared to building embankment which is a high capital intensive nature of investment).

3. Flood and Development: Observations and Impressions based on the Fieldwork in Uttar Pradesh, West Bengal, Bihar and Assam by Nirmalya Choudhury.

Comments after the presentation of flood and development

The presenter had mentioned that while in Bihar embankment is part of the public discourse, the same was not observed in Assam. In response to this one of the participants highlighted that while the discourse on embankment in Assam was not as intense as it is in Bihar, nevertheless even in Assam, embankment is a political issue and consequently is well covered in the

local media. It was pointed out that while one section of the populace in Assam did ask for embankments, some scientists and civil society organisations have continuously argued about the ill-effect of embankments. The participant also pointed out that there is perhaps also a generational issue: the younger generation see embankment as an infrastructure that provides protection, while the older generation are critical about the embankment.

With regard to education and health, one participant pointed out to the requirement of flood-resilient school building and toilets. In the absence of the same, the school drop-out rate was found to increase, particularly in some parts of lower Assam (close to the Bhutan border). Another participant pointed out that in the Barak valley (particularly in Karimganj district), the *haors* which would remain waterlogged [author's addition: in government parlance such waterlogging is a deliberate activity as the same functions as retention basins] for an extended period of time could be favourable for promotion of fisheries based livelihood development. Some participants drew attention towards importance of drainage of waterlogged areas and simultaneous usage of such drains for irrigation and waterways.

After the three presentations and discussions, the participants were divided into smaller groups and the small group discussion took place on the following topics: health, sanitation and nutrition in the flood prone areas, education in flood prone areas, women and floods. The following points that came up in the discussion were subsequently presented by the groups.

Group 1: Health, sanitation and nutrition in flood-prone areas

- There is a need for awareness building through collation, compilation and dissemination of good practices on how health, sanitation and nutrition could be improved. Further, examples of resilient health infrastructure could be compiled and communicated.
- Through community involvement, specific action could be undertaken whereby innovative pilot projects could be tried out pertaining to promotion of raised creeper garden on the homestead land, nutritional and medicinal plants and cage fisheries. All of these would contribute to the nutritional security of the household.
- Provision of secured infrastructures like raised platforms with provision for proper toilet facility and separate spaces for human being and livestock.
- Provision of boat clinics, tubewells on raised





Participants of a sub-group engaged in discussions at the Guwahati Workshop

platform, improvement in communication by using drainage canals as waterways, chlorination of tubewell water and prompt provision of medicines in the post-flood period.

Group 2: Education in Flood prone areas

The group categorised their discussion and comments under four broad headings, namely actions to be taken pre-flood as part of preparedness, to be taken during flood, to be taken post-flood, and a broad agenda for advocacy.

- Preparedness/Pre-flood: The group argued for Disaster Risk Reduction in village/school among children, skill development through training on first aid, search and rescue, provision of demonstration kit which would include life jacket for child, activation of ICDS centre/school during flood and preparedness for “child friendly space” (education volunteer) in shelter/relief camp.
- During flood: Establishment of “child friendly space” in shelter, convergence with ICDS/mid-day meal, ensure sports/music/library etc. in “child friendly space” and provision of special support in special case
- Post-flood: Continuation of “child-friendly space” for at least three months after floods with focus on skill building (toy making, flower), provision of remedial/tutorial classes in “child friendly space”, provision of education kit of the child (if lost due to floods), linking needy child with specialised agencies for continuing the education and undertaking motivational program for ensuring 100% retention in school/ICDS.
- The group also articulated a need for advocacy to ensure activation of ICDS/school during flood, to highlight issues on impact of flood in child education, to ensure all weather connectivity to school, to influence construction of school building

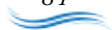
over Highest Flood Level and to ensure support to repair ICDS/school.

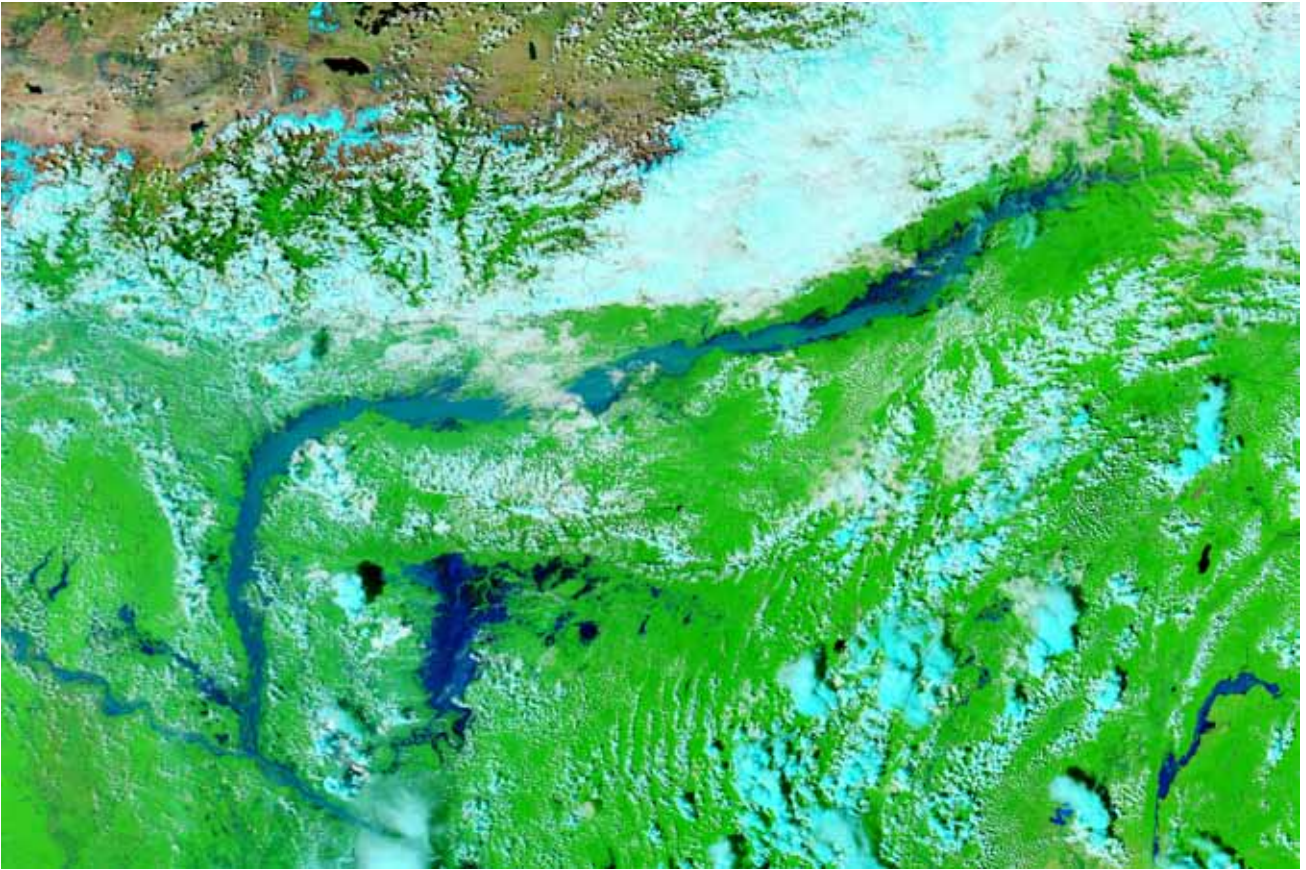
Group 3: Women and floods

The group categorised their deliberation into organising, capacity building, human resource development, access to resources and advocacy.

- Formation of women collectives like mother group, adolescent girls group and then forming a federation of groups.
- Capacity building of the collective through leadership development, training on water, sanitation and hygiene, awareness building on ill-effects of early marriage, and promotion of economic activities (like weaving, tailoring, handloom, scientific rearing of pig, goat rearing and strengthening market linkages) through these groups.
- Development of skilled mater trainers.
- Access/control of important resources like raised hand pumps and latrine facility, hygiene kits during floods, country boats which Assamese women can row and which they can use during floods for movement for livelihood and other activities, separate space for women in relief camps and support for promoting income generating activities (like handlooms).
- The group also articulated the need for advocating for an expansion of the list of work that could be undertaken under the Mahatma Gandhi Rural Employment Guarantee program.

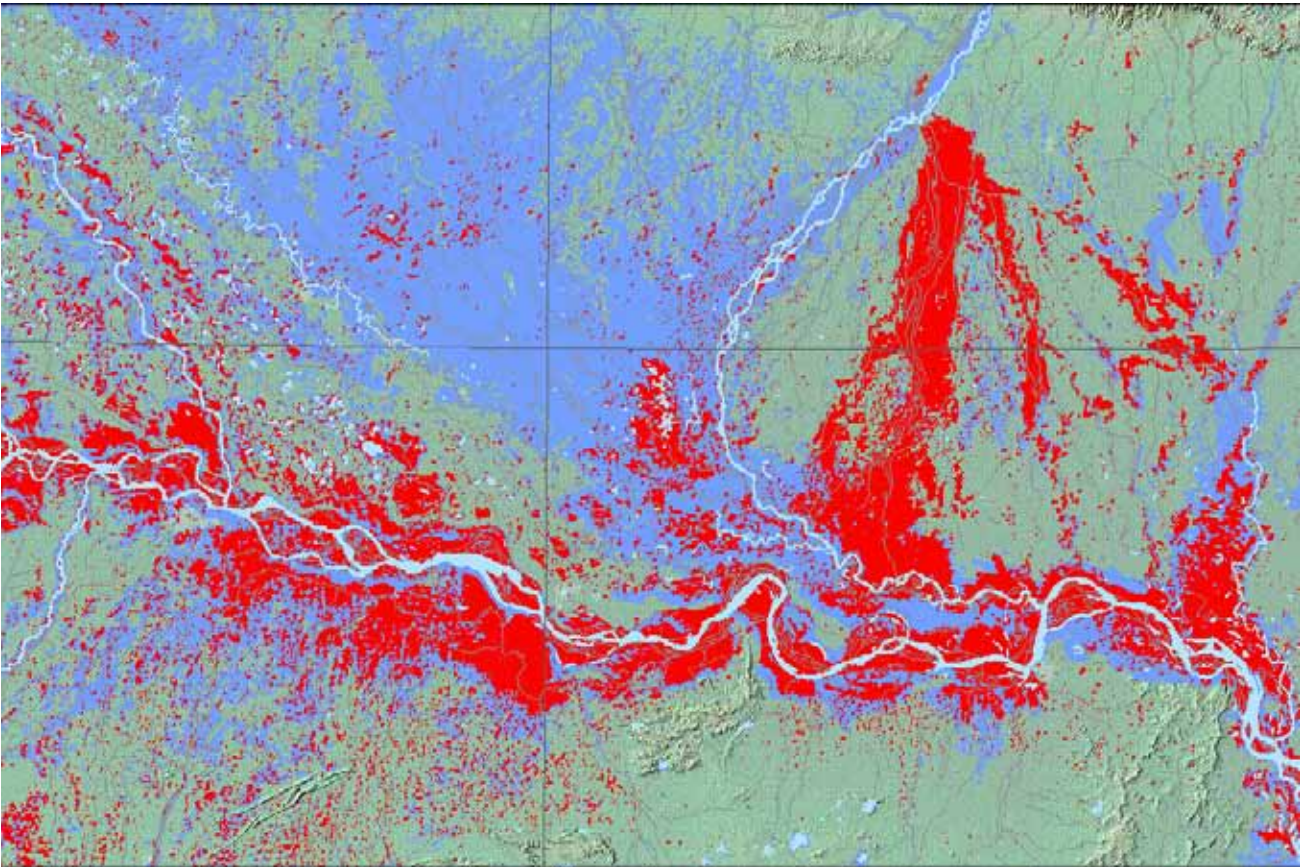
In the concluding remarks of the workshop Prof. Phansalkar thanked all the participants who had come from Assam and West Bengal and explained the position of the study in the overall scheme of things and possible outcome of the ongoing study. With these words the workshop was concluded.





September 2012, Brahmaputra at spate, lighter blue colour due to high sediment load

Source: NASA image courtesy, LANCE MODIS Rapid <http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=79267&src=ve>



Imagery of Bihar floods along the river Kosi in 2008. The embankment breached and the river took a different pathway, inundating everything that came in the way.

Terra MODIS September 2, 2008

Reference: Originally appeared on Earth Observatory NASA (<http://earthobservatory.nasa.gov/IOTD/view.php?id=9075&src=ve>), accessed from Visible Earth, NASA.



This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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VAF is an initiative of the Tata Trusts established as a not-for profit Company under Section 8 of Indian Companies Act. VAF aims to conduct research in two main streams. The first is in the nature of identifying and researching unattended issues of importance to the poor and the marginalised people with a view to evolve actionable programmes on them. Such programmes then could be developed and supported or implemented by civil society organisations, donors or Governments. The second stream is to explore and improve understanding about issues which are encountered in processes of implementing programmes in several domains. Such common issues pertain to the social development process rather than the domains themselves. VAF works in an inter-disciplinary manner.

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The documents brought out in this series are based on intensive and field based research work carried out by VAF staff and associates in the respective fields. Formal research papers have been written on these researches which are published and presented elsewhere. These documents are meant to primarily disseminate the findings with a view to create interest and awareness about the issue on which they are focused, act as bases of discussions and eventually lead to action. An attempt is made to emphasise readability rather than scholastic exactitude. These documents can be used freely for academic purpose or for the purpose of advocating action inherent to the issue. VAF will appreciate being acknowledged when they are so used.

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