



Agony of Floods

Flood Induced Water Conflicts in India

Edited by Eklavya Prasad, K. J. Joy, Suhas Paranjape, Shruti Vispute

Forum for Policy Dialogue on Water Conflicts in India

Agony of Floods: Flood Induced Water Conflicts in India

Eklavya Prasad, K. J. Joy, Suhas Paranjape, Shruti Vispute



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16, Kale Park, Someshwarwadi Road, Pashan, Pune 411 008

Maharashtra, INDIA

Tel: +91-20-2588 0786/ 2588 6542

Fax: +91-020-2588 6542

Email: waterconflictforum@gmail.com

URL: <http://conflicts.indiawaterportal.org>

Copies are available at the above address

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Preface

There is now a growing awareness about conflicts related to water. However, most of it is of the doomsayer variety, given the regularity with which it is predicted that the next world war will be over water! This growing concern and anxiety is not matched by systematic work on developing an understanding of water conflicts. While individual cases have been studied intensely - for instance, the conflict around the Sardar Sarovar dam on the Narmada River - not much work has been done to document water conflicts in a methodical and sustained manner.

The Forum for Policy Dialogue on Water Conflicts (the Forum, in brief) has been engaged in documenting several kinds of water conflicts in India since 2004-05. The present compendium of case studies of flood induced water conflicts in India is part of the same initiative.

The Forum owes its emergence to the first attempt to document water conflicts in India. In 2004, R. Doraiswamy and Biksham Gujja collected information on water conflicts in South India, and published a summary of the cases as a booklet called 'Understanding Water Conflicts: Case Studies from South India'¹. At a meeting to discuss this booklet, it was decided to set up the Forum as a loose network to work on water conflicts, and provide a platform to individuals and organisations engaged in such work. Today, the Forum includes more than 150 individuals and organisations across the country.

In its first phase, the Forum concentrated on documenting water conflicts in India at a national level. In this phase, the Forum documented 63 cases of water conflicts in peninsular India put together by nearly a hundred authors. These case studies have been published as a book, *Water Conflicts in India: A Million Revolts in the Making*, by Routledge². The book was released at the India International Centre in Delhi on 13th December 2006. Prof. Saif-ud-Din Soz, the then Minister, Water Resources, Government of India, released the book. A panel discussion was organised among eminent researchers in the water sector including Dr. Kirit Parikh, Professor Y. K. Alagh, Mr. Suresh Prabhu, and Dr. Mahesh Rangarajan.

The book is a modest attempt to capture a large number of cases representing a variety of water conflicts across India. It is largely pre-analytical documentation to build an information base that could aid deeper analysis in the future. The 63 case studies in the book are classified into eight broad themes with eight thematic reviews. The *Economic and Political Weekly* also brought out a special issue on water conflicts based on the compendium, featuring 18 of the case studies³.

In the present phase of the Forum's work which is about to end soon, the emphasis has shifted from understanding water conflicts to water conflict resolution. The Forum is now engaged in four broad areas of work: a) conflict documentation, b) conflict resolution, c) conflict prevention and d) networking and awareness. Two resource centres have been set up in Kerala and Odisha. Two working groups have been constituted to focus on the following themes which are

¹ Doraiswamy R. and Biksham Gujja, 2004, *Understanding Water Conflicts: Case Studies from South India*, WWF-ICRISAT Project, Patancheru (Andhra Pradesh) and Pragathi, Bangalore

² Joy K. J., Bikasham Gujja, Suhas Paranjape, Vinod Goud, Shruti Vispute, 2008, *Water Conflicts in India: A Million Revolts in the Making*, New Delhi: Routledge

³ See *Economic and Political Weekly*, 18-14 February 2006, Vol. XLI, No. 2

of central importance in resolving water conflicts, namely, 1) equity and allocations for ecosystem needs and livelihoods; 2) legal and institutional issues related to conflict resolution. The reports of both these working groups have now been published.⁴

The Forum has a central secretariat housed in the Society for Promoting Participative Ecosystem Management (SOPPECOM), Pune. Its resource centre in Kerala is managed by the Chalakudy River Samrakshan Samiti, and the one in Odisha is managed by the Odisha Water Forum and Srishti. The Forum has Steering Committees and Advisory Committees at the central and state levels that oversee and guide its work. It has also tied up with Megh Pyne Abhiyan, Bihar for documentation of conflicts around floods, and Aaranyak, Guwahati, for documentation of water conflicts in the north-east. The Forum has a website (<http://waterconflictforum.org>) and a portlet (<http://conflicts.indiawaterportal.org>) within the India Water Portal of Arghyam Trust, Bangalore.

Though the Forum has added more components to its work, the work on documentation itself is far from over. For example, the first compendium did not cover non-peninsular India, urban water conflicts, and flood related conflicts. We are finding that there is a great diversity in the local contexts around which water conflicts occur. Secondly, the process of documentation is as important as its outcome, since it raises awareness and facilitates networking which is a valuable asset for any grassroots work on water conflicts. It was with these purposes in mind that the Forum decided to document conflicts in Odisha, Bihar and Guwahati. The documentation work in Odisha was led by the State Centre of the Forum, that in Bihar was led by the Megh Pyne Abhiyan, and that in the north-east was led by Aaranyak, Guwahati.

The Rationale and Process of Documentation of Flood Induced Conflicts

Water conflicts are often associated with scarcity. In most situations, this may be true. However, conflicts also occur during times of plenty: the case of floods is one such situation. Though there has been much academic and civil society engagement with the issue of floods, there does not seem to be any serious, systematic attempt to look at floods from the point of view of conflict and contestation - an issue that has remained unexplored till date. India is the most flood-affected nation in the world after Bangladesh. It accounts for one fifth of global deaths due to floods. On an average, thirty million people are evacuated every year. The total area in the country prone to floods is 40 million hectares, of which an area of 8 million hectares on average is regularly affected. Floods are increasingly occurring in areas that did not normally experience them, such as cities, and low rainfall regions like Rajasthan.

The Forum's engagement with flood induced conflicts needs to be seen as part of its larger effort to understand water conflicts in India, which has been one of its core mandates. The Forum believes that the documentation and dissemination of water related conflicts can lead to more informed debates: the first step towards a possible resolution and/or prevention. Thus capturing, understanding, and disseminating knowledge, and initiating a dialogue around flood induced conflicts

⁴ The titles of the reports are: 1) *Life, Livelihoods, Ecosystems, Culture: Entitlements and Allocation of Water for Competing Uses*, and 2) *Water Conflicts in India: Towards a New Legal and Institutional Framework*. Both reports are available on the Forum's websites - <http://waterconflictforum.org> and <http://conflicts.indiawaterportal.org>.

in different locations in India, are the core purposes of the Forum's initiative. Problematising the relation between floods and conflict will not only broaden our understanding on water related conflicts in general and flood induced conflicts in particular, but can also help to develop better strategies to deal with floods and their impacts.

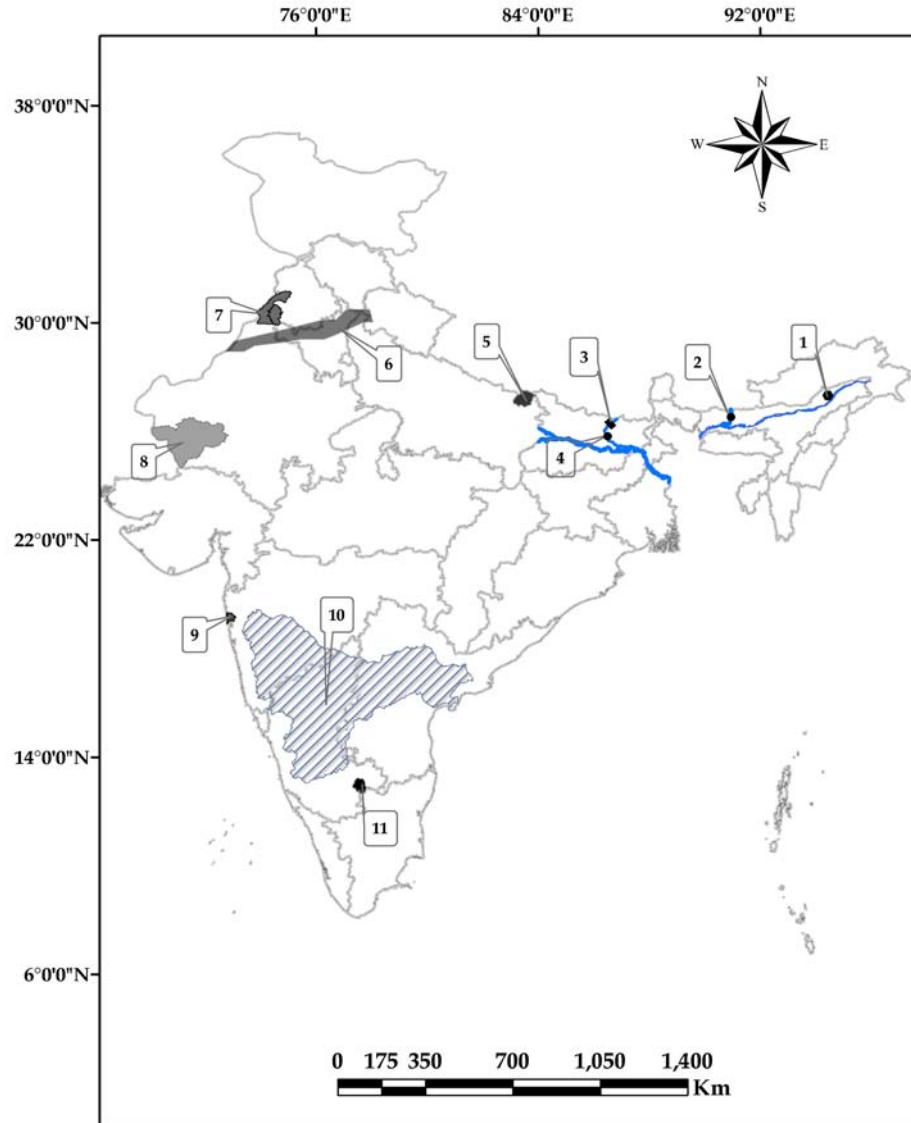
The Forum made an open call inviting abstracts of cases studies on flood induced water conflicts in the country. A note detailing the rationale of the exercise and the various elements to be covered in each case study was circulated widely. Since we did not receive a sufficient number of good abstracts, we identified important cases of flood related conflicts in the country, and approached prospective authors to write them. Efforts were also made to include a few case studies from Nepal, Bangladesh and Pakistan in order to capture the transnational dimension of flood induced conflicts. Of the case studies collected, we chose 20 which dealt with various dimensions of flood induced conflicts. Since a few authors dropped out, and a couple could not complete their case studies in time, we could include only 11 case studies for this compendium. The case studies from neighbouring countries could not be included, because of which the transnational dimension of flood induced conflicts is completely missing from the compendium. All case studies have been peer reviewed by Eklavya Prasad and K. J. Joy.

The 11 case included here represent a fairly wide range of situations, locations and issues. They capture the issues of embankments and floods, reservoir operations and interstate disputes, floods in cities and low rainfall areas like Rajasthan, rehabilitation related conflicts, etc. The compendium also covers a large geographical area, though it is concentrated on the north and north-east. Please see Table P1 and Figure P1 for the titles of the case studies and their locations.

Table P1: Flood related water conflicts

Sl. No.	Title of the case study
1	India's First Geo-Tube Embankment: Erosion of Community Hopes
2	The Char Dwellers of Assam: Flowing River, Floating People
3	Bridge over Kosi: Connecting People or Banishing Them?
4	Floods in North Bihar: A Recurrent Source of Conflicts
5	Flash Floods in Eastern UP: Hill Rivers Flood the Low Lying Region of Eastern Uttar Pradesh Causing Annual Distress Migration
6	Ghaggar Floods: A Manmade Disaster with Tragic Consequences
7	Floods in South West Punjab: Flood in the Arid Regions?
8	Floods in Western Rajasthan: Life after the Deluge
9	Mumbai under Floods: A Natural Disaster or Manifestation of an Underlying Conflict in Mumbai City's Skewed Urban Planning?
10	Flood in Krishna Basin: Institutional Responses to Flood Regulation
11	Floods in Bengaluru: No Respect for Water Bodies and Water Courses

Fig. P1: Location of Flood Induced Water Conflicts in India



1. India's First Geo-Tube Embankment: Erosion of Community Hopes
2. The Char Dwellers of Assam: Flowing River, Floating People
3. Bridge over Kosi: Connecting People or Banishing Them?
4. Floods in North Bihar: A Recurrent Source of Conflicts
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It should be emphasised that a majority of these case studies have not been carried out by professional academicians, and are more in the nature of pre-analytical documentation similar to the treatment in the Routledge compendium mentioned earlier. Though we have striven for uniformity in treatment, each author has brought his/her own emphasis to the case study.

⁵ For the format see
[http://
www.waterconflictforum.
org/contribute_provisi
onalcase.php](http://www.waterconflictforum.org/contribute_provisionalcase.php)

Structure of the Compendium

Following this preface, the compendium provides an overview of flood induced conflicts in the country. The next chapter looks at the phenomenon of 'plenty' in the specific context of Bihar and the conflicts around it. This is followed by eleven case studies. These case studies are further reviewed from the standpoint of 'conflicts over floods as struggles of knowledge' in the last chapter. The views expressed by the authors are their own, and not of their organisations, the editors of the compendium, or the Forum.

We understand that there are several areas of flood induced conflicts - both geographical and situational - that have not been covered in this compendium. This volume is only a beginning, and there is a need to take this incomplete and unfinished task forward. However, it is important that clear guidelines are followed while documenting water conflicts so that the information is reliable, is not one-sided, and will contribute to conflict resolution and prevention. There is a need for wide participation and access, as also for maintaining quality, reliability and authenticity.

The documentation carried out by the Forum is available on our website. We invite contributions of case studies in the format used in our earlier compendium.¹ They will appear on our website after they are reviewed. Suggestions to help us evolve methods and guidelines are also welcome. Please send your case studies and suggestions to waterconflictforum@gmail.com.

Understanding Conflicts around Floods in India

Eklavya Prasad and K. J. Joy

This article argues that it is crucial to engage with floods from the point of view of contestation and conflict. The article also points out that conflicts around floods arise out of multiple causes. In fact, this aspect has been one of the central gaps in the discourse on floods in the country. Floods have both a sub-regional and very local characteristics, and it is important to capture both. There is a need to develop a more nuanced understanding of the sub-regional variations of floods (during all three stages - pre, during and post floods) in order to develop conflict resolution strategies appropriately. This can also help agencies involved in addressing flood concerns to comprehend the differential impacts of floods on various social sections, which might help in developing intervention strategies that will be more contextual. Local experiences are of crucial importance as they vary greatly between and within communities according to culture, experience, and (especially for poor people) the pressure to survive. This compendium of case studies on flood induced water conflicts will hopefully bring out both the sub-regional and local contexts of floods in the country. Instead of looking at floods merely as annual occurrences, the compendium attempts to understand how these annual occurrences have long lasting impacts which lead to manageable or unmanageable conflicts.

¹ Report of Working Group on Flood Management and Region Specific Issue for XII Plan, October, 2011, Planning Commission, Government of India, New Delhi

² Report of Working Group on Flood Management and Region Specific Issue for XII Plan, October, 2011, Planning Commission, Government of India, New Delhi

³ Mohapatra P. K. and R. D. Singh, Flood Management in India, 2003, *Natural Hazards* 28: 131-143, 2003, Netherlands: Kluwer Academic Publishers

The Agony of Surplus

According to Rashtriya Barh Ayog's (RBA) 1980 assessment, the total flood prone area in the country was 40 million hectare (mha). The RBA arrived at this estimate by adding the maxima of flood affected area of 34 mha in any year to the protected area of 10 mha, and deducting from this 4 mha of protected area where protection works have failed.¹ The sum of the maxima of flood affected areas in any year considered by RBA has gone up to 49.815 mha by 2010. However, there is no credible database maintained by the states as required by a judicious criteria based on the frequency of flooding, duration and depth of inundation. The flood damages reported by the states from 1953 to 2010 have been projected at the 2011 price level as Rs. 812,500 crores approximately. Based on information provided by the Planning Commission about the expenditure incurred in various Five Year Plans, it has been assessed that about Rs. 126,000 crores (at the 2011 price level) have been spent in the flood control sector till date.² As per government records (as of 1991), 137 districts are vulnerable to floods. As reported by the Central Water Commission (CWC) under the Ministry of Water Resources, the annual average area affected by floods is 7.563 million ha. This observation was based on data for the period 1953 to 2000, with variability ranging from 1.46 million ha in 1965 to 17.5 million ha in 1978.³ It accounts for one-fifth of global deaths due to floods, and on an average, thirty million people are evacuated every year. India is considered to be the most flood affected nation in the world after Bangladesh.

Twenty-two states and one union territory (Andaman & Nicobar) are vulnerable to floods. Of these, the most vulnerable states are Uttar Pradesh, Bihar, Assam, West Bengal, Gujarat, Orissa, Andhra Pradesh, Madhya Pradesh, Maharashtra, Punjab, and Jammu & Kashmir.⁴ (See Figure 1). More than the loss of life and damage to property, the sense of insecurity and fear in the minds of people living in the flood plains is a cause of great concern. Floods are the most feared natural disaster due to their disastrous impacts such as the agony of survivors, spread of epidemics, collapse of local livelihood opportunities, erosion or inundation of cultivable land, non-availability of drinking water, essential commodities and medicines, and loss of dwellings. Heavy flood damages occurred in the country during the monsoons of the years 1955, 1971, 1973, 1977, 1978, 1980, 1984, 1988, 1989, 1998 and 2004.⁵ Floods have been affecting urban and rural centres, rainfall abundant and scarce regions, upstream and downstream habitations, within and outside embankments, cold and hot desert, land locked and coastal areas, etc. as indicated by the cases studies in this compendium. The case studies also establish the enormity and expanse of the disaster. As per a Government of India (GOI) report, there is a dearth of documentation on floods and the damage they cause.⁶ A disaster that has prodigious continuation cannot be seen merely from a water surplus standpoint. The sheer magnitude and frequency of floods necessitates further examination into their diverse and complex ramifications on the affected population.

Reactive and Relief Centric Approach to Floods

As large parts of the country perennially reel under recurring drought, the GOI has tried to address the crisis through a set of progressive and innovative measures like the Drought Prone Areas Programme (DPAP), the Desert Development Programme (DDP), the Integrated Watershed Development Programme (IWDP), the National Watershed Development Programme for Rainfed Areas (NWDPA), etc. The Department of Land Records in the Ministry of Rural Development has now merged the DDP, DPAP and IWDP together into a comprehensive programme called the Integrated Watershed Management Programme (IWMP). This programme is to be implemented according to the Common Guidelines on Watershed Development.⁷ Also, the Common Guidelines of 2008⁸ are binding on all government supported watershed programmes in the country. In addition, both individuals and civil society organisations have undertaken diverse works to address drought preparedness, mitigation, relief and drought proofing work, as well as research and documentation work concerning drought. There is a vast expanse of scholarly work within and outside India to highlight and induce understanding, develop coping mechanisms, identify solutions and highlight corrective measures to combat drought.

However, in the case of floods, such work has not been undertaken. The National Disaster Management Authority's (NDMA) guidelines on the management of floods claim that the extent of devastation of livelihood systems, property and damage to infrastructure and public utilities, loss of human and animal life, and ruination of the ecosystem by floods has largely been met with a reactive response.⁹ The guidelines mention that the response to floods has, by and large, focussed on rescue and relief after the flood. Preparatory, preventive and mitigative aspects of flood management have not received due attention. The

⁴ Joshi P.C., P. Khattri, M.M. Singh, M. Fordham, Guha-Sapir D., 2007, Flood: Trend and Social Impacts in Indian Context, Powerpoint Presentation, October, 2007

⁵ National Disaster Management Guidelines, Management of Floods, National Disaster Management Authority, Government of India, New Delhi, January, 2008

⁶ National Disaster Management Guidelines, Management of Floods, National Disaster Management Authority, Government of India, New Delhi, January, 2008

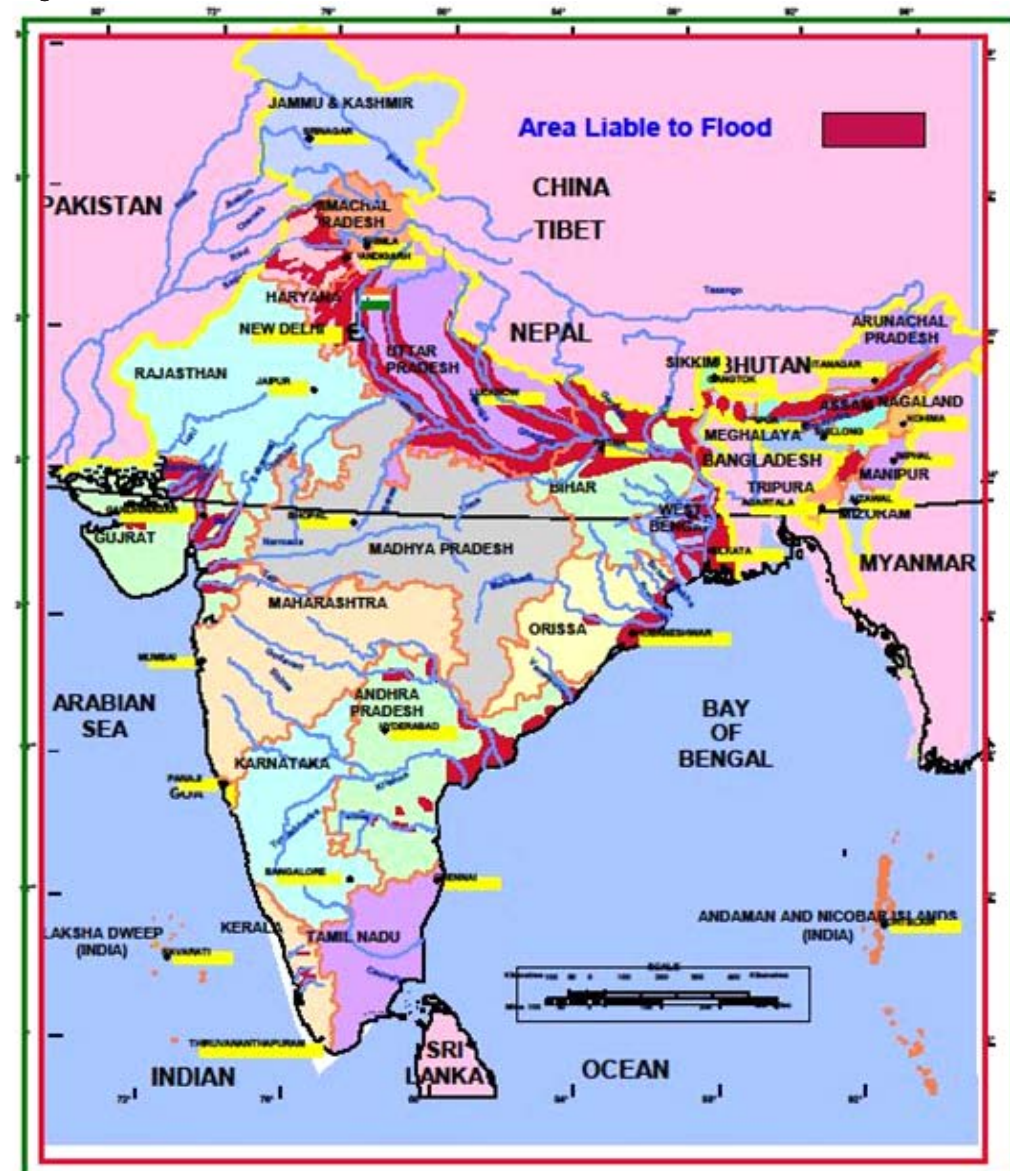
⁷ National Disaster Management Guidelines, Management of Drought, National Disaster Management Authority, Government of India, ISBN 978-93-80440-08-8, New Delhi, September 2010

⁸ This has been further revised in 2011 and 2012

⁹ National Disaster Management Guidelines, Management of Floods, National Disaster Management Authority, Government of India, New Delhi, January, 2008

overall recognition that floods cannot be prevented, and that technical and infrastructural interventions can work towards their control and minimisation, inevitably leaves only the option of rescue and relief operations for individuals and civil society organisations to work in flood prone areas. There have been efforts by civil society organisations to intervene in preparedness work. However, the flood prone area in India is approximately 49.815 mha, which includes 137 districts across 22 states and one union territory, and floods can occur in any area within and beyond these 49.815 mha. Therefore, preparatory work often trails a post-flood situation for the next season, with an assumption that floods are going to occur in the same place or region. As a result, other flood prone areas remain unattended, leading to complete mayhem if hit by a flood. The techno-centric arguments, analysis and prescriptions to address floods in India are also being supported by similar academic works, because of which various others facets of floods remain unattended. This points to a need to understand floods beyond structural measures.

Fig. 1: Area liable to floods in India



Floods to be Viewed in their Own Right

Floods occur due to various reasons including drainage congestion and waterlogging, river bank erosion, snow-melt/glacial lake outbursts and formation and subsequent bursting of landslide dams, littoral drift in river estuaries, monsoon/cyclones/cyclonic circulations, and cloudbursts¹⁰. Reservoirs which are constructed as flood cushioning structures, especially improper reservoir operations, also give rise to floods. Experience also shows that embankments that are supposed to protect flood prone regions either cause or exacerbate floods. Floods occur in both rural and urban centres, and are one of a few catastrophes which manifest in such diverse ways.

Floods also have varied impacts. In rural areas, people and livestock are particularly susceptible to becoming casualties of floods because of high population densities, an absence of zoning regulations, a lack of 'effective' flood control, and lack of emergency response infrastructure and early warning systems. Other factors like the lack of adequate evacuee sites above flood levels, accessible routes for reaching safe places, a lack of public information about escape routes and other appropriate response activities renders communities more vulnerable. Floods also compel vulnerability among women, adolescent girls, children and senior citizens. Urban deluges in the recent past have added a new dimension to the existing flood discourse. Urban floods trigger mass displacement of slum dwellers. Shortages of basic conveniences and the sky rocketing price of fundamental essentials, coupled with a high inaccessibility quotient, makes it difficult for poor and lower middle class people to overcome the catastrophe. Being stranded in flood waters without refuge for several days has a detrimental impact on these vulnerable groups. Hence, it becomes essential to not only categorise a flood situation as another water conflict, but also view it as a problem in its own right because of its local variations and differential impacts. Bracketing it as a part of a singular problem can lead to generalisations which will prevent it from being addressed comprehensively.

Varying Impacts of Floods across Social Groups

It has been claimed that a catastrophe like a flood impacts all without differentiating between social groups. However, on assessing the nature, intensity and duration of the devastating impact (both in rural and urban contexts), a specific impact trend emerges. Assessments have indicated that the vulnerability of the population depends on several social factors like age, gender, economic status, social construct, population density, health status, race/ethnicity, residential status, culture, etc. In rural areas, another factor affecting vulnerability is caste and social discrimination. The vulnerability quotient of floods is possibly linked with the very causal factors of floods. However, it is crucial to further explore the linkages between the vulnerability quotient and the causal factors of recurrent and unprecedented floods in India in order to identify the common space that could be the breeding ground for flood induced conflict. As floods impact different sections of society to different extents, it is essential to delve into these differences to develop a comprehensive understanding of the issue at a local level.

Linking Floods and Conflicts

Conflict in the context of floods can be defined as contradictory perceptions (between centre and state; state and non-state actors; vulnerable and secure

¹⁰ National Disaster Management Guidelines, Management of Floods, National Disaster Management Authority, Government of India, New Delhi, January, 2008

groups; and amongst vulnerable groups) about the course of action to overcome the calamity. What actions are taken and how they are taken in the aftermath of a flood provides the immediate context of flood induced conflicts. Conflicts also proliferate because of factual disagreements between individuals, groups and institutions with different values, priorities, interests, resources, survival mechanisms and hopes. Flood induced conflicts take place between groups, displaced communities, within and outside the embankment, states, regions, and nations. Water conflicts engendered by floods might correlate with the very reason for and scale of the devastation; extent of inundation; degree of exploitation and deprivation; resource crunch and allocation; inadequacy in attending to the immediate and long duration problems; inaccurate damage assessment leading to misplaced allocation of rehabilitation packages; forced compromise to accommodate the needs of other dominant groups; gender specific inequality and inaccessibility; constrained livelihood options; resettlement of displaced population; damage compensation; flood induced migration; political provocation; etc. Many other factors might have remained unexplored.

The issue of flood induced conflicts is not limited to what happens after the flood takes place. In fact, there are conflicting perceptions about structural measures like dams and embankments to either prevent or mitigate floods. It is as though the solution itself is leading to problems. Also, there are differences in worldviews about how one conceptualises rivers and floods, and the limit to “tame” rivers. There are differences in the epistemology itself. This difference in worldviews and epistemology get carried through what needs to be done to prevent floods. For example, the viewpoint that it is “natural” for rivers to flood gives rise to conceptualisations of “living with floods”. Cortesi calls these epistemological contestations over floods as ‘struggles of knowledge’¹¹.

Understanding Conflicting Parties

In the post-flood scenario, there are many factors that give rise to discontent among several contending groups. Some of these factors include: 1) the nature of efforts made to save lives and property, provide aid and security; 2) various insecurities that the flood affected experience; 3) the way aid is distributed and relief work is handled; 4) loss of life (of humans and livestock) and livelihood opportunities, and the process of rehabilitation; and 5) technical and administrative laxity and political rivalry. Apart from these very specific factors, there is a broader set of issues which lead to floods, such as the politics of controlling water, handling of floods as a recurring phenomena, infrastructure development processes, drainage problem due to construction and land reclamation mania, legal encroachments, urbanisation, local governance, etc.

Certain support systems and groups are also formed to face the crisis of floods. We will call these ‘collaborating groups’ as opposed to the ‘conflicting groups/ parties’. These collaborating groups come forward to highlight problems, campaign against mismanagement, and take actions to identify solutions and implement them. The experience of the post-flood scenario shows that collaborating groups do work together to overcome the problem or minimise its impact. Such groups are neither included in the institutional framework nor in the financial mechanisms of flood management. It is genuinely believed that there are only two contesting parties: the flood affected people and the state. However, as

¹¹ Cortesi, Luisa, “Nature is hard to know: conflicts over floods as struggles of knowledge”, in Prasad Eklavya, K. J. Joy, Suhas Paranjape, Shruti Vispute, *Agony of Floods: Flood Induced Water Conflicts in India* (Ed.), 2012, Pune: Forum for Policy Dialogue on Water Conflicts in India (this compendium)

the case studies in this compendium and the overall experience of the post-flood scenario clearly highlight, there are more than two contesting parties as well as collaborating ones in each flood related conflict situation. The involvement of the collaborating groups/parties should be a pre-requisite in addressing concerns and in identifying plausible ways forward towards far more equitable and sustainable solutions.

There is a web of institutions in the country that are responsible for policies, programmes and schemes and financial arrangements concerning floods in India. Some of the important ones include:

● **National Institutions/Agencies:** *National Disaster Management Authority, National Executive Committee, National Disaster Response Force, Central Government, National Institute of Disaster Management, The Central Flood Control Board (CFCB)/Irrigation Ministers Conference, Central Water Commission, Ganga Flood Control Commission/Ganga Flood Control Board, Brahmaputra Board/High Powered Review Board, India Meteorological Department, National Centre for Medium Range Weather Forecasting, National Remote Sensing Agency, National Flood Management Institute, River Basin Organisations-Interstate Coordination*¹² with varying responsibilities

● **State level organisations:** *Disaster Management Departments/Commissioners, State Disaster Management Authority, State Executive Committee, Irrigation/Water Resources/Flood Control Departments, District Disaster Management Authority, Local Authorities, State Disaster Response Force, Intra-state Multi-sectoral Coordination*¹³

● **Techno-economic Appraisal of Flood Management Schemes**¹⁴

● **Funding of Flood Management Schemes:** *Plans of Central Ministries/Departments, State Plans, Centrally sponsored/Central Sector Schemes, District Planning and Development Council Funds, Calamity Relief Fund, National Flood Mitigation Project*¹⁵

The fragmentation of institutions at the state level leading to “departmental fundamentalism” could also be a source of conflict. The state government is solely responsible for flood management and this also makes it the most obvious conflicting party in the entire process. This is why very often in the post-flood scenario the anger of the affected people is directed against the state government and the concerned departments. Also, unlike many other water related conflicts where there are clearly identifiable conflicting parties, in the case of flood related conflicts, the situation is rather hazy or grey, and apart from the people venting their anger and frustration against the state and its various arms, the other conflicting parties are often not visible.

In Conclusion

The sources of flood induced conflicts must be understood in order to engage with them effectively. Unfortunately, floods have never been looked into through the lens of conflict and contestation, despite significant variations in their magnitude, character, locations, and the space they impact. The problem of floods in itself has been colossal and diverse, hence the discourse has remained confined to issues,

¹² National Disaster Management Guidelines, Management of Floods, National Disaster Management Authority, Government of India, New Delhi, January, 2008

¹³ National Disaster Management Guidelines, Management of Floods, National Disaster Management Authority, Government of India, New Delhi, January, 2008

¹⁴ National Disaster Management Guidelines, Management of Floods, National Disaster Management Authority, Government of India, New Delhi, January, 2008

¹⁵ National Disaster Management Guidelines, Management of Floods, National Disaster Management Authority, Government of India, New Delhi, January, 2008

which despite reiteration, continue to be ignored by the concerned authorities. Therefore, understanding the correlation between floods and the conflict perspective will not only broaden the existing discourse around floods but also strengthen the effort to showcase the extended impact of human induced disaster in the country leading to better strategies in dealing with them.

There is also a need to view floods from the conflict perspective because the efficacy and dangers of the present flood control measures need to be viewed and debated as a source that can trigger multiple conflicts. More often than not, the debate concerning floods has been appropriated by technical arguments or the relief and rehabilitation discourse. This compendium on flood related water conflicts is an attempt to bring forth issues that will challenge/confront/ address the rhetoric of floods through a conflict and contestation framework which has not been included in the debate till date.

We hope that this document will help develop a more nuanced understanding of the sub-regional variations of floods (during all three stages - pre, during and post) in order to develop the conflict resolution strategies more appropriately. It can also help agencies involved in addressing flood concerns to comprehend the differential impacts of floods on various social sections, which might help in developing intervention strategies that will be more contextual.

We also urge state governments as well as civil society and academic institutions to ensure that each and every flood event is properly documented and damage assessed on a scientific basis with the help of latest technological advancements including remote sensing (RS) imagery and geographical information system (GIS).

Will Someone Share Our Extra Water?

Dinesh Kumar Mishra

Introduction

Stories of conflicts over scarcity of water are heard quite often. However, one rarely hears of conflicts that occur because a community wants to share its excess water with others. Scarcity of water is generally the dominant scenario, and statements such as 'water is life', or 'the next world war will be fought over water' are common. Much research is being conducted to devise means of conflict resolution and share scarce water. Scarcity of water links discourses on deforestation, pollution, climate change, rise in global temperatures, melting of glaciers, etc. Floods are only referred to in passing, for example, in statements such as 'climate change will lead to melting of glaciers and enhance the intensity of floods'. However, it is assumed that the focus will be on drought once the rains are over and the debate returns to scarcities, where small deficits in the availability of water are manageable, but a huge difference in supply and demand creates problems. Floods of small magnitudes are not only manageable, but even welcome, while large floods are problematic. Communities do not want the unmanageable extra water, and wish that it flows elsewhere to others. Also, the recipients of the unwanted water resist the move with all their might, which at times leads to violent conflicts.

Setting of the Parting Line of Interests

Embankments, which are artificial mud walls with trapezoidal section, built between people and rivers, are often constructed to provide protection against floods. People feel that their problems due to the river will be solved once the embankment is constructed, without ever realising that they may be exposed to surges of water if the embankment is breached in the future. Embankments provide a false sense of security, so people demand that embankments must be built to protect them against floods.

As a result, many settlements are trapped between the river and the embankments. People residing in such river-side settlements ultimately pay the price for the protection of those living on the country-side of the embankments.¹ The interests of people living on either side of the embankment differ drastically and are even opposed to each other. These embankments become the parting line of interests between those who are possibly protected against floods, and those who are devastated by them.

The people who face adverse impacts do not want the embankments to be built in the first place, because all the river water which used to flow over a vast area will be constrained to flow within the embankments. The flood level within the embankments will rise, and with progressive rise of the river bed because of sedimentation, it will always be pushed upwards with the passage of time. They will also have to face erosion of their land and dwellings and sand-casting due to the river. Rehabilitation on the country-side is not of much help to them because (i) their fields would be located at a greater distance from their new habitations

¹ In what follows, river-side refers to the portion between the embankment and the river and the country-side refers to the portion outside the embankment.

compared to their old villages; (ii) the rehabilitation sites could get waterlogged because of seepage through the embankments and/or obstruction to the natural drainage of the river. A possible breach in the embankment is also a looming threat, if they relocate to rehabilitation sites. Their resistance to the construction of embankments is therefore natural.

As a compromise, they demand that the spacing between the embankments should be as large as possible so that the depth of flow within the embankments remains manageable. This may result in the trapping of more villages within the embankments, and will naturally be resisted by the likely victims. Those close to the proposed alignment of the embankment may demand that the alignment be changed so that their village is located on the country-side of the embankment. Villages close to the river but away from the embankment on the river-side cannot demand shifting of the alignment, as locating these villages on the country-side will grossly reduce the spacing between the embankments, and the establishment will never concede their demands. They also insist that the spacing between the embankments is increased as much as possible.

The Kosi Case Study

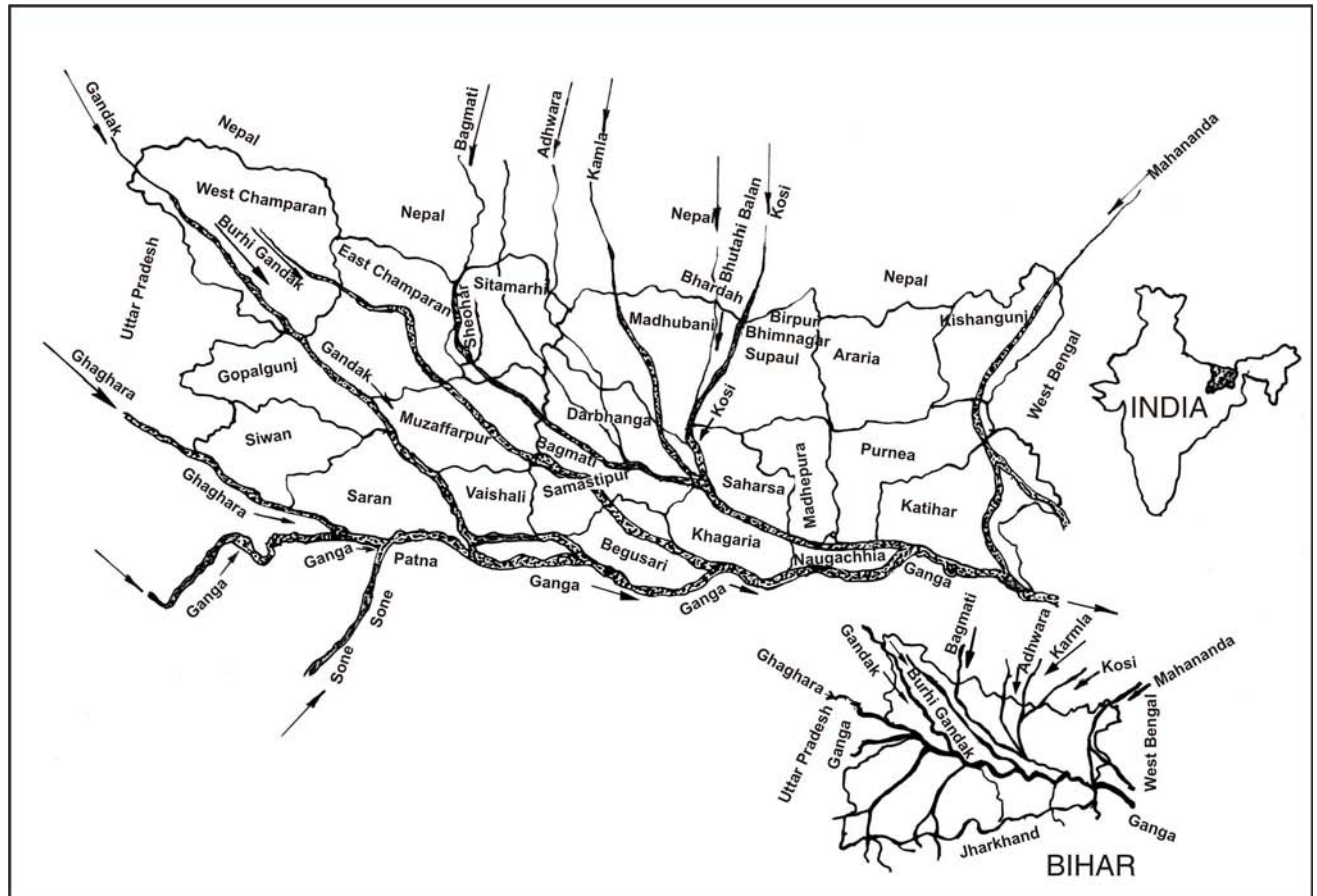
When the Kosi embankments were constructed in the late 1950s in north Bihar (Fig. 1), these controversies came to the fore. People on one side wanted the western Kosi embankment shifted eastwards, while others wanted the eastern Kosi embankment pushed westwards so that their villages could be located on the country-side of the embankment. If both these demands were met, very little space would be left between the two embankments for the floodwaters to pass through. According to P.N. Singh, former Chief Engineer of Bihar, "Had all the demands of all the people been met, both the embankments of the Kosi would have merged into each other and one does not know where the river would have gone."²

Those living in this zone did not want the embankments constructed in the first place. If this was not possible, they wanted the spacing increased to the extent possible, which could only be achieved if the first two demands were rejected. As if that were not enough, there was another set of people who were simply not interested in which way the embankments were aligned. They only wanted these embankments to be built so that they could get some employment. Their number was quite significant. The government was using these people to spread propaganda that there is a lot of demand for the embankments to be built. Each group had its own vested interest in the project and how the alignment was done, and was fighting the rest.

This is precisely what the government wanted: that the people fight among themselves without reaching any conclusion. This would give the government the necessary lever so that it could do whatever it wanted to in the name of technical propriety, which was thrown to the winds a long time back. In all fairness, the engineers should have decided the height, width and spacing of the embankments, and the government should have taken care of the displaced people. Instead, the entire issue was decided by an opinion poll. The final shape of the embankments (Fig. 2) tells the entire story. The spacing between the embankments should have increased as the river moved on after receiving waters of its tributaries; instead, in reality, the spacing shrank.

² Trivedi, P. N., Former Chief Engineer of Bihar, Personal communication.

Fig. 1: North Bihar



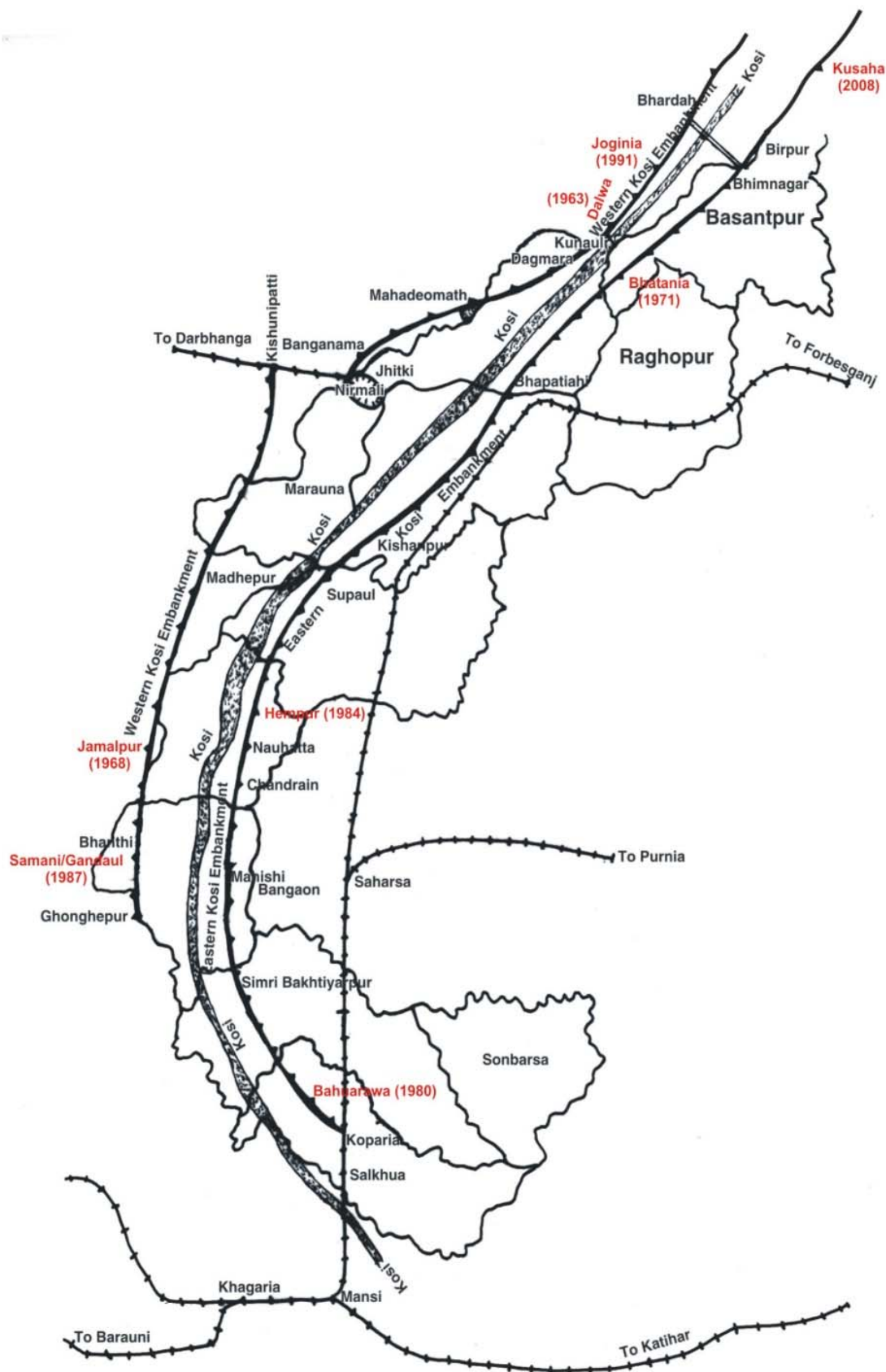
As the construction work on the embankments on the Kosi began, there was tremendous enthusiasm generated among the people who were likely to be protected against floods, since the objective of the project was to kindle hope in people's minds. At the same time, there was much anxiety among those who were likely to get trapped within these embankments.

Nobody Wants to Live within the Embankments

When the construction began, the villages located close to the river-side of the western embankment had successfully stalled the construction and changed its alignment in Ghoghardiha and Madhepur blocks of Madhubani district. They could manage to free themselves from the embankments through mass movements, though only after resorting to all sorts of agitations. This encouraged the villages close to the eastern embankment to demand the same. The inhabitants of Dharahara Thana of the Saharsa district demanded that the eastern embankment of the Kosi should be pushed westwards two kilometers south of Barahi to protect the villages of Barhara, Partaha and Gobindpur. Similar demands were raised from Bangaon and Mahishi villages further south. They all resorted to agitation, and managed to push the eastern embankment away from them, towards the west.³ In the meanwhile, the western embankment alignment was finalised, which helped many villages along the western embankment of the river to be located on the country-side there. The *thanas* of Singhia (Samastipur) and Biraul (Darbhanga) were also located outside the embankment now, and there was

³ Tul Mohan Ram, Former MP, Personal communication

Fig. 2: Kosi Embankments and the breach spots so far (shown in red colour)



occasion to celebrate this victory. Similar victories were achieved on the eastern embankment too when some villages north of the Navhatta block HQ managed to be located on the country-side.

Those Trapped inside the Embankments Want a Larger Waterway

With the squeezing of the embankments on either side, those left within the Kosi embankments were extremely discontent. Towards the end of the 1956, they began to organise themselves against the injustice done to them. They were demanding compensation for the losses incurred by them during the rains, arrangement of dwellings during the rainy season, and widening of the spacing between the two embankments to the extent possible. They thought that if the spacing of the embankments was increased, more waterways would be available, which would reduce the impact of the floods. They felt that the government was hell bent on destroying their lives, and decided to resort to *Satyagraha* if their demands were not met. The people were so disgusted that they even attempted to cut the western Kosi embankment at Alaula (Madhepur block) on 31st December, 1956. However, good sense prevailed and they decided to give the government another chance to decide matters afresh.⁴

Government's Threat to Deploy Armed Police to Quell Dissent

There was widespread resentment among the people regarding the embankments, and work was suspended at most places. The general elections of 1957 were approaching, and the government was not in a position to deploy armed police force on the scale that was needed in the area to ensure that the construction of the embankments proceeded as planned. The work on the western embankment remained suspended till the elections were held. A meeting of representatives of 87 villages under the leadership of Jaidev Salhaita was held in village Kusamaul, just before the general elections on 4th February, 1957. It was resolved in the meeting that the government should be pressed to follow the original embankment alignment.⁵ The people felt that in order to save 14 villages, the interest of 79 villages trapped within the Kosi embankments had been sacrificed. They pledged to fight it to their last breath. They also apprehended that by reducing the spacing of the embankments, the villages located within the embankments would be swept away in the current of the river waters. They conveyed their position to the concerned officials of the Kosi Project, and organised a *dharna* starting 6th February, 1957.

According to Shyam Sundar Jha of Dwalakh village in Madhubani district, "When it was almost certain that our village was going to get trapped within the river and the western embankment, meetings were held in many villages and it was decided that if the spacing between the embankments was shrunk, it would make life very difficult for the villages trapped. It was resolved that the western embankment should not be allowed to be built, and the original alignment via Madhepur should be adhered to. That would provide a larger waterway to the river flow and our miseries would be reduced. Residents of many villages in the south met Administrator of the Kosi Project, T. P. Singh, Additional Chief Engineer P. R. Guha, and the Chief Minister Dr. Shri Krishna Singh with the proposal. However, the meeting did not yield any result because the villages were deep inside the

⁴ *Aryawarta*, Patna
Edition: February 25,
1956

⁵ *Ibid.*, February 14,
1957

river-side and the government was hell bent on completing the western embankment. There were villages located within the embankments further south that fiercely agitated against the alignment, got it changed in that reach, pushed the embankment eastwards and were secure in the country-side of the western embankment, although there were many villages that wanted the embankment pushed further eastward and were not happy even with the changed alignment. All this was happening at the cost of the villages that were unlikely to come on the country-side of the western embankment. They had no sympathetic supporters who were willing to look at the issue from their eyes. Out of sheer desperation, the residents of Karahara finally cut the western embankment. The river was flowing close to the embankment and it spilled, took a turn and inundated the country-side. Emerging river water badly hit the villages of Rahua and Sangram. The residents of the villages on either side of the embankment picked up their *lathees* and came face to face with each other. A fierce fight ensued among people who were friends and relatives, now separated by the embankment. The people on the country-side wanted the embankment to be built, while the river-side residents were opposed to just that. The government was also trapped within the embankments along with the people.

According to Shyam Sundar Jha, “Cases were lodged against my grandfather Jageshwar Jha, Jaidev Salhaita of Bariyarawa, Bhekho Kunwar of Kharik and Nagendra Jha and Bhola Singh of Karahara. Lalit Narayan Mishra (the then Secretary of Bharat Sevak Samaj and later a Central Minister) came to our village to seek a compromise. There was not enough black cloth available in the village to stage a black flag demonstration against him. The villagers brought out their umbrellas and opened them before him in lieu of black flags as a symbolic resistance to the project. They were so agitated that at one time they even planned to drown the Additional Chief Engineer P. R. Guha in the Kosi. They even took him in a boat to the midstream of the river. The plan was abandoned because many villagers also might have died had the boat overturned.”⁶

Some 36 villages were issued a notice under article 107 of the Indian Penal Code. The collector of Saharsa assured the Project Authorities on 28th February, 1957 that police would be deployed at all strategic points by 13th March, 1957, as enough police force was expected to be available after the general elections.

After the general elections, the government took a stand to deploy armed police at the work sites, and the engineers too started taking a tough stance. P. R. Guha, Chief Engineer of the Kosi Project, stated clearly that no more changes in the alignment of the Kosi embankments would be entertained, which led to turmoil in the area.

Tara Kant Jha of Karahara village in Madhubani district said, “It was wrong to build the embankment in the first place. It was to pass through Madhepur according to the original drawing, and we all thought we would sacrifice in the larger interest of society, although we knew that we would be trapped inside the embankments. However, when they changed the alignment and placed the embankment here right over our head, we became alert to the fact that the government and people around us were not bothered about our well-being. In such a situation, how long could we undergo the rigours of sacrificing in the interest of those who did not care for us? Senior staff members working on the project including T. P. Singh, Chief

⁶ Jha Shyam Sundar, Personal communication.

Engineer Ekambaram, P. R. Guha and the Deputy Administrator of the Kosi Project, Sachin Datta, would visit our villages almost every day, to convince people to allow the embankment to be constructed according to the changed alignment. We were opposed to this, so one day we cut the embankment and hoisted our flag on it, and began a *Satyagraha*. This hurt the people on the other side, and they raided our villages armed with *lathees*. We were also prepared, and all of us had soaked our hands in buckets full of red color so as to distinguish between 'our men' and 'their men' while fighting. We were friends and relatives until yesterday, but the embankment had turned us into enemies. Some 87 villages south of Matras, were on our side and wanted the embankment to follow the original alignment. The collector of Darbhanga, Jacob, came to our village with T. P. Singh, P. R. Guha and other engineers. After going back to Darbhanga, Jacob wrote us a letter requesting us to allow the western embankment to be built, and assuring us that he would take care of providing us relief, education for our children, remission of cess, job to one person per family affected by the Kosi Project, and rehabilitation. However, a day before this letter was delivered, the Superintendent of Police booked us, charging us with torching of government houses and cutting the embankment, arrested many of us, and lodged us in Madhubani jail. The jail doctor was from a neighbouring village and was known to us. It was through his efforts that we got bail. We also filed a counter case against the government but the local Block Development Officer (BDO) advised us to accept rehabilitation and assured us that the government would help us. We demanded a ring bund around our village which was granted. The ring bund was constructed but was washed away in the floods of 1966. The story ended there. There is a limit to how much you can fight."⁷

It seemed that the IG of Police had already promised the Chief Engineer that police protection would be available soon. The Deputy Chief Administrator, Sachin Dutta, spent five days in the disputed villages convincing people to allow the embankments to be built. His efforts did not yield the desired results. The Additional Chief Engineer P. R. Guha went up to Jamalpur on a similar mission, but the people there were changing the alignment of the embankment. The agitators, who were opposed to the embankments, from Karahara to Bheja and from Bheja to Jamalpur and Bhanthi, were vigilant all along the length of the embankment. They uprooted pegs and flags put by the project engineers, snatched their dumpy levels, and chased them away at many places. Similar incidences were taking place in the Dharahara *Thana* on the eastern embankment. A spokesperson of the government told media persons on 8 March, 1957 that the government had an option to stop the work and warned that the people would have to face the floods. In such an eventuality, the government would not come to their rescue.⁸

Immediately after the swearing in of the government on 16 March, 1957, armed police were dispatched to the construction sites of the embankment on 17 March, and the work on the western Kosi embankment resumed. The resistance to the project, however, never subsided. The Kosi Project had successfully split the people into two camps, between those who wanted the embankment spacing to widen, and others who wanted it to shrink. The rival parties took to the streets. People faced one another with *lathees* at many places. They fought a pitched battle against each other in the area to the south of Karahara. The police was

⁷ Jha Tara Kant, Personal communication.

⁸ Press Release of Govt. of Bihar, *Aryawarta*, Patna Edition, March 9, 1957

neutral and free to assault either side. Many villages were issued written notices by the government not to obstruct the official work. The government apprehended that the movement may spread to other places and reinforced the police force at these points. As a reaction to the police, children and women also joined the protests. They would lie down in the trenches saying that the embankment can only be built over their dead bodies. No amount of persuasion and camping of senior officials was going to convince them. The contractors had vacated the sites, and the Additional Chief Engineer was pleading with them to resume work, but they would not respond. The political rivalry that was brought to the fore during the general elections and the professional rivalry of the contractors was adding fuel to the situation. Newspaper reports of the entire month of April 1957 were full of such events. Police had to intervene and separate the warring groups at many places, and a large number of agitators were put behind bars.

Baidya Nath Mehta, and many others Members of Legislative Assembly (MLAs) including Parmeshwar Kunwar, Tul Mohan Ram, Yuvraj, Janak Singh and Janki Nandan Singh, raised the issue in the Bihar Vidhan Sabha. Mehta challenged the government, "When you go there, you will find the Kosi roaring like a lion destroying the land and the population alike. When the people ask you, 'What is our future? What is the perspective you have of the things that you are doing?... What is the government doing for us?'... then you throw them behind bars."⁹

There was no possible solution to this problem. Somehow, the construction of the embankments was completed with police presence. It is no wonder that the Kosi embankments are a caricature of the original alignment, if there was any. Those living within the embankments and outside them still grudge each other. Mohammad Ayyub of Bhelahi village located within the Kosi embankments in Mahishi block of Saharsa district said, "When these embankments were built, the western embankment was to pass through Punach and the eastern embankment was to pass through Bangaon at a distance of 18 km. They kicked the embankment from both sides and the spacing between the embankments shrunk to Ghonghepur in the west and Mahishi in the east, such that it was almost half of the spacing as per design. We were lured by the promises made to us. They said they would irrigate all our fields. Where is that irrigation? There were promises of orchards. Where are they? They promised us that they would turn this place into heaven. If this is heaven, where else is hell? ... If we had known that this would be our fate, we would have either committed suicide or killed the embankment builders. Unfortunately, death is in nobody's hands. The western embankment breached once in 1968. It happened late at night. And before the breach, it was a sight of *Qayaamat*. Somehow we escaped death. Then there was some relief when the embankment breached in 1984. This embankment has made us so selfish that we want it to breach knowing fully well that it will spell doom for those living outside the embankment. Most of them are our kith and kin. We face the music every year; let those outside the embankments face it sometimes."¹⁰

Much to the comfort of the people living within the Kosi embankments, the western embankment of the river breached at Samani and Ghonghepur in 1987, at Joginia in Nepal in 1991, and finally the eastern embankment at Kusaha in Nepal breached in 2008. It must be said here that 380 villages of India and 34 villages of Nepal are located within the Kosi embankments, with a population of nearly 1.2 million. The Kosi's waters pass over these villages every year.¹¹

⁹ Mehta, Baidya Nath, Bihar Legislative Assembly Debates, June 21, 1957, p. 27

¹⁰ Mohammad Ayyub, Personal communication

¹¹ Mishra Dinesh Kumar, 2008, Trapped! Between the Devil and Deep Waters, Dehradun: People's Science Institute and New Delhi: SANDRP, p. 147 and pp. 157-159

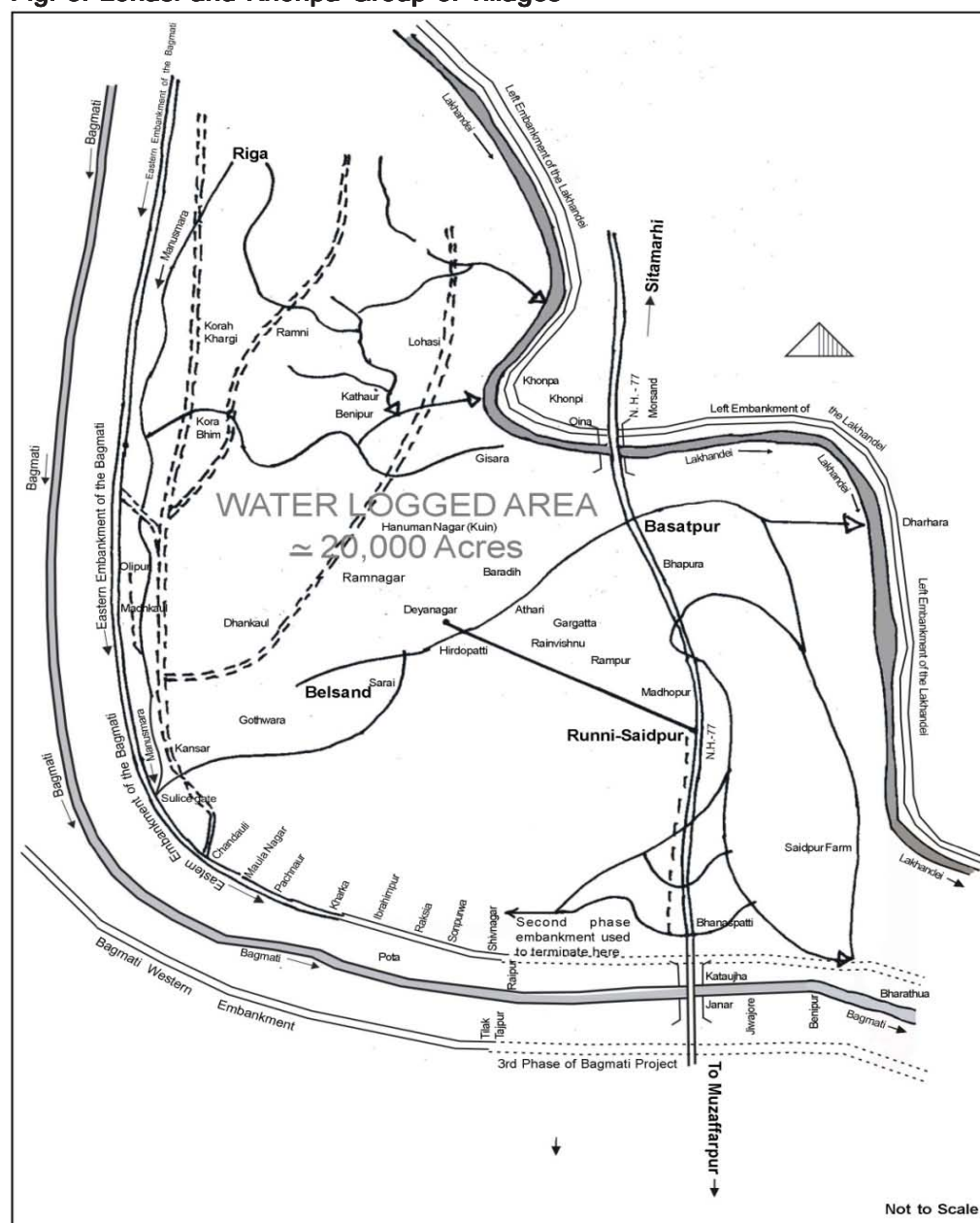
Only a breach in the embankment can reduce their suffering, and they pray for it. If the embankment breaches, the ones living outside suffer the deluge. It must be recalled here that this breach in 2008 hit 993 villages spread over 35 blocks in five districts. The resulting floods spread over an area of 3.68 lakh hectares, destroyed 2,22,754 houses killing 527 persons and 19,323 cattle.¹² So much loss has never been recorded in the known history of the Kosi till today.

Lohasi Carnage

Embankments Divide Communities

In 1970, the *doab* of the Bagmati and the Lakhadei (Fig. 3) witnessed a bloody conflict, when the warring communities came face to face with weapons and many persons lost their lives. Nowhere else in Bihar has such a conflict taken place till date.

Fig. 3: Lohasi and Khonpa Group of villages



¹² Annual Report of the Disaster Management Department, Govt. of Bihar, 2008

“Dharmakshetre Kurukshetre”

On 18th August, 1970, almost all newspapers published from Patna carried a story about a conflict in Sitamarhi. Referring to the incident, The Indian Nation (Patna edition) carried the following report, titled ‘4 Die in Police Firing Near Sitamarhi’: ‘Four persons were killed and six others injured when the police opened fire yesterday afternoon at the Khopi-Oina *bundh* in Runni Saidpur block...It is learnt that a clash started between the villages of Khonpi and Oina over the cutting of a *bundh* for giving outlet to floodwater...armed forces posted there with a magistrate intervened and had to open 11 rounds of fire when the villagers attacked them ... Three persons died on the spot and another in the hospital. The dead and the injured were brought to Sitamarhi sub-divisional hospital. The District Magistrate of Muzaffarpur, the SDO and the DSP Sitamarhi rushed to the spot. According to PTI, the number of those injured in the police firing is 20.’

Warring Factions Come Face to Face

The villages of Lohasi, Gisara, Kathaur, Dhurbar, and Benipur are located within the *doab* of the Bagmati and the Lakhandei, while the villages of Khonpa, Khonpi, Oina and Morsand are located on its left bank. Those days the Bagmati started creating a new channel on its left bank near Narayanpur village close to Dhanakaul (both these villages belong to the Piparahi block of Sheohar district now, which was carved out of Sitamarhi in 1994). This channel used to join the Lakhandei and some flow of the Bagmati used to be diverted into that river. This was before the construction of the embankments on the Bagmati in this reach. There was a low height *Maharaji* embankment on the eastern bank of the Lakhandei. When the water level of the Bagmati was low, its water which used to flow via Narayanpur and Dhanakaul would find a safe passage through the Lakhandei. In case of excess water coming into the Lakhandei, it would either spill on to the western side of the river that was not embanked, or it would breach the embankment on the eastern side of the Lakhandei and escape. In the latter case, the flood water would hit Morsand village first, which would face the flood fury for the longest period among the neighbouring villages.

Jagannath Singh, the *mukhia* (village head) of Morsand, was quite an influential person. Through his efforts, the eastern embankment of the Lakhandei was raised and strengthened in the late 1960s. Now if the Bagmati water reached Lakhandei, its eastern embankment was strong enough to prevent any overflowing or breaching, but the western bank of the Lakhandei was still open and the water used to inundate that side. In 1970, the flood in the Bagmati was severe and the eastern embankment of the Lakhandei was standing firmly on its left bank. The flood water spilled on the right (western) side, and the villages of Gisara, Lohasi, Kathaur, Benipur and Dhurbar started getting inundated by the spill. Residents of these villages thought that the newly repaired eastern embankment of the Lakhandei was the root cause of their trouble, and that if it could be cut, all the water would pass through the gap and they would be saved from floods. This of course, was a solution for the villages on the western side of the Lakhandei but the risk was imminent for the people living on the eastern side of the Lakhandei which included the villages of Bhimpur, Belahi Neelkanth, Morsand, Gaighat, Oina and Khonpa. The residents of these villages anticipated trouble and held the fort on their side. They informed the police, who set up a camp near Oina. The government appointed Sitaram Singh, a horticulture inspector, with the powers of a

magistrate assigned to him, to camp there and keep an eye on the law and order situation.

When the residents of Kathaur, Gisara, Benipur, Lohasi and Dhurbar set out to cut the eastern embankment of the Lakhandei, people from the eastern villages were ready with arms to take them on. The problem with the villagers from the western side was that they had to come by boats to cut the embankment, and were at a lower elevation as compared to the people on the east. They had to cut the embankment and save their lives too. The situation was not favorable to them. The people on the other side were not in direct contact with water and were at a higher level and therefore were in an advantageous position. Despite their position of disadvantage, the people from the west managed to reach the eastern Lakhandei embankment.

Food Was Not Cooked and Children Were Crying of Hunger

Villagers of Lohasi, Gisara, Kathaur and Benipur told the author, “The repair of this embankment in 1966-67 was a death knell for our group of villages. Earlier, some water would always find a way through small gaps or depressions in the embankment, but that stopped and the flood water started devastating villages on our side.”

“There was a heavy flood in 1970 in the Bagmati which was not embanked then. A flood was nothing new for us, but we had not experienced continuous flooding for such a long time. Water had entered the kitchens of most of the houses and cooking had to be suspended. People skipped four meals in a row and the children were crying for food. The situation became unbearable and then the people resolved to cut the Lakhandei embankment so that the water could be drained out. The crop was already lost because of submergence and now life too was being threatened. We all knew that our efforts would meet stiff resistance from the other side, but it was a desperate situation.”

“For two full days spears and (fodder) axes were prepared in the village, and on the third day everybody was ready for the assault. The party started moving around 10 o’clock in the morning and it was midday by the time they reached the embankment on the other side. Armed police were waiting for them there. The *jawans* stopped them from proceeding any further. Despite caution by the police, some people advanced. In the melee some people even tried to snatch the rifles of the police. The police retreated and told the attackers to go ahead and cut the embankment. As the people advanced, the police started firing at them from behind. There was a stampede and fist fighting between the two sides. Some of the people who intended to cut the embankment jumped into the Lakhandei to save their lives. The river was already in spate; many got swept away. Also, many were hit by bullets. A portion of the embankment was cut in the tussle, but whether that happened due to the efforts of this side is not certain. Four persons from Lohasi named Baldeo Rai, Sonphi Rai, Ram Asare Koiri and Soman Koiri were killed. One person from Damami, two persons from Kathaur and Awadh Bihari Sah and Kuldeep of Gisara were also killed.”

“People from the west were killed and police registered cases only against them. The *mukhia* of Gisara, Ram Lakhan Sah, was named in the First Information Report (FIR) and the police started raiding villages in the west to arrest him and

seize his property. Jay Mangal Pandey and Julfi Sahani of Gisara were put in jail, while the police continued to look for others. Later, we all approached the police and a wireless message from Muzaffarpur was flashed to the local police saying that people from the west were already facing a difficult situation and many of them had been killed and that they should not be put to more inconvenience. That saved us.”

According to villagers from Lohasi, Gisara, Kathaur and Benipur, “The *mukhia* of Gisara was a powerful person. He not only managed to save himself but protected others from the police and the courts. Later on, some Sohoni Sahib came for an enquiry but nobody was booked. After the emergency, Karpoori Thakur’s government came to power (1977) and withdrew all the cases. Ramanand Singh of Tariyani was a minister in his cabinet, and it was through his efforts that the cases were withdrawn ... Later, the embankment on the Bagmati was built and the floodwater does not usually come from that side. Close to our villages, Dhanakaul, Ramani, Jaffarpur and Olipur are located on this side of the Bagmati embankment. Now, the Bagmati’s water comes here only when there are breaches near these villages, to our north and west. We are not affected if the embankment breaches in the south.”¹³

Nobody Knows What Happened to Those Dead Bodies

Villagers on the eastern side of the Lakhandei said, “The *mukhia* of Morsand, Jagannath Singh, took the lead and the repair of this eastern embankment of Lakhandei was approved. Jamun Singh, *mukhia* of Bhapura, was instrumental in completing the work. This embankment gained a height of about 10-11 *haath* (about 15-16 feet) and had an adequate width. It belongs to the government and once it was repaired, the problems of the villages on its east were solved to a great extent but the suffering of the people on the west increased.

“The river water was not going eastward any more but the villages like Lohasi, Dilawarpur, Kathaur, Gisara, and Damami on the west and other villages of Parsauni and Belsand blocks faced enhanced flooding. Then came the flood of 1970 and those people thought of cutting the eastern Lakhandei embankment. Ram Lakhan Sah was the *mukhia* of Gisara and nearly 5 to 7 maunds of rice were collected at his residence for feeding the activists. Many people assembled there and made all arrangements to cut the embankment. We, at our end, started getting the news that the embankment would be cut in a day or so and informed the police to avoid any untoward incident. This report was lodged in the local police station and the police took cognizance of it. A horticulture supervisor with the powers of a magistrate was sent here to Khonpa with an armed police force. We were told that nearly 5000 people had had their food in Gisara and had set off for cutting the embankment. They put a red color flag on their boats and started coming to our side.”

“As news of their advance reached here, the youth from Morsand, Gaighat, Khonpa, Oina and Khonpi also came out to counter attack them. The *mukhia* of Morsand, Jagannath Singh, also joined them. They all assembled on the embankment, but the general feeling was that the people from the west would not dare to come here. We had waited for them a day earlier also but when they did not come, the crowd dispersed. However, the next day they were here in

¹³ Personal communication with the villagers of Lohasi, Gisara, Kathaur and Benipur

Hanuman Nagar which is a hamlet of Oina. They were armed with spears and fodder axes and most of them had come by boats. Some of them had reached this side by swimming. They included people from far away villages like Parsauni. Those who came by swimming had their heads covered by wide mouthed pitchers to escape identification. All that they had to do was to somehow pierce a hole in the embankment. Everything else would be taken care of by the pressure of water. The *mukhia* of Gisara and Damami were leading the mob from that side.

“On this side was the head constable of the local police station. He apprehended that the force with him was limited, and that it would not be possible to control the mob because their own lives would be risked. He ordered firing. The people who were coming from that side jumped into the river to save themselves. Almost all of them had some weapon or the other. As panic gripped them, many died due to the weapons used by people on their own side, but they succeeded in cutting the embankment. The police was on our side but listening to the cries and noise many more people had assembled from this side on the embankment. Then it was a free for all. Asharfi Sah from our side lost his hand in the scuffle; he died a couple of years ago. Ganesh Sah was hit on his head and hand and is alive at the age of about 90. Ram Chandra Sah also received a head injury and he too is alive. The water was now flowing on the river-side and also through the country-side. Many corpses were seen floating.”

“Our district headquarter was at Muzaffarpur in those days. The Superintendent of Police (SP) was informed and he rushed here. He publicly scolded the head constable and told him that eleven rounds were fired at the mob in the incident and he wanted him to hand over at least eleven dead bodies. Then the search for the dead bodies started. The SP announced a reward of ten rupees for every dead body, and the bodies were fished out to the extent possible. Then this entire area was sealed, the dead bodies were loaded in a boat and taken to the 23rd mile of the National Highway 77. A police van was already waiting there and the bodies were shifted into the van. Nobody knows what happened to those dead bodies.”

“The people on the other side had planned that once the embankment was cut, they would be saved. The people on that side were helpless. They did what anybody would have done in those circumstances. A good thing was that this hatred was not stretched over a long time because those who died are not there anymore!”¹⁴

Thoughtless tampering of rivers has led to many unpleasant incidents, and this is just one of them. The administration often remains a silent spectator, and the warring communities have to settle the dispute themselves, be it by force or mutual consent. The contesting parties have to go to the same block office, they meet each other in the market, and they all have to go to Sitamarhi for official and other work. There was tension for some weeks and then everything came back to normal.

During the rainy season, the gulf gets widened and results in deplorable events like the Lohasi carnage. The priorities of the groups change. While one group wishes that the embankment survives at all costs, the other wants it to go, and these people are separated by a distance of only 50-60 metres.

¹⁴ Personal communication with the villagers of Oina, Khonpa, Khonpi and Morsand

Blasting of Embankment in Samastipur

Villagers Blast the Embankment to Settle Personal Scores

September 14, 1998 witnessed an incident where commercial interests of two fishing communities led to the blasting of an embankment near Rosera in Samastipur district in 1998. There is a big *chaur* (land depression) named Maheshwar *Chaur* close to Kolhatta village of Rosera block in Samastipur on the right bank of the Kareh. There are many villages of fishing communities around the *chaur* who fish in this area. The *chaur* belongs to the landlords of Bhiraha village nearby who have an apex body of landlords that is divided into various interest groups. The division of interests also extends to the groups of fishing communities. The government has got no role in the bidding or allocation of *chaurs* for fishing, the rights of which are purchased by different groups of the fishing communities. The highest bidder gets the fishing rights after depositing the bid amount with the landlords. It seems that the competing group was not happy with the allocation of fishing rights that year, and it decided to blow off the embankment at an opportune moment so that the fish would escape and the deal would not work. This would put the group that had the fishing rights at a loss and its investment would sink. The landlords had already received their money and they had no interest in the losses incurred by the fishing community that was awarded the contract. The embankment was blasted on the night of September 14th.

These fishermen not only find employment in fishing operations, many of them also migrate to other places in search of employment in the off season. Some of these people are engaged in stone breaking / blasting and are conversant with the use of detonators in blasting.

Local people say that a deafening sound was heard before the breach of the embankment, which leads to the suspicion that the embankment was blasted. This version is refuted by others who maintain that nothing of the sort happened. The river was in high spate and the embankment was breached under its pressure. The landlords had got their money and therefore had no reason for complaint, and those who lost their money, had no standing to raise their voice. Whether by accident or by design, the embankment had breached and many villages suffered because the river was in spate. Chairman of Rashtriya Janata Dal (RJD), Lalu Prasad Yadav, and Minister for Water Resources in the state, Jagadanand Singh, visited the site by a helicopter and ordered relief distribution to the victims. After the breach, priorities changed as the affected people had to be rescued, relief had to be provided to them, and so on.

Shubhmurti, a social worker of Rosera, adds, "The Government of Bihar had instituted an enquiry into the incident headed by a political big-wig, Bachcha Babu, of Darbhanga. I don't remember whether it was a committee or a group of experts, because when Bachcha Babu arrived here, some people were accompanying him. He was a big man and it is quite likely that these people had joined him for their own reasons. They had a plan to visit Kolhatta but had to return from Bhiraha as the current was very swift and it was risky to go there by boat. It took about 20-25 days for the situation to return to normal and as far as I know, nobody went to the site to make an enquiry. A police officer of the DSP rank did go there to get some information, but he is dead now. The story ended there but it has left some bitterness behind."¹⁵

¹⁵ Personal communication with the villagers of Oina, Khonpa, Khonpi and Morsand

There are many such cases along the rivers where people living on one side of the river compete with those living on the other side in pushing their extra water to the other side. Breaching of embankments in the Kadwa and Pranpur block of Katihar district along the Mahananda is an annual feature. Bhutahi Balan embankments (Madhubani district) often make news when the people living on either banks of the river come face to face with arms. Those living inside the embankments try to breach them and those living outside them resist the move at all costs. If the embankments remain in place, those living within them will be ruined and if they breach, those living in the so-called protected areas will be doomed. The establishment's choice is limited to which side of the embankment it desires to drown. People suggest that the embankments should be done away with so that both the contending parties will face the floods together without competing with each other. The Government says that it is its 'sacred duty' to protect the embankments. If it so committed to its 'sacred duty' why should there be 371 breaches¹⁶ in embankments in the past 24 years in Bihar?

The Way Forward

Flood problems are mirror images of drought related ones. While water conservation is important in drought or famine conditions, drainage is important in a flood situation. The prescriptions for tackling drought will have adverse impacts in flooded areas. Drainage has been ignored by the establishment, although all official reports and recommendations emphasise its importance. However, when it comes to actually doing something on the ground, structures that impede drainage are built, be it embankments, canals, roads, rail lines, diversions and so on, at the cost of drainage. Nobody would ever suggest that these structures should not be built, but the differences in the problems of undulated areas and plains must clearly be understood. Since these structures obstruct the flow they should be provided with adequate drainage.

The engineers should take a holistic view of the post-construction impact of their projects failing which such incidents will recur in the future as well. It is essential therefore that the implications of the flood protection works should be kept open for public debate. Unfortunately, the government has stalled any public hearing on the flood control projects in the last EIA document, and has thus denied itself an opportunity to listen to people's views. It has strived hard to convince people that floods are a disaster, and forced the agenda of disaster management on them, though the villagers themselves welcome floods. The government also finds it easier to deploy police instead of engineers to tackle the problem, and provides relief instead of a solution. It has given a long rope to the people to demand relief as their right and celebrate victory in the form of securing the provisions of Calamity Relief Fund (CRF), and absolved itself of all the responsibilities after distributing relief. NGOs could have taken up the issue with the government, but they too have resorted to relief distribution under different names, and most of them have developed vested interests in disaster theory and relief distribution.

Accountability of the establishment in maintaining the embankments is another crucial aspect. A journey along the embankments in Bihar and other states unfolds the miseries faced by the people braving summer, sand storms, rains and winter for no fault of theirs. They have been forced to live there because of inundation, sand casting, and erosion of their homes and villages. The administration must assume responsibility to address their grave problems.

¹⁶ Annual Report (2011-2012), Water Resources Department, Govt. of Bihar.

Lastly, people have been living in the flood plains since time immemorial, and their ancestors must have made a conscious decision to live close to the rivers after weighing all the pros and cons of the situation. They must have found it beneficial to live in flood plains in exchange for some seasonal inconveniences. They must have developed means to minimise their inconveniences. Having lived all their lives on the banks of the river, they understand how the river behaves without studying rivers in schools and colleges. Their approach to dealing with the river derives from the experience of generations. Unfortunately, they do not have engineering skills. However, the engineers do not have a living relationship with rivers. Unless the experiences of the villagers and the skills of engineers are brought together, no tangible solution will emerge. While the engineers call villagers 'laymen', the villagers believe that the engineers have ulterior motives. This gap must be bridged as soon as possible.

India's First Geo-Tube Embankment Erosion of Community Hopes

Parag Jyoti Saikia

Erosion, Floods, Geo-Tube Embankment and Matmora

In the long drawn floods in Assam, some places have come to be characterized as periodically inundated. Dhakuakhana, a low lying area with number of tributaries of the Brahmaputra, is one such place. In the past, Ahom kings were keen to establish their kingdom here because of its fertile soil but did not due to recurrent floods. Flood is a disaster for the people of Dhakuakhana as 73.4 per cent of the population are dependent on agriculture.¹ In Dhakuakhana subdivision, Matmora on the bank of the Brahmaputra is one of worst flood hit and erosion prone areas.

Flood and erosion must be differentiated. Flood in Assam generally happens during the monsoon season when the river water rises and spills over its banks, submerging its flood plains for a certain period of time. Floods are a recurrent phenomena occurring every year, where loss of land is temporary. On the other hand, erosion implies a permanent loss of land when the river erodes its banks and flood plains. For the people living in the flood plains, erosion is more dangerous than floods. This difference between flood and erosion was best explained by a local from Majuli.

"Everybody here knows how to swim. In fact the floods are good for us, we require them for the paddy crop. But now, we're scared to build, scared to invest in the land, because everything is so uncertain. Here today, gone tomorrow."²

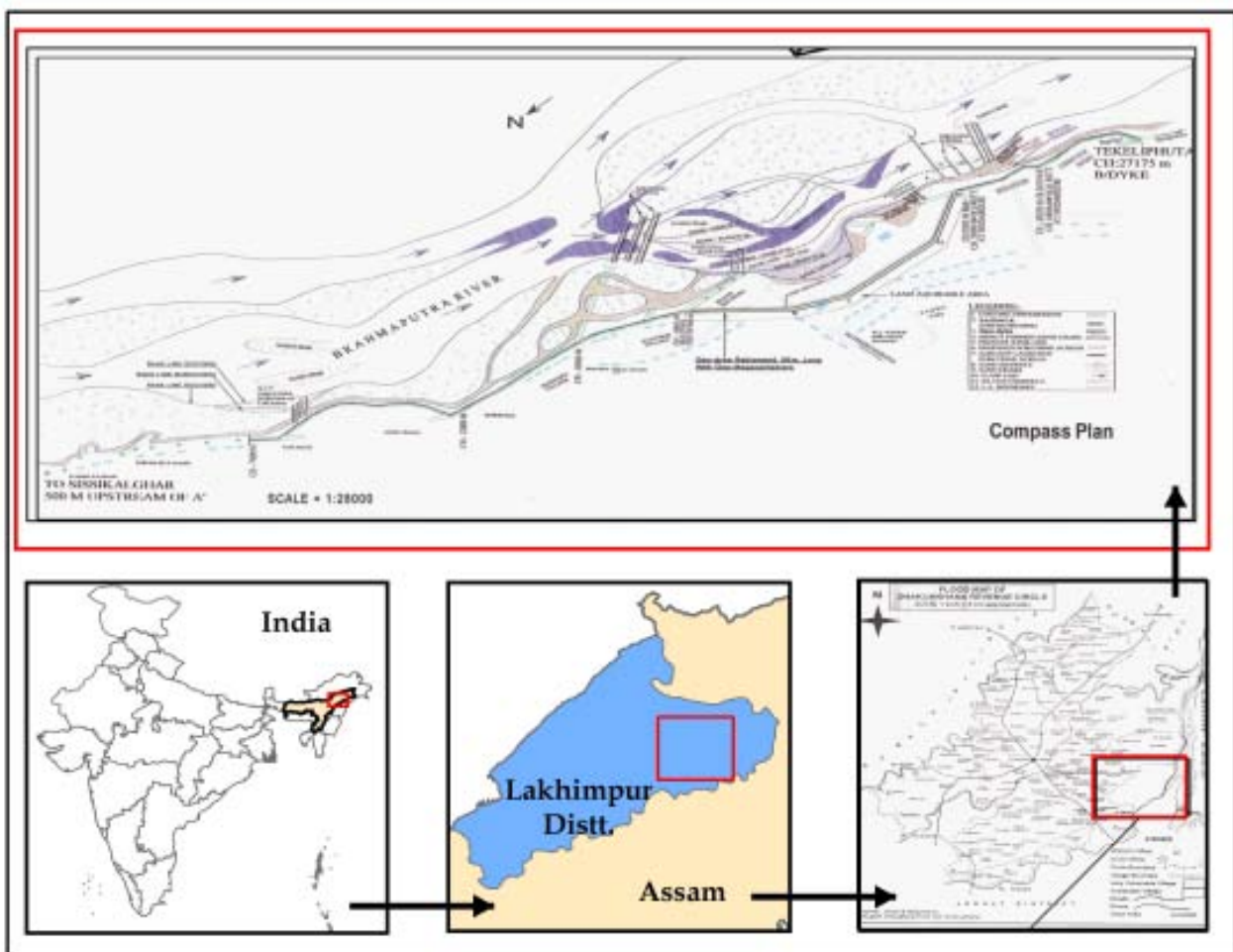
In Matmora, the Brahmaputra has eroded a significant portion of its banks into a bow-shaped line. On this new bow-shaped bank, stands the first geo-tube embankment of the country. It is a part of the Sissikalghar to Tekeliphuta embankment, popularly known as Sissi-Tekeliphuta embankment, constructed in 1955-56. The construction of the 5 km geo-tube portion of the *embankment* began in 2009, with a total investment of Rs. 140.98 crores, a huge investment on a single embankment by comparison, in 2005; in order to close the breaches of 354 embankments all over the State only about Rs. 170 crores were spent.³ Significantly till 1998, Assam accounts for one third of the country's embankment length, i.e., 4,448 km.⁴

¹ Tamuli Manoj K, 1998, Economics of Muga in Assam: A case Study of Dhakuakhana Subdivision of Lakhimpur District, Guwahati: OKDISCD

² Ghosh Sumita (ed.), 1998, Sanjoy's Assam-Diaries and Writings of Sanjoy Ghosh, New Delhi: Penguin Books India, pp.85.

³ Governor's Address, Assam Legislative Assembly, February, 2006.

⁴ Assam Legislative Assembly Debates, 1998.



⁵ Maps sources: Lakhimpur District - http://lakhimpur.nic.in/index_files/LAKHIMPUR.jpg, Flood map of Dhakuakhana - Dhakuakhana Circle office, Geo-tube compass plan: WRD, Dhakuakhana office.

Fig. 1: Map of study area and compass plan of Geo Tube Embankment⁵

The people of Matmora belong to the Mishing ethnic community. Historically, Mishings have been living closest to the river, in their traditional houses built on an elevated platform called “*chang ghar*” (Figure 2). Mishing society is basically an agrarian society with close social ties. In the last two decades Matmora had witnessed many waves of flood, which had changed the landscape. Matmora, once famous for rice production in the whole of Lakhimpur district, now has no land to grow rice as the land has either been eroded or has lost its fertility due to sand deposition. Sand deposition or sand casting in Matmora had done no less harm to the lives of the people than erosion. The paddy fields are covered with a thick layer of sand where people are unable to cultivate rice. The long drawn struggle to protect Matmora from flood and erosion has resulted in the construction of the geo-tube embankment.

History of Matmora’s Flood and Geo-Tube Embankment

Matmora geo-tube embankment is a part of the Sissikalghar to Tekeliphuta dyke. The dyke is 17 km long and was built in 1955-56. It came up to protect 10,117 hectares of land, which included 12 village panchayats of Dhakuakhana sub-division, including Matmora and Majuli subdivision of



**Fig. 2: *Chang Ghar*
(Traditional Mishing
House)**

Jorhat district. Upstream, Sissi-Tekeliphuta connected with the embankment from Deurighat to Sissikalghar and downstream with the Tekeliphuta to Chechamukh embankment. After the 1950 earthquake, the Brahmaputra significantly changed its course. The river started eroding heavily on the north bank mainly in the Matmora area, breaching the embankment. The year of first breach is contested as the Takam Mishing Porin Kebang (TMPK) or All Mishing Students' Union claims it was in 1962 but government documents state that the embankment was first breached in 1964. From 1980 to 2009, Matmora area had been devastated by flood almost 20 times.⁶ This case study focuses on flood and erosion that took place after 1998.

The rising waters of the Brahmaputra washed away 1400 metres of the Sissi-Tekeliphuta dyke in 1998. Matmora was the first village facing this breach and it led to catastrophic floods when waters reached Dhakuakhana town.

The construction of three Bull Heads by the State Water Resources Department (WRD) in 2002-03 was one of the first major steps for control of flood and erosion. Under the "Protection of Matmora area including Dhakuakhana town from the erosion of Brahmaputra, PH-I" scheme with an investment of Rs. 598.61 lakhs, WRD attempted to push the deep channels of the Brahmaputra from the north bank to the middle of the river course. But, this failed miserably. On 8th September, 2005, rising waters washed away Bull Head no. 3 and caused a breach in the Matmora dyke between 3125m and 3200m. Bull Head no. 2 was outflanked on 14th July, 2006. After this, Bull Head no. 1 came under severe strain from its upstream reach. It was finally washed away in the morning of 18th September, 2006.⁷

On 26th December, 2006, Assam's Chief Minister laid the foundation stone for

⁶ Matmora: A hope with Geo textile, a Souvenir published by Water Resources Department Govt. of Assam, 3rd December 2010

⁷ Construction of Retirement at 19 K.M. of B/dyke from Sissikalghar to Tekeliphuta near Matmora, Govt. of Assam, Water Resource Department.

the construction of two land spurs and repairing work of the existing dyke. But TMPK in a pamphlet published in 2009 points out that even after completion of 60 per cent of the embankment, the authorities did not take adequate measures to stop erosion. Catastrophe struck on 9th September, 2007 at around 9 at night. The embankment breached and flood water entered the houses while people were sleeping. The people of Arkep, Bali, Namoni Janji, Khamon Birina, Upor Khamon, Bor Khamon, Aunibari, Rupteli, Lakhipur, Rupahi, Dangdhora, Na-khamon, Khamon Lagasu, Modarguri, Santipur, Chekoni, Amlokhi, Ajarguri along with several hundreds of people of many other villages had to evacuate their houses and live on the embankment till the water receded.

The geo-tube project came up in the wake of these two failed attempts. On 16th February, 2009 the Chief Minister laid its foundation stone in the same area. The total cost of this project was Rs. 141 crores out of which Rs. 100 crores was for geo-dyke construction. Rs. 28 crores were assigned for raising and strengthening the existing embankment in the upstream and downstream of the geo-dyke. This was to be done for 14 km which included the launching of Reinforced Cement Concrete (RCC) porcupine screens. Rs. 8 crores were kept for other allied works. The contract of the geo-dyke construction was given to a Malayasian construction company, Emaskiara, which signed the contract worth Rs. 99.97 crores on 20th March, 2009 and targeted to finish the work in 100 days by end of June. Interestingly, the rainy season in Assam starts by early June and the rivers come to show their might by the end of the month.

In April 2009, the company gathered their necessary equipments in Matmora. The actual installation work started on 2nd of May, 2009. This geo-tube embankment was aimed to close the breach of 5000 m by laying 200 geo-tubes. Till 30th June, 140 geo-tubes were laid, which covered nearly 3500 m. But the water level had already started increasing from 27th June and three days later the rising waters made their way to the countryside through the 1500 m that was yet to be done. Some of the laid tubes also came under flood waters and water spilled over, forcing the company to close the construction work. The work resumed from 1st October but made no progress and stopped eventually. On 22nd March, 2010 work started again but heavy rains and rising water of Brahmaputra obstructed the laying of apron-tubes on the river-facing side of the embankment. The work regained pace only from 1st October 2010. The geo-tube embankment was completed and finally commissioned by the Chief Minister on 3rd of December 2010. This geo-tube is expected to benefit 52,000 hectares of land, 200 villages and 500,000 people. It was believed that this embankment will improve the socio-economic condition of the flood hit areas of Dhakuakhana and Majuli.

Present Day Conflicts in Matmora - Living with the Embankment

Change of Livelihood

Flood and erosion have changed the livelihood patterns of the Mishings in Matmora. Loss of land has impacted everyone irrespective of gender. Migration from Matmora has rapidly increased over the years. Young men are not only moving to nearby towns but to places outside the State, mainly to Kerala and Mumbai. Those who remain in the village are living either by selling fish or firewood, both of which are extracted from the river. They also constitute the labour force for embankment construction. This had also led to a belief in the town areas like Dhakuakhana that labourers themselves breach the embankment to get employment. There were also reports of stealing of RCC porcupines from the river bed in order to sell iron rods inside these porcupines. Besides, continuous flood and erosion had forced many people to live on the embankments themselves. People are still living on top of the old Sissi-Tekeliphuta dyke in miserable conditions (Figure 3).



Fig. 3: Houses on the old Sissi-Tekeliphuta Embankment

It is all the more dangerous for women during the times of flood. The continuous floods over the years have changed the role of women in Mishing households. Along with their household responsibilities, they are also earning members of their families now. Mishing women are expert weavers and for generations Mishing mothers had trained their daughters in the art of weaving. When flood blocked the traditional income sources for the Mishing society, Mishing women started earning by selling their hand-woven clothes. This might have led to strengthening the position of women within the household but, the tradition of young unmarried girls sitting together and weaving,

sharing their ideas and designs, has been lost due to competition. On the other hand, even though the demand for traditional Mishing clothes had increased, the weavers did not get their due price because of middlemen. Mishing women are supposed to be 'shy' and not capable of bargaining enough. So men who are familiar with a trader in the market, bargain for the price of the cloth and keep their own share from the price. In some other cases, because of their poor economic conditions many women are not able to buy yarn. So they take the help of a person known to a yarn seller in town and fix an agreement of providing final product as the price of that yarn. Women in Matmora normally can weave three sets of cloth out of a kilogram of yarn. Out of those three cloths, one set goes to the yarn seller. The rest goes to the market through the earlier process with the same middleman here as well. Besides, because the weavers are not organized they have no control over the price of their produce.

Loss of Land

With continuous submergence of Matmora during floods, the landscape of Matmora has completely changed. Official records show that from 1998 to 2008 nearly 3,346 hectares has been eroded by the river Brahmaputra.⁸ The International Center for Integrated Mountain Development (ICIMOD)-Aaranyak study of 2009 stated:

"The present location of the Matmora village is its fifth transit location in the last 50 years. About half a century ago, the original Matmora village was situated far to the east about eight kilometres from its present location on the bank.... Shifting of the river course has led to reconstruction of the embankment in other locations four times to date (1958, 1964, 2007, and 2009). During the same period people from the original Matmora village moved six times (1954, 1957, 1961, 1963, 1966, and 1968) to different locations."

The villagers have kept the same village name each time they have had to relocate. The above study also noted that embankments would be constructed nearby a village, each time the village was shifted to a new location. Loss of land (see Box 1) and sand deposition had forced the All Assam Miri Higher Secondary School, established in 1936 to relocate 10 times before coming to its present campus, nearly hundred metres away from the geo-tube embankment. The last time it was relocated because it was falling outside the geo-tube embankment. In 2008, the school building was buried under the sand deposited by the flood.

Box 1: Loss of land in Matmora Panchayat for the year 2010

- Total geographical area: 3,559 hectares
- Cultivable area: 1,168 hectares
- Land lost to erosion: 212 hectares (Jaji and Matmora villages)
- Land lost to sand deposition: 1,810 hectares
- Farm households affected by erosion: 250

(Source: Agriculture Department, Dhakuakhana)

⁸ Detail estimates for works of raising and strengthening to Brahmaputra dyke from Sissikalghar to Tekeliphutha including closing of Breach by retirement and antierosion measures.

Land in River, Land on Paper

After the construction of geo-tube embankment, people lost their houses as they fell outside the embankment. Land acquisition also took place to construct this giant embankment. Some of the displaced people got a land acquisition certificate which entitled them to a plot of land in another village. But they were not ready to go. Many displaced families were yet to get this certificate. After the catastrophic flood of 1998, the government of Assam had waived the land revenue in Majuli and Dhakuakhana for one year. But many of the villagers in Matmora were still paying revenue for the land which had already been eroded. Because of their close kinship ties, resettlement within their village was not difficult. But it did not give a person the right over the plot of land where he resided. In order to get a permanent resident certificate or land revenue certificate, revenue was being paid regularly. Permanent resident certificate is essential for applying for various scholarships for the family members who are in school or college. The land revenue certificate made them eligible to apply for loans under Kissan Credit Card, which later led to loan defaulting. In this whole process from acquiring land revenue certificate to loan defaulting, bribery and corruption was an integral part.

Construction of Fourth Bridge on Brahmaputra

Today, the gravest threat to this embankment is the fourth bridge on Brahmaputra, which is under construction between Kareng Chapori of Dhemaji district and Bogibeel of Dibrugarh district. The 4.94 km long bridge will shrink the wide river to a great extent. As a result of this “funnelling action”, the force of water will increase and it will directly hit the embankment downstream.⁹ The existing three bridges on the Brahmaputra had proved that braiding of the river course had increased after the construction of these bridges. Places in the downstream of the construction site had suffered heavily. In case of Saraighat Bridge, unprecedented flood and erosion was witnessed in Palasbari and Gumi area. Morigaona and Nagaon districts suffered in the same way after the construction of Koliabhomora Bridge. Construction of Naranarayan Setu, led to flood and erosion in Dakshin Salmara, Pancharatna and Mancachar.¹⁰ The geo-tube embankment at Matmora can also be viewed as a precautionary measure of the State to stop any criticism on the construction of the Bogibeel Bridge, cost of which had escalated to Rs. 3,230 crores from the initial Rs. 1767 crores.¹¹ After closing the breach of Barbil-Kareng Chapori dyke in 2002-03, Northeast Frontier (NF) railways constructed a road to join the north end of the Bogibeel Bridge, which obstructed the river channel. Senior water resource engineers said that though this had reduced the threat to Kareng Chapori, Matmora had come under grave threat due to increasing pressure of the river.¹²

A contractor associated with the construction of the geo-tube embankment said that many people did not want geo-tube because this would lead to permanent protection through the embankment.¹³ This would take away the seasonal jobs available for the repair of embankment breach or damage. There were reports that attempts were also made to cut the apron-tubes at the joining point of the old dyke and geo-dyke, on the Sissikalghar side of the embankment. In order to prevent this, Emaskiara (the Malayasian

⁹ Interview with engineer from WRD office, name kept anonymous on request.

¹⁰ Mahanta, C and Mahanta, A., 2006, Bridge over the Brahmaputra, Economic and Political Weekly, Vol. XLI No. 07, February 18, 2006, pp 79-581

¹¹ Available at: <http://mdoner.gov.in/writereaddata/sublink2images/Bogibeel-Bridge8710191504.pdf>

¹² Interview with Amar Jyoti Borah, Staff Reporter, Seven Sister's Post. During the time of construction of this project, he was associated with Down To Earth.

¹³ The person is kept anonymous on request.

construction company that got the job to construct the geo-tube embankment) decided to cover the apron-tubes with sand. It was also suggested that the trees which fall outside the embankment should be cut. But people whose houses fall outside the embankment opposed this as these trees could later be sold as firewood.

On the morning of 14th July, 2011, two of the apron-tubes at the tail of the embankment breached due to increased force of water. According to WRD engineers this happened because the trees which were left outside the embankment obstructed and increased the force of water. Immediate repair work was taken up and labourers from this area worked in neck deep water to cut those trees (Figure 4).

Fig. 4: Workers cutting trees on 14th July, 2011



Besides, some engineers associated with flood control in Brahmaputra suggested that boulder apron should be used in Matmora because geo-tube apron may be vulnerable. It was because the average scour depth of Brahmaputra is 25 m, calculated on the basis of the Bureau of Indian Standard (BIS) code. In Matmora, according to the same calculation, the scour depth was 45 m. But Central Water Commission (CWC) ignored all these suggestions and directed the implementing agencies to install geo-tubes as 'scour aprons' with 16 m depth for low lying areas and 12 m depth for level ground.¹⁴

Further Issues and Way Forward

From interactions with a cross section of people, i.e. locals, political leaders, organisation leaders and activists and government officials, it has been observed that before the advent of geo-tube embankment, erosion was the real threat for Matmora rather than flood. After the geo-tube embankment

¹⁴ Borah Amar Jyoti, Concern over safety of Matmora geo-tube dyke, Guwahati.

people of Matmora have heaved a sigh of relief. But saving only 5 km of a 21 km long embankment cannot eliminate the fear of breach in other parts of the Sissi-Tekeliphuta embankment. The construction of Bogibeel Bridge has intensified this fear, even among the government engineers. The government must come up with a visionary and nuanced plan of action where people in the downstream would not suffer for the development activities in the upstream. The Bogibeel Bridge is necessary for transport and communication in this area. But this should neither inundate nor erode downstream areas like Matmora or Majuli.

Increase of sediment load in the river is another cause of erosion. Rampant deforestation in the upstream, mainly in the hills of Arunachal Pradesh and tributaries carrying it to Brahmaputra has increased this sediment load. This is a more difficult problem to tackle, because it will need inter-state cooperation to curb deforestation. But construction of number of hydroelectric dams in Arunachal Pradesh is also leading to increase of sediment in the tributaries of Brahmaputra. The latter becomes a more troubled issue as Arunachal Pradesh has already been hailed as the “future powerhouse” of India.

2

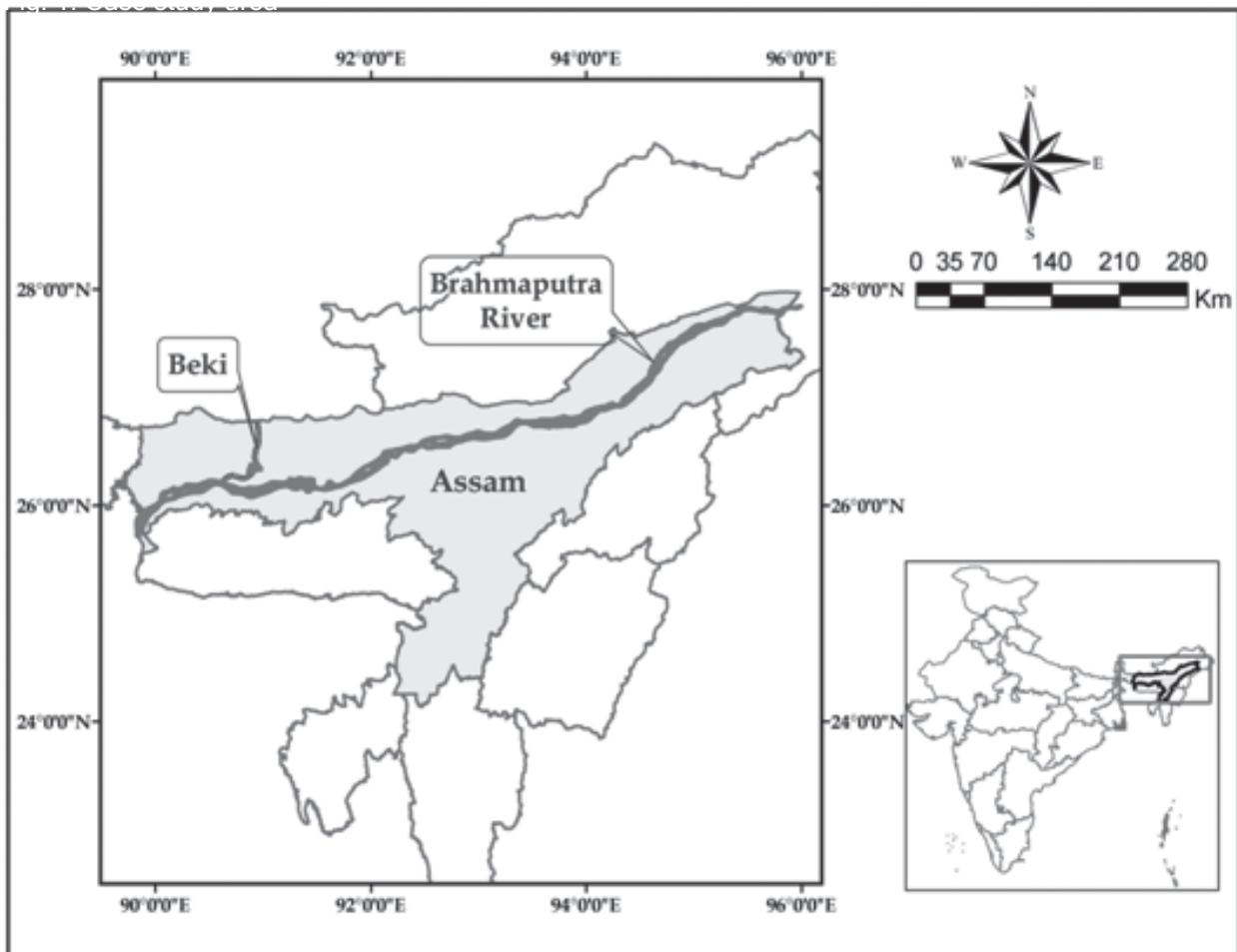
Chapter 2

The Char Dwellers of Assam Flowing River, Floating People

Gorky Chakraborty

Flood induced conflicts are seldom linear and are manifested over different spatio-temporal scales. They affect the victims according to their geographical location, ingenuity in adaption, resource endowment, institutional set-up as well as the capacity to influence state and non-state actors. Vulnerability to flood induced conflicts is, therefore, a function of a set of various social, economic and political factors woven together which may have both immediate and long term implications. Identifying the probable causes of flood induced conflicts with a nuanced understanding is of utmost importance for their resolution. This case study tries to understand the roots of conflicts and their manifestation at different levels of a flood prone population group living in the mid-channel bars (locally known as *chars*) of the Brahmaputra River and its tributary, Beki, in Assam.

Fig. 1: Case study area



Geomorphology of *Char*

Originating in a Himalayan glacier, the Brahmaputra River traverses a long route of 2,880 kilometre (km) covering four different countries (Table 1). During its meandering journey through Assam, it is joined by a large number of big and small tributaries, which influence the flow pattern, sediment discharge and bed load of the river in more than one way. The fluvial regime of the river is also greatly influenced by the characteristic feature of the Brahmaputra channel to migrate towards south. Various factors such as the existence of braided channels¹, the gradient² of the river, average discharge (Table 2), the large quantities of suspended particles, sediment load (Table 3) and bed load, the geology and the seismic instability of the region³ along with various other related factors⁴, facilitate the process of *char* formation.

Table1: Area of the Brahmaputra Basin

Region	Area (mha)
China	29.3
Bhutan	5.3
India	18.7
Arunachal Pradesh	8.14
Assam	7.06
Meghalaya	1.17
Nagaland	1.08
West Bengal	1.26
Bangladesh	4.7
Total	58

Table 2: Average Discharge of Ten Major Rivers around the World

Sl. No	Name of the River	Average Discharge At Mouth (1000 cubic feet per second)
1	Amazon	7500
2	Congo	1400
3	Yangtze	770
4	Brahmaputra	700
5	Ganges	660
6	Yenisei	614
7	Mississippi	611
8	Orinoco	600
9	Lena	547
10	Parana	526

with construction related to railways and roadways have disturbed the natural drainage in the state, which adds to the sediment generation in the river.

¹ A braided channel is one that is divided into several channels that successively meet and re-divide. Braiding in the case of the Brahmaputra in Assam seems to be influenced mainly by its high sediment load and weak bank materials.

² After flowing through the steep mountainous ranges in Arunachal Pradesh, the river gradient falls suddenly near Pasighat and then during its entire journey of 720 kms through the plains of Assam it has a gentle gradient. The river has a gradient of 0.27m/km at Pasighat, 0.09-0.17m/km at Dibrugarh and 0.1m/km near Guwahati. This makes the flow of the river slow which helps the process of *char* formation.

³ Major earthquakes of 1897 and 1950 have raised the river bed of the Brahmaputra, which inhibits the water flow and adds to the process of *char* formation. The bank line of the Brahmaputra is extremely unstable consisting mostly of fine sand and silt. Large scale slumping of riverbanks takes place when the water level falls after a flood, adding to the process of sediment formation. The river has a tendency for a lateral shift towards the south because of heavy silt charge of the northern tributaries. The width of the Brahmaputra is therefore highly variable and can change dramatically from one year to another. This also adds to the process of *char* formation.

⁴ The unmindful construction of river embankments, along

Table 3: Sediment Yield in Ten Major Rivers of the World

Sl.No	Name of the River	Sediment Yield
		(tons/ km/ yr)
1	Yellow	1403
2	Brahmaputra	
	(at Bahadurabad, Bangladesh)	1128
3A	Brahmaputra	
	(at Pandu, India)	804
3 B	Irrawady	616
4	Yangtze	246
5	Mekong	214
6	Orinoco	212
7	Colorado	212
8	Missouri	159
9	Amazon	146
10	Indus	103

When the suspended particles and bed load flow through the braided channels of the river during floods, it gives rise to almond shaped alluvial formations, locally known as *chars*. Since they are formed under flood environment, the height of the *char* is never greater than the height of the highest flood. Once formed these unstable formations become an integral part of the fluvial system of the Brahmaputra, till they are eroded by next or subsequent floods. These geo-hydrological formations follow a peculiar pattern of downstream migration as they are subjected to erosion on their upstream and deposition on the downstream. This affects the geometry and location of those *chars* (Bhagabati, 2001).

Soil Profile

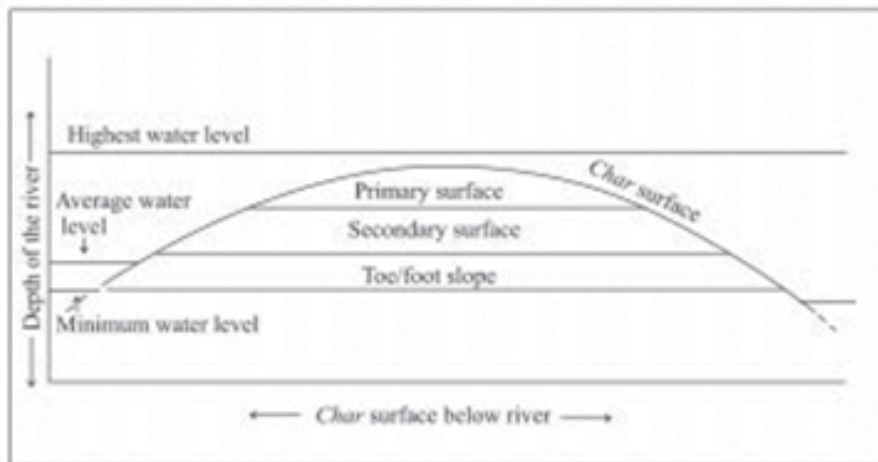
Distinctive soil forming process differentiates the soil profiles of the *chars* and the mainland areas. There are also differences in soil in terms of the location of the *chars* (those located in upstream usually have more coarse sand deposits and downstream *chars* have abundant silt deposition) as well as between those formed in the Brahmaputra and those in its tributaries. The *chars* of Brahmaputra (especially in the downstream) have comparatively more silt and thereby have more fertile soil compared to those of its tributaries. In the overall analysis, soil in the *chars* are alkaline (pH variations range from 7.9 to 8.4 respectively) vis-à-vis acidic in settled land and therefore, suitable for growing variety of crops. The surface layer, particularly in the toe and foot slope areas of the *char*, has high organic carbon, nitrogen and potash content which makes it more fertile and therefore ideal for cultivation (Bhattacharjee, Borgohain, Jha 1991).

Different zones of soil in a *char* can also be categorised according to the proportion of clay, silt and sand. It may be broadly divided into three zones (Figure 2):

1. The soil on the outer surface - referred to as toe and foot slopes - which remains above water for few months, is an admixture of silt and sand with smaller granules and thereby has the maximum threat of erosion
2. The secondary surface is a mixture of sand and clay, where the sand consists of bigger granules

The central / primary surface - the highest surface has maximum amount of clay and is ideally suited for habitation (Bhagabati 2002).

Fig. 2: Soil Profile in the Char Areas in Terms of Surface Layers



Inhabitation of the Chars

Historically, the *chars* of Brahmaputra were not inhabited permanently. There are few references (Powell-Baden, 1882 and 1892) of temporary habitations in limited number of *chars* mainly for floodplain cultivation of mustard during the winter months (*pam kheti*) in Upper Assam and as temporary shelters for livestock in Lower Assam, particularly in the undivided Goalpara district. It was only during the colonial period that revenue generation from unused land by means of agricultural spread became important and hence these places came under large scale habitation. The colonial policy of ascribing the label 'wasteland' to non-revenue yielding land and subsequent decisions for its utilisation by facilitating the migration of non-local population groups paved the way for the large scale inhabitation of *chars*; firstly in the name of tea plantation and secondly, for increasing the area under cultivation which completely transformed the situation. It was particularly during the phase of later transformation that the *chars* came under anthropogenic interventions. But there are no separate demographic and/or land settlement records related to the *char* areas. It is only from the macro-details pertaining to transfer of population and land settlement made with these groups, that an overview can be generated.

The Census Report of 1911 for the first time mentioned the movement of the people from various densely populated districts of East Bengal (presently Bangladesh) to Assam (mainly Goalpara district) for bringing the wasteland under cultivation. It is estimated that till 1951 the total number of farm-settlers

from East Bengal must have been around one to one and half million, which was between one-tenth to one-sixth of the then total population of the State (Goswami, 1994). They were officially settled with more than 6,213,000 acres of land up to 1947-48 (Census of India, 1951). The cropped area under cultivation increased from 2.40 million acres to 4.79 million acres and the area sown more than once from 0.21 million acres to 0.71 million acres between 1901-02 and 1947-48 (Guha, 1977). This group from East Bengal had a major role to play in this transformation, and their biggest contribution has been large-scale cultivation of jute. There was not only increase in the acreage of the crops cultivated (Table 4) by them but also corresponding increase in the productivity of those crops (Figure 3) in the areas of their settlement (Doullah, 2003). The State also gained revenue by exporting commercial crop⁵ cultivated by these new settlers (Medhi, 1978). Thus there was a complete overhaul of agriculture in the State, which would have been unthinkable without the advent of this group.

Fig. 3: Percentage Change in Production per Acre for Selected Crops in the Four Migrant Prone Districts vis-à-vis Assam, 1924-25 to 1947-48

Areas include 4 Districts, namely, Goalpara, Kamrup, Nowgong and Darrang.

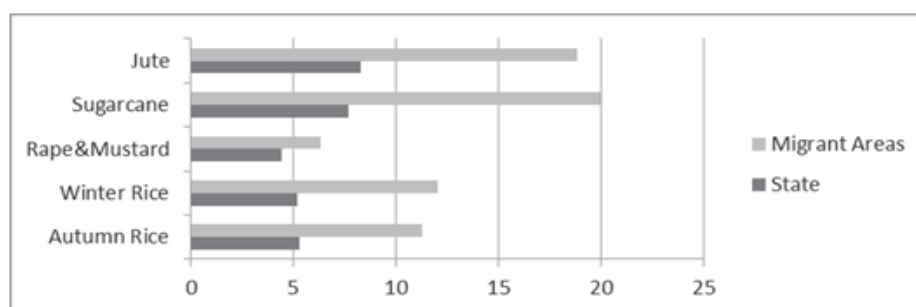


Table 4: Acreage under Different Crops in Assam, 1911-12 to 1947-48 (In thousand acres)

Crops	1911-12	1947-48
Rice	2573	4004
Cereals & Pulses	109	255
Rape & Mustard	238	310
Oilseeds	7	39
Sugarcane	30	60
Tobacco	8	20
Jute	58	210
Cotton*	35	34

*crop not cultivated by migrant population

⁵ It is estimated that during 1947, out of the total quantity of exports from Assam, 62.5 per cent, in case of railways and 37.5 per cent, in case of waterways comprised of jute and overwhelming quantity of these jute exported were produced in the immigrant prone areas, including the char areas.

⁶ This section is based on the two survey reports namely, Socio-Economic Survey Report, 1992-93 Char Areas Development Authority and Socio-Economic Survey Report, 2003-04, Directorate of Char Areas Development, Government of Assam

Contemporary Socio-economic Reality ⁶

There is severe dearth of data concerning the char areas and their dwellers despite being inhabited for over a hundred years. There are two benchmark surveys (1992-93 and 2002-03) conducted by the Government of Assam, which are the only source of field level data of the char areas. If we compare both the reports it is evident that between the two surveys the number of char

villages of the Brahmaputra has risen by 7.75 per cent but the population grown by 55.63 per cent (compared to 18.85 per cent for Assam between 1991 and 2001). The char dwellers comprise 9.37 per cent of the State's population but have only 4.6 per cent of the State's land and four per cent of its cultivable land. In fact, cultivable land as percentage of total land has declined from 70 per cent to 67.13 per cent during the time period. The density of population in the char areas (690 persons per sq km) is more than double compared to that of the State (340 persons per sq km). More than 81 per cent of the population is illiterate and four districts (Bongaigaon, Kamrup, Dhubri and Tinsukia) show a downward slide in literacy rates between 1992-93 and 2002-03. Due to large scale flood and erosion the number of char villages in a district varies widely. It is observed from the socio-economic survey that during 1992-93, Barpeta district had the highest number of char villages and char population followed by Dhubri and Jorhat. In 2002-03, Dhubri district had the highest number of char villages and char population followed by Jorhat and Barpeta. This is a result of migration not only from char to mainland areas but also within the chars as well. The plight of the char dwellers is reflected in the official poverty estimates. Population below the official poverty line increased substantially from 48.89 per cent to 67.89 per cent between the two surveys. Thus, the loss of livelihood, habitation, family members and identity on one hand and the continuous search for alternative becomes an inseparable part of the existence for all char dwellers.

Flood, Erosion and Conflicts

A scan through the data provided by Assam Water Resources Department reveals that depending upon the nature of floods there are wide fluctuations in the average annual area flooded in the Brahmaputra valley in the State. The reported average annual damage has been over Rs. 124 crores. The estimated area eroded since 1954 is 386,000 hectares, which have affected more than 90,700 families spread over 2,534 villages⁷. Estimated average annual erosion rate in the Brahmaputra valley has been around 8,000 hectares. These state level macro-data reveal a grim scenario but palpably much worse is the situation of those who suffer from being located within the river (the *chars*) and therefore bear the brunt of flood and erosion on every occasion. However, there is no data regarding the plight of the *char* dwellers nor is there much discussion about flood-induced conflicts affecting their lives and livelihood patterns. In order to understand these scenarios, we have no other way but to depend on micro-studies.

A socio-economic survey (Chakraborty, 2009) of 304 households in 6 *char* villages (4 in Brahmaputra and 2 in Beki River, a tributary) spread over three Development Blocks of Barpeta district reveals that 29 per cent of the households were affected due to erosion and 48 per cent of the land was wiped out between 1988 and 2003. During this time period, the biggest flood occurred during 1988 and the damage due to erosion was also most severe as was its aftermath. More than 46 per cent of the total households affected by flood were victims of erosion. Forty one per cent of the total eroded land so far was eroded during 1988. During the next 10 years (from 1989 to 1998), when the floods were of lesser intensity compared to 1988, 45 per cent of the total

⁷ These figures are based on the presentation titled "A Review of Flood Management and Future Vision in Assam" made by Secretary, Water Recourse Department, Government of Assam on the occasion of 3rd North Eastern Council Meet, Guwahati, 9- 11 March 2007

households were affected and 51 per cent of the total eroded land was lost. Nearly 8 per cent of the total eroded households were affected and 7.60 per cent of the land was lost during 1999 and 2003. This not only shows the severity of erosion but also its recurring nature in these areas.

Another micro-study (Chakraborty, 2006) covering a period of 1980-2004 of 22 households in Bechimari *char* village of Beki River in Barpeta district reveals that more than 77 per cent of these households have become landless due to erosion (earlier they owned land) and 94 per cent of their land was lost. All the eroded households have been reported to have migrated to mainland areas in search of livelihood options.

Once the households lose their land due to erosion, a spiral sets in whereby conflicts become a part of their daily existence. There are two broader ramifications to these conflicts. One set of conflicts relates to their migration to the settled / mainland areas and the second relates to erosion and re-appearance of land. We analyse these conflict-inducing sets separately.

Migration of *Char* Dwellers and Conflicts

The *char* dwellers migrate from their habitat to other areas as internally displaced persons in search of livelihood options. In the *char* areas of Lower Assam, women seldom take part in field based work. In other words, they seldom work outdoors. But as the eroded families move to urban areas, women join the workforce mainly as construction labour and maid servants. At a personal level, this transformation from non-worker to worker is full of risk, which not only leads to psychological trauma for the women but also generates family feuds and break-ups, in short leads to conflicts.

When these victims of erosion migrate to the urban areas, they are often victims of labour market discrimination (Chakraborty, 2011) which is reflected in two distinct forms. Firstly, when the *char* dwellers migrate in search of livelihood to various districts of Upper Assam (where the people are less aware about the environmental reality in the *char* areas), they are subjected to forced eviction and deportation from these areas by pro-active groups in the name of liberating their homeland from the invasion of these illegal infiltrators (read *Bangladeshi!*). This amounts to denial in the labour market, and results in exclusion by force and leads to conflict and violence.

Another phenomenon is observed in the urban centres of North East in general and Assam and Meghalaya in particular where there is seldom denial of entry of these victims of erosion as they are the source of cheap labour. But deprivation occurs as they are paid less than the prevalent wage rates for their manual labour (Dasgupta, 2001-2002). Any protest on their part leads to job loss and conflict. It is often seen in both the examples of labour market discrimination. Due to their socio-cultural difference from the mainland population groups, they are branded as illegal immigrants (i.e. *Bangladeshis*) although the actual cause of their migration is flood and erosion occurring within the boundaries of Assam.

On the other hand when these victims of erosion move to rural areas and natural habitats for livelihood options (mainly cultivation), it also gives rise to conflicts which are sometimes manifested over the long run. Often they settle in uninhabited land, which in the long run appears to be the *lived space* of the surrounding tribal population rooted in the practise of usufruct resource management. Conflict arises when the tribes claim these erstwhile unused lands and the *char* dwellers refuse to hand them over, which they have transformed into cultivable fields through their labour. The infamous massacre in Nellie (see Box 1) by members of Lalung and Tiwa tribes during 1983 and the recent incidents in the Bodo dominated areas of Lower Assam are major indicators of this direction. More group-identity based conflicts over resource seem to be imminent under these conditions (Dasgupta, 2001-2002).

Box 1: Genocide at Nellie

Nellie, otherwise an unforgettable name, is remembered today for its brutality. This is the place, only 40 km from Guwahati, where on 18th of February 1983 during the heyday of the Assam Movement, a massacre was organised where 2,191 persons were butchered to death within a span of seven hours.

Although there are various interpretations as to what triggered this gruesome event (e.g. abduction of tribal girls, disregard to the election boycott call given by the supporters of the movement etc.), where the victims were Muslim farm settlers historically hailing from erstwhile East Bengal and the alleged perpetrators belonged to the Tiwa tribe and other Assamese groups residing nearby Nellie. In hindsight it seems that land played an important role in generating palpable discontent, anger and frustration among both the communities over a long period of time, which was vented out on a different pretext on that fateful day.

Tribal land alienation has been an on-going process in this region. The 'colonial construct' of wastelands and the colonial designs of facilitating the migration of peasants from East Bengal to cultivate cash crops and food crops in these wastelands (and labourers for tea plantation) on the one hand and on the other the problems of flood plains and erosion among these settlers and their migration to alternative sites among a host of other inter-dependent factors were destined to result in conflict. Apparently, the tribals' urge to obtain ready cash by selling land at high prices and the willingness of the Muslim farm settlers to become landowners by arranging for it the sum / money seem nicely matched. Suruj Konwar, a veterinary department expert in Nellie says, "When people get Rs. 30,000-40,000 per *bigha*, they simply sell their land". Such processes continue unabated and grievances accumulate unknown and under the surface until one day, triggered by a petty cause, they cause a conflagration. Fellow citizens become mere *bodies* to vent their anger as the call beckons, *get rid of the Bangladeshis and save thy Motherland*. This is how Nellies are manufactured, and this is how Nellies are forgotten!

Sources: 1. Gokhlae, Nitin, A, "Who is responsible for Nellie massacre 1983?", September 21, 2011, <http://www.ibtl.in/news/exclusive/1254/who-is-responsible-for-nellie-massacre-1983>

2. Hazarika, Sanjoy, 2000, *Rites of Passage*, New Delhi: Penguin

Similarly, when they move into the forests or areas nearby, it leads to another set of conflicts. In these areas, they always remain illegal settlers at the mercy of various State authorities, which itself becomes the condition for various conflicts. The *char* dwellers also become a threat to the surrounding ecology of the forest areas. They not only disturb the green cover but also become the source for human-animal conflicts in these areas. Studies suggest that the illegal settlement of these flood victims in the Doyang Forest Belt in Golaghat district of Central Assam has given rise to various environmental problems, the more severe being the human-elephant conflict, that have resulted in loss of life and property in and around the forest area⁸. The same study shows that in Burhachapori Wildlife Sanctuary and Kaziranga Forest areas the settlement of the flood victims has resulted in a rise in livestock population in these areas. Their presence has resulted in excessive grazing and loss of grassland and top soil cover. The domesticated animals have become the carriers of various diseases affecting the wildlife in the forest. The cumulative effect of such a situation leads to ecological marginalisation⁹.

⁸ Buragohain, Pranjal, Protim, "Migrants and Their Socio-economic Status: A Case Study of Golaghat District", an unpublished seminar paper at a national seminar Tribal Demography of North East India, organised by UGC-SAP and Department of Economics, Dibrugarh University, 26th March 2005. For further details on human-elephant conflict in Golaghat district see, Talukdar, Bibhab, Kumar, and Barman, Rathin, "Man-elephant conflict in Assam, India: is there any solution? Gajah, Vol.22, July 2003, Multi-dimensional Mitigation Initiatives to Human-Elephant Conflicts in Golaghat and adjoining areas of Karbi Anglong District, Assam (Guwahati: Aaranyak, 2007)

⁹ Op. cit, no.1

¹⁰ Ibid

¹² A Study of the Land Systems of North Eastern Region, Vol. I, Assam (Gauhati: Law Research Institute, 1982)

Other than the urban, rural and forest areas, they occasionally also move to new *chars* and adjoining areas within the floodplain. When this type of migration occurs on a large scale or over a long period of time, it has a significant impact on the biodiversity of these natural habitats. The topographical maps of Survey of India prepared during 1911-12 show the presence of tall grasses (3 to 4 meters in height) in various river islands of the Brahmaputra. Among these grasses there was also the growth of *Hemarthria pratesse* which is considered as the best fodder for the Indian one-horned rhinoceros and *Imperata cylindrical*, the main habitat of the endangered Bengal florican. With anthropogenic interventions these grasses have become extinct and the wildlife dependent on them has also ceased to exist in these areas. Again, senseless commercial exploitation of valuable species of trees such as *Lagerstroemia flos-reginae* (for boat making) has made them extinct in these areas. Certain weed varieties such as *Cyperus* (used mainly for mat making) are now under the threat of extinction because of over exploitation. Unmindful commercial fishing has led to depletion of marsh vegetation in these *char* areas¹⁰. Flood induced migration has thereby come into conflict with environment as well.

While the probability of erosion in the *char* areas remains high that of its re-emergence is also a natural, but uncertain and unpredictable phenomenon. There are no legislative provisions to deal with such issues of re-emergence in Assam. This continues to be one of the main sources of conflict among the *char* dwellers. Neither The Bengal Alluvion and Dilluvion Regulation of 1825 (which was applicable in Assam for 32 years from 1897-1929) nor The Assam Land and Revenue Regulation, 1886 deals with this issue directly. This legal ambiguity lays the ground for conflict. Due to the contentious nature of the problem associated with the re-emergence of land, there have been several court cases. Based on these disputes, certain outstanding judicial decisions^{11(p.t.o)} were promulgated, which to say the least, provided an alibi for dealing with this issue of re-emergence¹². It was argued that eroded land reformed on the old site continues to be the property of the owner, provided

that it has not been completely abandoned meanwhile, where abatement of revenue is said to be an indication of complete abandonment. But Section 34(c) of the Assam Land and Revenue Regulation, 1886 states that there is a provision for reduction of revenue by the Deputy Commissioner, for land, which has been washed away. But in reality, due to the attachment of large number of complicated explanations attached with this section, it is commonly believed that if an owner appeals for abatement of revenue for the part of his eroded land then there is maximum likelihood that he will lose the ownership of the entire eroded land¹³. Similarly, although there is provision, which states that if the owner continues to pay revenue for the eroded land, after its re-appearance, the land will belong to the original owner. But there are conflicting references of time-period for which revenue has to be paid for an eroded land in various legislations. This inevitably leads to conflict among the contesting parties, where the scope of judiciary to deliver justice remains limited.

Another aspect related to land is observed among the *char* dwellers which on more than one occasion leads to conflict. In order to minimise flood related losses, the *char* dwellers have an insatiable urge to move from the peripheral regions of a *char* to the central area, which is the highest area within these alluvial formations. This takes place through land transaction i.e. sale of land in the peripheral areas and purchase in the central area. The same cycle is repeated when they migrate from an interior *char* to a comparatively less erosion prone *char* or settled areas within the flood plains. This risk minimising phenomenon of migrating from one place to another is a lifelong affair for a *char* dweller. A study¹⁴ of the *char* villages of the Brahmaputra and Beki Rivers shows that out of the 304 households surveyed 24 per cent were involved in these kinds of land transactions during the one year period 2003-04. Amongst those involved in land purchase, 40 per cent shifted to safer places within their respective *chars*, equal number of households migrated to a comparatively stable *char* whereas the other 20 per cent moved to mainland areas. This migration of the *char* dwellers to newer areas particularly to the areas in the mainland often raises various questions about their identity and

¹¹ There are few instances of legal disputes and promulgation of justice by the courts on issues related to land in *char* areas. Some of the cases include Lopez vs. Madan Mohan (13 MIA 467), Ramnath Tagore vs. Chandra Narayan Chowdhury (1 March 136), Imam Bandi vs Hargobinda (4MIA 403), Radha Prasad Singh vs Ram Coomar Singh (3 Cal. 796) etc. Details are available for some of the cases. In the Boroji Manipurini (Appellant) vs. The State of Assam and Others (Respondent), 1958 (AIR, 1958, 34) it was held that a land which has gradually and imperceptibly come out of the river-bed and added to the land of a riparian owner becomes part of the land belonged to him and is considered as his property...if it is considered an increment to the tenure of the land to which it has accreted.

Similarly, in another legal dispute between Sudhangshu Ranjan Dasgupta (Appellant) vs. Manindra Kumar Paul and Others (Respondent), 1972 (AIR, 1972, 38 & 34) it was pronounced that... any land accreted to plaintiff's periodic *patta* land by recession of river contiguous to such land automatically becomes part of the plaintiffs' land and cannot be allotted to any other person on the ground that the plaintiff had land in excess of ceiling fixed by The Assam Fixation of Ceiling on Land Holdings Act, 1957.

¹³ Ibid

¹⁴ Op. cit, no 12

antecedents, which often is a source of conflict in those areas where they shift. Moreover, the socio-cultural difference of the *char* dwellers vis-à-vis other population groups in the mainland (as observed in case of labour market discrimination) where they move in to settle, complicates the matter further.

Scope for Dialogue and Way Forward

The first question that arises is dialogue between whom? Who are the contending parties? What is the scope and methodology for such a dialogue for conflict resolution? At the macro-level since there are no contending parties as such, the first task is to sensitize the non-*char* dwellers about the geomorphological details of the *char* areas and its consequences on the life and livelihood of the *char* dwellers due to their habitation in these alluvial formations. The state agencies, the media as well as the civil / community based organisations should take the lead in this direction. The rationale behind the migratory nature of these people is basically flood-induced as they migrate from one location to another in search of livelihood options. Neither the *chars* are stable nor are its dwellers, so migration remains the only way of life for them. Migration also acts as an option to minimise risk and an instrument of insurance against their flood and erosion prone future. Until the non-*char* dwellers realise these ground conditions, it will be difficult to bring about a change in their perception of the *char* dwellers as intruders.

The location of these dwellers is geographically isolated and so they remain secluded from the psychological mainstream of the settled areas. Thus the issues related to the *char* dwellers are never a part of the dominant discourse. Under such a situation there is bound to be a socio-cultural difference between the *char* and the non-*char* areas, however optimistic one may be about assimilation. The situation becomes more complicated as there is little presence of the State and its apparatus in these remote areas. The only proof of identity for the fortunate is the inclusion of their names in the electoral rolls. But during flood-induced migration they take along only the bare necessities of life, and a copy of the electoral roll as a proof of their identity is beyond imagination. Electoral Photo Identity Card (EPIC) could have been one solution but Assam is still outside the ambit of such provision. Here the State has to intervene to allot some sort of identity proof in order to minimise conflict.

The issues related to land are of great significance for the *char* areas and the legislative gaps need to be filled up in order to minimise the chances of conflict. When the Goalpara Tenancy Act, 1929, Sylhet Tenancy Act (for Karimganj sub-division), 1936 and the Tenancy Act of 1935 were replaced by the Assam Temporarily Settled Areas Tenancy Act, 1971, it contained no reference to the *char* areas, which were at least sparsely mentioned in the earlier legislations. As a result, these areas remain outside the purview of land legislation. So when a new *char* emerges, it becomes the property of the State Government, which either keeps it as grazing reserve or settles it as per the Land Settlement Policy Resolution. But ground reality suggests that people in the densely populated *chars* seldom wait till its systematic settlement by the Government. They immediately occupy the newly formed *chars*. Power brokers play the deciding role, which ultimately leads to resource capture.

Field level data¹⁵ also substantiates the inequality of land ownership in the *char* areas, the Gini co-efficient of inequality for land ownership has been very high (0.60) among the surveyed villages. Without a proper legislative review for these areas backed by proper land settlement policies, conflict-resolution will be a far cry. Until measures are undertaken to institutionalise property rights, conflicts over issues of land will be rampant in these areas. The State Government needs to come out of its half-hearted effort for proper revenue settlements in the *char* areas (considering three failed attempts during 1979, 1983 and 1994) and start afresh by bringing in all the stakeholders together; else land issues will remain a recurrent source of conflict in the *char* areas.

Left to themselves, these flood-induced migrant *char* dwellers will float around in the region and beyond, and will be the perennial agents as well as victims of conflicts - both active and dormant.

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¹⁵ Ibid

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Bridge Over Kosi Connecting People or Banishing Them?

Jitendra Choubey

The Bridge of Conflict: Overall Scenario

Development as a concept and a political promise immediately raises our hopes, being associated as it is with the betterment of our lives, especially for the common masses. In practice however, development schemes often end up showing the opposite effect by causing serious damage to the well being of the people on the ground even though they sound good on paper and in bureaucratic reports. Often such damage is claimed to be unavoidable by the policy makers who argue that development will also have inevitable side effects. This particularly applies to mega projects which often end up ignoring the community and the environment, making a reasonable person wonder if a development scheme is worthwhile at all, and whether the so-called by-products are really unavoidable.

The Kosi Mega Bridge in Bihar is one such case. It ended up displacing more than 70,000 villagers in the name of road 'connectivity' in the region. With the completion of this 1.8 km mega-bridge apparently 52 villages would get inundated with the Kosi backwaters. But displacement is not the only problem in a project ridden with numerous technical faults that should have been rectified during the planning stage. The present case study focuses on the many altogether avoidable problems that the bridge has brought with it.

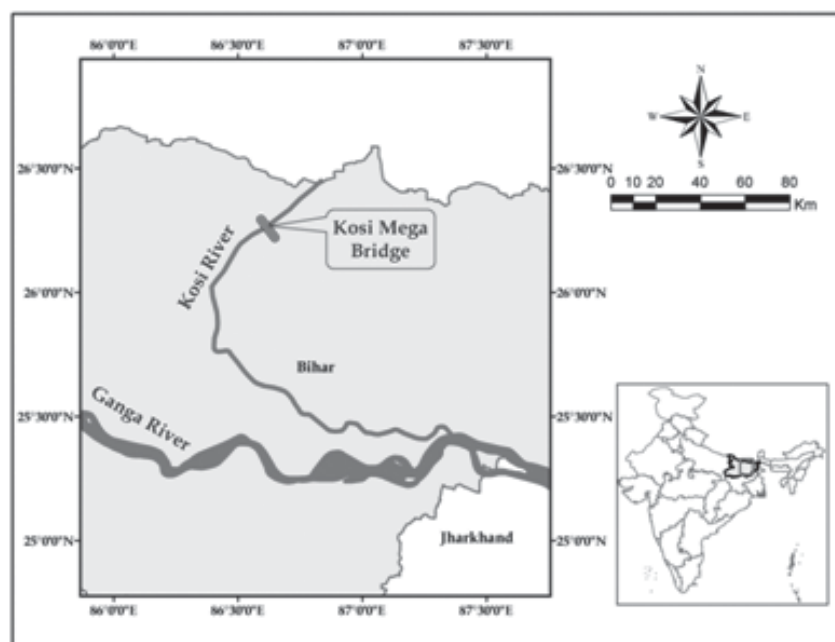


Fig. 1: Location of Kosi bridge in India

Mapping the Flood Affected Area in Kosi: Embankments as Solution?

The Kosi region lies about 250 km to the north-east of Patna, the capital city of Bihar.¹ The river Kosi which originates from the Tibetan Plateau of China / Tibet Autonomous Region of China² flows through this region from north to south across the six districts of Bihar - Supaul, Saharsa, Darbhanga and Madhubani, Khagaria, Katihar which comprise the Kosi region, before meeting the river Ganga at Kursela in Katihar district. Flood and devastation has been a regular feature of this region. Floods have become more widespread since the construction of embankments on the Kosi River five decades ago to tame its strong and turbulent currents. The ostensible aim of the embankments was to provide flood protection to an estimated area of 2.1 lakh hectares in this region.³ Before embankments were built, the Kosi River flood plain was more than 125 km wide, which has now been confined to a width 12 km. This has had disastrous consequences.⁴

According to the 2011 census, there are around 380 villages with a population of 9.88 lakh trapped between the two embankments of the Kosi. They are spread over four districts and 13 blocks (Basantpur, Kishanpur, Saraigarh-Bhatiyahi, Nirmali, Supaul, Navhatta, Mahishi, Simri Bhakhtiyarpur, Salkhua, Kiratpur, Laukahi, Marauna and Madhepur)⁵. The embankments have created a situation whereby these villages, which lie inside the embankments are flooded for four months annually. Silt deposit over the years has also raised the level of river bed and its banks between the embankments), so that it is now about 15 ft higher than the area just outside the embankment.⁶

The Kosi Bridge as Boon and Curse

The recently inaugurated 1.8 km Kosi *Mahasetu* (mega-bridge) only adds to the woes caused by the embankments for more than 70,000 people of the 52 villages⁷, upstream of the Kosi *Mahasetu*. This mega bridge has reduced the travel time from Madhubani to Saharsa from 299 km to 44 km is an obvious boon.⁸ The bridge constructed by Gammon India is part of the ambitious East-West corridor of National Highway 57. The villagers' sole way of survival is through farming inside the embankments. The bridge was built in spite of the fact that its design does not take into account the meandering course of the Kosi and the villagers.

There are two embankments, Eastern and Western embankments, between which Kosi river flows from North to South. The distance between the two embankments varies from 10 to 15 km.⁹ At the bridge site this width is 11 km. The government treats the area between the two embankments as 'No Man's Land', resultantly the villagers who live in this area are completely at the mercy of God.

The structures constructed for the bridge (see Figure 2) at Sanpatha, Nirmali act as a bow-shaped funnel designed to make 11 km wide river pass through a narrow 1.9 km passage underneath the rail-cum-road bridge. It is easy to see why the rise in water level caused by the funnelling of high water through a narrow passage, has led to full or partial submergence of 52 villages upstream affecting more than 70,000 people.¹⁰

¹ National Flood Commission Report, Ministry of Agriculture, 1980

² National Flood Commission Report, Ministry of Agriculture, 1980

³ National Flood Commission Report, Ministry of Agriculture, 1980

⁴ National Flood Commission Report, Ministry of Agriculture, 1980

⁵ Mishra Dinesh Kumar, 2006, *Between Devil and deep water*, Dehradun: Peoples' Science Institute

⁶ Jha T. N, *Kosi Mahasetu Ke Nirman se Utpann Sthaniye Sankat Evam Samadhan*, Patna: Global Peace and Justice Foundation

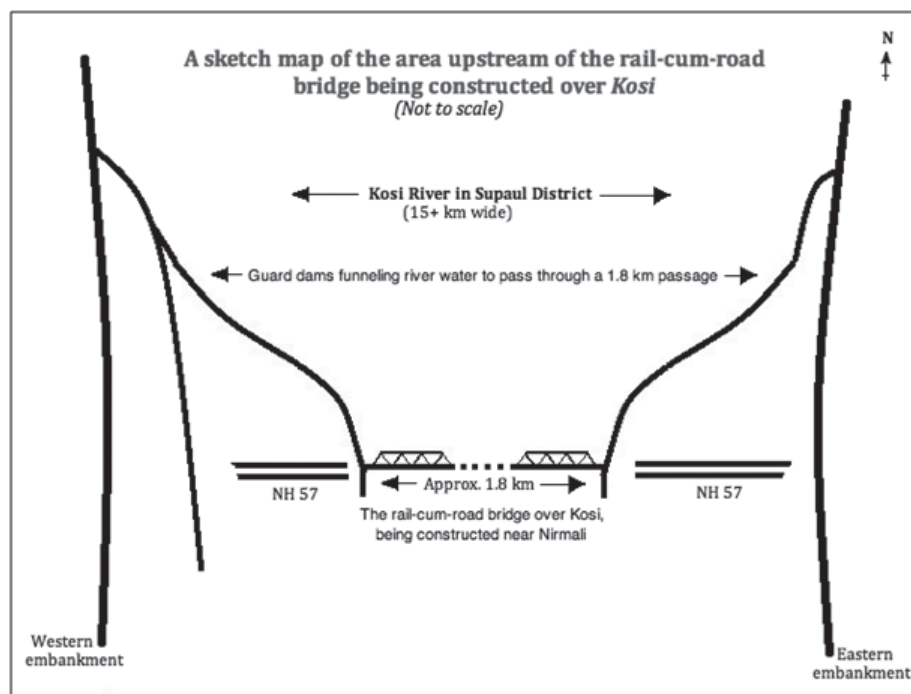
⁷ Jha T. N, *Kosi Mahasetu Ke Nirman se Utpann Sthaniye Sankat Evam Samadhan*, Patna: Global Peace and Justice Foundation

⁸ NHAI report on East-West Corridor consisting NH-57

⁹ Jha T. N, *Kosi Mahasetu Ke Nirman se Utpann Sthaniye Sankat Evam Samadhan*, Patna: Global Peace and Justice Foundation

¹⁰ Jha T. N, *Kosi Mahasetu Ke Nirman se Utpann Sthaniye Sankat Evam Samadhan*, Patna: Global Peace and Justice Foundation and Mishra Dinesh Kumar, 2006, *Between Devil and deep water*, Dehradun: Peoples' Science Institute

Fig. 2: Map of the upstream area of the rail-cum-road bridge¹¹



Antecedents of the Flood Induced Conflict

Faulty Flood Control Policy

Since its inception in 1954, the first flood control policy in Bihar was based on the idea of construction of embankments and dams to contain the floods. In north Bihar, over the years, embankments were systematically constructed on a large scale. As per the report of Government of Bihar, from a meagre 160 km in 1950 the total length of embankments constructed stood at 3,438 km in December 1987, of which 2,951 km was constructed in north Bihar alone. By 1998 the length had risen to 3,465 km.¹²

Ironically, the increasing length of embankments was directly proportional to the area¹³ of the flood prone regions. The total flood affected area was no more than 2.5 Million Hectare (MHa) in the 1950s. But by 1971, the flood affected area went up to 4.26 MHa. In 1998 the flood prone area was placed at 6.9 MHa and it has reached 7.5 MHa by 2007.

The above data inevitably leads to the conclusion that embankments will never be a solution to the floods in the area. Embankments breach every year, and the State Government continues to deny the facts. Experts however feel that the contractors play a major role in both construction as well as the breaching of embankments.

Early History of Kosi Bridge

Earlier a rail link did exist in this region between 1911 and 1934 which caved in due to the massive earthquake of 1934. Since then the region has been almost inaccessible. It was the only district in independent India where its District Magistrate had to visit his own jurisdictional area after crossing 125 km of distance through international border of Nepal.¹⁴

¹¹ Sketched (not to scale) after extensive field visit by Praxis India

¹² Floods, Flood Plains and Environmental Myths & Dying Wisdom; Centre for Science and Environment which are compiled in PUCL report on Floods in Bihar

¹³ Floods, Flood Plains and Environmental Myths & Dying Wisdom by Centre for Science and Environment which are compiled in PUCL report on Floods in Bihar

¹⁴ Sajanand Sarswati and Old British record and Dinesh Kumar Mishra, 2002, Living with the Politics of Flood, Dehradun: Peoples Science Movement

The people in this 'No Man's Land' have been facing the adverse consequences of embankments ever since 1956.¹⁵ In the beginning of the Kosi project, the affected people were shifted outside the embankment and promised land outside the embankments. Many people were given land papers (*parch / parwana*) for their settlement. But most of the people could not be settled for various reasons like waterlogging and livelihood problems. The government settled them by providing homestead lands but did not provide alternative cultivable land for their livelihood. Their location was nearly 8-10 km from their original village (inside the embankments). So they moved back inside the embankments to cultivate their original lands. The rehabilitation site adjoining the embankments became perennially waterlogged and proved to be unfit for human habitation. Therefore, the villagers, slowly but steadily, started moving back to their old villages. Gradually, thousands of these villagers became landless or lost their land due to soil erosion or submergence caused by embankments, and permanently settled on top of the embankments or by the side of the road, many of them for as long as 40 to 50 years. In the government files, the area is still treated as 'No Man's Land'.

The agony was summed up by 70 year old Jinneshwar Shah who is now president of the District Council of Supaul. In 1956, when he was 14-years old he participated in the construction of the embankments as a labourer. His job was to count the loads. He was from Jobha village of Marauna block inside the embankments where he had 30 acres of agricultural land. He says, "All the promises which were made about resettlement outside the embankment remain unfulfilled. The outside villagers did not show sympathy for all our sacrifice. Many incidents related to harassments and teasing of women while meeting nature's call infuriated us. There were clashes with the other villagers. Women had to cross the waterlogged area to meet nature's call during day time. Then, we started returning to our areas inside the bunds for agriculture, settled there and came out from there only during severe floods".

It is interesting to see how many times a family has lost its dwelling since embankments were built. For instances, Belwara village in the Simari Bakhtiyarpur block of Saharsa district in Bihar, located within the Kosi embankments, has been eroded 14 times within the span of 42 years.¹⁶

After the loss of the Kosi bridge in the 1934 earthquake, people in the area faced 78 years of separation between the two banks of Kosi, losing two generations of contact with their neighbours during this period.¹⁷ The people faced lots of hurdles while trying to reach the other side of the river. There have been a number of reports of capsizing boats in the region when villagers tried to cross five different streams of the river to reach the other side. Gradually people avoided the use of boats and embraced this hardship. There were a number of families who grew up without visiting their ancestral homes on the other side. Many of them lost contact with their relatives as many people of this region migrated in search of jobs to big cities.

¹⁵ Mishra Dinesh Kumar, 2006, *Between Devil and deep water*, Dehradun: Peoples' Science Institute

¹⁶ Mishra Dinesh Kumar, 2002, *Living with the Politics of Floods*, Dehradun: Peoples' Science Institute

¹⁷ Mallik Laliteshwar, Kosi, 1953

Indradev Shah, 50-yr-old of Chouhatta village visited his maternal home in Nirmali, after 19 years. "Last time I visited Nirmali, it was in 1991 during a

marriage ceremony of my cousin. Since then I did not visit” says Indradev.

The fact is the people in the region do want a bridge but longer bridge which does not cause displacement on such a massive scale.

Current Status of the Flood Induced Conflict

Sufferings of People Living Inside Afflux Area: Development Refugees

Thousands of villagers from the 52 villages in the afflux area, the upstream area between the embankments affected by the rise in water level caused by the bridge, have abandoned their houses and have taken shelter on National Highway (NH)-57 due to submergence of their villages.¹⁸ The villagers have been left with no other option but to move to other areas, abandoning their community relationships, their ancestral legacies of past, and more importantly, their houses. Nearly every household at the settlement site has someone or the other coming down with fever, diarrhoea, and other water-borne diseases.

A Visit to the Site during August 2011

As one enters the area between the embankments through the western end, distressed Narayan Shah of Sampatdeeh village, welcomes us with his belongings consisting of a locked wooden cupboard, chair, benches, aluminium boxes, roof of the hut, bundles of woods and materials for hut making. “My whole 7.5 acres of lands along with my huts was submerged. Earlier I too was temporarily displaced but this time the unfortunate Mega bridge uprooted me permanently”, says angry Narayan, waiting for his son who has gone outside the afflux area to arrange for shelter. His nine member family and his goats - their means of livelihood - were standing at the bank of the river under the bridge, said Narayan.

Aurahi village of Baniyani Panchayat is located at the bank of one of the Kosi’s streams. Dev Narayan Mandal, his wife and daughter were busy sowing the paddy crop. They used to possess more than 35 acres of land but the western embankment ruined them and their fellow villagers. “This time we are sowing crop in only one acre” says 45 years-old Mandal. Women workers in knee deep mud, girls in muddy school dresses were a common sight. The tin-shed school was closed two months back and there was no sign of a hospital. The villagers had to deposit Rs. 1,000 in advance for cases of emergency treatment at a private clinic situated outside the embankments. Kapileshwar Manjhi, 55, said, “There is no facility for emergency cases. One has to deposit the sum in advance for pregnancy cases only!”

Lagunia village was once a prosperous village in this region. A sudden new stream of Kosi emptied it out. The villagers left leaving behind uprooted huts, scattered bricks, bamboos, tin roofs, abandoned clay stoves, kitchen, silos, goats which were common sights in these villages.

After wading through knee-deep mud and water, one could reach Moura-Jhaura, Dengraandhi, Piprahi villages under Dighiya Panchayat. An old man

¹⁸ Mithila gram parishad report

named Govind Biswas and his wife, Sarswati Devi had taken shelter inside the tin shed of an abandoned school. The school's name was not mentioned but the recently concluded Panchayat election booth number was mentioned on it.

There were signs of dried water stream inside the village. A young man, Ujjawal Kumar studying at Supaul College was assessing the damage caused by the sudden rise of water level. The Rahariya village was under the turbulent stream. It used to have a railway station till 1934.

As one reached nearby Sinhpur village, after crossing another stream, one could easily feel the agony of villagers due to afflux. A few villagers, mostly Mahadalits, were trying their hands at transplanting paddy saplings. Most of the saplings had turned yellow due to excess waterlogging for number of days. Shusklal Sardar, a migrant labourer proudly showed his solar plate, the single one in the village. He said he earned it last year after returning from Punjab. Two years ago, he lost everything due to this bridge. These Mahadalits followed the traditional profession of making mattresses with wild shrubs. This village was the site of a huge fair and provided employment opportunity till two years ago which has now come to an end.

Md Iqbal Hasan, 38, was once a landlord, possessing more than 100 acres of land but has now become landless. His entire agricultural land is submerged. Iqbal was leading a prosperous life with his eight children and wife, but is now displaced, living a makeshift shelter on the eastern embankment. Rajkumar, a middle aged man, president of the village co-operative society said the villagers have to spend a whole day to buy a bottle of kerosene and other essential goods.

Fig.3: Kosi mega bridge (photograph by Vikas Kumar)



Agriculture and Livelihood

In the afflux area there was 56,340 acres of agricultural land on which the affected villagers¹⁹ carried out agriculture. The land was suitable for paddy, wheat, pulse, maize etc. It has been estimated that farmers earned an income of Rs. 21,000 from one acre of farmed land. Besides crops, fodder of Rs. 2,000 per acre was produced as a by-product. The total yearly production thus

¹⁹ Jha T. N, *Kosi Mahasetu Ke Nirman se Utpann Sthaniye Sankat Evam Samadhan*, Patna: Global Peace and Justice Foundation

fetches the area an estimated Rs. 1,29,58,20,000 and also provided employment to local farmers and labourers. The cost of livestock and labourer inputs are not included in the estimate.²⁰

The Circle Officer of Saraigarh Bhaptiyahi Block had listed 18 villages as revenue villages from which the government collected revenue of Rs. 2.23 lakh per year. Besides this, there were 26 schools and six sub-health centres in the submerged areas.

Legal Battle

The displaced people approached the local district administration including the Minister of Water Resource and the Chief Minister's Janta Darbar in November 2010 to demand justice. They also communicated their plight to National Highway Authority of India (NHAI), Railways, Ganga Flood Control Commission and other concerned agencies. But no action has been taken so far for their relief and rehabilitation.

A Supreme Court judgment on 9 August, 1991 regarding the case of B. D. Sharma Vs Union of India, Writ Petition (Civil) No. 1201 of 1990, clearly states that no displacement drives can be carried out without proper rehabilitation. The rehabilitation should be done as far as possible in a methodical and meticulous way, to enforce terms and conditions stipulated in the agreement such as 18-months notice before effective evacuation. The displaced people from the area have filed a Public Interest Litigation (PIL) (21CWJC-968-2012) in Patna High Court on 12 January, 2012. The case has been listed and notices have been served to the State Government and other concerned agencies like Railways, Centre for Water and Power Research Station (CWPRS) and the Surface Transport Ministry. In its first hearing on 18 January, 2012, the State Government had asked for six weeks to file a detailed reply.

Cautioning Voices

The rail-cum-road project in the Kosi region was sanctioned and initiated without any assessment of social, human and environmental cost of the bridge. Although, a technical assessment was carried out, it does not even mention the name of habitation falling in the course of the river.

Needless to say, neither any of the local communities nor their elected local representatives were consulted before or during the process of construction of the bridge, nor was any compensation ever offered to them. Even basic information regarding the likely implication of the construction (i.e. sudden spurt in water level) of the bridge was not made available to them.

The Kosi river is a highly unstable river. Even when embanked, its multi-channels have been changing course from time to time. There were five channels through which the river flowed in the concerned area. Four of these channels were plugged by the embankments of NH-57. The mega bridge spans the fifth channel, which was also the main stream.²¹

²⁰ Jha T. N, *Kosi Mahasetu Ke Nirman se Utpann Sthaniye Sankat Evam Samadhan*, Patna: Global Peace and Justice Foundation; Mithla gram Parishad report; Report prepared on Focussed group discussions with villagers by Praxis India

²¹ Verma Manas Bihari, 2010, Report on the NH-57 and Railway Bridge over the Kosi river at Nirmali, Darbhanga: Mithila Gram Vikas Parishad

Based on tests and studies conducted by CWPRS the waterway for both the bridges was fixed as 1.853 km and spread of the backwater and level of afflux upstream were estimated to be 8 km and 1.35 m respectively at the design discharge of 7.9 lakh cusecs. However, after the completion of guide bunds and afflux cum protection embankments, and at about 20 per cent of the design discharge, in the monsoon of the year 2010, the spread of the backwater and level of the afflux far exceeded the prediction made by CWPRS. This resulted in inundation of large number of villages upstream of the bridge. The eastern afflux cum protection embankment, guide bunds and the NH-57 bridge approach segment suffered breaches.

Concern regarding the construction of the bridge had been raised during the initial days of its design and construction. It was evident from two letters. Bhagwan Das, Chief Engineer of Water Resource Department of Bihar in his letter (no. 1079 dated 01.09.2003, which was written in response to letter no. 867 dated 11.08.2003) wrote “....our examination of the issues has revealed that serious problem may arise both upstream and downstream of the bridge as in the case of the road bridge over river Ganges at Patna and Road-cum-Rail Bridge at Mokamah.....we have also found that in the proposed region of construction, siltation is a very serious problem and as a consequence the freeboard of the embankment has already diminished. Hence the broader base of the river merged with river bed and the top narrow portion now bears the brunt of pressure of flood water. As a result, the HG (Hydraulic Gradient) lines also have shifted and become more obtuse.....”. Bhagwan Das also called for redesigning of the bridge to provide more water-way. This may somewhat push up the initial cost but will result in saving crores of rupees in anti-erosion measures, flood fighting and relief work in future.

Another letter no. 1020 dated 11.09.2003, was written by V. Jayshanker, Commissioner and Secretary of Water Resource Department of Bihar to Nirmaljit Singh, Member (Technical), NHAI, Ministry of Road Transport & Highway. Mr. Jayshanker raised the issue citing an example of earlier two bridges on rivers Ganga and Gandak. He wrote “.....it is evident that the purview of the studies were limited to the few basic general points only and it did not consider the critical aspects of the adverse impacts of the bridge on the structures in the vicinity and the flood protection embankments in particular. Clearly the concerns of the State Government are much broader in terms of floods and relief.....”

Later, Bihar government set up a committee under the Chair of Gokul Prasad to look into the matter, which presented its report on 25 August, 2004. This committee raised serious objection about the 60 meter spacing between NH-57 Kosi mega bridge (upstream) and the Railway bridge (downstream). From the strategic point of view the distance should be at least 400 meter. The committee's objections and recommendations were completely ignored.

Another report was prepared by a team of distinguished engineers and scientists on 28 April, 2010 in the light of the Gokul Prasad Committee report

and the team's own visit to the site, which raised technical queries regarding the site selection of the bridge, alignment, hydraulic design of waterway and river appurtenances like the common guide bunds, afflux cum protection embankments, physical model tests and computer model studies that were done by CWPRS, Pune under the guidance of a Technical Committee chaired by the DG (RD& AS), Ministry of Road Transport and Highways / member (Technical), NHA New Delhi. The recommendations of this committee were that design discharge of 7.90 lakh cusec of the Kosi river for the Return Interval (RI) for 100 years was an under estimate. The highest discharge was 9.5 lakh cusec in 1954 which was already known. This needs to be re-examined. The gross waterway of 1.853 km of the bridge was inadequate even at the design discharge mentioned above. This should be reviewed.

The prediction of backwater effect over a distance of 8 km and 1.35 m height of afflux was found to be flawed. Even after considering 20 per cent of total discharge of the river, backwater spread up to 15 km upstream and afflux rose to approximately 5 m height.²²

Hydrological data for the Kosi river between the barrage and the NH-57 bridge site was gathered during the pre and post monsoon months of 2002. The river bed and flood plain gradients, channel branching, location and area of shoal, grading of sediments, bank slope and vegetation in the river course have altered over the last eight years.²³ This should be reviewed and the height of afflux should be brought down so that the river gets more waterway.

Way Forward

Every major civilisation of the world developed in and around river basins and made full use of the resources available instead of trying to gain full control over its flow, an impossible target! Mega projects on rivers are often biased in favour of purely technical gains. Our debates often concentrate around technical planning and tradeoffs between the benefits and the social cost. But the value of natural resource cannot be seen in isolation.

Though the scope for a dialogue based resolution in the case of Kosi mega bridge is very limited, its lessons should be remembered while making further interventions with the other Himalayan rivers. Mansa Bihari Verma, a scientist, believes that the plugged streams of the Kosi river should be allowed wide enough passage while constructing bridges over it. In the case of the present bridge there were four streams plugged and merged into the fifth one over which the bridge is constructed. Allowing for easier passage may somewhat push up the initial cost but it minimises the future threats and the maintenance cost like anti-erosion measures, flood-fighting and relief work in future.

There is an important question that remained unanswered in this debate. Flood control at what cost? That flood is a threat and that we must continue to exhaust our energy in taming it, is a modern, industrial idea. Such attitude gives birth to reckless mega projects. Very often importance is given to

²² Verma Manas Bihari, 2010, Report on the NH-57 and Railway Bridge over the Kosi river at Nirmali, Darbhanga: Mithila Gram Vikas Parishad

²³ Verma Manas Bihari, 2010, Report on the NH-57 and Railway Bridge over the Kosi river at Nirmali, Darbhanga: Mithila Gram Vikas Parishad

research on growing water deficit crops, which is fine when we are dealing with water deficit areas, but the same seriousness is not seen when it comes to research on crops that can grow under flood conditions. For flood prone areas, we need research on “water friendly crops” that can withstand waterlogged conditions.

For some reason our technocrats are averse to following the traditional knowledge on controlling the floods. The idea of free flowing rivers seems to pose a challenge to their arrogant egos. Which is why we again keep hearing of flood resistant houses, but no attention is paid to devising flood tolerant houses.

In the past, the flood was regarded as a welcome feature in the Kosi region. There are still a number of sayings in Mithila region like '*Ayel Balan ta Banal Dalan, gel Balan ta tootal dalan*' (i.e. floods in river Balan brings prosperity but with no floods in Balan even the existing prosperity may be ruined). The traditional system of managing the flood in Mithila region is well articulated in this saying; '*Pag-pag pokhar, pan, makhan, Tab dekhiu Mithila ki saan*' (i.e. Lake, Betel creeper and Makhana plants all over, that was the grandeur of Mithila). When there were no embankments, flood waters would flow out quickly without causing much rise in the level of water. Moreover, flood would not last for long. Flood water replenished the fertility of the soil, added moisture to it for the next crop and then receded. It was for this reason that the flood was eagerly awaited for. Women sang songs eulogising the river.

There is one possible political solution to this mindless intervention against the Kosi river. There is nearly ten lakh population residing inside the embankments. It is enough to create a parliamentary constituency which elects its own representatives. People's voice and concern get a platform which is now lost in development chaos. Presently, this embanked population is divided among five different constituencies. It may give this 'insensitive' development some meaning and even a new lease of life.

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Floods in North Bihar¹

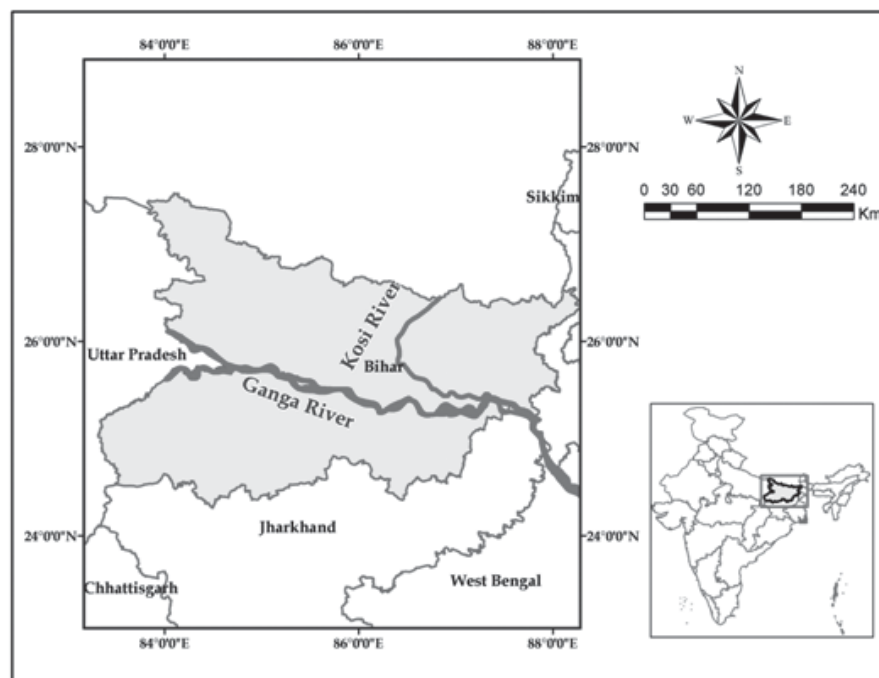
A Recurrent Source of Conflicts

Vinay Kumar, Ramesh Kumar, Prem Kumar Verma,
Rajendra Jha, Chandrashekhar and Pradeep Kumar
Poddar

About Bihar

Bihar, located in the eastern part of India (between 83°-30' and 88°-00' longitudes), is an entirely land-locked state between West Bengal in the east and Uttar Pradesh in the west. It is bounded by Nepal in the north and Jharkhand in the south.² The total population of the state is 103,804,637. This consists of a male population of 54,185,347 and a female population of 49,619,290.³ The population density of the state is 1102 persons per square kilometre (sq km).⁴

Fig.1: Location of the conflict



With a geographical area of about 94,200 sq km, Bihar is divided by the Ganga into two parts, North Bihar with an area of 53,300 sq km, and South Bihar with an area of 40,900 sq km.⁵ Bihar is a land of rivers and rich flood plains. It has 14 river basins: the Ghaghra, Gandak, Burhi Gandak, Bagmati, Kamla Balan, Kosi, Mahananda, Karmnasa, Sone, Punpun, Kiul-harhar, Badua, Chandan, and the main Ganga stem. All these rivers drain into the main Ganga stem. The seven river system from the Ghaghra to the

¹ This is the translation of original Hindi version of the case study

² <http://gov.bih.nic.in/Profile/default.htm>

³ <http://gov.bih.nic.in/Profile/default.htm> Census of India, Provisional Population Totals, Office of the Director of Census Operations Bihar, Patna, 2011

⁴ Census of India, Provisional Population Totals, Office of the Director of Census Operations Bihar, Patna, 2011

⁵ Bihar's Agricultural Development: Opportunities and Challenges: A Report of the Special Task Force on Bihar, Government of India, New Delhi, April 2008

Mahananda drains North Bihar. Most of these river systems of North Bihar originate in Tibet and Nepal, and hence are international rivers barring the Burhi Gandak.

Table 1: Basin-wise Flood Prone and Protected Areas in Bihar⁶

Name of the Basin	Catchment Area (sq km)	Length of River in Bihar (km)	Embankment Constructed (km)	Flood Prone Area (sq km)	Protected Area (sq km)
Ganga	19322	445	596.92	12920	4300
Kosi	11410	260	387.51	10150	9300
Burhi Gandak	9601	320	704.26	8210	4010
Kiul Harohar	17225	-	14.00	6340	NIL
Punpun	9026	235	37.62	6130	260
Mahananda	6150	376	225.33	5150	1210
Sone	15820	202	59.54	3700	210
Bagmati	6500	394	400.79	4440	317
Kamla Balan	4488	120	184.90	3700	2810
Gandak	4188	260	511.66	3350	3350
Ghaghra	2995	83	132.90	2530	790
Chandan	4093	118	83.18	1130	80
Badua	2215	130	NIL	1050	NIL
Lalbakeya	-	-	54.35	-	-
Adhwara	-	-	181.50	-	-
Bhuthi	-	-	54.70	-	-
Total	-	-	3629.16	68800	29490

Since its people live in harmony with nature, Bihar has enjoyed an honourable, prosperous and exemplary past worthy of emulation in the history of the nation. The people of Bihar have been content to accept the limitations imposed by nature on their lives. However, life in Bihar, in particular North Bihar, faces a number of challenges today. Floods in North Bihar pose a danger to the sensitive co-existence of its people with nature. It is necessary to look into the history of Bihar's rivers and floods in order to put the present issues and conflicts in context.

Life in Bihar has been firmly entrenched in its traditions and cultural heritage, with farming as the mainstay of its political economy. Over the ages, India's people have had a symbiotic relationship with its rivers. For centuries, people have dealt with floods by developing ever better techniques of flood management, water management and land management. These are mentioned in ancient writings and are a part of many folk cultures. Living with floods is an inevitable part of living with rivers. Not only in Bihar, but all over India, local communities have traditionally developed highly efficient and skilful ways of managing and storing water over thousands of years. Evidence of these methods is found in ancient scripture, in Vedic literature, and in the Ramayan and Mahabharat, as well as more recent Buddhist and Jain literature.

Kautilya's Arthashastra also clearly depicts the methods of rainwater and soil management as well as irrigation in the context of local conditions at the time. It shows that people of that era were knowledgeable about various techniques and used to practice them. The book also categorizes different areas from the Himalayas to the seas on the basis of their geographic characteristics.

⁶ <http://wrd.bih.nic.in/>

Historically, rainwater was being stored for irrigation through bunds and embankments. There would be bunds on the river to bring water from one place to another. Long, narrow canals were dug from river bunds, lakes and other water sources, to flow over large irrigation areas. Later, these canals came to be called 'pyne' in the local dialect. There was a survey of about 2500 villages that drew water from the bunds on the Kamala and Kosi rivers. Many ancient pynes were found during the survey in Madhubani district.

It is unfortunate that rivers came to be looked upon as obstructions to development in the faulty development model adopted in North Bihar in the last hundred or so years. Because of this, solutions to the danger posed by floods became the major issue in development schemes in Bihar. Many multipurpose schemes involving flood control, irrigation, and hydropower plants had been envisaged. After independence, there was a fierce competition for building embankments on the rivers of Bihar.

What were the major challenges that North Bihar faced during the past sixty years while fighting disasters caused by floods? What was the situation before the present modus operandi of flood management was adopted? These questions need to be explored.

In many places, the people of Bihar opposed the building of embankments⁷. However, they finally followed the leaders who took the country on the path of 'development' because they believed in them. This in turn gave rise to doubts, internal conflicts and loss of natural resources wherever embankments were built. The people of Bihar felt dissatisfied and alienated. Canals were dug for irrigation as a part of the development schemes in many river basins. But many of them failed to achieve their targets. Under these circumstances, doubts and internal conflicts multiplied and took a serious turn in certain areas.

As embankments were built across the region, the area affected by floods also increased. The extent of recurring damage can be estimated from the fact that initially Bihar had only 160 kilometres (km) of embankment length in 1952 with 2.5 million hectares (Mha) of flood prone area. However, in 2002, the total length of the embankment increased to 3,430 km and the flood prone area, instead of decreasing, increased to 6.88 Mha.⁸ In the past, free flowing rivers would flood two or three times during the monsoon, and discharge their waters in natural ways within a few days to return to their normal state. After embankments were built along rivers, the areas covered were free of floods, but the rain water falling over these areas would not get drained in the natural course of time. Hence, the affected areas faced the problem of waterlogging. Water, which would have drained out in a few days, remained stagnant for months after the monsoon had ended. Some areas remained waterlogged for nine months or throughout the year. Farming and animal husbandry were destroyed. The embankment along rivers has been the wound between two landscapes - countryside and riverside⁹ - each with its own specific problems, besides a few common ones. Problems encountered on the riverside range from the periodic onslaught of floods, inaccessibility to basic services such as

⁷ An embankment is an earthen wall built along the river. The purpose of embanking the river was to prevent river water spilling into the countryside and thus reduce the impact of floods on people, livestock and agriculture.

⁸ Thakkar Himanshu, 2006, What, Who, How and When of Experiencing Floods as Disaster, New Delhi: South Asia Network of Dam, River and People, November 2006

⁹ Embanking the river meant dividing the landscape into two prominent sections - riverside and countryside. The former is located within the river and the embankments and the latter is the area "protected" by the embankment.

healthcare and education, and the constant erosion of homestead and agricultural lands. Problems encountered on the countryside include waterlogging and restricted agricultural activities, mainly in low-lying areas. At the same time, different forms of water-based facilities/services are regularly affected. For instance, about 380 villages with a population of 9.88 lakh are trapped between the two embankments of the Kosi river. They are spread over four districts (Supaul, Saharsa, Darbhanga and Madhubani) and 13 blocks (Basantpur, Kishanpur, Saraigarh-Bhaptiahi, Nirmali, Supaul, Navhatta, Mahishi, Simri Bakhtiyarpur, Salkhua, Kiratpur, Laukahi, Marauna, and Madhepur)¹⁰. They are deprived of basic amenities like health care, education, electricity, roads as well as livelihood resources because of the floods. The Kosi Development Administration does nothing for these flood-affected people whose situation deteriorates with each passing year. Every year, the government gives some assistance to the flood-affected people. Every year, the people raise their voice against the policies of the government and for more aid. The Assembly reverberates with arguments over this issue. There is talk about discussing these matters with the government of Nepal. All this talk dies out by the end of October. It is amazing that the Human Rights Commission has never heard the voice of the victims. In short, the flood-affected people might have had a glorious past, but their present is rather bleak.

Current Reality

Bihar is synonymous with floods. Every year, the state (largely North Bihar) faces the vagaries of floods and waterlogging. The total flood prone area of the state is 6.88 million hectares, which is 73.06 per cent of its total geographical area, and 17.2 per cent of the total flood prone area in the country.¹¹ A substantial proportion of the total cropped area, nearly 41 per cent, is frequently affected by floods.¹² Almost 806,000 ha of land (roughly 15 per cent of the region) in North Bihar is permanently waterlogged, that is, covered by stagnant water that has no way out.¹³

Floods may be considered an additional season in North Bihar, bringing misery, destruction, and fatality.¹⁴ For centuries, the local people dealt with this season as 'a way of life'. The transformation of 'a way of life' to an assured devastation because of the structural flood management approach has made 'the once' self-sufficient communities highly dependent on external help for survival, and desperate for systems of support, as floods are an annual occurrence in the region.

Since 1731, the Kosi river has changed its course across a stretch of about 112 km from east to west, and in the process, has been building a fan shaped inland delta with its apex near its emergence from the gorge at Chatra.¹⁵ In 1980, the National Commission on Floods has identified Bihar as the most flood-prone state in India. In addition, the impact of floods has always been catastrophic. In 2008, a total of 3.3 million people were affected.¹⁶

¹⁰ Mishra Dinesh K., 2008, The Kosi and the Embankment Story, Economic and Political Weekly, 15th November, 2008

¹¹ Bihar's Agricultural Development: Opportunities and Challenges: A Report of the Special Task Force on Bihar, Government of India, New Delhi. April 2008

¹² Bihar's Agricultural Development: Opportunities and Challenges: A Report of the Special Task Force on Bihar, Government of India, New Delhi, April 2008

¹³ Bihar's Agricultural Development: Opportunities and Challenges: A Report of the Special Task Force on Bihar, Government of India, New Delhi, April 2008

¹⁴ Prasad Eklavya, 2009, Accessing Safe Drinking Water during Floods in North Bihar, New Delhi: *Yojana*, October, 2009.

¹⁵ <http://kosi-aayog.bih.nic.in/Docs/Morphology-of-the-Kosi-River.pdf>

¹⁶ Kosi Calamity: Rehabilitation and Reconstruction Policy, Resolution, Department of Planning and Development, Government of Bihar, November 2008

Fig. 2: Flood zones in Bihar

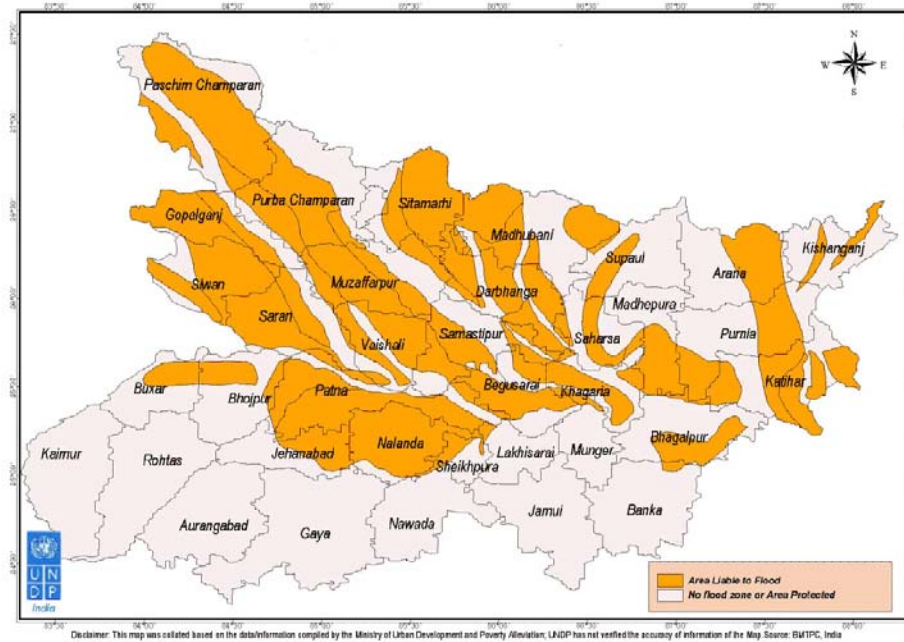


Fig.3: Flood inundated areas in Bihar

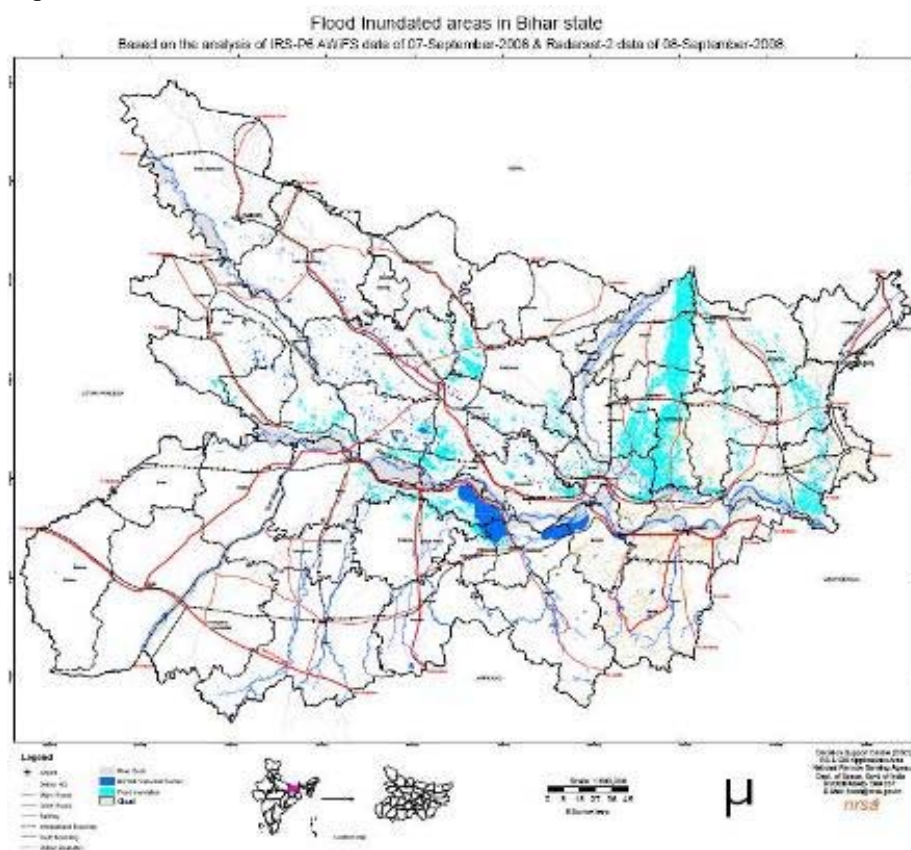


Table 2: Profile of the Flood Affected Areas in 2008 floods ¹⁷

Sl. No.	Heads	Supaul	Madhepura	Araria	Saharsa	Purnea	Total
1.	No. of Blocks Affected	5	11	4	6	9	35
2.	No. of Panchayats Affected	65	140	71	59	77	412
3.	No. of Villages Affected	178	370	141	169	140	993
4.	Population Affected	670709	1419856	626062	448796	164000	3329423
5.	No. of Families Affected	167526	374798	140895	114471	41645	839335
6.	No. of Human Deaths	211	272	2	41	1	527

Table 3: Profile of the Flood Affected Areas in 2008 floods ¹⁸

Sl. No.	Heads	Supaul	Madhepura	Araria	Saharsa	Purnea	Total
1.	Livestock Affected	417704	303640	80000	161000	35000	997344
2.	Area Affected (Lakh Ha)	0.75	1.57	0.45	0.44	0.47	3.68
3.	No. of Houses Damaged (<i>Pucca, Kuchha & Jhopadi</i>)	80696	114545	8773	25045	7562	236621
4.	No. of Livestock Deaths	8585	10725	0	13	0	19323

¹⁷ Government of Bihar, 2009, 1st Phase Bihar Floods - As on 24th February 2009, in http://www.disastermgmt.bih.nic.in/Bulletin2008/blockwise/block_06112008.pdf, March 2009

¹⁸ Government of Bihar, 2009, 1st Phase Bihar Floods - As on 24th February 2009, in http://www.disastermgmt.bih.nic.in/Bulletin2008/blockwise/block_06112008.pdf, March 2009

¹⁹ Mishra D. K., 2007, Bihar Floods of 2007: Some lessons for Everyone, *Dams, Rivers and People*, New Delhi: SANDRP, November-December, 2007

²⁰ Mishra D. K., 2007, Bihar Floods of 2007: Some lessons for Everyone, *Dams, Rivers and People*, New Delhi: SANDRP, November-December, 2007

In 2007, floods devastated the lives of 25 million people. Twenty one million were affected in 2004, 28.2 million in 1987, 16.39 million in 1974,¹⁹ and 7.61 million in 1954 (out of 18.393 million). In 1954, flood impacted 8119 villages (out of 21,107 villages) of North Bihar. 1,79,451 houses were destroyed, 63 persons lost their lives, and 1944 cattle perished. The loss due to floods was valued at Rs. 50 crores.²⁰ This clearly shows that the construction of embankments in North Bihar has led to terrible destruction brought about by floods every year. Under these circumstances, the social, economic, human and environmental scenario keeps changing for the worse.

Challenges, Struggles and Conflicts

The above data clearly indicates that the people of Bihar have been traumatised by the destruction of their heritage and natural resources, which has brought an end to their peaceful co-existence with nature.

At present, Bihar's people face the danger of losing their natural resources, traditional lifestyle and values based on their co-existence with nature. The people of Bihar have realized this. Many ideas are being tossed around about solutions to natural, social and economic problems in the name of development. But these solutions are likely to create more problems in the future. Finalising development plans for the rehabilitation of flood-affected areas without any regard to the importance of people's participation will add to the difficulties.

Only history will tell what was gained and lost in the name of development. The current reality is that the flood-affected are facing insurmountable challenges.

Before the Floods

The disaster management programme undertaken by the United Nations Development Programme (UNDP) could not effectively address issues relating to the disaster preparedness from the perspective of the community's roles and responsibilities, alertness to danger, and preparation and readiness for managing disasters in Bihar. According to the 73rd and 74th constitutional amendments, local self-government institutions have to take up the responsibility for disaster management at the local level. However, the local self-government institutions in Bihar are not yet capable of discharging the responsibility for disaster management at the Panchayat level. At the district level, material and human resources for disaster management are lacking. There are Village Safety Schemes and Village Safety Committees which are supposed to be active at the village level. However, there is no monitoring or follow-up of their work. Necessary equipment is not provided to them. As a result, these committees are ineffective during floods. This was evident in the 2008 Kosi disaster. Not a single Disaster Management Committee was found active during the floods. Committees outside the area did not offer help either. On the contrary, common people came forward to help. The government needs to prove, beyond doubt, its sensitivity, transparency, honesty and above all, its commitment to its own disaster management programme.

It is unfortunate that a huge amount of money is spent by national and international agencies, but to no avail. No positive impact can be seen anywhere. This is a challenge that has to be met at every level. Unless proper preparations are made, floods will continue to cause damage every year. This unpreparedness in the face of calamity can be a major source of conflict.

Bihar Floods of 2007: Some Lessons for Everyone

During the Floods

Conflict to Save Lives

Saving lives and property are the two most important concerns during floods. Normal life is instantly and drastically affected when the flood hits. People scramble to look for a safe place. People near safe areas or who have access to roads can get out easily and quickly. However, those caught in remote inaccessible places cannot. Rescue operations become difficult. Life and property are subject to the maximum damage in flood-prone areas. People with some money get out easily because they can pay the boat fare. However, the poor do not get help easily. The poorest of the poor suffer the most during any calamity, especially if there is a handicapped, infirm or old person, or a pregnant woman or nursing mother in the family. Such families suffer the most due to physical loss as well as emotional trauma. This has been experienced during the series of floods that have ravaged Bihar, especially by those who reside in remote, inaccessible areas. It often results in the loss of lives of newborn babies, pregnant women, and handicapped, infirm and old people. No material or equipment is available to help nursing mothers, malnourished children or sick people. One can imagine what could befall a starving mother who is unable to nurse her child and has to witness her death. Many have

health complications due to the lack of food. The scarcity of specific dietary foodstuffs, safe drinking water, etc. also adds to the problems.

Domestic animals also do not get fodder or shelter. When disaster strikes, thousands of animals drown, and those who survive are not properly fed. Ensuring their existence becomes a big challenge.

Wherever aid can reach, hungry people fight to grab it. There is no surety of what tomorrow will bring. Therefore, people try to grab as much as they can. Even here, the mighty grab almost everything while the really needy, i.e. the poor, the handicapped, single women, old people, nursing mothers, have to wait in line for aid to reach them. Shy, pregnant women cannot bring themselves to push ahead and wait helplessly. It is difficult to describe the pitiable condition of the survivors who barely escape with their lives and make desperate efforts to stay alive. Bihar witnesses this will to survive every year.

A great deal of material comes to the affected areas after a national catastrophe is declared. But it is doubtful whether the really needy get access to it. Much of the material never reaches its destination. It is grabbed either by the mighty or the corrupt. In order for aid to reach the right people, it is necessary to control corruption at every level. The management of aid and rehabilitation work must be transparent.

Conflict with the Government

The flood victims demand aid as well as security for their lives and property from the government. However, no steps are taken in this regard. People first request, then beg for, and finally demand their needs from government officials. However, the government responds with lathi-charge and firing, as it happened in 2007.

In 2007, the Kosi, Ghaghda, Mahananda, Kamala and Bagmati rivers were in deluge. That year, the floods devastated 12,610 villages spread over 264 blocks in 22 districts, affecting a population of 24.8 million. Standing crops over 16.63 lakh hectares were hit by the floods that affected 16.13 lakh animals and killed 1006 of them. Over 736,857 houses were destroyed and 960 persons lost their lives.²¹ There was fear and helplessness everywhere. Under these circumstances, people in Sonabarsha block of Saharsa district marched to the government offices on August 12, 2007 with slogans like '*relief do ya humari jaan lo*' (give us relief or else take our life). The police resorted to a *lathi*-charge. Bino Mistri of Parariya was killed in this *lathi*-charge. Dozens of people from Kopa and Parariya were injured.²² In Bettiah, the district headquarters, thousands of flood victims from seven Panchayats (Ranipakdi, Banuchappar, Gunauli, Purvikargiha, Barvat Parsarain, Barvat Sena, and Aghuvar Majhariya) of Bettiah block were chased by the local police from the block office to the collectorate square, because they were demanding that their area be declared flood affected, and that adequate relief material be provided. While chasing the group, the local police also attacked them with sticks.²³ On 23rd August, the flood victims from Kajichak village in Jitkiya Panchayat of Gogri block from Khagaria district blocked the National Highway

²¹ Mishra D. K., Bihar Floods of 2007: Some lessons for Everyone, *Dams, Rivers & People*, New Delhi: SANDRP, November-December 2007

²² *Dainik Jagaran*, 13th August 2007

²³ *Aaj*, 14th August 2007

31 for flood relief. Residents of Rajendra Nagar in Sanhauli Panchayat demonstrated after their unsuccessful effort to meet the Special District Magistrate and other senior district officials to demand relief material and highlight pilferage cases of relief items in the Panchayat. Villagers from Islampur in Kothia Panchayat resorted to a demonstration because of the discrimination by the local government officials in the distribution of relief material²⁴. In Simri Bakhtiyarpur of Saharsa district, the police came down with sticks and bullets on the flood victims who were demanding aid. Post firing, the aggrieved relief seekers pelted stones on the block office. Dozens of people sustained injuries. The Block Development Officer was responsible for the misappropriation of relief material, resulting in the demonstration of villagers from Belwara Panchayat of Simri Bhaktiyarpur block²⁵.

Aid distributed by the government and non-government organisations (NGOs) causes internal conflict among people, as publicity takes centre-stage instead of ensuring access to benefits and utilities. Both the government and NGOs claim that they are the ones who give succour to people. The aim of this entire approach is to create constituencies of convenience and benefit. More often than not, materials that are irrelevant to the context are distributed to the victims, creating discontentment and leading to conflicts. During the recent floods, umpteen such cases were reported, including the distribution of packaged drinking water either through tankers or bottles, installation of hand-pumps without testing the groundwater, or hand-pumps with a manual system to lift water and store it in tanks, distribution of iron dustbins without any follow up strategies, and distribution of toilet cleaners in places where there are no sanitation facilities.

Conflict due to Household Insecurity

The most neglected section of society during floods is children. More than anyone else, they are the victims of inhuman behaviour. An unborn baby is dependent on the mother carrying it for nourishment. If she does not have adequate nourishment or safety, it is inevitable that the baby will be harmed. These children are tomorrow's citizens. However, neither the government nor society seems to have any sensitivity about this issue. The nutritional needs of pregnant women, nursing mothers or new-born babies are neglected. When nursing mothers starve, so do the infants. Children below three years need special nutrition which is never available. During the 2008 Kosi disaster, the government had camps for victims in which proper nutrition, educational and recreational facilities were provided for children, though this happened late. However, such measures are usually not implemented. The disruption in the family's life affects its children the most. This gives rise to many psychological problems leading to conflicts arising from the desperation because of the challenged upbringing of children.

Safety of women and girls poses a great problem during floods. Many families lose everything in the flood and their parents get desperate. Pimps and immoral traffickers pay small sums for girls and take them away with promises of marriage or an easy life. Once a girl is separated from her family, she is lost for good. During every flood situation, the trafficking of girls becomes

²⁴ *Dainik Jagaran*, 24th August 2007

²⁵ *Hindustan* (Bhagalpur Edition), 30th August 2007

rampant. One of the reasons for child marriages in the flood-prone areas is the insecurity that girls face. Women and girls face the effects of psychological trauma occurring due to the disruption of life and resulting insecurity. During the floods, carrying out daily toilet activities for example, defecating, bathing, changing clothes, taking care of menstrual hygiene and so on becomes difficult. Antisocial elements take advantage of this as can be seen from rapes and molestations. Women and girls have to struggle with these problems leading to a complex situation at the individual, household and community levels.

Conflicts due to Non-government Organisations (NGOs)

Before detailing out the reasons for conflicts, it is important to reiterate that floods as a disaster are an annual feature in North Bihar, and the adverse conditions that are confronted during its aftermath are a constant phenomenon. Therefore, any single event leading to hostility during relief after floods cannot be taken as a standalone instance, because of the recurring character of floods and the impact on the region.

One of the reasons for conflict during floods is the intervention of NGOs, largely because of their ignorance about the geographical conditions, layout of the affected areas, the social structure, local lifestyles, etc. Paucity of time to indulge in an in-depth assessment along with the scramble to distribute relief prevents them from knowing the reality. To overcome the constraint owing to lack of knowledge, NGOs forge ties with local groups or individuals with the intent of facilitating relief distribution, but more often than not, the nexus turns out to be counterproductive for the flood victims as the aid material does not reach them but finds other outlets. Even when it reaches the affected population, it gets distributed among those who have paid money for the relief materials. The role of middlemen in appropriation during floods has always been a bone of contention, and despite this, they continue to flourish. The experience of discrimination because of the nefarious approach during relief distribution leads to hostility. Often, victims in remote locations are bereft of relief material due to inaccessibility, and sometimes despite overcoming this impediment through their own efforts, the victims are still unable to receive benefits, which escalates the conflict further. Conflicts also arise because relief organisations have limited relief material to distribute, whereas there are more hands to hold in the affected area. As a result, the processes adopted by the relief organisations are questioned by those who have been left out. There are many instances where the relief organisations, in order to ensure transparent distribution of relief, undertook a rapid survey of the victims from an identified affected area to put together the list of beneficiaries. Discrepancy in the information shared during the survey and the reality leads to conflict during the relief distribution.

It has often been observed that it is impossible for any relief organisation to provide all the items required by the people after the disaster has struck. There are different needs and requirements depending upon the location, socio-economic status and other parameters of the affected population. Standardisation of relief distribution, distribution of items that are readily

available in the market, and lack of coordination between different NGOs and the government leads to duplicity and distribution of materials that are irrelevant, which too creates an unhealthy environment. Last but not least, the absence of an adequate response towards marginalised sections (physically challenged, pregnant women, widows, the elderly, diseased, infants, adolescent girls, etc.) with specific needs also leads to conflicts.

After the Floods

Bihar is a complex rural society, with 89 per cent of its population living in rural areas with a poverty ratio of 44.3 per cent.²⁶ Bihar's economy is highly dependent on agriculture. The agricultural sector employs about 81 per cent of the working population and accounts for almost 42 per cent of the State Gross Domestic Product (SGDP).²⁷ This huge population dependency on agriculture (directly and indirectly) and related activities for their sustenance, in one of the states most vulnerable to disaster,²⁸ with recurrent floods and waterlogging impacting 73.06 per cent of its total geographical area, has a grave impact on local livelihood opportunities.²⁹ A high population density of 1,102 persons per sq km³⁰ and the enormous impact of recurring floods leads to a high percentage of out migration of rural men, with a 76:24 ratio between men and women leading to a catastrophic impact.³¹ Besides, rural Bihar is marred by poor service delivery, a caste ridden socio-economic and political fabric, polarisation of institutions by the elites, limited economic opportunities other than agriculture, and poor development of infrastructure. It is also divided along caste lines determining social behaviour and economic segmentation which have constrained social and economic mobilisation in Bihar, especially the development of collectives of the poor.³² The absence of support and facilitation systems to deal with consequences of recurring floods since decades has led to low threshold levels among the poor which brings conflicts. Without a proper redressal system, the discontentment continues.

In 2008, the Kosi floods affected 2,73,679 acres of land through sand casting, and the total crop damage has been estimated at Rs. 8 billion for the five districts.³³ According to the Chief Minister of Bihar, on 23rd May, 2012, the government was still in the process of formulating a special scheme for removing sand from lands that were affected during the 2008 floods. The affected farmers would be imparted training in agriculture technique in the sand-filled land. The state government would provide necessary assistance to the affected farmers.³⁴ This claim comes after almost four years of the catastrophe.

In 2007, standing crops over 1.67 Mha hectares were hit by floods.³⁵ In 2004,

²⁶ Project Implementation Plan - JEEVIKA, Bihar Rural Livelihoods Project, Government of Bihar and The World Bank

²⁷ Bihar's Agricultural Development: Opportunities and Challenges - A Report of the Special Task Force on Bihar, Government of India, New Delhi, April 2008. However, in a recent report published in 2010, it is stated that "agriculture contributes nearly 33 per cent to the state's GDP, but its share in the workforce has reduced by 74 per cent" (as per 2008 figures). Towards Accelerated Agricultural Development in Bihar: Report of the Steering Group on Vision of Agriculture Development in Bihar, Department of Agriculture, Government of Bihar, Patna, 2010

²⁸ Bihar's Agricultural Development: Opportunities and Challenges - A Report of the Special Task Force on Bihar, Government of India, New Delhi, April 2008

²⁹ Bihar's Agricultural Development: Opportunities and Challenges - A Report of the Special Task Force on Bihar, Government of India, New Delhi, April 2008

³⁰ Census of India, Provisional Population Totals, Office of the Director of Census Operations Bihar, Patna, 2011

³¹ <http://iussp2005.princeton.edu/download.aspx?submissionId=51757>

³² Project Implementation Plan - JEEVIKA, Bihar Rural Livelihoods Project, Government of Bihar and The World Bank

³³ Bihar Kosi Flood Recovery Project, Social and Environmental Management Framework, Bihar Disaster Rehabilitation and Reconstruction Society, 2010

³⁴ http://articles.timesofindia.indiatimes.com/2012-05-23/patna/31825911_1_kosi-division-kosi-embankment-road-construction

³⁵ Mishra D. K., 2007, Bihar Floods of 2007: Some lessons for Everyone, *Dams, Rivers and People*, New Delhi: SANDRP, November - December, 2007

floods destroyed crops over an area of 1.40 Mha.³⁶ In the floods of 1987, crops over an area of 2.51 Mha were destroyed.³⁷ Likewise in 1974, crops over 1.751 Mha were destroyed.³⁸ The consistent impact of floods on agriculture, the main source of livelihood, has increased the vulnerability quotient among the victims, thereby creating a climate of conflict. Though the affected population does find ways of facing the loss in their own limited manner, the loss remains insurmountable. Another impact of disastrous floods is the loss of domestic animals, which is yet another source of livelihood for the landless, marginal and small farmers. Loss of livelihood support without proper compensation also becomes an issue of conflict in the affected region. Huge animal population is lost during each flood, and those who survive the wrath are under extreme stress conditions.

³⁶ Mishra D. K., 2007, Bihar Floods of 2007: Some lessons for Everyone, *Dams, Rivers and People*, New Delhi: SANDRP, November - December, 2007

³⁷ Mishra D. K., 2007, Bihar Floods of 2007: Some lessons for Everyone, *Dams, Rivers and People*, New Delhi: SANDRP, November - December, 2007

³⁸ Mishra D. K., 2007, Bihar Floods of 2007: Some lessons for Everyone, *Dams, Rivers and People*, New Delhi: SANDRP, November - December, 2007

³⁹ Mishra D. K., 2007, Bihar Floods of 2007: Some lessons for Everyone, *Dams, Rivers and People*, New Delhi: SANDRP, November - December, 2007

⁴⁰ Government of Bihar, 2009, 1st Phase Bihar Floods - As on 24th February 2009, http://www.disasterngmt.bih.nic.in/Bulletin2008/blockwise/ock_06112008.pdf, March 2009

⁴¹ Owner Driven Reconstruction: Summary Report - Towards a Policy Framework, Workshop on Owner Driven Reconstruction and Rehabilitation for Kosi Floods Affected Regions, Department of Planning and Development and Owner Driven Reconstruction Collaborative, Patna, December 2008

Struggle for Rehabilitation

Around 1,79,451 houses were destroyed by the flood of 1954. The number of houses destroyed by floods was 5,16,353 in 1974, 16,82,059 in 1987, 9,29,773 in 2004,³⁹ and approximately 2,36,621 houses in 2008.⁴⁰ There are no figures for the effect of floods on the same households over these major flooding years in North Bihar, except 2008, as the floods in that year had impacted a different region in the state. The problem of rehabilitation becomes more and more acute each successive year. Rehabilitation is the main bone of contention in Bihar for all concerned. People displaced by floods continue to struggle with the state regarding their demands. It was only after the 2008 Kosi floods that the state government decided to adopt an owner-driven reconstruction strategy for the rehabilitation of 3,40,742 houses that were damaged.⁴¹

The rehabilitation initiative of the Bihar government has been supported by the World Bank, through the Bihar Kosi Flood Recovery Project, with an estimated cost of \$220 million. This project has six key components, including owner-driven housing reconstruction of 1,00,000 houses; reconstruction of roads and bridges; strengthening flood management capacity, livelihood restoration and enhancement; improving emergency response capacity and project management and implementation support.⁴² The initiative by the state government was tainted in the beginning due to the perception that there was large-scale bungling in the selection of beneficiaries. Those with their houses intact were identified as homeless, while those who lost all their belongings in the houses that were swept away could not get their names registered as victims. According to official figures, damaged houses were far more than the number of houses to be reconstructed according to the government's decision. There were also instances of state violence inflicted on the flood-affected people demanding proper relief and rehabilitation (See Box 1).

⁴² The World Bank, Report No: 55671, Emergency Project Paper On A Proposed Emergency Recovery Credit To The Republic Of India For A Bihar Kosi Flood Recovery Project, August 2010

Box 1: Police firing on flood victims at Basantpur, Supaul district

The chaos on the rehabilitation front led to police firing on 18th February, 2010 at Basantpur block office in Supaul district, in which 27 rounds were fired at a crowd of 3,000 demonstrators. The government had given an ex-gratia grant ranging from Rs. 1,500 to Rs. 10,000 for those who had lost their houses in the 2008 floods. It was suggested that an additional grant of Rs. 55,000 would be given only to those who were given Rs. 10,000 in the first instance. The demonstrators were demanding that the grant of Rs. 55,000 should be given to all, irrespective of the amount paid earlier.⁴³

The execution of the first phase of the project was further divided into three phases. In the first phase, the government was committed to constructing 32,000 houses across Supaul, Saharsa and Madhepura. Until now 5,600 houses have been constructed, and work continues on the remaining 26,400 houses. After the completion of the first phase, work will be initiated to complete another set of 34,503 houses, taking the total to 66,503 out of the target of 1,00,000, of which 33,497 odd houses will be constructed in the final phase.⁴⁴ The Bihar state government has now decided to take a loan of \$750 million from the World Bank for the second phase of work, after failing to get assistance from the centre.⁴⁵ If the state government is successful in getting a loan from the World Bank, the total borrowing would be \$970 million. What is unclear is the inclusion of different activities in the second phase of the Kosi rebuilding initiative, for which the state government will be asking for \$750 million. The status of the remaining 2,40,742 houses that are to be constructed (out of the total affected 3,40,742 during the 2008 floods) remains unclear. People believe that the remaining houses will be constructed, whereas there are murmurs in the corridors of power about the authenticity of the identified one lakh beneficiaries for the first phase. Hence, there are chances that the government will try to re-strategise the selection process for the remaining beneficiaries, a time consuming process that might lead to an environment of conflict, which will add to the already existing level of disenchantment concerning the rehabilitation work. While there is a lot of discussion on the impact and future strategies of floods in 2008, what about all those who lost their dwelling before the 2008 floods? Will they remain unattended to, or do they have to blame their fate for the floods that destroyed their houses? The victims of floods before 2008 have not got the same visibility as those of the 2008 floods.

⁴³ [Thttp://www.hardnewsmedia.com/2010/07/3617?page=3](http://www.hardnewsmedia.com/2010/07/3617?page=3)

Table 4: Damage in Bihar due to Floods from 1979 to 2006 ⁴⁶

Year	District	House Affected	Public Property Damaged (in Lakh Rs.)
2006	14	18,637	8,456.17
2005	12	5,538	305
2004	20	9,29,773	1,03,049.60
2003	24	45,262	1,035.16
2002	25	419,014	40,892.19
2001	22	222,074	18,353.78
2000	33	343,091	3,780.66
1999	24	91,813	5,409.99
1998	28	199,611	9,284.04
1997	26	174,379	2,038.09
1996	29	116,194	1,035.70

⁴⁴ Personal communication, Owner Driven Reconstruction Collaborative, 26th June 2012

⁴⁵ http://articles.timesofindia.indiatimes.com/2012-05-23/patna/31825911_1_kosi-division-kosi-embankment-road-construction

⁴⁶ http://en.wikipedia.org/wiki/Floods_in_Bihar

1995	26	297,765	2,183.57
1994	21	33,876	151.66
1993	18	219,826	3,040.86
1992	8	1,281	0.75
1991	24	27,324	139.93
1990	24	11,009	182.27
1989	16	7,746	83.7
1988	23	14,759	150.64
1987	30	1,704,999	680.86
1986	23	136,774	3,201.99
1985	20	103,279	204.64
1984	23	310,405	2,717.72
1983	22	38,679	258.14
1982	15	68,242	955.33
1981	21	75,776	Not available
1980	21	118,507	Not available
1979	13	27,816	Not available

There are voices that are being raised within the state concerning the condition of the eight districts in the Kosi region - Purnia, Kishanganj, Araria, Katihar, Madhepura, Saharsa, Supaul and Khagaria, which at one point of time was considered as a punishment posting. In the beginning of 2012, the Kosi Bedari Morcha, a non-political organisation, convened a mass gathering at Kala Bhavan in Patna to demand special status for the Kosi region on the eve of the Chief Minister's ninth leg of the Seva Yatra. They raised the demand for special status to Bihar's Kosi region. The group reiterated that the Sachar Commission and Ranganath Mishra Commission reports have pointed out that these eight districts of Bihar are the most backward. According to them, if the state government accords special status to these identified districts, many problems will be solved, and the region will develop.

Future Possibilities and Suggestions

The first national policy on water management was formulated in 1955. Many embankments were built in Bihar under this policy. By 2006, the embankments covered an area of 3,420 km, but the problem of floods in Bihar became more serious. The flood-affected and waterlogged areas expanded year by year. Statistics show that the problems of Bihar are becoming insurmountable as the years pass by. People working on floods say that constructing high embankments and containing rivers does not present a permanent solution to the discharge of water from the embankments. Geologists say that most of the flood-affected area of Bihar is within the earthquake-prone zone. Given these conditions, a high embankment is not an adequate security measure. The work of raising the height of the embankment and concreting is proceeding very rapidly. Other basic support facilities are also being developed at a fast pace. Whether these efforts will be sustainable is something that only the future will tell. Until then, some basic concepts should be incorporated into development schemes, and their implementation should be ensured.

The government should give the people a clear idea about the situation and the efforts being made to control floods. In fact, full information should be made

available to people on demand with relevant documentation. The formation of a citizens' committee will be very useful to bring this about. Along with this, taking into consideration the special conditions in the Kosi disaster area, the rules regulating the Employment Guarantee Scheme (EGS) and the National Disaster Relief Schemes (NDRS) should be modified to suit the special conditions.

The basic underlying value of flood control measures should be the safeguarding of human life, which should not be put at risk by adopting faulty or archaic control measures. For the disaster management programme to be effective, it is essential that a proper system is developed that imparts equal attention and significance to all three phases of the disaster - pre, during and post phases. By doing so, the affected population can further sharpen their skills of developing local mechanisms to engage with floods. In addition, the state needs to implement appropriate measures in order to discharge excess water from waterlogged areas and thus ensure that the area becomes fertile and productive again. During the floods, it is imperative that primary measures for survival and rehabilitation, namely, clean drinking water, sanitation facilities, nutrition for people of all age-groups, educational facilities, and healthcare and special package for groups with specific needs should be in place and functional. Educating people and bringing them together for disaster management is necessary in order to resolve all manners of conflicts. A disaster management protocol should be developed and made known to all concerned. The relief work protocol should be followed at every level when disaster occurs. At the same time, there should be coordination, transparency, proper use of human and material resources and exchange of ideas at every level. The main responsibility for rescue, aid and rehabilitation should be entrusted to local voluntary organisations and people's organisations with proper monitoring. When putting together the schemes and implementing them, traditional knowledge, resources, techniques and capabilities of local people should be used as much as possible. Schemes for management of flood-prone areas should provide opportunities for vocational training, recreation, water supply and sanitation, employment generation and so on. The positive impact of these facilities should be taken into consideration while formulating schemes.

Our ancestors knew how to live with floods. They had a relationship with their rivers and the technical know-how of dealing with floods. This should have a place in development schemes. People have their own perspectives on development. If it is respected and acknowledged, differences among different communities would not turn into conflicts. This should be kept in mind while formulating schemes. The government / NGO relief work in ultra-sensitive areas should be limited to emergency situations and that too for a short while. If the relief work continues for a long time, people lose interest, independence, pride and ultimately, strength. The relationship of 'giver' and 'receiver' in North Bihar is harmful for the social development and self-reliance of the people.

5

Chapter 5

Flash Floods in Eastern UP Hill Rivers Flood the Low Lying Region of Eastern Uttar Pradesh Causing Annual Distress Migration

Alka Pande

Introduction

Uttar Pradesh (UP) is the most populous State of India and one of the most vulnerable regions for floods. According to the Department of Agriculture, Government of Uttar Pradesh, out of India's total flood-prone area of 34.6 million hectares, 7.3 million falls in UP, majority of which lies in the eastern part of the State. The State government statistics reveal that an average of 7.56 million hectare land is affected annually by floods of which 3.55 million is agricultural land.

The reports of the State Agriculture Department mention that on an average, every year, floods in UP claim over 1,500 human lives, about 95,000 cattle, besides damaging around 1.2 million houses. This annual damage can be converted into financial losses of more than Rs. 1,200 crore.

Eastern UP is known as the most backward region of UP and is infamous for its poverty, cheap labour and professional shooters. Nonetheless, a few official facts from the State Planning Departments also underlines an ironical contrast: eastern UP has a better sex ratio (944/1000) as compared to rest of the State (898/1000) and the region has less number of families living below poverty line as compared to the rest of the State. The irony also lies in the fact that the area has fertile soil and good potential for irrigation and agro-climatic conditions for rice, its main crop; yet it is not a rice exporter. The region is rich in natural resources important for industrial growth but has no industries.

Flood plays a major role in bringing about this irony. Although the whole region faces the annual tyranny of floods, the case study mostly focuses on Maharajganj district, situated at the far eastern part of the State. Spread over an area of 2,934 sq km, the district came into existence as early as in 1989.¹

Having a population of somewhere over 2.6 million and a density of about 900 people per sq km, the district boasts of a 64 per cent literacy rate, which is on the higher side in comparison to other districts in the region.² Maharajganj has highly fertile alluvial soil and therefore, livelihood of more than 75 per cent of these rural residents is directly dependent on agriculture. However, the average land holding is less than 0.8 hectare and more than 80 per cent of farmers qualify as marginal farmers.³

¹ <http://maharajganj.nic.in/>

² <http://maharajganj.nic.in/>

³ Author's communication with Oxfam authorities during her visits to Gorakhpur / Maharajganj in 2010-11

Flood is a most common natural calamity in this region due to several geographical and topographical reasons. Maharajganj shares its northern boundaries with Nepal from where over half a dozen tributaries of the Gandak river flow into the district.

Since these rivers emerge in the hills in the north and a sudden reduction in slope as they enter the low lying Terai region slows down their current and causes heavy deposition of sediments. The deposition of sediments thus creates multiple channels with shallow beds leading to water-logging and flash floods. Besides, during monsoon, these swollen rivers overflow their banks and shift channels. The sudden outpour of uncontrollable water causes flash floods in the low lying areas of Indo-Gangetic Plains.

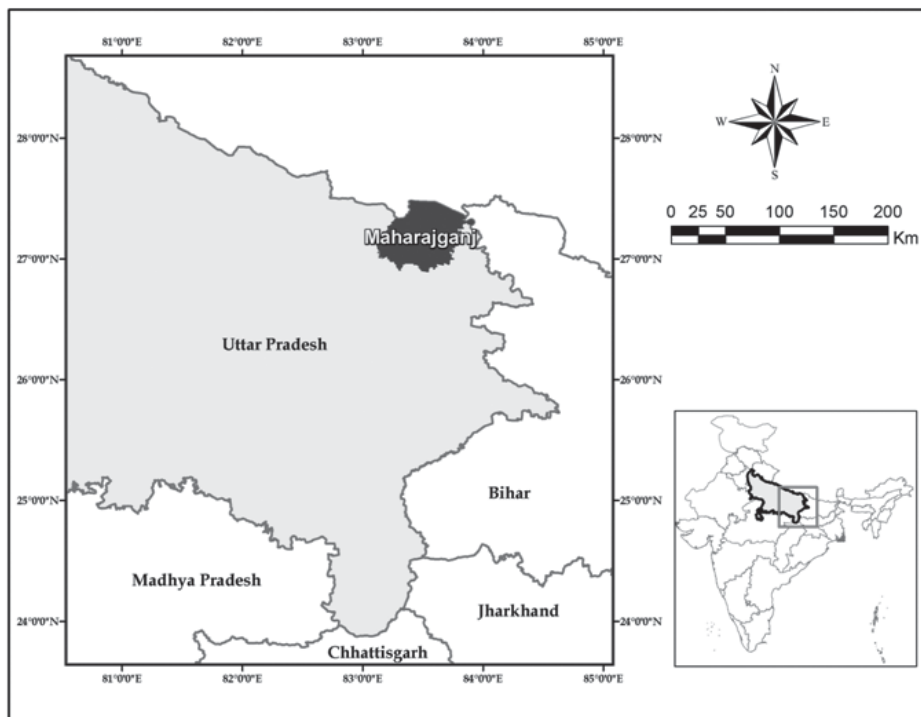


Fig.1: Location of Maharajganj in India

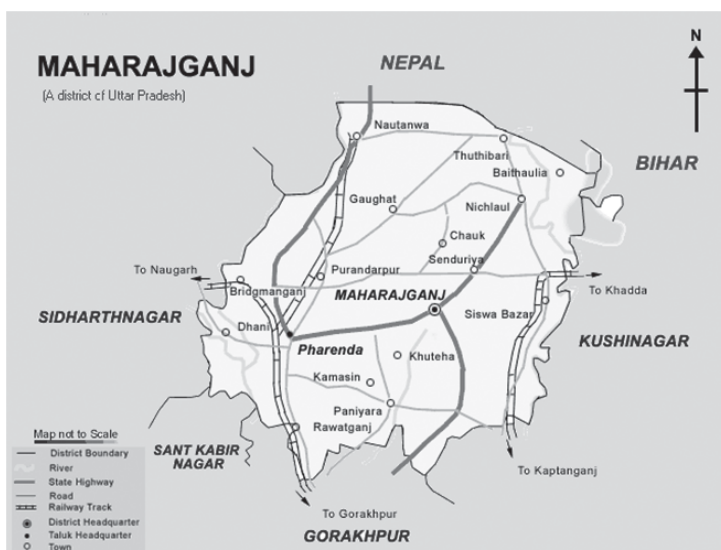


Fig. 2: Maharajganj district (Source: <http://upgov.nic.in/>)

The Impact and Reasons

The flowing river water is termed as the natural wealth of any nation and looked upon as a boon but if the same water starts overflowing, the sudden excess, especially in low-lying areas with inadequate drainage options, becomes a curse.

However, in a study conducted a few years back, the organisation Oxfam, a rights-based organisation in India, found that among many other causes, climate change too is playing a role in increasing the frequency of floods (which is now more or less every year) and in the absence of any flood protection mechanism, the number of days when area remains waterlogged too has increased. Now the agriculture fields remain waterlogged for 90 -100 days while they used to get drained in maximum 75 days in the past.

More than 25,000 families are affected every year by these flash floods caused due to water-logging.

These families are solely dependent on their basic agricultural practices for their survival. These villages are in the low-lying areas with no or inadequate drainage systems and therefore, rain water accumulates in these villages. Since paddy is the main monsoon crop in this area, it gets destroyed due to water-logging. Floods raise the ultimate question of livelihood for the people of this region.

In distress migration, the families shift base to temporary settlements at higher places, which are provided to them either by the government (in the form of temporary relief measures) or on smaller scale by some local organisations. Every year during monsoon the government makes temporary shelters at elevated and dry land areas for people and cattle, who leave their homes in low-lying areas which get inundated with rain water. There is no work for the local residents at this time of the year. Therefore, for their survival they are forced to borrow money from local money lender sharks for their survival. A father of three children, 46 year old Pradhan, is a marginal farmer and earns his livelihood by selling rice and vegetables that he grows in his small land. But, when his land gets submerged and his crop gets damaged, he is left with nothing to feed his family. At that time the local money lender becomes his sole saviour. He borrows money at an interest rate as high as Rs. 10 per hundred a month, to look after his family and feed his cattle. The same is the story of more or less all those who live in such low lying areas. In some of such villages the schools, community centres and even the Gram Panchayat buildings get submerged.

Shortage of safe drinking water and lack of proper sanitation is a common problem, which results in outbreak of diseases such as gastro enteritis and diarrhoea. Water-logging gives rise to mosquito breeding and various skin and eye infections. The Communicable Disease Department of Gorakhpur Medical College confirms that the region has been facing Japanese Encephalitis for over ten years and every monsoon over 300 people, mostly children, die.

There are several reasons that are aggravating these flash floods in this region; among them are cloudbursts and intense rain fall in the Terai region of Nepal. But, most critical reasons are human-made. Rapid population growth is one of them, which leads to conflict between man and river.

Encroachment

The area used to have large number of water bodies developed over time, which used to function as catchment areas for overflowing rivers. However, greed and need for more land and more money led to rampant encroachment of these water bodies. Most of these water bodies have now become sites for housing schemes or concrete construction. Many ponds have been encroached upon for agriculture purposes. People are also rampantly using the newly created fertile silt stretches for cultivation. This silt is left behind when the floods recede. The practice encourages expansion of human settlement close to rivers thereby narrowing the course of the river.

The closer the human settlements are moving towards the rivers, the worse the situation is becoming as far as floods are concerned. Since the width of the rivers and tributaries as well as passage for its flow is decreasing fast due to encroachment, the rivers are changing their course and creating new channels.

Embankments

Uttar Pradesh Irrigation Department records mention that the State has more than 300 embankments over about 20 rivers, which length-wise measure a little over 3,000 km and which have been constructed over the years starting from 1954 after the enunciation of national policy on floods. A study conducted by Grameen Development Services (GDS) mentions that majority of these embankments were constructed between 1950 and 1960 when the reliable hydrologic data were not available. According to the study it was realised much later that those embankments offered inadequate protection.

An in-depth study conducted by GDS highlighted a few problems with these embankments such as:

- At many places the design-flood adopted for embankment was lower than the high flood levels recorded in subsequent years. This happened due to lack of proper studies about flood levels. But in some places, the problem occurred gradually as the area within the embankment got silted thereby raising the riverbed.
- There were inadequate drainage sluices, which resulted in drainage congestion behind the embankments.
- Some embankments were not aligned through a suitable foundation, which caused seepage through the seat of embankments.
- Embankments were constructed close to the riverbanks to protect as many villages and towns as possible and thus anti-erosion works had to be undertaken subsequently to protect them.

Nature's Fury

Heavy rainfall makes the rivers spill over the embankments in a short period of

time. The constantly narrowing channels are unable to carry the excess water, which is beyond their transporting capacities. The rivers break into various tributaries. In addition, there are major landslides in the hills especially during monsoon, which first block the course of the stream and later there is sudden rush of water when the blockages are cleared.

Deforestation and Erosion

Rampant deforestation in the upper catchment areas is fast reducing the capacity of soil to retain water. Besides, soil erosion caused due to deforestation is resulting in silting of riverbeds, which keeps shifting course with soil erosion cases. Erosion of rivers and tributaries - caused due to heavy rains, repeated floods, quarrying in the river banks, human habitats close to river banks, waste disposal in and close to rivers, livestock inhabiting in the area and agriculture practices when the river is dry – is a serious cause of concern.

Drainage Congestion

Severe rainfall-induced drainage problems occur in naturally low land lying areas and large areas (may be up to 2 million hectares) remain under water for long times. Drainage congestion is caused mainly by heavy rainfall in a short duration coupled with high flow levels in the main river preventing rainwater from being absorbed quickly into the riverbed. It can also be induced by construction of roads, railway tracks and embankments that obstruct natural flows and also by encroachment on the areas close to river beds due to population pressure.

The 1973 Floods

The floods of 1973 were a landmark in UP when, according to the State Revenue Department records, 52 districts were affected and about 4.3 million hectare of cropped area was inundated. The calamity affected about 250,000 people and over 45,000 villages besides destroying property worth more than Rs. 680 crores.

Since then the flash floods/water logging in the eastern part of the State, including Maharajganj happens more or less every year, during the peak of the monsoon. The water stays in the area for as long as 100 days. It is for sure that there would be floods if there are monsoons. People have taken it as part of their lives. They remain mentally prepared to migrate. Once the monsoon is over and water recedes, people come back to the places of their original habitation and resume their normal lives. But during this process the residents of this area lose their property, their health remains at stake, and they face livelihood problems.

Current Status

Despite of all concerns the status remains unchanged in this region of the State. The government spends on plantation to check soil erosion due to

rampant cutting of trees and to enhance the capacity of soil to absorb more rain water. The focus, at present, is also on rain water harvesting so that the rain water, to some extent, can be used for groundwater recharge.

Fig.3: Soil erosion in the area



Fig.4: Bunker beds made by people



There is no quick-fix solution to the problem as tackling floods is a process, which requires preparedness and management. A few interventions in this direction have been made by a few development agencies. But these organisations are working in small pockets. Their work targets education of farmers in particular and the local residents in general.

These organisations like Shohratgarh Environmental Society (SES), Gorakhpur Environmental Action Group (GEAG) and many others are training farmers in cultivation of flood resistant crops and also of early maturing varieties of paddy, which mature before the time of floods. Besides, these organisations are educating the residents about flood mitigation techniques especially preparation in advance for floods and minimising the damage to their property, crops and livestock.

People also Responsible

Primarily it is the government to be blamed for the periodic floods and their impacts as the lopsided government policies like arbitrary construction of embankments result in floods in the region. However, the people also indulge in encroachment and deforestation, which only worsens the problem. Besides, there are people who grow vegetables on the fertile silt of the river bed, which causes silting of river. Nonetheless, this can be checked to a certain extent if the residents are provided with holistic development.

Way Forward

The budget allocation for irrigation and flood control is ever increasing and so are the flood affected areas and flood losses. Government introduced a law on disaster management and accordingly disaster management plans were prepared.

However, the issue is that problems like flood cannot be solved in isolation. It is an issue related to overall development. Along with disaster management there is a need to re-design and reformulate policies and programmes as per the need of the flood prone areas. Both the flood control schemes and the rural development programs need to be reviewed in the context of the vulnerability of the poor. The programmes should aim at reducing the vulnerability of the poor in the flood prone areas.

The records of Irrigation Department of UP government mention that a long term perspective plan to protect almost all the flood affected areas was prepared in the year 1988. The programme cost was about Rs. 10,000 crores (1988 price level). However, out of 7.3 million hectare flood prone land, the government has been able to provide flood protection to only 1.5 million hectares under the State plans, admit the department records.

The government admits that the progress in its implementation was not satisfactory because of resource limitations, and therefore it has proposed a few steps to be adopted in the flood sector. These steps are:

Planning and Funding

It is important to prepare a long term plan, say at least a 20-year plan, in which priorities are fixed for tackling the areas, which are worst affected by floods both in terms of frequency of occurrence and also in terms of extent. In the planning of water resources projects, issues like flood protection, arrangement to check waterlogging and drainage decongestion should be

included as an integral part of the programme, wherever possible. The funding should be in accordance to targets set in the plan and the allocations should be done well before time and the preparations also should be done in advance.

Conservation

It is time to work on conservation of natural resources. It is never too late. Strict implementation of law is required in cases of deforestation, encroachment of riverbeds, other water bodies and drainages. The action should be coupled with measures for reform like afforestation, plantation and rain water harvesting. Strict regulation of laws is required when it comes to encroaching of water bodies, river banks, quarrying in river beds and also illegal quarrying of soil for land fillings, etc.

Developmental Schemes

Flood and development of an area go hand-in-hand, which means if the area has basic development indicators, the climatic adversaries can be dealt with successfully to a certain extent. Therefore, a holistic approach is required in the formulation of all development schemes. Besides, all the schemes of rural development, whether it is employment generation or poverty alleviation, need to be restructured and aligned with the specific requirements of the flood-prone and water-logged areas.

A few examples are as follows...

Housing: The objective of any welfare housing scheme is generally to provide affordable houses or grants for construction of houses to the marginalised members of the society. These schemes are made on a universal pattern whereas the design of houses should be area specific. The kind of houses required in drought hit areas, are not suitable for flood-prone or waterlogged areas. Right from the selection of the site, design to construction, everything should be as per the requirement of the area.

Employment: Same is the case with employment programmes. The needs of people from a specific area should be given important consideration in the formulation of employment opportunities for people. Different kinds of job opportunities should be evolved for people living in different climatic, social and financial conditions.

Health: Health schemes need to be formulated keeping in mind the topography of the region. For example, places prone to heavy rains and floods cannot have same toilet construction as places which do not see much rain. The design and technology needs to be area-specific. In the same way, location of community health centres need to be decided by looking at the geography of the region. These minute details can ensure less disease burden during floods.

Education: In India there are regions, which have their specific problems. Sometimes these problems are man-made but otherwise, they are natural

calamities like floods and droughts. Educating people about the calamity and the way to deal with it or manage it is like empowering people. For example, in one small pocket of Maharajganj district, Oxfam is empowering people by educating them on flood management. In that particular pocket, the inhabitants prepare themselves for floods much in advance and this helps them minimise damage to their properties. They grow a variety of rice, which matures early so before the monsoon arrive people are ready with their crops. Besides, they build their houses at a higher level so their belongings remain safe even when the area is inundated. Here the farmers have made their own seed company, which supplies the early maturing rice seeds to other farmers also. The residents are well versed with the treatment and first aid in cases of diarrhoea and snake bites, which is common during floods.

In the same way, Gorakhpur Environmental Society is working in parts of Gorakhpur, which too faces annual floods. The result is that people in the area where GEAG is working, are earning profits through agriculture even during flood period whereas the rest of the region is running for shelter in monsoon leaving behind their fields and other belongings.

Rural Sanitation Program: Total sanitation campaign under the Rural Sanitation Program was launched in 1999 and now all 70 districts of Uttar Pradesh are covered under the campaign. The campaign is focused on sanitation and aims at hundred per cent coverage in rural and urban areas by the end of 2012. The key concern is that either one pit or two pit latrine designs are prepared as they are suitable universally and the cost per latrine is fixed (for UP Rs. 1,900). However, no consideration seems to have been given to their suitability in flood flood-prone or waterlogged areas.

Ghaggar Floods

A Manmade Disaster with Tragic Consequences

T. V. Jayan

Background

The river Ghaggar in northwestern India is often described as the river of sorrow. The sobriquet is rather apt because the people living in the Ghaggar basin often experience its fury, particularly during the monsoon months.

Unlike other rivers that originate in the Himalayas such as the Ganga, Sutlej and Yamuna, the Ghaggar is relatively small. It rises in the Himalayan foothills, enters the Indo-Gangetic plains near Chandigarh, and meanders its way through three Indian states: Punjab, Haryana and Rajasthan. Since it is not fed by glaciers, its runoff is highly erratic and is dependent mainly on monsoon precipitation. As a result, the flow of the river varies from a 10-metre deep torrent in August to a trickle by early March. The west-flowing Ghaggar has many tributaries, including the Tangri, Markanda, Saraswati, and Pachhisdhara. The Ghaggar basin is spread over 32,132 square kilometres.

¹ http://www.sandrp.in/basin_maps/Ghaggar%20dams150411.jpg

Fig.1: Map of the Ghaggar river basin¹



The threat of floods looms large over the Ghaggar and its tributaries almost every year. The course of the river is hampered by huge silt deposits. The man-made canal systems built along the river have further complicated its drainage system. More often than not, they fail to function in a desired manner.

In 1993, high water levels in the river Ghaggar, coinciding with heavy precipitation on the Ghaggar drainage tract, inundated large areas in the districts of Ambala, Kurukshetra, Kaithal, Fatehabad and Sirsa. Similarly, large areas were inundated in the Karnal, Jind, Sonapat, and Rohtak districts of the Yamuna drainage tract, and in the Bhiwani and Jhajjar districts of the Internal Central tract. There was continuous heavy rainfall for 76 hours from 9th July onwards which resulted in floods in all rivers and drains. The total rainfall from 10th July to 12th July, and again from 22nd July to 23rd July, was of the order of more than 50 per cent of the average annual rainfall in just five days. Heavy rainfall was also experienced in Punjab areas, and as a result, a thick sheet of water flow entered Haryana through the Sutlej-Yamuna Link (SYL) canal, inundating a large number of villages. This inundation caused loss of human lives and cattle, and destroyed large cropped areas and other property.²

In 1995, high water levels in the Ghaggar river coincided once again with high rainfall over much of the state of Haryana, causing inundations of large areas. The rainfall that led to the large inundations in 1995 was between 200 mm and 250 mm during September 2-4, which followed heavy rains earlier from 26th August to 30th August, which had already caused inundations. The districts of Rohtak, Bhiwani, Hisar, Jind, Kaithal, Ambala, Rewari and Sonapat were largely inundated, and the situation was exacerbated by the entry of floodwaters from Punjab through the SYL canal. Floodwaters also entered hundreds of villages in Rohtak, Bhiwani, Dadri, Gohana, Ambala Cantonment, Ambala city, Panipat, Kaithal, Siwani, Pehowa, Tohana, Narwana, Hansi, and Barwala, Rewari and Ratia towns were also affected. All the cities and rural areas were under 0.6 to 3 m (2 to 10 ft) floodwater, and the water remained stagnant for many days due to the non-availability of a natural drainage system in Jind, Hisar, Rohtak and Bhiwani districts. All drains and canals overflowed and were not able to drain out the surface runoff. Road networks, public health installations including water works, electric installations, etc. were submerged and badly damaged. The total cropped area affected by floods was 573,319 ha during this year, and crop damages were assessed as Rs. 11,880 million.³

Floods of 2010

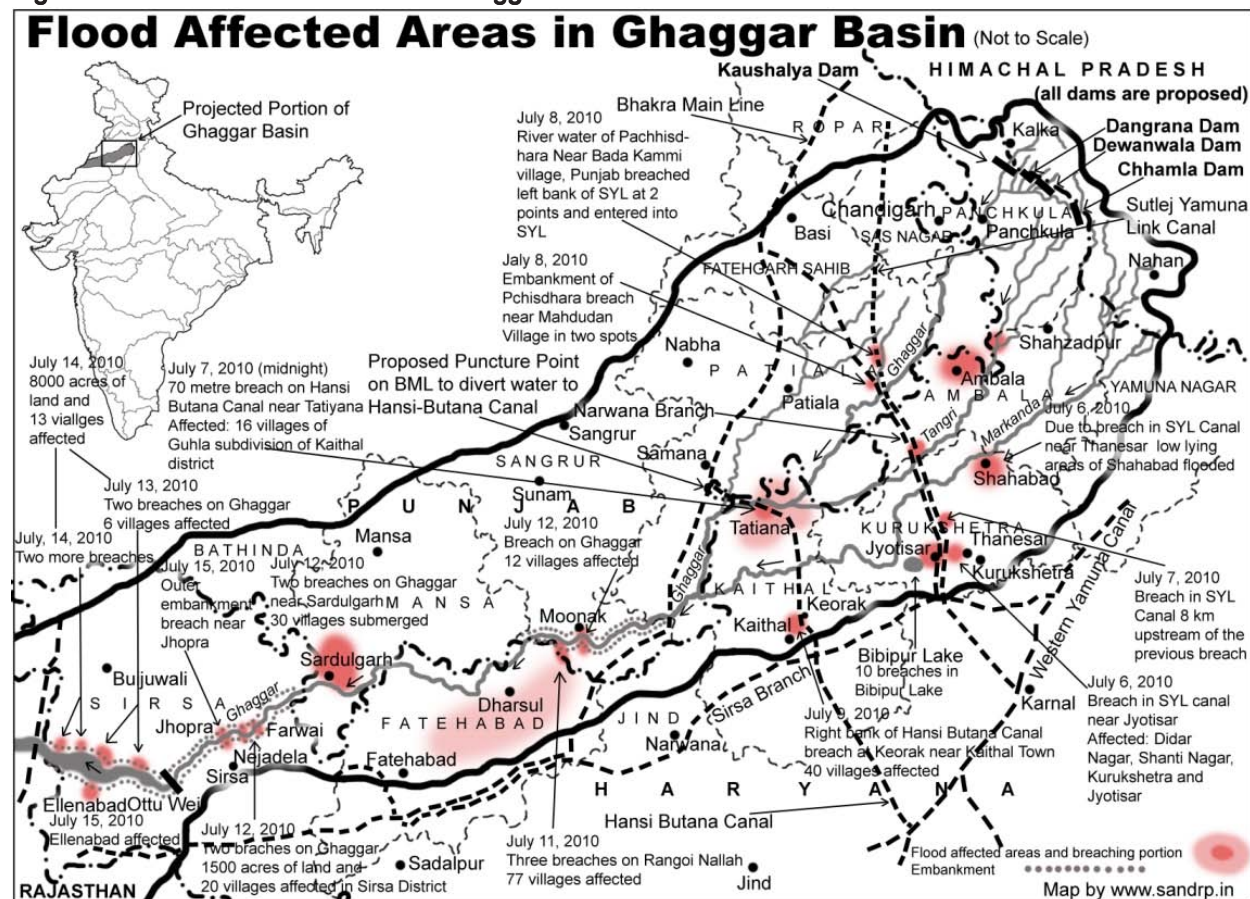
The year 2010 was not different. In the first and second week of July 2010, many parts of Punjab and Haryana that lie in the drainage basin of the Ghaggar experienced massive floods. Ghaggar and its tributaries breached embankments one after another along their stretch and flooded vast areas. In a short span of 10 days, there were an innumerable number of breaches, submerging as much as 2,00,000 hectares of agricultural land. Scores of

² Ahlawat Jai Singh and Rajeev Bansal, Flood Management and Drainage System in Haryana, Haryana Irrigation Department, Chandigarh

³ Ahlawat Jai Singh and Rajeev Bansal, Flood Management and Drainage System in Haryana, Haryana Irrigation Department, Chandigarh

people and hundreds of cattle perished due to the gushing floodwaters, which also damaged houses, roads, bridges, railway lines and canals. The water levels in many villages remained nearly 5 feet above the ground level for days on end.

Fig. 2: Flood affected areas in the Ghaggar basin⁴



Pachhisdhara, a tributary of the Ghaggar, received heavy flow and overflowed in Punjab in the first week of July. The main river, Ghaggar, along with Markanda and Tangri, were in full spate during that period. On 6th July, both Ambala and Patiala districts started receiving floodwaters due to breaches which moved along the slope of the basin and finally entered the Hanumangarh district of Rajasthan, some 350 kilometres away, by 22nd July.

The 2010 Ghaggar floods could be seen in two ways; one, the breaching of embankments and spreading of river water into the fields, and second, river water entering the canals like SYL and the Hansi Butana canal (HBC) which were poorly designed and not maintained properly. These two highly controversial canals are yet to be commissioned, and hence are not supposed to carry water. The swelling river water not only flowed through these canals, but also reached far-flung areas, only to destroy standing crops which were sown barely a month earlier in June. The breaches in man-made canals such as the SYL and the HBC, leading to a transfer of floodwaters to other parts of the basin distant from the rivers, spread floods to areas that should not have

⁴ http://www.sandrp.in/basin_maps/Ghaggar%20floods%202010.jpg

experienced floods. On their part, the Punjab and Haryana state governments demanded financial assistance to the tune of over Rs. 1,000 crores each from the central government.

Box 1: How the Flood Unfolded and Travelled⁵

July 6, 2010

- Ambala Cantonment, Ambala city was flooded due to a breach of embankment nearly 5 km north-east of the town on the Tangri river.
- Parts of the Shahabad town of Ambala district was submerged due to a breach in the Markanda river.
- The left bank of the Sutlej-Yamuna Link Canal (SYL) breached near Jyotisar, Kurukshetra district, Haryana. Thanesar, Kurukshetra, Didar Nagar, Shanti Nagar and Jyotisar were affected.

July 7, 2010

- Another breach occurred 8 km upstream of the site of the breach in the SYL which occurred the previous day near Jyotisar.
- The waters of the Ghaggar spread on both sides of the river near Tatiana, Kaithal district of Haryana. Bordering villages of the Patiala district of Punjab were flooded. Punjab blamed Haryana for blocking river flow at the siphon site of Ghaggar with the Hansi Butana canal.
- Pachhisdhara water overflowed and inundated the Bada Kammi, Lachhuroo, and Sarala villages of Patiala district, Punjab.

July 8, 2010

- Ghaggar water breached the Hansi Butana canal and water entered into the HBC at 0030 hrs near Tatiana.
- The right bank of the HBC near Tatiana breached at 0330 hrs.
- Pachhisdhara breached the left bank of the SYL at two places near Bada Kammi, Punjab. Pachhisdhara flow entered into the SYL.
- Two more breaches on the Pachhisdhara occurred near the Mahdudan village, Punjab.
- The Bibipur lake near Jyotisar breached.

July 9, 2010

- The right bank of HBC breached near Keorak, Kaithal district, Haryana.

July 11, 2010

- Three breaches on Rangoi *nallah* in Fatehabad district, Haryana occurred. 77 villages were affected.

July 12, 2010

- The Ghaggar breached near Moonak, Sangrur district of Punjab. 12 villages were affected.
- There were two breaches on the Ghaggar near Sardulgarh, Punjab. Thirty villages were submerged.

⁵ Bhattacharya Swarup and Vineet Kumar, 2010, Unprecedented floods in Ghaggar Basin, *Dams, Rivers & People*; New Delhi: South Asia Network on Dams, Rivers and People, June-July 2010

July 13, 2010

- Two breaches occurred downstream of Ottu weir in Sirsa district, Haryana. Six villages were affected on 14th July, 2010.
- Two more breaches occurred downstream of the Ottu weir. 8000 acres of land and 13 villages were affected.

July 15, 2010

- The outer embankment breached near Jhopra in Sirsa district. Ellenabad of Sirsa district was affected.

July 22, 2010

- The Hanumangarh district of Rajasthan was affected.

The Sutlej-Yamuna Link Canal (SYL)

The Sutlej-Yamuna Link canal (SYL) with a capacity of 2000 cubic feet per second (cusec) was built in 1989-90 (90 per cent of the length of the canal was built, except some portion in Punjab and its head work near Anandpur Sahib) to divert water from the Sutlej river to the Yamuna. Since then, due to an interstate dispute about the sharing of river water between Punjab and Haryana, the SYL canal has not been commissioned.

Despite this, the SYL retains some water round the year, according to villagers living close to the canal. Since its inception, the SYL has not been maintained properly. According to a Punjab irrigation department official working with the Patiala drainage division, during the July 2010 downpour, the rainwater from the area around entered the SYL through cracks in the canal wall. Farmers in Haryana blamed their Punjab counterparts for transferring excess water from their fields into the SYL by deliberately puncturing the canal wall.

On 6th July, the left bank of the SYL near the Haryana town of Jyotisar - where the Kalpana Chawla Planetarium is located - breached and flooded the surrounding area. The floodwaters spread up to Shanti Nagar and Didar Nagar localities of Kurukshetra city. According to an eyewitness, only 10 days before the breach occurred, the site was being repaired to fix a previous breach.

The eyewitness said that the breach could have been avoided if the department had cared to put in place a permanent plug, instead of a temporary one. This would have helped avoid inundation of vast areas in the district. The very next day, yet another breach occurred in the canal just a few kilometres upstream of the Jyotisar breach site.

Pachhisdhara, a small tributary of the Ghaggar, originates near Chandigarh and joins the river near Sarala village in Patiala district. This tributary also receives sewage water from Chandigarh drain. Villagers living close to Pachhisdhara said that the Ghaggar tributary was flowing beyond its capacity for three days since 6th July, and water was seen overflowing at many places

near Bada Kammi, Lachhuroo, Kapuri, Sanjanpur, Sarada, Raipur, and Bada Lachhuroo. An assistant engineer of the Punjab Drainage Department, who was in charge of this region, said that the Pachhisdhara had breached the left bank of SYL near Bada Kammi village early in the morning on 8th July, but fortunately this breach was plugged.

However, the authorities were not as lucky with yet another breach that occurred a few hundred metres downstream. In a short span of time, it developed into a 100-feet long breach, paving way for water from the Pachhisdhara to enter the SYL canal. It was clear from this sequence of events that flood water entered the badly maintained SYL, and when the canal breached at downstream locations, it spread the floods to newer locations which would not have been affected but for the breaches in the canal. The lack of proper maintenance on the part of both Punjab and Haryana authorities was one of the major reasons why the floods spread to distant localities which remained submerged for days on end. This story of poorly maintained canals causing disasters is not limited to the SYL. The same is true in the case of the Hansi Butana canal, another of the Haryana canals which are awaiting commissioning.

Hansi-Butana Canal

The Hansi-Butana canal (HBC), a project of the Haryana government, officially known as BML-HBBB-MPLC, was completed for most of its length in 2008-09 at a cost of Rs. 400 crores. The canal was designed to carry Sutlej waters to the Hansi and Butana region of Haryana. This brick-lined canal is supposed to carry 2086 cusec of water. As per the project design, it is supposed to get water after puncturing the BML (Bhakra Main Line) when it enters into Haryana for a brief stretch in Kaithal district near Samana in Punjab.

The canal is yet to be commissioned since Punjab and Rajasthan, which have a share of the water in the BML, have opposed this project, and Haryana did not get their consent before building the canal. The case is now pending in the Supreme Court.

On 7th July at around 00.30 hrs, a massive breach of about 70 m occurred on the left bank of the HBC at Kharal village. A number of senior officials of the Haryana Irrigation Department were present when the mishap took place. This left bank of the HBC is also the left embankment of the Ghaggar (note that water flows in the opposite direction in the HBC compared to the flow in the Ghaggar). According to Arvind Kaushik, executive engineer in the irrigation department in Kaithal district, the Ghaggar received heavy discharge due to rains and inundated floodplains in the Kaithal district in Haryana and the Patiala district in Punjab. Floodwaters created pressure on the left embankment near Tatiana village and breached the embankment. The Haryana irrigation department claimed that on 8th July, the water level in the Ghaggar reached 27.50 ft in a gauging station near Tatiana, which was the second highest level in the last 26 years.

Residents of Khambheda, a flood affected village near Tatiana, told South Asia Network of Dams, Rivers and People (SANDRP) that after 1993, they have for the first time witnessed such a massive downpour as well as heavy discharge in the Ghaggar river. They also said that the 1993 floods hadn't affected them so much, but this flood had taken everything from them. They pointed out that the siphon of HBC on the Ghaggar had obstructed the natural flow and hence, the backwater effect inundated vast areas. The Punjab government has also accused the Haryana dispensation of not maintaining adequate capacity in the siphon, which was responsible for flooding of many villages in Patiala district. A villager said that the large number of pillars of the siphon had obstructed the natural flow.

The executive engineer Kaushik, however, denied this. He said that while in 1993, the water level in the Ghaggar rose from 21 ft to 30 ft in one week, the rise was more spontaneous in 2010. At night on July 6-7, the water levels in the Ghaggar near the Tatiana gauging station recorded a quantum jump from 16 ft to 27.5 ft, making an intervention impossible.

However, there are not many buyers for this argument. According to a notice board put up by the Haryana irrigation department at Tatiana, the discharge capacity of the siphon aqueduct is 1,62,300 cusec, whereas the flow in the Ghaggar on the night of July 6-7 was 63,460 cusec, which was way below its carrying capacity. If that was the case, how is it that so much water flowed out, submerging vast tracts of paddy fields in adjoining areas? The Haryana irrigation department may have a lot to explain⁶.

Gurnaam Kaur, a fifty-five year old farmer residing beside the siphon, said that her paddy field was submerged but not affected much because it was located downstream of the siphon on the Ghaggar river. However, she said that many of her fellow farmers whose land was upstream of the siphon, were affected severely. She was clearly hinting that the siphon did act as a block even at the below design flow of 63,460 cusec.

Though the HBC is only two years old, the breaches have already exposed the poor quality of construction. Many villagers blamed the authorities for using poor quality construction material and neglecting maintenance work. They accused the state government of misusing Rs. 400 crores for the HBC project. Reportedly, both banks of the HBC from Tatiana to the siphon site (nearly 4 km) were in bad shape when the floods occurred. A collapse of the right bank of the canal where the puncture point for HBC is located on the BML some 25 kilometres from Tatiana buttresses this contention. Though the villagers together with district officials tried to strengthen the embankment, their efforts remained futile.

Conflicts and Floods

Villagers residing in the upper catchment of the Ghaggar in Patiala (Punjab) and Ambala (Haryana) districts said that the river flow was abnormally high for four days from July 5, 2010. As a result, the river began to overflow and

⁶ http://www.sandrp.in/floods/ictoral_depiction_of_Ghaggar_Flood_2010.pdf

submerge floodplains at many places. Provincial governments in Haryana and Punjab ruled by rival political parties blamed each other for blocking the river flow and diverting the water. While Haryana was ruled by the Indian National Congress - a party which has a pan-India presence, the regional Shiromani Akali Dal party, supported by the right wing Bharatiya Janata Party, was ruling in Punjab. The then Punjab irrigation minister, Janmeja Singh Sekhon, had alleged that the union government was being pressured by Haryana regarding two issues. Firstly, while Punjab claimed that the Hansi-Butana canal was acting as a barrier to the natural flow of the Ghaggar waters, the part channelisation of the Ghaggar following objections by Haryana had marooned a dozen villages in the Moonak belt in Sangrur. The Ghaggar had been channelled across 22 km in the first phase, and work on the 17 km long second phase was stopped following objections filed by Haryana. Secondly, the irrigation minister also claimed that the union government did not initiate a survey of the affected areas, and also failed to react to the flood situation in Punjab, thinking that the situation had partly stabilised in Patiala district, whereas parts of the Moonak-Budhlada area were still under water. The conflict between the Punjab government and the centre became starker when the state irrigation minister claimed that a project worth Rs. 10.24 crores had been designed for the purpose and submitted to the Central Water Commission. The minister claimed that the Punjab government directed its executive engineer, Bari Doab drainage division, Amritsar to prepare the project. However, this claim was rebutted by the former union minister for water resources, Pawan Kumar Bansal, because according to him the Punjab government had not submitted any such project, therefore it was not followed up.⁷ The differences between Punjab state and the union government continued to impact the flood control projects. The union government continued to pressurise the state government to give its consent to the Hansi-Butana link. Despite all technical formalities being completed, the state government was not given permission to complete the channelisation work initiated on the Ghaggar river. During consultations between Haryana and Punjab over the issue of completion of the 40 km channelisation of the Ghaggar, it was emphasised repeatedly that Punjab should give its nod for Hansi-Butana if it wanted the Ghaggar project to be completed soon. Despite the presence of four major rivers in the state, Punjab has not been provided with enough funds to deal with flood problems. The Ravi, Sutlej and Beas have been tamed, while the Ghaggar flows freely. To tame it, the government undertook channelisation of 40 km, of which work on 22 km is already complete. According to the minister, the union government is unable to understand that the Hansi-Butana project will sound the death knell for Patiala.⁸

⁷ <http://www.doabaheadlines.co.in/story/7254>

⁸ <http://www.doabaheadlines.co.in/story/7254>

⁹ Singh Jangveer, State's Hope of Central Survey Dashed, Tribune News Service, July 12, 2010

Despite being keen to replant paddy in their fields, farmers were not able to do so in 2010. As a way out, the State Agriculture Director, Dr. B. S. Sidhu, had proposed that the farmers could also opt for maize cultivation for which seed would be made available.⁹ The suggestion of shifting from paddy to maize might have been easy for the state agriculture director, but in doing so the harassment encountered by the farmers did not get highlighted nor discussed. During the 2010 floods in Punjab, a total of 814 villages were

affected, of which 283 were in Patiala, 200 in Ludhiana, 190 in Fatehgarh Sahib, 58 in Rupnagar, 55 in SAS Nagar and 28 in Sangrur. Three to four lakh people were severely affected.¹⁰ The loss incurred by the affected population due to breaches in the Ghaggar was overshadowed by the tripartite conflict between Punjab, Haryana, and the centre. An official with the Punjab irrigation department in Patiala said that in Patiala district alone, there were 73 major or minor breaches in the initial days of the 2010 monsoon season. A breach means the breakdown of a manmade barrier called an embankment on either side of the river.

One point that officials belonging to both state governments agreed upon was that there had been an unprecedented downpour in the catchment areas of the river and its tributaries. However, what they did not admit was that the human interference in the natural flow of river water as well as the lack of maintenance of embankments and canals are apparently the reasons for such a massive loss of life and property of the common people.

The sequence of events indicated that the poorly designed and badly maintained HBC played a crucial role in causing floods in new areas of the Ghaggar basin. Significantly, 20 years ago, a high level committee, with a Central Water Commission member as chairperson and representatives of Punjab, Haryana and Rajasthan as members, was formed to deal with situations arising from 'unprecedented' rains in the catchment areas of the Ghaggar river. Even after 20 meetings since its formation, the Ghaggar standing committee failed to suggest anything concrete. Continuous heavy rains for days can wreak havoc in any place. However, a critical analysis of the 2010 flood situation in many parts of Haryana and some villages in Punjab along the Ghaggar river presents a different picture. The human interference in the natural flow of the Ghaggar river caused the devastation.

As it emerges very clearly, in the name of channelisation or embankment, policy makers virtually want to turn a river into a canal. The embankments basically work to rapidly transfer floods from upstream to downstream areas. When a river basin receives more rainfall than what the poorly maintained embankments can safely carry, the establishment blames unprecedented rains or other basin states. In this manner, we restrict the free flow of a river in the name of building embankments. By building a wall, we narrow the river's course. Besides, we do not maintain the embankments properly. Additionally, we create ancillary structures like canals, which are neither properly designed, nor properly maintained.

There are a number of other factors that have contributed to the Ghaggar basin flood disaster. At a number of places, the floodplains and even the flow paths have been encroached upon by various builders, with the connivance of bureaucrats, technocrats and politicians. Secondly, the local water harvesting structures have been poorly maintained. Thirdly, there is no coordination within the state, let alone between the riparian states. Therefore, when an upstream state/district receives such a heavy downpour, they don't bother to alert the downstream states/districts. The downstream areas are also not

¹⁰ Singh Jangveer, State's Hope of Central Survey Dashed, Tribune News Service, July 12, 2010

using information about rainfall and flows in the upstream areas. At times, the upstream states are hiding facts and blaming others.

One of the direct consequences of these developments can be seen in Sirsa district, where the wheat is stored in the open. Though the authorities were aware more than a week in advance that the floods were bound to come, they did very little, and the entire stock of grain was destroyed.

According to newspaper reports, recurring floods along the Ghaggar river have changed social and economic practices in the villages that flank its banks. Men from rich landlord families do not find marital alliances in other districts, and land is sold for dirt cheap.¹¹ Farmers lose a lot of their standing crop to floods almost every monsoon and suffer heavy financial losses, because of which some have started growing lotus flowers which can survive heavy rains.¹² The villagers almost everywhere claimed that no cleaning work was carried out for many years in the Ghaggar and its tributaries – the Bhakhra main canal, Nirwana branch, Tangri rivulet and Jacob drain. According to them, nothing was done to save Patiala and adjoining areas from the 2010 floods.¹³

Farmers in several villages across the Ghaggar river had rubbished government claims of help to the flood-hit, and instead had dug deep into their savings to combat the losses caused by the 2010 floods. People's complaints became stronger after the floods. The common complaint was that agricultural fields were washed away, but the affected farmer received no help from the government. The government had announced Rs. 5,000 per acre of affected land, but the money was not disbursed when required the most. Hard pressed to make ends meet on a daily basis, the farmers were further burdened with sowing paddy all over again since saplings were not cheap. Farmers like Mandhir Singh of Kartarpur, who owns 15 acres, had already spent nearly Rs. 5,000 per acre on labour, fertilisers and water. After the floods, he spent Rs. 1,500 per acre to buy saplings, then paid Rs. 2,500 per acre to plant them. According to him the only help the government extended was in the form of a doctor who had visited the village for two days during the floods, and he too disappeared after the waters receded. The floods in the region had come during the first week of July. However, till 28th July, the breach in Rasoli had not been repaired, causing fear midst the affected population. Drinking water was also a big problem in numerous villages, since the tubewells were choked with eroded soil. The villagers had to travel long distances for water.¹⁴

The events in the Ghaggar basin in July 2010 have clearly indicated the kind of manmade disasters we are inviting. Unfortunately, we are not learning any lessons from these disasters.

Box 2: Contestation amongst Punjab and Haryana and the Floods in the Ghaggar Basin

Heavy rains alone are not responsible for the 2010 floods in the Ghaggar river basin. A dispute, brewing between two neighbouring states - Punjab and Haryana - for a better part of four decades, also played its part, albeit indirectly.

¹¹ Sood Aman, Our sons don't get good matches because of floods, The Indian Express, July 29, 2010

¹² Sood Aman, Our sons don't get good matches because of floods, The Indian Express, July 29, 2010

¹³ Sood Aman, Our sons don't get good matches because of floods, The Indian Express, July 29, 2010

¹⁴ Sood Aman, What govt help, ask farmers as they foot the flood bill, The Indian Express, July 8, 2010

The two states have been fighting a long-drawn-out battle over sharing river water for quite some time. Since the carving out of Haryana from Punjab on 1st November, 1966, though most major rivers of Punjab - which literally means the land of five rivers - do not flow through Haryana, it was decided that the latter being a successor state will get a share of the undivided state's river waters. Though Punjab never showed any inclination to part with its precious water resources, the central government intervened as early as 1969. It was agreed upon in 1976 that a canal that links the Sutlej to the Yamuna would be constructed in two years. The Sutlej-Yamuna Link canal (SYL) was never completed, and in 2004, by an act in the Punjab state assembly - ironically by a congress government led by Amarinder Singh - the state scrapped the water sharing deal with Haryana.

The passage of the Punjab Termination of Agreements Act, 2004 by the Punjab Assembly not only put the fate of the SYL in jeopardy, but also denied Haryana a rightful share in the river water. It was then that Haryana first conceived of the new Hansi-Butana canal (HBC). Through this canal, Haryana was planning to divert 2000 cusec of water from the Bhakra canal command areas to the western Yamuna canal command area of southern Haryana. The objective of the canal is listed as 'multi-purpose', in order to meet not only the need for canal water, but also drinking water for the southern areas of Haryana.

The proposed construction of the HBC has been an issue of contention between Haryana and Punjab. Punjab has been objecting to diversion of water from the Bhakra Main Line (BML) by Haryana. Haryana has made it clear that it would divert 2000 cusec of water from the left bank of the BML for the HBC, when it briefly enters Haryana in the Kaithal district.

The Punjab government argued that this type of diversion would amount to reduction of the BML flow downstream by 35 per cent (at the proposed off-taking point, the Full Supply Discharge is 6795 cusec). According to Punjab, this is a 'substantial volume' and could upset the hydraulic functioning of the BML canal. This could pose problems for 'inter-state' water delivery, and has the potential to hit supply to Rajasthan, the tail-end state in this system. As the regulation of the canal system is the responsibility of Punjab, it filed a suit in the Supreme Court, pleading that Haryana should be refrained from going ahead with the HBC project.

Following the 2010 July floods, however, a new controversy erupted. Punjab wanted Haryana to refrain from strengthening a 3.5-kilometre-long concrete wall being built along the HBC next to the Ghaggar river in Kaithal district. While Haryana claimed that it would help secure an embankment on the canal, Punjab feared that the wall may lead to flooding of some villages in Patiala district.

In September 2011, the Supreme Court rejected Punjab's contention when a division bench comprising Justices J. M. Panchal and H. L. Gokhale ruled that Haryana has every right to protect its people from floods.

The bench noted that Punjab's stand was not correct because the Ghaggar *bundh* was constructed by the erstwhile state of Punjab in the 1950s for the purpose of "preventing flood waters from entering and submerging (its own) areas to the south of the *bundh*," which have now become part of Haryana.

The *bundh* was constructed neither to guide the course of the Ghaggar nor was it designed to be "deliberately weak enough" to give way during heavy floods, as was argued by Punjab, the apex court said.

The SC said it was not convinced by Punjab's hypothesis that preventing the *bundh* from breaching would cause flooding of its 70 villages. Of the 15 villages affected in the July 2010 floods, 11 were situated far off from the *bundh*, it pointed out.

Status Quo

According to a recent newspaper report¹⁵, living in Ambala is like being entangled in a web of an unwholesome pallour. Three rivers originating from Himachal Pradesh are known to cause floods in the monsoons, but it seems that steps will never be taken to prevent them. Ambala is a low-lying area and flooding is inevitable, but it is always possible to deal with the situation. According to the report, administrative sources said that the government allocated Rs. 15 crores this year to the Ambala irrigation department to strengthen the edges of 12 small and big rivers adjoining Ambala, including the Tangri, Ghaggar and Markanada, but the process was never completed.

¹⁵ <http://timesofindia.indiatimes.com/india/Monsoon-flood-threat-cripple-Ambala/articleshow/14815304.cms>

Floods in South West Punjab Flood in the Arid Regions?

Arshinder Kaur

Description of the Area

August 2011 saw floods in villages of Muktsar and Ferozpur districts of South Western Punjab. Until mid September, news reports kept pouring in and several thousand hectares of fields were under water and hundreds of houses had been washed away.

Fig 1: Map of the case study area

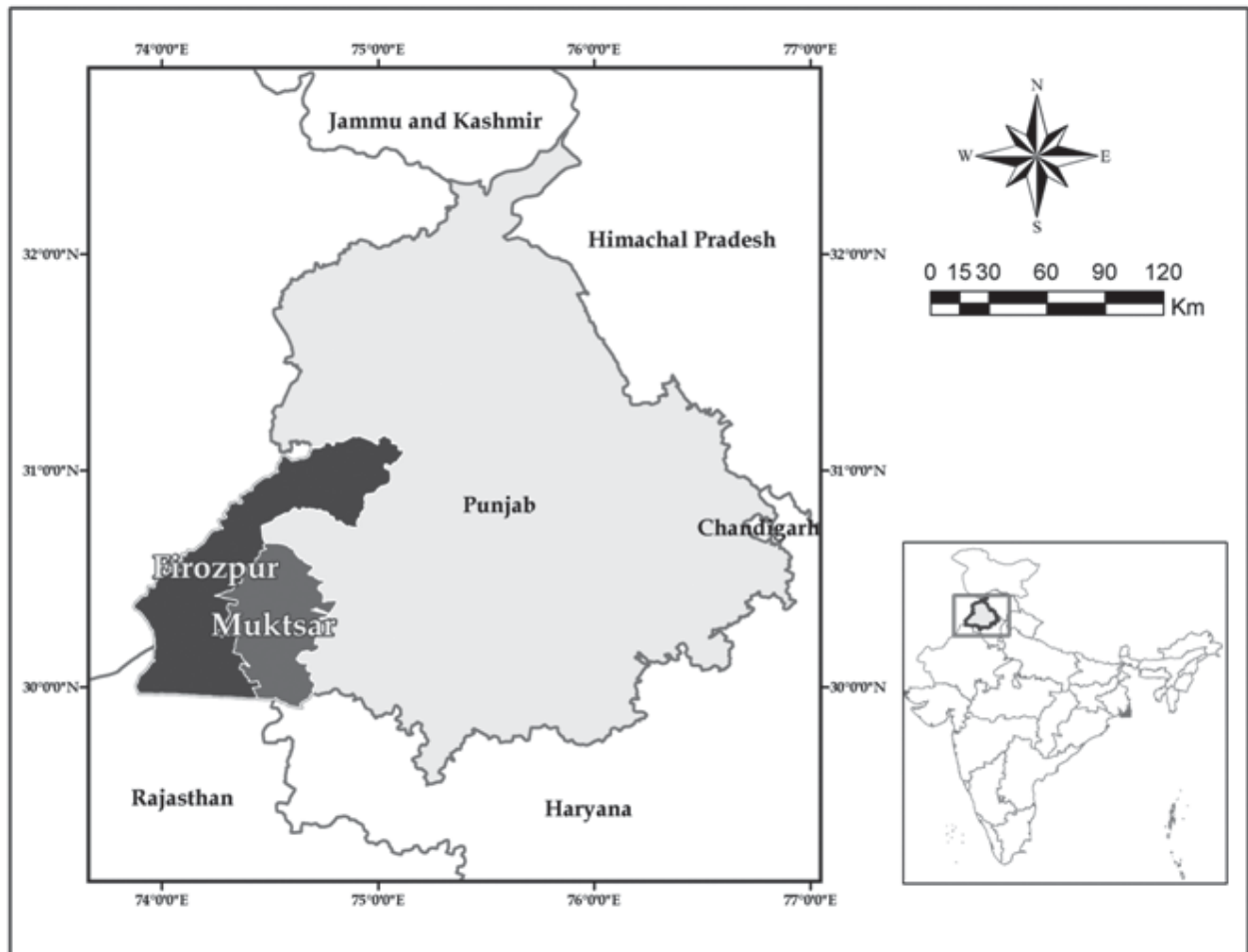
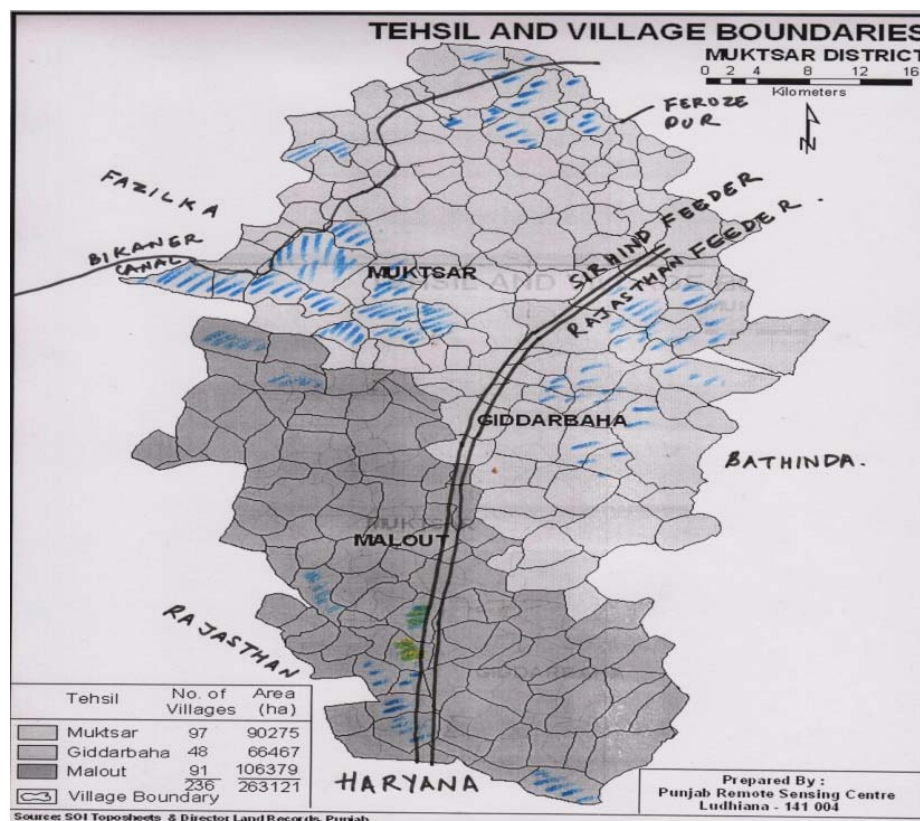


Fig.2: Tehsil and village boundaries of Muktsar district



District Muktsar is bounded by the states of Rajasthan and Haryana in the south, and district Faridkot in the north, Ferozepur in the west and Bathinda in the east.

The climate is generally dry and characterized by a very hot summer, a short rainy season and a bracing winter.

The period from July to the middle of September constitutes the south-westerly monsoon season. The south-western monsoon brings to it the much needed rain bearing depression during summer. Nearly 70 per cent of the year's rainfall is received during three months (July to September). July and August are the rainiest months. The latter half of September and October may be termed as the post-monsoon or the transition period. There is wide variation in the seasonal temperature with mean monthly maximum temperature as high as 45°C in June and mean monthly minimum temperature as low as 2°C in January. The maximum temperature may rise as high as 47°C. The rainfall in the district generally increases from the south west towards the north east.

The soil is predominantly calcareous, developed under hot and arid to semi-arid conditions. The pH value ranges from 7.8 to 8.5 which shows that the soil is normal in reaction. Grey and red desert, calsisols, regosols and alluvial soils are found in this zone. The soils of south western Punjab can further be sub-divided into two major categories Desert and Sierozem soils. The soil is deficient in nitrogen, phosphorous and potassium. Wind erosion is a serious

problem in these areas. The major part of the district has an aridic (torric) moisture regime¹.

The area forms a part of Sutlej sub basin and main Indus basin alluvial plains. Topographically the region is almost flat. It has an average elevation of 200m and slopes gently towards south and south west. It is dotted with a number of isolated sand dunes of varying dimensions. The sand dunes are of longitudinal type and do not show any preferred alignment. There is no river flowing through the district. However, a number of artificial drains cross the region that carry the excess run off during rains, which have currently become a source of crisis. The soils in the districts have largely developed on alluvium, the material laid by rivers under the dominant influence of climate followed by topography and time.

Crops grown previously were gram, wheat, barley, bajra, jowar, cotton, rope and mustard. Now the crops in the area are predominantly wheat, rice and cotton. The shift to these crops has led to a six-fold increase in the total irrigation requirement.

The State of Punjab has been divided into five agro-ecological zones with this region lying in the region IV and V of the agro-ecological zones being arid and prominently irrigated by canals. The major issues that afflict the region are groundwater and lowering water table in some parts of south Punjab. The rest of the area has a rising water table problem because the saline groundwater is not being used for irrigation. This area also has a problem of soil with sandy texture, having less moisture holding capacity. The underground saline water and rising water table have affected the growing of cotton, the main crop of the area, and people have shifted to paddy and other crops. However, it has been overlooked and not recognized as water requirement of paddy is 180 cm as compared to 45 cm for cotton, 40 cm for maize and 25 cm for groundnut, for which extensive canal irrigation has been provided in this area ecologically designated as an arid zone.

The Need to Understand Conflict of this Region

Extent of Irrigation

Muktsar district has 224,000 hectares of sandy loan area which is the same as the net sown area. Irrigation by canal network is spread over 222,000 ha³.

Rest of the area is irrigated with bore and tube wells. Agriculture contingency plan indicates that cotton is grown in 124,000 ha and rice in 68,000 ha.²

The contingency plan dated May 2011 for Muktsar district does not classify the district as vulnerable either to drought or floods but as vulnerable to waterlogging, attack of pests and diseases.³

Nevertheless, Muktsar district and parts of Ferozepur saw major flash floods in the year 2011 with the paddy and cotton fields inundated with water and breakdown of 'kuccha' houses (houses where mud is used for walls/roof or dry stone masonry) in the region. A news report of floods in seven districts of

¹ A regime where the annual precipitation is less than the potential evaporation and transpiration, and where soil moisture status is normally less than field capacity

² <http://agricoop.nic.in/Agriculture%20Contingency%20Plan/Punjab/JAB%2018%20Sri%20Muktsar%20Sahib%2031.05.2011.pdf>

³ Though a contingency plan is made every year for the district and scientifically the region is not vulnerable to floods, this is an indicator of floods that were politically created.

Punjab, three of which are in south western Punjab, i.e., Fazilka, Ferozepur and Muktsar, stated that 0.419 lakh ha of land in 886 villages of 7 districts of Punjab was affected during the floods of August 2011.⁴ In Fazilka, crop was damaged in 9133 ha and in Jalalabad subdivision of Ferozepur district, damage took place in about 1214 ha. Another figure indicated a damage of 25,000 ha in Bathinda.⁵

Fig. 3: Water pumps installed on water logged and flooded lands for extraction of water



Environment Report 2007⁶ indicates that these districts have one of the lowest soil organic carbon and a general deficiency of phosphorus. The groundwater is classified as saline and unfit for irrigation. Waterlogging, salinity, alkalinity and flooding have been recognised as the continuing issues of these districts in the State Environment Report 2007 and previously too.

The State of Punjab has six major canals, namely, Upper Bari Doab Canal, Bist Doab Canal, Sirhind Canal, Bhakra Main Canal, Bikaner Canal and Ferozepur Canal. District wise data on irrigation shows that Bathinda district has maximum area (95.22 per cent) under irrigation followed by Muktsar (93.28 per cent) and Ferozepur (92.89 per cent) in the State of Punjab. The figures are awe-striking in spite of this region being marked mostly by sand dunes and climatic aridity.

Additionally, the report states that in the south western parts of the State, the water table has risen in the range of 0-2 meters in several parts of Muktsar, Ferozepur and Bathinda districts during 2004-05 resulting in waterlogging and soil salinity. It is also indicated that, "low lying pockets in south western districts of the State have been facing a severe problem of waterlogging and resultant soil salinity, which is attributed to excessive canal irrigation, inadequate drainage system and under exploitation of groundwater resources due to salinity".

⁴ <http://www.indianexpress.com/news/chief-sec-visits-flood-affected-areas/844698/>

⁵ http://punenvis.nic.in/News_2011/Sept/Sept13.htm

⁶ <http://www.moef.nic.in/soer/state/SoE%20report%20of%20Punjab.pdf>

Two major canals flow through the region of south-west Punjab, the Rajasthan Feeder which carries Ravi-Beas waters exclusively for Rajasthan and the Ferozepur Feeder. The Rajasthan Feeder takes off from the Harike Headworks. It has a capacity of 18,500 cusecs. However, the head regulator of the canal has a capacity of 15,000 cusecs which is sufficient for supplying allocated quantum of Ravi-Beas waters to Rajasthan. The canal which was constructed in the year 1958-1961, runs for a length of 149.53 km through Ferozepur, Muktsar and Faridkot districts of Punjab.

The Ferozepur Feeder also takes off from Harike Headworks. It has a capacity of 11,192 cusecs and was constructed in 1952-53. This runs for a length of about 51.30 km, for supply of Ravi-Beas waters to the two distributaries of Mayawah and Sodhinagar having a combined discharge of 309 cusecs. The Sirhind Feeder, which takes off from the Ferozepur Feeder at Reduced Distance (RD) 55413 ft. was constructed during 1954-55 and runs for a length of about 136.50 km. It has an authorized capacity of 5,264 cusecs, having a cultivable command area of 3.6 lakh hectares.

The Rajasthan Feeder is a lined channel, with single tile lining in bed and double tile lining on side slopes. This type of lining was adopted, probably for the reason, that groundwater table was 33 meters deep at the time of construction of the Rajasthan Feeder. The full supply depth from 0 - 179000 was kept as 14.40 ft. and in the downstream reach RD 179000 to tail, the same was kept as 21.00 ft.⁷

The seepage from Rajasthan Feeder and Sirhind Feeder in Punjab Territory has assumed alarming proportions. Seepage from these canal systems has been found to be 191.05 MCM i.e. 21 per cent of the total annual groundwater recharge. There has been an enormous rise in Sub Soil Water Level (SSWL) in reach RD 179000 to 496000 of the Rajasthan Feeder and RD 124000 to 434000 of Sirhind Feeder. Out of 84,800 hectares of fertile land critically affected by waterlogging in Faridkot, Muktsar, Malout, Lambi, Abohar and Gidderbaha tracts of Punjab, 25 per cent area is adjoining Rajasthan and Sirhind Feeders.⁸

The continuous seepage from these canals is aggravating the situation and further making the land saline and unfit for cultivation. Relining of these canals is the only option for which two projects have been prepared at an estimated cost of Rs. 889.95 crores and Rs. 363.50 crores respectively for Rajasthan and Sirhind Feeder Canals.⁹

The canal network ought to have an equivalent spread of drainage network. The irrigation network in the State that runs over 14.5 thousand km has a complementary drainage network of eight thousand km only.

The 'End of Season' report by the Indian Meteorological Department did not mention flood situations in Punjab at all for the south west monsoon 2011.

⁷ <http://pbirrigation.gov.in/cansystem.html>

⁸ <http://pbirrigation.gov.in/cansystem.html>

⁹ <http://pbirrigation.gov.in/cansystem.html>

Fig. 4: Salinized pathways along the flooded fields



Antecedents of the Floods in the Region

According to a farmer of Taamkot village, “the first flood appeared in the year 1987”. The water level rose to 12 ft below ground level in that year which allowed farmers to change their cropping pattern from cotton and pulses to rice production. This allowed the functioning of tube-wells and pumps effectively for almost 10-12 years in the region. Though in some places the floods brought in changes in crop pattern and in agro-socio-economy, there are villages for example, Ratta Khera in Malout division, that have been completely destroyed and still remain waterlogged. The standard of living in these regions has completely deteriorated. The water pumping system to extract water has also completely failed.

The affected farmers of Abul Khurana village (Malout block of Muktsar district) think that ‘the major attribute of the flood is waterlogging and rising groundwater level, as high as 1-1.5 feet’. The farmers exclaimed that the increased intensity of rainfall in this season (i.e. monsoon of 2011) was difficult to be estimated. (A meteorologist’s opinion at the Punjab Agriculture University is that the number of rainy days had decreased, however, the intensity of rainfall had increased this year in south-western Punjab). The low lying lands were flooded. In addition, the strong flood waters could not be curtailed because of the flattening of sand dunes. The seepage drains have been constructed but at a distance. There is also absence of drains in the low lying areas. The farmers’ claim was that it’s often the ruling parties that determine where the drain canal ought to be constructed rather than the topography and regional space. Currently there is lack of drainage canals and non-continuity of the drainage system. The Abul Khurana drain was supposed to be laid through the village Abul Khurana, which instead was diverted through the village Tappa.

The velocity of the accumulated rain water was high, which broke the field edges to move into other villages because it could not percolate into the soil.

The original sand dunes have been cleared or levelled by farmers to be brought under irrigation. In the previous government, i.e. from 1997-2002, a group of farmers had sought approval for construction of a seepage link drain, the Abul Khurana link drain, through Malout drain for which these farmers with low lying land ran from pillar to post. However, at the time of implementation the election code of conduct was implemented as it was close to re-elections, and, subsequently the efforts were nullified because of change of policies with the change in the State Government. Efforts for construction of the seepage drain were undertaken in 1998 as the farmers were then too unable to harvest their paddy crop because of the flood situation and were unable to sow the next wheat crop.

LIFE CRIPPLED	THE DAMAGE FIGURES
■ Standing crop of paddy, fodder and cotton in over 2500 acres of land was inundated in more than half dozen villages	25,000 hectares in Bathinda
■ The only boat ferrying the villagers has some leakage in it and is also sans safety belts. The water has to be drained out after each turn	10,000 hectares in Nathana
■ The only entry point to the village, the barbed wire fencing gate, has also inundated	6,200 hectares in Sangat
<p>“ We have all the facilities available but no one has approached us so far. If need be, we would provide everything immediately ”</p> <p>— CS Mann, Fazilka ADC</p>	25,000 hectares in Talwandi Sabo
	6,000 hectares in Maur
	1,500 hectares in Rampura
	1,000 hectares in Rampura Phul

Even until the month of December 2011, the water stood up to 2 - 4.5 ft at places in the low lying lands of village Abul Khurana in an area more than 200 acres with a standing crop of paddy to the tune of Rs. 25,000 per acre amounting to an approximate loss of Rs. 5,000,000 for the paddy season for at least 25 farmers of the village in the Muktsar district. The claimant cited an example of one of the farmers who harvested his rotting paddy crop to be able to manage his land by shelling out Rs. 24,000 for a crop production estimated for an amount of Rs. 21,000 incurring an additional monetary loss of Rs. 3,000 to himself. The farmers have not fed fresh fodder to their livestock for the past three months. The land being waterlogged has been rendered unfit for sowing fodder too, with the cattle being fed on dry hay bought from the market at a rate of Rs. 500 per quintal with a milk yield reduced to half and a reduction in the fat percentage because of change in their feed. The cattle feed has become expensive by 1.5 times, and the cost for cotton production has gone up, in comparison to cotton purchase price. On query if the farmers had reached out to the judiciary for compensation of flood losses, they were reportedly classified as political issues and brushed away as it was time for elections in January 2012. The code of conduct had already been implemented leading to non-payment of compensation. Additionally the farmers reached out to the State Chief Minister who ordered the construction of seepage drains. However, another conflict is that the farmers through whose land the drain canals would be extended do not want to give affidavits stating that they shall not claim any money for the land given for the construction of the seepage canal. There is no community agreement and co-operation. For the purpose of extraction of water, the farmers were given an

option of laying pipes in their fields and installation of motor pumps. For the purpose, the farmers of this village bought four motor pumps from their own funds. The government granted free electricity for 30 days but the process of pumping of water was stalled by the police sent by the neighbouring village on the pretext that their own check dams would burst with the amount of water that would be extracted from this village. Now there is no electricity either to pump out more water. An example of installed filters was shown on the Grand trunk road for a village Channo, where 400 acres of land lie waterlogged for the past 12 years.

The farmers compared the structure of the new Abul Khurana seepage drainage, which is currently choked, to the Chander bhan drainage which was created several years ago. It was also highlighted that the main canals due to which main seepage occurred had not been repaired for the past 20 years. There is only one main drain originating from Abul Khurana and seven more drains converge into it such as the Badal drain. The convergence of the drains had begun in 1998. The seven drains together which are exclusively meant to remove seepage are not capable of removing the natural excess flow. Additionally there is silt in the drains. The drains are choked with hyacinth and algae. Five hundred pumps were installed on the edges of the canals, which were removing the seepage along the Sirhind canal and the Rajasthan feeder canal, which have now been discontinued. This was because the farmers whose lands were being prevented from waterlogging did not want to pay for the electricity used by these pumps, and they were charged with penalties on non-payment. Earlier water was 20 ft below ground in this area. The major rise of these floods is also because the canals are not being repaired. The farmers also complained of absence of lining in the canals. They said that these canals have actually ruined them.

Fig. 5 : Flood water still standing to a depth of 2.5 ft. in Manawala village: 26-12-2011



Tour through the village showed that the former Sarpanch whose land lay approximately at a distance of 500 meters from the most affected farmer did have seepage drain constructed on the outskirts of his land. The conflicting situation was that even though some seepage drains had been constructed, they were politically determined. In some situations, the farmers did not want to offer their land to be able to use maximum land for agriculture under irrigation. The current flow of water from the elevated villages moved over the high lying Grand trunk road towards the low lying villages. Observation shows that the region is dotted only with Eucalyptus and Populus, roots of these trees have the ability to raise water table.

The government has announced total loss compensation of Rs. 5,000 per acre whereas the income loss to a farmer for having deviated from growing crops because of canal water diversions has been Rs. 57,000 per acre per annum for both Kharif and Rabi crop losses. The farmers will be unable to sow crops until the next season of 2012. This compensation is also awaited in several flood affected villages because of the implementation of the election code of conduct. The delivery of drinking water was also suspended in the months after floods, because of malfunction in the overhead water tanks and water contamination.

Understanding the Climatic Variability in the Region

The region receives an annual rainfall of 380 mm in 22 rainy days, sources at the meteorological department of the Punjab Agricultural University, Ludhiana said that though the rainfall remains the same, the intensity of rainfall has increased and additionally an uneven distribution of rainfall was being observed, along with the decrease in the number of rainy days.

The change in cropping pattern led to a higher demand of water, mentions another professor at the Department of Soil Conservation at the Punjab Agriculture University, Ludhiana. The extensive canal network in the region of Bathinda, Muktsar and Ferozepur led to 20-30 per cent seepage losses of water to the neighbouring lands. Additionally there are percolation losses. Fifty per cent of the seepage loss enters the groundwater. It was also explained that higher intensity of rain in shorter duration, redundant seepage canals and the waterlogged affected people having pumped the excess rain water and seepage water into the normal canal system led to floods in several areas of south western Punjab this year (2011). It was explained that gradient for the construction of drainage canals and seepage canals is a major factor in ensuring that flooding does not happen in the adjoining areas.

Way Forward

- There is a need to provide regular information through regional and local communication channels to the farmers on water to be used for irrigation.
- Agriculture potential of the original soil in the region needs to be identified.
- Development of GIS data to establish the presence of drainage canals in the low lying areas, which have been waterlogged in the past.
- Evaluation of the eco-system, and the direct and indirect costs to the socio-economic and ecological fabric.

- Co-ordination and negotiations between various departments such as the Bhakra Beas Management Board, and the canals, drainage, agriculture, forestry, soil and water conservation.
- A risk assessment to be incorporated in each district contingency plan based on water demand and usage.
- Information to farmers and residents on the functioning of the departments of disaster management and irrigation management in vernacular languages.

In a Food and Agriculture Organisation (FAO) Corporate Document Repository, an Irrigation and Drainage paper - 'Organization, Operation and Maintenance of Irrigation Schemes' mentions three main types of irrigation maintenance, namely:

- Routine or normal maintenance which includes all work necessary to keep the irrigation system functioning satisfactorily and is normally done annually.
- Special maintenance includes repairs of damage caused by major disasters, such as floods, earthquakes and typhoons. The unforeseeable nature of such natural phenomena makes it very difficult to take specific preventive action, although general safeguards can be installed in particularly prone areas, for example, large drainage dykes in flood areas. In irrigation schemes located in places subject to these hazards, a 'special reserve fund' or budget allocation should be established for repair work.
- Deferred maintenance includes any work necessary to regain the lost flow capacity in canals, reservoirs and structures when compared to the original design. It often includes large modifications to the canal system and structures arising from important changes (cropping patterns, drainage problems, etc.) that have occurred in an irrigation scheme. In practice, it's difficult to differentiate between so-called 'deferred maintenance' and a 'rehabilitation program'. The difference is mainly of financial nature, because 'deferred maintenance' is normally undertaken with funds from the national budget allocated to operation and maintenance while rehabilitation program are considered as an investment and the funds come from a different source (loans, national development banks, etc).

Observations

1. Lack of mechanisms for sharing the benefits of water (rather than water itself) across different stakeholders
2. A strong preference for asset creation over demand management
3. Lack of minimum professionalism in the water sector hence dilapidated, wasteful infrastructure and an inability or unwillingness to manage water in an integrated fashion as an economic good with social imperatives
4. The website of the Punjab irrigation canals shows the absence of any water user's associations in the entire irrigation system.

NEWS BOX 1

HC notice to Punjab govt on floods in Fazilka¹⁰

Dinesh K. Sharma, TNN; Oct 21, 2011, 06.30AM IST

FAZILKA: The Punjab and Haryana High Court, while hearing a public interest litigation (PIL) seeking compensation of Rs. 75,000 per acre against crop loss due to diversion of excess water from Lambi area in Muktsar, has issued notice to the State government to file its reply.

The case pertains to diversion of excess rain water from Chief Minister Parkash Singh Badal's assembly constituency to Abohar and Ballauana areas of Fazilka district, during the recent monsoon season. The step was apparently taken to save crops in Lambi.

A division bench comprising acting Chief Justice M. M. Kumar and Justice R. N. Raina issued notices for December 12, 2011 to the State government to file a reply.

Incessant rain had caused extensive damage to cotton and paddy crop in Malwa region of Punjab, hitting cotton growers and farmers hard. The rain water had also damaged several houses in the area. It was alleged that the CM, whose assembly segment Lambi falls under Muktsar district, had ordered release of flood water into Abul Khurana drain through Sarawan Bodla and Wahabwala drains, in an effort to assuage the feelings of farmers in Lambi, Giddarbaha and Malout areas.

But this increased volume of water had an adverse effect on about 30 villages of adjoining Fazilka district. Sardarpur, Datarianwali, Rajiawali, Bhagu, Bhagsar, Amarpura, Ram Sran, Bhabwala, Khatban and Tabba Kokrian villages of Fazilka were badly affected due to the draining of water from Lambi and Gidderbaha, leaving the fields marooned and damaging the crops.

Dharmvir, a resident of Fazilka, had filed a PIL alleging that due to release of flood water towards Fazilka area, standing crop worth Rs. 11.55 crores was damaged besides an estimated loss of Rs. 9 crores, caused to several houses in the area. Holding the State government responsible for these losses, he demanded a compensation of Rs. 75,000 per acre to affected farmers.

NEWS BOX 2

Congress, Akalis play politics over floods

Balwant Garg - Tribune News Service, Lambi (Muktsar), September 20, 2011

Devastating floods are ravaging over a dozen villages of the Lambi Assembly constituency, damaging the crops and demolishing a large

¹⁰ <http://timesofindia.indiatimes.com/topic/Floods-in-Fazilka>

for the residents but this drastic situation seems to be a time ripe for the politicians to play politics, keeping in view the forthcoming Assembly elections.

NEWS BOX 3

Flood fury: Residents asked to evacuate

Praful C. Nagpal, Tribune News Service, August 20, 2011

“We have all the facilities available but no one has approached us so far. If need be, we would provide everything immediately,” said Fazilka ADC Charandev Singh Mann, who visited the area after passing through the flood water in a boat to convince the villagers to shift to safer places.

Mann informed The Tribune that so far the standing crop of paddy, fodder and cotton in over 2500 acres of land was inundated in more than half dozen villages. The villagers have to cross 32-feet deep Sutlej flood water to come to the main land.

During an on-the-spot assessment of the flood situation in the only boat ferrying the villagers, it was noticed that there is some leakage in the boat, which is without safety belts. Hence, the passengers are left to the mercy of god. The water has to be drained out after each turn.

The only entry point to the village, the barbed wire fencing gate, has also inundated as the village is surrounded by barbed wire fencing from three sides and the Pakistan boundary on the other.

BOX 4

India: Cotton crop rots under flood

“We had great hopes for a good yield this year, but weather and floods have washed away all our hopes. In Muktsar alone, 10,700 hectares have been damaged. Out of this, 1,000 hectares have suffered 75 per cent damage. In Fazilka, 3,200 hectares have been damaged. If water is not drained out of the remaining area in Muktsar, it will further add to the loss. In Ferozepur district, 13,000 hectare cotton crop is under water,” said Chief Agriculture Officer, B. S. Chahal.

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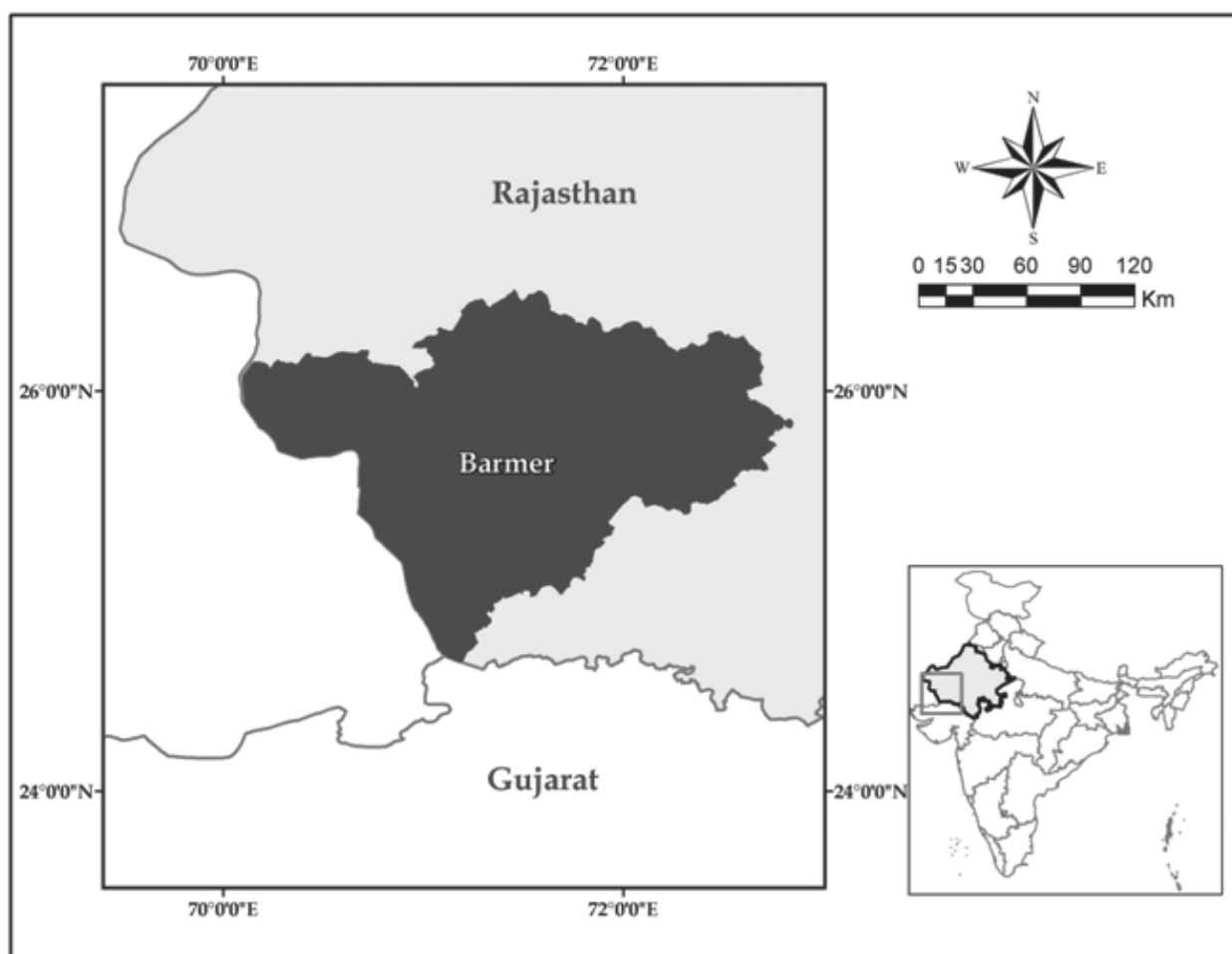
Chapter 8

Floods in Western Rajasthan Life after the Deluge

T. V. Jayan

Barmer District in western Rajasthan, where severe droughts are the norm rather than exception, had an unusually wet year in 2006. The heavy rains that came after a spell of six consecutive droughts, however, did not offer relief. On the contrary, the incessant downpour, which went on unabated for 100 hours, from August 19 to August 23, gave rise to one of the worst floods the State had ever witnessed in over a century.

Fig.1: Location of Barmer in India



Even though a total of 12 districts in the State received heavy rains, Barmer was worst-hit among them. According to the rainfall data available with the India Meteorological Department (IMD), the district as a whole received 509

mm of rainfall in the month of August alone, which is 4.25 times the monthly average. The swirling waters engulfed many villages in the district, but the worst affected were Kawas, Malwa, Bhadka and Sheo. Most parts of these villages remained inundated for months as the underlying impermeable subsoil strata prevented flood waters from draining. What aggravated the situation further for these Barmer villages was the excess rainwater that flowed in from Jaisalmer district. According to official accounts, over 800,000 people - nearly 30 per cent of the district's population of 2 million - were affected by the flash floods. Over a hundred people died and more than 69,000 livestock perished in the disaster. In villages like Kawas, nearly 95 per cent of the population was rendered homeless and was forced to move to high sand dunes with no or little belongings. Though the floods affected all people irrespective of caste or religion, the worst-hit were poor people who lived in mud houses build on marginal lands.

The calamity had some positive upshots too. As many as 20 new lakes were formed - three of them as large as seven to eight square kilometres. In many areas of the district that bore the brunt of nature's fury, groundwater levels went up by as much as 10 metres, improving the drinking water and irrigation situation. As a result, in the following year the net crop sown area in the district registered a marked increase of around 18 per cent, indicating a revival in farming activities in the district, which had reeled under six years of successive droughts.

When the Floodgates in the Sky Opened

Barmer, the land of shifting sand dunes and extremely low rainfall, is an integral part of India's arid landscape - the Great Indian Desert of Thar. It is surrounded by Jaisalmer in the north, Jalore in the south, Pali and Jodhpur in the east and Pakistan in the west. The district is sparsely populated with a population density of 92 people per square kilometre.

Barmer gets an average annual rainfall of 277 mm - a third of national long-term average of 880 mm. But, even that rainfall - 90 per cent of which is received during the southwest monsoon - is extremely erratic. The rainfall has been in deficit for so many years at a stretch that drought has almost become a permanent feature. For instance, in 2005, a year before the flash floods, Barmer received a scanty rainfall of 102 mm, making it the sixth drought year in a row.

In 2006, rains set in reasonably well, but there was no indication of what was in store. The sand storms in the summer of 2006, many elders in Barmer predicted, could be harbingers of a good monsoon, which local people had been eagerly waiting for. Their experience in the past has shown that bountiful rains follow sand storms that carry around abrasive sand particles (Awasthi, 2006).

The age-old wisdom was spot-on. Rains did come in copious amounts. But their hopes were shattered sooner than later as the showers picked up intensity. After August 19, 2006, many parts of Barmer got flooded as the

Fig. 2: Flood affected area



district got more than 500 mm of rainfall within a week. The situation worsened further as rainwater from neighbouring Jaisalmer district also flowed into Barmer opening up once-defunct paleochannels. The breach of anicuts and check dams meant for conserving water for dry months also contributed to the misery. The surging waters also destroyed a large number of traditional water harvesting structures across the district, making safe drinking water a scarce commodity amidst plenty. According to the statistics available from Rajasthan state government, as many as 485 villages across the district were affected by the heavy rains. However, large scale devastation was confined to a total area of 50 square kilometres, which was completely immersed under water. At places, the water level was as high as 30 feet at its peak.

The 2006 floods may be one of the severest in recent memory. But experts say that Rajasthan has been witnessing an unusual weather cycle of a good monsoon followed by three to four years of drought. Similarly, there is excessive rainfall and flooding once in 75 to 100 years. In the recent past, at least in two years - 1990 (720 mm) and 1994 (600 mm) - Barmer received excessive rainfall. But, both these years, it did not cause a calamity because the rainfall was evenly distributed over the year.

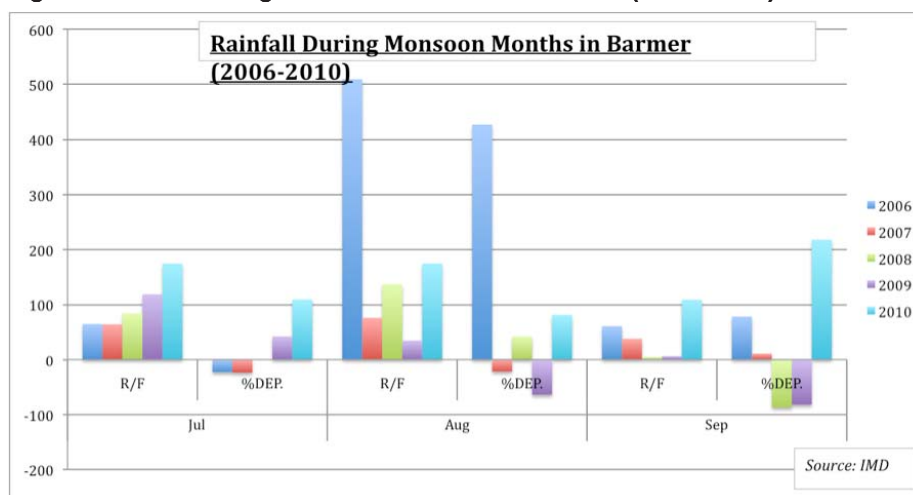
“It is wrong to say that the 2006 flood was unprecedented in the history of Barmer. In the last 100 years, there were 13 floods in the region and they all took the same natural drainage channels,” says Farhad Contractor¹ of the Ahmedabad-based Sambhaav Trust, who played a significant role in getting Malwa, one of the most affected villages in the region back to normal. According to him, what aggravated the situation was the lack of understanding of desert ecology and the blocking of natural drainage channels. Most check dams built in the affected region several years before the calamity occurred burst as they could not withstand the gushing water and further aggravated the situation, Contractor says. All these dams were technically ill-conceived and were not suitable for a desert region like Barmer, remarks Contractor.

¹ Personal communication

The situation got further complicated when the district administration in a knee-jerk reaction decided to pump out flood waters from inundated areas against the wise counsel of experts and environmental activists, who felt that the water should be allowed to seep through and recharge the groundwater table. Good sense finally prevailed, perhaps because the authorities very soon realised that the task was humungous and humanly impossible. They not only dropped the idea but, in discussion with local community leaders also decided to relocate the affected people whose houses were inundated in flood water to higher plains wherever possible. It is another matter that the promised settlements were not built for months and not until villagers started agitating.

The newly formed water bodies were thus left alone and over the months water percolated down and recharged the underground aquifers. “People failed to remember that in desert ecology, water, whether it comes as devastating floods or through bountiful rains, it is really precious. It needs to be preserved to the fullest possible level,” says Contractor. It was unfortunate that many people lost their lives and means of livelihood, albeit temporarily, due to floods. “But I would say it was more of a man-made creation. If those stupidly-built check dams were not there and natural drainage channels were not blocked, things could have been quite different,” Contractor feels. The disaster it seems has had a positive impact. Now, community leaders do not allow new developmental projects in their neighbourhood, without proper scrutiny.

Fig. 3: Rainfall during Monsoon months in Barmer (2006-2010)



The 2006 floods caused additional damage since most houses in this region were built in depressions between sand dunes. Villagers chose to do so because sand dunes work as a shield against sandstorms in normal circumstances. However, this proved to be detrimental as the flood waters first entered and filled up such low-lying areas.

“As water entered most homes in the middle of the night, when people were sleeping, they weren’t left with much choice,” Contractor says.

In the absence of any drainage and negligible percolation, the water remained stagnant for weeks. Most houses, particularly that of poor people, were made of mud and they failed to withstand the surging water. Even the *pucca* houses and other structures in affected areas were not inhabitable as the area remained waterlogged for months.

Many parts of Barmer have huge deposits of gypsum and such deposits could have happened only over hundreds of thousands of years. “Had drainage been effective, gypsum would not have been formed,” says Vijay Kumar Joshi,² a former geologist with Geological Survey of India, who had studied geological features of the region many years ago. The presence of gypsum is an indication that the entire region was part of a lake in the geological past. “It could either be a huge lake or a series of lakes like the salt pans of Rann of Kutch,” Joshi says.

Gypsum is highly soluble in water, but the compound is left behind as sediment as water evaporates. Geologists say another factor that contributed to poor water penetration could be excessive irrigation by canal water.

The Barmer flood watchers also say that the inexperience of local people and that of administration in dealing with such situations, as they have not dealt with such flash floods in the past, also complicated the matter further. Another reason why the impact was felt more was that these villages were very sparsely populated and had very low level of infrastructure facilities, which made access to services difficult.

Lost Livelihoods

The impact that the flood had on human life in the region was manifold. With their homes destroyed and livelihood lost, people were forced to live in temporary shelters provided by the government as well as civil society groups for a long time. With most areas remaining under water for weeks together, if not months, returning to farming or cattle rearing was not an option available to the local people. Similarly hit were non-farming activities. With the floodwaters entering quarries, entrepreneurs were forced to stop mining of gypsum and bentonite for a considerably long period of time, seriously denting the potential of locals earning a livelihood from working in these mines. Needless to say, it shattered the economy of the district.

One community that was particularly hit by the 2006 flash floods was Manganiyar - a great folk singer community of the Thar Desert. Reports say that as many as 600 villages, including Kawas, inhabited by Manganiyars were affected by the heavy rains. For these classical folk singers, who enjoy the patronage of the wealthy Hindu community across the region, not only lost their habitats, but also their quaint musical instruments - handed through generations - to the flood waters.

Despite being largely covered by sand and highly drought-prone, Barmer has a thriving agricultural economy. More than half of its 2.83 million hectare area is cultivated with pearl millet and a legume variety locally known as *moth*

² Personal communication

(*Vigna aconitifolia*) as predominant crops. Most farmers in Barmer are engaged in subsistence farming. Another 7 per cent of the land is used as pastoral land for grazing cattle. About a quarter of the land is non-cultivable and largely remains fallow through the year.

Turning a New Leaf

Like the old saying, this disaster too presented people with new possibilities and newer opportunities. From a sociological point of view, the rigid caste system that once put people in different camps seems to have lost all relevance in the face of disaster. “The days immediately after the flood women across all caste and class cooked meals for each other while men pooled resources for basic needs,” said a report by New Delhi-based NGO SEEDS India (SEED, 2007).

It also gave an opportunity to address issues relating to safe drinking water, sanitation and hygiene. Government and civil society groups not only built new traditional water harvesting and storage structures in many affected villages, but also put an end to open defecation to a large extent by building toilets in new houses meant for flood victims and also by educating them about the need for maintaining a hygienic lifestyle.

Post-floods, there has been vast improvement in the water scenario across Barmer district. While new water bodies, created thanks to impervious layers of gypsum, fullers earth and bentonite clays, ensured near universal access to

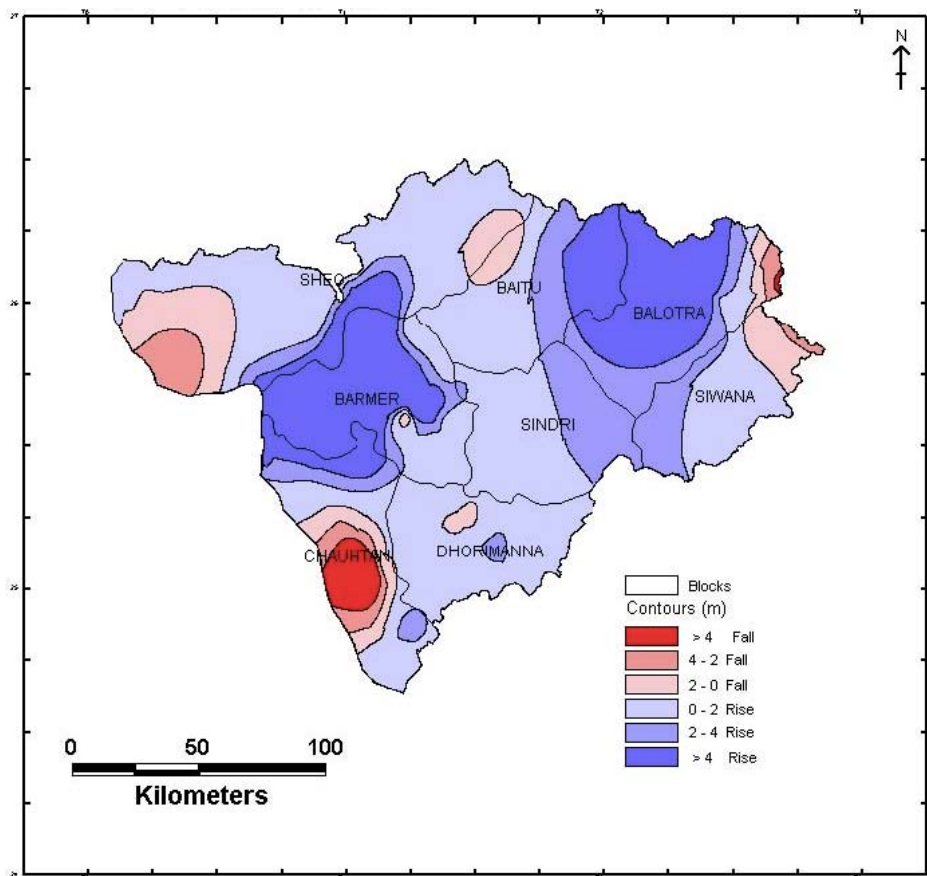


Fig. 4: Groundwater fluctuation map in pre and post monsoon in 2006 in Barmer

water, there has been a substantial improvement in groundwater levels as well. According to a study by the Central Ground Water Board, in two worst-flood-hit blocks - Barmer and Sheo - the groundwater level in the aftermath of the disaster went up by 10 metres. Except in certain pockets, there has been an overall improvement in the groundwater situation in the district.

Improved water availability also meant better avenues for farming. This encouraged many small-time farmers who had migrated to states like Gujarat and Punjab in search of jobs to return to Barmer for cultivating their land. Data available for the State government indicates that in 2007 the acreage under cultivation increased almost by about 18 per cent. While gross cropped area in 2004-05 was 1.55 million hectares compared to a total geographical area of 2.83 million hectares, it increased to 1.79 million hectares in 2006-07. The share of pastures and other grazing land has also more than doubled between 2004-05 and 2006-07 from 7.2 per cent to 15.38 per cent of the total land.

Future Course

The flood has also helped geologists to unearth some evidence about paleochannels believed to have existed in the past. They speculate that the reason why only few villages got inundated while others were spared despite getting equally high amounts of rainfall was probably because these villages fell in the line of these ancient drainage networks. As per past studies (Sridhar, 2008), when a movement of huge mass of water occurs - flood waters as well as that from breached anicuts - it prefers to take the natural course. However, in a semi-arid State like Rajasthan such natural drains are not immediately visible as heavy rains are a rarity. Besides, shifting sand dunes sometimes mask such drains. After a prolonged dry spell, which is not uncommon in a Desert-State like Rajasthan, people knowingly or unknowingly go for settlements in the very same area. Flood fury, such as the one witnessed in 2006, is capable of reactivating such forgotten water channels, which in turn, will carry large volume of water, often engulfing regions that come in their way.

S. R. Jakhar, geologist with the M. L. Sukhadia University in Udaipur, thinks that such a hypothesis could explain why a large-scale devastation fell on Kawas during the 2006 floods. In a paper presented at the 31st Asian Conference on Remote Sensing, held at Hanoi, in Vietnam, in November 2010, Jakhar³ said that Kawas village, one of the worst affected areas in the 2006 floods, is situated on a paleochannel of a long-forgotten tributary of the Luni river, called Lik. Now dried up completely, Lik used to originate from rhyolitic mounds of Bhaniyana village in Jaisalmer and traverse more than 100 kilometres before it emptied into the Luni river. Due to scarcity of rainfall in the desert, the river has dried up and is on the verge of extinction. "With lapse of time the meandering river lost its identity as its course is obstructed by the moving sand dunes. The human habitation has now encroached the site of the old and abandoned channel of the Lik river," Jakhar says. He calls for a detailed survey of the riverbed and wants settlements that have encroached the riverbed to be shifted to safer places so that future calamities can be averted.

³ S. R. Jakhar, Desiccated Lik river of the Thar desert: A potential site for flood fury, Rajasthan, western India, <http://www.a-a-r-s.org/acrs/proceeding/ACRS2010/Papers/Oral%20Presentation/TS18-5.pdf>

Re-activation of similar extinct channels was speculated in Malwa too, a village which witnessed the second highest level of casualties after Kawas. Many experts, however, feel that flash floods are not always a bad proposition for arid regions. By making abundant quantities of water available in a short span of time, such events help provide much needed water resources in arid regions. According to a 2005 study, western Rajasthan witnessed 9 moderate and 19 severe floods as compared to 21 moderate and 4 severe floods in eastern Rajasthan. It is interesting to note that severe floods occur more frequently in the drought-prone western region, suggesting that an opportunity exists to convert a part of the flood water into groundwater recharge by constructing a large number of groundwater recharge structures, which are non-existent now (Narain *et al*, 2005). Besides, they help flush out salts and other chemicals from desert soils, which are left behind by evaporating water. This is extremely important for sustaining the productivity levels of desert soils (Sharma, 1997).

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Chapter 9

Mumbai under Floods

A Natural Disaster or Manifestation of an Underlying Conflict in Mumbai City's Skewed Urban Planning?

Nidhi Jamwal

Mumbai: A City of Paradoxes

Mumbai, capital of the western Indian State of Maharashtra, is the fourth most populous city in the world with a population of over 20.5 million. The metropolis is also a rich commercial hub generating five per cent of India's GDP, and accounting for 25 per cent of the industrial output and 70 per cent of its maritime trade.¹ Because of its growth potential, Mumbai attracts a large migrant population. For instance, a study by Mumbai-based Tata Institute of Social Sciences found that around 8.6 lakh migrants came to Mumbai between the year 1995 and 2000.²

Fig. 1: The districts of Mumbai (Source: <http://upload.wikimedia.org/wikipedia/commons/5/57/Mumbaicitydistricts.png>)

Mumbai consists of two distinct regions: Mumbai City district (Island City) and Mumbai Suburban district. The total area of Mumbai is 603.4 square kilometre (sq km). Of this, the Island City spans 67.79 sq km, while the Suburban district spans 370 sq km, together accounting for 437.71 sq km under the administration of Municipal Corporation of Greater Mumbai (MCGM). The remaining area belongs to Defence, Mumbai Port Trust, Atomic Energy Commission and Borivali National Park, which are outside the purview of MCGM (see Figures 1 & 2).³

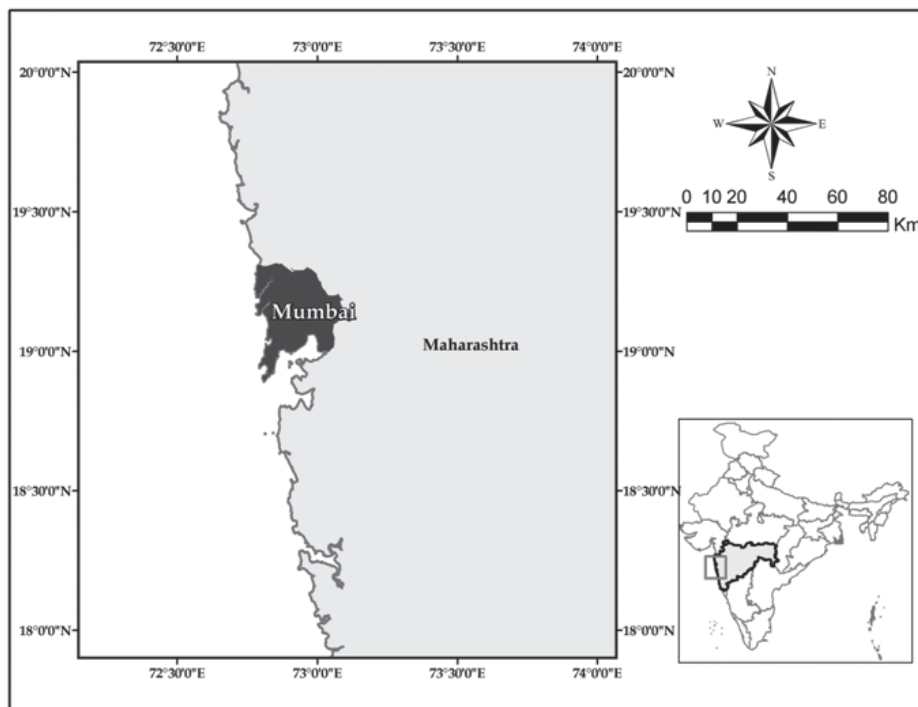


¹ <http://en.wikipedia.org/wiki/Mumbai>

² Viju B. 2008, Mumbai has large number of migrants from rest of Maharashtra as well, The Times of India, http://articles.timesofindia.indiatimes.com/2008-11-05/mumbai/27921104_1_indian-migrants-migration-mumbai

³ <http://en.wikipedia.org/wiki/Mumbai>

Fig. 2: Location of Mumbai in Maharashtra, India



Mumbai is also a city of paradoxes. It has the highest GDP compared to any city in South, West or Central Asia and yet over 55 per cent of Mumbai's population lives in slums. These slums occupy only 12 per cent of the city's land area, but accommodate more than half of its total population.⁴ Dharavi, Asia's second largest slum, is also located in the heart of Mumbai with a population of over one million. This translates into a very high population density of 270,000 - 450,000 inhabitants per sq km (average population density in Mumbai is 29,500 per sq km).^{5,6}

This contradiction in the city's growth is a result of skewed urban planning and neglect of its poor people. The conflict also reflects in the manner the city's natural resources are used or misused, including its water systems that are heavily built upon and almost a thing of the past. The conflict runs so deep that boundaries between 'legal' and 'illegal' are often blurred. A project or an activity termed 'illegal' in certain context turns 'legal' within another context. And this conflict got reflected when Mumbai faced the deluge on July 26, 2005, commonly called as 26/7 (see Box 1).

⁴<http://www.indiamarks.com/guide/Slumdog-Millionaire-A-Real-Look-into-Mumbai-s-Slums/9260/>

Box 1: A Night *Mumbaikars* Will Never Forget

From about 12.30 pm on July 26, 2005, heavy rains lashed Mumbai city and did not stop until the next morning (5.30 am on July 27). The rainfall intensity was so high that within few hours areas in suburbs such as Kurla, Kalina, Andheri, Chembur, Govandi, and Malad were completely flooded. At least one third of the area of Mumbai was flooded. Phone lines were lost or disrupted, electricity supply was cut, Mumbai airport was shut down, local trains came to a halt, and lakhs of people were stranded on the roads, in offices, at train stations wherever they were. Some areas experienced

⁵ <http://www.patriciasendin.com/2011/03/dharavi-mumbai-future-of-asias-second.html>

⁶ Katia Savchuk, Matias Echanove & Rahul Srivastava 2009, Intro: Lakhs of Residents, Billions of Dollars, http://dharavi.org/B._Introduction

landslides, whereas tenements in low lying areas were flooded (in a few places up to second floor of the building). In this flash-flood, the city received 944 mm of rain within 24 hours, a record in itself. Mumbai, thus, was literally cut off from the rest of the world.

In this extreme hour of crisis, both the government and the civic authority was found missing. What came to people's rescue was the undying spirit of fellow *Mumbaikars*. Hundreds of ordinary *Mumbaikars* (strangers to each other) risked their lives to rescue people. People from different communities (even in communally sensitive areas) forgot their differences and came together in their hour of need. Office goers who were stranded on the road were offered tea and biscuits by neighbourhood people.

Mumbai Marooned: An enquiry into Mumbai Floods 2005, prepared by a Citizens' Commission, has documented such stories of valour and courage. For instance, Aslam Merchant received a distress call at 4.30 pm on July 26 and called a rally in Dongri at 6 pm. Within three hours, he and his fellow volunteers had raised Rs. 50,000 in cash and Rs. 1.5 lakh worth of provision. For the next ten days, Merchant and his volunteers carried out repeated rescue missions at Kalyan, Mumbra and Panvel. While wading through waist-deep water, snakes clung on to their legs, but that did not deter them from carrying out the rescue work. "It was my duty to lend a helping hand," Merchant told the Commission.

However, the relief and rehabilitation efforts by the government were both delayed and inadequate. There were anomalies in official aid distribution. According to the Commission's investigation, up to one-fifth of the aid was unaccounted for.

Mumbai's Lost River System

Till flood waters inundated Mumbai on July 26, 2005, neither its citizens nor the authorities nor the government had ever heard of any river flowing through the metropolis. They were only aware of dirty *nullahs* (open drains) that carried the city's untreated sewage and wastewater into the Arabian Sea. It was only after facing the worst ever floods in 2005 - with the city's suburban rail system inoperable for 18 hours, all communication lines snapped, electricity supply cut, people marooned, 10-15 feet deep water, shortage of drinking water, city's airport shut down, State government declaring two days holiday - and after literally being cut off from the rest of the world, that the government and the *Mumbaikars* learnt about the existence (and fury) of the unique local rivers and rivulets within Mumbai.

Almost overnight, Mithi river, a 15 km long river that is a confluence of tail water discharges of Powai and Vihar lakes, became the buzzword and got blamed for flooding the city. Authorities also became aware of other small 'rivers' that pass through the suburbs of Mumbai such as Oshiwara river, Dahisar river, etc. These rivers have been an integral part of the city's natural drainage system (see Figure 3). "These rivers are Mumbai's natural water system and help drain off excess water into the sea. But, they have turned

into open sewers, without any riverbank,” said Girish Raut, a local environmentalist. Post 26/7, the Mumbai Metropolitan Region Development Authority (MMRDA), a planning body for the entire region, launched a comprehensive study of five rivers - Mithi, Dahisar, Poisar, Oshiwara and Ulhas (Kalyan).⁷ But even today these rivers are polluted and encroached upon (see Box 2).



Fig. 3: Mumbai's Mithi river and other river systems

(Source: <http://upload.wikimedia.org/wikipedia/commons/6/69/River-Geography-Mumbai.png>)

⁷ Clara Lewis, 2005, MMRD studying 5 rivers, The Times of India, <http://timesofindia.indiatimes.com/city/mumbai/MMRDA-studying-5-rivers/articleshow/1240005.cms?curpg=1>

Box 2: Mumbai's Rivers or Open Sewers?

Mithi river originates from the overflow of Vihar Lake and also receives the overflows from Powai Lake about 2 km later. It flows for a total of 15 km before meeting the Arabian Sea at Mahim Creek. It is a natural drainage channel for Mumbai Suburbs carrying excess waters during the monsoons.

Oshiwara river begins in the Aarey Milk Colony, cuts through the Goregaon hills, before emptying into the Malad Creek. On its way, it picks up industrial effluents and sewage from various colonies, slums and industrial estates. Most of the call centres in Malad area of Western Suburbs are built on reclaimed ground at the mouth of this river.⁸

Dahisar river originates from Tulsi Lake in Sanjay Gandhi National Park and flows through the northern suburbs, finally emptying into Manori Creek. It is highly polluted with the dumping of industrial effluents from workshops and sewage from slums and storm water drains.⁹

Poisar river: This river also begins in the Sanjay Gandhi National Park, but empties into the Marve Creek. It is a small stream, which is highly contaminated because of industrial effluents and sewage.¹⁰

Mithi's Journey: From River to Stinky *nullah*

Mithi river was once a healthy river system, created from the outflow of Vihar and Powai lakes. Both these lakes were a source of drinking water to the city for many years but, because of growing pollution these were abandoned as drinking water supply sources by early 1990s. And along with the contamination of these lakes, Mithi's destruction began.

With the rapid growth of the city in the last two decades, the once extensive mangrove ecosystems along the Mithi river and the Mahim creek were destroyed. Hundreds of acres of land was reclaimed for construction. According to Concerned Citizens' Commission: An Enquiry into the Mumbai Floods 2005, Mumbai has lost about 40 per cent of its mangroves between 1995 and 2005, some to builders and some to encroachment (slums) and garbage dumps. Much of the Bandra-Kurla Complex (BKC) has been created by replacing such swamps and mangrove areas.¹¹

In its report, the Commission noted that the mouth of the original Mithi river was once several hundred metres wide. Today, due to a number of interferences, the mouth is only about 40 metres wide. The river's catchment area covers about three-quarters of Mumbai, from the Sanjay Gandhi National Park in the north to Dadar TT in the south. The Commission concludes that "vast reclamation of land over the years for purposes such as BKC, the Bandra-Worli Sea Link, the unabated construction of unauthorised settlements along the banks and the 'channelisation' of the river are three main interventions that have interfered to varying degrees with the Mithi's free flow, causing the destruction witnessed on 26/7. Each of these interventions is an

⁸ http://en.wikipedia.org/wiki/Oshiwara_River

⁹ http://en.wikipedia.org/wiki/Dahisar_River

¹⁰ http://en.wikipedia.org/wiki/Poisar_River

¹¹ <http://cat.org.in/files/reports/Mumbai-Marooned.pdf>

indication of the faulty planning that has become the norm in Mumbai, either because of skewed priorities or vested interests.”¹²

Poor Drainage and Dilapidated Sewerage: Ready Recipe for Floods

As per the MCGM, Mumbai’s ‘official’ Storm Water Drainage Network (SWDN) consists of road drains, minor *nullahs*, major *nullahs* and the outfall. All are interlinked, and finally they empty either directly into the Arabian Sea or into the four creeks that finally open into the Arabian Sea. The Island City is extremely privileged. It has 115 storm water drain outfalls. In contrast, the Western Suburb has 43 and the Eastern Suburb a paltry 28 - the Mithi river carries most of the discharge from these. Suburbs were developing so rapidly that the municipality could not provide proper drainage. Also, low-lying areas and old ponds have been filled to make multi-storey buildings and shopping malls. So, the natural drainage system of holding ponds and water channels, no longer exists. Flood gates - which close when the tide reaches 4.6 m high, or in heavy rainfall, to avoid a seawater backflow - are located only at Love Grove (Worli), Cleveland Bunder (Worli), and Haji Ali. Flooding is but natural.¹³

Experts claim Mumbai’s drainage problem is completely an effect of the construction and reclamation-mania. The quantity of water falling on the city has not decreased, but the space for water to flow has, tremendously. Earlier, almost 50 per cent water would seep into the ground, drastically reducing the total volume to be managed. But today the whole city is cemented. Hence, whenever it rains, the ground cannot absorb the water. Most *nullahs* and drains are encroached upon and choked. They, too, cannot drain off excess water.

MCGM’s approach towards the problem of flooding is lackadaisical. Way back in 1992, it conducted an elaborate study of Mumbai’s drainage system. The Brihanmumbai Storm Water Drainage (BRIMSTOWAD) report recommended to: divert dry weather flow to sewage pumping station; provide storm water pumping stations; increase drain capacity; improve floodgates; repair dilapidated drains; augment railway culverts; and deepen and widen *nullahs*. At that time the cost of the project, to be implemented over 12 years, was Rs. 616 crores. By July 2005, when Mumbai was flooded, the cost had shot up to Rs. 1,200 crores. And it is estimated that the project now costs Rs. 3,535 crores.¹⁴ Post 26/7, the Indian government approved Rs. 1,200 crores for BRIMSTOWAD project, but the MCGM has failed to raise rest of the finances and the project remains incomplete.¹⁵

Drainage problem aside, Mumbai’s 1,400 km long sewerage network is no better. It comprises 41 satellite pumping stations and seven major pumping stations. Sewage is collected in sewer lines through gravity and conveyed to satellite pumping stations. From here it is pumped to the main Sewage Pumping Station (SPS). The SPS sends untreated sewage to a sewage treatment plant of a zone for treatment and final disposal into the sea. MCGM, with financial support from the World Bank, is implementing an integrated water supply and sewerage project, and has prepared a sewerage master plan till 2025.

¹² <http://cat.org.in/files/reports/Mumbai-Marooned.pdf>

¹³ <http://www.downtoearth.org.in/node/10141>

¹⁴ <http://www.indianexpress.com/news/brimstowad-price-tag-swells-to-rs-3-535-cr/795935/>

¹⁵ <http://urbanindia.nic.in/programme/uwss/Annex-2.pdf>

However, the present sewerage covers only 60 per cent of Mumbai, leaving out slums and some upcoming residential and commercial complexes. The other 40 per cent of untreated sewage makes its way into the *nullahs* and the local river systems, including Mithi. These rivers finally empty the untreated polluted sewage into the Arabian Sea. Experts claim this is a typical development syndrome most urban cities across the world are facing. Cities are growing at such a rapid pace that basic infrastructure has failed to keep pace with it. However, when it comes to flooding and pollution, the blame is conveniently shifted towards the slums.

This became amply clear post 26/7, when the State government and MCGM went on an over-drive to clear slums along the Mithi river. For instance, in April 2006, the corporation razed 276 slum units at Mahakali Nagar, near Powai, as they were 'obstructing the flow of Mithi river'. Without prior intimation, the slum houses were demolished and slum-dwellers were not given any time to collect their belongings, which were buried under the rubble. However, both the corporation and the police did not take any action against a seven-storey building (under construction), next to the Mahakali Nagar slum, which was standing right on the Mithi's river bank and was 'sanctioned'. No wonder slum-dwellers were angry. "If our slums are being demolished because they are affecting the Mithi river, what about these buildings around us? If the state government is serious about flood control, it should demolish all the buildings so that Mithi gets back its original width," said Suhit Sharma, a resident of Mahakali Nagar whose house was demolished.¹⁶

Slum demolition drives have still not stopped. Slums across the city are facing demolition threat sometimes under the pretext of river widening schemes, and sometimes to make way for 'development' projects. 'Legal' encroachments, however, continue to flourish.

Legal Encroachments!

Illegal encroachments aside, a close look at the city's growth shows that the government has allowed and promoted 'legal' encroachment on riverbanks. Over a period of time, Mithi's course has been officially changed, which has affected the river's capacity to drain excess rainwater into the sea (see Fig. 4: Mithi's changed course). Two major 'legal' encroachments on Mithi riverbed are the existing Mumbai airport and the Bandra-Kurla Complex. These projects faced severe criticism post 26/7.

It would be no exaggeration to call Bandra-Kurla Complex (built near the mouth of Mithi river) an urban planning disaster. Way back in mid-1990s, this was acknowledged by the MMRDA, but it still went ahead with the project. The MMRDA's 'Environmental Review of Bandra-Kurla Complex' in 1996 Mumbai states: "In the early days, the low-lying marshy land on either side of the river served as the flood absorption reservoir during the monsoon. The indiscriminate reclamation of low lying land over the years and dumping of solid waste by the BMC progressively reduced the flood absorption capacity of the Mithi River basin, thereby causing flooding of the adjoining areas including major transport arteries such as LBS Marg, part of Western Express Highway

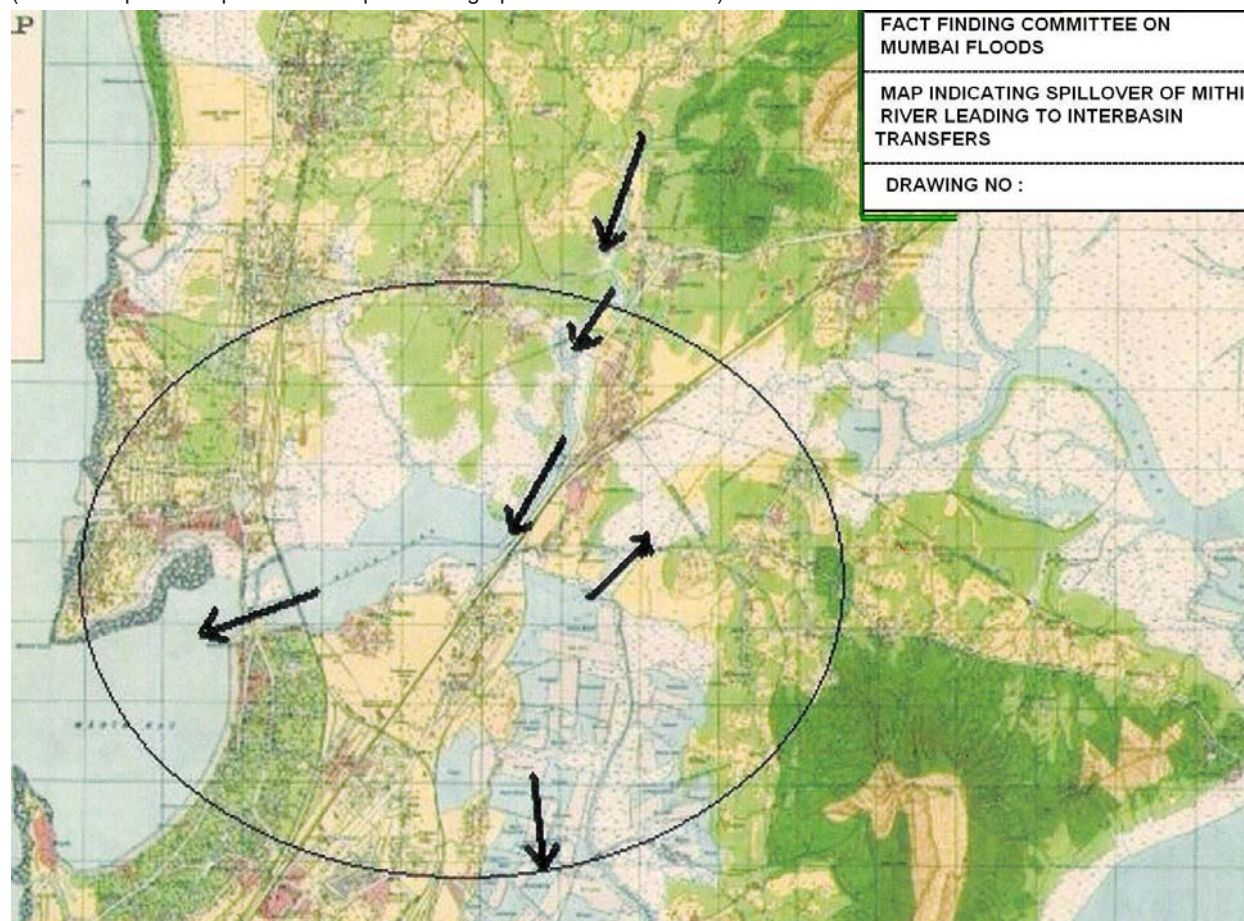
¹⁶ <http://www.downtoearth.org.in/node/7807>

and the Central Railway tracks.” Yet despite this accurate analysis of the reasons for upstream flooding, the BKC, which itself was involved in large-scale reclamation, was proceeded with.¹⁷

Fig. 4: Mithi's changed course

Note: The arrows on the right side show how earlier Mithi had two additional draining points into the sea. These no more exist and have been built upon.

(Source: <http://www.spaenvis.nic.in/pdfs/monographs/flood-hazard.PDF>)



Between 1994 and 1996, the G-Block of this complex was reclaimed. According to experts, this was a blatant violation of the then Coastal Regulation Zone (CRZ) Notification, 1991. In a presentation, Bulu Saldanha, member of Action for Good Governance and Networking in India (AGNI), points out that 250 acres out of the total 730 acres of wetland with jungle that have been reclaimed, fall in the G-Block of BKC. MMRDA has built its head office on the course of the river in the E-Block of the complex, (see Figure 5). Not only that but the gap between the coffer dam walls, which are located on the west of Mahim Causeway, were narrowed for the Marine Outfall Project by MCGM. Hence, the outflow of Mahim Creek has been restricted. Consequently, in 1996 severe floods were experienced in the Kurla, Kalina, Sion and Matunga areas.¹⁸

Experts have also raised serious questions on the ‘development’ approach adopted by MMRDA. The authority has adopted a process of ‘channelisation’

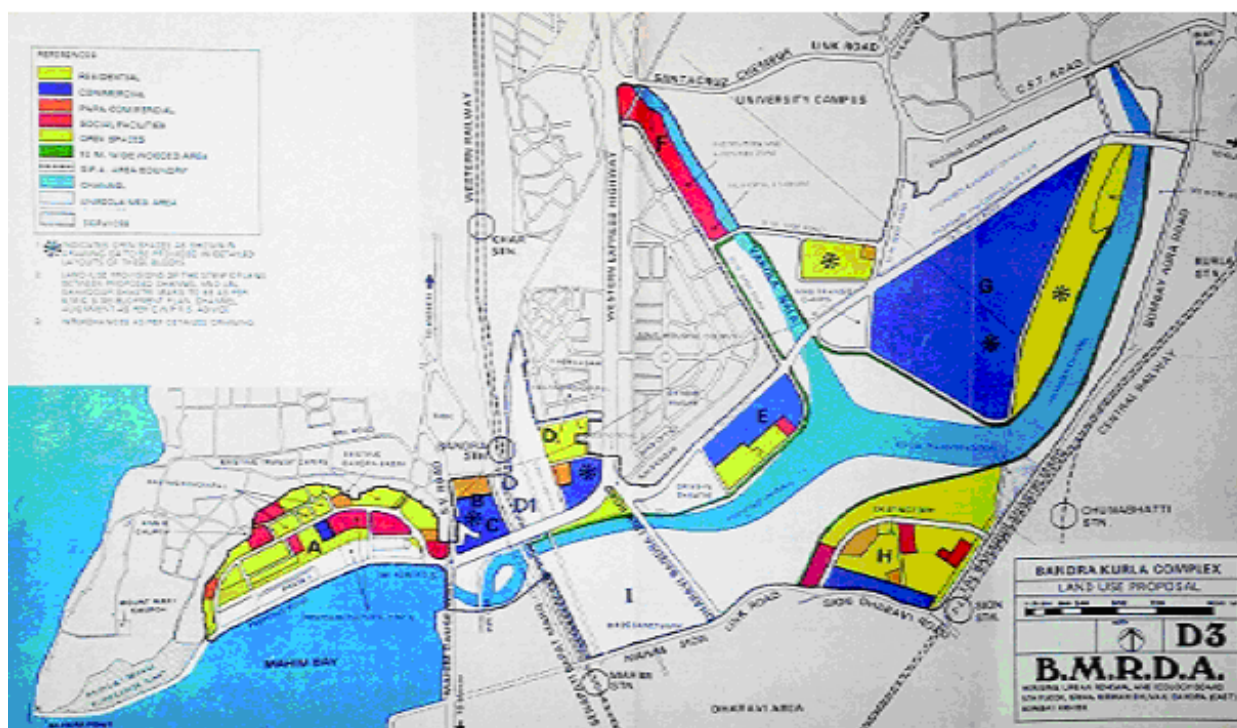
¹⁷ Mumbai Marooned: An Enquiry into Mumbai Floods 2005

¹⁸ <http://dccbombay.tripod.com/id10.html>

whereby the original course of river is changed artificially through the creation of bunds on the river sides. The part of Mithi river that flows into the Mahim Creek has been suppressed through its reclamation. As a result there is no natural mixing of river with sea, which is a basic characteristic of any estuary. This amply proves the attitude of treating Mithi river as a gutter.¹⁹

Fig. 5: Location of Bandra-Kurla Complex on Mithi riverbed

(Source: Mumbai Marooned: An enquiry into Mumbai floods 2005, p. 49)



Apart from BKC, the existing Mumbai airport also has committed violations. For instance, the authorities are trying to extend the runway and in doing so they have trained Mithi river, made it flow in a channel by taking two sharp (90 degrees) turns. Even a layperson understands that a river never makes a sharp 90 degree turn! No wonder then that Mumbai airport faced the wrath of Mithi's fury on July 26 when the river breached the airport wall and flooded the entire runway, leading to closure of the airport.

Way Ahead

According to a Monograph on flood hazard in urban India, which is a case study on Mumbai floods 2005 prepared by New Delhi-based School of Planning and Architecture, "Watershed based development planning can ensure sustainable development of urban habitat and security against deluges as occurred on July 26, 2005". The first step should be restoration of existing degraded rivers and river-banks to initiate recovery of the urban ecosystem. There is an urgent need to provide river flushing system to initiate rejuvenation of river channels. Apart from this, degraded urban ecosystems including lakes, ponds, rivers, creeks, and coastal zones need to be rejuvenated. Mangrove ecosystem needs to be protected, and so do the hills, slopes, lakes and ponds in the Mumbai region.

¹⁹ <http://dccbombay.tripod.com/id10.html>

Apart from these steps, MCGM needs to work on improving city's solid waste management and upgrade its sewerage, which was constructed during the British period. Forty per cent untreated sewage that makes its way into the various rivers and rivulets need to be collected and treated at STPs before discharging into the sea. There is an urgent need for Mumbai to adopt water recycling projects to reuse water. At present, Mumbai is being supplied with water (total water supply of 3,470 million litre per day (mld) as against a demand of 4,250 mld) from lakes that are located some 120 kms away from the city.²⁰ This not only is a costly and unsustainable practice but, a lot of water is wasted during transportation (as against a water loss of 20 per cent in other states, Mumbai loses almost 40-50 per cent water due to pilferage, leakages, faulty meters).²¹ Also, 80 per cent of supplied water turns into wastewater and is thrown into the sea. MCGM has drawn up plans to recycle and reuse treated wastewater, but these projects are yet to be implemented.

MCGM needs to develop a participatory process of preparing a Development Plan (DP) and involving citizens in the process. Plans must take into account the natural drainage system. Rules such as CRZ need to be followed and implemented both in letter and spirit. Water channels and rivers should not be diverted at the whim of a project, and activities of blasting hills must be regulated. In a positive move, some citizen groups and NGOs have already started the process of formulating their own version - citizens' version - of Mumbai's next DP. Once the citizens' plan is complete, it will be presented to the MCGM and a campaign will be launched to ensure people's voices are heard and incorporated in the new DP 2014-2034.²²

NGOs like CitiSpace are running campaigns on protection of open spaces, which are not only the city's lungs but also act as holding ponds during heavy rainfall. At present Mumbai has only 1.95 sq m open space per capita, which is worse even than the world's most populous metropolis Tokyo and New York. The United Nations Food and Agriculture Organisation (FAO) prescribes a standard of 9 sq m per capita.²³

Incidents like 26/7 also bring to the fore importance of rescue and relief operations, and disaster preparedness. For instance, Mumbai had a Disaster Management Plan (prepared in 1998), headed by the Additional Chief Secretary (Home), listing different kinds of calamities (floods, fires, landslides, industrial disasters, etc). However, when floods inundated Mumbai on 26/7, this plan did not work and was a complete failure. Investigations revealed that this plan was not printed until 2000, and when floods hit Mumbai, most departments did not even have a copy of this plan. It is, thus, crucial to prepare management disaster plans with complete support of citizens, ward level civic offices, and all concerned departments. Local NGOs must be made part of rescue and relief operations. Such organisations must be given regular training in disaster preparedness and management.

The ward level plans, as part of 1998 Mumbai Disaster Management Plan, do not contain any chapter on mitigation strategy. This lacuna needs to be

²⁰ <http://globalnewsdiscussion.com/index.php?topic=20.0>

²¹ http://www.dnaindia.com/mumbai/report_water-loss-in-mumbai-at-50pct-is-highest-in-country-report_1490423

²² http://articles.timesofindia.indiatimes.com/2011-04-27/mumbai/29478486_1_development-plan-survey-fsi

²³ <http://www.mid-day.com/news/2011/nov/071111-Mumbai-has-the-least-open-space-for-citizens.htm>

addressed immediately. Such plans should include specific measures proposed to be taken to remove bottlenecks and to improve civic infrastructure to deal with flooding.

Keeping these facts in perspective and the images of 26/7 still fresh in our mind, both the government and the citizens need to work together and address the challenges that Mumbai faces in this age of global warming, rising sea level, and climate change. Otherwise, we must budget for many more 26/7 type disasters.

Flood in Krishna Basin

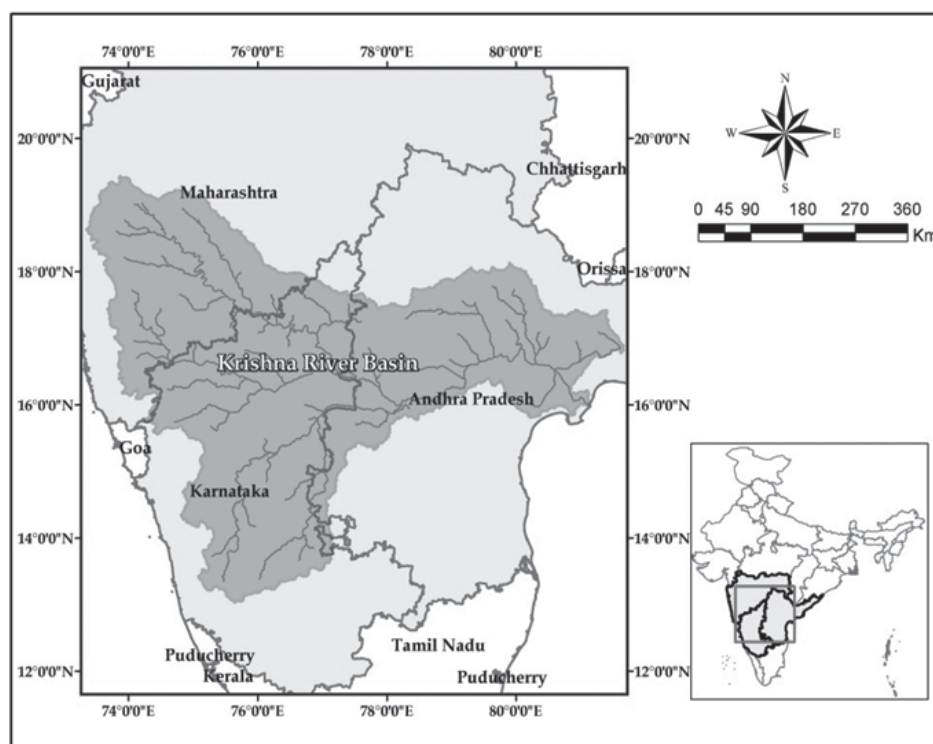
Institutional Responses to Flood Regulation

Narendra V. Killada, Shrinivas Badiger and Bejoy K. Thomas

Introduction

The October 2009 flood in Krishna river basin is one of the worst disasters that we have seen in the recent past. Several districts in the States of Karnataka and Andhra Pradesh were severely affected by this flood, which primarily was a result of heavy, unprecedented rainfall over the entire basin from 29th September to 3rd October 2009. The high intensity of rainfall resulted in flash floods in several smaller catchments and sub-basins of the Krishna river. Fifteen districts in Karnataka and thirteen districts in Andhra Pradesh were severely affected by the flood, which took the toll of 319 lives¹, flattened more than a million houses, and destroyed vast areas of standing crops. There was severe damage to public infrastructure including roads, culverts, bridges and embankments leaving several villages stranded and hindering rescue operations.

Fig. 1: Location of Krishna Basin in India



¹ 229 deaths were reported in Karnataka and 90 in Andhra Pradesh. 21.92 Lakh hectares of crop land was damaged in Karnataka and 22.6 lakh hectares in Andhra Pradesh. 6,55,484 houses were damaged in Karnataka and 2,59,095 in Andhra Pradesh. The damage to livestock was also very high with 7,882 cattle deaths in Karnataka and 48,686 in Andhra Pradesh. The total damage in Karnataka was estimated at INR 18,568.25 Crores and INR 12,455.75 Crores in Andhra Pradesh (GoK, 2009 and GoAP, <http://disastermanagement.ap.gov.in/website/history.htm>, accessed on 30 December, 2011).

The three riparian States of Maharashtra, Karnataka and Andhra Pradesh, through which Krishna flows, have built small, medium and large reservoirs across the catchment to tap the water for irrigation, power generation and domestic water supply. It was pointed out that the intensity of floods could have been reduced if the reservoir levels were managed effectively. The downstream State of Andhra Pradesh argued that the upstream Almatti and Narayanpur reservoirs in Karnataka released water without adequate notice (Hegde, date unknown), resulting in the backwaters of Srisaillam reservoir in Andhra Pradesh extending into the town of Kurnool, which had never before seen a flood of that magnitude nor was prepared to deal with it. Observers have, on the contrary, questioned why the release from Srisaillam reservoir in Andhra Pradesh to the downstream Nagarjuna Sagar reservoir was delayed in the aftermath of the rainfall (Ramachandraiah, 2011: 435). Thus, on the one hand, storage and release of water from the reservoirs remain a contested issue where multiple economic and political interests overlap and on the other, it is important that the institutions, governance structures and the local communities in the region prepare for and adapt to flood events in the future.

While this debate has been controversial with political connotations sparking the inter-state water sharing debate, there has been little attempt to look at available data on what actually happened during the five days of the disaster, reflect on what went wrong and think forward to introducing specific measures for disaster preparedness. This case study attempts to do this using empirical analysis, field visits and interviews with affected communities, government agencies, local formal and informal institutions and offer some insights on the institutional aspects of dam operations and flood management. Even though the flood might not have been completely averted, we argue that a timely and proactive response would have reduced the severity of flood, both in terms of magnitude and duration, and its impact on the affected communities. In this article, firstly, we provide a brief overview of the events that led to the flood. We then examine the operation of reservoirs and compare it with an empirical simulation exercise involving an alternate strategy of reservoir operation. Finally, we discuss the complexities of reservoir management and flood control, and the need for disaster risk reduction strategy by combining results of our simulation exercise with field observations and assessment of institutional responses.

The Chronology of 2009 Floods

The geographic setting of this case study is best represented and demarcated by the major dams built across Krishna and Tungabhadra in Karnataka and Andhra Pradesh. The map (Figure 2) shows the major dams including Almatti and Narayanpur (Tungabhadra dam) in Karnataka, and Srisaillam, Nagarjuna Sagar and Vijayawada (Prakasam barrage) in Andhra Pradesh.²

² We have used the popular nomenclature instead of the official nomenclature for the convenience of the readers.

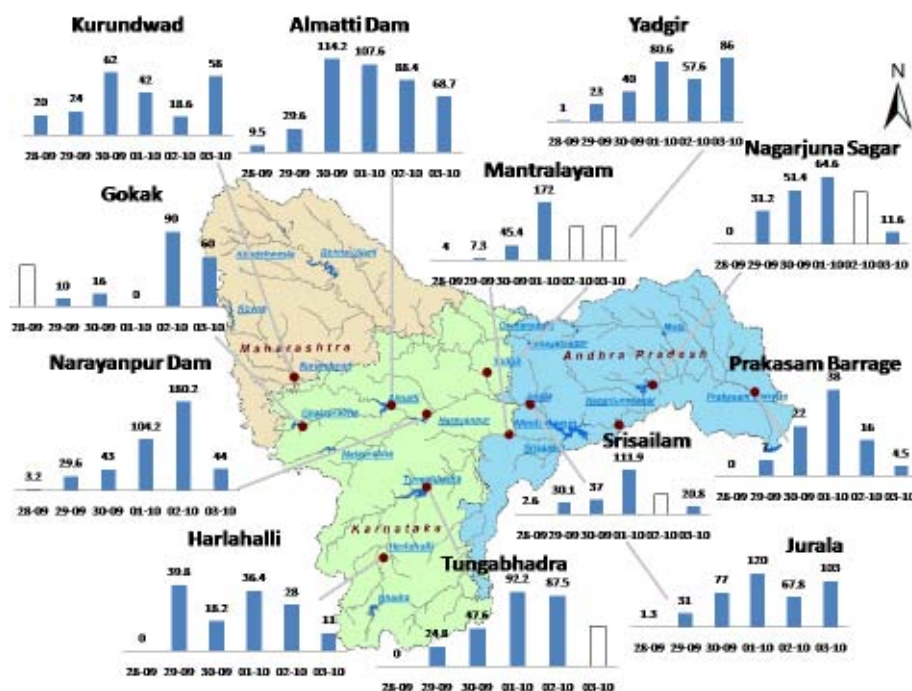
³ Northern Interior Karnataka region covers several districts including Bidar, Bellary, Dharwad, Bagalkote and Bijapur.

The entire Krishna basin, particularly the lower parts of the basin, constituting the Northern Interior Karnataka³ and South-western Andhra Pradesh received extremely high rainfall from 28th September to 3rd October 2009. The region is typically characterized by frequent droughts and the average annual rainfall in most of the districts varies between 600 - 800 mm. Sudden downpour of

intense rain storms began on 28th September and took the form of cloud burst resulting in heavy and high intense rainfall from 29th September to 3rd October. The observed cumulative rainfall in the catchments of these reservoirs during these six days was much higher than even the normal monthly average rainfall (GoAP, 2009; GoK, 2009).

Fig. 2: Map of Krishna basin with major dams and rainfall from 28th September to 3rd October, 2009

(Source: (1) Rainfall data: Bulletins of Central Water Commission, Lower Krishna Division (GoAP, 2009). (2) Map: Adapted from the map produced by International Water Management Institute (IWMI) <http://krishna-basin.iwmi.org/> (accessed on 30 December, 2011)).



The average annual rainfall for Mehboobnagar and Kurnool districts in Andhra Pradesh was 603 mm and 670 mm respectively. Several mandals⁴ in both the districts received rainfall ranging from 300 mm to 560 mm over four days between 30th September and 3rd October (GoAP, 2009). The six days' rainfall from 28th September to 4th October in Northern Interior Karnataka when compared with the week's rainfall from 1970 showed a +555% departure from the normal (GoK, 2009). The previous event of highest departure occurred in 1994, which was +221%. Raichur district in Karnataka received the highest rainfall of 403 mm during this period and it was about nine times the normal. However, rainfall of this high magnitude is not totally unfamiliar to this region as several places received even higher rainfall at least once in the previous century⁵ (GoK, 2009).

The heavy rains resulted in rapid swelling up of the entire stream network because of which even smaller streams and rivulets carried high inflows into the major river bodies. Tungabhadra river carried an inflow of 900,000 cusecs⁶ against its maximum discharge capacity of 400,000 cusecs on 2nd October (Ramachandraiah, 2011). Hundri river which joins Tungabhadra on the

⁴ A 'mandal' is an administrative sub-division of a district that comprises of a number of villages.

⁵ For instance, Hungund in Bagalkote district recorded 163 mm rainfall in 24 hours on 2nd October, 2009 which is the second highest recorded in a day, highest being 182.8 mm recorded on 8th April, 1937 (See, GoK, 2009).

⁶ Cusec or cubic feet per second, is the most commonly used unit for measurement of flow.

outskirts of Kurnool town carried an inflow of 200,000 cusecs, four times greater than its maximum discharge capacity of 50,000 cusecs on 2nd October between 10 am to 1 pm (Ramachandraiah, 2011).

Fig. 3: Flooded streets in central Kurnool

(Source: Authors)



Fig. 4: Local NGO volunteers rescuing flood victims in small fishing boats

(Source: Authors)



Fig. 5: Damaged weir of a local tank (Source: Authors)



All the reservoirs received very high inflows in an increasing trend till 3rd October. Srisaillam reservoir received record inflows of the order of 2,500,000 cusecs from 8 pm on 2nd October to 4 am on 3rd October which created havoc as the maximum discharge capacity of the reservoir at Full Reservoir Level (FRL) is only 1,110,300 cusecs (GoAP, 2009). The available storage in reservoirs, if created, could have greatly helped in moderating the flood by providing the storage cushion for peak inflows. To create this storage, releases from the reservoir should have been initiated immediately and increased gradually after the forecast warnings of heavy storms across the basin were communicated. However, there was no storage available in all the reservoirs except at the Nagarjuna Sagar to facilitate such flood moderation, as all of them stored water very close to the FRL. Table 1 shows the reservoir levels of the major dams from 29th September to 4th October.

Table 1: Reservoir Levels at Various Dams from 29th September to 4th October, 2009

Dam/Reservoir	FRL (meters)	29 September	30 September	1 October	2 October	3 October	4 October
Almatti	519.68	519.60	519.60	519.56	519.35	518.70	518.80
Narayanpur	492.25	492.11	492.17	491.55	490.44	490.68	490.00
Tungabhadra	497.74	497.74	497.72	497.73	497.65	497.63	497.48
P.D. Jurala	318.52	317.70	317.75	317.75	317.15	317.60	316.65
Srisaillam	269.75	269.50	269.55	269.63	268.70	272.70	272.83
Nagarjuna Sagar	179.83	162.95	163.46	165.20	172.76	176.17	178.16

Source: Bulletins of Central Water Commission, Lower Krishna Division (GoAP, 2009)

Maintaining the reservoir very close to FRL at Srisaillam proved to be fatal with severe flooding in Alampur mandal, Kurnool town, and surrounding villages as a result of gradual and prolonged flow accumulation in the reservoir immediately downstream. A total area of 11.5 sq km which is about 30 per cent of the total geographic area of Kurnool town was submerged by flood waters (Ramachandraiah, 2011). This submerged area falls between elevation contours of 271 and 284 meters much above the FRL of the reservoir. The reservoir level at Srisaillam increased beyond 271 meters from 7 am on 3rd October to 7 am on 4th October (the maximum reservoir level recorded was 273.32 meters⁷ at 1 pm on 3rd October), which is clear evidence that the backwaters of Srisaillam reached up to Kurnool town. The backwaters not only flooded parts of the town, but also prevented flows from Hundri and Tungabhadra rivers entering the reservoir, and diverted them into Kurnool town which coincidentally has an antiquated storm drainage system. The combined effect of both these factors had a severe impact on Kurnool town, pockets of which were inundated by more than 13 meters deep water for several days. The villages in Alampur mandal faced a similar situation, particularly, the temple town of Alampur at which Tungabhadra merges with Krishna before flowing into Srisaillam reservoir.⁸

The discharges from Srisaillam reservoir were far lower compared to the inflows until 2 am on 1st October (GoAP, 2009). The discharges were eventually increased but were still lower than the heavy inflows which were of the order 1,200,000 cusecs received by 9 pm on 1st October. As noted earlier the peak inflows increased to 2,575,000 cusecs by 10 pm on 2nd October, and in response the reservoir discharge was increased to 1,410,800 cusecs, much higher than the reservoir's design peak discharge capacity of 1,320,000 cusecs at the maximum water level of 271.8 meters by 10 am on 3rd October. The twelfth gate of the reservoir was only opened on 3rd October at 1 pm after 20 years, which enabled a higher outflow of 1,480,000 cusecs.⁹ The outflows were maintained above 1,000,000 cusecs until 6 pm on 5th October. Nagarjuna Sagar reservoir received inflows greater than 1,000,000 cusecs from 9 pm on 1st October which had also been gradually releasing water into Prakasam barrage from 1 pm the same day. Prakasam barrage received the maximum inflow of 1,110,404 cusecs at 11 pm on 5th October, which is the highest since its construction, creating havoc in Vijayawada town and the villages in the river delta situated further downstream. An important observation from Table 1 is that the reservoir level at Nagarjuna Sagar was around 14 meters, far less than the FRL until 1st October, which in terms of storage is half the reservoir storage capacity. Diverting the flood water from Srisaillam early enough into the Nagarjuna Sagar reservoir and then downstream would have been a logical decision and would have greatly reduced the impacts on the catchment of Srisaillam.

Numbers Count: A Closer Look at Reservoir Inflows and Releases

Results of the analysis of the rainfall, reservoir inflows and discharges at Srisaillam reservoir suggest serious lack of flood regulation mechanisms even under such extreme flood events. As noted earlier, the releases from the

⁷ We have used the conversion factor 1 ft = 0.3048 meters to represent reservoir levels throughout the article.

⁸ During field visit to Alampur town on 6th November, 2011, two flood affected households who were still living in temporary flood camps were interviewed. They had lived in houses along the temple embankment prior to the floods, which were damaged due to submergence for more than ten days. Similar references to the backwater effect were made by residents of Kurnool town as well during interviews.

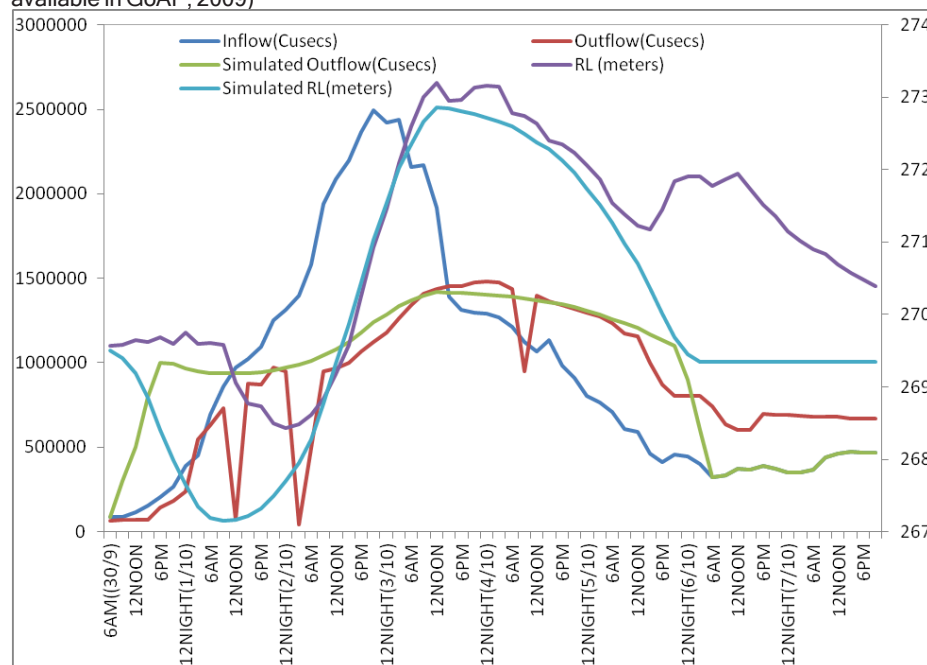
⁹ Information gathered from the then Chief Engineer of Srisaillam dam (interviewed on 1st November, 2011).

reservoir were significantly low on 29th and 30th September pointing to deficiencies in the emergency response by the reservoir authorities despite forecasts of heavy downpour in the entire Krishna basin. The delay of more than 24 hours in responding to the heavy downpour and reservoir inflows was a primary reason for exacerbating the flood and its impact in the Alampur mandal, Kurnool town and surrounding villages.

To arrive at an alternate real-time reservoir operation scenario, empirical simulations (Figure 6) with the observed inflow and reservoir discharges (estimated) were carried out starting from the morning of 30th September, which was when the depression in the Bay of Bengal and a possible cloud burst was forecast. Reservoir outflow data and the reservoir levels available in GoAP, 2009 were used to establish a simple linear relationship between the reservoir stage and discharge (the actual relationship is a polynomial of the order 1.5). Using this relationship, revised reservoir operations including discharges, observed inflows and resulting reservoir levels were simulated. Reservoir discharges were gradually increased to the maximum discharge capacity and subsequently maintained at maximum possible discharges at the prevailing reservoir level to create the necessary storage space for accommodating incoming flows to the Srisailem reservoir. The fact that more than half of the storage was available in Nagarjuna Sagar was also considered in parallel to facilitate these discharges from Srisailem.

Fig. 6: Results of simulation compared with the actual outflows and reservoir levels from 30th September to 7th October, 2009

(Source: The outflows and corresponding reservoir levels were simulated using the data available in GoAP, 2009)



With this simulation exercise, we were able to create a storage cushion of 40 TMC (Thousand Million Cubic feet) on an average from 12 am on 1st October to 12 am on 2nd October. If this storage cushion had been created in reality, it

would have allowed the flood water to flow into the reservoir and subsequent releases downstream would have reduced the severity of flood in the upstream submerged areas by reducing the area under high and moderate submergence. Also, the duration of flood in which the reservoir water level crossed the dangerous level of 271 meters would have reduced by at least two days.

In the simulation, we have taken care to provide for realistic operational issues such as delays that would have happened between events, emergency consultations and decision making. We have also accounted for dam safety by making sure that the outflow simulated did not exceed the maximum discharge capacity, which it did in the real case on 4th October as a response to drastic increase in the inflows to the reservoir.

Discussion

While the 2009 floods in Krishna basin was an extreme event that could not have been fully averted, reading the chronology of events together with the alternate reservoir operation scenario built from the simulation exercise above clearly shows that there was scope for a more timely response to the extreme rainfall. However, some experts who reviewed the situation after the floods recommended that there was no need to reschedule the regular reservoir operations based on a 'freak and isolated' event (Basheer, 2010) as it might lead to shortage of water for irrigation and power generation (Subba Rao, 2010). There is increasing concern among the research community and policy makers backed by scientific evidence that such extreme events are expected to be no longer 'freak and isolated' events, but more frequent and probably worse under the changing climate scenario. It would be a very risky policy choice to prioritize water for irrigation over loss of lives. Hence, the design of the reservoir operations urgently require an effective flood management protocol and disaster risk reduction strategy which can respond in real-time to rain and flood forecasting, and manage the floods both in the upstream and downstream more effectively.

Absence of Pre-depletion and Politics of Water Control

The analysis clearly suggests that the absence of pre-depletion of reservoir, if implemented, would have decreased the risk of inundation of low lying areas situated both in the backwaters as well as downstream. Pre-depletion would help in absorbing the peak inflows by facilitating storage of flood water in large quantities and then releasing gradually into the river course downstream. Andhra Pradesh state water policy 2008 had identified several structural and non-structural measures for flood management, one of which was provision of appropriate flood cushion in water storage infrastructure (GoAP, 2008). The well-drafted policy statement, however, never got translated into action during the floods. Pre-depletion process was not initiated till 1st October as all the reservoirs, except Nagarjuna Sagar, stored water close to the FRL (GoAP, 2009). The outflows from the reservoirs just matched or at some sites were significantly lower than the inflows showing that there was no pre-depletion. If pre-depletion of the reservoir had been done, the magnitude of the flood as well as the duration of inundation, particularly in Kurnool town and Alampur,

would have been greatly reduced. These areas would nevertheless have been affected by floods but the degree of impact would have been reduced significantly. This can be seen in Figure 6 where the reservoir level could have been brought down to 267.15 meters by the afternoon of 1st October. Reservoir discharge at Srisaïlam in the simulation exercise was initiated only in the morning of 30th September, possibly due to administrative delays in decision making. Ideally, with dependable weather forecasts in hand the process should have been initiated gradually from the morning of 29th September itself.

It is intriguing why pre-depletion was not initiated, and the authors suspect whether the decision, not to release water from the reservoir was due to communication delays between the forecast system and the reservoir staff or motivated by political compulsions to retain as much water as possible for irrigation and hydro-power generation. Interview with the Chief Engineer of Srisaïlam seemed to suggest that since there was no certain and accurate knowledge of the behaviour of unpredictable events such as a cyclone, emptying the reservoir in anticipation might have put the dam managers (as well as the political leadership) in trouble¹⁰. Irrigation, particularly in South Indian States, is a major manifesto point in political campaigns. The risk of miscalculating the weather and the consequent water shortfall from pre-depletion of reservoir is one which the political leadership in the command areas cannot afford to or is not willing to take. The dam has to cater to the irrigation and power needs of millions of users, and the reservoir may not be emptied to a safe level as an early response to a cyclone or an extreme rainfall given the record of inaccurate predictions. It appears that this mix-up of political and regional interests with the techno-administrative structures led to the dams not serving the crucial flood control functions.

The fact that Krishna basin falls in three States presents the complex overlap between State administrative boundaries, with associated regional and political interests, and the hydrology of the catchment. The tendency to group the reservoirs in each State into a 'political' entity complicates flood prevention and mitigation. The inferences drawn from our field visits point to the complexities in the information flow between different dam offices situated in Karnataka and Andhra Pradesh. An unequal power structure has been created based on geographic position and political boundaries. While there could be disagreements and disputes in releasing and sharing water in normal conditions, confrontation should be avoided during such emergencies. Instead the agencies involved in these project offices across the States and in the State should collectively share crucial information on actual releases and predictions on the runoff responses of the intermittent catchments.

Technical and Administrative Laxity

While technological advances in India have made use of satellite technology to collect meteorological data and Geographic Information Systems for river basin planning, the country still seems not to have achieved the required degree of certainty in weather predictions and forecasts and its subsequent stream flow generation. This is all the more surprising as India has specially

¹⁰ Interviewed on 1st November, 2011.

dedicated organisations, namely, Central Water Commission (CWC) and Indian Meteorological Department (IMD) to provide necessary forecasts and information. After the devastating floods that occurred in Krishna Basin in 1998, a study was commissioned by the Andhra Pradesh State (Basheer, 2010) to estimate the pre-depletion required to keep the Srisaillam reservoir level at the Maximum Water Level (MWL) of 271.88 meters if there was an event of the design flood of 1,955,000 cusecs. The results also highlighted the need for an advance forecast mechanism that would provide information more than a day in advance. Due to constraints posed by manual operation of the spillways it would be extremely difficult to limit the water level to MWL if the forecasts were available in less than a day in advance. The 2009 floods illustrated that the forecast apparatus and spillway operations through mechanisation for emergency response has not improved much in the eleven years since the 1998 study.

The resolution of data and information on rainfall as well as stream flow, both spatial and temporal, is also very coarse despite high variability of rainfall in the region. A major reason is also the density and positioning of these gauges. Further, manual operations make these stations inaccessible in the event of a flood. Many of these stations were submerged or marooned during the days of floods in 2009. The inflow and outflow forecasts were not presented in CWC bulletins for Srisaillam dam for the period 2nd October to 4th October. Similar was the case with rainfall data at several rainfall stations (CWC bulletins in GoAP, 2009). The lack of reliable forecast is a major hindrance to real-time decision making on flood management. There is also ambiguity in CWC bulletins regarding the magnitude of the disaster (Ramachandraiah, 2011).

There is also a lack of adequate assessment of the runoff from the intercepted catchment of the Srisaillam reservoir. The runoff generated by this intercepted catchment flows into the reservoir directly without being stored in any other storage structure. The CWC measuring gauges are located at an interval of 100 km which does not adequately capture the flow processes at times of high intensity localized rainfall. The Chief Engineers who monitored the flood in real time at Almati and Srisaillam dams pointed to the lack of scientific and technical support to estimate the runoff and peak discharge generated from the intercepted catchments¹¹. These dams have been functioning for several decades and the lack of such a decision support system even now is a matter of serious concern. The Committee on Integrated Operation of Krishna River Irrigation Projects (CIOKRIP), comprising of senior irrigation engineers, advisors to government in irrigation department and other experts, that monitored the floods in Andhra Pradesh has recommended the installation of automatic recording of rain and river gauges to transmit data to enable informed decision making without any loss of time, especially in the intercepted catchment of Srisaillam (GoAP, 2009).

We must, however, also ensure that the data generated is utilized for prompt and proactive decisions, without being influenced by the political pressures discussed earlier. The storage buffer which was available at Nagarjuna Sagar

¹¹ From interviews with the then Chief Engineers who monitored the dam operations at Srisaillam (1 November, 2011) and Almati (24 November, 2011).

was not utilized until 2nd October (GoAP, 2009), even though there were no technical constraints to release water from Srisaïlam dam. The storage buffer if created could have acted as a cushion to absorb the peak runoff and later regulated to flow into the downstream. This would have been a better strategy for downstream areas as well since the delta regions downstream of Prakasam barrage have a low threshold to flood. The Government Order to maintain the reservoir level at FRL on 1st October every year could have been a reason for not releasing water¹². While the decision not to irrigate the command area of Nagarjuna Sagar during the Kharif season was based on inadequate quantity of water in the reservoir, the inflows from pre-depletion in Srisaïlam could have helped irrigation in the command area of Nagarjuna Sagar for Rabi or summer cropping season. In effect, the command area of Nagarjuna Sagar was irrigated in that Rabi season from the releases of Srisaïlam stored during the flood.

Final Remarks

The case of 2009 Krishna basin floods illustrates the unintended consequences of purportedly rational choices of the State and the latent conflict of interest between citizen welfare and safety. The challenge, however, lies in pre-emptive and real-time response to disasters by the State even under situations where little information exists. Our analysis suggests that citizen safety seems to have been compromised through the interplay of political interests and technical inefficiencies in decision making during the flood event.

While some of the measures to this end such as flood risk identification, providing storage cushions in reservoirs, modernising current forecast systems and preparing the vulnerable communities were suggested in the State Water Policy of 2008, none of these seem to have taken effect in the case of Krishna basin floods. Further, the politics of water control and the tacit pressure by interest groups often stand in the way of building adaptive and resilient social-ecological systems. A participatory decision making process should be set in by the three States in the Krishna basin bringing together representatives of key political parties, water resource experts, regional interest groups and the concerned government departments. Extreme and unpredictable events are increasingly becoming part of the social-ecological system, due in part to the changes in global environment including climate. Identification of risks and deployment of adaptive management systems are crucial for responding to such events.

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¹² Interview with a CIOKRIP member on 2 November, 2011.

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Floods in Bengaluru

No Respect for Water Bodies and Water Courses

Manasi S. and Smitha K. C.

Introduction

Bengaluru, the capital city of Karnataka, has grown at a phenomenal rate over the past one and half decade. It happens to be India's sixth most populous city¹ and fifth most populous urban agglomeration. Groundwater resources drawn from aquifers and groundwater reservoirs play a major role in meeting the demands of the citizens besides the water drawn from Cauvery River.² Groundwater resources are sustained through careful networking of numerous water bodies like lakes³ and tanks since several decades. There were about 370 tanks in Bengaluru, but they have declined gradually due to urbanisation and encroachments to build various establishments, both private and government, resulting in one of many urban catastrophe—flooding. Bengaluru has an advantage of having nearly 70 rainy days spread over the year. However, Bengaluru's drainage system (infrastructure) can handle only 30 mm of rainfall in one hour and there are areas where the handling capacity is far less than 30 mm. So, whenever there is a heavy down pour, the city faces problems. The rainwater infiltration has declined as the soil exposed for this purpose has gradually decreased over time. Besides, the construction of asphalt and cement roads has increased leading to the lowering of the groundwater table and the disappearance of open wells. The side drains and the shoulder drains are filled with mud and other garbage and this adds to the blocking of the natural flow of water. This has resulted in flooding of the city roads during heavy rainfall. The low lying areas in the city are prone to annual flooding due to overflowing of water from the drains causing immense inconvenience to the residents.

The areas of conflict are the old settlements (Jakkasandra⁴, Koramangala 1st block⁵, Cauvery colony⁶, S.T. Bed layout⁷, Ashwini layout⁸ and Ejipura⁹)

⁶ Cauvery colony is part of Ward 68 and Koramangala area, Bengaluru.

⁷ This locality is one of the many tank beds that have been converted to layouts in the Bengaluru city.

⁸ Ashwini layout is part of Ward 68 and Koramangala area, Bengaluru.

⁹ Ejipura is located close to Koramangala, Bengaluru.

¹ With a population of 9,588,910 in 2011 compared to 6,537,124 of 2001

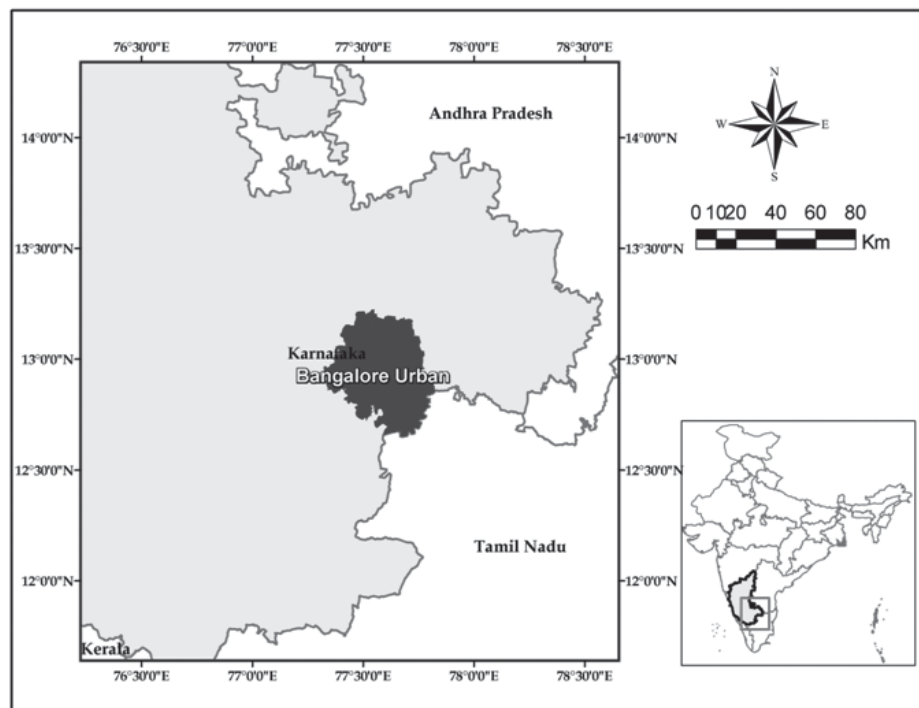
² The city of Bengaluru is getting around 950 MLD of water from Cauvery & Arkavathy sources as against the present demand of 1350 MLD for a population of around 9 million. As such, there is a short fall of 400 MLD. (www.bwssb.org)

³ Valerie Fernando, 2008, paper titled 'Disappearance and privatisation of lakes in Bengaluru' mentions that Bengaluru has only 117 lakes. The disappearance of Bengaluru lakes started from 1980s but has increased due to rapid urbanisation. While there were 262 lakes in 1961 (though official statistics mention presence of only 117 lakes), only 33 lakes are still more or less visible on satellite imagery. (<http://base.d-p-h.info/en/fiches/dph/fiche-dph-7689.html>)

⁴ Koramangala 1st block is part of Jakkasandra area in Bengaluru.

⁵ Situated in the south eastern part of Bengaluru city, one of the largest highly sought after residential locality and commands one of the highest property prices. Koramangala is divided into 8 blocks spread over approximately 1800 acres. Blocks 1-4 are separated from blocks 5-8 by the Old Airport Road leading to Domlur/Indiranagar.

Fig. 1: Location of Bengaluru (Bangalore) urban area in Karnataka, India



located in the south of Bengaluru. These are seen in the Cantonment map of 1870, Bengaluru also. These old settlements were surrounded by villages, lakes and few tanks through which excess water was collected during rains. This low land connected erstwhile Sinivaigalu Tank and Bellandur Tank, and has been absorbing all the excess surface rain water runoff during monsoons for decades. It has been acting as a receptacle where excess rain water turns it into a tank, thus charging the groundwater reservoirs. This area is a naturally formed rain water harvesting bed, which hosts several water species during winter, provides a grassland for village cattle and provides the much needed lung space for Bengaluru. During the course of urbanisation, city planners and urban development authorities started granting permissions for new constructions and development of new layouts unmindful of preserving tank beds. As a result, the inappropriate urban planning policy and the failure to assess overall impact on the environment and consequently on lives of people has led to urban conflicts and insecurity among the urban residential communities.

Unmindful Obstruction of Water Courses and Water bodies

The current case of urban conflict describes the problems faced by low lying urban residential communities in Bengaluru due to ineffective urban planning. The low lying areas of Koramangala (Krishna Gardens / Jakkasandra extension, Koramangala 1st block, S.T. Bed layout, Cauvery colony, Friends colony, Ashwini layout, parts of Ejipura and Koramangala 80 feet road) are surrounded by villages, lakes and few tanks through which excess water is collected during rains. It was during the course of urbanisation that city

planners and urban development authorities started to develop new residential colonies and layouts; as a result vital tank beds were occupied. The tanks were allowed to be reclaimed for urban housing colonies in many cases by government agencies themselves. As a result, the safety valve for excess water flowing in the drain during the rainy season ceased to exist.

The conflict arose due to violations of urban planning at four levels. Firstly, in violation of Rau Committee report (1988), National Games Village complex was constructed by Karnataka Housing Board (KHB) during 1996-97, which drained off the existing tank and built storm water drain with concrete columns inside raising the bed level of the tank by eight feet. This has led to the inevitable flooding in the adjoining residential areas of Ejipura and Koramangala on an annual basis.

Secondly, the rain water from the drain finds its way ultimately to Bellandur Lake via Sinivaigalu / Aminikere. A layout was developed by Bengaluru Development Authority (BDA) on the Sinivaigalu Tank bed. Presently the tank bed is dry and vacant land, which still acts as a reservoir for excess water from the storm water drain during rainy season and is the only safety valve left for the surrounding areas like Sinivaigalu Tank bed, Jakkasandra (1st Block Koramangala). The problem of flooding was further aggravated when the width of the storm water drain was gradually reduced owing to encroachments and development of residential colonies and layouts on either side of the drain with the approval of urban development authorities.

Fig. 2: Aerial View of Cascade of Tanks in and around Koramangala, Bengaluru (Source: Survey of India Map (1973 edition))

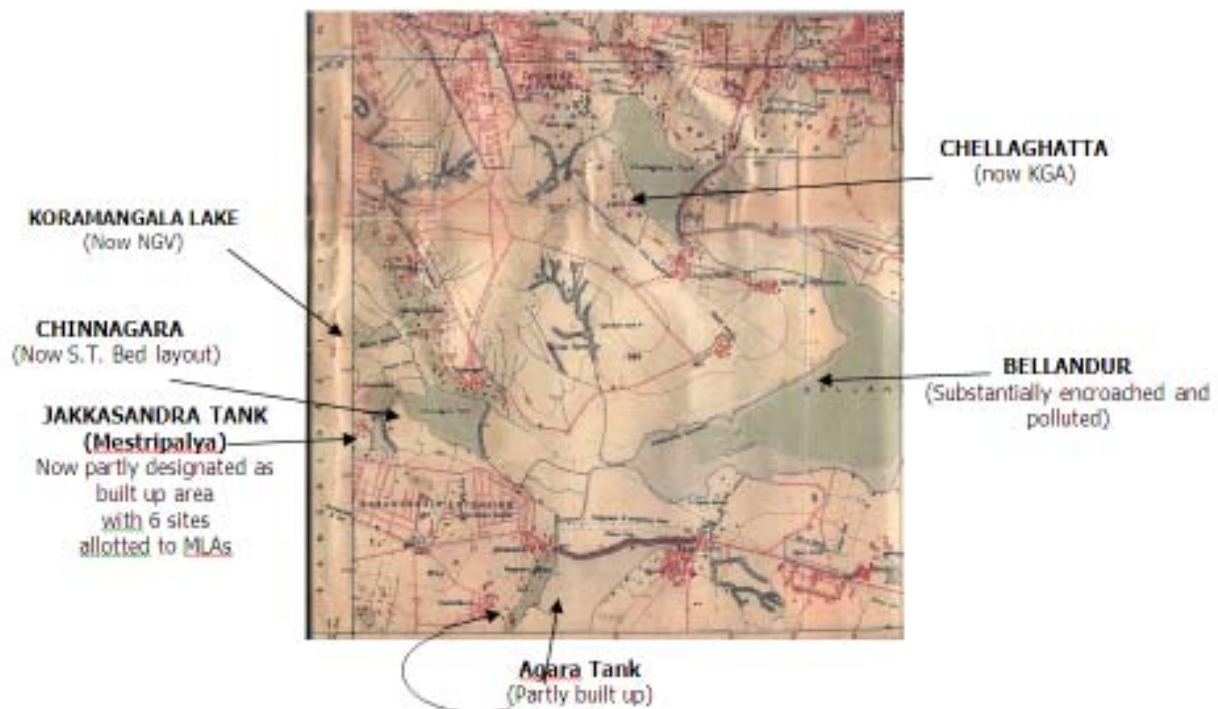


Fig. 3: The chain of water bodies of Koramangala-Challaghatta Valley system
(Source: Koramangala Residential Welfare Association, 3rd and 4th Block, Koramangala, Bengaluru)



Thirdly, the construction of the new intermediate ring road connecting Indira Nagar to Koramangala - the road level was raised by seven feet above the ground level leading to annual flooding in some of the low lying areas of Ejipura. The matter was further compounded by the fact that BDA went about remodelling adjacent tank beds and low lying areas by raising the ground levels, further choking the natural drainage from low lying areas. Ignoring government orders (Rau Committee's recommendations of 1988), the Revenue department and BDA permitted land use change from natural tank bed and low lying areas to housing layouts several feet higher than adjacent existing colonies, thus, causing damage by flooding.

¹⁰ Bengaluru Development Authority

¹¹ Agaram Tank has been reclaimed recently, but the lowland connecting this with Bellandur is being encroached and filled up at feverish pitch. As per Karnataka Government Gazette Notification of 30 June 1988, both these areas should be developed by planting trees and setting up parks under the responsibility of Forest department.

Finally, another important development was in the context of approval given by the Revenue department and BDA¹⁰ for a project of M/s. Shantinagar House Building Co-operative Society and other private projects. This valley area connected Agaram Tank¹¹ and Bellandur along Sarjapur road and this project envisaged filling up and raising the level of Sinivaigalu / Amanikere areas. These developments further aggravated the problem of flooding into the other areas including Krishna Gardens / Jakkasandra extension, Koramangala 1st block, S.T. Bed layout, Cauvery colony, Friends colony, Ashwini layout, parts of Ejipura and Koramangala 80 feet road. In complete disregard to the notification, the Revenue department hurriedly acquired 60 acres and 20 guntas (40 guntas = 1 acre) land from land owners for the private builders of Shantinagar House Building Co-operative Society, and continued to show the valley area as projected 'housing sites' in the City Development Plan (CDP) of 1995.

Forward 68 Takes Action

The layouts and colonies that exist in Ward 68 are located in the lowlands of Koramangala Valley. These are surrounded by other areas that are at a higher level. Subsequently, FORWARD 68 (Federation of Residents Welfare Associations of Ward 68) (Ejipura) was formed in 2002, mainly for the purpose of co-ordinating efforts to secure better civic facilities for the residents of Ward 68, which included water supply, sanitation, roads, etc. Besides directly interacting with civic bodies and elected representatives of Bengaluru City Corporation, it also collaborated with other civil society organisations like Janaagraha, Public Affairs Centre (PAC), Swabhimana and Civic-Bengaluru.



Fig. 4: A view of the reduced width of the drain

(Source: Koramangala Residential Welfare Association, 3rd and 4th Block, Koramangala, Bengaluru.)

FORWARD 68 constantly lobbied and continuous efforts were made to draw the attention of the concerned civic bodies and Urban Development Authorities on occurrence and consequences of annual flooding in affected areas like Ejipura and Koramangala ward. Though BBMP (Bhruhat Bangalore Mahanagarapalike)¹² announced remodelling of the drain in 2004 work on the project started late. Even after six months of commencement of work, the drain did not see the light. After 18 years of the S.T. Bed Layout formation, only 30 per cent smaller roadside rainwater drains are completed by the Karnataka Land Army (KLA). Work was stalled as the bills were pending from the corporation. In the meantime, certain urban developments such as construction of National Games Village Complex, encroachments and development of colonies on either side of the drain diminished the benefits expected from the remodelling project; further aggravating the flooding menace in the low lying areas of Ejipura and Koramangala.

Another issue of concern has been the maintenance of roads. Roads were first asphalted in 1994 and were again repaired in 1996. The layout was handed over by the BDA to the BBMP in 1998 along with the responsibility of

¹² In 2007, the state of Karnataka announced merging of 100 wards the erstwhile Bangalore Mahanagara Palike, along with 7 City Municipal Councils (CMC) (Rajarajeshwari, Dasarahalli, Bommanahalli, Krishnarajapuram, Mahadevapura, Byatarayanapura and Yelahanka), one Town Municipal Council (Kengeri) and 111 villages around Bangalore formed 'Bruhat Bengaluru Mahanagara Palike'

operations and maintenance of roads and other infrastructure. As a follow up, in 2001 and 2003, BBMP took up the maintenance work but, the quality of roads hardly remained intact for a year. As opined by the members of the residents association, the contractors were unwilling to take up other civic works on a regular basis in the S.T. Bed layout. Hence, KLA was given the contract. Although they were given the contract with better terms, they stopped work due to non-payment of dues, which prolonged for several months. KLA stalled their work till the dues were paid. The BBMP officials explained that it was the responsibility of the KLA and hence they could not intervene and only when the work is withdrawn from KLA, the work could be taken up by the BBMP. It was the residents who suffered because of this conflict between the KLA and the BBMP.

FORWARD 68 addressed number of representations to the authorities of BDA, BBMP and the Revenue department, in addition to meeting the concerned officials but the problem remained for long. But, persistent efforts led to resolving the issue to a great extent. There are few achievements that FORWARD 68 has been able to accomplish. For example, in pursuance with the Bangalore Water Supply and Sewerage Board (BWSSB), a sewage blockage and overflow problem was resolved with the installation of a wet well in Ashwini layout to collect the sewage from Ejipura and pump it to Challagatta Valley, and coverage of the drain near Games Village and so on.

- In response to the delay and negligence, a decisive mass action was undertaken by FORWARD 68 on behalf of the affected colonies compelling authorities to act promptly to retain Sinivaigalu / Amanikere as a tank bed and prevent further shrinking of the width of the drain by preventing encroachment of all lowland areas. These lowland areas are Sinivaigalu Tank bed and Bellandur Tank. Further argument was that water resources of Bengaluru must be preserved and protected by prohibiting any conversion of lowlands into concrete jungles to maintain the natural drainage corridors in valleys.
- In 1990, residents filed a writ petition in the High Court as the storm water drain along the layout emitted bad odour and requested for coverage of the drain.
- Worst floods were encountered during April 2001 and water entered houses of residents. In view of this, a secondary smaller drain was built to direct flood waters into the storm drain, which aided partly in resolving the problem of the residents.
- In 2002-03, due to incessant rains and thunder showers, which is so common in Bengaluru, storm water drain overflowed, and for several days water and filth stagnated in the houses in Ejipura, Ashwini layout, Sinivaigalu Tank bed layout and Jakkasandra blocks of Koramangala (low lying residential areas). There was huge loss of property and health of inmates was affected for several days. As a result the BBMP was obliged to make an outlet drain, which ran through the valley area to finally dissipate in the wetlands of Bellandur providing some relief to the households.

- Frequent meetings were held and during these meetings there was tough exchange of arguments between the residents and the officials on the state of affairs regarding the problems in the layouts.
- During summer months too, when the residents did not feel the direct impact of flooding, the process and follow up with the departments were going on. Monthly meetings were regularly held between the residents and the department officials during which, related issues were discussed and debated. It is interesting to note that the members have systematically maintained detailed documentation of these meetings and interactions.

Fig. 5: Sinivaigalu Tank Bed, Koramangala

(Source: Koramangala Residential Welfare Association, 3rd and 4th Block, Koramangala, Bengaluru)



At Loggerheads

Civil Society: The NGOs and Residential Welfare Associations (RWAs) argued that legal requirement of any development must not infringe upon the rights of the neighbourhood and it was the duty of Urban Planning Authorities and BBMP to ensure free flow of water. They strongly opined that the State Government appointed expert committee, N. Lakshman Rau Committee, in July 1985 was ignored although it clearly stipulated the road map for preserving Bengaluru's underground water resources, to protect against illegal encroachments on tank beds for urban housing as it directly affects the environment and groundwater tables and aquifers apart from infringement of rights of urban citizens. They even submitted a detailed request to the Principal Secretary, Urban Development Department (UDD), specifying the areas that face grave threat of remaining water logged, flooded or where damage is likely to be caused by water seepage from underground, as a consequence of new layouts being permitted, especially by blocking natural drainage. Besides, this area is a natural rain water harvesting area and if

concrete jungles are permitted to come up in valleys and drainage corridors, Bengaluru's most prolific and promising aquifers and groundwater reservoirs will be destroyed forever.

The representatives opined that BDA had approved a plan to build a housing colony as far back as in 2003 much against the recommendations of the Rau Committee and the approval was accorded without obtaining feasibility report from BBMP and BWSSB, and apparently without considering the adverse environmental impact that such step would have on the neighbouring layouts. It was revealed that private builders started developing housing sites by filling the tank bed up to 8 to 9 feet above the neighbouring houses, resulting in flooding.

The argument was that Urban Planning Authorities particularly BDA deliberately choose to misrepresent the facts by omitting to declare and show the existence of main storm water drain and the secondary drain made by BBMP in 2002. Sites were shown in the areas where actually storm water drains and public roads existed. The plan appears to have been approved by BDA in 2003 without due process of investigation, feasibility report from either BBMP or BWSSB and on the possible adverse ecological and environmental impact on public.

Besides arguing for their own case, they also requested the following:

1. To freeze all land use changes to residential layouts in valleys and lowlands including the ones under consideration or where housing activity has not yet begun
2. To enforce N. Lakshman Rau Report of 1988, proactively
3. To order an 'Environmental Impact Study' on all proposals including on the new CDP by experts in the field of Environment and Geology
4. Being of special importance, to set up a watchdog body to monitor water management of Bengaluru's groundwater reservoirs, and to preserve and augment the same
5. To follow in letter and spirit the National Environment Policy, 2004
6. To stop all the construction activities in all villages and lowlands of Bengaluru city
7. To convert all such lowlands into forests and parks thus turning them into natural rain water harvesting areas
8. To preserve and maintain all natural rain water harvesting areas in Bengaluru
9. To prevent encroachment of all lowland areas falling in Koramangala Valley, specifically lands connecting to Sinivaigalu Tank bed and Bellandur Tank and those connecting Agram Tank on Sarjapur Road with Bellandur Tank
10. To stop permitting housing layouts on tank beds and valley areas and restore land to its original ecologically functional state

Fig. 6: A closer view indicating reduced width of the drain flowing into the Tank

(Source: Koramangala Residential Welfare Association, 3rd and 4th Block, Koramangala, Bengaluru)



Local Governance: Issues and solutions related to urban flooding are often discussed. The BBMP has drawn up a list of 150 areas in Bengaluru that are prone to flooding during rains for taking appropriate measures in time and also cautioning residents of those localities. The four major valleys (Rajakaluve) - Vrushabhavathi, Hebbal, Challaghatta and Koramangala have been constructed for taking rainwater to lakes. The city has a vast network of storm water drains and funds are pumped into remodelling them. A number of action plans are drawn up to tackle the monsoon year after year. A sum of Rs. 400 crores has been spent on remodelling drains between 2006 and 2011 - part of Rs. 640 crores grant by Jawaharlal Nehru National Urban Renewal Mission (JNNURM). Although BBMP has taken up desilting work in some portions of the four valleys, the city is still unprepared for heavy rains. BWSSB plans to construct percolation pits on all government lands. The innovative flood alert system of Karnataka State Natural Disaster Monitoring Centre (KSNDMC) may assist the BBMP in handling floods during heavy rains. The KSNDMC is planning to install the facility of 'SMS alert system on floods' in the BBMP area so that the civic body can take up safety measures during downpours without delay.

Specific to this case, the BDA and Town Planning Authorities (TPAs) were non-committal about whether verification of environmental factors was taken into account for the layouts which were formed three decades ago. However, currently there is a definite provision for environmental evaluation before initiating new layouts. The officials also feel that they have promptly executed the work wherever required sanctions and work orders were issued, yet people bring to light the deficiencies and due acknowledgment by people is not given.

Ecological and Environmental Impacts

Environmental protection is an integral part of any developmental process supported by constitutional provisions. A rational urban planning must ensure holistic development and effective land use and land management practices, which will ensure citizens' right to safe environment and protection of natural resources. Watershed areas need to be protected not only from water resource point of view, but also for other vital environmental and hydrological processes that directly affect lives of people. Bengaluru metropolitan area's most potential and live groundwater reservoirs lie in south-eastern part of South Bengaluru, comprising Sarakki-Koramangala-Bellandur grid. Frequent land use changes and haphazard occupation of tank beds as a consequence of new layouts especially by blocking natural drainage would inevitably destroy most prolific and promising aquifers, and naturally formed water harvesting areas in urban centres such as Koramangala area.

This would inevitably constitute denial of the citizen's basic right to enjoy vital natural resources like water. The establishment of the S.T. Bed layout is an obvious example indicating encroachment ignoring environmentally sensitive lands besides interfering with the natural gradient of the Koramangala valley. S.T. Bed layout issue was implicit wherein the water to the drain passed through wetlands into Bellandur lake downstream affecting the natural flow and the residents living in the vicinity. This layout has another issue pertaining to its construction along the storm water drain. The storm water drain has inlets of sewage and effluents from households and industries throughout the drain causing pungent odour, thus causing inconvenience to the residents. Many reminders were sent by residents to the concerned urban authorities complaining about corrosion of metal equipment within their households. In view of this, residents filed a writ petition in the High Court against the issue and requested for covering of the drain. The government provided Rs. 110 crores for the remodelling plan of covering all open drains along the four valleys. In 2003, a letter was addressed to the former Chief Minister, S.M. Krishna by the residents offering an innovative and creative solution with a detailed plan for using the space for a sculpture and mural garden, which could be used by walkers and joggers. Although the remodelling of the drain was discussed the proposal to cover the drain was not considered. However, a part of the drain close to the National Games Village was covered, which did solve the problem partially.

Social Impacts

Citizens are entitled to a healthy and productive life in harmony with nature as enshrined in Article 21 of the Constitution of India. They should remain the centre of developmental activities. State is a mere trustee of all natural resources, which ensures that the public enjoy natural resources without any conflicts in terms of destruction, alteration or appropriation of individual interests at the cost of collective well-being and interest. Ineffective urban planning infringe upon collective rights of citizens.

Way Forward

The main focus of the city Development Plan must aim towards achieving

rational land use and land management to ensure that people enjoy a clean and safe environment and are not subjected to improper planning that denies them or inhibits use of natural resources. As land rights in India are not well-defined, there have been implications in terms of conflicts, misuse and inequitable distribution of resources. Time and again, the need and emphasis on well-defined land rights system has been stressed by researchers and policy makers. Land security can be attained with a well-defined land rights system in place. There are various institutions (Department of Survey Settlement and Land Resources, Bangalore Development Authority, Private Land Developers, Co-operative Societies etc.) involved in processing of records related to property in terms of issuing and approving, which have been largely misunderstood in relation to property rights besides poor maintenance of land records. It is crucial that there is a comprehensive understanding of roles, responsibilities and co-ordination amongst these institutions in land management and service delivery. It is also important that appropriate legal framework should be structured to correspond and support the varied institutions. S.T. Bed is one of the cases of such violation in urban development. Several such cases are witnessed in the city with the demand for land increasing enormously.

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Nature is Hard to Know

Conflicts over Floods as Struggles of Knowledge

Luisa Cortesi

“(Natural) systems that are complex are not merely complicated; by their nature they involve deep uncertainties and a plurality of legitimate perspectives.

Hence the methodologies of traditional laboratory-based science are of restricted effectiveness in this new policy context;

(..) natural temptation to try to reduce them to simpler, more manageable elements, as with computer simulations. (..)

But environmental problems have features which prevent reductionist approaches from having any but the most limited useful effect.

(Funtowicz 2009:5-6)

The papers reproduced in this compendium are case studies of floods and flood-related conflicts that have occurred across India in the last decade. Although different in focus, language and argumentative style, the collected case studies have a few characteristics in common, which this commentary aims to highlight and discuss. In fact, despite narrating different stories in different contexts, these articles can be read as a collective representation of the ways in which the contemporary Indian middle class knows its nature, particularly when disastrous. This commentary, thus, problematizes selected concepts involved in the above narrations of floods with the purpose of emphasizing the common ways in which the authors of the papers narrate nature, contextualizing and analyzing their multi-vocal but shared narration. As a consequence, instead of posing separated heuristic enquiries, this paper originates with the idea of appreciating what the authors themselves have deemed important to ask.

This paper synthesizes and abstracts the very questions posed by the authors and the languages used to answer them, aiming at exploring their narrations of floods and revealing their collective problematic endeavors. If we exclude the interrogations about flood-related conflicts implicit in the task, these essays are constructed primarily around two questions. The first, sweeping interrogation in which they feel invested is whose nature is this, or, more specifically, who has the right to make decisions about it. Second, these essays ask what are floods like, and, by extension, what is the nature (intended as the natural environment) of floods. These two questions will be shown as correlated with the two languages primarily used to discuss floods,

those of political ecology and of science and technology. The preference accorded to these questions and languages conveys the awareness of nature as political, and the need for a common and neutral ground to recompose nature-related conflicts. Nonetheless, if we consider these essays as points of exposure and at the same time moments of formation for knowledge of nature, then the fact that the discussion finds ways through specific narratives, while leaving others unexplored, is revelatory of specific ways of understanding and discussing nature.

Where Dove (2008) has argued that the concept of disastrous nature co-evolves with the disaster itself, this commentary proposes that the narrations of disastrous nature reproduced here reveal our own contemporary ways of understanding nature, in particular when nature is of a disastrous kind. In other words, if we read these essays as moments of representation and at the same time of formation of India's collective understanding of nature, we can engage them to trace the ways in which nature is explored, understood, questioned, considered unintelligible. We also find that understanding nature has the character of a struggle. Difficult to know, this struggle to known nature is expressed and at the same time discursively composed through standardized forms of "rhetoric of compromise", languages that represent a balancing act on the basis of the authority and morality we collectively grant them. However, these languages also shade other understandings of nature, and therefore engender the possibility of incomprehension, which can in turn incite conflicts. As we will see, the experiences in this compendium suggest that conflicts over floods can be the result of incompatibilities between specific understandings of nature.

Questions of Nature: Whose Nature is this?

Different groups of people are grappling with the meanings of nature. At first, it is necessary to ascertain whose understanding of nature we are discussing. The preceding case studies are expressions of a variegated group of mainly journalists and development workers, in a few cases researchers, who, although composing a diverse set of people, can be heuristically (and roughly) inscribed in the urban middle class. The article by Poddar, Jha, Chandrashekar, Verma, Singh, Vinay Kumar and Ramesh Kumar is the only one whose authors belong to and reside in rural areas, and have been recurrently exposed to floods. This does not imply that these eighteen contributors are representative of the necessarily heterogeneous contemporary Indian urban middle class, nor that the collective picture they compose is representative of today's Indian, urban middle class' understanding of nature. However, together they offer an interesting window into it, and invite several reflections, one of which is proposed here.

If we consider this corpus as of a semi-scholar nature, as intended by its editors, we are aware that it cannot be considered an expression of popular knowledge. Since Said (1978), the literature has widely expressed awareness of the fundamental flaws in the way in which people are represented by intellectuals, even outside the orientalist, postcolonial, and subaltern studies theoretical frameworks. Baviskar, for example, has well discussed how middle

class perceptions are severely divergent from local adivasi ones. The voiceless are dubbed with what the speaker wants to hear, says Baviskar, generally producing caricatures of “environmentalists by default” and exercising paternalist violence by negating their conscious subjectivity. In her opinion, the urban middle class’ representation of adivasis overstates their transformative power and at the same time downplays that of the dominant castes. Thus, underestimating both the adivasis’ need for help and the role of external activists, the resulting configurations disregard their current exposure to violence and renounce to protect them from further violence (1995).

That the voices of the subordinated or subaltern are seldom heard is a known fact (see Spivak, 1988), which, nonetheless, should not prevent, but instead encourages, the expression of democratic concerns about it. What is important is that the preceding essays do not pretend to represent “the other”, but are pervaded by the tension of recognizing the unfairness of life “at the margins”, and share civil and democratic anxiety towards the worrisome extent of poverty and marginality in the democratic and increasingly rich but constantly unequal India. The authors acknowledge that for lower classes and rural inhabitants whose life and livelihood is closely dependent on nature, the stakes are greater and the possibilities of voicing them smaller. Thus, their political anxiety is not necessarily a gesture of solidarity or a reproduction of claim, but a civil, more than conceptual, recognition that nature is a political matter. This said, because different groups view the relationship of nature to everyday life differently, it is necessary to recognize that they probably also perceive differently its implications for social, cultural and economic life.

The question that pervades these essays about “whose nature is this?” indicates a strong awareness of the political dimension of nature. Far beyond the dichotomy of “virtuous peasants” fighting against “vicious states”, and the correspondingly binary opposition between state and community, the focus is placed on the difference in perceptions of nature in general, and floods in particular, between people living in floods and decision makers. The authors address the constant dilemma between collective and individual interests with the awareness (although variegated) that it is a matter of power, hence they enact the debate on nature through invocations of rights, governance and democracy. It is mainly in this light that the middle class, aware (and hopeful) of its political possibilities, assumes the role of civil critical consciousness.

Distant, Unnatural and Disastrous Nature

In fact, the positioning of these essays’ authorship in the geographical and political realm reveals some features of the nature they collectively draw upon. Sivaramakrishnan and Vaccaro (2006) have highlighted the difficulty of knowing nature for people growing up in steel cities and urban jungles, when the referent of nature is not in their spatial proximity nor in their remembered past. Similarly, the floods described here are often distant, reported, unknown. This is not necessarily to say that the authors of these essays have not experienced them, but that they have seldom chosen to narrate what it means to experience floods in sensorial, material and conceptual ways. This does not mean either that the authors of these essays do not know how to describe

floods, but that they have chosen selective representations and specific languages through which to vehiculate them, as will be elaborated. The next paragraphs will suggest a possible abstraction of the representations proposed by the essays in answer to the second question, “what is the nature of floods?”

The authors of these essays are coherent in recognizing the unnaturalness of the nature they describe, and they strive to define nature in the impossibility of claiming its character as “natural”. Nature is recognized as man-made: rivers are channels, and channels are the new rivers (Assam and Bihar’s case studies). Apt is a description of a canal by Worster: “Quite simply, the modern canal, unlike a river, is not an ecosystem. It is simplified, abstracted Water, rigidly separated from the earth and firmly directed to raise food, fill pipes, and make money” (1985:5). In these essays, the unnaturalness of nature reveals a dilemma, similar to what is described by Cronon (1995): many of the authors continue to understand nature as original, pristine, ancestral, and blame human intervention as the cause of nature-related problems such as floods and its effects (see for example the case studies on Bihar, in Rajasthan and in urban areas such as Bengaluru and Mumbai). In fact, separation from nature is not a choice that the actual citizens claim to have opted for (see both cases from Bengaluru and Mumbai). At the same time, there is a clear sense that today’s nature could not be “natural”: not only is its management acceptable, but necessary. In fact, management of nature is identified as the solution to the very problems management itself has created, while remaining more an assumed value rather than the signifier of a coherent and shared meaning (see the different ways in which it is used in the case study on UP and that on Assam).

While contemporary city dwellers (or rural inhabitants, for that matters) cannot renounce the benefits derived from the exploitation of nature’s economic value (see the Punjab case study, for example), they call for its sustainable management (for example in the case study on Mumbai and also implicitly those of Bengaluru, UP, Assam). Nonetheless, it remains unclear whether the coexistence of projects both of natural restoration and of the economic exploitation of nature is, or could be, at all doable. However, precisely the concept of management, in its various rhetorical algorithms (natural resource management, water resource management, disaster management, to name a few), permits their compatibility, at least discursively. Management, in this sense of malleable administration, eliminates the nature of opposition and incompatibility of priorities, and provides a supposedly neutral vocabulary for promises of betterment and organization. The idea of management acts as a convenient carpet under which to throw uncomfortable polarities that are in reality “hard to manage”: to say that something “has to be managed”, or “will be managed”, assumes that a compromise exists and can settle problems. This said, the purpose of this elaboration is not to downplay the idea of management altogether, but to highlight the commonly shadowed assumptions hidden in one of the concepts more often reproduced in the preceding papers.

Even if encounters of global connections and the particular historical moment are not drawn into the picture, in the previous essays there is a sense of urgency, of emergency, an indication that we are entering difficult times of environmental instability (see for example the case of Mumbai). It is clear from these papers that the sense of urgency that pervades the civil society involved in environmental issues is not felt by the civil society as shared by decision makers (see cases of Assam, Bihar, Mumbai, Bengaluru for example). It is in this light that the “managerial solution” appears problematic to some of the writers. Many accounts implicitly pinpoint the “inappropriateness of envisaging environmental management policies based on assumptions of steady-state equilibria” (Dove, 2008:336). Instead, “it is become all the more clear to common people that the ‘normal’ state of nature (..) is to be recovering from the last disaster, not equilibrium and repose” (Dove, 2008:336), a concept translated here in a call for a more responsible acceptance of the recurrent temporality of disasters (very explicit are the cases of the Krishna basin and the Ghaggar river on this regard).

Similarly, the excuse of “unprecedented” natural events is deemed unacceptable by many of this compendium’s authors. Researchers, such as geologists¹, and environmental historians (D’Souza, 2003), often historically question these claims, digging up oral and written, but sometimes disguised, records of similar occurrences. The civil society here represented reacts to paradoxically reassuring declarations about unexpected and unreliable natural behavior as the cause of disaster. They reject the disaster’s connotation of fortuitousness, since it assumes consequential political de-responsibilization of previous (mis-) management, and they refuse its corollary that similar circumstances are unlikely to occur again, therefore radical measures are not worth the effort (see Ghaggar case study as a wonderful example of this)². Nature’s temporality is instead read by several of the writers in its current urgency: it is seen as the revelation that the problem of disastrous nature cannot be left unattended, and, as the stakes are increasing, the politics of nature will play an increasing role in people’s lives. The management of nature is therefore not only necessary, but urgent.

Management is conceived as the way in which modern people live, as opposed to archaic ways of inhabiting with nature. In fact, nature is seen as dangerous factually and potentially, but, interestingly, never violent or inherently adverse to humans per se. Even the difficult nature of recurrent floods is conceived as benign, and, in some papers, floods are suggested as the “way of life” for “some people” (see the cases on Bihar and Assam). However, these people are remote either (or possibly both) in place or in time, and are characterized by not being known. The literature of reference has understood a culture of flood hazards (Zaman, 1991 and Hill, 1990) as parallel to other disasters such as volcanoes, famines, frosting, drought, etc. (Dove, 2008; Torry, 1986; Waddell, 1975; Turton, 1977) or unpleasant environments (Jalais, 2009), but the contemporary existence of people living “comfortably” in or with floods has yet to be ethnographically accounted for, at least in India. This is not to say that these people do not exist, but to suggest that their remoteness is more significant than their intellectual domestication. They

¹ Brian McAdoo, personal communication.

² Exclude embankments, explain that the cost-benefit analysis excludes the cost and enlarge the benefits.

serve a discursive purpose precisely by virtue of being unknown and impossible to narrate: their remoteness and primitiveness stand for the unrealistic pursuit of “living in untamed nature” on the part of contemporary “modern” citizens. This archaic way of life symbolically pairs with morally superior pristine nature (Cronon, 1995) (Assam and Bihar case studies): the anachronism and remoteness of these people justify the need for the moral and material compromises of modern life. In turn, the need for a compromise with nature encompasses and enacts the necessity of management. In simpler terms, nature, even a disastrous one, is not inherently wrong, is not an enemy. Instead, we, modern humans transforming nature to pursue our priorities, and producing its unnaturalness as a consequence, have lowered our moral standards to make them compatible with modern life and modern nature.

Floods, despite being often distant (and sometimes conveniently so), expose the character of steadily unstable and unnatural nature. This nature requires urgent consideration, but is difficult to manage and even harder to know. In fact, both the instability and the unnaturalness of the natural referents challenge sedimented constructions of nature, and forces new exercises for “knowing” the new nature. The civil society is therefore confronted with understanding this difficult nature, mediating its violent characteristics and the moral references it represents, and assuming the responsibility of indicating the way out. As convenient explanations of unexpected nature are deemed unacceptable, management is flagged as the sole solution. However, the meaning of the word “management” relies more on what it obscures than what it reveals: it is a hazy answer to a problem recognized as political, and its meaning is subjected to the political structuring of priorities. Nonetheless, civil society appears convinced by the dilemma between “modern” and “natural” life to surrender to the moral indeterminacy of the concept of management. In order to further expose some of the contradictions of these understandings of nature and the conflicts they engender, the following paragraphs will be devoted to examining the language through which they are discussed.

Languages of Nature

In parallel with the two questions raised by the case studies, whose answers have been abstracted and problematized above, two main types of languages seem to be deployed to describe nature. It should be remembered that both questions and languages discussed here are abstractions and interpretations of the papers, neither mentioned in the call for papers, nor explicit in the contributions themselves. Aligned to the first question (“whose nature is this?”) the language most commonly used is that of political ecology, which assumes features of the development³ discourse when referring to the “poor/marginal” and acquires shades of discourses of wellbeing and welfare when alluding to the urban middle class. Corresponding to the second most important question (“which kind of nature is this?”) the language preferred is one of science and technology, where the stress is at times more on science, at times more on technology. The understanding proposed in this commentary results from an abstraction of the total corpus of case studies in its diversity and richness: single cases will be merely used as supporting examples for the analysis.

³ Development is here used in the connotation of anti-poverty development policies, both in the governmental and non-governmental sectors, and not in the other meanings of the word employed in the papers, such as “urban development” or “natural resources development”.

Language of Political Ecology

It is well recognized by the case studies that the stakes are greater for the poor, whose livelihoods often depend directly on natural resources (particularly evident in all the cases on Assam and Bihar). This common stand is expressed through the language of political ecology, which highlights the powerlessness of the flood-affected, their lack of voice and influence in decision-making processes. More often than not the political ecology language designates “development” as the way through which the poor can survive in disastrous nature. Nonetheless, the large majority of the authors do not assume uncritically the “black-box” of development discourse, hierarchizing instead a sort of “ideal development” above the “actual development” policies, which are admitted as not necessarily improving beneficiaries’ livelihood (See Bihar, Assam, but also Haryana and Punjab case studies). More critical papers find in the unproblematic deployment of development discourse the very source of floods and related conflict (Assam and Bihar case studies are very clear about this). The introduction of the article on Bihar’s bridge speaks very clearly of the development delusion: “Development as a concept and a political promise immediately raises our hopes, being associated as it is with the betterment of our lives, especially for the common masses. In practice however, development schemes often end up showing the opposite effect by causing serious damage to the well being of the people on ground even though they sound good on paper and in bureaucratic reports” (Choubey, this compendium).

More subtly, the languages used here differentiate priorities of development for the poor and of wellbeing or welfare for the non-poor. The UP and the Bengaluru case studies can be juxtaposed as an example. In the first, basic development is called for as a way in which people will be less vulnerable to floods. That powerless groups are more likely to live and work in disaster-prone areas, and that pre-disaster inequalities exacerbate disaster’s effects, have been discussed by the literature for a long time (Torry, 1986; Zaman, 1991; Haque and Zaman, 1994; Johnson, 2001; to name a few), although, as mentioned above, it remains to be seen whether so called development policies and programs actually help to reduce poverty and structural marginalization. In contrast, the middle class reaction to disaster (even when the disaster is not life-threatening) ensures a more effective mobilization of resources to protect “neighborhood rights” and to avoid the recurrence of the event. This is not to question the unpleasantness of sewage smells inside habitations (quite the opposite, as it will be seen) and the right of the neighborhood to collectively engage against it, but to reason on the different traumata and the collective acceptance of differential perceptions of rights.

In the limited scope and space of the cases, wider relations of production and consumption of nature are less apparent, but not less consequential. While the larger economic network lies out of the case study’s reach, it is unavoidable to read the connections between changes in processes of production and those in processes of consumption, towards the idea that the political ecology approach is at its best when adopting a wider outlook, (for example, see the 1985 path-breaking study by Mintz on sugar). For example, in

the examination of agricultural changes towards irrigation-intensive crops that engendered canalization and its consequences (for example the Punjab's case study reports that the recent cropping pattern has resulted in a six-fold rise in irrigation requirements), it would be interesting to verify the modifications in the demand pattern. The case study of the Krishna basin reveals the complexities of reservoir management, and the political priorities that lead to compromise certain citizens' safety for others' welfare. Other examples include the constructions of roads and bridges, also rooted in subtler networks of political ecology and justified through discourses of development and technology, but whose beneficiaries are not at all clear. In order to juxtapose the different registers used for the poor (in terms of development) and about the others (in terms of welfare and wellbeing) it would be interesting to adopt a larger outlook in which both groups are seen as interconnected ends of the same political economic processes.

It would also be interesting to connect wider networks of production and consumption of nature to the political ecology idea that "a community's capacity to cope with hazards is embedded in and thus a function of its relations of production; and if the latter are weakened, then so is the former", and that hazards are "redefined by the transformation in the social relations of production" (Watts, 1983:252). It is in this sense that we can expand the idea of ecological marginalization discussed by several of the studies here proposed. While certain ecologies are marginal when politically and discursively convenient, as argued above, they can still be materially connected to the "centre" as sites of production of nature, but do remain marginal if their relevance is neither economically nor discursively recognized. In the current market economy, these marginal ecologies are likely to be essential site of "production of nature", while their marginality may well serve to silence/obfuscate the possible contraindications of this production, such as floods (through canals, see Punjab and Haryana case studies). Similarly, people living in these "marginal ecologies", offsetting the troubles of their ecology through migrations (see Assam and Bihar case studies), constitute the migrant, cheap, seasonal and flexible labor base from which the whole country benefits. In political ecology terms, it would be fruitful to empirically demonstrate the relation between the marginality of the migrants' ecology of origin and the broader framework of their political and economic inequalities.

Language of Science and Technology

Also very apparent is the authoritative place attributed by the authors of the studies to the language of science⁴ in the description of floods. Even more prominent than the discourse of development, scientific descriptions are the preferred language to describe the "reality of floods" (as an example see the cases on Rajasthan, Punjab). Far from obvious, the need to narrate nature in scientific terms is stretched to points in which it seems at odds with, or redundant to, the argumentation itself. Three possibilities seem to justify this attachment to scientific language. First, science benefits from unquestionable authority, as discussed for decades by many historians and commentators of science in the South-Asian context (Alvarez, 1992; Visvanathan, 1997; Prakash, 1999; Nandy, 1988; Itty, 1998⁵). Second, the civil society evidently

⁴ The term science is loosely used here to mean environmental sciences.

⁵ The argument put forward by these authors is more complex and nuanced. A further step discussed by these authors, not found in the texts and therefore not mentioned here, is about the use of science by politics, or how science has been used to justify political claims, or vice versa, how politics have been able to majorly influence the directions taken by science.

feels the need to tap into science in order to engage with policy makers and assert their right to discuss the environment. This is particularly visible in the recurrent accusations of not “mastering science enough” (see an example of these accusations in Pandit, 2009⁶). Third, science is supposedly veiled by the mantle of impartiality, which, in discussing nature-based conflicts, may be the best path to follow towards a common ground for the resolution of the problem. Decision makers and communities’ definitions of disaster, risk, hazards can be at odds, but science is seen as the place where to find (the) impartial truth. By contrast, the legal framework proposed by some is generally considered necessary but not a guarantee of impartiality, neither in its establishment nor in its enforcement (see Bihar, Mumbai and Bengaluru case studies as example).

If the language of science is preferred by virtue of its supposed authority, officiousness and impartiality, the language of technology, often paired to science, has in general a very different connotation in many of the essays of this compendium. Technology can often be managed wrongly (as an example see the Krishna Basin case), and is not necessarily right in itself (evident in both the cases on Bihar embankment and bridge, and the Assam case study on geo embankment, and the Ghaggar case), but is often a political decision (“The farmers’ claim was that it’s often the ruling parties that determine where the drain canal ought to be constructed rather than the topography and regional space”, in the Punjab case study). The historians of science and technologies mentioned above have in fact commented on the decline in faith towards technology since the early 80s, identifying Bhopal as the watershed event between trends of blind trust and skepticism towards science and technology (Visvanathan, 1997). In fact, in these few cases, technology is considered the very source of conflict, instead of its answer. The two cases from Bihar (but also others, for example the Ghaggar case study) voice the argument against embankment, first understood and reasoned in India by Mishra (also contributing to this volume), in which the technology of embankment not only has worsened floods instead of controlling them and has increased the vulnerable area instead of reducing it, but more importantly has created conflicts between the people living inside and those living outside, between the inhabitants of the upstream and downstream areas, between those cultivating low lying lands and those farming in elevated ones.

More interestingly, in the cases in which technology is the source of conflict, blind trust in science seems vacillating, and the call for concrete legal and governance remedies becomes more compelling. The article on the Kosi bridge asks for precise and concrete measures, some of which are directly proposed by the author, in order to deal with the embankments and the consequent floods (see also the Ghaggar case study). This is partially true even in the article by researchers on the Krishna Basin that mentions the lack of reliability in current methods of meteorology forecast. In their nuanced portrait, science is not only general scientific knowledge, but a system of knowledges and artifacts that perform through mechanisms of communication, and that are finally subjected to enactment only by authorities, or, to paraphrase, that are finally subjected to power. Even if the

⁶ It should be remarked that, in the article mentioned, Pandit reacts against sound arguments questioning the science of embankment, technology of which he himself has been an active proponent.

cases are too few to reach a conclusion, it could be hypothesized that, when technology is evidently problematic, the language of science acquires shades/ overtones of skepticism, and is unable to hold its aura of authority and impartiality. In fact, the technologizing and managerial idea of nature produced disruptive effects, which in turn disappointed the very base of a concrete, rock-solid, unquestionable science on which technocrats are holding technology. Moreover, if science and technology are subjected to power, questions on who benefits from it are raised accordingly.

Missing Languages of Nature

In identifying the languages used, it is also interesting to note the languages that are missing, or are consistently devoted less space and therefore collectively attributed less importance. In fact, cultural, moral, sensorial and religious languages are stark in their absence, and reveal the selectivity of the languages through which floods are narrated. The focus on the political ecologic and scientific aspects of floods obscures the fact that floods are likewise a phenomenon with symbolic, moral, and conceptual relevance. This is not a critique to the authors: the languages used and those missing are evidence, to be verified at a larger scale, of the accepted ways in which floods, or for that matter nature, are discussed in the realm in which both these authors and their intended audiences operate. Borrowing from Bourdieu the concept of *doxa* (1990), the borders of the discourses on floods are not only of a substantial nature: it is not only the content of what we say that reveals the *doxa*, but which instrument, or which languages, we use to say it.

Most of these essays offer glimpses of implicit and hidden ways of discussing nature in sensorial, symbolic, or moral ways, all of which have corollaries. First, in these texts both urban and rural dwellers voice, even if at times implicitly, the need for a re-appropriation of nature that has aesthetic, moralizing, and sanitizing value. Second, these essays reveal cultural and religious feelings of belonging to a particular nature, often vehiculated with nostalgia (see the multi-authored Bihar's case study, for example). Third, the essays implicitly take in account perceptions of risks, which are referred to as varying among different sets of people and adapting with time and experiences (see Rajasthan's case study, for example). In all these cases, floods are understood as unnatural occurrences that call for claims to the natural past: reference is made to the nature-before-floods, where and when inhabitants could live in harmony with nature. Since inhabitants did belong to this "unspoiled" beautiful, virtuous and clean nature, they should be able to return to it. The consequence is the assertion of people's authority in decision processes related to nature, a type of entitlement that enables the reinforcement of statements of citizenship (see cases on Mumbai, Bengaluru, Bihar, Assam, Rajasthan).

The impression is that we have given up our imaginary, sensorial, spiritual understanding of nature to systematic and authoritative ones. Despite Bachelard narrating our imaginary ("imaginaire") of water as resistant to systemization (1942), this imaginary is hardly allowed to surface in our discussions about nature. Instead, it is easier to find what Linton narrates as

“modern water” as “the dominant, or natural⁷, way of knowing and relating to water, originating in western Europe and North America and operating on a global scale by the end of the twentieth century”, and “the modern tendency to fix water (..) in scientific discourse, (..) (tendency) made invisible to society at large and thus (..) hegemonic” (2010:13-14). The point that will be put forward here in response to the concerns of the authors as discussed above will be that, in giving up certain ways of describing of nature, we have (also) missed their political significance.

Sensorial and aesthetic descriptions of water are as political as (political) ecologic and scientific ones, even if less evidently so, as debated previously with reference to citizenship. This is not to take away the focus from the livelihoods of the environmentally vulnerable through elitist claims of beauty and perfume, but to challenge simplistic explanations of nature that pass only through standardized canals, such as (numeric and abstract) indicators of access to resources, resource scarcity and ecological security. Latour writes: “when we speak of colors, odors, or lights, we are designating secondary qualities. Nothing is more innocuous than this distinction, at first glance. Yet we need to modify it very slightly to bring fully to light the political arrangement that it surreptitiously authorizes” (2004:47). Similarly, Mosse’s study of water tanks in rural Tamil Nadu shows that even for the landless and the “poor”, it was not access to material resources that mattered as the reason to be included in the water association committee, but the symbolic capital that could be translated into upward mobility, honor, respect (2003).

Politics, Knowledges and Conflicts of Nature

If we continue to understand these texts as both moments of forming knowledge over nature and their sedimentation, and we further abstract what has been discussed till now, we can frame what we have argued for as a set of hypotheses on the ways in which we discuss, know, and fight about nature. First, we should recap the binary ways in which, as it has been argued in this commentary, we know nature. On the one hand, we discuss nature in codified ways even before defining it through our senses, cultural and religious references, symbols and imaginaries. However, even if we publically talk about political ecology and science, we experience nature through its sensorial, material and spiritual characteristics, and we value these experiences. Also, we do attribute symbolic and immaterial values to nature, for example engaging it as a moral compass (Sivaramakrishnan and Vaccaro, 2006) to guide the resolution of our political troubles.

Nonetheless, we authorize certain codified ways of understanding nature to know nature for us, and not only to explain it to us, but sometime to hide and rule it for us, and even to seclude it from us as the domain of the experts. Recent work has reconsidered the hydrologic cycle demonstrating its historical and cultural base (Linton, 2010), and shifted focus to the hydrosocial cycle of water (particularly in urban areas, see Kaika, 2005; Swyngedouw, 2004), suggesting to denaturalize “fetishized” knowledges. Often even the emotional ways in which we describe nature have an ideological and political component to it. Several case studies convey the atmosphere of

⁷ Unlike the use of the word in this essay, with the word “natural” Linton is referring to the realm of the natural sciences.

disappointment, despair, anger, and sufferance emphatically perceived and narrated by the authors (see cases on Bihar, Assam, and Mumbai, for example). In some cases, also the emotions of the author transpire through the pages. However, the descriptions narrate the emotional effects of political injustice and technological mis-management more than fear of floods' water, the disgust of what it leaves behind, the sorrow of finding our own houses in ruins⁸. Moreover, as we have concluded in the previous paragraph of this commentary, if our embeddedness in relations of power shapes our concern and knowledge about nature, our lived realities and how we think about them also matter for the same reason. In fact, as discussed above, politics of nature does not deprive it of its affective constitution. In turn, the affective constitution of nature may play a role in how the politics of nature are played.

As we have seen, nature, particularly an unstable and changing one, is difficult know. As Latour writes, nature is a hard-to-capture assemblage of relationship and connections (2004), and the social construction of the separation of the modern life from nature does not make it any easier. From the analysis proposed here, we could conclude that, embedded in the land and waterscapes where human livelihoods are produced, humans do live in natures of different sorts and necessitate knowing them. At times in which nature is instable and challenging, the need and the struggle to know nature is unsurprisingly more intense. The languages used to discuss nature in these essays reveal the ways in which it is known, but, also, and perhaps most importantly, how difficult it is to do so. The difficulty of knowing nature is disclosed in its descriptions, as well as in the languages used and under-represented.

Languages are of political significance: even when languages of compromise, they reveal and engender conflicts more markedly than mere descriptions of the conflicts themselves. On the one side, the languages used in the preceding essays aim to assert what is perceived as right and just for the society, and at the same time to find an authoritative and neutral common ground over which there can be no diversity of opinions, and therefore which can lead to the resolution of disputes. If these languages are a response to conflict because they search to establish a compromise, by attributing authority to certain understandings of nature, they obscure other ones and deprive them of legitimacy, though not necessarily of political relevance. The other understandings, in turn, do engender opposing perceptions of nature, and the coexistence of divergent productions of knowledge is likely to generate conflicts. It is therefore possible that conflicts about floods are not only conflicts of interest, but also conflicts of knowledge.

In other words, we do not know much about this unnatural, distant, difficult nature of floods. We struggle to understand it, as much as we struggle to compose these conflicts, but we are stuck in prioritizing certain modalities of knowledge over others, glued to discourses and languages that feel right, those of political ecology and development, and of science and technology. As a result of this fetishism of knowledge, alternative understandings can be sidelined and their marginalization can potentially escalate into conflicts.

⁸ The most evident exception to this, the multi-authored Bihar's case, confirms the argument, if we take in account the authors' biographical multiple experience of floods, as discussed above.

However, without viable alternatives within the *doxa*, we are content with accepting forms of “rhetoric of compromise” that perform balancing acts, both based on the moral significance of political ecology to fill our gaps of political choice, and rooted in the authority of science to fill our gaps of certainty. As a result, as much as these languages satisfy our need to represent the voiceless, they are unable to do so; they gratify our willingness to solve conflicts while failing in the same.

To conclude, semi-scholarly representations of nature are vitally necessary, not simply for democratic representation, but also for knowledge formation. The case studies proposed here read like rich, original, honest, well-informed representations and reflections of (hardly-discussed) floods in today’s India. At the same time, they provide a window on how different social groups understand nature and their troubles in doing so. The ways in which nature is described, known and communicated follows political mechanisms, and civil society, sensitive to the politics of nature, feels compelled by political responsibility to voice problems and therefore mobilizes discourses that are perceived to be persuasive to decision makers. However, by drawing attention to the ways in which the informed urban middle class focuses its understanding of nature on a scientific and technopolitical formation, this analysis has suggested that the public realm is currently impoverished of, or at least segregated from, sensorial, literary, cultural, references to nature. The codified understanding of nature deployed through standardized languages of political ecology and science and technology can be seen at the same time as a response to, and a basis for, conflicts. Where environmental anthropology has argued that narrations of nature are inevitably socially and culturally constructed (Dove and Carpenter, 2008), Watts writes “I argue that hazards research has been framed by concepts and assumptions which carry a historically specific view of nature, society and man and hence, by extension, of the relations between them” (1983:231). Similarly, this commentary indicates the need to be attentive to how our knowledges of nature are formed and discussed and to consider their role in shaping and framing new ones.

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About Contributors

Alka Pande

By virtue of being a journalist Alka Pande has been writing mostly on developmental issues for last fifteen years. During these years she has come in contact with several agencies working on various developmental issues. This case study is also the result of one of those associations.

Contact:

Alka Pande

B-303, Raj Sampati Colony, Mall Avenue, Lucknow 226001, Uttar Pradesh

Mobile/Tel: 0091 9839369393, 0091 222237563

Email: alkapande@gmail.com

.....

Arshinder Kaur

Arshinder Kaur has observed the conflict through the association of farmers who are in the process of transition to organic methods of food production in South West Punjab area, however, find difficulties in compliance to international standards while coping with such disasters. She has been associated with them since the past five years as a trainer, and as a capaciator.

Contact:

Arshinder Kaur

Eco & Agro Resource Management, House no. 20, sector 70, Mohali, Punjab

Mob./Tel: 0091 9779902070

Email: arshinderkaur@gmail.com

Website: www.eco-agro.org

.....

Bejoy K. Thomas

Bejoy K Thomas is a fellow at Centre for Environment and Development, ATREE, Bengaluru. He holds a PhD in the interdisciplinary area of Development Studies from Tilburg University, The Netherlands (2009) and uses insights from economics, social anthropology and critical development studies in his research and teaching. Thomas's past research and published output focused on multidimensional poverty and vulnerability, particularly at the household level. Currently he is extending vulnerability analysis to integrate social and ecological systems, drawing from field research and working in collaboration with engineers and natural scientists.

Contact:

Bejoy K Thomas

ATREE, Royal Enclave, Srirampura, Jakkur Post, Bangalore 560 064, Karnataka

Tel: 0091 80 23635555 (EPABX)

Fax : 0091 80 23530070 Email: bejoy.thomas@atree.org

.....

Chandrashekhar

Chandrashekhar is the Founder and Secretary of Gramyasheel, a Supaul based non-

government organization. He is a journalist turned development worker and has been working in the region since 1994. He and his organization have been associated with various activities concerning peoples' organization, education, innovative works relating to governance, women's livelihood, water, sanitation and groundwater contamination, and contextual agriculture for the flood prone areas.

Contact:

Chandrashekhar

Gramyasheel, Gandhi Path (Behind Jail), Supaul - 852131.Bihar

Mob/Tel: 0091 9430858277, 06473225739

.....

D. K. Mishra

Dr. Dinesh Kumar Mishra is a civil engineer from IIT, Kharagpur. Since 1992 he has been working in the Ganga and Brahmaputra river basins in Bihar state, India's most flood-prone region, where he has created an umbrella network, the Barh Mukti Andolan (BMA), of over 700 rural groups of "flood historians."

Dr. Mishra is organizing communities in flood-prone areas of India to remember local, decentralized ways of coping with floods. Through country-wide education programs on traditional flood management systems, he has launched a movement that empowers citizen groups to re-establish their cultural ownership over rivers and create a new paradigm of flood control - non-confrontational tools that respect the natural cycle of floods and respond with minimum technological interference. He is often referred to as the "walking encyclopaedia on Bihar rivers".

Contact:

Dinesh Kumar Mishra

Convenor-Barh Mukti Abhiyan, D-29, Vasundhara Estate, NH-33, PO MGMC

Jamshedpur 831018, Jharkhand

Mob: 0091 9431303360

Email: dkmishra108@gmail.com

.....

Eklavya Prasad

Eklavya Prasad has been associated with the development sector since past 14 years. He has devoted close to 12 years in the area of decentralized water resource management. For the past five years, he has been working with the flood prone regions of north Bihar as a Development Practitioner of the Megh Pyne Abhiyan - MPA (Clouds Water Campaign). The campaign was conceptualized by him and is currently being implemented in partnership with four local organizations across five districts of north Bihar. Eklavya Prasad is leading the campaign with the intent to construct a congenial social environment through sustainable technological innovations and adaptation of conventional wisdom in order to ensure a shared, sustainable and effective management of water. However, much beyond that, the wider mandate is to stimulate collective action and accountability towards a 'common good' amongst the local habitants for grassroots cooperation through social, ecological, and technological awareness amongst the stakeholders.

Contact:

Eklavya Prasad

A 702, Abhyant CGHS, Plot No 2, Vasundhara Enclave, Delhi 110096
Mob: 0091 9810307445
Email: graminunatti@gmail.com

.....

Gorky Chakraborty

Gorky Chakraborty, presently with Institute of Development Studies Kolkata (IDSK), has a keen interest in development related issues in India's North East.

Contact:

Gorky Chakraborty
Institute of Development Studies Kolkata (IDSK), 27/D, D.D. Block, Sector-1
Salt Lake, Kolkata-700064
Mob: 0091 9933421664
Email: gorky8bob@gmail.com, gorky@idsk.edu.in

.....

Jitendra Choubey

Jitendra Choubey is a Patna based journalist and civil rights activist. He did his graduation in Mass communication from Magadh University and Master's in Electronic Media from Makhnallal Chaturvedi Journalism and Communication University, Bhopal.

He had worked for different publications like The Central Chronicle, The Hitavada, The Times of India, during college days. Presently, he has been working with Newzfirst, since October, 2010. He has immense interest in Development reporting. He has compiled volumes on Human rights violations in Bihar and Bihar prisons both published by the Bihar unit of PUCL.

Contact:

Jitendra Choubey
S/o Sri Naresh Choubey
House No.- 3 J / 388, New Patliputra Colony, Patna- 800013
Mob./Tel: 0091 8987130820/ 0612-2270866, 9955446090
Email: neermanmegh@gmail.com

.....

K. J. Joy

K. J. Joy has a Master's degree in Social Work from the Tata Institute of Social Sciences, Mumbai. He has been an activist-researcher for more than 25 years and has a special interest in people's institutions for natural resource management both at the grassroots and policy levels. His other areas of interests include drought and drought proofing, participatory irrigation management, river basin management and multi-stakeholder processes, watershed based development, water conflicts and people's movements. He was a Visiting Fellow with Centre for Interdisciplinary Studies in Environment and Development (CISED), Bangalore for a year and was a Fulbright Fellow with University of California at Berkeley. Joy has been the coordinator of the Forum for Policy Dialogue on Water Conflicts in India.

.....

Contact:

Society for Promoting Participative Ecosystem Management , (SOPPECOM), 16, Kale Park, Someshwarwadi Road,, Pashan, Pune 411 008, Maharashtra

Tel: 0091 20 2588 0786/6542

Fax: 0091-20 2588 6542

Email: joykjjoy2@gmail.com

.....

Luisa Cortesi

Luisa Cortesi is an environmental anthropologist, specialized on water issues in South Asia. She is currently researching on floods and drinking water from the perspective of disaster management, environmental knowledges, technologies of water access, and water quality. She has a decennial experience on water-related problems and more broadly social development in India from both social and natural sciences perspective. With a MA from SOAS, University of London, an MPhil and MSc from Yale University, she has worked for both small rural NGOs and several UN agencies. She is now pursuing a joint PhD in Environmental Studies and Anthropology at Yale University, USA, as a Fulbright and a MacMillan fellow.

Contact:

School of Forestry and Environmental School/ Department of Anthropology
Yale University, New Haven, CT, USA

Email: mpa.luisa@gmail.com

.....

Manasi. S

Manasi. S. is currently working as Assistant Professor in Centre for Ecological Economics and Natural Resources, Institute for Social and Economic Change, Bangalore, India. She has long time research experience in water resources both in the rural and urban contexts. She has worked specifically on issues related to water quality, water institutions and integrated water resources management. Her other research interests are waste management, land resources, and climate change.

Contact:

Manasi. S

Centre for Ecological Economics and Natural Resources, Institute for Social and Economic Change, Dr. V.K.R.V. Rao road, Nagarabhavi, Bangalore - 560 072

Mob: 0091 9900496579

Email: manasi@isec.ac.in

.....

Narendra V. Killada

Narendra V. Killada is trained as a civil engineer from Birla Institute of Technology and Science, Pilani. He is currently associated with the Land, Water and Livelihoods programme at Ashoka Trust for Research in Ecology and the Environment, Bangalore where he works on issues in water and development. Killada is a recipient of the young explorer grant from National Geographic Society (2011) to conduct field research on the impacts of large scale watershed development on downstream water users. He will be shortly joining the graduate programme in Water Policy Science and

Management at Oxford University, UK.

Contact:

Narendra V. Killada

ATREE, Royal Enclave, Srirampura, Jakkur Post, Bangalore 560 064, Karnataka

Tel: 0091 80 23635555 (EPABX)

Fax : 0091 80 23530070

Email: narendrakillada@gmail.com

.....

Nidhi Jamwal

Nidhi Jamwal is a Mumbai-based freelance journalist with 14 years of experience in development and environment reporting. She started her career with the Down To Earth magazine, India's only science and environment fortnightly, where she worked for 12 years. She has travelled across the states of India and reported on issues such as forests, water, renewable energy, industrial pollution, and waste management. For the last two years, she is working as a freelance writer, contributing articles to various publications.

Contact:

Nidhi Jamwal

A-1003, Evershine Embassy, Opposite Country Club, Veera Desai Road, Andheri

West, Mumbai 400053

Mob: 0091 9867213234

Email: nidhijamwal@gmail.com

.....

Parag Jyoti Saikia

Parag Jyoti Saikia holds a MA in Development Studies from Indian Institute of Technology Guwahati, and an undergraduate degree in Political Science from Delhi University. As a field researcher and a surveyor, he analyzed MGNREGA implementation in Bihar. He has also worked with Matu People's Organization as a research assistant, advocating for peoples' right over the rivers in Uttarakhand. During his tenure as a summer research intern with Dr. Arupjyoti Saikia, he has dealt with post-independent embankment history of Assam. His master's dissertation looks at the politics of embankment in Assam. His research interests include political ecology, political economy of flood control and hydropower.

Contact:

Society for Promoting Participative Ecosystem Management , (SOPPECOM), 16, Kale Park, Someshwarwadi Road, Pashan, Pune 411 008, Maharashtra

Tel: 0091 20-2588 0786/6542

Fax: 0091 20-2588 6542

Email: paragjyotis@gmail.com

.....

Pradeep Kumar Poddar

Pradeep Kumar Poddar is the program officer of Megh Pyne Abhiyan (MPA) and has been working with MPA since 2007. Initially he was the field associate in Saharsa thereby implementing the innovative works of MPA in one panchayat. For past six years he has gathered the experience of implementing, monitoring and leading

programs and projects within MPA. He has developed skill in undertaking groundwater profiling, baseline studies and field based action research, construction of water and sanitation solutions.

Contact:

Pradeep Kumar Poddar

At post Mahishi, Dist. Saharsa 852216, Bihar

Mob.: 0091 9470619007

Email: pradeep.mpa@gmail.com

.....

Prem Kumar Verma

Prem Kumar Verma is the Secretary of Samta, a Khagaria based voluntary organization working in the flood affected areas of the district with Musahars, the socially and economically backward community residing in the district. As a student he actively participated in Bihar in the Jay Prakash Narayan's movement for Total Revolution. After a long stint in state level politics, he returned to the development sector and ever since he has been associated with various local, state and national level movements. Since 1984, he has been actively working on the issue of floods and post 2005 he has been addressing issues of drinking water, groundwater contamination, sanitation and livelihood in the flood prone areas of Khagaria district.

Contact:

Prem Kumar Verma

At Post Sanhouli Khagaria 851205, Bihar

Mob.: 0091 9430042978

Email: samta_khagaria@rediffmail.com, samtaforwater@gmail.com

.....

Rajendra Jha

Rajendra Jha heads Kosi Seva Sadan in Saharsa district and is a thorough Gandhian. He has been working in the flood prone areas of Saharsa district since 1981. Over the years the organization under his leadership has been working on various issues - strengthening co-existence with floods, water management, health, water and sanitation, groundwater contamination, environment, agriculture etc. He has led many struggles in the flood prone area of Mahishi block for the rehabilitation of people displaced because of the embankment and to curb nefarious activities like encroachment, alcoholism and dacoity.

Contact:

Rajendra Jha

Kosi Seva Sadan, Gram Post Mahishi, Dist. Saharsa 852216, Bihar

Mob.: 0091 9934797023

.....

Ramesh Kumar

Ramesh Kumar is the Chairman cum CEO of Ghoghardiha Prakhanda Swarajya Vikas Sangh (GPSVS), a Madhubani based grassroots organization working in different districts of the north Bihar region. He has been involved in development work since past 21 years and has been working on education, integrated community development, health, water and sanitation, groundwater contamination, disaster management and women's empowerment, contextual agriculture issues. His

experience is not only from working in the rural areas but also from his background in law and the vast national and global network of which he and GPSVS are an active member.

Contact:

Ramesh Kumar

Ghoghardiha Prakhand Swarajya Vikas Sangh , Gram Post Jagatpur, District
Madhubani 847402

Mob.: 0091 9431025373

Email: gpsbsjp@gmail.com

Shrinivas Badiger

Shrinivas Badiger is a Fellow and Programme Leader of the Land, Water and Livelihoods Programme at the Centre for Environment and Development, Ashoka Trust for Research in Ecology and the Environment, Bengaluru. He has a Ph.D. in Soil and Water Resources Engineering from University of Illinois, Urbana-Champaign and a Masters in Water Engineering and Management. His research anchored in the water sector, uses systems approaches linking climate, agro-ecological and socio-economic processes to understand the context of changing waterscapes within a larger framework of sustainable environments and human wellbeing. This includes understanding land-use change and cropping system choices, surface and groundwater interactions in natural and anthropogenized hydrologic systems; inter and intra sectoral water allocations, water management practices and policies in changing socio-economic, institutional and climate conditions.

Contact:

Shrinivas Badiger

Fellow and Programme Leader, Land, Water and Livelihoods Programme, Centre for Environment and Development, Ashoka Trust for Research in Ecology and the Environment, Royal Enclave, Srirampura, Jakkur PO, Bangalore 560064. Karnataka, India

Tel: 0091 80 23635555 (EPABX)

Fax : 0091 80 23530070

Email: sbadiger@atree.org

Shruti Vispute

Shruti Vispute is a graduate in Political Science from Fergusson College, Pune and has a postgraduate degree in Environmental Politics from School of Politics, International Relations and Environment at University of Keele, England and M. Phil. in Political Science from University of Pune, Pune. Her research arenas explore the phenomenon of water conflicts in India, gender issues in water sector, development politics, and environmental activism especially around water issues. She has written for the popular press on contemporary socio-political issues, feminist issues, women's movements. She works with Society for Promoting Participative Ecosystem Management, Pune.

Contact:

Society for Promoting Participative Ecosystem Management

(SOPPECOM), 16, Kale Park, Someshwarwadi Road, Pashan, Pune 411008, Maharashtra

Tel: 0091 20-2588 0786/6542
Fax: 0091 20-2588 6542
Email: vispute.shruti@gmail.com

.....

Smitha K.C.

Smitha K.C. is Research Associate, at Centre for Ecological Economics and Natural Resources, Institute for Social and Economic Change, Bangalore, India. She has recently submitted her PhD thesis from the Department of Political Institutions, Governance and Development, ISEC. Her research interest includes urban governance, political economy of service delivery, urban water supply and sanitation and urban poor.

Contact:
Smitha K.C.
Research Associate, Centre for Ecological Economics and Natural Resources
,(CEENR), Institute for Social and Economic Change, V.K.R.V. Rao Road
Nagarabhavi Village, Bangalore -560072
Mob: 0091 9844882316
Email: smitha@isec.ac.in

.....

Suhas Paranjape

Suhas Paranjape has a B.Tech (Chem.) from Indian Institute of Technology, Bombay. He has actively participated in different movements like People's Science Movement, Adivasi agricultural labourers' movement, etc. Suhas has participated as a core team member and consultant in many action research studies and pilot projects undertaken by Centre for Applied Systems Analysis in Development (CASAD) and Society for Promoting People's Participation in Ecosystem Management (SOPPECOM), Pune in the areas of participatory management of natural resources especially in the field of participatory irrigation management. For three years from 1996 to 1999 he worked as a core team member of the Bharat Gyan Vigyan Samiti (BGVS) in its watershed development project across the country. He was a Visiting Fellow with CISED, Bangalore for a year.

Contact:
Society for Promoting Participative Ecosystem Management , (SOPPECOM), 16, Kale Park, Someshwarwadi Road,Pashan, Pune 411 008, Maharashtra

Tel: 0091 20-2588 0786/6542
Fax: 0091 20-2588 6542
Email: suhas.paranjape@gmail.com

.....

T. V. Jayan

T. V. Jayan is a New Delhi-based journalist, who has been writing on science and environment related topics over the last two decades. He has earlier worked with Down To Earth magazine and is currently with The Telegraph, a new premier English daily published from Calcutta and other eastern Indian cities.

Contact

T. V. Jayan

194 Samachar Apartments, Mayur Vihar Phase - I Extn, Delhi 110 091

Email: tvjayan@gmail.com

.....

Vinay Kumar

Vinay Kumar is associated with the social development sector for past 25 years and during this period he completed his Bachelor of Education and Masters of Arts in Sociology. Presently, he is the Secretary of Water Action, a West Champaran based organization, working in two diverse ecological zones - in the outer foothills of Himalayas and in the flood plains. He is championing the cause of safe drinking water, secure sanitation, groundwater quality, and livelihood in the flood prone areas of the district. Since past few years, he has undertaken diverse field based research and documentation as per organization's areas of interest and priority.

Contact:

Vinay Kumar

Water Action, Gram Diulia, Post Jagadishpur, Dist. West Champaran 845459 , Bihar

Mob.: 0091 9934208994

Email: wateractionbihar@gmail.com

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The Forum and its Work

The Forum (Forum for Policy Dialogue on Water Conflicts in India) is an effort to bring together all those interested in working on issues related to water conflicts in India into a loose network for action and interaction. The Forum began its work towards the end of 2004 as a collaborative effort of a few organisations and independent researchers and was supported by World Wide Fund for Nature (WWF). Presently the Forum has more than 150 organisations and individuals and the present phase of Forum's work is primarily supported by Arghyam Trust, Bangalore. The Forum's work covers the four broad areas of conflict documentation, conflict resolution, conflict prevention and network and outreach.

Contact

Forum for Policy Dialogue on Water Conflicts in India
c/o Society for Promoting Participative Ecosystem Management (SOPPECOM)
16, Kale Park, Someshwarwadi Road, Pashan, Pune 411 008 Maharashtra, India

Phone: 0091-20-25880786, 25886542 Fax: 0091-20-25886542 Email: waterconflictforum@gmail.com
URL: conflicts.indiawaterportal.org