NMML
OCCASIONAL PAPER

PERSPECTIVES
IN INDIAN DEVELOPMENT

New Series
22

Ecology, Floods and the Political Economy of Hydropower: The river Brahmaputra in the 20th century

Arupjyoti Saikia

Nehru Memorial Museum and Library
2013

Published by

Nehru Memorial Museum and Library
Teen Murti House
New Delhi-110011

e-mail : ddnehrumemorial@gmail.com

ISBN : 81-87614-99-4

Price Rs. 100/-; US $ 10

Page setting & Printed by : A.D. Print Studio, 1749 B/6, Govind Puri Extn. Kalkaji, New Delhi - 110019. E-mail : studio.adprint@gmail.com

Ecology, Floods and the Political Economy of Hydropower: The river Brahmaputra in the 20th century*

Arupjyoti Saikia**

Abstract

The Brahmaputra exits into the Bay of Bengal before traversing a complex terrain of rugged mountains and flat alluvial plains. The river traverses through three nations. This physical experience remains instrumental in shaping varieties of political cultures. Focusing on the Indian part of the Brahmaputra in the twentieth century this occasional paper explores how in the twentieth century, the river acquired a new economic identity. The river helped in the consolidation of the colonial administration and economy. The improved and mechanized navigation facilitated export of tea from Assam. In the 20th century the floods began to haunt the colonial government and networks of embankments were constructed to save agriculture. In the last quarter of the 20th century, flood management gave way to the hydro-power generation. This paper examines the political economy of this transition from flood protection to hydro-power generation.

---

* Revised version of paper presented at the National Conference titled 'Rivers and Flood Plain: Landscape and identity in the Brahmaputra basin' held at the Nehru Memorial Musuem and Library, New Delhi, 26–27 November 2012.

** Arupjyoti Saikia is Associate Professor, Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati, Assam.

Rivers, floods and post-colonial India

Indian environmental historiography has been long engaged in examining the British colonial government's complex relationship with the Indian rivers and river system. Primarily these studies have dealt with the political economy of river engineering as well as ecological fall out of this river engineering. These works have also focused on how the colonial government restored pre-imperial irrigation networks, emergence of complex rights over these irrigation projects or formation of landscape or new intensity of epidemics as a result of new ecological crisis. One could also notice that the role of the government in changing the fate of the Indian rivers has been widely debated in these works. On the other hand, the Indian social scientists, political critics and ecologists have played a role in retelling the critical narrative of rivers for the post-1947 period. The engagements of environmental historians with the political economy of the river in independent India, with a few exceptions which are region specific, are strikingly limited. These studies have gained several insights from the accounts of Indian official agencies. The latter have produced large numbers of reports on the India government's relationship with the river. These narratives are produced by river engineers or geologists who believe that modern science should be used to harness nature for the greater good of the community. At the same time, various scientific institutions or bodies have conducted studies of the rivers and their systems.

Historical researches could gain immensely from an engagement with these wide ranges of scientific publications. This is particularly true for the floodplains of the river Brahmaputra. While one can read narratives of the European travellers along the difficult course of the Brahmaputra, little scholarly work has been done to highlight the complex relationship of the Brahmaputra with the people and state at different historical times. In the twentieth century, the river became a pre-dominant symbol of Assamese nationalism and most of literature on the river was mostly aimed at reinforcing this relationship between the river and the cultural history of the people living around it.

This working paper discusses the changing political economy of the Brahmaputra and its floodplain. The paper narrates how this changing political economy of the river laid the foundation for the discovery of a new utilitarian meaning of the river and its water. The paper explains this in several sections. First, the paper outlines the basic features of the river and its floodplain as well as dependency of the peasant communities on the river and its floodplain. Secondly, the paper spells out various attempts by the colonial government to understand and explore the river. In the third section, the paper explains the changing perspective on the river and its floodplain which holds the key to understanding the changing meaning of the river.

The River and Its Flood Plain

The Brahmaputra originates in the Himalayan glaciers in the Tibetan plateau and travels a distance of 1,800 miles through three different countries. It enters the Indian plains in Assam. Here, it is joined by two other mountain streams to be collectively known as the Brahmaputra. In Assam, it flows for 700 kilometers, receives several rapidly rushing Himalayan streams, and forms an alluvial flood plain (hereafter Valley) before entering Bangladesh. The Valley has an average width of approximately 80 kilometers and is circled by low hills. During the rains, the river's swollen banks are more than five miles apart in Assam. A commonly cited description of the river is how it "flows between sandy banks, covered with dense jungle grass, the home of wild buffalo, rhinoceros, and other large game, and from the decks of the river steamers few signs of population or cultivation can be seen. A few miles inland, however, the appearance of the country changes, and rice fields or tea gardens takes the place of the riverine".[1]

The river's catchments area is about 30,000 square miles, distributed across the eastern Himalayan ranges. More than 50 tributaries with high-order drainage feed the Brahmaputra and form alluvial flood plains.[2] The river discharges about 19,830 cubic meters per second at its mouth. This makes it one of the

highest water carrying rivers in the world. The Brahmaputra along with the Ganges carries nearly six million cusecs of water to the Bay of Bengal. With a large drainage area, the rivers are also laden with high volume of sediment. The Brahmaputra transports approximately 13 million tons of suspended sediment per day during floods.[3] The large discharge and heavy sediment load makes the river extremely unstable, with the channels constantly migrating laterally. The river has carved and subsequently abandoned numerous river courses. These movements are primarily controlled by major faults or fractures in the earth's tectonic system. In sum, the river refuses to flow between its two banks which forced an observer to comment that it is "swift, imperious, it hurls down its multi-channeled course, oscillating slightly from bank to bank".[4]

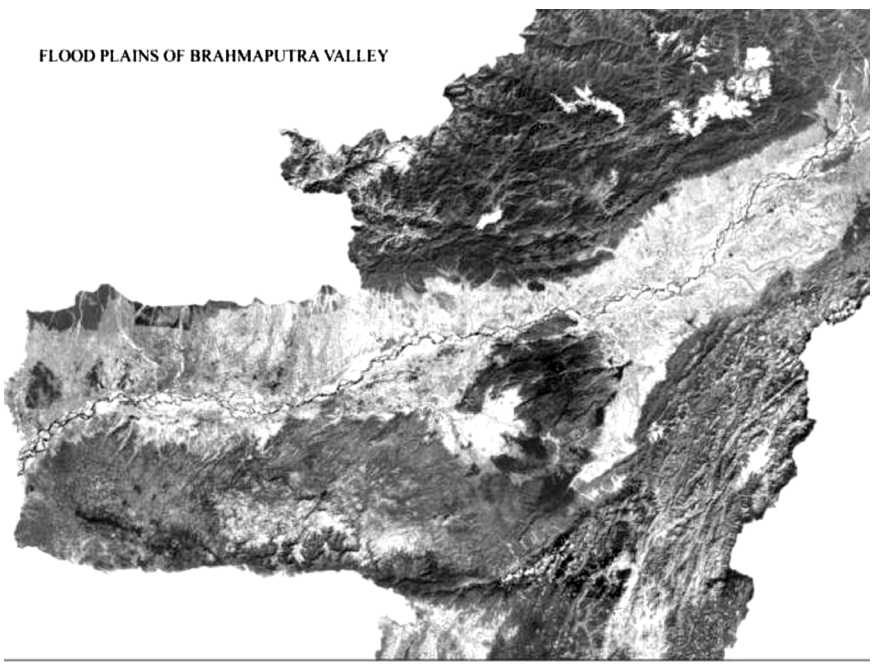

Figure 1: The flood plains of Brahmaputra

The commentator further describes the results of this process:

> Sand shoals, the colour of rock salt and fine ash, break up the waters into a number of channels. There are hundreds of them, crust-thin, irregular diamonds of land, like hides of pre-historic animals spread out to dry, with small, absurd heads, wide bodies and long scalloped tails, they are scattered up-on the pigeon-grey waters. They give the river its 'braided look'.[5]

This braided river's channels are continuously multiplying. Often channels are abandoned by the river. Such dead channels are known as dead rivers and such river channels are always quickly reclaimed. These abandoned channels — *moranodi* (dead river) — are cultivated, as the replenished soil and complex vegetation allows yield in plentiful.

Also, short-term channel migration is quite drastic. Conservative estimates suggest that such channel migration takes place at the rate of movements as high as 2,600 feet per year. Sand bars are formed but can disappear the next season. Peasants prefer such newly formed sand bars for growing winter crops rather than permanent habitat.

These peculiarities of the Brahmaputra and its floodplains, over the centuries, gave birth to a floodplain agrarian ecology. The river's waters contain, especially in the rainy season, a large quantity of matter in suspension, but it is the sand, which is deposited, while the silt is carried on until the slackening of the current allows it to settle down and fertilize the floodplains of the Valley. This also played an important role in the formation of the Bengal delta. Constantly changing river courses prevented human settlement close to the river. The pre-imperial Assamese rulers depended on the river as a source of military advantages. The river was also a window to the outside world.

Peasant communities worked out ways to overcome these challenges to agriculture.[6] By the middle of the first millennium, the Valley's agrarian practices became fully tuned to the flooding

pattern. Peasants avoided flood-prone tracts or places where chances of people, cattle or houses being swept away by flood waters existed. Peasants and their rulers usually divided the Valley according to the flooding pattern. Also, a tradition of protection of fields from floods could be traced back to the eleventh century.[7] But the idea of flood protection of the fields gained significant royal patronage since the 15th century when the Assamese rulers used *corvee labour* to build embankments.

Despite occasional flood-protection, flood dependency was an accepted wisdom. This meant that while flood-induced damages like failure of agricultural crops were frequent these were accepted as part of the river pattern. During the colonial times, the British officials noticed how the Assamese peasants considered regular inundation normal and beneficial to the fertility of the land.[8] These officials were aware of the damage the swollen Brahmaputra waters could inflict. The floods 'damage crops in two ways…' a 19th century report noted 'both by the rapidity of the current which actually carries away the plants, and by the depth of the water, owing to which the plants are submerged…'[9]

Floods would hamper fresh reclamation of land in the riverine tracts. Flood waters left behind silt (*palosh*) in the fields. Silts replenish the hungry fields with nutrients. Farmers could get increased yield from inundated fields. Loss caused to one crop would be compensated by the next harvest in winter. Colonial officials continued to report on such wisdom of the peasants from the Valley until the later decades of the 19th century. Early 20th century researches carried out in other Indian provinces had already confirmed the importance of the silt left behind by the gushing waters in the rainy season.[10]

Till the beginning of the 20th century, floods in many parts of the Brahmaputra valley were considered to be of 'ordinary' and 'local' nature, which did not cause widespread destruction. There were many reasons for this. In the western part of the Valley, "The Brahmaputra and many of its tributaries occasionally overflow their banks, but the area subject to inundation is well

known, and the villagers do not attempt to cultivate anything more than summer rice or cold weather crops in these flooded tracts."[11]The rivers were also prone to change their course very frequently, making it difficult to cultivate close to their banks. The Assamese peasants usually avoided such hostile riverbanks.

The riverine tracts (*chaporis*) were highly productive tracts. These tracts were inundated regularly. But as they were covered by long grass its reclamation was comparatively easier. The valley's peasants regularly cultivated these tracts during the winter. The agriculture here was temporary. The Assamese gentry and rich peasants could afford to cultivate such fields, as they were not the only source of cultivation. *Pam*–temporary cultivation, as such practices came to be known in the Valley, disappeared during monsoon. In the nineteenth century production of winter crops like mustard, opium or cereals was already underway.[12] At the same time these tracts were auctioned out to rich and powerful peasant families.[13]

Though these tracts were under temporary cultivation, the colonial state could not raise any revenue from these tracts as there had been no survey done to find out the crop yield or production pattern. The tracts required urgent transformation into productive category. The matter gained serious attention by the end of the 19th century. By this time, the Valley became well known for its tea-plantations, petroleum and coal mining and forests thick with timber.[14] The Valley was not even modestly self-sufficient in food production. The government's earning from land revenue during 1868–98 increased four times while the expansion of acreage under cultivation was only 7 per cent.[15] More than half a million people had migrated to the Valley in the second half of the 19th century to work in the tea plantations. A vast belt of tracts, on both sides of the river, was still waiting reclamation. These patches were considered wastelands by the colonial administrators. The colonial government had different views about the riverine tracts. It claimed:

> Down the centre of the valley flows the Brahmaputra, but, owing to the rapidity of its current, it does not, in this the upper part of its course; exercise the fertilizing influence of the Nile, the Ganges, and other great rivers. This view is not universally accepted, and it is held by some that the chars (*river islands*) of Upper Assam, though sandy, are fertile.[16]

One should keep in mind that the Valley was sparsely populated though land was abundant. The colonial government did not deny that this was not always the case. Pockets of densely distributed villages were often noticed in the 19th century. Many agreed that current forested tracts were previously settled areas. Civil wars and attacks by foreign armies meant a decline in population density, significantly throughout the 19th century and through the early decades of the 20th century. Pressure on the riverine tracts was relieved to a modest extent in the 19th century. Epidemics of smallpox, malaria and kala-azar (black-fever) increased mortality rate manifold. By the early 20th century, annual floods came to be largely visualized as a source of constraints for both agrarian production as well as human settlements. What happened to the river when floods became sorrow of the Valley?

The River as Source of Colonial Anxiety

Unlike other rivers of British India the colonial government paid little attention to the Brahmaputra until the 20th century. The river of course remained a curious geographical entity full of mystery. One key anxiety was its source of origin. Amateur geographers speculated about this until the early 20th century when the river's upper course was fully explored. The river also drew the attention of the colonial government as a possible navigable route to China. These expeditions also helped in understanding territories and people living beyond the northern and eastern frontiers of Assam. But economically most of such expeditions were a failure. Essentially, these explorations into the Brahmaputra redefined the British colonial state's notion of its unknown eastern frontier. These expeditions helped in the accumulation of extensive geographical knowledge of the river.

The colonial government also used the river to get access to interiors and foothills of Assam. This helped in asserting control over forest produces.

By the late 18th century, several mechanisms were in place through which the colonial state investigated the river system in eastern India. This happened in an age when this eastern territorial limit was yet to be visualized. For instance, James Rennell (1742–1830), in the late 18th century, meticulously examined the lower reaches of Brahmaputra. Rennell's survey laid the foundation for future possibilities. Much later, in the second half of the 19th century, a few more British explorers planned to explore various land and river routes to China in India's northeastern border, and the river Brahmaputra became the central point of these ambitious projects. The primary interest of these explorers was to understand the hydrology and river system of Brahmaputra, along with the exploration of safer and easier routes to countries lying beyond the existing boundaries. Moreover, these endeavours, as mentioned above, were motivated by an urge to find out a more suitable trade and strategic route to these regions. These trade projects, which could have involve many engineering wonders, never finally took off. At the same time some others—mostly British colonial administrators—kept their eyes open for more anthropological wonders along the river. By the early twentieth century, the river began to gain attention for its possible military importance resulting in the commission several studies.

Years of exploration into the geography setting of the Brahmaputra and its tributaries had resulted in investigating the industrial potential of the river. Attention was drawn towards the hydroelectricity potential of various tributaries of the Brahmaputra. In the last quarter of the 19th century, new technological developments took place in the field of hydroelectricity generation. In British India, experimental hydroelectricity generation had already shown some preliminary success. Extensive surveys were undertaken across British India to evaluate India's hydroelectricity generation capacity. And, by early 20th century, the Brahmaputra river and its tributaries began

to draw attention as a possible means of hydropower generation. An investigation was carried out to find ways to achieve this goal. The investigation led by G.T. Barlow and J.W. Meares commenced in 1918. This massive survey also drew the attention of the international audience including leading science journal *Nature*. This all-India survey had aimed at surveying the case of eastern Indian rivers. B.A. Blekinsop, a British electrical engineer was entrusted with the task of examining this aspect in Assam and its adjoining territories. The survey began in 1919 and Blekinsop submitted his report in 1923, highlighting the possibilities of five hydroelectricity projects. Sixty-six proposed sites were distributed across the major tributaries as well as different geo-ecological formations. Sixty-seven surveys in one of the sites had to be abandoned early due to financial consideration. The survey estimated that 93,000 kilowatts of hydropower could be possibly generated from these rivers. Blekinsop also believed that most of the projects would be cost effective and would be able to generate electricity at a cheap rate. "Hukkong valley as regards power and cheapness could compete with North America and Scandinavia, current could be generated from water power at 0.1 anna to 0.05 anna per unit." Blekinsop's ideas did not succeed. It was only in the last quarter of the 19th century that the post-independent Indian federal government had taken up comprehensive hydroelectricity generation. The government displayed great enterprise and energy in collecting physical facts concerning the region's hydropower resources. But political and economic uncertainties of the 1920s did not help in achieving the desired results.

Reclaiming floodplain

Annual floods were part of the valley's natural history. Critical changes in the flooding pattern of the valley began visible towards the late 19th century. Two events, which almost took place simultaneously (in geological sense of time) altered the courses of the rivers and their surface. The 1897 earthquake measuring 8.1 on the Richter scale changed the river regime of the valley. New patterns of flooding led to slow decline of agricultural

endowments. The river erosion had rapidly unfolded a crisis of agricultural land. The situation deteriorated further after 1950 when another earthquake measuring 8.6 on the Richter scale hit the region. Scientific reports revealed how this led to rise in river bed and increased silt load in the river. In several areas, the river had changed its course. All these led to increasing land loss and erosion.

However, by the early decades of the twentieth century, riverine tracts were no more exclusive resources for the rich. Increasing population pressure, as epidemics were under control, now forced the poor and landless to cultivate in the riverine areas. In another event, the vast floodplain of the river came under rapid reclamation. Migrant peasants from lower reaches of the river converted large patches—from an estimated 38,000 acres in 1902 to 300,000 acres in 1932—of alluvial grass land along the river Brahmaputra into the agricultural fields. To know this event we have to go back a little earlier. Indeed, the idea of reclamation of these riverine tracts—an estimated 6.78 million acres—had the long-drawn attention of the Indian colonial government. One of the first proposals was proposed in 1888, but fear of mortality and challenges of an unfavourable climate and cultural barrier advised the government not to act proactively then. In 1897, Henry Cotton, the Chief Commissioner of Assam famously asserted that the fight of civilisation against nature demands its victims no less than war against a human enemy. He argued:

> Land cannot be reclaimed from jungle, except at the cost of comparatively high mortality among the pioneers of cultivation. This sacrifice of life is not confined to reclamation of land in Assam.... But the cost of life and treasure has never been allowed to count in the balance and the triumphs of peaceful industry must continue to claim their victims.[17]

Cotton also lamented, "the millions of acres of culturable land now lying waste represent millions of rupees which might be dug out of the soil, but are now allowed to lie useless like the talent wrapped in a napkin".[18]

As the demands for settlement of the riverine tracts of the Valley found increasing supporters within the official lobby, two primary but interconnected concerns had to be resolved.[19] These were choice of crop and who would cultivate the sandy tracts. The first question was resolved by deciding in favour of jute as the soil was unsuitable for tea-plantations. This meant that peasants would have to do the job.

By the 1870s, jute cultivation was extensive in Bengal, the most important Indian province.[20] Demand for raw jute was increasing regularly, as Bengal now had a highly organised jute industry.[21] Jute, in the new organisation of colonial agricultural production, was crucial for its economic value. It came next to cotton as a fibre crop.[22] Until the end of the 19th century, its production was limited to northern and eastern Bengal along the Gangetic hinterland. Jute was grown along both the flooded banks of the Brahmaputra in Bengal. The littoral lands of the deltaic regions of Mymensingh, Dhaka or Faridpur produced high quality jute.[23] Bengal became a major jute-producing area because of its sandy loom, optimal rainfall, hot and humid climate and the jute fields' easy access to rivulets. In Bengal, the farmers preferred the alluvial sandbanks in the *chars-chaporis* (river islands) for the cultivation of jute. For the most part, jute was grown on flooded lands. It covered only a small portion, around 4 per cent of the total cultivated area in the jute-producing districts of Bengal. The plant that yields the jute is *pat* in the Valley or *koshta* or *pat* for the Bengali farmers. Jute belongs to the family of mallows (*Corchorusolitorius* and *Corchoruscapsularis).* This summer crop survived high floods before the harvesting in August and September.[24] This was mostly because of its height; it often grew more than 12 feet. After cutting, stems were tied up in bundles, and were thrown into receding floodwaters or into pools of water. This helped the bundles to rot to such a degree that the stem's outer coat could be peeled off easily. The bundles were then taken out of the water, the fibre removed and washed. The traders bought thus extracted long, soft and silky thread like fibre.

The extensive river networks across the Bengal countryside helped extensively in the jute trade. Mobile Bengali petty traders

would reach out to areas of jute production in boats. Jute, thus collected was transferred to wholesale merchants, who shipped it to Calcutta by steamer or large native boats. By the early twentieth century, extensive experiments were on to explore the possibilities of jute cultivation across different parts of British India, especially around river deltas. But every effort was not successful as soil and climate are also important factors for jute. In the south, the Godavari delta's dirty water led to poor fibre.[25]

Around the time that the Valley was considered for jute production, Bengal was also troubled by famine. To overcome any criticism of converting food-growing areas into cash-crop zones, officials argued that jute never replaced rice as crop and the former was always secondary to the latter.

> [T]he fertility of the rice-fields of Eastern Bengal is such that they could support a much denser population than at present. Jute, in short, is no rival of rice; but a subsidiary crop, from which the cultivator makes money, while he reserves the rice for his own consumption.

The government also thought that jute contributed immensely to the well-being of the Bengali peasants. William Hunter, the imperial statistician, endorsing this view, reiterated that the demand for jute in Europe had contributed more than any administrative measure to raise the standard of comfort throughout eastern Bengal.[26] Evidence, however, runs contrary to this. Despite the direct interest of the jute industries, it remained in the hands of small-peasant producers. The peasants continued to be dependent on market-led price fluctuations and were often in debt.

Jute was the highest export earner for India in the early 20th century. The revenue earned from the jute trade helped Britain to overcome its trade deficit with the United States and Germany. The colonial government wanted to expand the jute acreage beyond Bengal as the latter had exhausted all its land and was

by now saturated. The riverine tracts of the Brahmaputra in Assam consisting of grassland and savannah—similar to Bengal—were considered best suited for cultivation of jute. The texture of soil, rainfall pattern and availability of clear water in the alluvial tracts of the Valley also matched the requirements for jute cultivation. The little jute that was grown in the Valley would be a supplement of the paddy cultivation; it was seldom the principal crop. Colonial officials thought that plenty of land, all along the upper courses river Brahmaputra in Assam, ideal for jute cultivation, was laying waste. The government's view was fully endorsed by the jute industrialists in Bengal.

The success of the expansion of jute cultivation was dependent on the availability of peasant labour. The government could not afford to invite previous settlers from eastern and central India who came to work in the tea-plantations since the middle of the nineteenth century. There was widespread fear, endorsed by the British tea-planters, that such a migration would drift away the existing workers from the plantation. Alternately, this could be successful if only peasants from the lower courses of the river Brahmaputra could undertake this task. The government believed that immigration of peasants from these East Bengal villages and their settlement along the riverine lands would make the project of jute a success. The fragile ecology of the Bengal delta and over-population had already forced peasants to move out. The East Bengal villages exhausted "intensive margins" of land use. Famines during 1896–97 also forced migration out of the densely populated tracts of East Bengal. Officials of the Government of India thought that the Valley needed "the stout and fanatical Mohamedan of Eastern Bengal"[27] as the best choice to convert these areas into jute-producing fields. The importance of Bengal farmers as the future settlers in the Valley continued to get official endorsement.

Migration into the western areas of Assam sharing a similar ecology from the contiguous villages of northeast Bengal began since the last years of the 19th century. The zamindars of Goalpara had settled peasants from the northern districts of East Bengal in

their uncultivated chars to cultivate jute. Linguistic-ethnic, not religious, similarities and a long-shared history of economic exchanges across this micro-region had helped people to move in. River routes and a new railway made travel comparatively easier.

Flood and the Assamese Elite

> In a sense, the river can be compared—in point of rendering the valley fertile and the harvest rich and copious—with the father Nile of Egypt. (Barua 1991, 12)

As the floodplains witnessed dramatic transformation through the process of reclamation, annual floods also acquired new meaning. Floods now posed a challenge to the jute crop. As jute was washed away, the flood-induced damages became visible. This meant immediate need of protection to the floodplain. That floods caused serious dislocation of the valley's agrarian economy was regularly highlighted in various public forums. Press as well as legislatures frequently pointed to the extent of flood induced losses. Press referred to how sands carried by the flood waters covered arable plots with sand. Official accounts suggested a phenomenal increase in the number of landless peasants across the flood plains.This forced peasants to look for land in government owned forests. This was also the time when forested lands were rapidly cleared off for agriculture.

Demands for protection of the plains from floods began to surface around the 2nd quarter of the 20th century. Assam's ruling establishment—political leaders, bureaucrats, engineers, and a host of contractors— had after 1950 tried to solve the problem of increasing floods by a combination of political rhetoric and by the innovative use of "science". Everybody tried to win over the peasantry through promises of tackling the annual floods in Assam. Whether it was in the floor of the legislative houses or public platforms, everyone agreed on the urgent necessity of flood control. What could be done to overcome the recurring floods?

The Assamese elite considered floods in the Brahmaputra and other rivers of the state as a major source of suffering for the local peasantry. The Assamese politicians cutting across the ideological divide were convinced of the need for river control. The underdevelopment of Assam was already being widely discussed and the question why was being repeatedly asked. Following successive failure of crops and an imminent famine-like situation looming large over the state in the 1940s, the ruling class was focused on flood-control. It was perceived that flood control would restore a crisis-ridden agrarian economy. In the floor of the Legislative Assembly, debates raged on how best to control the annual Brahmaputra floods. In 1947, the acclaimed architect of modern Assam, Gopinath Bordoloi, in a debate on the House, argued for immediate need of river engineering:

> The best method as is now advocated by the scientists is that the river could be best controlled by putting some dams…. For controlling the Brahmaputra, the scheme is to put up a dam somewhere 8 miles from Pasighat in the Abor country. (Assam Legislative Assembly Debates, 1947)

Similar concerns continued to be reflected on the floor of the Assembly. Hem Barua, the vocal Assamese Socialist spoke eloquently about the destructive mood of the river Brahmaputra. Barua said:

> ... it is quite often that they over bring and spread across the fallow lands in great pressing volumes, and destroy cultivation, human habitation and cattle lives. At times, whole villages far and near are swept away. In a miniature scale, they are, in the destructive aspect of thing, like of the often heard tidal wave of the Japanese islands. (Barua 1991: 11)

As flood crisis aggravated after the 1950 earthquake, the Assam Pradesh Congress Committee, in 1951, passed a resolution, which sought help from the Government of India "to take necessary steps to train or otherwise deal with the river Brahmaputra in order to stop floods which are devastating the state almost every year

causing huge loss to the agriculturists".[28] Through this stand, the Assamese ruling elite made several issues clear: (i) it affirmed that modern engineering could tame the river and (ii) it expressed Assam's helplessness in doing so due to lack of resources. This twofold approach continued to shape the Assamese ruling class's relationship with flood problem. That river engineering through embankments and multi-purpose dams would pave the way for safe cultivation was widely articulated in different political forums. Many suggested that this would open up new areas for the extension of permanent agriculture and hoped land reclamation would be possible.[29] The peasantry, not convinced of this political rhetoric, and distressed by flood crisis, only hoped for some miracle to happen. Such rhetoric, however, served to strengthen the Assamese ruling class's control over peasant dependence and helplessness. Away from this, legal intervention was thought as the best possible remedy. Accordingly, in 1953, the Assamese ruling class reinforced an existing legal instrument, the Assam Embankment and Drainage Act 1953, in an apparent bid to control flood. This came to have a serious implication for the electoral politics of the region.

In Search for Possible Remedy

In a bid to overcome challenges posed by flooding of the Brahmaputra and its tributaries, the government began to search for some urgent remedies. Structural intervention into the river system was increasingly seen as the possible solution. The need of the hour was a sound engineering solution. Several commissioned surveys advanced possible remedies apart from trying to explain the cause of the river's worrisome behaviour. The key beginning was made in 1929 and this continued until 1980s. Towards the end of the 20th century, the volume of these surveys multiplied and the political economy behind the objective of these surveys became complex. During 1929–50, the international engineering cooperation was limited and their suggestion included either dredging of the river or construction of storage reservoirs and embankments as possible protection against flood. The only exception in this period was S.C.

Majumdar. Majumdar was a senior engineer, credited with extensive works on the rivers of the Bengal delta and a key adviser to the Indian government on the flood protection. He came down heavily on the benefits of embankments. That embankments could become a disastrous remedy was unhesitatingly predicted by Majumdar.

After the 1950 earthquake, floods had become more frequent. Official and non-official perceptions concurred on the increasing ferocity of flood after 1950.[30] Most government reports now agreed that floods had become a "common phenomenon" in Assam since 1950.[31] The earthquake forced changes into the course of several rivers. The river beds had become shallow due to deposit of silt brought down from the surrounding hills affected by landslides. Such rivers then lost the carrying capacity of water during the monsoons, and even a small rise in the water level could result in the waters spilling over the banks and damaging the outlying fields and habitations.[32]

A typical alluvial river cannot maintain a channel section which is capable of carrying the flood discharge within its formed banks. This is particularly true where the rainfall is concentrated during the monsoon months, where the rainfall is heaviest. .

Floods in Assam even before the great earthquake were frequent and damaging. Since the earthquake of 1950, however conditions appear to be progressively worsening.[33] The frequent change of course by the rivers, particularly in the north bank of the Brahmaputra, was identified as another factor that caused flooding in their respective valleys. "Any spill channel that may form during a high flood by scouring out the river bank goes on developing and the deeper drainage channel draining the adjacent valley cuts back through gully erosion to catch up the river through the spill channel and the river changes its entire course into the adjacent drainage channel creating new flood problems in the valley."[34] Such a phenomenon was noticeable in case of the large number of tributaries of the Brahmaputra. Moreover, blocking of river channels by soil and vegetation was identified

as another factor contributing to the floods in the north bank tributaries, which "happened occasionally prior to the earthquake but has been very common in north-eastern Assam after the earthquake".

Coinciding with the devastating floods of 1950, the First Five Year Plan of the country (1951–56) emphasized on the need for large dams and production of both hydroelectricity as well as creating facilities for irrigation. The country witnessed a conceptual shift from embankments toward large dams intended to store floodwaters. Several rivers in northern and eastern India became integrated with this framework, though no storage dams were conceived for the Brahmaputra or its tributaries. While possible, reverse impacts of storage dams on the river ecology was yet to be widely perceived and articulated; the reason for not allowing the river Brahmaputra to have storage dams was somewhere else. The uncertainties of the political future of the region kept all possible investment of public finance and it resulted in a series of political debates and mobilization against a perceived bias in the framework of Indian federal structure.

Assam experienced severe flooding in 1954 along with several northern and eastern Indian states. Severity of floods—perceived of a much higher intensity because of the 1950 earthquake—prompted the state to formulate urgent flood strategy. Few selected towns and other key areas, which had critical importance from the economic point of view, were to be afforded protection. The most publicly visible protection work was for the city of Dibrugarh in eastern Assam, which had key tea-plantation interests. Suggestions were put forward to raise the height of some flood-prone villages. This would be done through the construction of new embankments and spurs.[35] Viability of extending the existing embankments and improvement of drainage channels was now investigated. In the end, the government strongly pushed for the future construction of storage dams and new embankments. This radical ideological shift in the government as well as Assamese ruling establishment's attitude towards floods, the actual physical control of the river did not take place.[36]

Soon the need for watershed management programmes came to be recognized. Such voices were at first feeble. But it became clear gradually that deforestation was one of the primary causes of floods in Assam. An official report thus blamed deforestation: "Progressive opening up of unclassed forests and grass land in the submontane areas for cultivation must have contributed its share to this. How far deforestation in the hills and *jhumming* are responsible for increased flood discharge is a matter of detailed study?"[37]

That the flood-prone areas needed better flood warning systems was also suggested. However, this was the period when concerns were raised about the effectiveness of embankments as a flood protection instrument. Engineers, who had been working in the region, in the meantime began to suggest that embankments were catalysts for confinement of flows. The latter was understood to be the reason for increased flood levels. It also reduced natural drainage to be accompanied by augmented waterlogging. It also became apparent that complete flood protection could not be ensured. In 1958, an official report of the Government of India equivocally admitted that "the various flood control measures either executed or visualized should not lead to the wrong impression that complete immunity from flood damage is physically possible in some distant future. Any such illusion has to be dispelled".

Beginning with 1958, more surveys were conducted. International cooperation to help tame the Brahmaputra was sought during this period. Experts from U.S.A. and Europe began to study the Brahmaputra's physical system. The government of India roped in the U.S. Army Corps of Engineers in 1965. B.P. Bellport, the Chief Engineer of the U.S. Bureau of Reclamation visited the region. Recommending long-term investigation to determine the magnitude of the floods, Bellport suggested the need of both hydrological as well as economic features of the Brahmaputra basin. He agreed that there must be "an effort to determine the feasibility of constructing dams on the tributary streams".[38] This study emphasized on a multipurpose

dam and it was emphasized that construction of big dams in the region could not be justified if generation of electricity was one of the primary aims. Earthquake and large siltation charge in the rivers could be a constraint in construction of any mutipurpose dam. Instead, that report suggested the watershed management could reduce this silt load in the rivers.

In 1966 another team of the U.S. Army Corps of Engineers made a detailed study of the Brahmaputra. This report suggested that the most desirable plan for controlling of the Brahmaputra was complete stabilization. This could be brought about by having sufficient reservoirs to reduce both sedimentation and aggrading tendency of the river. The report agreed that a limited number of reservoir sites might not sufficiently reduce sediment load. The river could be restricted into a single channel and trained into a series of easy bends, preferably along the main channel by methods of channel stabilization. This could be done only by investing huge resources as well as equipment and material. Confinement of the river in a single channel might raise flood heights requiring higher embankments. As complete river stabilization was not feasible, and, therefore, work in specified locations would have to be considered. The report agreed that dredging could also train the river. But before these promises could be fulfilled a careful study of the river basin was urgently required.[39]

Meanwhile, in 1963, the government of India sought the advice of the National Hydraulic Laboratory of France to improve the navigability of the Brahmaputra as well as protection of its banks. The French organization joined hands with the United Nations Economics Commission for Asia and the Far East. Trials were taken up from 1963 to 1970 for improving the navigability of the Brahmaputra. The experiments were found to be successful in three places but failed in two others. After these results it was impossible to go ahead with the "river-training" project for the Brahmaputra, without a suitable and systematic long-term programme to study the evolution of its "channel-processes".[40]

The temporary setback did not deter the government of India from seeking advice from the United States Aid for International Development in 1970. W.A. Stufft who led this investigation recommended that the Brahmaputra Flood Control Commission should prepare plans for mitigating floods and bank erosion as well as for improvement of the drainage. He suggested that "the function of irrigation, power, navigation, soil conservation, water supply, fisheries should also be considered where they are directly related to the primary purpose." The immediate task was to complete construction of embankments and construction of bank protection at selected spots where towns or other important structures were threatened. The report suggested that the existing section of embankments should be improved and the standard adopted for Mississippi river embankments followed.[41] The report also suggested that adequate investigations were needed to see if a system of reservoirs would be feasible. In the long run detailed investigation should be done, aimed at multi-purpose development of the basin through construction of reservoirs at suitable sites. The plan required services of engineers who specialized in hydrology and sedimentation. According to Stufft, an economist who would undertake a thorough cost-benefit analysis of the planned projects had to be consulted.

The 1970s witnessed continuous expression of interests by the United States to study and advice on water resources in South Asia. U.S. President Jimmy Carter and British Prime Minister James Callaghan in their visits to India in late 1970's also offered their country's assistance to projects for "harnessing" the two major rivers of South Asia.[42] Investigation and ideas on river control became widely available.[43] Similar surveys continued to be pursued until the first decade of the present century. While surveys conducted during this period largely agreed with the threefold issues of embankments, storage reservoirs, and dredging, at the same time, there was increasing uneasiness at the gigantic nature of the river and its great unpredictably. It was suggested that it was important to control watershed for erosion control along with the fact that the river should be stabilized to single channel.

The 1954 policy statement on the flood control continued to be the guiding principle for tackling surging rivers. Further political intervention came in 1964 when a ministerial committee re-examined the flood-control program (Government of India, 1964). The suggestion of the committee largely reinforced the existing methods of structural intervention into the rivers apart from a controversial idea for inter-basin diversion of river waters. The idea of multi-purpose dams was further reinforced. Other advice for non-structural intervention came in—flood forecasting, floodplain zoning, and flood insurance. That soil conservation was a core issue for future flood management was also suggested by the committee. These ideas were further reinforced in 1972 when another ministerial committee agreed with these suggestions. The Indian establishment of the time firmly believed that flood moderation and not power generation should be the priority for multipurpose dams. Until now, what was missing from the flood control schemes was the independent assessment of individual rivers. In 1978, another technical expertise group reiterated previous suggestions but also recommended that flood-affected states should prepare master plans for each river basin. The newfound distrust with the embankment remained visible and it was acknowledged that although embankments were providing a certain degree of protection at relatively low cost, "the effects of embankments on the river regime were not well understood". This search for an engineering solution to floods also coincided with the new thrust areas of focus to understand flood problem. In the late 1970s, the Planning Commission, before unveiling its sixth plan, categorically argued:

> One of the important causes of occurrence of floods viz., the devastation of forests and lack of other conservative measures on the catchment areas of the rivers leading to heavy soil erosion and consequent increase in silt load in rivers, has not so far received adequate attention.

Preliminary geo-morphological studies conducted by the Geological Survey of India during the early years of the 1970s also convinced policymakers to harness water resources of the Brahmaputra's tributaries, making way for flood control

downstream (Rao 1979: 79). A number of experts suggested dredging of the river Brahmaputra during the 1950s and early 1960s. Within popular imagination, the idea of dredging would remain a successful remedy. The Assamese engineers, not essentially river engineers, supported this view. Notwithstanding the lack of financial support required for such massive dredging on the Brahmaputra, the Assam government undertook this on an experimental basis in 1966. The experiment began in western Assam, in 1974.[44] The high cost ensured that the experiments remained confined to small stretches only. The result of the experiment was not convincing. It was now understood that while dredging could prevent bank erosion, the dredged segment got instantly filled up with silts. What was required now was to undertake civil work "to train the river to flow through the dredged area and to remove the earth". This optimism could not be sustained for long due to the huge expenditures involved, and such practices were not recommended again. The idea of dredging became unattractive within the engineering lobby only in the 21st century (Phukan 2005) but continued to draw support in the popular imagination. While this shift was perceptible regarding the upstream of the river, popular demand for dredging in the lower reaches of the Brahmaputra remained.[45]

The emphasis for multi-purpose dams as a remedy for floods came back in the beginning of the 21st century. This was reflected in the several official reports on the river. In 2009, the Assam government initiated discussions to frame its future policy on water. The policy reinforced the idea of a multi-purpose dam as a key solution to controlling dams.[46]

Flood Control and an Era of Embankment

By the mid-twentieth century construction of embankments emerged as the most sought after tool as remedy against recurrent floods. Embankments would help prevent water spilling over to the paddy fields. Embankments would also help in the stabilization of river channels. This would ensure a regimented water flow. It would also help in controlling the overflow or spill-

over of excess water during the floods. This would finally protect both crops and human lives. In keeping with this ideological push, an Embankment and Drainage (E&D) Department was established in Assam in 1944. The department had mandate to monitor and improve the river drainage system. The department could both construct embankments and divert the river wherever possible. Construction of massive embankments began since the middle of the 20th century.

As mentioned earlier, the valley experienced a destructive flood in 1954. Three major floods came in quick succession within three months, each more damaging than the last. In recent memory the 1954 floods exceeded all past records. Official records claim that this wave of flood "completed the destruction of whatever property the unfortunate people had left after the two earlier floods and rendered them totally destitute".[47] An area of over 12,000 sq. miles — approximately one half of the valley — was inundated. In 1954, the floods badly affected 255,873 families consisting approximately of 1,279,365 persons. In addition, 7,500 families with approximately 37,500 persons lost their homesteads and cultivable lands due to erosion. Loss of human life due to the floods was estimated to be seventeen. Approximately 65 per cent of the total summer paddy and half of the total jute produced in Assam was destroyed.[48] Moreover, a considerable proportion of winter crops was lost either because seedlings were destroyed or transplantation could not be carried out due to the late monsoon flood. At this juncture, apart from the proposals of building additional flood-protection works, the government proposed that "The agriculturalists living in the rural areas will be provided with homestead lands and agricultural lands for cultivation as well as house building advances and subsistence grants."

The floods of 1954 brought erosion of the inhabited and cultivated banks of the rivers into focus for the government. An official account noted how, "a large number of families have been more or less affected by erosion and in some places houses and properties have also been washed away. Devastation caused by the river's tributaries was also significant. For instance, high

floods from the river Aie, flowing through the north bank of the Brahmaputra in western Assam, washed away about 400 bighas".[49] The official figures of cattle lost stood at above 3,000, while the area eroded was reported to be 17,617 acres, 354 villages and 7,791 families were affected by erosion.[50] The immediate response of the Assam government in the aftermath of the series of floods in 1954 was the construction of earthen dykes and embankments along the Brahmaputra and its tributaries. Flood control measures carried out in the winter season of 1954–55 included 125 miles of embankments on the Brahmaputra apart from over 400 miles of tributary embankments in the floodplain districts of the valley.[51]

Building of embankments acquired massive political backing after 1954. These embankments were constructed using locally available sand and manual labour. After two decades, the region has come to be crisscrossed by about one-third of India's total length of embankment. By 1986, Assam had 4,448 kilometres of embankments and official records claimed that embankments protected an estimated 1.56 million hectares of agricultural land. The Assamese ruling establishments had reposed faith in embankments as a way to prevent floods. For instance, the Assam government in 1952 confidently noted that

> In a backward country like Assam, where agriculture dominates the economic life of the people but where methods of agriculture are still primitive and Nature plays the most important role in the production of food, the importance of embankment and drainage works are being realized by our people every day.…The government have realized the necessity of a comprehensive embankment and drainage system scheme in the state.[52]

The efforts of the E&D Department often resulted in unforeseen damages and resultant public protests. In 1950, an attempt was made to divert water from Buri-Dihing to Noa-Dihing in eastern Assam though its effectiveness was never recorded. In 1953, the government adopted a resolution condemning such works of this department. Occasional river engineering took place, which

attempted to divert excess water into a less filled river in the neighbourhood.

The critical moment came in 1957 with the adoption of the Assam Embankment Act, which put in place several institutions to channelize both technology and financial grant as a means of controlling the fund. In the next couple of decades, as embankments became the answer to 'floods', it gave birth to a class of interested groups. The resultant class of contractors who would be instrumental for implementation of these embankment projects would remain the primary determinant for the electoral gains of all political parties. Attention was drawn to the creation of more state instrumentalities as effective means of flood control to which I will come back a little later.

Several years of tryst with embankments, however, now convinced both the ruling class and the technocrats, of the non-viability of embankments. Thus, after a series of devastating floods in 1986, an Expert Committee had observed, "the embankments have changed the behaviour of the rivers for the worse". The new policy was simple, no more embankments. The popular perception was that floods of 1986, whose devastating impact was widely visible in central Assam, was caused by the newly built storage dams across tributaries of the Brahmaputra. Little was subsequently studied to verify such perceived threat and ill effects of storage dams.

Possible ill effects of embankments had already began to surface in official accounts. There were increasing scientific evidences which described how embankment led to high flood level within the embanked area. Embankments resulted in the rise of riverbeds. Consequent to this was reduction of fertility of land of the flood-protected area. Official accounts conceded that there were regular breaches of embankments and protected areas were submerged. Water logging, drainage congestion, and repeated failures of mechanized outlet instruments were also regularly cited in these reports.

The Indian river technocrats agreed that all these led to the rise of riverbeds. The rivers' channel become narrower. An official report thus claimed that the land drainage pattern got changed drastically because all streams were now guarded by marginal embankments. Increasing siltation in the river channels also led to aggradations of the river beds. The silt which earlier spilled over to the flood plains, now got deposited inside the channels. Embankments also suffered from erosion of river banks.

The investment for river engineering since post-1947 in the Brahmaputra valley primarily aimed at controlling floods, improvement of drainage, and reduction of erosion. Embankment construction was based more on expertise of Indian technocrats. In doing so the river's ecological setting did not get enough attention. Reflecting on decades of experiment with embankments, it was conceded early in the 21st century:

> ... throughout the more than three decades during which flood management policy was evolving, necessity dictated that physical interventions continued. Despite well-founded concerns over embankments, they were in fact the only reasonably cost-effective measure that afforded protection from lesser floods, and their construction went on practically unabated in the Brahmaputra and Barak basins of the Northeastern Region.

Despite gigantic efforts and colossal expenditure—more than Rs 15,000 million—in building 3,647 kilometers of embankments, 599 kilometers of drainage channels, and 431 square kilometers area for soil conservation, the Brahmaputra continues to wreak havoc through uncontrollable floods year after year. Floods repeatedly occurred in the 1960s to the 1990s annually affecting an average one tenth of the geographical area of Assam.

Overcoming Resource Crisis: Floods a 'National Problem'

In the 1950s, Assamese ruling establishment repeatedly emphasized its failure to do justice to the flood victims with its "limited state resources" and demanded for central government

financial assistance. For instance, in response to flooding between 1982 and 1987, Assam sought flood relief from the central government amounting to US$150 million and received assistance of US$26 million. The flood-prone areas in Assam were estimated to be 3.15 million hectares. Between 1999 and 2004, the average annual flood damage in Assam was estimated at US$163 million, Assam received an average US$21 million as allocation of the central government in New Delhi.

Contemporary commentators agreed that the discrepancy between the volume of financial support sought and the support granted was in part due to differences of opinion over the estimate of damage and "a general shortage of financial resources, and also in part political bias". Increasing failure to provide sufficient finances for flood control forced the Assamese ruling establishment to ask the Centre to declare floods as a national problem. The Assamese ruling establishment, across the ideological divide, insisted that floods be declared as a "national problem". National problem would mean more diversion of fund as well as technical support. Despite Assamese ruling establishment's repeated pressure, the Indian government refused to declare this a "national problem". For the Assamese urban middle class, this refusal was another example of injustice to a northeastern state and inability to put forward its political demands within the Indian federal structure.

Withering Agrarian Economy: Towards a National Consensus

While the search for an engineering solution to floods continued, the recurrence of floods forced the Indian government to take a fresh look at the problem. The result was the formation of the National Flood Commission in 1976. Years of reflection on the issue convinced the commission in 1980 to emphasize that measures like flood forecasting and warning systems, new embankments, drainage improvement, soil conservation including afforestation needed to remain the primary focus of the flood control measures. At the same time, in 1976, the National Commission for Agriculture suggested the need for a change in

the crop-cycle for the flood-prone area. The commission advocated for the reorientation of the cropping system for flood-prone areas. This was also endorsed by the National Flood Commission. A farming cycle capable of withstanding floods was the need of the hour. The commission recommended cultivation during the flood-free months.

Meanwhile various public forums highlighted Assam's declining agrarian production. There was consensus within the Assam Legislature that floods were responsible for the rapid decline of food grain production. From being a food sufficient state, Assam was turning to a food deficit one. There was widespread concern of the rapid loss of available arable land. Others argued that since the last quarter of the 20th century, rather than loss of land there was significant evidence of sand deposition in various parts of the river channel leading to formation of land mass.

> Floods have impeded the technological transformation of agriculture in Assam. Farmers do not apply costly inputs such as fertilizers and high yielding variety (HYV) seeds for fear of being washed away by floods.

The helplessness of Assam's ruling establishment was apparent. In the late 20th century, in a move to hold back shrinking agrarian production, the government strongly argued for change in agricultural practices.

> … (in) Valley worst floods are experienced in the months of July and August, although in some years floods have been reported in early June or in end of September. In general, however, the cropping has to be restructured to avoid the months of July and August.

Flood moderation, rather than 'control', became the primary agenda. Towards the end of the century, the Assamese peasantry faced with repeated failure of state instrumentalities to protect their land and crops began to slowly change their agrarian cycle.

New choices involved shifting to an intensive winter crop to irrigation-based summer crop. Summer crop required intensive irrigation. Absence of any state-sponsored irrigation facilities, however, ensured that the ability to grow summer crops remained confined to a limited number of peasants. Those with political connections were able to secure loans from banks ans get the benefits. Within a year, for instance during 1993–95, there was an estimated 158 per cent increase in the area under summer crop acreage. This coincided with the discovery of new varieties of paddy, able to withstand the pre-flood cycle. Areas of new choices expand to areas where the social origin of the peasantry differs.

Birth of a Regulatory Regime: The Brahmaputra Board

In 1963, the Assam Flood Control Board was created. One reason for this new government body was the devastation caused by the 1962 floods. The board was mandated to plan and oversee all possible flood control measures in the state (Report of the Annual Flood Control, Assam 1964: 5). In the first few years of its existence, the board's functions were confined to examining causes of breaches into the embankments and possible human role in such incidents.

Years of negotiations finally resulted in the formation of the Brahmaputra Board. The Board would look after the affairs of the river Brahmaputra and ways to regiment the river. The Indian Parliament passed an Act in 1980 to set up this statutory body. The Board had a larger political mandate to bring under a regime of control the entire river system in the region. The Act stipulated that the Board would carry out surveys and investigations in the Brahmaputra river basin. Mandated to prepare a "master plan", the Board was to provide measures for the control of floods, bank erosion, and improvement of drainage in the Brahmaputra valley. To maximize the utilitarian end of the river and its water resources, the Board tried to conceptualize plans for irrigation, hydropower, and waterways. By this time, the idea of storage dams began to gain remarkable support amongst the Assamese ruling establishment and the Board was specially directed to

"prepare detailed project report and estimates in respect of the dams".

The rivers and their resources came under increasing regulation and national control. The Board would have to obtain prior permission from the Centre for all constructions on the river. The storage dams would be under the Board's control. So it had to "draw up standards and specifications for construction, operation and maintenance of such dams and other projects" and it would undertake to construct multipurpose dams. On issues of capital investment and possible interstate water disputes, the board did not have any clear mandate.

Prior to the promulgation of the act, the Brahmaputra Board had already carried out planning and documentation of the water resources of the Brahmaputra river basin. Being both bureaucratic and technocratic in nature, the board undertook these works in several phases. A new era had begun in understanding the river and its water resources. The road map was prepared, with a clear political mandate, for future capital investment in a territory already visited by the imperial capital.

Producing National Wealth:
Flood Mitigation to Hydropower Generation

> The rivers are a network; they give to Assam a tremendous waterpower potential. (Barua 1991: 6)

Along with this new-found desire to control the river, the idea of development of the region— modelled more in terms of industrial development—also gained ground among cross sections of people. On one hand, the ruling class, mostly because of its failure to understand the silent transition taking place in the peasant economy, began to condemn the agrarian economy. That the rivers could emerge as the storehouse of hydropower generation became the new thrust of political debates.

In the meanwhile, the Brahmaputra Board did set up stations to monitor water flow, meteorological, and earthquake-recording

stations. The erstwhile flood forecasting equipment was now modernized. Few anti-river erosion schemes through setting up of spurs were taken up. Several of these schemes came to be implemented with grants from central government's funds. The Board visualized several proposals for construction of multipurpose storage dams. The Board was now convinced that construction of storage dams in the north bank tributaries[53] of the Brahmaputra would be able to generate enough hydropower. Technocrats also began to speculate that besides generating power, these storage reservoirs would also ensure moderation of floods in the flood plains of the valley.[54] Slash and burn agricultural practices in the upstream of the river were also condemned for its possible role in increasing sedimentation of the river.

We should keep in mind that the challenge of tapping the tumultuous river water and harnessing it for people's use was thought of since the 1940s. The need for river valley projects was the dream of early Indian planners. But with no hope of investment of private capital and with the central government refusing to share its national resources for this purpose, any such works remained mere dreams.

Debates also grew on how reservoirs should also act as "multi-purpose" agents to ensure both agriculture and wealth generation would get equal importance. Until the beginning of the 21st century, the models for future dams were prepared keeping these priorities in view. By the late 20th century, Indian national water policy began to emphasize the role of private capital in converting water resources to productive national wealth. In official discourses, there was increasing emphasis to enforce an idea of zoning the flood plains, parts of which could be excluded from human activities. At the same time attention was drawn to the fact that floods were increasingly caused due to deforestation and consequent siltation of the rivers in the Himalayan system.

Political Economy of River Control

In the backdrop of this shift in priorities and apparent success in defining the river as "sorrow" of the people, in 2001, the Central Electricity Authority, a statuary body of the Indian government, conducted a ranking of the hydroelectric potential of various river basins in the country. The Brahmaputra river basin was given the highest marks and accordingly 168 projects having a cumulative installed capacity of approximately 63,000 megawatts were identified. The idea that the region could become the nation's "future powerhouse" had been proactively spelled out since then.[55] In an age of neo-liberal economy, the responsibility of power generation was now entrusted to private capital that refused to undertake any responsibility for protection of the peasant economy.

Global capital also began to aspire for a larger role in the affairs of the management of the river. This resulted in two possibilities for the investors. The first was to support the existing flood management programmes by enhancing financial support to structural interventions and to create the political ambience for hydropower generation. At the same time, articulating a confident view of the region's imperial past, the World Bank reminded that global capital has returned back to refashion the fate of its resources. Citing the history of Assam tea and petroleum, the bank reminded that global capital had already successfully transformed the region's untapped natural resources into global wealth and the case of the river is only natural successor. An Asian Development Bank report noted how:

> ….it is increasingly acknowledged that riverbank erosion and flooding are major factors hampering the development of Assam, which has fallen back and lags behind India's average development indicators. Recognizing this deficit Government has decided to develop the region's large untapped potential and to provide a better future for the large percentage of poor rural households in the densely populated Assam plains.

The World Bank in 2008 agreed that the best possible way out to overcome potential danger of floods is to generate hydropower through mega dams. While storage dams can only moderate floods, a position paper for the bank argued that it would be better to begin with the run-of-the river to generate hydropower. Apprehension about a storage dam was also raised by the bank. A position paper cautioned against having storage dams, considering the susceptibility of the region to earthquakes. By the early 21st century, work for two major large dams had progressed at different levels, but neither of them contained any significant flood moderation benefits.

At the same time, there has been growing emphasis on the fact that instability in the river is caused by factors largely outside the state and which are beyond human factors. By the early 20th century, rivers began to be seen as potential generators of wealth, both public and private.

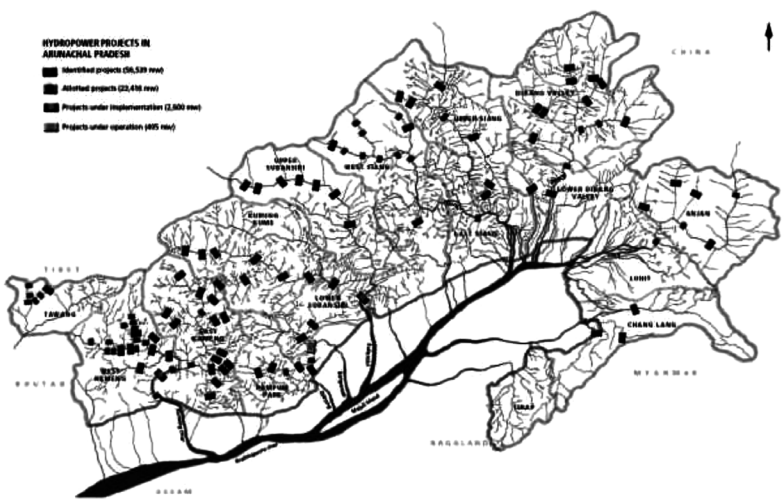

Figure 2: Visualising Hydropower Projects in Brahmaputra River Valley

Resisting River Engineering

The World Bank was optimistic that unlike in other parts of South Asia, there would be limited resistance towards the hydropower projects in the Brahmaputra basin. Popular opposition

in the floodplains of the Brahmaputra valley to upstream hydropower projects gained momentum in the first decade of the 21st century. These anti-dam movements have drawn their ideological inspiration from their engagement in the local eco-system and their dependence on the floodplain for the agrarian production. The ideologues of the popular resistance repeatedly cite the crucial dependence of the peasants on the river and its floodplain as their primary reason to oppose the hydropower projects.

One could find a number of distinct but overlapping layers of resistance. First, the localized peasant resistance movement which continues to engage with river discourses as well as a continuous struggle to survive the peasant economy. Anti-dam activists, mostly consisting members of peasant families, had not only provided ideological leadership to the resistance but challenged the technocrats' vision of the river system. Some of them had independently carried out studies to assess the ecological and societal impacts of these storage dams. Their ideas were further reinforced by the findings of cross-section of scientists. They argued that the drastic alteration of flow regimes by the proposed dams would alter the northeastern landscape—the river systems and their associated natural–cultural–social linkages as well as the larger political scenario. Unlike this unison amongst the peasant leaders, the Assamese ruling establishment is clearly divided.[56] With clear patronage of private capital, the ruling establishment have left no stone unturned to camouflage the ecological disaster emanating from storage dams and river engineering. The possible benefits of flood moderation, land reclamation, irrigation along with hydropower production for the larger well-being of the state and its people were reiterated in their arguments. This group equated the dams and private capital as capable of changing the "lack of development" of the entire region.

Anti-dam movement has drawn ideological inspiration from the region's historical experience of nineteenth and twentieth century. For instance, the movement highlights how colonial exploitation of natural resources like forests and mineral resources

could not benefit the local communities. The movement also expresses apprehension about the possible detrimental role of this nexus between private capital and rivers for the larger well-being of the peasantry in particular and the region in general. The movement have pointed out that storage dams as proposed for the river basin would not provide any explicit flood moderation benefit.[57] It had also been pointed out that the sudden rush of private capital for multiple mega hydropower projects was another attempt to siphon off resources from the region. Many have asked for a re-examination of the technological aspects before undertaking such river engineering.

Conclusion: Ecology, Governance, and Democracy

By the first decade of 20th century, both technocrats and corporate capital were enthusiastic of the future of the river and its system. This confidence has the strong backing of the Assamese ruling class. Despite this trust, scientists have expressed concerns on the growing uncertainties of the deltas in several part of the world including the Brahmaputra. A recent finding is more than categorical about the possible fall-out:

> Many of the world's largest deltas are densely populated and heavily farmed. Yet many of their inhabitants are becoming increasingly vulnerable to flooding and conversions of their land to open ocean. The vulnerability is a result of sediment compaction from the removal of oil, gas and water from the delta's underlying sediments, the trapping of sediment in reservoirs upstream and floodplain engineering in combination with rising global sea level.[58]

Contemporary ecological perspectives would have critical implications for the river and its governance. Ecological sensibilities may even divide technocrats, bureaucrats, and most politicians about river engineering. Such divisions are evident in north and northeast India. Many dam projects on the river Ganges have been cancelled by the Indian government. What explains the hesitation vis-à-vis river engineering? Is it due to a new ecological consciousness of river systems? Alternatively, is it a sign of grass roots protest working?

Notes :

[1] Government of India, *Census of India*, 1901, Assam, Vol.3, Part 1.

[2] B. Datta and V.P. Singh, 'Hydrology', in *The Brahmaputra Basin Water Resources*, V.P. Singh, N. Sharma and C.S.P. Ojha (eds), London: Kluwer Academic Publications, 2004, p. 193.

[3] M.A. Allison, 'Historical Changes in the Ganges–Brahmaputra Delta Front', *Journal of Coastal Research*, Vol. 14, No. 4, 1998 , pp. 1269–75.

[4] A. Rangasami, 'The Paupers of Kholisabhita Hindupara: Report on a famine', *Economic and Political Weekly*, Vol. 10, No. 5/7, Annual Number (February), 1975, p. 267.

[5] *Ibid.*

[6] A recent study estimates that of a culturable area of 3.4 million hectares in Assam, 3.1 million hectares are flood prone. Only 270,000 hectares are protected. B.G. Verghese, *Waters of Hope ,integrated water resource development and regional cooperation within the Himalayan-Ganga-Brahmaputra-Barak basin*, Delhi: Oxford & IBH Publishing, 1990, p. 126.

[7] A.F.R. Hoernle, 'The Gauhati Copper-plate Grant of Indrapala of Pragjyotiisa on Asam', *The Journal of the Asiatic Society of Bengal*, Part, 1, No. 2, 1897, pp. 131–32.

[8] *Report on the Land Revenue Administration in Assam*, 1881–1882, Shillong: Assam Secretariat Press, 1882.

[9] F.C. Henniker, Officiating Director, Department of Land Records and Agriculture, Assam to The Secretary to the Chief Commissioner of Assam, No. 2374, Shillong 18 May, 1898, Assam Secretariat Proceedings, May 1898, Asom State Archives [hereafter ASA].

[10] Series of official reports confirming silt's contribution to increased yields in crops were published in *The Agrarian Ledger*. Such experiments were for both river silt and canal silt. For instance, see, J.W. Leather, 'Indian Manures: Their composition, conservation and application', *The Agricultural Ledger*, Vol. 4, No. 8, 1897, pp.34–36.

[11] B.C. Allen, *Assam District Gazetteers*, Vol. V, Darrang, Allahabad: Pioneer Press, 1905.

[12] B.C. Allen, *Assam District Gazetteers*, Vol. 4, p. 124.

[13] The Zamindars of Bengal continued to resist the government's attempt

to bring newly formed *char*s under taxation. In Bengal, such lands were administered under the Bengal Alluvion and Diluvion Regulation of 1825. See, for instance, *Secretary Of State for India vs Bijoy Chand Mahatap* on 22 May 1918, Calcutta High Court. indiankanoon.org/doc/205099/ (accessed 10 October, 2012). For further discussion, see, Iftikhar Iqbal, *The Bengal Delta*, London: Palgrave, 2010. Newly formed *char* lands in the Valley continue to be a site of intense competition even in the twenty-first century. The widespread communal violence in the north bank of Assam in October 2008 was a result of similar contest over *char* land.

[14] A. Saikia, *Forests and Ecological History of Assam*, Oxford University Press, New Delhi, 2011; J. Sharma, *Empire's Garden: Assam and the Making of India*, Duke University Press, Duke, 2011; A. Saikia, 'Imperialism, Geology and Petroleum: History of Oil in Colonial Assam', *Economic and Political Weekly*, Vol. 46, No. 11, 2010, pp. 48–54.

[15] Note by Chief Commissioner of Assam on 'The Extension of Cultivation in Assam and Colonization of Wastelands in Assam', p. 35.

[16] Government of India, *Census of India*, op. cit.

[17] Note by Chief Commissioner of Assam, op. cit., p. 44.

[18] Ibid.

[19] The other issue was the nature of tenure in these tracts. As for the last question, there was a strong sentiment against *ryotwari* system. It was argued that with *ryotwari*, it would be difficult to convert Assam's wastelands into rich crop-producing areas. One reason for the opposition could be that *ryotwari* foreclosed the possibility of earning *zamindari* rent. In a memorandum submitted to the Assam government against any move to eliminate the middlemen between the state and peasant, the *Jorhat Sorbojanik Sabha*, powerful conglomeration of Assamese landlords argued that "middleman is not only politically important, but also necessary for the extension of cultivation". But, this did not find favour with the government. Although petitioning by the local elite proved to be of no avail, it became clear that the interests of the Assamese landed class and colonial state converged on the reclamation endeavour, for each stood to partake the resultant surplus. See, D. Das and A. Saikia, 'Early Twentieth Century Agrarian Assam: A Brief and Preliminary Overview', *Economic and Political Weekly*, Vol. 46, No. 41, 2011, pp. 73–80.

[20] S. Bose, *Peasant Labour and Colonial Capital: Rural Bengal Since 1770*, Cambridge: Cambridge University Press, 1993, p. 27.

[21] T. Sethia, "The Rise of the Jute Manufacturing Industry in Colonial India: A global perspective", *Journal of World History*, Vol. 7, No. 1, 1996, pp. 71.

[22] W. Hunter, *The Imperial Gazetteer of India*, Volume 4.

[23] F.A. Sache, Mymensingh, *Bengal District Gazetteers*, p. 51. Also see, W.W. Hunter, *The Indian Empire: Its History,People and Products*, p. 391.

[24] Hunter, *The Imperial Gazetteer of India*, op. cit.

[25] Government of India, *Review of Agricultural Operations in India*, 1904–13, p. 26.

[26] Hunter, *The Imperial Gazetteer of India*, op. cit.

[27] For Bengal cyclones, see, Mymensingh, *Bengal District Gazetteers*, p. 58.

[28] Assam Legislative Assembly Debates, 1951.

[29] In 2010, the Assam chief minister reiterated this stand of the Assamese ruling class.

[30] An official report prepared five years after the earthquake, titled *A Note on the Damage caused by floods in Assam during 1954–55 and relief measures undertaken or proposed*. Situated between the eastern Himalayas and the Indo-Burmese Range, Assam which covers the area of the heaviest rainfall in the world[,] used to have periodical floods in the past. These floods used to occur at intervals of a few years so that people had some respite in between these periodic attacks. *But floods have become an annual visitant since the Great Earthquake of 1950, which has severely disturbed the riverine system*. Unlike in the past, more than one flood now occurs in the course of the same year. *Appendix III: A Note on the Damage caused by floods in Assam during 1954–55 and relief measures undertaken or proposed*, Shillong: Assam Government Press, 1956.

[31] *Note on the Damage Caused by Flood and Erosion in Assam during 1955–56 and Relief Measures Undertaken or Proposed*, Shillong: Assam Government Press, 1956, p.1.

[32] Ibid., p.1.

[33] *A Note on the Damage Caused by Floods in Assam during 1954–55 and Relief Measures Undertaken or Proposed*, Shillong: Assam

Government Press, 1956.

[34] Ibid.

[35] Ibid.

[36] *Master Plan of Brahmaputra Basin, Part I, Main Stem*, Brahmaputra Board, Government of India, Ministry of Water Resources, 1986.

[37] *A Note on the Damage Caused by Floods in Assam during 1954–55 and Relief Measures Undertaken or Proposed*, Shillong: Assam Government Press, 1956.

[38] *Master Plan of Brahmaputra Basin, Part I, Main Stem*, Brahmaputra Board, Government of India, Ministry of Water Resources, 1986.

[39] Ibid.

[40] Ibid.

[41] Ibid.

[42] Ibid, p.130.

[43] Centre for Population Studies at the Harvard University investigated the Ganga and Brahmaputra Rivers. Funds were provided by the World Bank and the Ford Foundation. The findings of this investigation aptly argued that an "idea for a revolutionary technical fix that might provide water for all seasons and all uses, and might also mitigate floods". See, 'Harnessing Ganga and Brahmaputra: Implications of Anglo-American Move', *Economic and Political Weekly*, Vol.13, No. 4/5 (January 28 – February 4 1978), pp. 129–130.

[44] This took place in a tract called Chimmna in western Assam. A seven-kilometre long stretch was dredged. The width was 30 meter. A second round of dredging was done at a placed called Alikash to reduce erosion.

[45] In 2009, a human chain was formed in Dhaka seeking an immediate dredging of the Brahmaputra to make the river navigable during the winter. See *The New Nation* (2009).

[46] Where flood control is one of the key purposes of multipurpose dams, it would be ensured that the dam intercepts significantly in the catchment/drainage above the affected area. Wherever dams and reservoirs exist or contemplated for multipurpose benefits, flood management would be integrated among its purposes. In highly flood prone areas, flood management would be given overriding consideration in reservoir policy even at the cost of sacrificing some irrigation or power benefits. See, *Assam State Water Policy*, section 8.9.4.

[47] *Appendix III: A Note on the Damage Caused by Floods in Assam during 1954–55 and Relief Measures Undertaken or Proposed*, Shillong: Assam Government Press, 1956.

[48] Ibid.

[49] *Note on the Damage Caused by Flood and Erosion in Assam during 1955–56 and Relief Measures Undertaken or Proposed*, Shillong: Assam Government Press, 1956, p.1.

[50] Ibid.

[51] *Appendix III: A Note on the Damage caused by floods in Assam during 1954–55 and Relief Measures Undertaken or Proposed*, Shillong: Assam Government Press, 1956.

[52] Assam Governor, Budget Speech to the Assam Legislative Assembly, March 1952.

[53] Brahmaputra Board Act (Act 46 of 1980) under the Ministry of Irrigation (now renamed as Ministry of Water Resources).

[54] It includes both the Brahmaputra and Barak Valleys. It covers all the states of the northeastern region apart from the rivers of the northern region of West Bengal which fall into the Brahmaputra river basin.

[55] The 50,000 MW Hydro Initiatives launched by the Ministry of Power in 2003 also has a major focus on the Northeast. The "Pasighat Proclamation on Power" adopted in January 2007 at the North East Council's Sectoral Summit on the Power Sector identifies the region's hydropower potential as one of the priority areas to contribute to the country's energy security. (Northeast Business Summit, Mumbai, July 2002).

[56] Conservative regional political formation like Asom Gana Parisad have now officially endorsed their anti-dam position while others like the Communist Party of India had already clearly articulated their pro-dam position. The latter cites the provision of flood moderation in large dams as their reason for supporting over 100 dams planned in Arunachal Pradesh.

[57] Out of the 117 MOUs already signed for construction of hydroelectric projects between the Arunachal Pradesh government and various power companies, only one, that is the 3,000 MW Dibang Multi-purpose Project, has flood moderation benefit.

[58] James P.M. Syvitski, et all. 'Sinking deltas due to human activities', *Nature Geo Science*, 2009.

References

Allison, M.A. 1998. 'Geologic Framework and Environmental Status of the Ganges– Brahmaputra Delta', *Journal of Coastal Research* 14(3): 826–836.

— —. 1998. 'Historical Changes in the Ganges–Brahmaputra Delta Front', *Journal of Coastal Research* 14(4) (autumn): 1269–1275.

Anonymous. 1968. 'Taming the Brahmaputra', *Economic and Political Weekly* 3(30): 1166.

Assam Legislative Assembly, 'Resolution Regarding to Train or Otherwise Deal with the River Brahmaputra in Order to Stop Floods', Assam Legislative Assembly Debates II(15) (August–September 1951). Shillong: Assam Government Press, pp. 838–853.

Asian Development Bank. 2006. Erosion Management Project (Assam).

— —. 2006. Situation Report, Assam Floods.

Assam Pradesh Congress Committee, Election Manifesto 2004.

Barua, H. 1991. The Red River and Blue Hills. Guwahati: LBS, p. 11.

Boyce, James K. 'Birth of a Megaproject: Political Economy of Flood Control in Bangladesh', *Environmental Management* 14(4): 419–428.

Brichieri-Colombi, Stephen and Robert W. Bradnock. 2003. 'Geopolitics, Water and Development in South Asia: Cooperative Development in the Ganges–Brahmaputra Delta', *The Geographical Journal* 169(1): 43–64.

Custers, Peter. 1993. 'Bangladesh's Flood Action Plan: A Critique', *Economic and Political Weekly* 28(29/30): 1501–1503.

Das, J.D. and A.K. Saraf. 2007. "Technical Note: Remote sensing in the mapping of the Brahmaputra/Jamuna River channel patterns and its relation to various landforms and Tectonic Environment", *International Journal of Remote Sensing* 28(16) (August).

Dhar, O.N. and S. Nandargi. 2000. 'A Study of Floods in the Brahmaputra Basin in India', *International Journal of Climatology* 20: 771–781.

Goodbred, Steven L., Jr. and Steven A. Kuehl. 2000. 'Enormous Ganges–Brahmaputra

Sediment Discharge During Strengthened Early Holocene Monsoon', *Geology* 28 (December): 1083–1086.

Goswami, R. 2010. 'Rivers and History: Brahmaputra Valley in the Last Two Centuries', unpublished PhD thesis, Jawaharlal Nehru University, New Delhi.

Government of Assam, 1975. A Brief Note on Flood Situation in Assam.

— —. *A Review of Flood Management Measures and Future Vision in Assam*, Water Resources Department.

— —. *Detailed Estimate of Revenue and Expenditure, 1956–57*, Public Works (Flood Control) Department.

— —. *Documentation on Past Disasters, Their Impact, Measures Taken, Vulnerable Areas in Assam*, Centre for Natural Disaster Management.

— —. 1917. *Floods in the Surma Valley, Assam.*

— —. Note on Assam Flood of 1954.

— —. 1965. *Problem of Flood Control in Assam.*

— —. *Protection of Dibrugarh Town from Erosion by the Brahmaputra 1955–56*, Public Works Department.

— —. 1929. *The Sylhet Cachar Flood Relief Committee.*

Government of India, *Agriculture and Allied Sectors: Constraints and policy options in Assam*, Planning Commission, New Delhi.

— —. 1964. *Ministerial Committee on Flood Control.*

— —. 2008. *Annual Report of the Brahmaputra Board for the Year 2007–2008.*

— —. 2004. *Annual Report of the Central Water Commission*, 2003–2004.

— —. *Detailed Project Report for Lower Subansiri Hydro Project, Brahmaputra Board.*

— —. 1977. *Master Plan of Brahmaputra Board*, Brahmaputra Board.

— —. 1986. *Master Plan of the River Brahmaputra, Main Stem*, Brahmaputra Board.

— —. *National Report on Hydrology for the Year 1957–59.*

— —. 1981. *Report on Development of Chronically Flood Affected Areas, National Committee on the Development of Backward Areas,* Planning Commission, New Delhi.

— —. 2006. *Study on Natural Resources, Water and the Environment Nexus for Development and Growth in Northeast India,* workshop report, Ministry of Development of Northeastern Region and World Bank.

Gupta, S., et al. 2003. "Economics of Flood Protection in India", *Natural Hazards* 28: 199–210.

Hazarika, U.M. 2007. 'Flood Environment in Assam with Special Reference to Jiadhal Basin of Dhemaji District: A critical review', *IE Journal* 87 (March).

Islam, Mohammad Rezwanul, Yasushi Yamaguchi, and Katsuro Ogawa. 2001. 'Suspended Sediment in the Ganges and Brahmaputra Rivers in Bangladesh: Observation from TM and AVHRR Data', *Hydrological Processes 15*(3) (28 February): 493–509.

Kalita, S. and S.K. Sarmah. 1984. 'On the Occurrences of Dry and Wet Sequences in the Brahmaputra valley', *Proc. Indian Academy of Sciences* (Earth Planet. Sci.) 93(1): 27–36.

Khalequzzaman, Md. 1994. 'Recent Floods in Bangladesh: Possible causes and solutions', *Natural Hazards* 9: 65–80.

Majumdar, S.C. 1942. *Rivers of the Bengal Delta*. Calcutta: Government Press.

Mirza, M. Monirul Qader. 2003. 'The Choice of Stage–Discharge Relationship for the Ganges and Brahmaputra Rivers in Bangladesh', *Nordic Hydrology* 34 (4): 321–342.

Mishra, D.K. 1997. 'The Bihar Flood Story', *Economic and Political Weekly* 32(35): 2206–2217.

Nguyen, ThiDieu. 1996. 'The State Versus Indigenous Peoples: The impact of hydraulic projects on indigenous peoples of Asia', *Journal of World History* 7(1): 101–130.

Northwest Hydraulics Consultants. 2006. 'River Flooding and Erosion in Northeast India', background paper, World Bank, Alberta.

Phukan S.N., 2005, *The Sentinel*.

Report of the Annual Flood Control, Assam, 1963–1964, p. 5.

Rao, K.L. 1979. *India's Water Wealth.* U.K.: Orient Longman.

Rao, V.V.K. 2006. Hydropower in the Northeast: Potential and Harnessing Analysis, background paper, World Bank.

Sarma, A.K. Reservoir for Flood Moderation and Water Utilization: Some critical issues.

Syvitski, James P.M. 2009. 'Sinking Deltas Due to Human Activities', *Nature GeoScience*.

Sparks, Richard E., John C. Nelson, and Yao Yin. 1998. 'Naturalization of the Flood Regime in Regulated Rivers', *Bio-Science* 48(9): 706–720.

Talukdar, K.C. and B.C. Deka. 2005. 'Cultivation of Summer Rice in the Flood Plains of Assam: An assessment of economic potential on marginal and small farms', *Agricultural Economics Research Review* 18 (January–June): 21–38.

Thompson, Paul M. and Parvin Sultana. 1996. 'Distributional and Social Impacts of Flood Control in Bangladesh', *The Geographical Journal* 162(1): 1–13.

Technical Assistance Consultant's Report, Northeastern Integrated Flood and Riverbank Erosion Management Project (Assam), 2007.

The New Nation, 'Human Chain Formed on Brahmaputra River Demanding Dredging',

The New Nation, 28 April 2009.

Verghese, B.G. 2006. 'Water Resources in the Northeast: Development Options in a Cooperative Framework', background paper, World Bank.

World Bank. 2007. 'Development and Growth in Northeast India: The Natural Resources, Water, and Environment Nexus', Strategy Report.