

CHAPTER-5

CO-PRODUCTION OF KNOWLEDGE: LOCAL ADAPTATION EXPERIENCES

‘Nodi khon bohut kumol, laheke sule mane’. (The river is very soft, if touched gently, it surrenders.)

Surjit Hajong, a respondent, December- 2021)

5.1 Introduction

After the floods recede, the ensuing phase of recovery is a space of social and institutional prescription, which includes providing planning, prescriptions with ethical engagement to reconstruct a society. As observed in the field, governance of floods in a post-flood phase is usually tied to providing compensation to the affected people (in terms of housing and livestock loss) and reconstruction of infrastructures¹ which are breached by floodwater. Since the 1990s, rather than solely focusing on the bio-physical impacts of disasters on social systems, disaster research has gone beyond understanding disaster as an event that requires recovery, to understand the role of institutions, state and civil society influencing the outcome of recovery processes. The phase of recovery is also an active site of problematizing how a disaster comes to be understood and the assumptions that goes beyond in planning and prescribing resilience to disasters (Dowty and Allen, 2011; Revet and Langumier, 2015; Tierney and Oliver-Smith, 2012).

In the context of Assam, policy and practice guided by state-defined disaster management definitions to recovery in disaster, invisibilize the historical role of the state and how it has contributed to the vulnerability of the riparian communities. The construction of a disaster as a hazard and risk is intertwined with the possibilities and contestations in the process of recovery and reconstruction (Cretney, 2019,500). Furthermore, disasters is a political act when the response to disasters is achieved on the grounds of framing them as ‘unprecedented’, ‘unexpected’ or ‘unusual’; entrenching vulnerability and risk to society. In Dhemaji, the local officials while planning strategies for recovery hold the distinction that breach of embankments or roads by the floods is an

¹ Usually embankments, dykes, roads, bridges, etc that is deemed necessary for operation of society.

‘unexpected’ situation. Following this trajectory of how the agency of the non-human can foreclose governing possibilities of the humans, this chapter explores the knowledge practices of the engineers. Different definitions are put into discussions to decide which would be the best way to manage erosion. Further, the chapter locates the new subjectivities of people that emerge at sites where the landscape is constantly shifting. Different views on managing the landscape bring to focus the politics of managing a shifting landscape and the people who shape them.

The twin processes of flooding and erosion requires different approach to governance. While preparedness and prevention of flood is governed from a distance through an assemblage of documents and discourses, governing the after effects of floods require tending at sites where floodwater destabilizes the infrastructures meant to control its overflow. In contemporary times, hydraulic infrastructures like embankments, dykes, sluice gates, geo-bags, porcupines are used to control the overflow of river. Additionally, the twin process of floods i.e. erosion is identified as a hazard which requires intervention by the government. These hydraulic infrastructures are used to control and manage the accretion of land by water as well.

In this sense, these hydraulic infrastructures are the boundary objects² that control and train the course of flow of the river. These wide ranges of infrastructures have characteristics that are internal to its own workings, but these infrastructures form a part of the larger systematic governance of altering the riverine landscapes. As Larkin (2013, 330) opines, an infrastructure is an amalgamation of technical, administrative and financial techniques that bring to the fore how a non-technological object provides the ground for other matter to operate, while this interaction is a part of a larger systematic thinking/episteme. When infrastructure is a part of larger system of thinking, as is in the context of this study, they divulge the underlying forms of political rationality in technological projects revealing the apparatus of governmentality (Larkin, 2013,328).

The main focus of this chapter is an examination of the built environment of hydraulic infrastructures as a substrate for managing the course of the river and the political logic that goes into it in response to the environmental disturbances of floods. Taking water as

² Boundary objects are a kind of arrangement that allow different groups to work together at multiple scales without consensus. For details see, Star, S. H (2010). This is Not a Boundary Object: Reflections on the Origin of a Concept. *Science, Technology, and Human Values*, 35(5):601-617.

an ethnographic subject and attuning to the worlds of how adaptive management in maintaining the contour between land and river is constructed, I locate the varied meaning making processes that goes into defending this contour. The conceptual framework of Lyng's (1990) 'edgework' is employed to capture the activities that go on at the edge of the shifting landscape, between land and the river.

Before discussing the ethnographic vignettes of infrastructures as tools to recover people from the risk of floods, a brief note on how people comprehend these infrastructures are an important point of concern. Recent studies have established how disaster governance from a top-bottom approach oversees the local knowledge of communities in their interventions of disaster risk reduction (Suri, 2018; Kelman, 2018). State approach to anticipate disasters do not consider the sensibilities of the people who actually live in close proximity of the rivers. This active exclusion of the sensibilities of the riparian communities comes to define how they come to 'experience' disasters. The following section is a brief description on how do communities view the state approach to controlling floods with the help of hydraulic infrastructures.

5.2 Control of flood and erosion with hydraulic infrastructure?

Flooding has been an imminent part of the history of the Brahmaputra plains. As discussed in the introductory chapter, riparian communities are accustomed to the annual swelling of the river and its tributaries. As a result of the deposition of silt by floodwaters, for generations it enhanced their income and livelihood, and hence floods was an 'accepted wisdom' (Saikia, 2013, 6). Henceforth, the phenomena of floods in the Brahmaputra plains became a part of the hydro-social cycle around which various social and cultural activities were organized (Berry, 1998).

Although riparian communities adapted to annual floods through this cycle of dependence, which Spivak describes as 'living in the rhythm of water' (Spivak, 1994,55), was broken when massive hydraulic infrastructures were constructed for flood and erosion control. In the pre-colonial period, flood control infrastructures, mainly embankments were built by the Ahom rulers using corvee labour to facilitate wet-rice cultivation in the Brahmaputra floodplains (Guha, 1967). Originally descendent of the ethnic Tai people, the Ahoms ruled Assam for six centuries (1228-1826) before the British took over. The water management practices during the reign of the Ahoms were mainly driven by agricultural expansion and to protect the lowland villages (Gait, 1906, pp. 117). These factors influenced the construction of bunds along the floodplains to protect their habitation and agricultural lands. Building of embankments against the annual floods received royal patronage since the 15th century. Several Ahom rulers undertook ambitious projects of embanking small and at times big tributaries of the Brahmaputra (Gait, 1906, pp. 83). In building these embankments, it is important to note that large majority continued to live away from high flooded areas, as for instance the banks of the Brahmaputra. People adapted to the seasonal rhythms of the river and in years of severe floods and damage to crops, the rulers would shift their capital. Historians have pointed out to the changing environmental dynamics of the region in the 16th century that may have propelled them to undertake massive embankments construction. A series of military, financial, and political crises, famines remain the other plausible explanations for the need of the Ahoms to redesign the floodplains (Saikia, 2019, 64). During the 19th century, the British paid attention to the efforts of the Ahoms in designing flood control systems. According to F. J. Monahan, the then Deputy Commissioner of Sibsagar in late 19th century, noted the embankments made by the former rajas were sometimes built with the intention of controlling inundation in the monsoons while some were intended as roads and at times both combined (Monahan, 1897, 40-42). However, the impact of these hydraulic infrastructures on the ecology of the river was minimal.

In the 20th century, massive technological interventions altered the hydrological flow of meandering rivers, causing unprecedented changes in the nature of the floods and soil erosion (Saikia, 2013). In the 20th century,

the bureaucratic interventions made by the British colonialists to floodplain governance were influenced by expansion of jute and tea cultivations. This led to increased pressure on reclaiming the floodplains. In this process, building bunds and embankments featured distinctly in the efforts of the British to regulate floods so as to make more land available for cultivation (Saikia, 2019, 409). After Independence, the Nehruvian ideology of industrial development saw a conceptual shift in the country's effective way of controlling floods in tandem to the large figures of agricultural loss and property. To prevent/mitigate flood damage in the Brahmaputra floodplains, large dams were envisioned to store flood waters (especially after the catastrophic floods following the 1950 earthquake). Simultaneously, dams were intended to store floodwaters, generate hydropower and irrigate dry lands as well. Given the underdevelopment of Assam, during the middle of the 20th century, flood control was seen as an urgent need to restore crisis-ridden agrarian economy. Here, it is pertinent to mention that no discussion on the possible negative impact on the river ecology of the Brahmaputra was explored (ibid, 472).

The political debate about control of floodwaters became a point of contention among the ruling elites of Assam-political leaders and bureaucrats, engineers and the contractors. But, from an engineering perspective, the Indian engineers did not have enough expertise to tame the turbulent water of the Brahmaputra together with its difficult terrain (Saikia, 2019, 472). Also, since no storage dams were conceived for the Brahmaputra earlier, political uncertainties about public finance remained ambiguous. Therefore, the inability of modern science to tame the river and lack of financial resources of the State continued to shape the Assamese elites relationship with the river and the problem of flood (ibid, 473).

After Independence, the Assam Embankment and Drainage Act, 1953 was instrumental in rapid expansion of flood control measures by the state and a network of around five thousand kilometers of embankments were built along Brahmaputra and its tributaries (Government of India, 2013). Presently, dykes, boulder spurs, geotextile bags, concrete porcupines are new means which are used by the Government of Assam to control floods and erosion. Baruah (2013, 52) argues that the twin processes of floods and erosion are rooted specifically on the role of the state. First, the introduction of hydraulic infrastructures aimed ostensibly to control flood and erosion have aggravated the hydraulic processes of the Brahmaputra floodplains to be more disastrous. Discussing the impacts of the embankments in Majuli, he argues that the embankments and the boulder spurs together have confined the course of the Brahmaputra and Subansiri rivers. Emergency situations owing to breach of embankments and dykes explicate that these events are a result of both natural and a product of human influence. Naturally, these rivers are known for changing their course of flow, they tend to exert pressure on the man-made materialities that evade their hydrological flow. As Colton (2005) maintains, during the monsoons the embankments confine and takes the water level to a higher degree causing enormous pressure on the river. A breach or toppling of spurs or porcupines demonstrate the river's agency, which remains unaddressed or ignored in understanding floods as a disaster. From the field narratives in Majuli, Baruah (2013, 57) shows the perception of people towards these hydraulic infrastructures. People sometimes refer to the boulder spurs as '*mrityubaan*' (weapon of death) indicating the potential risk these structures posed to the nearby villages in case any of these were to be toppled. In the 2012 floods, this apprehension saw the light of the day when many villages were washed away in Salmora, Majuli. B Such episodes reflect the lack of trust by the people on the state's measures to control flood and erosion.

In governing floods through the built environment, the material consequences are overlooked. By remaining partial to the material consequences of the built environment and how it is experienced in varied ways by the local people, aggravate flood as a problem at many scales, distinct and specific to villages, if observed from various sites. Additionally, this epistemic and cognitive gap among the government officials and the locals leads to insecurity and vulnerability for communities residing near embankments

or dykes. Also, policy practitioners do not take into consideration the traditional knowledge accumulated by people in living along with the annual cycle of floods.

The Brahmaputra floodplains have already been shaped by large-scale power and economic relations under the rubric of 'development' in terms of its use, treatment and signification. Utilization of water as a resource in the form of large scale hydel power projects has echoed at the wider scale of state making processes. This has also seen wide scale contestations by communities living along the rivers in tandem to irreparable damage that would be done to the health of the river ecology. Thus, the contemporary nature of floods is not only a hybrid of ecological factors but also inequalities of power. Bringing this argument to supplement what Perry (2018, 14-15) describes that causes of rest in the 'social structure, social interactions and the environment as a whole'. In other words, any disruptions in the present social system can potentially be a long-lasting transformation of previous social structures and practices. Going back to history to make a sense of the contemporary events is what Sewell (1996) refers to as historical events that reveal the interaction between action, culture and structures including material infrastructures and the environment that co-produce social transformation.

The above discussion establishes that the hydraulic infrastructures are inherently complex in transforming the landscape of the Brahmaputra floodplains. This in turn provides an understanding and to comprehend the contemporary, we need to constantly refer to its beginnings in history.

5.3 The framing of hydraulic infrastructures as mode of recovery

Destruction, death, displacement and loss of land to the river are the hazards known to the Brahmaputra floodplains. The floodwaters amass a large area that poses significant geographical and socio-economic challenges to riparian communities. Floods and soil erosion prompt people to relocate within the village due to flooding and soil erosion. Losing land to the river inevitably reduces their agricultural land. At this juncture, in the name of compensation, they are entitled to receive benefits only to reconstruct their house as mentioned in the preceding chapters. As a result of the governmental mode for documenting and inspecting the extent of destruction, flood compensation remains largely a pen-and-paper exercise.

At the same time, people are also not enthusiastic to receive these benefits because the cash they are entitled to receive do not add up to the real costs of re-constructing the houses. Therefore, to meet their physiological needs in terms of re-establishing familiarity with the place they live in terms of re-building houses, finding alternatives for livelihood and relocating government infrastructure (in case of Pomua village, a lower-level primary school was the only means of government welfare institution) destroyed by floods, managing for new tube-wells, etc. were few of the post-flood activities that were observed. Drawing from these ethnographic vignettes, the central question of this chapter is how are the paths of a disaster defended through infrastructures?

As Das (2007) suggests, this process of inhabiting the same place that has been destroyed or disrupted while continuing to engage in daily mundane activities is an act of 'social remaking'. Acts of providing food and shelter and tendering care to the elderly people are mundane acts that allow people to create a sense of place in a space that stands in ruins. In this space where people make attempts to recoup from the effects of floods, it gives them a kind of autonomy to break away from the dominant political logics and structures (Monticelli, 2018). On a similar tangent, the ethnographic narratives that are discussed in this chapter demonstrate how people construct their own worlds, sometimes with and sometimes without state support, they have their own vision and perception of flooding and erosion.

To describe a post-flood scene at the level of governance comes down to one thing. It is to repair the unpredictable impulses of the unruly waters. To tide over the impact of floods in varied forms like breach of embankment and dykes, devastation caused to bridges and roads and in certain cases re-building infrastructures like government schools are the significant concern of local bureaucrats. In Pomua village, after floods recede, erosion of soil becomes a serious issue of concern. As discussed in the first chapter, the process of flood and erosion remains conformable bio-physical reality in the Brahmaputra floodplains. Therefore, in the context of floods in Assam, after the devastation of floods, erosion becomes an issue that requires adaptation or mitigation. So, the compartmentalization of floods into phases of preparedness, during and post-flood mitigation is ambiguous in the context of Assam.

Nevertheless, the bio-physical reality of erosion and the haphazard way in which the waters carve away the landmass can be seen as a way how the non-human becomes an

invasive element into our human worlds. Managing this shifting landscape between is a serious concern for the dwellers on land, after the floods recede. In attending to water as an ethnographic subject and to pay attention to its messages, Rebecca Empson (2017, 235) urges to shift our perspective from being cultured land dwellers to think and imagine ‘how it is to inhabit world that emerge out of the ebb and flow of this force’.

Invocation of Rebecca Empson takes me to the ethnographic narratives of the people in Pomua village. Their particular phrases, ‘*paniye eibar gora³ tu bohut nile*’ (Floodwaters have eroded substantial amount of land) or ‘*paniye gora kati kati ahi thakibo*’ (floodwaters would erode the portions of our land substantially in the coming years) or ‘*oha bosorole gora tu nathakibo goi*’ (the contour would not be the same next year) indicate their attunements to what is left behind in the ebb and the flow of floodwaters as they continue to dwell along the river.

5.4 Framing control of disaster

The local decision-making process in tandem to repairing or maintenance of the existing embankments, constructing or replacing geo-bags or dykes are carried out by the Irrigation and Water Resource Department in Dhemaji. These departments are situated in different sites, yet there is coordination among the engineers and bureaucrats in regard of the active maintenance of the water infrastructures. Since each department has clearly defined roles and responsibilities, yet they share common duties with respect to control of floods such as which embankment would be selected for repairing and the amount need to be allocated for the cause. It reflects once again the bureaucratic process of extensive paper work and documentation. This process involves a long duration of waiting such as the funds being sanctioned by the state government, the permission given by the District Commissioner and then the irrigation engineers along with the water resource officials to go on field-visits to inspect and supervise the maintenance work of these infrastructures. During the course of this study, no breach of embankments due to floods occurred. Hence the data collected revolved around observing the maintenance and repair work by engineers, officials and sub-contractors.

Following the parlance used by interlocutors in this area, control room refers to the offices of water resource department/ irrigation department where the senior officials sit

³ ‘Gora’ refers to the term the interlocutors use to define the contour between land and sea.

and make decisions regarding the construction of water infrastructure. Field refers to the site where local bureaucrats, engineers and sub-contractors work. The construction work usually starts in October - March, after the monsoons retreat and usually the dry weather during this time of the year aids maintenance work. According to one junior-engineer, on their morning shift, the senior officials hand them out a chart of places where embankments, dykes and geo-bags need to be constructed. When the weather is dry, an order is sent to the Block Development Officers and the village headman to gather laborers. The BDOs are sent an order to facilitate the raw materials like pebbles, cement, mud and cement bags to be used in construction. Although this process is mundane, the availability of raw materials and labor become a relevant temporality of work. This factor changes the day-to-day work of the engineers and whichever site has the availability of raw materials, construction or repair work begins there.

At the same time during this period of waiting, the officials in the control room are involved in a number of recurring routine tasks. First, there is a continuous monitoring of water current and formed into files into their desktops. Second, previous files/records are opened to look into any preceding maintenance/repair work that may have been done due to breach or wearing out by floods. Third, the senior officials chart out the design as how the junior engineers and officials would proceed at the site. Fourth, in the process of maintenance of these infrastructures, the officials are advised to have a dialogue with the locals that usually make up the labor group for on-site work. These rules and protocols control the on-site behavior of the officials as it is observed that almost all the officials had the same point of view as to how to approach the field, irrespective of who sits at the chair⁴ in the offices.

Such bureaucratic practices in the control room produce an everyday framing for the officials as to what are the standard protocols with which an unknown future⁵ will be brought into the present for intervention and deliver effective control of the floods. This creates an exercise for the engineers as to how do they need to imagine the future and contain the agency of floodwater. This abstract framing and taming depicted control of any environmental breach/risk as an automatic action. Does this pursuit of predictive

⁴ Since officials at this office have a transferable job, the researcher met new officials at the same position, during the course of field-work.

⁵⁵ By the term unknown future, I refer to the unpredictable change by the river that causes breach in embankments. It also refers to the critical thresholds in terms of the impressions left on the embankments and dykes showing its agency on the materiality of these infrastructures which causes their wear and tear.

framing of floodwater by materiality of infrastructure combat the realities an emergency situation may offer? What is striking is that the ground level actors who also supervise the entire project of the repair team are civil engineers and junior engineers. Given their educational qualifications and training to solve construction problems, what has been gathered from the field is that they are not given any hands-on training in dealing with the unique behavior of the Brahmaputra or its tributaries.

At the field site, Manash Gogoi (34), an engineer who was on field duty, I enquired as to how does he understand a breach in the hydraulic infrastructures and how do they define this breach as an emergency situation? In response, the informant explains that breaching of embankments occurs when the path of the river changes arbitrarily and surges over any upper drafts of the embankments. He shows few papers to glance over in which mass observations and calculations are done statistically. According to the interlocutor, 'Despite knowing the applicability of physics and kinetics, a comparison of the reports to understand what makes the river reactive is not usually discussed'. Since breach of these infrastructures happen arbitrarily in few years and within a particular period of monsoon season, other scenarios of risks as in how the volume of water may hit these infrastructures from the opposite side⁶, when water is diverted by dykes from the opposite town are not considered. In such a scenario, understanding the dynamics of fluid and how it may jump the calculated frequency, flow, spread and intensity becomes difficult to predict containment by these infrastructures. In such cases, any report of the breach in their parlance is written as: 'breach due to incremental sequences'.

Monoj Handique (47), at the control room gives an answer to the question of why do breach occur. Since most of the embankments that are repaired after the floods are old structures, whatever maintenance work they carry out is made within/on these structures. He states:

"Before working on these structures, we are required to research how similar structures are redone in the past years. There are times when our restoration work gets delayed because of the light drizzles after the monsoons. In such instances, when there is less time in our hands, we have no choice but to cover worn-out patches with mud. Around November, when the seasons are dry,

⁶ At the field site, local actors and engineers maintained that the dykes constructed at Dibrugarh town puts undue pressure on the water infrastructures of Dhemaji district.

we use peat and cement to cast over the worn out embankments to strengthen the structure. This technique helps to some extent limit water run over the top”

Both the narratives reveal a simplistic framing of the fatalistic risk that is inherent in the maintenance process. The restoration process that supposedly was meant to be post-disaster recovery stage gets extended to the time before the floods occur, and hence becomes a vital mechanism to impede the floods before they happen. In simple words, two opposite framework of repair and prepare overlap.

In this regard, the study of long-term processes reveals that it is necessary to investigate, through multi-scale ethnography, these dynamics through both the analysis of public discourses and the direct observation of interactions in the ecosystems and social worlds affected by hazards and disasters. It is through ethnographic fieldwork that the existence of a multiplicity of local solutions, new configurations and alternatives, and even new forms of experimental interactions between human devices and non-human environments can be grasped (Tsing, 2015). The elaboration of this perspective draws on the work of anthropologist Anna L Tsing who explores the concrete possibilities of a life without the promise of what she depicts as the peculiar modern compromise between stability and progress. Her aim is to draw – and bring awareness to – a world composed of a diversity of assemblages operating across scales.

5.5 Experimenting with infrastructures

The following section deals with two different understanding of how an edge⁷ of a landscape needs to be managed. Following the perspectives of the local engineers and the local people reveal how different people attach different meanings to these spaces. Focusing on the meaning-making processes of land-river, nature-culture in shifting landscapes allows us to explore the knowledge that emerge while keeping an edge into fixed dichotomy (Valentine et al., 2012).

⁷ By the term edge, I refer to the physical distinction between the land and the river

5.5.1 Epistemic challenges in controlling the Edge

Surjit Hajong (51) explains the issues that they are facing in his village. He states:

“Our main issue is that the river is gradually encroaching on our village. A few tiny streams are starting to move in our direction. There is a good chance that our settlements will be destroyed by the next year. Second, despite our complaints going unanswered for the past two years, the government has suddenly arrived for inspection after we mounted a little demonstration at the Circle office. The choice of materials they have chosen to utilize to control the flow of the river, however is disconcerting”.



Image 5.1 The shifting landscape caused by the river in Pomua. The photo was taken on 22nd December, 2021. Photo taken and represented with due consent.

Villages residing along the edge of the river have come together to see how the placing of sand-bags would be done to alter the course of the river that seemingly was making an intrusion towards them. It is worth mentioning that in this landscape there is no micro-processes of erosion, which otherwise is a significant problem tandem to the Assam floods. The perspectives of the local actors are different.

According to Monjit Pegu (34), ‘the government and engineers always have a well-thought-out strategy that anticipates how the river will behave. But as you can see, the Jiadhal river a long history of altering its course. One cannot overlook the complexity of

the multiple rivers flowing through our plains. So we must cooperate with nature in accordance with how it manifests by developing a relationship with it". These narratives reflect the ontological underpinnings of how the local persons residing beside the river observe the non-human. Here, taming of the edges is done by placing the agency of the river at the foreground. It is only after studying its behavior one needs to decide what kind of infrastructures to be used at these sites.

On the other hand, governing shifting landscapes has a different approach. Lakhinath Pegu (39) is an assistant engineer at the irrigation office, Dhemaji. He was supervising the labor team of how the sand bags would be placed. The sand-bags were supposed to be dumped at the site the following day. Determined to maneuver the terrain, Lakhinath Pegu maintains: "We must continue working to control these shifting edges. One cannot avoid the incursions the river makes. But it is our duty to keep the water out we can safeguard land from soil erosion by protecting it from floodwater". Unlike the riparian communities who look out to the river to decide their adaptation strategy, governance approach is exclusive taming and diverting the incursions of the river. Focusing solely on a short-term solution and not contemplating how it might serve the community in the long-run was not well received by the villagers. This is so because the villagers drew from their earlier experiences to make sense of the present use of materials which would serve as flood control measures.

Monjit Pegu (46) serves as the Block Development Officer. One of his job roles includes assisting the engineers in better adaptive management of floods and combat soil erosion. In his thirteen years of service in his job role, he has had countless experience of constructing revetments made of pebble on which the sand-bags would be placed. According to Pegu , 'We are managing a site where these small streams need to be diverted so that it does not build into a further course for the river. When the sand bags are placed at a higher elevation it slows the process of the river in its attempt of incursions'.

It is worth mentioning that the framing of the river happens in normal condition when the river is shallow and an estimation of the speed and the acceleration of the currents are not known. At the same time, framing of the river as to be tamed by constructing stoic water-control infrastructures depict their knowledge construction. By establishing a strong nature-culture divide where the flow of the river can be tamed is a distinctively

political act. Their single approach of ‘diverting the water out’ becomes more of a performative job of preventing any breach comes to be seen as to what Bijker (2007:121) argues that immediate acts of engineers to keep disaster out is a ‘technical issue’ that is tied to the professional obligations of the engineers to act at any cost.

A local resident, who was witnessing the work of the engineer and his team at the site, exclaims: ‘Nodi khonok bheta di, amale bipod sopai anise’ means; by encircling the flow of the river, we are put into a position of danger. The officials always look into short-term solutions. Given the fact that the Jiadhal river in 2011 made an abrupt turn towards the town by washing away the Jiadhal bridge up to 8 km, it is not difficult to gauge its might. The lay persons lamented that the government officials are often keen for easy solutions by encircling and taming the natural flow of the river. Further, as Bonti Konwar (58) adds, ‘if the river make an intrusion towards our village and the volume of water rises abruptly, water would seep through the bags and the river would end up having a great impact (collision) on the sandbags. Breaking of this infrastructure would mean doomsday for us’. The approach to adapt to the twin processes of flood and erosion by laying down sand bags may reduce uncertainty for some time. However, stress is not laid to understand the dynamics of river ecology and hydrology.

These local decision-making at local sites of shifting landscape lack any indication of how the engineers intend to enhance their management in the future. Absence of any recursive strategy shows the lack of studying the river for improved intervention. It was found that when the engineer was directing the labor team as to how to build the revetment, locals gathered nearby the labor team and were observing the entire process. These locals were vocal and negotiated with the labor team saying that the bed of rocks (because of the size of the pebbles) would be washed away in a year when these face multiple waves of the annual floods.

The local authority, especially the field engineers claim that they are aware of the apprehensions of the villagers. However, their approach is to find stability between making use of the knowledge available with timely release of funds to make way for raw materials to construct/ repair an infrastructure and charting out a best possible short-term outcome for the riparian communities at large. The ontological position of the engineers at the control room and at the field site is different from the local actors who reside along the edge of the river. The local actors hold the conviction that the non-human river has

the agency to shape the landscape. The course of action that the river would embark on and the amount of landmass it would engulf cannot be known beforehand. They strongly believe, it is only with a relationship of reciprocity and finding attunements with the river would help them in the long run.

To these differences in perspectives, it is pertinent to reflect that the engineers do not experiment and wait to see how the river would behave. While making interventions, these government officials are very cautious as they spend public money. Funds allocated for control of disaster and making efficient risk management by the government, these actors have to produce certain outcome/result to the challenges/complain made by villagers. In such a context, finding a counter-productive way of dealing with the personality of the rivers in a wider context is not considered. As one local respondent replies, '*sorkaror manuhe amar birombona nubuje, june nodir datit thake teuluke he nodi khonok buji pai*' which translates as: the government do not understand our plight, only us who live along the river understand the ebb and flow of the river.

Therefore, standing at the edge of the river one gets to witness not only the river but also the communities residing along it. This co-existence of humans and non-humans at a particular setting, the edge becoming a site where there arise negotiations as to who gets to decide how the infrastructure will be built when the river is constantly recreating landscape and shifting distinction of nature and culture- these infrastructure projects surface as an important trajectory (Empson, 2017, 247).

5.5.2 Making of different worlds

In a wider context, the policy domain of disaster management does not consider the flow as well as the direction of the circulation of water. To comprehend the tidal flow and current of the river or are there any anthropogenic activities impacting the resultant incursions or erosion are not observed. The government's well-intentioned initiatives are derailed by the lack of a monitoring team to examine the patterns of river movement. At this juncture, what has been observed in the field is that people turn into political subjectivities and challenge the governmental model of built environment to control floods. To paraphrase Jarett Zigon (2014), what types of worlds are being lived in and constructed with the shifting assemblage of humans and non-humans? In the following

section, I introduce three worlds where the inhabitants at the river's edge make their own decisions on how to design a landscape that allows the river to flow to its natural course.

5.5.3 Living at the edge with experimentation: Concrete porcupines and erosion

There exist varied explanations/understandings of how the river may be managed where the impact of the river can be reduced and at the same time how the natural flow of the river may not be challenged aggressively. An example of a case study in this chapter involves villagers forming their own community to demonstrate their desire not to have geo-bags installed to control erosion, but to install concrete porcupines instead. At this local space, one can witness the river causing gradual erosion gnawing away the landmass. A temporary bund made from a mix of mud, pebbles and sand were built by the villagers some years ago. Now, the situation is alarming because the river has been cutting down the bund.



Image 5.2 Porcupine as an hydraulic infrastructure to control the shifting landscape before floods. Image was taken on 18th December, 2021

The Block Development Officer and the village headman founded the community to promote the need for concrete porcupine as a material to stop this erosion. The BDO has his own personal interest in the initiative because he himself belonged to this village and was wary of how the river behaves. In giving attention to their idea of why concrete porcupines are better than geo-bags or dykes, a respondent maintains, ‘The government singularly focuses on protecting the landmass to protect people and our homes wherein

the vibrancy and the liveliness of the river is overseen'. The respondent further states, 'Buwati nodik bhetibo napai' which translates as: a flowing river should not be dammed.

In maintaining the edge between land and the river, the local residents voice an opinion against the human control by the local bureaucrats over the river as a passive entity. For them the materiality of geo-bags, dykes and bunds disrupt their co-existence with the river. Henceforth, the residents of this village are making recurrent visits to the Irrigation Department to know what kind of infrastructure may be sanctioned for their village. As Mithun Payeng (51) exclaims: 'We are coming out together- as we know partially how to manage the edge and the erosion. As we have the BDO on our side, we are hopeful that he may get the job done from the side of the government'. True to the anticipation of the villagers, concrete porcupines were granted to the village to fortify their edge and channelize the flow of the river.

Standing on the bund, the respondent explained to me the dynamics of concrete porcupines and how it had helped in their successful management of the river. These villagers living at the edge of the river are accustomed to the flows and the rhythm of the river across seasons. Most of the time, these locals view the river-scape from land and take into account any visible changes, like river invasions or gradual erosion brought on by shallow rivers. Their campaign, therefore, aimed at using infrastructure that would not tame the river. At the field site it was noticed numerous porcupines were aligned at a stretch, not on land, but right beside where the land ends and the marshy reserve exists.



Image 5.2 Bamboos and porcupines are used together by the villagers to break the water currents of the river and avert its intrusions towards the village. Photo taken on 18th December, 2021.

The porcupine is a three-dimensional triangular shaped infrastructure made out of concrete. It is also known to be cost effective, because given its shape, it can withstand the impact of the floodwaters. At times, even if these materials tend to be toppled by floods, it is not washed away. The triangular shape of the porcupines allows water to pass through it and at the same time the sharp edges of the concrete slow down the water currents. When water currents are slowed down at the edges; it flows away from the landmass. Lack of water currents slows down the speed of water which results in sand casting by the river at its edges. This in turn raises the elevation of the land which serves in the interests of the villages living along the river.

The aforementioned case exhibits how the local residents take into consideration the agency of the river. At the same time, the local actors do not directly intervene the natural course of the river flow. Instead, they attempt to break the speed of water in a gradual way. This was also reflected as bamboos were installed right before the porcupines. In this way the bamboos and the porcupines together would slower the speed of water; thwarting the water currents and protecting the landmass from erosion.

5.5.4 Creating a surveillance site

After encountering erosion along the edge of their habitation, the villagers have attempted to create an artificial canal kind of infrastructure. Basically, the point from where the river was making an incursion into their village, at the mouth of the incursion a deep canal is constructed towards the middle of the river basin, so as the river may meander through it. When the natural tendency of the river to migrate its channels if impended on one side (toward the villages), it is supplemented by creating an alternative canal. As it was observed, water was gradually making its way towards the artificial canal. From this behavior of how water was rippling through this new-built canal, the members are sure that in the next year, during the monsoons when water inundates the river, it would flush through this canal. At the same time when the river would gush through it, the velocity of water would delve/corrode the basin. As a resultant, the canal would expand and get deeper so as to accommodate high volume of water dispensed into the river basin. The BDO along with the village headman and few villagers constantly monitor the trail of water and hence turning it into a surveillance site. ‘We know the river’s process of sedimentation and its tendency to migrate...In three days we have seen the river takes this route...therefore, we have started to dig the canal in its length towards

the far end, so as this migrating channel meets the main river basin downstream’, exclaims Surjit Hajong.

5.5.5 Experimentation with plantation

Pomua village has been subjected to severe erosion since last several years. This is reflected in the narratives of people who claim their houses to be in the middle of the river. The landscape, as observed, testify their statements as the land is asymmetrical with deep gorges carved by the river. After the floods recede, these villagers especially in the winters when the river lies dormant, continue observing the phenomena of erosion. As Khirod Doley (61) asserts, ‘*Paniye mati khorangt besikoi niye*’ means water erodes substantial land during dry seasons. To control erosion, he opines, there is a need to know how the river behaves even when it flows dormant. The problem is that the officials come once a year to correct the flow of the river, do their bit here, something in the upstream and little bit in the downstream and fixing where water may seep in, but with no effect. The interlocutor exclaims that the ‘harder we try to suppress the river, the worse it gets and devastates in the forms of unknown’.

The local residents relate to the river from their own everyday experience. In thinking along the line of protecting their land from erosion, they do not singularly think only in terms of land; but also relate to how the river may behave when suppressed. When they speak from their everyday experience, there is a sense of reciprocity and care attributed to the river. It is also striking that when these villagers intervene to slow/stop the process of erosion, they religiously perform a small ritual. Before starting any government sanctioned project or endeavors made by community members alone, they take a betel leaf with an areca nut along with a coin and allow it to flow away in the river. This is followed by lighting few incense sticks as a form of reverence to the river body. Such rituals demonstrate how local dwellers acknowledge the river not as inert or passive. In other words, it can be referred to as human recognition of the non-human agency of the river. This approach of disaster management is not in parity with engineers’ perspective of physical ordering of the river/floods as a reality that requires political action through suppression.

Villagers of Pomua village are in anticipation of the critical thresholds that has been crossed by the river as it had corroded much of the land and flow few meters away from

human habitation. As they anticipate, the following year the river may wash away houses that now stand at the edge of the river. At this juncture, we also find a community who do not wait for any procedural government intervention or infrastructural project to check the process of erosion. In this space we do find structural figment of governance but regular activities where people click photos of the gradual event of erosion, especially in the winters. This kind of documentation is used to bolster their own local knowledge when they intervene in the phenomena of erosion. Through these photos a mapping is done among the community members as to how to experiment with the agency of water.

In winters, when the water level is low people make use of wild shrubs that grow on the landscape. These shrubs are cut and laid on top of one other against the steep land which acts as a wall. By the time the year goes round, and the season of monsoon starts these shrubs dry out. This character of the shrubs acts as a barrier to flood water- the water currents are fragmented, the speed reduced and water ripples away from the landmass. By cutting heaps of wild shrubs, Pomua village, to a large extent have been saving themselves from accretion made by the river.

The model of evaluation used by the locals, which involves tracking the river's year-round progressive accretion and then applying a local mechanism to slow down the water's flow, does not match an engineers' desire for an immediate solution

5.6 Varied Infrastructures and varied Ontological Worlds

In situating the above three sites regarding the decision making of what kind of infrastructure would suit best to manage the edge of land and the river, I draw direct reference from the work of Jensen and Morita (2015) on how infrastructures as ontological experiments mold different ontological worlds. A general meaning of infrastructure refers to systems and facilities that serve human interests. An understanding of infrastructures is limited to its physical form and how it provides a network for exchange of people, goods and services over space. Recent intellectual turn has provided a central place to the role of infrastructure going beyond its physical form. Following the culture of how infrastructures are built transforms scholars into phenomenal worlds of culture, episteme and social structure.

As Larkin (2013) claims, the most spirited way of approaching infrastructure in social sciences has come through understanding the techno-politics that undergirds infrastructure. Studying infrastructures, at sites that are far removed from the territories where government seek to organize populations and spatial territories, has the potential to reveal the consequences of political decision-making (Mitchell, 2002, 2011; Callon, 1998; Latour 2007). Hence, infrastructures, are absorbing materiality to engage with as they reveal variation in political rationality embedded in technological projects in this work are interesting because they reveal forms of political rationality that underlie technological endeavors that result in the creation of an ‘apparatus of governmentality’ (Foucault, 2010,70).

Bruno Latour (1993) intervenes skeptically and appeals that ‘infrastructures’ to be treated as objects of study since it would spill into multiple detached domains that might be difficult to encompass. In a similar plane, showing infrastructure as more than mere objects, Kockelman (2010) explores how breakdown in infrastructures give rise to forms of life that the breakdown created. On a similar tangent, this study approaches towards an ethnography of infrastructure to discuss how forms of infrastructure reveal practices of government and how it shapes forms of sociality with non-humans. Invoking the characterization of infrastructures, Brian Larkin (2013, 329) claims that infrastructures as objects create the ground for more objects to operate and when they operate together, they do so in systems. In sum, they are things but also reveal relation between things. This specification reveals the ability of infrastructures to reconfigure the material realities to which they are synthesized to intervene and produce desired effects.

Therefore, taking infrastructures as material strata that is embedded in social actions mediated by knowledge practices and their ability to reconfigure realities, Jensen and Morita (2015) use infrastructural arrangements to understand what counts as ‘social’ and ‘natural’ in in the context of ‘culture’ of adaptation. While scientific experiments refer to practices that are highly organized to produce scientific knowledge, experimental systems do not have a planned and certain outcome outlined and hence are a kind of open-ended practice in tandem to knowledge production. It always has an element of surprise in it.

Additionally, Jensen and Morita (2015, 82) points out to the entanglements inherent in an infrastructure – historical, geographical and technological. Their interactions diverge the

intentions of planners as they have to make compromise with the existing configurations of the existing infrastructure. At this juncture, it can be pointed out that infrastructures alter practical/intended effects of infrastructure. The intended effects of infrastructure as to how it would serve our interests are referred to as practical ontologies¹ by Jensen and Morita. By employing the term of practical ontologies, they try to focus and illuminate how people take into account non-human activities. It includes observing the interaction between microbes, bacteria, rice crops and spirits that inform social practices to humans through infrastructures. In a similar way, the practical choice of infrastructures by people in Pomua reflects their social practices. Practices like observing the river in all seasons, taking into account the changing personality of the river, etc demonstrate their relationality with the river. Additionally, the rituals to pacify the river before making any intervention to it showcase their cosmological relationship with the river.

5.7 Conclusion

Living along the edge of the river that is subjected to continuous/rapid change, people are inclined to experiment with different infrastructural projects to protect their homes. Depending on whether residents or engineers are involved in managing these edges, the idea of stability for the local residents are also shifting depending on how steep the edge in the landscape is. This difference in the geographical landscape and how the river is morphing across their landscape become the criteria as to how communities would experiment with infrastructure and materiality at their disposal. Geographical differences show that how communities are fragmented on a daily basis and how they imagine their new futures. In other words, not every community living along the river bearing the brunt of the twin processes of flood and erosion are united through a ‘shared sense of catastrophe’ (Evans and Reid, 2013). Singular conceptualizations of people living at the edge as either suffering entities or as resilient ones oversee the quotidian activities through which they try to articulate a different way of living in the world. Empson (2017, 255) focuses on the precariousness, suffering and insecurity among communities who do not encompass how they envision the future while living along with non-human entities.

¹ The scholars refers to practical ontologies as the material-semiotic reconfiguration. It refers to how make use of the material world to live which would also turn and interfere in unknown ways.

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