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Jute or Flood: Exploring the fate of certain schemes in the Brahmaputra River Valley

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The Indian state is on an ambitious program to transform an 'idyllic' waterscape in the Brahmaputra river valley as the country's future power house. Behind this grand ambition lies an uneasy and critical relationship of the modern Indian nation-state with the country's river systems. The dynamics of this uneasy relation go back to earlier times. But it began to surface more acutely in the last two hundred years as the colonial government redefined its relationship with the south Asian rivers.[1] The colonial state's infatuation with the Indian rivers did not impact much the Brahmaputra and its valley till the beginning of the 20th century. Early in the 20th century, after long wait and speculation, it was time for some decisive action to make the river and its valley more meaningful to the British Empire. This resulted in the introduction of two schemes. The first one revolved around the introduction of jute cultivation into the river valley. Millions of people, spanning several decades, were pushed into the valley from the neighboring areas to transform the Valley into Asia's most formidable jute producing area. In fact the Valley became the jute frontier of the British Empire. The other scheme intended to protect the

[1] D'Souza, R. *Drowned and Dammed: Colonial Capitalism and Flood Control in Eastern India*, Delhi: OUP, 2006. Hill, C. V. *Rivers of Sorrow: Environment and Social Control in Riparian North Bihar, 1770–1994*, Michigan, 1997.

Valley from inundation through introduction of engineering solution. By introducing the river embankments transformed the nature of the rivers. The rivers relation with the flood-plain changed permanently. These state sponsored projects to tame nature and river, initially to introduce high yielding crop and then to protect this crop, resulted in immense social and ecological transformations. The contemporary Indian state's ambitious river valley projects, seemingly aimed at improving the condition of Valley, not only ignore these historical complexities but only simply reinforce James C Scott's powerful argument of how bureaucratic institutions *can never adequately represent the actual complexity of natural or social processes*.[2]

The paper is divided into three parts. The first part introduces the river, the flood-plain and agrarian landscape. The second part explains the conversion of riverine tracts of the Brahmaputra into a jute kingdom and finally the beginning the modern river management in the flood-plain. The concluding part claims how these schemes combined together achieved only partial success but at the cost irreversible ecological cost.

I

The River and its flood-plain:

The Brahmaputra, originating in the Himalayan glaciers, travels a distance of 1800 miles through three different countries. It enters Indian plains in Assam before making an adventurous journey through the Tibetan mountains. In Assam it is joined by two other mountain streams to be collectively known as the Brahmaputra. In Assam it flows for 450 miles, receives several rapidly rushing Himalayan streams, plays a decisive role in forming an alluvial flood-plain (hereafter Valley) before entering Bangladesh. The Valley has an average width of fifty miles surrounded by hills. During the rains the river's banks are more than 5 miles apart in Assam. A most commonly cited description of the river is how it '*flows between*

[2] Scott, J. C., *Seeing like a State: How Certain Schemes to improve the Human Condition Have Failed*, New Haven: Yale University Press, 1998, p. 293.

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 take the place of the riverine.[3] The river's catchments area is about 30,000 square miles which is distributed across the eastern Himalayan ranges. More than 50 numbers of tributaries with high order drainage feed the Brahmaputra and also form alluvial flood-plains.[4]

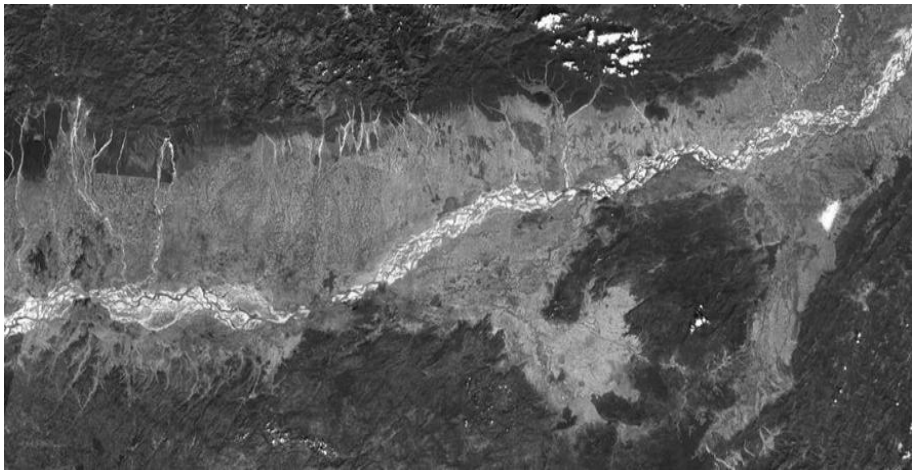
Figure 1
India, Assam and Brahmaputra

With an annual discharge rate of about 19,830 cubic meter per second at its mouth the river becomes the fourth biggest river in terms of discharge. The Brahmaputra along with Ganga carries nearly 6 million cusecs of water to the Bay of Bengal. Having such a large drainage area, the rivers are also heavily charged with sediment. The Brahmaputra transports approximately 13 million tons of suspended sediment per day during flood.[5] The large discharge and heavy sediment load cause the river to be extremely unstable, and the channels are constantly migrating laterally. The river has cut and subsequently abandoned numerous river courses. These

[3] Government of India, *Census of India*, 1901, Assam, vol.3, part.1.
[4] Datta B. and Singh, V.P., 'Hydrology', in V. P. Singh, N. Sharma, C. S. P. Ojha ed. *The Brahmaputra basin water resources*, London: Kluwer Academic Publications, 2004, p. 193.
[5] M. A. Allison, 'Historical Changes in the Ganges-Brahmaputra Delta Front', *Journal of Coastal Research* , Vol. 14, No. 4, 1998 , pp. 1269-1275.

movements are primarily controlled by major faults or fractures in the earth's crust. In sum the river refuses to flow between 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’[6].

Figure 2
The Flood-Plain 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”’. This braided river’s channels are always and continuously multiplied. Often channels are abandoned by the river. The abandoned channels are often cultivated for its ability to yield high. Short-term channel migration is quite drastic. Conservative estimates suggest that such channel migration takes place at rates of movement as high as 2,600 feet per year. Sand bars are formed. Their longevity is never permanent. However, they became crucial acreage for the expansion of winter crop.

[6] Rangasami, A., ‘The Paupers of Kholisabhita Hindupara: Report on a Famine’, *Economic and Political Weekly*, Vol. 10, No. 5/7, Annual Number (Feb., 1975), p. 267.

Nevertheless these peculiarities of the Brahmaputra, and its flood plains, over the centuries, gave birth to a flood-plain agrarian ecology. Peasant communities forged ties with these natural challenges to stimulate agriculture.[7] It is true that its 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 till the slackening of the current allows it to settle down and fertilize the plains of Bengal.

At least since the middle of the first millennium the Valley's agrarian practices were fully tuned to the flooding pattern. Careful choices were made to avoid tracts which were highly flood-prone or could pose challenge both to the material well-being of the peasantry as well as of the crops. Peasants and rulers commonly distinguished the Valley into several zones depending on their flooding pattern.

At the same time tradition of protection of fields from flood could be traced back to 11th century AD.[8] 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. Similarly peasants were still dependent on popular wisdom to predict arrival of flood and possible intensities. Flood would hamper fresh reclamation of land in the riverine tracts. But they would wait for flood to leave behind silt (*palosh)* which will nourish agricultural fields and subsequent increase in yield. Loss caused to one crop would be compensated by next harvest in the winter. Colonial officials continue to report such wisdom even till the later decades of the 19th century. Early 20th century researches carried out in other provinces had already confirmed such wisdom on silt.[9]

The riverine tracts –*chapories*- were only occasionally cultivated. The *chapories* were chiefly characterised by their long grasses which were liable to

[7] 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. Waters of Hope, p. 126.
[8] Hoernle, A.F. R., 'The Gauhati Copper-Plate Grant of Indrapala of Pragjyotiisa on Asam' *The Journal of the Asiatic Society of Bengal*, 1897, part, 1, no.2, p. 131-132.
[9] 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. See, 'Silt Deposits', *The Agricultural Ledger*, 1893, no.1.

regular inundation. Their reclamation was comparatively easier. It requires only burning of grasses in the winter. Chaporis were highly productive tracts. They were vulnerable to high risk due to flood induced damages. The only way to escape from this risk was to depend on late winter crop. The agrarian production was organised around temporary settlement. The local gentry and rich peasants could afford to cultivate such fields as they were not the only source of cultivation. *Pam* cultivation as such practices came to be known in the Valley largely disappears during monsoon. In some tracts, with easier access from the markets, production of winter crops i.e. mustard or cereals was already underway.[10] During the early days of colonial land, -the Valley became part of the British Empire in 1826 AD- such tracts were auctioned out to rich and powerful peasant families. Like neighbouring Bengal presidency the rich Assamese peasant families always laid their claim on such lands which often led to legal disputes.[11]

Though these tracts were under temporary cultivation the colonial state could not fix revenue on these tracts due to their un-surveyed character and nature of production. These tracts require urgent transformation into a productive category. The matter gained serious attention by the end of the 19th century. By this time the Valley became well-known for the vastly laid out tea-plantations, petroleum and coal mining and Reserved Forests endowed with high yielding timbers.[12] The Valley was not even modestly self-sufficient in food production. Government's earning from land revenue during 1868-98 increased four times while the expansion of acreage under cultivation was only 7 per cent.[13] More than half a million people had already moved to the Valley in the previous decades to

[10] Allen, B. C., *Assam District Gazetteers*, Volume 4, p. 124.

[11] The Zamindar of Burdhwaman continued to resist the government's attempt to bring newly formed Chars under taxation. In Bengal such lands were administered under the Bengal Alluvion and Diluvion Regulation of 1825. Secretary Of State for India vs Bijoy Chand Mahatap on 22 May, 1918, Calcutta High Court. Newly formed char lands in the Valley continue to be site of intense competition even in the 21st century. The widespread communal violence in the north bank of Assam in October 2008 was a result of similar contest over char land.

[12] Saikia, A., *Forests and Ecological History of Assam*, Delhi, OUP, 2011; Sharma, J. *Empire's Garden: Assam and the Making of India*, Duke, 2011; Saikia, A., 'Imperialism, geology and petroleum: History of oil in colonial Assam', *Economic and Political Weekly*, vol.46, no. 11, pp. 48-54.

[13] *Note by Chief Commissioner of Assam on the extension of cultivation in Assam and colonization of wastelands in Assam*, p. 35.

work in the tea plantation. A vast belt of tracts, in both sides of the river, was still waiting reclamation and was 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 churs of Upper Assam, though sandy, are fertile).'[14] The Valley was also regularly condemned for its sparse population and abundant land. The government did not deny that this was not the case always. Pockets of densely distributed villages conditioned by lack of land were noticed in the nineteenth century. Many agreed that presently forested tracts were previously settled areas. Civil wars, attacks of foreign enemies meant only a decline of population density significantly throughout the nineteenth century through the early decades of the 20th century. Pressure on the riverine tracts was relieved to a modest extent in the nineteenth century. Epidemics of small-pox, malaria and kala-azar (black-fever) increased mortality rate manifold.

Meanwhile the river regimes underwent perceptive geographical changes. Two earthquakes, first one in 1897 and another in 1950 measuring 8.1 or 8.6 respectively in the Richter scale changed the river regime.[15] Intensive flooding resulted in slow decline of agricultural endowments. The river erosion had rapidly unfolded a crisis of agricultural land. Several reports have subsequently pointed out that the bed of the river had risen. There was increased siltation. In several areas, the river changed its course and also there was significant increase in erosion. All these led to increasing loss of agricultural land. However, by the early decades of the twentieth century riverine tracts were no more exclusive resource for the rich. Increasing population pressure, as epidemics were under control, now forced the poor and landless to cultivate in the riverine areas. At the same time flood became

[14] Government of India, *Census of India, Assam,* 1901, vol.3, part 1.
[15] Oldham, R. D., *Report on the great earthquake of 1897* Geological Survey of India, Calcutta, 1899; F. Ward, 'The Assam Earthquake of 1950', *The Geographical Journal* , Vol. 119, No. 2 (Jun., 1953), pp. 169-182.

sources of both constraints and advantages. What happened in the intervening period?

II

Reclaiming Flood-Plain: Producing Jute

The idea of reclamation of these riverine tracts, an estimated 6.78 million acres, had 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 and British liberal famously asserted that the fight of civilisation against nature demands its victims no less than war against a human enemy. He argued that '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'.[16] Cotton also lamented that '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.'

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.[17] The first one pertains to the choice of the crop for

[16] *Note by Chief Commissioner of Assam on the extension of cultivation in Assam and colonization of wastelands in Assam*, p. 44.

[17] 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 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

these tracts and secondly who would be the cultivators. The first question was resolved by deciding in favour of jute. These tracts, the government believed were not unsuitable for tea-plantations and must be subjected to peasant production.

Jute cultivation was, by the 1870s, deep rooted in Bengal, the crucial Indian province.[18] Demand for raw jute was increasing regularly as the Bengal now had a highly organised jute industry.[19] Jute, in the new organization of colonial agricultural production, became highly crucial for its economic value. It came next to cotton as a fiber crop.[20] Till the end of the 19th century its production was limited 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 deltaic regions of Mymensingh, Dhaka or Faridpur produced high quality jute.[21] The colonial officials agreed that credit for Bengal being the major jute producing area of the world should go to its sandy loom, optimal rainfall, hot and humid climate and jute field's easy access to rivulets. In Bengal the farmers preferred the alluvial sandbanks in the chars and chapories for the cultivation of jute. For the most part, jute was grown on flooded lands. It only covered a very small portion i.e 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 (*Corchorus olitorius* and *Corchorus capsularis*). This summer crop was able to survive high flood before the harvesting in the August-September.[22] This was mostly because of its height; it often grew more than 12 feet. After being cut, the stems were tied up in bundles, and thrown into the receding flood water or pool of water. This process helped the bundles to get rotten to such a degree that the outer coat could peel off easily. The bundles were taken

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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*, 2011, Vol:46, Issue:41, pp. 73-80.

[18] Bose, S., *Peasant labour and colonial capital: rural Bengal since 1770*, p. 27.

[19] Sethia, T. (1996). "The rise of the jute manufacturing industry in colonial India: a global perspective." Journal of world history 7(1): 71.

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

[21] *Bengal District Gazetteers*, Mymensingh, p. 51. W. W. Hunter, *The Indian empire: its history, people and products*, p. 391.

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

out of the water; the fiber was removed and washed. The extracted fiber would be a long, soft, and silky thread and would be marketed.

The extensive river networks across Bengal countryside helped extensively the jute trade. Mobile Bengali petty traders would reach out to areas of jute production in boats. All jute thus collected would be transferred to wholesale merchants, who ship it to Calcutta by steamer or large native boats. By the early 20th century extensive experiments were going on to explore the possibilities of jute cultivation across different parts of the British India beginning with river deltas. Not every experiment gave away to favourable results due to ecological challenges. In the south the Godavari delta dirty water led to poor fiber.[23]

As the Valley began to be considered for jute production Bengal was also troubled by famine. To overcome any criticism of converting food growing areas into cash production zone officials argued that jute never replaced rice as crop and the former was always secondary to the latter. "…the 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 crucially to the well-being the Bengal peasants. William Hunter, the imperial statistician, endorsing this view, reiterated that the demand for jute in Europe has contributed more than any administrative measure to raise the standard of comfort throughout Eastern Bengal.[24] Evidences, however, run contrary to such perceived belief. Despite the direct interest of the jute industries the jute production came to be dominated as small-peasant production. But the peasants continued to be depend on market led price fluctuations and subjected to heavy indebtedness.

Jute was the highest export earners for India in the early twentieth century helping the metropolis square much of the trade deficit it faced vis-à-vis the United States or Germany. It was but natural for the British capital to look for more land to grow the golden fibre as Bengal land was saturating by this time. Plenty of land all

[23] Government of India, *Review of agricultural operations in India*, 1904-1913, p. 26.
[24] W. Hunter, *The Imperial Gazetteer of India*, Volume 4

along the river was found to be ideal for jute cultivation. Experiments were carried out to understand the jute cultivation in the Valley. The riverine tracts in the valley, mostly consisting of grassland and savannah, like similar environment in Bengal, would best suit for cultivation of jute. The texture of soil, rainfall pattern and availability of clear water in the alluvial tracts of the Valley also match perfectly for jute cultivation. The Valley's advantage, in the colonial official view, was that it did not require any irrigation. Also, there was example of the Valley producing jute but to the extent of bare minimum for household needs of the peasantry.

The government's view was fully endorsed by the jute industrialists in Bengal. The Indian government in 1898 asked F. J. Monahan, the assistant director of Assam Land Records and Agriculture Department, investigated into the prospect of jute cultivation in the Valley. Monahan's report only reaffirmed the speculation of the Bengal jute industry. But who would undertake the vast reclamation of riverine tracts and jute production? Officials, like the Deputy Commissioner of Nowgong, Sheer, a central district of the valley had noted the apathy Assamese peasants share for jute cultivation. The little jute that was grown would supplement paddy cultivation; it was seldom the principal crop. The government could not afford to the invite the previous settlers from eastern and central India who came to work in the tea-plantations since the middle of the 19th century. There was a widespread fear, endorsed by the British tea-planters, that such a migration would drift away the existing workers from the plantation.

Monahan recommended immigration and settlement of riverine lands with peasants from East Bengal. He was right. Not only 'intensive margins' of land use was exhausted in East Bengal but famines in the Bengal countryside during 1896-97 also forced migration out of the densely populated tracts of East Bengal. The government of India had already advocated that the Valley needed 'the stout and fanatical Mohamedan of Eastern Bengal' 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. These farmers were "hardy and prolific cultivators...gradually working their way northwards. These people are

accustomed to the risk arising from diluvion and devastating floods, which other cultivators are unwilling to face". Fortunately there were examples to imitate. In western extreme of the Valley the landlords of Goalpara had welcomed peasants from northern districts of East Bengal to settle in their unused char land as tenants and cultivate jute. These northern districts were located along the river Brahmaputra. The western areas of Assam shared a similar ecology with its contiguous north-east Bengal from where most future migration would take place. This migration into the *chars* of Goalpara, mostly unaided by state, was facilitated by a combination of various factors. Linguistic-ethnic, not religious, similarities and long shared history of economic exchanges across this micro-region had aided in helping people to move in. River routes and a new railway made travel comparatively easier. Unlike the climate of north-east Bengal the Brahmaputra valley in Assam was protected from the ravages of cyclones.[25] This protection came from the hill ranges along the southern boundary of the Valley.

Unfolding Social Dynamics:

Most migration took place since the first decade of the 20th century. The migration from north-eastern Bengal was along the northward and upward course of the Brahmaputra. Migration from these densely populated but equally prone to natural calamities areas had already set in by the last quarter of the 19th century.[26] By 1911 around 118,000 migrants would settle in Goalpara, the western areas of the Valley. This constituted 20% of the district population. Since then more would travel eastward and settled in the interior tracts. The partition of Bengal in 1905 and placing Assam and Eastern Bengal into new administrative arrangement also helped in the movement of the population. In the first three decades of the 20th century nearly one million peasants migrated from the East Bengal districts to settle in the Valley.[27]

[25] For Bengal cyclones, see, Bengal District Gazetteers, *Mymensingh*, p. 58.
[26] *Census of India, Bengal*, vol.5, part 1, Chapter III, pp.147-149.
[27] Government of India, *Census of India*, vol 5, part 1.

Rapid settlement in the next two decades helped expansion of jute acreage. From 1903-04 to 1919-20 export of raw jute rose by more than three times. Low price of jute would disturb this liner growth of jute acreage. During the same period growth of paddy acreage was only 12%. The industrial boom after the First World War forced the jute industrialists to push for further expansion of jute cultivation in the Valley.[28] The results were clear. By the Second World War Assam was the third largest jute producer of the country. Along with the migrants local peasants (both Assamese and Bodo) also expanded their jute acreage but at a slow rate.

Most migrants settled as small holders. The colonial government had already reaffirmed that any future land settlement in the Valley would be guided by the *raiyatwari* system i.e. the government would settle land with the cultivators directly. The migrant peasants largely moved in with their families. Jute cultivation required capital and labour. The traders-moneylenders often fixed the crop prices during the time of payment of loan. Money was controlled by a complex network of trader-moneylender nexus. Also by the time the Valley witnessed rapid expansion of jute cultivation Bengal jute industries, independently of the Dundee jute mill lobby, became powerful in terms of their ability to decide prices and other aspects.[29] Meanwhile majority of the migrant families failed to overcome their economic and social burdens which they used to face in East Bengal. Indebtedness burdened them enormously. Their disappointment appeared in print form and began to circulate through folk literature. Heavy indebtedness amongst the jute cultivators continued to be noticed until a much later period.[30] Jute cultivation also simultaneously increased flow of usury capital. Benefits went to both Marwari traders and petty Assamese landlords-cum-traders.

Migrant peasants converted large patches – from an estimated 38000 acre in 1902 to 300,000 acres in 1932 --of alluvial land along the river Brahmaputra, into highly productive export zone. This land reclamation now only resolved the

[28] Imperial Institute, *Indian Trade Enquiry. Reports on jute and silk*, London: J. Murray, 1921.
[29] The growth of Indian jute industry in the second half of the 19th century has been carefully explain in Gordon Thomas Stewart *Jute and empire: the Calcutta jute wallahs and the landscapes of empire*, Manchester: Manchester University Press, 1998.
[30] Government of Assam, *Report on the Survey Conducted in the Jute Growing Areas of Assam: For the study of Indebtedness among the Cultivators*, 1963.

nineteenth century colonial concern about the Assamese peasants' supposed apathy to production. Officials often described the Muslim peasants from East Bengal as 'hard-working' compared to 'simple and lazy' and 'non-productive' Assamese peasants. Jute production meant reclamation of tracts nearer to water bodies, or low lying areas were leaving only forested savannah tracts as the only areas of the valley not under the plough.

Effect of immigration on demographic composition of the Valley was highly critical. In 1874 the percentage of Muslims in the Brahmaputra Valley was 5.9 per cent. In another 65 years this figure rose to one fourth of the valley's population. The rate of population growth was strikingly high compared to the all India average in the first three decades of the twentieth century. Much of this could be attributed to immigration from East Bengal.

Introduction of jute cultivation massively impacted the ways that the Assamese peasantry used to organize their economic practices. At the same time, new settler farmers' agrarian practices, centred on jute production in low lying flood prone areas, appeared different from the Assamese peasants. The introduction of jute cultivation into the Brahmaputra's riverine tracts redefined Assamese peasants' interaction with an ecological zone and this received a critical setback. Competition over resources soon spilled over to the other areas like animal husbandry. In sum within a very short period the migrant jute farmers could reorganise the space of economic activities in the Valley. The Assamese peasants' found themselves in a receiving end. All these led to massive political dissatisfaction which acquired various political forms at different times and never subsided.

The earliest setback came after the First World War. By now land settlement and jute production sparked intensive localised clashes. The government was forced to control the pattern of settlement. This official policy aimed at regulating the settlement of East Bengali Muslim peasants into specific tracts. Known as Line System, this official policy's essential origin could be connected to imperial rulers' fixation with the idea of separate space for different religious and ethnic communities. The Assamese peasants and East Bengali migrant peasants

were visualized as two distinct social and economic entities. The Line System came into effect since 1920 which segregated migrant settlement from the land of Assamese peasantry.

Revenue officials would draw lines on the cadastral survey maps within which immigrants would have to restrict their economic activities. These areas would typically be far away from settled Assamese villages and would be occasionally closer to flood-prone areas. Any kind of transfer of land from Assamese to migrant peasants was also restricted. The maximum area that a migrant family could reclaim was fixed at 5.33 acres. Though subject to rampant manipulation, the Line System became a bone of contention in the provincial politics. Also the migrant peasants, who were seen as crucial partners for sustaining imperial British jute industries in Bengal, continued to resist the idea of Line. Soon groups representing the Muslim electorate sought its abolition, while the nationalist Indian Congress party, which largely represented the Assamese peasantry, kept on defending the system. However, rising migration pressure had rendered the Line System ineffective.[31] As resistance surfaced, both through political debate and physical resistance, the government allowed the mechanism to lose its intended meaning. Nonetheless this settlement pattern continued to have enduring impact on the rural landscape of Assam.

Till the end of the '20s, unlike the Punjab experience in British India, the government did not play any role in extending official support in land reclamation by the Bengal peasants. Equally worrying fact was that despite an inspiring rate of growth in the newly reclaimed land along the river the revenue collection was equally poor.[32] Also the government had limited control in this flow of population. Most reclamation took place beyond the notice of the state apparatus and most new settlement could easily escape taxation. As decadal census estimate gave a clear picture of this migration, the government was forced to enforce regulation in

[31] A. Guha *Planter Raj to Swaraj: Freedom Struggle and Electoral Politics in Assam 1826–1947*, 1977, p. 207.

[32] During 1902 and 1922 the rate of increase in the settlement had increased in the valley by 19 percent whereas at the same time rate of revenue increase was only by 12 percent in the Valley. This estimate is based on figures provide at Section II A of the *Annual Land Revenue Administration Report of Assam* for the years 1902-3 and 1921-22.

ensuring that settlement takes place under its supervision. This led to the introduction of limited regulation of settlement in 1928 just on the eve of the World Economic Depression set in. This scheme aimed at making the welfare state visible in the ground level but none cost any major financial investment. The scheme could partially improve the official revenue status but it did not bring any change into the way jute production was organised in the Valley.

Till India's Independence in 1947 jute produced in the Valley was exported into Bengal (west). The India's partition suddenly disrupted the Valley's river transport link with Bengal. This was major blow to the jute industry but migration did not stop. Another half a million migrated to the Valley from East Pakistan during a short period of August 1947 and November 1949. Jute production continued to grow in Assam till the 1960s and after that it continue to decline till the end of the 20th century.[33] The temporary growth in jute acreage after partition was partly determined by the fact that jute prices grew as India's partition resulted in jeopardizing Bengal's jute economy. While all the jute mills became part of India, almost four-fifth of jute production became part of East Pakistan. Supply from East Pakistan to the Indian jute mills declined for both imposition of export duty of jute and political rivalry between India and Pakistan.[34] The prices increased and the Valley could derive this benefit till the recovery of the Pakistan's jute industry. However, despite the Valley being the crucial space for production of jute no jute industry was established as late as 1959 but even this small establishment failed to take off.

Ecological Consequences:

For several reasons the ecological impact of jute production turned out to be different from that of traditional practices of cultivation. For jute cultivation, farmers were dependent on various agencies for supply of seeds. Formerly the

[33] Based on Jute statistics provided from the Indian government sources in http://www.indiastat.com/default.aspx

[34] R. Ahmed, *The Progress of the Jute Industry and Trade (1855-1966)*, Pakistan Central Jute Committee, Dacca, 1966.

Assamese farmers used to manage seed for paddy or mustard from the previous year's crops. For the jute cultivation not only seed came to be supplied by the market but the government effort to derive better yielding jute it carried extensive experiments in the fiber. Qualities of seeds often changed and farmers were now dependent on outside agencies- which were beyond the traditional networks of seed collection, to acquire seeds. Secondly, unlike the traditional farming practices, the imperial government invested in protecting the crop from insects and pests. This also necessitated that farmers gradually being dependent on pest insecticide. Localized issues, like pollution of stagnant water-bodies during retting, began to surface. But its long term impact was yet to be validated. At the same time ecological advantage of jute cultivation, like its ability to restore soil health was also reported from the Brahmaputra delta in Bengal.[35]

The reclamation of flood-plain also meant the increasing pressure on the wildlife habitats. For long these riverine tracts acted as crucial habitats for range of wild animals, the herbivores in particular.[36] Floodplains are biologically productive areas which support large mammals. Also they acted as instrument of dispersal of species and facilitate their wide distribution. Some species are adapted to cope with and benefit from the seasonal inundation.[37] The floodplain helped them to survive challenges elsewhere. The illustrative example was that of the rhinoceros.[38] In the first decade of the 20th century several tracts were reserved as game reserve as asylum for the one horned India rhinoceros. The three selected tracts were inevitably such riverine floodplain tracts.[39] These tracts were inter-connected or only liner extension of similar landscape. For long large mammals used these tracts

[35] P. Ravenscroft, H. Brammer, K. Richards, *Arsenic Pollution: A Global Synthesis*, chapter 4.
[36] Ahmed, F. et. all, *Report on Assessing the Potential of the Brahmaputra River Islands to Support Dispersing Tigers within The Central Assam, North East India,* Guwahati: Aranyak, 2009.
[37] This point has been persuasively highlighted for other floodplains. See, Saikku, M., *This delta, this land: an environmental history of the Yazoo-Mississippi Floodplain,* Georgia.
[38] The relationship between floodplain and rhinoceros is best explained in Dinerstein, E., *Return of the Unicorns: Natural History and Conservation of the Greater-One Horned Rhinoceros*, Columbia, 2003.
[39] Saikia, A., 'The Kaziranga National Park: Dynamics of Social and Political History', *Conservation and Society*, 2009, vol. 7, pp. 113-29.

as part one single habitat.[40] After introduction of jute cultivation and consequent reclamation of floodplain large mammals witnessed rapid decline of their habitat. The pressure on the wildlife habitat in the large landscape had already increased. This could be easily gauged from the fact that during 1870-1950 in the meanwhile an estimated 700,000 hectares of dense forest and woodland were re-allotted to agricultural or plantation use. Reclamation of *chapories* aggravated this process of habitat fragmentation and pushed large mammals further away, forced them into closed and fragmented habitat or in most cases brought closer to human settlement.

III

Rivers, Flood and Flood Management in the 20th century:

By the middle of the 20th century a Valley, long considered by the colonial government was transformed into a highly productive zone. The migrant settlers settled close to the rivers. The low lying flood-plains came under regular and permanent peasant cultivation. This made their settlement and crops easily susceptible to regular and repeated inundation and erosion. That the riverine tracts were regularly exposed to erosion also became apparent in official reports.[41] Also the jute producers in the Valley had chosen the flooding season for jute cultivation so that they could also undertake paddy cultivation for the winter. Loss of land due to flood and erosion forced the newly settled migrant peasants to move out repeatedly in search of land. New reclamation of land put pressure on tracts where the Assamese peasants had already settled. As the Valley's flood-plain was domesticated afresh in the first half of the twentieth century, floods in the Valley began to pose serious challenges in the 20th century. At the same time any kind of

[40] Sharma N. et all, 'Socio-economic Drivers of Forest Cover Change in Assam: A Historical Perspective', *Economic and Political Weekly*, 2012, vol. xlviI no. 5, pp. 68-77.
[41] As East Bengal settlers had settled down in the riverine tracts, the government became aware of the actual physical space. Erosion was regularly reported by the revenue officials.

natural challenges into this highly remunerative productive zone could not be ignored by the government.

Compared to the other river valleys in British India, flood in the Valley did not invite any serious engagement from the colonial state in the 19th century. Till early years of the 20th century the colonial government gave little importance to flood induced damages. State intervention was limited. Unmaintained high raised roads, from the pre-colonial period continued to protect the homes and fields in a limited way. The colonial officials viewed flood in the Valley as of localized nature. The Assamese peasants, colonial officials noted, would know well those areas close to the rivers which were liable to regular inundation.[42] The peasants on their part cultivated little of those tracts temporarily which were prone to regular inundation.

The colonial government's apathy to engage with the flood question in the Valley began to change in the 20th century. Official reports began to report increasing damages of jute caused by flood. No official investigation was carried out to understand this sudden escalation of flood. Notwithstanding absence of any investigation the 1897 earthquake turned out to be only point of reference. A major earthquake measuring 8.1 on the Richter scale vastly changed the river regime of the valley; flooding resulted in slow decline of agricultural endowments. The river erosion had rapidly multiplied unfolding a crisis of agricultural land. The situation deteriorated further after another major earthquake in 1950 measuring 8.6 MW. Several reports have subsequently pointed out that the bed of the Brahmaputra had risen considerably. Siltation increased and in several areas, the river had changed its course. All these led to increasing land loss and erosion. Increased siltation, change in the course of river channels immensely contributed to the dynamics of riverine area (*chapories*). In meanwhile, as we discussed earlier, the *chapories* were already brought under permanent cultivation through jute production. The 20th century witnessed repeated increase in monsoon rain.[43] Monsoon rain induced

[42] Allen, B.C., *Darrang District Gazetteer*

[43] Table 7.4, D.R. Sikka, "Climate, Climate Variability and Climate Change for North-East India' in Pramod Tandon, Y. P. Abrol, Suman Kumaria ed. Biodiversity and its significance, Delhi: pp.110-118.

flood caused more damage to crops. Inundation of newer areas was also reported. In the last three decades of the 19th century (1871-1900) occurred mostly during the monsoon period. Pre-monsoon flood was very limited. This means that the pre-dominant traditional crop cycles based on winter crop were less susceptible to damages.

Till the end of the 19th century, given the complicity of the state towards flood, no effort was made to invest in flood protection. H.Z. Darrah, the Director in the Department of Land Record and Agriculture of the Assam government, writing to the Indian government in 1897, categorically acknowledged the absence of 'any action' for flood protection.[44] Yet, by this time, the colonial officials commanded a fair understanding of the existing networks of the flood protection mechanism in the form of embankments which used to crisscross several places of the Valley. That the Valley's trunk roads act as embankments and protect the urban settlements and fields were fairly accepted amongst the official circles.

The most prolonged, devastating and unprecedented flood came in 1929 which impacted the central part of the Valley, a major jute producing area. The flood was mostly induced by pre-monsoon rain. Flood came back to central Assam again in 1933 causing widespread damage to crops. The government after decades of comparative unpreparedness had no option but to look into the problem. In a bid to overcome challenges posed by the flood, the government began to search for some urgent remedies.

Explaining Flood and Search for Remedy (1929-1980)

The fresh appraisal of the causes behind flood began to refer to the increased intensity of flood after 1897 earthquake. One of the easiest ways to explain the increasing ferocity of flood was to refer to the earthquake itself. Reports submitted by the *Geological Survey of India* in 1898 indicated the rising river beds. The

[44] 'Embankment in Agriculture' *The Agricultural Ledger*, no 2, 1897. Darrah noted 'The Deputy Commissioners of Goalpara, Darrang, Nowgong, Naga Hills, Khasi and Jaintia Hills, and Garo Hills report that no action has been taken in recent years to promote the construction of dams and bunds in their districts for purposes other than that of irrigation.

report also predicted that it would take a longer time for the river to come back to stable situation as it would need to carry and distribute silt away from the present locations. Such explanation could hardly provide safeguard against flood. The 1897 earthquake made number of tea plantations in eastern Assam vulnerable to floods.[45] The newly cultivated jute fields were also prone to floods. Both these were causes of concern for the government requiring intervention. Structural intervention into the river system was seen as the possible way to avoid this embarrassment. The need of the hour was sound engineering solution and implementation of these advices. In the next few decades several commissioned surveys suggested possible remedies apart from trying to explain flood and the causes of the river's behavior.

The earliest search for structural remedy was made in 1929.[46] A committee was appointed to examine the railway tracts in the Valley as possible reasons of the flood in the Valley.[47] The committee concluded that the newly introduced railways, which crisscrossed the flood-plain, aggravated along with public roads the flood as there was not sufficient passage for water.[48] The railway seriously obstructed natural flow pattern. These artificial obstructions, against the flow of flood water, were in most cases of grave nature and in some cases turned into serious nature. Also peasants in affected areas asked for making drainage through the railway tracts for release of flood water. However, flood damage, the committee felt, could be controlled by effective change in bureaucracy, installation of gauges and dredging of the river. The river and its flood problem required effective monitoring and hence a waterways department was proposed. Also required is the installation of gauges like rivers of Eastern India.[49] The latter would result in fair amount of understanding of flood. The report hesitantly suggested that the lower reaches of the river be dredged.[50] The idea behind such an ambitious project could be easily

[45] Antrobus, H, 1957 #306}
[46] In 1929 due to the sudden furry of the flood which caused serious damage to the crop and property, the Assam Legislative council constituted a commission to enquire into the causes of flood in Assam and their remedies.
[47] *Tindiniya Asomiya*, 11 January, 1930.
[48] *Report of the Flood Enquiry Committee*, Assam 1930, p.5, para.32.
[49] In rivers of Orissa gauges already had been reading water levels since 1868. See, Mahalanobis, P. C. (1940). "Rain Storms and River Floods in Orissa." *Sankhya*, 5(1): p.3.
[50] *Report of the Flood Enquiry Committee*, Assam 1930, p.5, para.32 (2).

gauged from the fact that river dredging was already a much sought after aspect of river engineering in Europe and America.[51] But making a crucial departure the report expressed its hesitation which was based on a suggestion made by the Orissa Flood Enquiry committee in 1928. The latter report was based on an investigation of flood into the Indian state of Orissa in 1928. This report adversely commentated on the outcome of the dredging. Dredging only led to disruption in deltaic formation and could not stop sand deposition and thus to the ultimate failure of any dredging. Dredging did not take place; neither there was a waterways department. For the government it became clear how to measure flood-damage. This was important given flood now meant increasing uproar from the Assamese nationalists for remission of land revenue.[52]

The idea of dredging of the river Brahmaputra again came back during the 1950s and early 1960s. Within popular imagination, dredging would remain a successful remedy. The Assamese engineers, not essentially river engineers, articulated their opinion in favor of river dredging. Notwithstanding the lack of financial support required for such massive physical intervention, the Assam government undertook to dredge the Brahmaputra on an experimental basis in 1966. An experimental dredging was carried out in 1974 in western Assam.[53] The high cost ensured that the experiments remained confined to small stretches only. The result of this small experiment was not very convincing. It was now understood that while dredging could prevent bank erosion it proved a failure to serve as good measure because the dredged segment got instantly filled up with silts. What was required now for an effective accomplishment of dredging was to undertake civil work 'to train the river to flow through the dredged area and to remove the earth'. This optimism could not sustain for long as with huge expenditures involved, such practices was not recommended again. The idea of

[51] *David Blackbourn. 2007. The Conquest of Nature: Water, Landscape, and the Making of Modern Germany. New York: W.W. Norton.* Also, B F Thomas and David Alexander Watt, *The Improvement of Rivers.*

[52] Couple of year later revenue remission became a major nationalist plank in the flood of the council debates. Guha, A, *Planters Raj to Swaraj*.

[53] A stretch of seven kilometers at Chimmna in western Assam was dredged. The width was 30 metre. A second round of dredging was done at a placed called Alikash to reduce erosion.

dredging became unattractive within the engineering lobby only in the 21st century.[54] While this shift was perceptible in the upstream of the river, there was an increasing popular demand for dredging continued in the downstream.[55]

Surveys multiplied in the decades to come. The political economy of these surveys also became complex. Till 1950 the international engineering cooperation was limited and no actual physical survey of the river basin was conducted. Suggestion included dredging of the river, construction of storage reservoirs and embankments as possible protection against flood. The only exception in this period was S.C. Majumdar, a senior engineer, credited with extensive works on the rivers of Bengal delta and also a key person advising Indian state on the flood question. Majumdar came down heavily on the benefits of embankments: That embankment could become a disastrous solution as remedy to the flood problem, Majumdar unhesitatingly predicted.

Meanwhile India witnessed a conceptual shift from embankments toward large dams intended to store floodwaters. The first five-year plan of the country (1951-56) emphasized on the need of the large dams and production of both hydro-electricity as well as facilities for irrigation. While several rivers in northern and eastern India became integrated with this framework, no storage dams were conceived for the Brahmaputra or its tributaries. 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 at bay. This resulted in a series of political debates and mobilization against a perceived bias in the framework of Indian federal structure.

Devastating floods swept away crops and other properties in 1950. Earthquake induced flood killed more than 1500 people. Assam experienced severe flooding in 1954 along with several northern and eastern Indian states.[56] The 1950 earthquake and subsequent flood, especially during 1954 helped to explain better

[54] S.N. Phukan, The Sentinel, 2005,

55 In 2009 in Dhaka a human chain was formed seeking an immediate dredging of the Brahmaputra to make the river navigable during the winter. 'Human chain formed on Brahmaputra river demanding dredging' , The New Nation, April 28, 2009.

[56] Misra, D., 'The Bihar Flood Story', *Economic and Political Weekly*. 32 (35), 1997.

the river topography and its relation to flood crucially. Severity of flood, now perceived as of much higher intensity as a consequence of 1950 earthquake, prompted the Indian government to formulate urgent flood strategy. A survey conducted in 1954 found that the rivers and their siltation pattern had changed dramatically due to the earthquake. The river beds were full of tough clay soil unlike its natural sandy material. These were brought down heavily from the highly exposed hills. The catchment areas became highly volatile. Landslide brought down timbers clogging the channels. All these led to heavier than usual silt. Raised river beds helped river channels to change courses rapidly.[57] Well-formed bank lines also suffered from erosion. Erosion of high bank inundated new areas which had long been settled and turned into productive agricultural fields.[58] Away from such official surveys alternative explanation came from British botanist F. Kingdon Ward who was intimately familiar with the lower Himalayan hills and upper reaches of the Brahmaputra.[59] Ward pointed to the very complex nature of catchment areas of the Brahmaputra and tributaries for this varied nature of flood.

The government strongly pushed for the future construction of storage dams and new embankments. Subsequently construction of embankment was undertaken at a war footing. Few selected towns and other areas having tea plantations and jute growing areas were to be provided flood protection. The most publicly visible protection work was for the city of Dibrugarh in eastern Assam which had key tea-plantation interests.[60] Suggestions were put forward to raise height of some flood-prone villages. This would be done through the construction of new embankments and spurs.[61] Viability of extending the existing embankments and improvement of drainage channels was now investigated. This gave an impression of a radical

[57] Government of Assam, *A Note on the Flood in Assam submitted to the Union Minister of Flood and Irrigation*, 1954.
[58] The tributaries used to flood their independent basins. When the Brahmaputra overflows simultaneously along with its tributaries the flood acquires a challenging dimension.
[59]
[60] Government of Assam, *Protection of Dibrugarh Town from Erosion by the Brahmaputra 1955-56*.
[61] Government of Assam, *Protection of Dibrugarh Town from Erosion by the Brahmaputra 1955-56*.

ideological shift within the government in the understanding of flood and willingness to tame the river but actual implementation led to a complex journey.

These surveys also brought out the larger uncertainty of the Indian state to the river and flood. That structural solution of the flood problem could not be the last answer and simultaneous attention to landscape like watershed management was required also surfaced. Such voices were feeble. Deforestation in different parts of region came to be increasingly identified as the primary cause of flood. The large rainfall catchment area of the Brahmaputra basin and the role played monsoon came to the forefront. That the flood prone areas needed better flood warning systems was also suggested. Equally concerns were raised about the effectiveness of embankments as a flood protection instrument. Engineers, with experiences of basin's river system in the meantime began to suggest that embankments were catalyst for confinement of flows. The later was understood be reason for increased flood levels. It also reduced natural drainage to be accompanied by augmented water-logging. In the meanwhile, that complete flood protection could be ensured came to be heard within the dominant discourse of the Indian government. 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 and such pursuits continued to be there till the end of the 20th century. Surveys conducted during this period largely agreed with the three fold issues of embankments, storage reservoirs and dredging. At the same time it began to express uneasiness at the sheer gigantic nature of the river and its' great unpredictably. It was suggested that it was important to effectively control watershed for erosion control along with the fact that the river should be stabilized to single channel.

Meanwhile the 1954 Indian national policy on flood continued to be the guiding principle of Indian flood control regime.[62] Political intervention came in

[62] Misra, D.K., 'The Bihar Flood Story', *EPW*.

1964 when an Indian ministerial committee reexamined the flood control issue.[63] The committee reposed faith on the existing methods of structural intervention into the rivers but also suggested a would-be controversial idea for inter-basin diversion of river waters. The idea of multi-purpose dam was further reinforced. Advice for non-structural intervention also came in: flood forecasting, floodplain zoning, and flood insurance. That the soil conservation was a core issue for future flood management was also suggested by the committee. These ideas came to be further reinforced in 1972 when another ministerial committee agreed with these suggestions.

Till now the Indian political class still had no disagreement on the fact that the flood moderation as opposed to power generation should be afforded a higher priority on multipurpose dams. Yet, what was missing from such ideological intervention on flood control was the independent assessment of individual rivers. In 1978, a new working group on flood control reiterated previous suggestions but also recommended that flood-affected states should prepare master plans for each river basin. Distrust with the embankment became visible and the Indian government agreed that although 'embankments were providing a certain degree of protection at relatively low cost, the effects of embankments on river regime were not well understood'. This search for engineering solution to flood also coincided with the new thrust areas of focus to understand flood problem. In the late 1970s, the Indian planning commission, before unveiling its sixth five year plan categorically, argued that "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''. Notwithstanding such mixed reaction official circles believed that flood had been controlled.[64] In this view recurrence of flood was no more than mechanical failures of structural solution which could be easily improved upon.

[63]Government of India, *Ministerial Committee on flood control*, 1964.

[64] 'Although the flood problem has been controlled a great extent due to construction of dyke system on either bank, nevertheless there exists certain gaps in the existing dyke system where flooding occurs year after year.

Flood Damage Trends in Assam[65]

Period	Average Area affected per annum	Average Annual Crop Area Affected		Average population Affected per annum	Population affected per hectare of area affected by floods	Average total flood damages per year (Rs. Crore)	Average annual crop damages as % of total flood damages
		Actual	% of total area affected				
1953-59	1.13	0.10	8.85	0.86	0.76	5.86	66.02
1960-69	0.75	0.16	21.33	1.52	2.03	7.57	92.33
1970-79	0.87	0.18	20.69	2.00	2.3	15.18	89.33
1980-88	1.43	0.40	28.05	4.55	3.2	142.52	96.38

An era of Embankment (1947-1980s):

River technocrats began to argue on the need of flood control and putting embankments as a tool for remedy against that recurrent flood. Flood, majority argued, could be controlled by laying embankments. The embankments will help prevent water to spill over to paddy fields. The embankments would, it was believed, help in the stabilization of river courses and determine a regimented water flow across the river channel. It will also help in the controlling the overflow or spillover of the excess water during the heavy flood and thus would protect both crops and human lives. The flood plains of the Brahmaputra valley embarked on the construction of massive embankments since the middle of the 20th century. An Embankment and Drainage Department already began to function in Assam since 1944. The department was responsible for engineering of the river drainage system in the Valley. This included both the construction of embankments and the diversion of river wherever possible. Since Independence in 1947 embankment was constructed for 200 kilometer.[66] This slow pace of embankment construction gained rapidity after 1954. Between 1950 and 1954 the flood committed massive damages to property and resources. The impact of 1950 earthquake was critical on

[65] This table is prepared from Agarwal, A & Narain, S., *Floods, Flood Plains and Environmental Myths, Centre for Science and Environment*, New Delhi, 1991 (hereafter CSE Report), p. 73.
[66] Government of India, *Report of the National Flood Commission*, vol.1.

the river system of the region. The earthquake helped in the rise of river bed and increased volume of silt in the Brahmaputra along with most north bank tributaries. Along with poor farmers rich farmers also suffered as flood waves reached out to new areas.

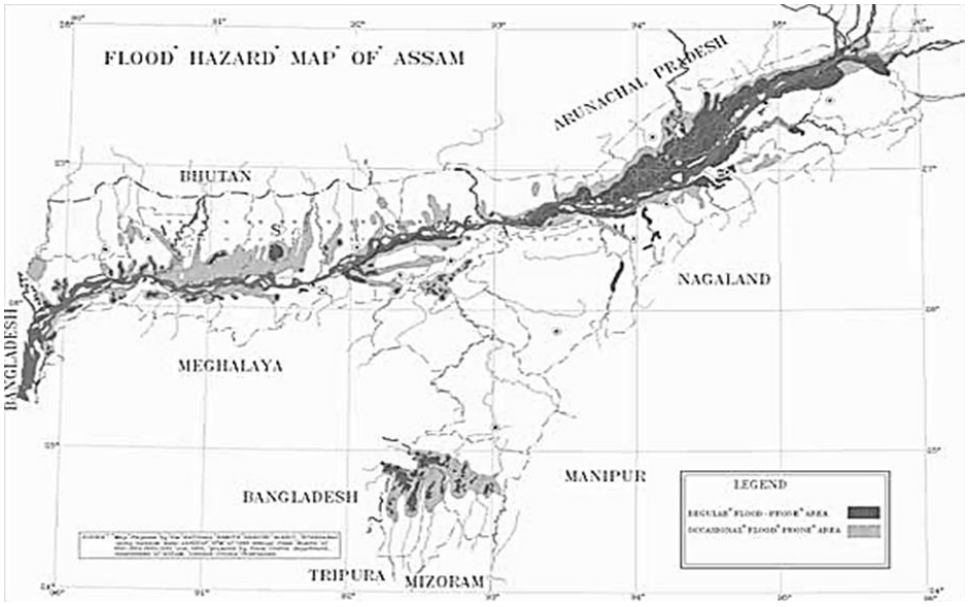
Building of embankments gained massive political backing after 1954. But the government admitted that the embankment was only a temporary relief meant to protect the farmers of their crops. This would also help to cope with the food production scenario in the Valley. Simultaneously it was agreed upon that the larger geological factors go against the whole idea of flood control in the valley. Notwithstanding such counter currents the best idea would be to have path breaking studies so that multi-purpose river engineering could be proposed as a way out.

After three decades, the region has come to be crisscrossed by about one third of India's total length of embankment. By 1986 the state of Assam had 4448 kilometers of embankments. Official claim was these lengths of embankments protect an estimated 1.56 million hectares of agricultural land. As embankment became an answer in 1957 the Assam Embankment Act put in place several institutions to channelize both technology and financial grant as a means of controlling the flood. In the next couple of decades, as embankments became the answer to 'flood' and simultaneously gave birth to a class of interested groups. The contractors who would implement these 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.

Embankment served well in the first years of their construction. They also served as roads and place of shelter during flood both for humans and domestic animals. However, after several years of tryst with embankments and repeated flood brought uneasiness to the ruling class, technocrats. After a devastating flood of 1986, the Assam Flood Expert Committee had observed that 'the embankments have changed the behavior of the rivers towards worst. And therefore, suggested that no more embankments should be constructed to avoid a deterioration of the situation'. In the popular perception the floods of 1986, whose devastating impact

was widely visible in central Assam, was caused by the newly built storage dams. Such perceived threat and ill-effect of storage dams was not verified by the state agencies neither the ruling class was convinced of such a claim.

Figure-3
Flood-Protected Area and Flood Damaged Area



Between 1954 and 1987 Assam built 4448 kilometers of embankments, 599 km of drainage apart from soil conservation. Official claim was these lengths of embankments protect an estimated 1.56 million hectares of agricultural land. Despite gigantic efforts and colossal expenditure (more than ₹ 15,000 million) in building channels and 431 square kilometer area for soil conservation. But flood continued to be there at regular interval. Between 1954 and 1998 catastrophic floods occurred for sixteen years. Upwards of 9600 square km land, floods annually affect 12.21% of the geographic area of Assam. In 1998, the floods which came in four frightening waves deluged 38,200 km2 or 48.65% of the geographic area of the state, putting in perils the lives and properties of 15 million people.[67]

[67] Kotoky, P.et. all 'Nature of bank erosion along the Brahmaputra river channel, Assam, India' *Current Science*, vol. 88, no. 4, 2005, pp.634-641.

Flood and Valley's Indian Nationalists

The governing classes-political leaders, senior bureaucrats, engineers and host of contractors- in Assam after 1950, had desperately tried to solve the problem of increasing flood problem by a dose of political debates and less aggressively by the innovative use of 'science'. Everybody mastered language to win over peasantry showing their intention of resolving this crisis. Whether it was in the floor of the legislative houses or public platforms no one would like to spare any opportunity in the race to speak about the urgent need for flood control. But what to do to overcome this recurring flood? Everybody had a ready answer in construction of embankments.

That flood caused serious dislocation in the Valley's agrarian economy was agreed upon by cross sections of the Assamese elites. Press as well as legislative forums articulated the extent of loss of cultivable land due to flood. 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 serious implication for the electoral politics of the region. The confidence of the Assamese ruling class in the ability of embankment to prevent floods and also to protect agrarian economy is easy to notice:

> "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 realised by our people every day…The government have realised the necessity of a comprehensive embankment and drainage system scheme in the state…"[68]

The Assamese elites began to consider the ferocity of floods in the Brahmaputra and other rivers in Assam as a cause of sorrow and suffering to Assam and Assamese peasantry. The Assamese politicians across ideological conviction convincingly argued for the need for river control. The underdevelopment of Assam was already widely discussed and causes for it searched for. Following

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

repeated failure of crop and eminent famine like situation looming large in the state in the 1940's, the ruling class drew their attention to overcome flood. It was perceived that flood control would restore a crisis ridden agrarian economy. The best example of such articulated voices surfaced in the floor of legislative assembly. Inspired and convincing debates on flood would take place in the assembly and often such debates for several days. In 1947, the acclaimed architect of modern Assam, Gopinath Bordoloi strongly 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*. Such concerns repeatedly surfaced in the floor of the assembly. That the river and its system carry havoc for the peasant economy of the region came to be reflected by others too. Another nationalist wrote how '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'.

As flood and flood crisis aggravated after 1950 earthquake, the Assamese nationalists 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.' Through this stand, the regional ruling class made several issues clear: first, it affirmed it's in the ability of modern science in taming the river and secondly, it expressed its helplessness in regimenting the river due to lack of resources. These two-fold approaches continued to shape the Assamese ruling class's relationship with the Valley's river and floods. That river engineering through embankments and multipurpose dams would pave the way for safe cultivation was widely appreciated. Few suggested that this would open up new areas for the extension of permanent agriculture along the Brahmaputra and new land reclamation would be possible. Such rhetoric, however, served to strengthen the ruling class's control over peasant dependence and helplessness.

The peasantry, not convinced of this political rhetoric, and also distressed by flood crisis, only hoped for some miracle to happen. Flood carried silt and siltation either covered arable plots with sand forcing the peasants to look for other plots of land. This also led to the increasing number of landless peasants across the flood plains of the region and consequent pressure on forested land. This was also the time when clearance of forest land began to acquire rapid character.

In the 1950s, the government repeatedly emphasized its failure to do justice to the flood victims with its 'limited state resources' and appealed for central funding. In response to flooding between fiscal years 1982 and 1987, Assam sought flood relief from the central government amounting to ₹ 6610 million and received assistance of ₹ 1150 million.[69] The flood-prone area in Assam was estimated to be 3.15 million hectares. Contemporary commentators agreed that the discrepancy between the volume of financial support sought and the support granted was in part due to difference of opinion over the estimation of damage and 'a general shortage of financial resources, and also in part political bias'. Increasing failure to provide finance for remedy of flood forced the Assamese ruling class to argue a case of declaring flood as national problem. The Assamese nationalists insisted that floods be declared as a 'national problem'. Over a period of time, flood remained to emerge as 'national problem'. For the Assamese nationalists this unfulfilled dream was another example of wrong within the Indian federal structure. Yet, there is no doubt that the continued struggle of increased flood relief and parallel failure of flood control measures is a reflection of the 'technical difficulty of managing flooding and erosion and the failure to provide appropriate levels of relief further punishes the victims'.

Transforming a landscape: environmental consequences

The investment for river engineering since 1947 in the Valley primarily aimed at controlling floods, improvement of drainage, and reduction of erosion. The new regime of river control through embankment was based more on contemporary

[69] CSE Report, p. 5.

wisdom than sophisticated and combined application of science and river ecology.[70] Reflecting on decades old experiment with embankments, early in the 21st century, a study conceded that

> *'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'.*[71]

Trouble with embankment began to surface early. The efforts of the E & D department often resulted in unforeseen damages and resultant public protests.[72] In fact the government itself had divided opinion about the activities of the department. Thus in 1950 when the department made an attempt to divert water from Buri-Dihing to Noa Dihing in eastern part of Valley, though its effectiveness was never recorded, the government came down heavily condemning such works of this department. Occasional river engineering took place which attempted to divert excess water into a less filled river in the neighborhood.

Embankments lined up across both bank of the river Brahmaputra and its other tributaries. In western part of the Valley this could be give protection of jute producing fields as could be seen from the Figure 3. These rivers came to be characterized by their erodible bank lines and heavy siltation. Official reports pointed out how embankments had created further trouble. In 1986 floods breached embankments and put this engineering solution into serious disarray.[73] High silt

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[70] Most embankments followed guidelines prepared by the Embankment Manual of Central Water Commission, Government of India. This was also largely based on Harrison, Henry L. *The Bengal Embankment Manual: Containing an Account of the Action of the Government in Dealing with the Embankments and Water-courses since the Permanent Settlement: A Discussion of the Principles of the Act of 1873*, Calcutta, 1875.

[71] Government of India, *River flooding and erosion in northeast India*, Background paper no. 4, Ministry of North East Development, 2006.

[72] Popular perception pointed how embankments were causes of increasing flood. M. S. Prabhakar, *Frontline*,

[73] During 1985-86, 86-87, 87-88 and 88-89 more than 20, 18, 96 and 97 percent of the total area under embankment protection got breached leading to unexpected crop and other damages. CSE Report, p. 85. This is true across the Brahmaputra. The flood-induced losses inside the embankments are much higher than outside the embankments in Bangladesh. Pl M. Thompson and P Sultana, 'Distributional and Social Impacts of Flood Control in Bangladesh', *The Geographical Journal* , Vol. 162, No. 1 (Mar., 1996), pp. 1-13.

loads carried by the rivers and changed land drainage patterns in the flood plains were considered as major factor behind the flood in 1986. High silt led to choking of river channels. River slopes decreased.[74] Embankments aided in the process of filling and raising the level of the river channels through a simple process. Prior to embankment flood water would push the silts to the distant fields. A controlled river channel meant silt would remain in the channel. The Commission however agreed that though the agricultural fields were now deprived of silt whether it deprived from their re-nourishment could not be conclusively proved.[75]

The 1986 flood came as an eye opener. An expert committee which looked into the flood problem, admitting that such intervention had changed the behavior of the rivers in Assam for the worst, suggested that no more embankments be constructed to avoid recurrence of such problems.[76] An official survey highlighted loss of land, embankment failure, disruption in fish breeding between flood-plain and rivers and reduced passage for flow of flood water.[77] The troubles did not end there. The Indian National Commission on Flood in 1976 highlighted few more challenges. The commission agreed that river aggradation poses threat to the safety of the embankments. On the challenges posed by railway tracts the Commission reiterated the finding of the 1929 Flood Enquiry Committee.

The Commission noticed that the north bank tributaries in western Assam continue to cause flood along the railway tracts in the upstream. That some rivers in the north bank of Brahmaputra refused to be tamed continued to haunt policy makers and technocrats. Some tributaries were erratic in their behavior, carry heavy silt and often experienced flash floods. Many tributaries are inter-dependent and flow pattern in one river could influence another neighboring river. They changed their course erratically causing unpredictable and extensive damages to crops. In 1975 the Indian government reaffirmed its 'sustained effort' to 'train' problematic subjects of 'flashy floods'. For the government the obvious solution was

[74] CSE report, p. 87.
[75] India. National Commission on, Flood. (1980). Report. New Delhi, Govt. of India, Ministry of Energy and Irrigation, Dept. of Irrigation, pp. 83-84, vol.1.
[76] Anon, 1987. *Report of the Expert Committee on 1986 floods in Assam*, Government of Assam, Guwahati, India.
[77] Government of Assam, *Documentation on past disasters, their impact, measures taken, vulnerable areas in Assam*, Government of Assam. Centre for Natural Disaster Management.

construction of another embankment despite knowing that it was doomed to be a failure. Neither the government refused to bow down and gave a brave face to repeated failures of embankments. Unfazed by failures the flood control department continued its search for new causes of flood.

Embankments could not help safety against the bank line erosions.[78] Often like 1998, embankments failed after they got saturated due to long-period of flood and relentless rainfall.[79] Erosion brought river banks close the embankments which led to breaches. In most such cases sudden breach brought damage to crops apart from immovable properties of the local residents.[80] Both paddy and jute suffered hugely in western and central part of the Valley at regular interval. What was new at this moment was increasing scientific evidence about the fact that the embankment led to high flood level within the embanked area. That it also resulted in the rise of river beds with consequent reduction of fertility of land of the flood protected area was now suggested. The government conceded that the embankments, through breaches and entry of the floodwater, regularly submerged protected areas. Attention was also drawn to the emerging threats of water logging, drainage congestion and repeated failures of mechanized outlet instruments. Technocrats unanimously held that all this resulted in rising of river beds including narrowing of the channel. 'The land drainage pattern gets changed drastically because all streams are now guarded by marginal embankments.'[81] Aggradations of the river beds occur because of increasing siltation of the river channels. The silt which was now deposited inside the channels earlier used to be deposited in the flood-plains. For a long period, this silt was considered as a key element of land fertilization. Meanwhile, as work on structural interventions into flood management acquired bigger dimension, it became obvious that erosion control was inescapably connected to flood management. Embankments that were intended to reduce

[78] The Assam government through its irrigation department continued to embark on localized erosion management system. Annual Flood Report, 1961, p. 1.
[79] R.B. Singh, 'Flood Mitigation and Flood plain Management in the Brahmaputra plain: a case study', in Ugo Maione, Beatrice Majone Lehto, Rossella Monti *New Trends in Water and Environmental Engineering for Safety and Life*, pp.
[80] *Annual Flood Report, Assam*, 1961, p. 4.
[81] Government of Assam, *Documentation on past disasters, their impact, Measures taken, vulnerable areas in Assam*.

overbank spill were being destroyed by river erosion. Embankment multiplied the problems. Rainwater which falls outside the embankments failed to recede to the river after being obstructed by these embankments. This excess water would remain in the fields leading to the formation of stagnated water bodies. There was drainage congestion. Neither the structural operation of embankments was effective to help release the water. Embankments were constructed at a cost of massive irreversible damages to the wetland bodies. Water hyacinth growth also reduces drainage efficiency.

Flood control through embankments also put local social dynamics into disarray. The idea of construction of embankments came to be solely rested upon the hydrological behaviour of the river. The intricate social relationship of people across different communities with the river and flood did not fit into the hydrological understanding of the river and flood. The idea of damage also came to be rested upon such a perspective and the idea of compensation came to be variously articulated.[82] Localized dissent emerge which contested such views about water and river. Fishermen communities relentlessly resisted the move for construction of embankment in eastern Assam.[83] They argued that embankment would jeopardize their livelihood while others who depended on agriculture had welcomed it with the hope that their crops and properties would be protected. As days passed by the embankments had to be protected through state-sponsored vigilance.[84] Often such vigilance could not help and human induced breaches took place. Cattle were also blamed for breaches.

Notwithstanding such challenges the government continues to endorse structural remedies of maintaining embankments as the only possible method against flood protection. New engineering measures included additional protection,

[82] Amrita Rangasami, 'The Paupers of Kholisabhita Hindupara: Report on a Famine', *Economic and Political Weekly* , Vol. 10, No. 5/7, Annual Number (Feb., 1975), pp. 267-282

[83] The Matmora embankment in Lakhimpur in eastern Assam invited strong resistance from the fishermen communities requiring sustained political negotiation. Similar was the story of Puthimari river embankment and the government admitted that the work could not be completed due to strong opposition of villagers. *Annual Flood Report, Assam, 1961*, p. 5.

[84] In 1961 the newly constructed Puthimari river embankment in western Assam could only be protected by 'vigilant patrolling' and additional defense supported by sand filled bags. Annual Flood Report, Assam, 1961, p. 5.

protection against challenges like seepage, wave wash or erosion by river currents. As water level was raised the height of embankments was increased almost annually. The emphasis for multi-purpose dams as a remedy for flood came back in the beginning of the 21st century. This came to be reflected in the several policy formulations on the river. A new water policy of 2009, the provincial government reinforced the idea of multi-purpose dam as a key solution to controlling dams.[85]

Conclusion

Late in the twentieth century both jute and flood have lost crucial relevance in the valley in terms of governance. The jute cultivators are still the most impoverished lot. Flood refuses to go away. The Valley's floodplain is India's one of the most flood-prone places.[86] For the Indian policy makers the Brahmaputra basin's priority is in terms of hydro power generation. The Indian state's continuous urge not to allow a river's floodplain remain idle is driven by an urge to secure the Valley economically colonial era. In this century-old engagement with the river and the valley the colonial state and then the Indian nation-state ignored, and continue to do this, the historical complexities and ecological niceties of the river.

[85] Where flood control is one of the key purposes of multi-purpose 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 multi-purpose 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. , State Water Policy, section 8.9.4. This policy is yet to be adopted by the state's ruling class.

[86] In India during 1953-1987 on an average the total area affected by annual flood is 7.66 million hectares area, 31.84 million people are affected, Rupees 7680 million would be the total damage to crops, houses and other public utilities. CSE report, p. 2.