A Study of Impact of Industrial Pollution in Ganga River

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Abstract- India and Bangladesh have signed the Ganga/Ganges River Water treaty in December 1996. The GangaWater treaty is cited as one of the important examples of peaceful negotiations between upstream and downstream neighbors in South Asia. The present article revisits the Indo-Bangladesh Ganga Waterpolitics and understands the political dynamics which led to the signing of the treaty between the twocountries. The reading of the negotiation process since beginning to the present time suggests thatthough the technical nature of the problem remains the same, a change in domestic politics facilitates orobstructs the negotiation process. Since India and Bangladesh share another 53 rivers, it is important tolearn a successful mechanism from the negotiation of 1996 which can be applied to other river issues.The article is based on primary as well as secondary sources.

Keywords- Ganga Dispute, politics of river water, 1996 Treaty, operation of the Ganga Treaty, domestic politics,Indo-Bangladesh hydrological relationship

I. INTRODUCTION

The Bay of Bengal (Figure 1) is the largest bay in the world by area, which covers 2,172,000 squarekilometers and it reaches a depth of up to 5,258 meters. It extends from Ganges/Brahmaputra deltaaround 20°N latitude to south around 7°S latitude, with a maximum width of about 1000 km at around15°N latitude (Sarma et al. 2000). Many major rivers of India and Bangladesh flow into the Bay ofBengal: in the north, the Padma (distributary of Ganges), Meghna and Brahmaputra River, and in thesouth Mahanadi River through the Mahanadi River Delta, Godavari River, Krishna River, Irrawaddyand Kaveri River. The Ayeyarwady River of Myanmar also flows into the bay. The Sundarbans forest,one of the largest mangrove forests in the world, is formed at the delta of the Ganga, Brahmaputra andMeghna rivers on the Bay of Bengal. Although the geographical setting of The Bay of Bengal is similarto The Arabian Sea, it is widely different from the Arabian Sea in terms of physical, chemical, andbiological features (Brown, 2005). At the same time, The Bay of Bengal is characteristically differentfrom the other tropical basins of the world primarily due to the huge amount of freshwater runoff (~1.5x 1012 m3 per year) and the associated sediment load (billions of tones) it brings in to the basin (Kumar et al., 2006). In the Northern Bay of Bengal the bathymetry is shallow, and depth to the seabed occurs less than 2000 meters.

Fig.1:

According to Sarma et al. (2000), in the Bay of Bengal, ocean current, from January to October, isnorthward flowing, and in the northern part of the bay a clockwise circulation pattern is observed whichis called the 'East Indian Current'. Monsoon moves in The Bay of Bengal in a northwest directionstriking the Nicobar Islands, and the Andaman Islands by end of May, then the North Eastern Coast ofIndia by end of June. During the remainder of the year, a counterclockwise current is flowingsouthwestward, and the circulation pattern is called the 'East Indian Winter Jet'. The months ofSeptember and December are considered as 'very active weather' months in the Bay of Bengal whichproduces severe Cyclones and largely affect southern Bangladesh, western Myanmar and eastern India.

It is a reality that, The Bay of Bengal is one of the least scientifically explored areas of the worldoceans, although the oceanic features are quite diverse. Residual current (net current after the tideinduced current is excluded) plays primary role for the net transport of scalars (temperature, salinity,nutrients and contaminants) as well as suspended and bottom sediments which in turn dictate theerosion and accretion process of the estuary and coastal islands. Future climate change inducedmeteorological features, sea level rise and altered hydrologic conditions are expected to change thehydro-climatic conditions of the Bay of Bengal, significantly. The present research focuses on thevariation of salinity distributions and residual flow during non-cyclonic conditions in the Bay of Bengalunder future hydro-meteorological conditions.

II. CONFRONTING THE HYDROSOCIAL LITERATURE WITH RIVER SEDIMENTS

The materiality of rivers

Our approach positions itself within the 'political ecology of water', a critical literature thatstudies the social and political dimensions of water (Loftus, 2009). This literature mainlycriticizes apolitical analyses of water-related phenomena. Case studies related to drought forexample show how power relations affect access to water as well as scientific knowledgeproduced about water, while water scarcity gets 'naturalized' in discourses (Budds, 2009;Kaika, 2003; Mehta, 2011). In this vein, the concept of hydrosocial cycle emerged within thefield to emphasize the internal and dialectical relation between water and society, drawingattention to 'how water is made known and represented, and its effects' (Linton and Budds,2014: 177). Such analysis may for example reveal the political processes behind thescientifically produced 'Minimum Flow Requirements' of the Garonne River in southwesternFrance and their effects on water control decisions (Fernandez, 2014).

Conversely, the role of the materiality of water is also acknowledged in this framework.'We contend that the hydrosocial cycle comprises a process of co-constitution as well asmaterial circulation' (Linton and Budds, 2014: 170). In Linton and Budds' terms, watermateriality is characterized by its 'agential role' in hydrosocial relations (2014: 176). Forexample, hydrologic processes produce material flows of water but may also be agents ofLafaye de Micheaux et al. 643social, economic or cultural reorganizations (like after a severe flood); other studies alsoshowed the agential properties of assemblages of water and technology/infrastructure(Barnes, 2012; Birkenholtz, 2009; Swyngedouw, 2007). Political ecology of water, andwithin it, hydrosocial analysis, have been applied to study rivers and river basins(Alatout, 2012; Bakker, 1999; Matthews, 2012; Molle, 2005; Norman and Bakker, 2009;Peterson, 2000; Sneddon and Fox, 2006; Vogel, 2012 and for hydrosociality, Bakker, 2000;Boelens, 2014; Bouleau, 2014; Bourblanc and Blanchon, 2014; Budds, 2009; Budds andHinojosa, 2012; Fernandez, 2014; Hommes et al., 2016; Mollinga, 2014; Perreault, 2013;Swyngedouw, 2007). However, to date, we observed that in river contexts, hydrosocialstudies often restrict considerations of the materiality of rivers to water flows. Forinstance, the sediments that rivers carry, or the biodiversity they shelter, are often notconsidered or only briefly taken into account. The perspectives of dominant actors andavailable data often promote a view of river waters as a liquid resource only. Lack ofavailable data on river ecosystems may be a constraint for researchers. For example, intheir hydrosocial study in Peru, Budds and Hinojosa (2012) mentioned that the impactsof mining extraction on the ecology of headwaters are scarcely documented. Mollinga's(2014) study of an irrigation canal in south India also corroborates this argument as heshowed that singularising the meaning of river water in productive terms was the result of astate strategy.

Some scholars however mobilize more than water flows in their analyses. Bouleau (2014)highlights the mutual shaping of scientific categories used to describe hydrosystems, likebioindicators such as diatoms or habitats such as wetlands, and the waterscapes themselves;

Perreault (2013) shows the significance of distinguishing different 'forms of nature', like sediment and water, and different qualities, like clean or contaminated, to reveal instances of local communities' dispossession in a mining region of the Bolivian Andes. This attentionto materiality is also stressed by Birkenholtz (2016) in his study of water transfers from ruralto urban areas in Rajasthan, showing that water's variability, spatially and temporally, affects hydrosocial relations as well as capital accumulation.

Drawing on these works and on critical physical geography that calls for integration of physical and human geographies while acknowledging the politics of environmental science (Lave, 2015), we seek to enrich hydrosocial analyses with greater attention to materiality of rivers 'over space and time'. In this regard, we choose to focus here on the sediment component of rivers.

The emergence of capitalist agriculture in West Bengal

Barddhaman district and adjoining areas have received migrant workersfor rice cultivation work for well over a century (Rogaly 1999). However,in the last thirty years there has been a big increase in the number ofpeople migrating into the sub-region seasonally, with estimates of asmany as 500,000 people in a single season. Moreover, the number ofseasons in which employment in rice work is available for migrants hasdoubled since the 1970s with the widespread adoption of an additionalsummer rice crop (boro) (Rogaly et al. 2001).

The large number of people migrating in the 1999-2000 seasons, whenfieldwork for this study was carried out, reflect a specific historicalmoment. The growth in the number of days worked and the number of6 In his debate with Tom Brass, John Harriss, though explicit about clients' ambivalencetowards such relations, emphasises the use of ideals of 'moral economy' byclients to push patrons into continuing protection (1994).

The workers is correlated to the mechanisation of agriculture in southernWest Bengal (Rogaly et al. 2001). This is evident in mechanised tillage,and in electric and diesel groundwater extraction and threshing machines,all of which directly reduced the demand for labour in ploughing, irrigationand threshing, but indirectly increased demand for harvesters andtransplanters. There has also been an expansion of motorisedtransporttractorswhich carry harvested sheaves of paddy to threshing grounds,more moram (all weather stony) and pich (tarmacked) roads, and greaternumbers of bus routes and buses, mostly run by private companies.

Migrant workers tend to differ from local workers, both at home andat their destination workplaces, in that they are less involved in personalized labour arrangements. We will discuss the merits and demeritsof such arrangements and of patron-client relations more generally below.

It is important to note here that, alongside mechanisation, a greater proportionof migrant workers was now being employed in Barddhamandistrict than had been the case earlier, and there was thus an increase inrelatively impersonal employment arrangements.

The CPI(M) portrayed itself as bringing capitalist production relationsto rural Bengal by ridding it of 'feudal elements' through agrarian reforms,'and as implementing an elected local government before any other majorstate government in India. The most dynamic and energetic phases ofthese reforms took place during the United Front government of the late1960s and the first term of the Left Front government. The first of thesephases involved the support of a coalition government, in which theCPI(M) was a partner, for the seizure of land held in surplus of the legallypermitted ceiling. Following years of repression by Congress regimes inthe early and mid-1970s, the CPI(M) was elected in 1977 with an absolutemajority and had led the coalition Left Front government ever since.

The second of the two phases saw the energetic implementation of asharecropper's registration programme (Operation Barga), and the continuingredistribution of land held over the legal ceiling. In the first yearof power, the Left Front government implemented Panchayati Raj. Thesewere very significant changes which, together with the memory of theprevious bloody years, have contributed to six successive Left Frontelection victories at the state level.

As one government minister explained to us in December 2000, capitalist productionrelations were 'progressive' in relation to the feudal relations which preceded themandthe migration of workers could be seen in the same terms. (Interview with SurjaKanta Mishra, then Minister of Land, Land Reforms, Rural Development and Panchayats,Kolkata, 14 December 2000.)

The technological changes in agriculture referred to at the beginningof this section have closely, but not precisely, overlapped with the periodof Left Front rule. For example, the Damodar Valley Corporation's canalirrigation system, which enabled double cropping of rice in parts of Barddhamandistrict, had been completed in the 1960s, the boro crop beingintroduced from the late 1960s and early 1970s. However, it was theLeft Front that brought relative stability to the West Bengal countrysidein the 1980s and 1990s, and created the environment in which smallholderswere willing to risk investment in the groundwater irrigationpumpsets that formed the main technical motor for the expansion of capitalist production (see Rawal 2001).

Ganga Basin

The issue of river water sharing has been at the centre stage of India and Bangladesh's relationship forthe past four decades. Bangladesh, in fact, inherited this legacy from Pakistan as the Farakka barrage hadbecome a bone of contention even before Bangladesh was born in 1971. Since then, its relationship withIndia has often acquired a mono-focal character till 1996 because of their long-standing and deep-rooteddispute on the Farakka barrage. Furthermore, Dhaka's handling of this issue has also determined the fateof its top political leaders and considered as the single most-important yardstick for judging the performanceof its successive ruling regimes.

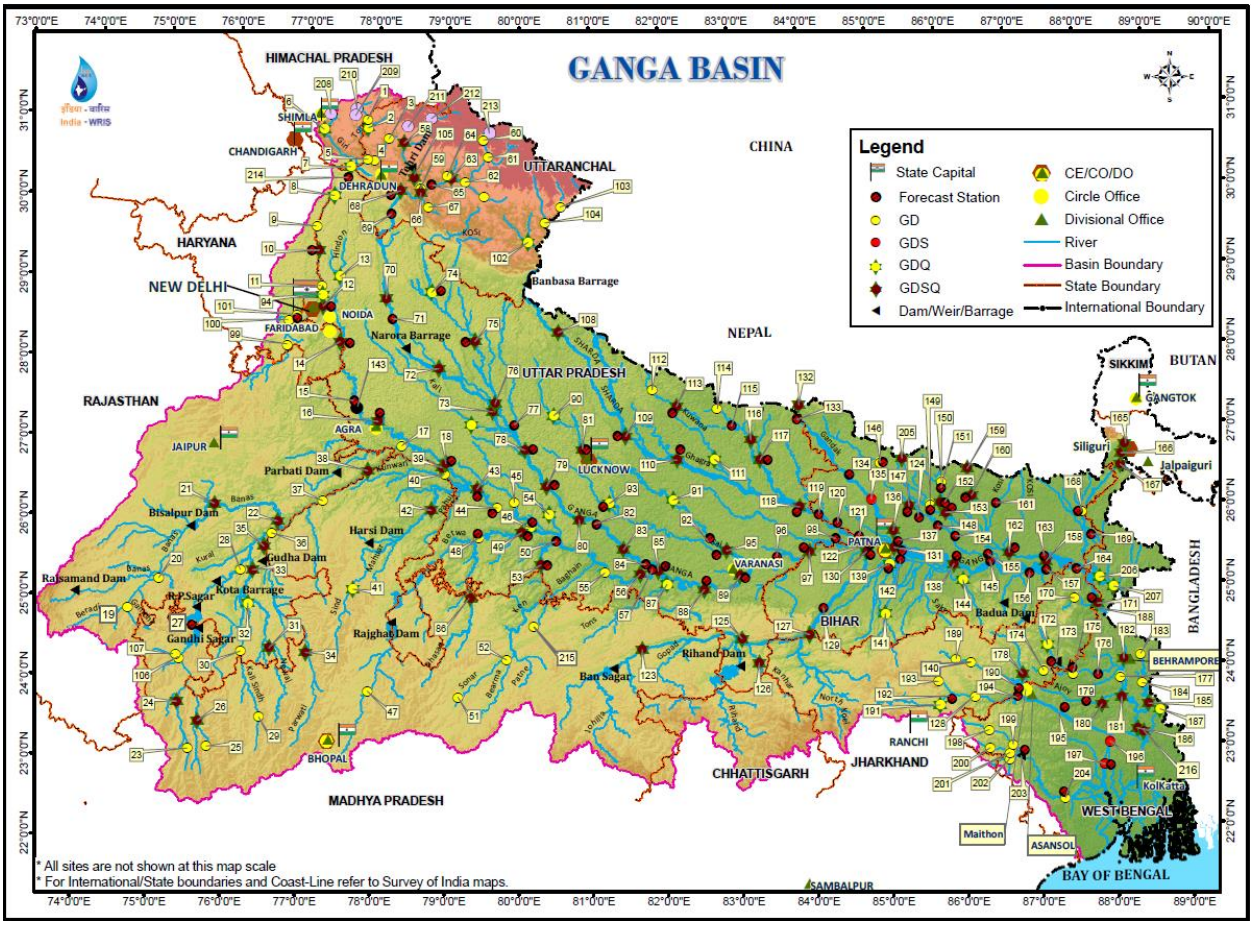

Fig.2:

The present article approaches the Ganga river water sharing issue between India and Bangladesh with fresh research insight gained through the primary sources. Interviews have been conducted withpeople who were directly involved with the negotiation of the treaty. The article argues that both India'sand Bangladesh's approach towards the issue of river water sharing over the Farakka barrage and their eventual agreements, or indeed disagreements, have not been shaped so much by the technical issues atstake. In fact, the propensity of reaching an agreement on this issue is directly linked to two critical factors:first, the political relationship between their respective ruling regimes in New Delhi and Dhaka atany given historical juncture; and second, the politicisation of the Farakka issue, especially in Bangladesh,by various political parties and leaders for their domestic political ends.The article is structured in the following manner. The post-1971 negotiation is divided into fivephases, which takes into account the changing equations of New Delhi's relationship with Dhaka andhow these have, in turn, influenced the negotiations on the issue of river water sharing. Before addressingits political dynamics, however, it is important to briefly outline the geographical features of theGanga that traverses a 2,510-kilometre long journey through India and Bangladesh. It rises in Gangotri,on the southern slope of the Himalayan range in India and moves in a south-east direction towardsBangladesh. The mainstream of the Ganga bifurcates into two channels which are known as Bhagirathi–Hooghly in India and Padma in Bangladesh. After covering a distance of about 112 kilometres, the rivermoves towards the south-east and joins the Brahmaputra in the heart of Bangladesh and their combinedflow then runs south to empty into the Bay of Bengal. This geographical feature divides India andBangladesh (earlier East Pakistan) as upstream and downstream riparian states.

Pollution of Ganga

For many people in Varanasi, the River Ganga is the medium of life. Few areas along the ghats of the river have very high population density which also includes areas with slums where the inhabitants are dependent on the river for both their religious as well as potable water needs. About 60,000 people are at the ghats of Ganga everyday for their holy dip. Most of

these people either do not care or do not believe that the water of the River Ganga is polluted.

The situation in Varanasi was not like this before. The city was given its due importance during the British period in India. The city got its first underground gravity sewage system during that time which was constructed for a maximum population of 200,000 people (Mishra, 2005). The sewage then flowed into the river but the locations of outlet sewage pipes into the river were selected so as to not affect the water quality near the ghats in the city. It has now been more than 60 years and the population of the city has increased from a meagre 200,000 to more than 3.6 million (Directorate of Census Operations, Uttar Pradesh, 2011). Due to rapid growth of population, construction of settlements along and on the low-level lands along the rivers Assi and Varuna has caused severe detrimental effects on those rivers. Assiriver is now nothing more than a drain through which only the sewage from the city flows and enters into the river Ganga. Many plans for cleansing of River Ganga, cleaning of the city, development of the city etc. were and are made but due to political pressures, they are sometimes suspended, discarded or are changed because of which they are unable to achieve their objectives. In the year 1986, the Government of India passed Ganga Action Plan (GAP), the objective of which was to reduce or remove the pollution of the River Ganga by putting up more treatment plants and better sewage system so as to avoid dumping of untreated raw sewage directly into the river.

Fig.3:

Even after the completion of Phase I of the GAP in the year 1993, the river water quality did not show considerable change (Hamner et al., 2006; Pandey et al., 2005). In fact, the faecal coliform level was higher than ever. Raw sewage was still flowing into the river freely from various types of point sources. Even today, a stroll along the ghats or a boat ride along the river will show many drains, ditches, sewer pipes and other outlets which are continuously putting more raw sewage and other chemical waste water coming from the small scale industries in the city. In the last 50 years, Varanasi has undergone very haphazard and unplanned growth. Solid waste disposal is also a big problem in the city since there is absence of any good system for it. Because of this, a lot of solid waste is either thrown in the river or it flows down in the sewage lines and/or open drains and gets dumped in the river via around 30 such point sources located along the ghats in the city.

III. METHODOLOGY

Quality data of Ganga river water collected from various ghats of the city was collected from the website of 'SankatMochan Foundation, Varanasi'. Dissolved Oxygen (DO in mg/l) and Faecal Coliform Count (FCC/100ml) were given the most importance in this study. Quality data collected from three major ghats (viz. TulsiGhat, Rajendra Prasad Ghat and PanchgangaGhat) and from the Varuna River confluence are included in this work. From all the various data periods available, quality results from four time periods were selected.

The selection of the time periods was made with the objective of selecting the same months of different years so that an actual trend can be seen independent of different weather conditions. Various published research articles related to Ganga river quality and water-borne diseases were collected and the studies conducted in those articles were incorporated in the present study. Other articles like media reports and unpublished government reports which talk about water quality status and their relation to water-borne diseases were also collected. The data collection thus made was used in GIS environment to analyse the visible trends.

IV. CONCLUSION

The long-standing conflict of Farakka and tortuous negotiations over decades for resolving this issueunderlines the importance of understanding water conflicts in the social and political context in the internalas well as the external domains. The technical nature of the problem—both in terms of finding appropriateinstrument and using the right technology as well as deciding the quantum of each party's share ofcommon waters, and finding ways of augmenting the water flows had not radically changed over thedecades. When the Ganga treaty was signed in 1996, augmentation issue was segregated from watersharing because augmentation involves technicalities. The technical experts of both countries were comingto the same conclusion about the means of augmentation in almost all meetings and the deadlockused to be maintained. Hence in 1996, both issues got separated. Even when the Joint Committee wasformed in 1996 to solve the water issue, water experts were brought under political control. Thus, the1996 treaty was a political decision and even the figure of the quantum of water agreed between the twocountries was 35,000 cusecs, little more than what the 1977 Agreement had agreed upon. The real story,however, lies not in finding technical solutions but understanding the local, social specificities of waterusage and political compulsions of the ruling regimes on both sides of the border. Another lesson can be drawn from the discussion is the importance of the role of the Chief Minister of West Bengal JyotiBasu. As the earlier discussion suggests that the crucial visit made by JyotiBasu toBangladesh immediately before the signing of treaty helped in smooth conclusion of the treaty. Not onlythis, Bangladesh foreign minister also made a visit to New Delhi as well as Calcutta. This has got psychologicalimportance as the Chief Minister of the state was made an important stakeholder in the issue.This is a very good example of inclusion of important stakeholder in the resolution of the river waterdispute which can be emulated for resolution of other river water disputes between India and Bangladesh.

It is important to note that the 1996 treaty does not offer an ideal solution. It has been criticised on both technical and political grounds, but the very fact that it became possible to negotiate and sign along-term treaty in the first place and then, to make it work well for more than a decade is a huge breakthrough,which in turn, materialised precisely because the government in New Delhi and Dhaka haveshown the requisite political resolve to achieve this objective.

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