

**Event, Process and Pulse
Resituating Floods in Environmental Histories of South Asia**

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Abstract

The notion of the flood in South Asia is no longer solely characterised as the archetypal natural disaster episode. This perceptual shift, as this essay will point out, draws from a conceptual churning within the field of environmental history of South Asia. In the course of exploring and debating ideas about environmental change, environmental historians have in the course of several monographs and research articles drastically reconsidered the role and impacts of flooding in South Asia through three distinct narrative frameworks: a) *hydraulic event*; b) *geological process* and c) *biological pulse*. Environmental history as a field, thus, has helped flesh out and radically revise our understanding of flooding from previously being an ahistorical calamitous event to instead providing contexts for revealing complex relationships between ecological processes, biological pulses and livelihood strategies. The notion of the flood in South Asia, consequently, is now acknowledged as an ecological force that is modulated by social, cultural and political interventions rather than exclusively belonging to the domain of Nature.

Keywords: Floods, South Asia, review, biological pulse

The Unquiet Woods (1989) by Ramachandra Guha is widely considered to be the monograph that self-consciously initiated the environmental history of South Asia as a disciplinary field.¹ While the core claims in *The Unquiet Woods* explored how peasant

¹ South Asia rather than the nation-state, perhaps, better captures the environmental scale of the subcontinent that was steadily brought under British colonial domination between 1756-1947. Following

resistance aimed to defend traditional village forests from British colonial authorities and the independent Indian government, a flood event finds prominent mention for heralding a ‘turning point in the ecological history of the [lower Himalayan hills] region’.²

The unusually heavy monsoon of 1970 precipitated the most devastating flood in living memory. In the Alakhananda valley, water inundated 100 square kilometres of land, washed away 6 metal bridges and 10 kilometres of motor roads, 24 buses ...366 houses collapsed and 500 acres of standing paddy were destroyed. The loss of human and bovine life was considerable.³

For Guha, the flood of 1970 caused the villagers — who bore the full brunt especially from landslides — to reason with ‘folk sense’ that strong links existed between soil erosion, the mass felling of trees and the intensity of monsoonal downpours. This realization of the villagers, Guha argued, proved crucial in setting off a chain of protest actions by them to save their local forests and ultimately led to the founding of the *Chipko Andolan* (tree hugging movement)⁴ — acknowledged to be one of the most celebrated environmental movements in the third world for its time.⁵

the period of decolonization from the late 1940s onwards, however, this vast territorial expanse of the erstwhile British India now comprises the independent countries of Bangladesh, Nepal, Bhutan, India, Pakistan, Afghanistan and Sri Lanka.

² Ramachandra Guha, 2010 [1989]. *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalayas*. Ranikhet: Permanent Black p.156.

³ *Ibid.*, p.155.

⁴ *Ibid.*, pp.156-84.

⁵ For critiques of the ‘romanticized’ understanding of the Chipko movement see Haripriya Rangan, 2000. *Of Myths and Movements: rewriting Chipko into Himalayan history*, Verso: London and Emma Mawdsley, 1998. ‘After Chipko: from environment to region in Uttaranchal’, *Journal of Peasant Studies*, 25(4), pp. 36-54. For a recent rehabilitation of the Chipko legacy as a significant environmental imagination and intervention see Shinya Ishizaka, 2014. ‘Re-evaluating the Chipko (forest protection) movement in India’, *The South Asianist*, 2 (1), pp.9-27 and Trent Brown, 2014. ‘Chipko Legacies: sustaining an ecological ethic in the context of agrarian change’, *Asian Studies Review*, 38(4), pp.639-57.

While the 1970 flood was undoubtedly an ecological inflection point in the Uttarakhand hills, the ‘folk sense’ that saw connections between deforestation, erosion and floods, however, bore an uncanny overlap with earlier ‘alarmist discourses’ that were propagated by several Indian foresters. The causal links between climate, forests and erosion, as Vasant Saberwal notes in his path breaking *Pastoral Politics* (1999), was actually first debated by foresters, environmentalists, soil scientists and civil engineers in the United States of America in the early decades of the twentieth century.⁶ At heart, the disagreements over the impact of deforestation on stream flow were shaped by turf wars between the Army Corp of Engineers and American foresters. While engineers wanted dams and embankments to impound flood waters, foresters vigorously argued that forests would more ably soak up a heavy precipitation event. The ‘exaggerations’ of the American foresters, however, overtime, became difficult to support with quantitative and evidence base scientific studies. On the other hand, in the very same period, environmentalists in the United States increasingly began to argue that water run-off depended on complex interactions between soils, water, climates and vegetation. Consequently, no easy correlation existed between deforestation and floods in the lower plains.

In British India, on the other hand, much of the nuance and disagreements within the United States over the flood and forest relationship seemed lost in translation. From the 1920s onwards, especially, Indian foresters selectively drew upon the American debate to argue instead that there was enough clinching evidence to prove that flood intensity could be checked by increasing forest cover. In great measure, these loud assertions for protecting forests by the Indian foresters, Saberwal suggests, were actually intended to limit and overturn the powers of the colonial government’s revenue departments — who were then actively campaigning to bring forests under their control as revenue paying units.⁷

It is most likely, therefore, that the understanding about the 1970 flood in Guha’s *Unquiet Wood* was not exclusively put together by folk sense. Rather, it could have

⁶ Vasant Saberwal, 1999. *Pastoral Politics: shepherds, bureaucrats, and conservation in the western Himalaya*, New Delhi: Oxford University Press, pp. 113-41.

⁷ Ibid., pp.124-39.

been equally probable that the villagers of the Uttarakhand hills might have been influenced, partly if not wholly, from how Indian foresters were debating and establishing the links between floods and deforestation. It bears mention here, nonetheless, that in both Guha's *Unquiet Woods* and Saberwal's *Pastoral Politics*, floods are overwhelmingly acknowledged as natural disaster events. That is, floods are exclusively natural calamities — an abnormal precipitation moment that inundates human settlements.⁸

In 1991, the New Delhi based Centre for Science and Environment (CSE) — arguably one of Asia's most celebrated and pioneering Non-Governmental Organization (NGO) on the environment — published its third 'State of India's Environment' (SOE3) report.⁹ The SOE3 was exhaustive in collecting, collating and making sense of the reams of data on floods, flood damage, river behaviour and flood control measures that the Indian government had accumulated.

What strikingly emerged was that both the flood-affected and the flood prone areas in India were on the rise, despite higher investments on flood protection measures. It was noted, for example, that the flood-affected area jumped from an annual average of 6.48 million hectares in the 1950s to over 9 million hectares in the 1970s and 1980s; and likewise, the flood prone area leapt from 25 million hectares during the 1960s to about 34 million hectares by 1978.¹⁰ Having thus arrived at a puzzle via statistical reasoning, the SOE3 systematically re-examined the various official and standard narratives and concluded that two 'environmental myths' needed to be dismissed: that a) large dams and embankments could control floods and b) forests acted as sponges in reducing floods and their impacts.

⁸ Floods as a natural disaster event is similarly reproduced in Meena Bhargava, 2007. 'Changing River Courses in North India: Calamities, Bounties, Strategies — Sixteenth to Early Nineteenth Centuries'. *The Medieval History Journal* 10(1&2), pp. 183-208

⁹ State of India's Environment (3), 1991. *Floods, Flood Plains and Environmental Myths*, A Citizen's Report. New Delhi: Centre for Science and Environment.

¹⁰ *Ibid.*, pp.5-6.

Floods, instead, for the SOE3, were ‘not entirely a bad phenomenon’: they brought ‘ecological advantages’ and the seasonal fluvial bursts were integral to river behaviour.¹¹ Bluntly put, ‘even when the Himalayan mountains were uninhabited and the forest cover was intact, major floods visited the valleys and disrupted human civilization’.¹² The SOE3 then put forward two major correctives to the standard narrative:

- a) First, afforestation in the Himalayas would only make a very minor difference to the flood situation in the sprawling plains. There was ‘no evidence to believe that ecological solutions like afforestation will control floods any more than engineering solutions like dams and embankments have been able to.’ Landslides and volatile river behaviour in the higher reaches thus were only to be expected as facts of everyday life.
- b) Second, the continued construction of embankments, a range of obstructions and the steady encroachment of wetlands had blocked off and choked much of the natural drainage patterns in India, and needed to be recognised as being some of the chief causes for aggravating flood impacts.¹³

In effect, the people of the Himalayan region and the hills were being held ‘hostage’ to the presumed ecological needs of the plains.¹⁴ And the only way forward lay in declaring a ‘truce’ with the rivers and adapting to their different moods by ‘living with floods’.¹⁵ While the SOE3 was not intended to be a contribution to the field of environmental history, it nonetheless became an important disruptive outlier to the writings of Guha and Saberwal.

Unsettling the Event: flooding as a Eurocentric conundrum

¹¹ Ibid., p. 147.

¹² Ibid., p.153.

¹³ Ibid., p.148.

¹⁴ For Bangladesh, there is a similar delinking of deforestation in the upland hills with flood intensity in the low lands (deltaic segment) in Thomas Hofer and Bruno Messerli, 2006. *Floods in Bangladesh: history, dynamics and rethinking the role of the Himalayas*, Tokyo, London, Paris: United Nations University Press.

¹⁵ State of India’s Environment (3), 1991, p.153.

Christopher V. Hill in a striking essay on the Bengal rivers in colonial India in the *Environmental History Review* (1990), was the first to draw compelling links between river behaviour, disastrous flooding and what he termed as ‘Eurocentric riparian legislation’.¹⁶ Hill began by underlining how the familiarity of the officials of East India Company in the late 18th century with their own British rivers — steady rainfall and predictable channels — often hobbled their efforts to fully grasp the volatile energies of the monsoon fed rivers in the Bengal region. In particular, they failed to make sense of how the copious rains of the summer months caused the rivers such as the *Ganges*, the *Brahmaputra* and their various arms to repeatedly burst their banks and even dramatically changes channels. These volatile rivers as they began to hurtle from the Himalayan mountains and high hills tore up and carried vast quantities of soil, silt, rocks and detritus, which were then sprayed across the plains and the deltas with devastating impacts on the surrounding lands.¹⁷

For Hill, what really confounded and perplexed many of the company officials was not merely the inherent dynamism of the Bengal rivers but the several contradictory ecological impacts created by fluvial behaviour. For one, when the currents were not too violent, the rivers could end up fertilizing vast tracts of land with their silt deposits. Second, the rivers were capable of swallowing up huge chunks of land within a single season in the course of their meanderings and equally, in a reverse action, could spit out and create altogether new islands or fresh lands.

This ‘capriciousness of the river systems of Bengal’, Hill points out, had a ‘profound affect on land control’.¹⁸ Colonial revenue officials met with much grief as they sought to transfer almost ‘wholesale common English legal practices into the Indian countryside’. Notably, the defining colonial legislation to control land which was instituted as the Permanent Settlement of 1793 — based on exclusive ownership

¹⁶ Christopher V. Hill, 1990. ‘Water and Power: Riparian Legislation and Agrarian Control in Colonial Bengal Author(s), *Environmental History Review*, 14(4), 1990, pp.1-20.

¹⁷ *Ibid.*, pp.2-3.

¹⁸ *Ibid.*, p.7.

over land and a consistent revenue demand — fell apart during efforts to implement it on the ground.

How could a government, determined to instil the sanctity of private property, legislate a land revenue settlement in an area that yearly changed in size, shape, fertility, and even location, on a revenue payment which was to "remain unaltered forever?"¹⁹

Hill's essay insightfully goes on to then discuss the many troubled attempts of the colonial authorities to stabilize their revenue collections by instituting various legislations such as the Bengal Alluvion and Diluvion Regulation (BADA) of 1825 and the Act 9 of 1847. At heart, these attempts were to put in place a portfolio of surveys, inspections and ground level negotiations that could administratively make legible the sudden emergence or disappearance of accretions/lands/islands (*diaras* and *chars*). These legal adjustments, however, Hill notes, ended up only further empowering the colonial landlord (*zamindars*) to rapaciously rack rent their tenants and hide the full extent of their actual holdings. In time, the colonial authorities simply found it both convenient and expedient to entirely abandon any pretence of settling the diara lands with tenancy acts or rights and accepted a full retreat of sorts by preferring a light administrative or 'limited raj' presence in such territories.²⁰

For Hill, the entire British colonial project to settle the riverine plains and deltas of Bengal with Eurocentric notions of property and revenue collection strategies thus came to grief because of the flooding regime. What Hill is particularly keen in noting, is that floods were not solely natural disaster events. Rather, the volatile rivers, he points out, were capable of potentially realizing a range of possibilities: devastation, disruption, creating fresh lands, a fertilizing agent through silt deposition and swallowing up vast chunks of land in a single season. The deltaic flood in British India, consequently, for Hill, was not a singular event that dislocated social and economic arrangements but was instead a complex ecological phenomena with diverse implications for both nature and society.

¹⁹ Ibid., p.8.

²⁰ Ibid., pp.14-16.

Hill further extended several of the above mentioned insights in a subsequent monograph titled *River of Sorrow* (1997), which examined colonial efforts to anchor their rule in the diara belt of Purnia district that was coursed through by the intensely temperamental and volatile *Kosi* river (Bihar, Eastern India). In *River of Sorrow* too, Hill retained much of his previous argument that the British colonial dispensation pursued a ‘policy of intentional neglect’.²¹ That is, in the ecologically dynamic riverine zones the colonial administration mostly yielded control to local landlords, who not only rack rented their tenants but proved skilful in dodging the revenue demand and concealing the actual size of their holdings.

Geomorphologic Process and Flood Control

In contrast to Hill’s claims about the environmental origins of the ‘limited raj’ in the Kosi region, Rohan D’Souza in *Drowned and Dammed* (2006) argued the reverse: British colonial authorities energetically strove to prevent flooding by the Mahanadi river system (Orissa, Eastern India) with infrastructures such as embankments, canals and even a large dam.

This singular quest to suppress, if not eliminate, ‘seasonal inundations’ within the dynamic hydraulic environs of the Orissa delta did not emerge, D’Souza suggests, solely from the colonial imperative for maximising tax collections. Consolidating British rule in Orissa, especially in the initial decades of the nineteenth century, was critically premised upon replacing the pre-colonial social and political arrangements within a distinctly colonial political economy. More precisely, colonial rule sought to create the loyal ‘improving landlord’ through the introduction of bourgeoisie landed property — the Bengal Permanent Settlement Act of 1793 (henceforth, PS). Settling land as exclusive legal ownership, however, also set the context for the British response to the deltaic environment; flooding impacts were overwhelmingly documented either as a loss to private property or as severe disruptions to revenue collections. The

²¹Christopher V. Hill, 1997, *River of Sorrow: Environment and Social Control in Riparian North India, 1770- 1994*, Michigan: Association for Asian Studies, p.161.

bourgeois notion of land, hence, turned the colonial administrators towards viewing the seasonal inundations as ‘natural calamitous events’.

In thus treating all river inundations as wholly natural disaster events, the colonial administrators failed to grasp the ecological significance of deltaic flooding. In particular, the fact that inundations —when not raging as powerful currents —usually deposited fertilizing silt which increased crop yields. In addition to which, it was also becoming apparent to many keen colonial observers that the floods as they unburdened their charge of rock, soil and silt were steadily raising the flood plains above the main channels of the rivers and thereby also building up the entire delta. River flooding consequently behaved more as process rather than as a one-off abnormal disaster event.

Drowned and Dammed argued for reconceptualising floods as geomorphologic process — the net transfer of muddy material from the hills and inner hinterlands to the cavernous deltaic mouth. A process that cultivators in pre-colonial times tapped for silt to fertilise their crops and create an agrarian world that was flood dependent. Colonial flood control measures, on the other hand, amounted to interrupting these recurring waves of erosion and deposition and forced an unprecedented social ecological rupture in the delta— from previously being a flood dependent agrarian regime in the pre-colonial period to becoming instead a flood vulnerable landscape during colonial rule. Deltaic flooding and efforts to controlling them, hence, were not a neutral backdrop or a mere disruption to the rough and tumble of colonial rule in Orissa.²² Rather, flooding and flood control measures through embankments, canals and a large dam were intricately wrapped up with colonial efforts to sustain bourgeois private property in land.²³

Drowned and Dammed by viewing flood control essentially as a top down imposition by colonial administrators and engineers, however, failed to capture the complex negotiations over floods and its varied impacts that played out at the local level. Praveen Singh’s detailed explorations of flood control at the ‘ground level’ in North

²² Rohan D’Souza, 2006 (b). *Drowned and Dammed: colonial capitalism and flood control in Eastern India*, New Delhi: Oxford University Press. pp.20-96.

²³ *Ibid.*, pp.215-25.

Bihar (Eastern India), in fact, advances this much needed corrective to D'Souza's over emphasis on the exclusive and specialised worlds of technical experts and revenue administrators.²⁴

According to Singh, the flood plains that made up colonial North Bihar — stretching between the districts of *Saran* and *Purnea* — were traversed by numerous streams, rivulets and muscular rivers which gave the vast plains the morphological character of an 'in land delta'.²⁵ Originating in the mountainous Himalayas, these rivers crisscrossed the bowl-shaped plains before emptying their waters into the main arm of the Ganga and when filled up with precipitation in the monsoon months they exploded into raging torrents and threw up several temporary land forms called diaras or *chars*. On the reverse, cultivated lands could also be swiftly swallowed up by river action.

Unsurprisingly, given the rapidity with which lands could appear or disappear in the diara zones, intense and bitter conflicts were almost inevitable between cultivators, tenants, *zamindars* (colonial landlords) and revenue collectors. Much of the violence and litigation was further aggravated, as Singh explains, by the haphazard construction of these flood control embankments. While it was widely believed that such structures would protect cultivated lands from the full force of recurring floods, in time, it became apparent that such protection was only being achieved by the transfer of flood currents onto unprotected lands and destroying their crops. Several ecological complications also resulted such as waterlogging from the interruption of drainage lines by embankments, besides becoming the source for endless court battles over whether it was the obligation of the zamindar or that of the colonial state to pay for flood protection.²⁶

²⁴ See Praveen Singh, 2003 'Colonising the Rivers: colonial technology, irrigation and flood control in North Bihar, 1850-1950', PhD Thesis submitted to the Centre for Historical Studies, Jawaharlal Nehru University; Idem., 2008. 'The colonial state, zamindars and the politics of flood control in north Bihar (1850–1945)', *The Indian Economic and Social History Review*, 45(2), pp. 239–59 and Idem., 2011. 'Flood Control for North Bihar: an environmental history from the 'Ground-Level' (1850-1954)' in Deepak Kumar, Vinita Damodaran and Rohan D' Souza (ed.), *The British Empire and the Natural World: environmental encounters in South Asia*, New Delhi: Oxford University Press, pp. 160-80.

²⁵ Singh, 2003 'Colonising the Rivers', pp. 14-56.

²⁶ Singh, 2008, 'The colonial state, zamindars and the politics of flood control in north Bihar', pp. 239-49.

For Singh, in contrast to D'Souza's claims, embankment construction, location and proliferation were essentially driven by local politics and zamindari initiatives rather than decided as top down technical interventions. Flood control infrastructure in the diara tracts was thus spurred onwards essentially by 'vested interests' and alliances forged by zamindars, local civil and revenue officials and irrigation engineers.²⁷ Put differently, the 'environmental context in the locality...became a delicate arrangement ...between various social, technical, administrative and economic forces'.²⁸ In effect, for Singh, flood control became the means for enhancing the power of local elites and marginalised the weak by degrading their unprotected environments. By treating river flooding as a geomorphologic process D'Souza and Singh could argue that the project of flood control in Eastern India was ideologically driven and intended to create and defend bourgeois landed property. Flooding as process, hence, helped reveal colonial imperatives for transforming environments, the play of infrastructure as power at local levels and how dominating rivers became crucial to anchoring the British presence in Eastern India.

This perspectival turn to geomorphologic process, soon enough, spurred studies along two particular themes in environmental histories of South Asia: a) the impacts of the flooding regime of the Brahmaputra river in the making of a colonial agrarian and social world and b) debates over the role of hydraulic volatility in constraining colonial revenue taxing strategies in the deltaic Eastern Bengal.

Flooding and the Making of Colonial Society in Assam

The Brahmaputra river that drops precipitously from the Eastern flanks of the Himalayas and hurtles down the narrow flood plains of the state of Assam is today substantially embanked on either side of its many braided channels. The Brahmaputra, nonetheless, still remains the source for some of the most vicious and devastating flooding in the valley with heavy losses brought about almost annually to life and property.

²⁷ Ibid, p.252.

²⁸ Singh, 2011, 'Flood Control for North Bihar', p.161.

Ritupan Goswami's PhD dissertation (2010), submitted to the Centre for Historical Studies at the Jawaharlal Nehru University (New Delhi), was arguably the first attempt to discuss the Brahmaputra's floods as a concern for environmental history.²⁹ The central plot, as spelled out in a subsequent publication, was to 'historically examine the metamorphosis of this benevolent river' from earlier 'making cultivation possible by fertilising the land with silt' to now overwhelmingly being viewed instead in current times as a 'problem' river.³⁰ Goswami, in other words, intended to underscore that flooding by the Brahmaputra river in the Eastern Indian state of Assam was not simply a natural event but a hydraulic feature that was historically mediated by a range of political and social interventions.

According to Goswami, three distinct ecological zones lay on either side of the Brahmaputra river. The first zone extending for a few kilometres away from the banks of the river's channel is referred to as the *Char* or *Chaporis* areas: made up mostly of the fluctuating flood plain in which annual floods often throw up islands or swallow up large chunks of existing lands. The riverine communities such as the *Mishings*, *Kaivartas* or *Nadiyals* mostly inhabited these marshy and temporary chars and chaporis till late into the nineteenth century. These socially marginal groups mostly crafted their subsistence through a type of risky cultivation (*Pam*) of rice and cash crops (mustard and pulses). The second zone or *Rupit* lands — beginning from where the chaporis or char lands ended — were relatively flood immune lands and were cultivated by the dominant and powerful castes, who mostly grew the famed transplanted rice of the valley. The final stretch or third ecological zone comprising the submontane tracts that hugged the foothills were largely populated by indigenous tribal communities.

Interestingly enough, Goswami points out, that during much of the colonial period the annual floods were more or less viewed both by the local communities and

²⁹ Ritupan Goswami, 2010. 'Rivers and History: Brahmaputra Valley in the last two Centuries', PhD dissertation, Centre for Historical Studies, Jawaharlal Nehru University.

³⁰ Ritupan Goswami, 2012. 'Floods and Fields in the Brahmaputra Valley: 20th Century Changes in Historical Perspective' in Sumi Krishna (ed), *Agriculture and a Changing Environment in Northeastern India*. New York, New Delhi: Routledge, pp. 27-52.

government officials in a positive light and considered helpful for rice cultivation as the annual flexing of the river caused the deposition of fertilising silt in the Brahmaputra valley. The riverine communities, in fact, were well attuned to handling the recurring inundations by devising innovative cropping strategies and remaining mobile enough to temporarily abandon their holdings and return to the chars when the flood waters retreated. By the last quarter of the nineteenth century, however, colonial officials began to dramatically change their previous understanding and now urged instead for reclaiming the uncultivated ‘wastelands’ within the riverine tracts of the Brahmaputra valley.

From 1910 onwards, colonial officials aggressively encouraged peasants (also victims of high rents and land exhaustion) to move from their villages in East Bengal (mostly Mymensingh) in order to be then settled within the riverine tracts ‘on the north and south banks and the chars and chaporis from the westernmost district of Goalpara through Darrang, Kamrup and, Nowgong to parts of Lakhimpur’.³¹ By the second decade of the 20th century, Goswami inform us, the government decided to even systematise and direct the settlement of these immigrants through a ‘colonization scheme’. Since the new immigrants originated from the flood prone deltaic tracts in Bengal the colonial officials confidently presumed that these inundation hardened peasants would be quick to adapt to the seasonal flooding. The annual ferocity of the Brahmaputra, however, proved to be so full of surprises that the immigrants were soon found to be losing their crops and having their lands regularly cased in sand from violent flood effluxes. Soon enough, the British administration, found themselves on a treadmill of sorts in having to repeatedly shuffle the flood affected communities to more stable and relatively flood immune tracts.

By the 1940s, a clear and discernible shift in the official view towards the annual flooding regime of the Brahmaputra became visible. Henceforth, flood imagery, Goswami observes, tended to be evoked in alarmist and adversarial notions such as ‘disaster, destruction, problem’ and, inevitably, a ‘curse’ of nature. This stark perceptual transition, Goswami is keen to underline, was not a result of a natural shift

³¹ Ibid., p.35.

in the Brahmaputra's behaviour but borne more profoundly by a change in the 'production relations within society'.³²

In an article in the *Modern Asian Studies* (2015), Arup Jyoti Saikia, on the origins of flood protection and control in Assam chose to interpret the immigration story differently.³³ For Saikia, the 'arrival of millions of small holding peasants' from East Bengal into the flood plains of the Brahmaputra were driven in large measure by colonial efforts to commercialize and increase jute (*Corchorus olitorius* and *Corchorus capsularis*) production. Jute, Saikia explains, especially from the last quarter of the nineteenth century onwards, became critical for the global packaging industry and was fast becoming one of the highest export earners for the British India government. This 'golden fibre', it was repeatedly noted, was ideal for high flooding conditions as it was able to grow as high as 12 feet.³⁴

But the 'reclamation' of the riverine tracts for growing jute also increased the flood plains vulnerability to sudden and intense inundation. Inundations that were further aggravated by the continuing effects of the earthquake of 1897 in the Brahmaputra valley, which had caused the bed of the river to rise and sharply altered the movement of silt and sand. In 1929, Saikia tells us that an unusually destructive flood ravaged the valley and finally brought home to the colonial authorities that much of the highly commercialised jute crop was dangerously situated in the low lying flood prone zones. By the early 1940s, jute production, nonetheless, reached an 'all-time high' and Assam soon became the third largest jute producer in British India.³⁵ The mix of immigration, jute production and crop losses from recurring floods, inevitably, for Saikia, compelled the independent Indian government by the late 1950s to begin heeding the advice of several river technocrats, who were by now loudly arguing for

³² Ibid., p.48.

³³ Arup Jyoti Saikia, 2015, 'Jute in the Brahmaputra Valley: The making of flood control in twentieth-century Assam', *Modern Asian Studies*, 49 (5), pp.1405–1441.

³⁴ Ibid., pp.1410-11.

³⁵ Ibid., p.1420.

erecting flood control embankments for preventing flood overspill to protect agricultural cultivation and human lives.³⁶

While Saikia argued that comprehensive flood control in colonial Assam was driven by British efforts to create the ‘empire’s eastern-most jute frontier’, he kept in step with the earlier claims of D’Souza, Singh and Goswami that the deltaic tracts in Eastern India prior to colonial rule were overwhelmingly harnessed for flood dependent agriculture. In the Brahmaputra plains too, Saikia reiterates, that cultivation in pre-colonial societies viewed the annual floods as having ‘dynamically united the river, its islands, and floodplains’ — by bringing nutrients, fertilizing soils, flushing stagnant waters, supporting fisheries and destroying mosquito breeding grounds.³⁷

The dominant narrative that emerges from the above environmental histories on flooding in the Brahmaputra river, the various interfluves of the Ganges and the Mahanadi system is that British colonial interventions ended up arresting geomorphologic process by the introduction of landed property and the intensive commercialization of crops. The colonial agrarian world, in other words, according to the authors, could only be created and sustained by flood control infrastructure and by agricultural production that remained flood vulnerable rather than flood dependent.

In his *The Bengal Delta* (2010), however, Iftekar Iqbal argued that the implementation of British flood control measures were not widespread across the deltaic tracts.³⁸ And virtually by default, therefore, neither was the Permanent Settlement implemented in a good part of Eastern Bengal (much of which is today’s Bangladesh). For Iqbal, the sheer ferocity of the Ganges river system, especially in the *Sundarbans* (the mangroves) forced the British to entirely retreat from reproducing their signature agrarian order. Instead of attempting to institute private property in the volatile delta, colonial authorities actively sought to encourage the ‘occupancy *raiyats*’ (independent

³⁶ Ibid., p.1430.

³⁷ Ibid., pp.1413-17.

³⁸ Iftekar Iqbal, 2010. *The Bengal Delta: ecology, state and social change, 1840-1943*, UK, New York: Palgrave Macmillan.

peasants) to cultivate rice and jute in the marshy and estuarine zones.³⁹ Despite this more or less hands off approach, the hydraulic integrity of the river systems in the Eastern Bengal delta were nonetheless disrupted with the introduction of the railways in the region. Notably, with the crisscrossing of river channels by ill planned railway tracks and by numerous poorly designed culverts and bridges the deltas intricate natural drainage patterns were invariably interrupted. And amidst the steady clogging of the fluvial circulation regime, water hyacinth (*Eichhornia*, origins in South America) began to proliferate and fatally ended up deoxygenating and fouling a vast number of wetland bodies.⁴⁰

But were British revenue calculations in Eastern Bengal truly thwarted by the rivers? Put differently, could colonial rule minus the Permanent Settlement hold on only as a highly negotiated and weakened presence, approximating a version of the ‘limited raj’? Not so, however, argued Nitin Sinha, whose essay ‘Fluvial Landscape and the State’ was written up to specifically take issue with Iqbal’s neat claims.⁴¹ Upon a careful and detailed review of British revenue collection strategies in the middle Gangetic diaras (Bihar) from the late 18th and early 19th century, Sinha could conclude the opposite: that the colonial government, in fact, deliberately chose to opt out of implementing its property based ‘standardizing’ revenue practices in the volatile riverine regions. This striking decision Sinha suggests was mainly brought on by the fact that colonial officials found speculative farming exceedingly profitable in the middle Gangetic diaras as they were often able to force cultivators to accept short term leases and seasonally reassess the revenue paying cultivable areas. In sum, Sinha surmised that in the middle Gangetic region the colonial government rather than being defeated or dissuaded by the ferocity of raging rivers ended up instead harnessing the volatile ecology to good effect by further refining their speculative capacities and even managed to craft a special bureaucratic agility to adapt, adjust and enhance their revenue collections. In effect, deltaic flooding did not halt the colonial project in its tracks, as Iqbal claimed. Rather, river volatility, for Sinha, helped spur a range of

³⁹ Ibid., pp. 18-66.

⁴⁰ Ibid., pp. 117-60.

⁴¹ Nitin Sinha, 2014. ‘Fluvial Landscapes and the State: Property and the Gangetic Diaras in Colonial India, 1790s-1890s’, *Environment and History*, 20, pp. 209-237.

colonial administrative innovations and bureaucratic abilities for maximising their revenue agendas.

Clearly through a survey of the studies and debates by Hill, D'Souza, Singh, Goswami, Saikia, Iqbal and Sinha, flooding opened up as a geomorphologic process rather than a singular disaster event could help explore and situate colonial flood control measures within larger political and economic concerns that related to the creation of private property in land, the drive to extend the commodity frontier, the ecological limits for maximising revenue collections and the troubled efforts to consolidate landlordism.

Pulses of Muscle and Fin

As early as the 1980s — while environmental historians of South Asia were yet to evolve their ideas about rivers as a geomorphologic process — river ecologists the world over were already actively debating the notion of the 'flood pulse': arguing that flood intensity and flow variability, especially within large tropical river systems, were critical to forging a vast number of complex ecological interactions between the floodplains, wetlands, swamps and estuarine zones. The seasonal flooding or pulsing regimes, in particular, it was pointed out, was crucial to connecting fluvial ecosystems and maintaining intricate biological webs. Rivers, in other words, were more than raging geological agents that sculpted landscapes through waves of erosion and deposition.⁴² And at the heart of such efforts to reconceptualise rivers as a biological

⁴² Junk, Wolfgang, Peter B. Bayley, and R. E. Sparks, 1989. 'The flood pulse concept in the River-Floodplain Systems' in D.P. Dodge (ed.) *Proceedings of the International Large River Symposium*, Canadian Special Publications in Fisheries and Aquatic Sciences, 106, pp. 110-127; J. R. Sedell, Ridley J.E. and Swanson F.J. 1989. 'The River Continuum concept: a basis for the expected ecosystem behaviour of very large rivers?', in D.P. Dodge (ed.) *Proceedings of the International Large River Symposium*, Canadian Special Publications in Fisheries and Aquatic Sciences, 106, pp. 49-55; K. Tockner, F. Malard and Ward J.V., 2000. 'An extension of the flood Pulse Concept', *Hydrological Processes*, 14, pp. 2861-2883 and also see Brij Gopal, 2013. *Environmental Flows: An Introduction for Water Resources Managers*, New Delhi: National Institute of Ecology.

lay the significance of fish population dynamics and the fluvial contexts for sustaining aquatic diversity.

As pointed out earlier in this essay, British colonial efforts in deltaic Eastern India through the course of the long nineteenth century were dominantly aimed at trying to harness the Gangetic river system as an economic resource — either for navigation or for perennial irrigation.⁴³ Seasonal flooding, in such a narrow economic and technical perspective, consequently, appeared essentially as natural disaster events. Unsurprisingly, therefore, colonial authorities remained woefully blinkered as well about the complex ecological weave between fish, flooding and their linkages with what Deb and Haque aptly describe as the social domain of ‘fishantry’— marginal artisanal/small-scale fishers, who in contrast to the land based peasantry critically depended upon the river’s flow variability.⁴⁴

Gunnel Cederlof in *Founding an Empire* (2014) notes that the early British Company officials in Eastern India despite their otherwise careful and detailed documentation on social and economic realities on the ground, nonetheless, overwhelmingly failed to acknowledge the dietary connections between river fish (protein) and rice cultivation (carbohydrates). Fishing even remained largely untaxed

⁴³ See Elizabeth Whitcombe, 1972. *Agrarian Conditions in Northern India: the United Provinces under British Rule (1800-1900)*, Vol. I, Berkeley: University of California Press; Ian Stone, I., 1985. *Canal Irrigation in British India: perspectives on technological change in a peasant economy*, Cambridge: Cambridge University Press; Imran Ali, 1988. *The Punjab under Imperialism, 1885-1947*, Princeton: Princeton University Press; David Gilmartin, 1994. ‘Scientific Empire and Imperial Science: colonialism and irrigation technology in the Indus basin’, *Journal of Asian Studies*, 53 (4), pp. 1127-49; David Gilmartin, 2015. *Blood and Water: the Indus river basin in modern history*, Berkeley: University of California Press; Rohan D’Souza, 2006(a). ‘Water in British India: The Making of a ‘Colonial Hydrology’’, *History Compass*, 4/4, pp.621-8; Daniel Klingensmith, 2007. *‘One Valley and a Thousand’: Dams, Nationalism and Development*, New Delhi: Oxford University Press ; Daniel Haines, 2013. *Building the Empire, Building the Nation: Development, legitimacy, and hydro-politics in Sind, 1991-1969*, Karachi: Oxford University Press.

⁴⁴ Deb, A. Krishna and C. E. Haque, 2014, ‘Beyond the Lens of Peasantry’: Theoretical Basis of ‘Fishantry’ as a Distinct Social Domain (Part 1), *International Journal of Social Science Research*, 2 (1), pp.77-101.

and when a duty was finally imposed by the colonial authorities it was limited to the fish that were exported.

As one officer complained, when the land was under water people simply entered the fields and caught the fish. No revenue could be got from such activities. Thus, the daily fishing that sustained people never entered the revenue files...⁴⁵

Even as fish were erased in colonial land revenue – centric imaginings, the reality of rivers as a biological force began to unsettle engineering narratives that pressed for dams, weirs and diversion structures such as *anicuts* (temporary bunds/embankments). Sometime in August of 1867, the then Secretary of State for India sent a despatch to the Madras Government calling attention to an uncharacteristic communication from the much celebrated colonial irrigation engineer, Sir Arthur Cotton (1803-1899).⁴⁶ The despatch flagged Cotton's fears about the probable 'injury to the coast [al] fisheries' from the irrigation works that he had constructed on the *Kaveri* (1834-36), *Krishna* (1852-57) and the *Godavari* (1844-46) rivers. On 27th March 1868, Surgeon-Major Francis Day (1829–1889), the then Inspector General of Fisheries, was tasked to examine the impacts of these anicuts or weirs on fisheries in the Madras Presidency, Orissa and Lower Bengal, British Burma and at the end of 1869 the brief was even extended to the distant Andaman islands.⁴⁷

Day's report, submitted to the Madras government in 1873, made for arresting reading. While carefully detailing, just as Cotton had feared, how weirs, under sluices and dams were indeed hindering fish migration and destroying several fish runs along the Eastern coasts, his conclusions, more significantly, challenged the reigning civil engineering orthodoxy on rivers.⁴⁸ Unlike the quest to classify rivers according to their irrigation potential, for Day flows needed to be re-categorised according to what they offered for sustaining fish populations, breeding aquatic diversity and maintaining fish

⁴⁵ Gunnell Cederlof, 2014., *Founding an Empire on India's North Eastern Frontiers (1790-1840): climate, commerce, polity*, New Delhi : Oxford University Press, p.21.

⁴⁶ Lady Hope, 2005 [1900], *General Sir Arthur Cotton: his life and work*, New Delhi: Asian Educational Services (Reprint), pp. 77-88.

⁴⁷ Surgeon-Major Francis Day, (Inspector General of Fisheries), 1873. *Report on the Fresh Water Fish and Fisheries of India and Burma*, Calcutta: Office of the Superintendent of Government Printing, p.1.

⁴⁸ *Ibid.*, pp. 7-13.

habitats. Reconceptualised thus, three types of rivers in British India and neighbouring Burma were described and assessed:

- a) Emerging from hills with ‘Alpine sources’ [snow fed]. These rivers which descend from the Himalayas with ‘spasmodic’ and torrential flows required their fish species to be equipped with adhesive suckers.
- b) Emerging from hills but monsoon fed such as the Krishna, Godavari and rivers flowing from the Western Ghats and the Nilgiri ranges. These rivers with their relatively warmer waters and with flows subject to sudden rise and falls during the rains enabled a variety of fish to ascend and descend the hills for spawning.
- c) The third comprised the huge river systems such as the Indus, Ganga, Brahmaputra and the Irrawaddy that coursed across the vast flood plains and were made of up of ‘impetuous’ currents during the monsoons that allowed fishing only at the ‘edges’.⁴⁹

The three distinctions for Day explained how the peculiarity of a flow regime could affect fish breeding habits and shape their migratory patterns.⁵⁰ But at the heart of this new understanding about the meaning of river flows was the effort to emphasise how the monsoons were critical to energising a range of links between fish migration and breeding and how their movements to spawn and complete migratory journeys defined several integral ecological and fluvial rhythms for the entire sub-continent.⁵¹ Floods in such assessments, consequently, played out as a type of biological pulse in which a broth of soil, silt, vegetation, sediment, muscle, fin, ova and fish was flushed into innumerable channels, drainage lines, depressions, rice fields, tanks and capacious rivers systems. In a further enquiry in 1906 by K.G. Gupta, Member Board of Revenue, Francis Day’s notion of Eastern India turning into a fish hatchery during the monsoons was further supplemented with an equally vivid description:

During the rains i.e. from July to September, a great part of the country [Bihar and Bengal] is under water and may not be inappropriately regarded as one vast inland fishery, even the rice fields attracting swarms of fry and small fish. By a wise

⁴⁹ Ibid., pp.5-6.

⁵⁰ Ibid., pp.4-6.

⁵¹ Ibid., pp.5-7

provision of Nature this is also the period when most of the fresh water species spawn.⁵²

Several studies and enquiries followed in the early decades of the twentieth century as perspectives about fisheries and floods increasingly collided against the civil engineering narrative on the need for perennial irrigation. T. Southwell the Deputy Director of Fisheries Bengal, and Bihar and Orissa in a report of 1915, for example, acknowledged even more forcefully that intricate and delicate linkages existed between the monsoons, fisheries and livelihoods:

These fish occur in the rivers and their fry are extensively cultivated in tanks. .. We have noted that these fish breed during the rains. At that time the Province [Bihar and Bengal] may be said to be flooded. Consequently tremendous number of eggs and young fish –probably the greater part of the total spawn in the rivers – escape into the paddy-fields...They are extensively caught by the poorer ryots [peasants] from the Nalas [drains], paddy fields and tanks... The eggs are buoyant and float on top of the water such as the Chital (*nototerus chitala*) and the Boali (*wallago attu*).⁵³

Clearly, the dynamic ecological weave between the monsoons, rivers, wetlands, fish migratory routes, aquatic habitats and spawning grounds meant that much of Eastern deltaic India was made up of soil and water admixtures rather than neatly separable into distinct domains of land and flow.

But are rivers when grasped principally as a biological force impossible to harness for irrigation? Put differently, could a flood dependent irrigation overcome the ecological challenges that were posed by the colonial bias for perennial irrigation, which required standardised and controlled flows?

The first considered and systematic reflections by a British engineer on ‘inundation irrigation’ in the Indian subcontinent was put forward by William Willcocks (1852-

⁵² K.G. Gupta (Member, Board of Revenue), 1908. *Results of Enquiry into the Fisheries of Bengal and into Fishery Matters*, Calcutta: The Bengal Secretariat Book Depot, p.5.

⁵³ T. Southwell (Deputy Director of Fisheries Bengal, and Bihar and Orissa), 1915. *Report on Fishery Investigations in Bengal and Bihar and Orissa with Recommendations for Future Work*, Calcutta: The Bengal Secretariat Book Depot. pp.8-9.

1932). Born in India and having survived the events of the ‘Indian Sepoy Mutiny’ of 1857, Willcocks launched himself through the Indian Irrigation Service and acquired a sizable reputation for his services in Egypt and Mesopotamia (modern day Iraq).⁵⁴ In the twilight years of his career, however, he chose in early March of 1930 to deliver four strikingly provocative lectures at Calcutta University. Despite a lifetime spent in espousing the ideals and virtues of modern or perennial canal irrigation, at Calcutta, Willcocks stoutly argued the opposite. In a drastic reassessment, he now claimed that a large network of ‘overflow canals’ had previously traversed the deltas of the Ganga and Damodar basins and irrigated almost 7,000,000 acres of land. These overflow canals, furthermore, comprised a vast complex and vibrant network for enabling an inundation based or flood based irrigation strategy, which following British rule had been physically erased from the province of Bengal.

These broad and shallow inundation canals were specifically designed to tap the silt laden crest waters of the flooding rivers. Willcocks also noted that for the cultivators the ‘rich red water of the river and the poor white water of the rainfall’ needed to be combined for growing crops. Inundation irrigation, thus, meant that water had to be augmented with the fertilizing properties of silt for agriculture to be kept sustainable in the delta.

... if your rice fields have been irrigated by rain water alone, they are weak and cry for irrigation in October with excessive and costly supplies of poor river water If however you have irrigated your rice fields with rain and river water mixed together in the early months of the monsoon when the river water is rich and full of mud, you so strengthen the plants of rice that they resist the hard condition of an early failure of the monsoon in a way rice irrigated by rain water alone has no knowledge of. River water in the early months of the floods is gold.⁵⁵

⁵⁴ For Willcocks' experiences in Egypt, especially his bitter fight with Sir Murdoch Macdonald over the flow data records of the Nile river see Herbert Addison, 1959. *Sun and Shadow at Aswan*, London: Chapman and Hill. pp.69–78. For an autobiographical sketch see William Willcocks, 1935. *Sixty Years in the East*, Edinburgh; London: W. Blackwood. Also see Canay Ozden, 2014. ‘The Pontifex Minimus: William Willcocks and Engineering British Colonialism’, *Annals of Science*, 71(2), pp. 183–205.

⁵⁵ William Willcocks, 1984 [1930]. *Ancient System of Irrigation in Bengal and its Application to Modern Problems*, Delhi: B.R. Publication, p. 32.

On these muddy waters, moreover, bobbed a multitude of fish eggs which floated and drifted into an intricate fluvial mesh, made up of subsidiary channels, drainage lines, tanks, depressions and rice fields. These eggs soon hatched into young fish and then voraciously fell upon and ‘lived on’ the mosquito larvae and thereby eliminated or diminished much of the potential malarial fevers in an otherwise moisture saturated and waterlogged terrain. Overflow irrigation, moreover, helped steadily build-up the delta by widely diffusing silt and depositing sediment across the alluvial fans. In sum, for Willcocks, inundation irrigation was, in essence, an ecologically regenerative practice as it mimicked or extended rather than worked against the geomorphologic and biological momentum that was brought on by the variable flood pulses. Inundation irrigation as an amplification of a deltaic flooding rhythm, thus, fertilised the rice fields, nourished the soils with fresh deposits of sediment and enabled vast fish populations to crisscross the fluvial breadth of the delta.

While Willcocks’ lectures, undoubtedly, sought to radically revise the meaning and relationships between floods and irrigation in the Bengal delta, his provocative formulations, nonetheless, largely retained the usual distinctions between soils and flows. That is, Willcocks still seem to subscribe to the view that deltaic flooding was overwhelmingly a fluvial phenomenon that was driven exclusively by the action of deltaic rivers. This familiar separation between land and water or soils and flows, however, has been recently compellingly unsettled by the geographer Kuntala Lahiri-Dutt and the environmental historian Gopa Samanta in their recent jointly authored monograph *Dancing with the River* (2013) — which explored the ecological and social worlds of the people inhabiting the *char* regions in the Ganga delta.⁵⁶ For Lahiri-Dutt and Samanta, the chars cannot be summed up as being an admixture of land and water. Rather, these ambiguous, uncertain and tentative ecological forms need to be grasped as ‘hybrid environments’ that ‘destabilize’ the simple land/water dichotomy and open up the possibility for understanding them as ‘lived-in’ landscapes that have been shaped by the cultures and material practices of the people inhabiting them.

⁵⁶ Kuntala Lahiri-Dutt, K. and Gopa Samanta, 2013. *Dancing with the River: people and life on the chars of South Asia*, Yale: New Haven & London.

As pieces of accumulated sand and silt, floating on and rising above the water of the riverbeds, they [chars] are literally embedded in water, enmeshed into the riverine environments. ... a divide between land and water as two different elements belonging purely within the physical domain [has] robbed the chars of their histories, extracted them from their social contexts of human experience, and essentialized them.⁵⁷

For Lahiri-Dutt and Samanta the char dwellers, in fact, through a creative mix of 'risky' livelihood strategies such as subsistence agriculture, wage labour, livestock rearing, fishing, informal trading and mobility have been able to craft possibilities for place-making in hybrid environments.⁵⁸

Environmental histories that can conceptualise floods as biological pulses, consequently, can help us grasp how biological webs, livelihood strategies and a range of human material practices have both made as much as they have been able to harness volatile deltaic environments.

Concluding Remarks

To briefly reiterate: in this essay, I have underlined how three major frameworks have thus far described and discussed the notion of floods in environmental history writings on South Asia. The initial understanding that floods were entirely a natural disaster event and therefore outside the pale of historical and sociological analysis has been substantially challenged. From the late 1990s, especially, a number of studies began to explore how flooding proved critical to the shaping of several political, economic and social outcomes. In particular, these studies were able to convincingly argue that British colonial efforts, for example, to institute the Permanent Settlement of 1793 in Eastern India was given much grief not only because of the internal legal contradictions within the Act but essentially as the latter failed to contend with the ecological dynamism brought on by deltaic flooding. At heart, in these writings, I point out, the notion of the flood was thus no

⁵⁷ Ibid., 2013, pp.7-8.

⁵⁸ Ibid., pp.135-207; also see Imtiaz Ahmed, *People of many Rivers: tales from the riverbanks*, The University Press Limited: Dhaka, Bangladesh, 2015.

longer treated as a natural disaster event. Rather, these studies or revisionist environmental histories were able to develop the notion of the deltaic flood as a geomorphologic process — in which the annual inundations were part of a larger process for building up the delta and therefore was critical to land formation in the region. Floods as geomorphologic process, hence, could no longer be simply treated as an ahistorical noisy environmental backdrop to the real drama of political economy but rather as a fluvial process that was central to how power and politics played out.

The third and final framework in which floods were conceptualised as biological pulses helps us open up for exploration, in particular, fisheries, fish migratory patterns, inundation irrigation and livelihood strategies and the risky cultures of the people who inhabit the diaras and chars. At heart, is the possibility of understanding flooding as being but one element of a ‘hybrid environment’ — a contingent continuum between land and water. While floods as a biological pulse is still an incipient formulation, it, nonetheless, pushes environmental histories on South Asia to move beyond the usual hard binaries of treating land/water or forests/rivers as distinct environmental domains. Instead, deltaic flooding as a biological pulse throws up the possibility for exploring the fluid and uncertain worlds of riverine communities and their intricate entanglement with fluvial biological webs.

Floods in the environmental histories literature on South Asia, thus, can no longer be made to squarely fall within the exclusive realm of disaster histories. If anything, floods in South Asia opens up the urgency to explore and debate the fate of hybrid environments, amidst growing concerns about climate change, global warming and environmental politics in the epoch of the anthropocene.