Capacity Building Workshop on Systems Thinking and Adaptive Governance

The Context of Flood in Lakhimpur District, Assam

28-31 January 2014

Venue: TERI North Eastern Regional Centre, Chachal, Express Highway, Guwahati

The Energy and Resources Institute (TERI), New Delhi with the support of the Asia Pacific Network for global change research (APN) organized a 4 day capacity building workshop on "Systems thinking and Adaptive governance with the context of flood in Lakhimpur district of Assam" from 28th to 31st January. The workshop had a mix of panel discussions, lectures and group activities using conceptual systems modeling techniques which helped stakeholders to understand issues of flood from different perspectives; learn about challenges posed by uncertainty and strategize accordingly. It provided an opportunity to learn theory and practice of systems thinking and network with peers from civil society, academia and government. Resources persons included eminent researchers, faculty members and government officials from institutions like Humanities and Social Science Dept. of IIT, Guwahati, Management Development Institute (MDI), Gurgaon, National University of Singapore (NUS), TERI University, Assam Agricultural University, Water Resources Department (WRD), Govt. of Assam (GoA), Centre for North East Studies and Policy Research, Jamia Milia Islamia, Aaranayak, Guwahati and Assam State Disaster Management Agency (ASDMA). Stakeholders included researchers and scholars from IIT, Guwahati, Lakhimpur College, student activist associations and non-governmental organizations like Rural Volunteers Cell (RVC), Aaranayak and Farm2Foods, government officials from extension offices of Revenue and Disaster management Department and WRD, GoA.

Date: 28 January 2014- Day 1

The workshop began with opening remarks by Dipankar Saharia, Associate Director of Environment and Industrial Biotechnology Division and Coordinator of TERI-North East, who raised issues of flooding and erosion as the major concerns of the State of Assam. He mentioned that erosion has affected settlements, rendered people landless and has been contributing to out-migration. Following these remarks there was a round of introductions among the stakeholders which included doctoral students, government officials and members of Non-Governmental Organizations. Navarun Varma, Research Associate, Earth Science and Climate Change division of TERI then explained the purpose and structure of the workshop and mentioned the aim of the workshop is about understanding causes, impacts, and responses and linkages between the three for flood hazard. The lectures, panel discussions and breakout activities were designed to gain an understanding of issues of hazard, governance and uncertainty surrounding the Brahmaputra basin through different perspectives and also learn an approach for integrating different aspects of a problem.

Lecture- Dr. Arup Jyoti Saikia, Associate Professor, Humanities and Social Science Department, IIT, Guwahati

The first lecture was from Dr. Arup Jyoti Saikia, Associate Professor, Humanities and Social Science Department, IIT, Guwahati on the environmental biography of the Brahmaputra River. This river has a large and ferocious character but in order to investigate issues of uncertainty, erosion, siltation one has to demystify romantic stories surrounding it. The river and humans, through their interactions, have together

shaped the destiny of the region. People's experiences of the river of the last thousand years needs to be retold. There are several historical examples of human experimentation with rivulets in the Garo and Khasi Hills of the Brahmaputra basin. However, till the close of the 20th century, people refrained from living close to the river. The notion of human settlement is a very recent story – a very short time frame in human history of the basin. In the last few hundred years, as the hills (i.e. the Eastern Himalayas)became increasingly uncomfortable as a source of life, people started descending from the hills and settling in the plains and adapting to life in the floodplains (through their houses and crops).

Humans had become attuned to the flood regime of the Brahmaputra. Several elements contributed to people coming close to the river e.g. boats, gold washing, fishing, driftwood, pirates, dacoits and military strategies. There is a need to reflect on and learn from this rich historical experience, rather than bringing in ready-made doses of experience from other landscapes. In answer to audience questions he mentioned dearth of major research projects on the Brahmaputra River and expressed his uneasiness with the idea of experts. Engineers' expertise of the Brahmaputra dates back only 50 years and European expertise has been restricted to military strategy and hydropower generation.

Lecture-Mr. Ratul Sarma, Retd. Commissioner and Special Secretary to the Govt. of Assam, Department of Water Resources, Government of Assam (GoA)

Right after a historical perspective, the participants were exposed to the views from the government. Mr. Ratul Sarma, Retd. Commissioner and Special Secretary to the Govt. of Assam, Department of Water Resources, GoA presented on the challenges of planning due to changing nature of the course of the Brahmaputra river. He pointed out that protecting the Brahmaputra from erosion in the upstream may increase the same risk in downstream. He also showed the river's elevation profile and its sharp drop of 3000 meters and demonstrated its huge hydropower potential. The river is widening at an alarming rate: it has increased by more than 50% due to erosion in the last 30 years. The estimated annual average land loss is nearly 8000 hectares. The main cause of siltation in the main branch of Brahmaputra is its upstream tributaries, the gradient of upstream river is too steep and the water flow with great potential energy and while coming down brought lots of silt downstream. According to him the causes of the decrease of the "natural discharge carrying capacity" and increase of the width of Brahmaputra in Assam are- 1) the frequent tectonic activities which trigger geo-morphological changes and landslides in the upper catchment leading to excessive sediment charge in the river and 2) rising of river bed due to the sediment deposition in the downstream.Further he shared facts like the river has 1280 Km of shore line which is vulnerable to erosion, the total eroded area since 1954 is 4,27,000 Ha which is 7.4 % of the total plane area of Assam and nearly 1,30,000 families are affected due to erosion in the Brahmaputra basin.

For the protection of the river bank of Brahmaputra the government has responded with the implementation of the National Flood Policy, 1954 which has immediate measures as embankment construction and drainage channels, short term measures as improvements over the immediate measure infrastructures and long term as construction of storage reservoir and additional embankments. He described various embankment schemes being constructed by the government with national and international funding. He gave examples of different types of embankments and illustrated problems created by encroachment. A pilot project from downstream of Pandu to Bohori (about 35 Km) in downstream region within Assam is proposed for channelization of Brahmaputra for reclamation of huge area. He called for soil conservation with the cooperation of communities as an important measure, and also recommended upstream storage reservoirs. Further, he identified budgetary constraints along with

delays in allocation process as a barrier implementing flood/erosion protection plans. He also criticized the upstream Sate of Arunachal Pradesh's unilateral decision for going ahead with run of the river projects which have serious impacts in downstream localities within Assam.

The participants questioned the downstream impacts of proposed dams within Assam like release of water and siltation and the community's response to non-structural measures. Some also pointed out the need for basin-level planning and cooperation with the upstream state of Arunachal Pradesh. Despite the prevalent view that flood control would have been easier in the absence of embankments, one participant spoke about the false sense of security that embankments have created among communities and noted that it is an irreversible decision. He also pointed to the risk that the same may happen in the case of other engineering solutions, such as new projects like geotextile revetment or upstream reservoirs as proposed by Mr. Sharma.

Movie screening- Filmaker Mr. Mouli Senapati

After this talk there was a movie screening for an hour by a filmmaker from Assam, Mr**.** Mouli Senapati. The objective of the film was to portray the human stories behind the statistics of floods and erosion. This was followed by lunch.

Lecture- Professor Sanjoy Hazarika, Center for North East Studies and Policy Research, Jamia Milia Islamia

After the lunch, Professor Sanjoy Hazarika, Center for North East Studies and Policy Research, Jamia Milia Islamia connected with participants from TERI, Delhi through video conference. Professor Hazarika started by emphasizing the need to visualize the river as an entity in itself – not just something for enjoyment or use of humans. In order to design interventions for controlling is to challenge this entity. He spoke about three aspects of governance in the context of flooding in Assam:

- Accountability
- Transparency
- Dialogue

In order to illustrate the 3 above elements of governance he pointed out 3 important questions in the midst of his talk-

1. Who is responsible for the damage caused by embankments?
2. Why is it that the ecologically richest parts of our country are home to the poorest people?
3. It is an alarming trend that North Eastern states have lost more forest area than any other part of India in the last few years. Why is this happening – even in areas with community-led forest management? What is the responsibility of non-constitutional traditional authorities to natural resource management?

He mentioned that accountability is essential for the government while designing policies or interventions for a vast and evolving region like the Brahmaputra river basin. Questioning the transparency of the policy process, he called for a greater focus on the needs of the masses rather than policy being driven by the ideas and concerns of a few. Inclusive governance means that the government has to plan for the region as if people matter, otherwise it can create a situation of conflict. He felt that the government has failed to provide the basic needs of the poorest leading to issues of conflict. Such conflicts in parts of Assam with resource-dependent people also demonstrate that people have not been involved in processes of government and fear that they will lose their land. Political insurgency has reduced but ethnic conflict has increased. This means that there is a need for greater dialogue between traditional and constitutional institutions. In this context, he also pointed out the importance for researchers in both social sciences and life sciences to work together.

He also mentioned the future risk of unsilted water reaching Brahmaputra in Arunachal itself as a result of eleven cascading dams proposed to be implemented by China in Tibet in the next 10-15 years. Finally, he criticized the lack of specialization and the exceedingly slow processes of the government in north east India. The government tends to function on an ad hoc basis without any long term memory or strategic vision.

Lecture- Dr. Vishal Narain, Associate Professor, Management Development Institute (MDI), Gurgaon

After presentations of different perspectives surrounding the issues in Brahmaputra Basin, Dr. Vishal Narain, Associate Professor, Management Development Institute (MDI), Gurgaon, India introduced the participants to the concepts of narrative, discourse, and model. He explained that it is our understanding, and more so its articulation, that influences policy choice. For example, in the preceding lectures, the historian, the government representative, and the film-maker addressed the same problem of flooding in very different ways. He explained that a narrative is a story with a lesson – that is used to justify a policy intervention. Such a story may be repeated such that it comes to acquire the status of established wisdom. Such narratives help to simplify complexity. Narratives persist because they are consistent with certain scientific theories and because they serve the interests of certain groups. But the problem with narratives is that they become a blueprint for development. Hence, to understand any policy choice, we need to understand the dominant narrative. A discourse, on the other hand, is an ensemble of ideas which shapes problems. Examples of development discourses are neo liberalism, gender, climate change, and affirmative action. Similarly, discourse can be linked to explain narratives and policy choices can be understood by identifying the underlying discourses and narratives. For instance, the North-South discourse in climate change has become the basis for international negotiations and donor funding. Dr.Narain then described the purpose of modeling and types of modeling according to the need of understanding a context or anticipating future trends. He pressed the importance of these concepts because in order to identify a policy solution it is imperative to recognize how the problem is framed.

In response to questions from participants, Dr. Narain agreed that discourses are about power and about which interest groups have the strongest influence on policy. Discourses often influence donor priorities and are often accepted by recipients because they come from donors (e.g. the formation of water user associations as suggested by the World Bank was considered as mandatory by the recipient government bodies). According to him there is always a need to challenge conventional wisdom and come up with counter-narratives of a problem situation.

After Dr. Narain's lecture, Professor Arabinda Mishra explained about the key concept around which the workshop was conducted i.e. systems thinking. He explained that in defining any system, inter-relationships within elements of a system are the most crucial. He mentioned that changes in one element of a system stimulate responses (or adaptation) in other inter-related elements; hence the focus is on complex adaptive systems (CAS). Both complexity and adaptive behavior are inherent in such systems. Not only do the individual entities change, but the entire system may change which becomes an important aspect when it comes to policy interventions. Typically policy interventions are directed at specific entities not at the system as a whole. So policy outcomes may not materialize as socially desired and even throw surprising results. Systems have an inherent tendency to go back to their natural / equilibrium states, after being subjected to pressures. Some powerful equilibrium states are called "attractor states" but other equilibrium states can be "surprises". Dr Mishra further explained the concepts of resistance as the capacity to retain in any equilibrium state while resilience as the capacity to shift to other equilibrium states without losing its structure and identity while collapse as the loss of the system structure.

Ignorance about certain elements or interrelationships in the system translates into uncertainty about the outcomes. Hence a paradigm shift towards acknowledging uncertainties while planning is needed. The standard rational actor model assumes the existence of a defined objective function, knowledge of all the alternative ways to achieve that objective, and a method to optimize the objective function. The alternate organizational behavior model is defined in terms of standard operating procedures. In the group politics model, outcomes are the result of bargaining or negotiations. But systems thinking approach strives to explain outcomes that cannot be explained by these three models, particularly when it comes to complex systems with human-nature interactions, such as flood management. Here outcomes are defined because of the behavior of a complex adaptive system. In the flood management example, the rational actor model leads to a limited focus on only technologies, the organizational behavior model leads to a focus on only institutions, and the group politics model leads to a focus on only conflicts. But it is important to look at flood management through a systems thinking lens. The application of this approach attempts to capture all inter-relationships in a system, for example by using the tool of causal loop diagrams. It attempts to capture linkages within narratives in the model. From a governance perspective, it becomes useful to identify factors which prevent different narratives from coming together, and identify possible barriers as well as bridges. He concluded by saying that systems thinking becomes more meaningful if it is embedded in public policymaking, for which the first step is for different stakeholders to recognize that there may be more than one narrative of an issue.

Group activity was initiated after this lecture. 4 groups were made- Water Resources Department, Other government departments, Academia and NGO/Civil society. Preliminary model was shared with each group and participants got hands-on the systems thinking technique called causal loop diagrams (CLDs).

Date: 29 January 2014- Day 2

The lecture series was started on Day 2 after lunch due to continued group activities in the morning.

Presentation on Multiple states of context: case of villages within Dhokuakhana sub-division in Lakhimpur District of Assam- Navarun Varma and Prasoon Singh, TERI

The first presentation was by Navarun Varma, Research Associate, The Energy and Resources Institute (TERI) who presented a part of his doctoral research work which has its empirical work in the context of the group activities. He explained multiple states of the part of Upper Brahmaputra Valley agro-ecosystem comprising of some villages in Dhokuakhana Sub-division of Lakhimpur district in Assam. From paddy cultivated agro-ecosystem, the ecological regime had shifted towards coarse sediment deposited landscape. The local riparian tribe-Mishings had become rich paddy cultivators as they started cultivating transplanted varieties of rice after flood protection through embankment in mid 50s. Although there were breaches in 60s, major breaches around the studied villages started from 1998 with a peak High Flood Level (HFL) in this upstream region. But the breaches were continuous from 2005 till 2009 without any peaks in the HFL, thus the breaches may not be just due to thrust of flood waters. Moreover, the Mishings were losing land due to erosion of the Brahmaputra and the receding flood waters deposited huge amount of coarse sediment in the remaining cultivable land. Since 2010, few villages stay protected from further inundation due to construction of a 5km. geo-textile revetment, but the issue has changed from flood hazard to landlessness. Following this, Prasoon Singh, Research Associate, TERI presented landsat images from 1990, 2001 and 2014 of the same 5km stretch in order to illustrate the changes owing to flood, erosion and sediment deposition.

Presentation on Climate change and associated uncertainty- Mr. Saurabh Bhardwaj

After illustration of the changes that have been occurring till date in this part of Upper Brahmaputra Valley, Mr. Saurabh Bhardwaj, Associate Fellow presented on future risk from the global phenomenon of climate change and the associated uncertainties. He started his presentation by explaining the basics of climate, its difference with weather processes and emphasized on the complex interactions between each climate component. The components within the climate system interact non-linearly amongst each other that lead to climate variability at spatial as well as temporal scales. Any change or forcing in one the component induces change or responses in all the other components in a non-linear way which makes the scientific problem of assessing the change highly complex. He showed how these non-linear interactions are numerically quantified by suing various models which are a set of mathematical equations explaining the various dynamical processes that govern the climate system. The framework of a climate model along with the flow chart of climate modeling process was explained wherein the importance of observations was established. Mr. Bhardwaj stated that observations not only help in model development and help in model simulation by providing boundary forcing and initial conditions, it also helps in validation process for any model. He then pointed out on the uncertainty aspect in the climate science and modeling which arises due to lack of observations, type of observations and resolution of model utilized. Hence to overcome these uncertainties, it was mentioned that Intergovernmental Panel on Climate Change (IPCC) have brought out various scenarios and ensemble approach which the modeling community uses to present their results to the research community and stakeholders.

He ended his presentation by showing different international and national news articles on climate change impacts on Assam which included impacts on livelihoods due to extreme rainfall events, drying up of tea production and uncertainties regarding natural hazards in the future. He emphasized on the awareness of these uncertainties among policy makers as well as masses in order to make informed decisions.

Lectures on elements of vulnerability, adaptation and resilience- Professor Ravi Rajan, Department of Environmental Studies, University of California, Santa Cruz and Professor Arabinda Mishra

This was followed by lectures from Professor Ravi Rajan, Department of Environmental Studies, University of California, Santa Cruz and Professor Arabinda Mishra on the vulnerability, adaptation and resilience. Professor Rajan presented a new approach called High Reliability Organization (HRO) for disaster management. He mentioned that there are large complex systems that are prone to disasters on a daily basis but which are quite robust, e.g. intensive care units in hospitals, military aircraft carriers, air traffic control which can be referred to as “high reliability organizations” (HRO). In order to demonstrate what makes these systems reliable he presented a comparison of traditional and HRO approaches for management. Traditional models are characterized by standardized processes, which assume that problems are repetitive. But the HRO model sees large problem variety and novelty requiring unstandardized processes, improvisation, real time action, and use of experiential, tacit knowledge (e.g. identifying and learning from “Jugaad” processes). He stressed that apart from systems dynamics, there is also complexity of human relationships which may or may not facilitate desired outcomes. In HROs there is focus on creating cultures – one which allows feedback, bargaining redundancy, accountability.

There was a question from a participant regarding the importance of resource constraints considering that it is only under such constraints that “Jugaad” i.e. innovation emerges. Prof. Rajan clarified that the reference to “Jugaad” wasmore in terms of tacit knowledge than innovation. He also stressed that more than resource constraint it is about creating incentives at work to foster innovation. Similarly, good

processes of governance need to be put in place – just grassroots democratic movements are not enough. The second question was about how a HRO culture can be created within a larger context of hierarchal structures without appreciation of feedbacks. To this an array of examples were given-Maruti Suzuki, Neyvelli Lignite Corporation, Delhi Metro-which follow such culture and instances of accidents are low in their outcomes.

Prof Mishra started by citing a paper from Smit et al., 2001to define adaptation as "changes in processes, practices, or structures of human and natural systems to moderate or offset potential damages or to take advantage of opportunities associated with climate change and variability". Thus adaptation is closely related to evolution. But literature on adaptation has tended to focus on incremental adjustments rather than on transformational changes. Most human decisions are taken in an environment of uncertainty – some sources of which are easily identified and resolved while others are deep and remain unknown. Adaptation responses are decisions, which are influenced by drivers, which in turn are subject to different sources of uncertainty (e.g. scientific uncertainty regarding climate change). Decision lifetime is a combination of lead time and consequence time.

Examples of decision lifetimes

		Consequence time	
		Short	**Long**
Lead time	**Short**	Farmer's crop choice	House construction
	Long		Infrastructure decisions e.g. flood embankments

As opposed to incremental change, which is change in specific aspects of a system, transformational change refers to fundamentally changing the system itself. Transformational change usually requires a long lead time, i.e. invest in what kind of change is required. This is usually beyond the capacity of any one individual. It is benefitted by stakeholder participation. The issue of scale is very important in decision making. Further, we cannot think of a decision in isolation of its organizational context. The way a particular decision making framework is embedded in an organizational context may be at a mismatch with the larger context due to the state of unpreparedness/preparedness within that organization. Other important aspects of decision making are the desired level of precision in information and the need for risk hedging. Usually adaptation policy making or planning in India has an emphasis on decisions with short lifetimes (due to political imperatives). Automatically one is directed to incremental rather than transformational changes. Decisions are taken independent of scale. There is a focus on precise information and very little hedging of risks.

Professor Mishra then went to explain the psychological and social barriers for adaptation. The implicit assumption in the current literature is that adaptation action will result once the cost of inaction is demonstrated. But this ignores the role of psychology and culture in the translation of such information into action. Psychological and social barriers can lead to denial or maladaptation for a particular/or range of risks. An example of the latter is shifting of blame or de-problematization (i.e. dilution of the problem). Secondly there are cognitive barriers for adaptation. As there maybe challenges in processing new and

complex information, the tendency may be to fall back on past experiences though past trends may not suffice for guiding future action. Thirdly, in order to illustrate institutional barriers or challenges within governance structures and rules, he cited the example of sparse involvement of local governments in climate change adaptation planning though such policy implementation has to be done at the local scale. One way of addressing these barriers is to incorporate process of highly reliable organizations in current ongoing decision making.

In response to a question that whether academicians should align themselves with government or with community protests, Professor Mishra explained that it is imperative to first understand the root causes for the emergence of such protests and also the gaps in the government which led to the failure of addressing local interests. Protests can make a system vulnerable but also has the ability to improve a system.

Date: 30 January 2014- Day 3

Lecture- Ms. Nandita Hazarika, Deputy Secretary and State Project Officer (DRR program), Assam State Disaster Management Authority

The third day of the workshop started with a lecture from Ms. Nandita Hazarika, Deputy Secretary and State Project Officer (DRR program), Assam State Disaster Management Authority. Ms. Hazarika presented on the government approach to disaster risk reduction and described the hazard profile of the State of Assam. It was explained that floods are an annually recurring phenomenon leading to average annual loss of Rs. 200-300 crore in repair and relief. Yet, governance approach has been reactive rather than proactive and there was focus on relief and rehabilitation rather than preparedness, which the 2005 National Disaster Management Act tries to change. After Assam adopted the disaster management act in 2006, it constituted a State Disaster Management Authority (SDMA); District Disaster Management Authorities (DDMAs) for all 27 districts and also drafted the State Disaster Management Plan.

She raised various issues regarding the disaster preparedness capacity of the State, for example a status survey of school and hospital buildings found that 34% of schools are structurally not safe, the planned growth of Guwahati city is in a direction that is highly earthquake prone, lack of sensitization regarding earthquake risk, etc. Flood Early Warning System was developed in collaboration with North East Space Applications Centre, which had a pilot in Lakhmipur district and now being rolled out to other districts. It differs from the Central Water Commission's Flood Warning System – which has only 17 points and indicates river level at a couple of points but does not tell which villages will be flooded and is hence of limited use to administrators.

In case of Guwhati urban floods, she mentioned that there are multiple agencies looking after the drains and rivulets in the city and there is lack of coordination among them. Not much progress has happened under the Integrated Guwahati Flood Management Project.

Following the presentation, the participants questioned if there were any guidelines for rehabilitation of erosion-affected people. Ms Hazarika explained that has been no study on erosion or in fact on the Brahmaputra basin as a whole because of which intervention measures tend to be ad-hoc. To another question on perverse use of raised platforms ad embankments, she clarified that it is not the flood-affected people who are living on embankments; rather it is the landless people who have lost land to erosion and nowhere to go. Thus there is a need to identify government land where such people can be rehabilitated. Concern was also raised that is coordination with Arunachal, Nepal, and Bhutan, but not with China in order to tackle basin wide challenges.

Panel discussion on Novel Interventions

Following the presentation by Ms. Hazarika there was a panel discussion on novel interventions in the hazard context of Assam, that are in design or in pilot phase. Dr. Partha Jyoti Das, Head, WATCH Program, Aranyak presented the learning from a pilot project on community based flood early warning system in Lakhimpur and Dhemaji district of Assam while Dr. Subal Maibangsa, Senior Scientist, Assam Agriculture University presented on the need of diversity of crops according to the variance in depth and age of the river sediment deposition in some villages of again Lakhimpur and Dhemaji. Ms. Ulka Kelkar, Fellow, TERI moderated the panel and discussions ranged from cost effectively of the early warning system, involvement of local talent (e.g. from IIT, Guwahati) in its development phase to understandability and credibility of the warnings to ensure action. As for the Dr. Maibangsa's presentation, discussions focused on traditional knowledge, challenges of convincing farmers when expert recommendations keeps changing and the time lag between knowledge generation and implementation.

Thereafter the group activities continued till Day 4 afternoon, after which certificates of participation were distributed.