

SPECIAL SECTION: New Epistemologies of Water in India

Fluid Epistemologies: The Social Saga of Sediment in Bengal

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Abstract: By using the term “fluid”, this article critically interrogates western ontologies of “solid” (land) and “liquid” (flowing waters), which were transplanted in colonial South Asia and transmitted in post-Independence river/water policies and actions with severe socio-ecological implications. Drawing lessons from recent environmental history and political ecology of water (“hydrosocial”) literature that shed light on liminal scapes beyond the mainstream land/water binary in hydrological studies, this study conceptualizes “fluidscapes” by drawing on field research in the river islands (*chars*) of Lower Bengal. By capturing snippets of livelihoods in the chars of the Malda and Murshidabad districts, West Bengal, situated upstream and downstream of the Farakka Barrage respectively, this article advances why and how it is imperative to rethink sediment beyond its physical-geomorphological existence and to see it as social sites of interactions. It unravels avenues through which chars can be perceived as not only emblems of uncertainty but also as zones of possibility bestowed with rich ecosystem services and the collective resilience of *choruias*.

Keywords: River Islands, Sediments, Ecosystem Services, Ganga, Bengal

1. INTRODUCTION

The Anthropocene, loaded with a planetary doomsday message and a clarion call to collectively understand complex systems like the environment, has made for epistemic pluralities dedicated to challenging

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and surpassing various forms of Cartesian binaries that have operated for long, constricting our mindscapes and actions. The formulation of the “fluid” or of “fluidscapes” is an attempt to critically interrogate western ontologies of “solid” (land) and “liquid” (flowing water), which were transplanted to colonial South Asia and transmitted into post-Independence river/water policies and actions with severe socio-ecological implications. Drawing on lessons from environmental history and the political ecology of water (including “hydrosocial”) literature, which shed light on the liminal, nebulous scapes beyond the mainstream land/water binary in hydrological studies, this article conceptualizes “fluidscapes” based on information and insights from field research conducted on the river islands (*chars*) of the Lower Ganga Basin, West Bengal.

We shed light on two chars: Hamidpur in Malda District and Nirmal in Murshidabad District, West Bengal, situated upstream and downstream of the Farakka Barrage, respectively. The barrage has intensified erosion and sedimentation by interrupting the natural flow of the River Ganga in its lower course. These chars have complex histories of land submergence and emergence, which in turn have shaped the lives and livelihoods of the *choruas*.¹ These areas have also been marked by conflicts arising from contestations of inter-state (Bangladesh) and intra-state (Jharkhand) boundaries due to the constant shifting of the river. Moreover, the residents of Hamidpur Char recently gained citizenship rights in India by mobilizing the *choruas* with the support of non-statist organizations.

The literature on river islands is scarce and features overtly declensional narratives. By capturing snippets from the lives and livelihoods of people living in chars, and exploring the everyday lived and embodied realities of *choruas* in these shifting sediments, this article advances why and how it is imperative to rethink sediment beyond its physical-geomorphological existence and perceive it as a site of social interaction. The multilayered physicality of sediment, along with its ephemerality in estuarine contexts, comprises dense social stories woven within the web of temporality, crafting inexplicable trajectories awaiting explorations from a pluralistic research lens. Here, we attempt to unravel the avenues through which chars can be considered not only emblems of uncertainty but also as zones of possibility, which are bestowed with rich ecosystem services and the collective resilience of the *choruas*.

¹ In the Bengali dialect, people inhabiting chars are known as *choruas*.

2. THEORETICAL APPROACHES

The social dimensions of sediment can be contextualized within the environmental history and political ecology of water studies and, more specifically, hydrosociality. Till date, the significance of sediment has been studied mainly from technical perspectives—physical geographical, sedimentological, fluvial geomorphological, hydrological, and hydrobiological—that attest to the significance of sediment circulation in riverine systems. However, these perspectives ignore the sediment–society connect, i.e., livelihoods that depend on sediment, which are thickly populated by ecosystem-dependent marginalized communities that adapt to these “muddyscapes”. By addressing problems relating to the implementation of “colonial hydrology” (D’Souza 2006), South Asian environmental social science scholarship has exposed us to multilayered realities surrounding human engagements with muddy terrains in tropical-deltaic-estuarine geographies across time (Mukherjee 2011; Lahiri-Dutt and Samanta 2013; Baruah and Mukherjee 2018; de Micheaux, Mukherjee, and Kull 2018).

The hydrosocial cycle describes how “water and society make and remake each other over space and time” (Linton and Budds 2014, 170). While early hydrosocial literature mainly dealt with political and social injustices around water services in urban landscapes, the recent thrust has been on rivers, and specifically on issues surrounding dam construction and the related controversies, irrigation maintenance and conflicts, and river basin governance (Baruah and Mukherjee 2018; de Micheaux, Mukherjee, and Kull 2018). What happens when hydrosociality encounters sediment? De Micheaux, Mukherjee, and Kull (2018) have postulated a “hydro(sediment)social” (HSS) cycle by advancing hydrosocial analysis with an enhanced consideration of the sediment component of river materiality. The HSS cycle encompasses the manifold ways in which humans and non-humans mesh in hydrological and social relations, impinging on water circulation, distribution, and quality, along with the materials that the water gathers—muddy sediment (Mukherjee 2018). The formulation becomes extremely relevant and meaningful in the tropical deltaic-estuarine contexts of South Asia. The conceptualization challenges “colonial hydrology” and its continued legacy and implications for river discourses, management, and governance paradigms and actions. Drawing on the work of geographers and anthropologists (Appadurai and Breckenridge 2009; Lahiri-Dutt 2014; Krause 2017), researchers have very recently coined the term “fluidscape”,

which combines “moving” biophysical and social realities, and includes water flows, sediment, river channels, populations, etc.²

3. SCHOLARSHIP ON RIVER ISLANDS

Despite a growing interest in island studies, river islands have been largely ignored (Baruah and Mukherjee 2018). In the words of Lahiri-Dutt (2014), “[River islands] exist in the vocabulary neither of those who study rivers, nor those who study islands, and have largely remained beyond the mainstream discussions on nature/culture” (22). Within the (eastern) Indian context, Lahiri-Dutt and Samanta (2013) offer an intimate glimpse into the microcosmic world of the (Damodar) chars. They depict coping mechanisms rooted in the embodied experiences of choruas who keep “dancing with the river” and drifting in the nebulous space. However, Mukherjee (2011), while describing empirical realities in the Ganga chars, explains why coping should not be romanticized, but should rather be understood as a “compulsory exercise”.

The recently edited volume by Basu, Roy, and Samaddar (2018) employs a political ecology perspective to explore riverine erosion in the Brahmaputra chars, crises relating to resource allocation, massive displacements in deltaic Bengal, and challenges emanating from migration resulting from floods in the Barak River in Northeast India. Going beyond this declensionism implicit in political ecology narratives, we explore both the challenges and potentials of river islands, which, we argue, can be harnessed in the long run to reimagine the fates of chars and choruas across shifting material and social realities.

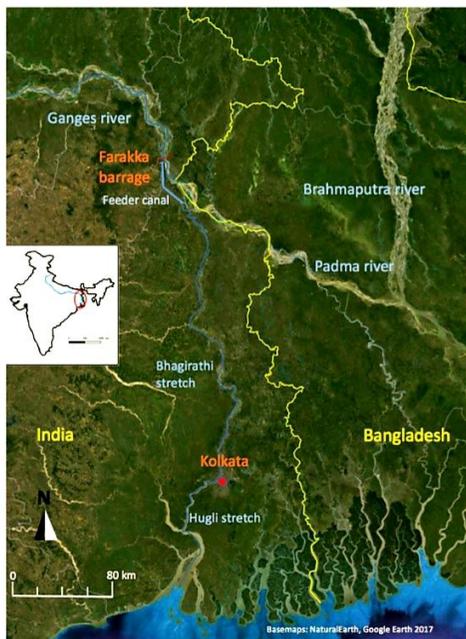
4. METHODOLOGY

This article is based on a series of field explorations conducted upstream (Malda) and downstream (Murshidabad) of the Farakka Barrage as part of a International Union for Conservation of Nature (IUCN) Project (2011–12), in which teams from India and Bangladesh documented existing ecosystem services in the chars. This research was followed by another exchange grant (Indian Council of Social Science Research-University of Lausanne) between Indian and Swiss scholars (2015–17), which allowed for the livelihood dynamics in these fragile fluidscaapes to be explored (Map 1).

² The EU-India funded EqUIP Project (of which the lead author is the Indian Principal Investigator) uses “fluidscape” as the theoretical traction to forge “fluid governance” in the Ganga and Rhône Deltas.

In January 2020, a field visit was conducted to generate more up-to-date information on the quotidian realities of the choruas. These realities are determined and shaped by river erosion and floods; the roles played by several statist and non-statist actors like block development officers,

Map 1: The Lower Ganga Basin, West Bengal



Source: Google Maps. Accessed on 23 January, 2020.

*panchayat pradhans*³, non-governmental organizations (NGOs), and grassroots organizations; and an array of situated adaptive practices pursued by the choruas for sustenance and survival in the chars. Field explorations were conducted during different seasons (summer, winter, and monsoon) to observe whether livelihood equations are affected by seasonal variations. Detailed ethnography through the application of qualitative methods like focus group discussions (FGDs), key informant interviews (KIIs), and case narratives were pursued to validate and cross-validate information across a range of actors, from government officials to choruas.

5. LESSONS FROM THE FIELD

Char formation is a natural occurrence in the Lower Ganga Basin. However, the implementation of the Farakka Barrage Project has impacted patterns of riverine sedimentation with repercussions on the formation, consolidation, and dissolution of chars. The upstream and downstream of the barrage is dotted with more temporary chars; the constant emergence and submergence phenomena has forged repetitive cycles of settlement—displacement—resettlement—re-displacement (SDRR), in turn shaping

³ The elected head or decision-maker of the lowest unit of the village administration—the panchayat.

vulnerability and adaptive practices among choruas (Mukherjee 2011). The two empirical case studies presented here will validate this proposition.

5.1. Case study 1: Hamidpur Char, Malda

Hamidpur Char is located in Kaliachak II Block, Malda District (Map 2). It is situated 15 km upstream of the Farakka Barrage. It spans 15,700 ha and about 210,000 people inhabit the char. Agriculture is the primary occupation in this char. Kaliachak II is one of the most environmentally vulnerable blocks among Malda's 15 blocks. There are disastrous floods and erosions almost every year during the monsoon. In the last 20 years, one-fourth of the territory of Kaliachak II has been eroded, 22 villages have been completely destroyed, and 8 villages have been partially swallowed by the river. Within the Hamidpur Gram Panchayat (GP) boundary, eight villages were completely waterlogged during frequent floods in 2011, 2013, 2015, and 2016.⁴

With the eastward shifting of the Ganga since the 1970s, villages on mainland Hamidpur have been submerged, and new chars have emerged on the other bank of the river, adjacent to Jharkhand, the neighbouring state. The flood and erosion victims were compelled to migrate and settle in the newly emerged chars to pursue their livelihoods. Hamidpur Char is one such island with a settled population. Indeed, the desperate attempt of those who lost their homes on

Map 2: Hamidpur Char



Source: Google Maps. Accessed on 23 January, 2020

⁴ Interview conducted with the Kaliachak II Block Development Officer in July, 2017.

mainland Hamidpur to retain their old connections and memories is evident in the nomenclature of the char.

Although the choruas have established some basic mechanisms to sustain themselves on Hamidpur Char, the government does not recognize their tenurial rights. The char is considered as *shikasti* (governmental non-revenue land) according to the Revenue Bill (an outcome of the Bengal Alluvion and Diluvion Act, 1825), which states that if a piece of land that was previous submerged in water re-emerges, it becomes state property; as such, no revenue can be generated on the re-emerged char. Due to the lack of governmental recognition, people in Hamidpur Char suffer from a lack of access to basic infrastructural facilities like schools, roads, health centres, etc. There have also been instances of illegal trafficking of cattle, crops, medicines, etc. and other criminal activities, including the trafficking of women. Trafficking occurs most during the winter and monsoon because the fog and rain act as significant barriers to Indian Border Security Force (BSF) personnel operating from check posts.

The continuous shifting of the river and the emergence and submergence of chars are crucial variables that complicate the story of citizenship or non-

Figure 1: An interview respondent showing documentary evidence of land entitlement



Source: Authors (19 November 2011)

citizenship in this “fluidscape” (Figure 1). While the Government of West Bengal has remained indifferent to granting citizenship rights to the choruas settled in Hamidpur Char, the Jharkhand Government issued voter ID cards to some of the villagers (particularly to those inhabiting villages in the western part of the char, close to Jharkhand) in 1990. When the char started eroding on the western side in 1998 and the choruas migrated to the eastern part, they still retained the voter ID cards issued by the Jharkhand Government but could not avail of any facilities as they could not access the state directly; the river lay between them and Jharkhand.

In 1998, troubled by material losses and the government’s apathy, educated and informed villagers formed the Ganga Bhangam Pratirodh Action Nagorik Committee (GBPANC). These villagers were supported by active researchers working in the area. Soon, a grassroots movement emerged with the support of action groups and NGOs like Child Rights and You (CRY).

The movement aimed to secure disaster relief and better rehabilitation for the choruas. The action groups mapped and surveyed the chars and attempted to initiate the institutionalization of these islands to ensure better protection and eligibility to access government welfare schemes for the *choruas*.

These efforts finally culminated in the choruas in Hamidpur Char collectively demanding recognition and their citizenship rights. Scholar-activists like Kalyan Rudra promoted and supported the movement. Rudra's technical findings shed light on the Farakka Barrage's role in disrupting the natural flow of the Ganga and in turn aggravating floods and erosion in the Malda and Murshidabad districts (Rudra 2003); his work provided a much-needed scientific edge to the choruas' cause. In December 2010, GBPANC organized a multi-stakeholder meeting in Hamidpur Char. At that event, the choruas got the opportunity to show their (past) property entitlements to the additional district magistrate (ADM) of Malda District. As a direct consequence of this event, the choruas received identity cards and voter ID cards from the government in 2011.

Once the char received governmental recognition, two primary schools and a junior school were constructed between 2012 and 2015, and electricity access was ensured in 2015. Emergency centres were also built. Since 2014, a woman from Hamidpur Char has represented her people as an elected member of the Hamidpur Gram Panchayat. Official recognition also paved the way for the political participation of the choruas. They are now the beneficiaries of numerous government initiatives and schemes such as *Nirmal Bangla* (Clean Mission, Bengal), Madhyamik Siksha Kendras (MSK) and Sishu Siksha Kendras (SSK), pulse polio and other immunization programmes. The char residents can now reap the benefits of government schemes through continuous activism and simultaneously remain free of having to pay agricultural revenues, as it still enjoys the status of shikasti. The choruas access an array of environmental services from this fertile land (Annexure); they get immense livelihood benefits, evident in the remark of the block development officer (BDO), Kaliachak II, "People are no longer poor there".⁵

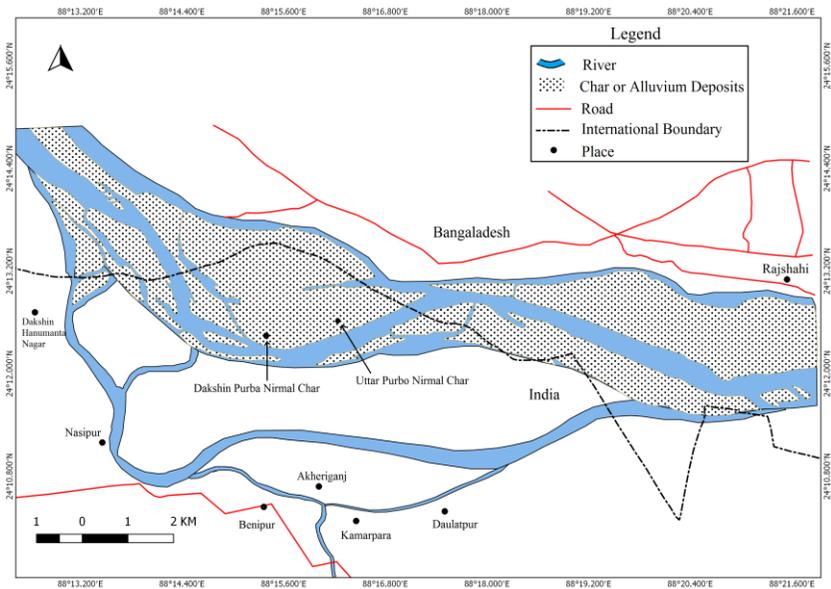
5.2. Case study 2: Nirmal Char, Murshidabad

A severe flood in 1989–1990 caused major erosion and led to the submergence of Akherigunj in Block Bhagwangola II, Murshidabad District. "Akherigunj", which literally means "the last settlement", disappeared from the map. The disastrous erosion engulfed 2,766 houses

⁵ Interview conducted in July 2017.

and left 23,394 persons homeless (Rudra 2003). Nirmal Char emerged on the opposite bank of the river between 1990 and 1992 (Map 3). The erosion victims migrated and settled in the newly emerged char. Another massive flood occurred in 1998, following which Nirmal Char took its present shape (Map 3). The northeastern part of Nirmal Char has a big village that covers 571.42 ha under the Akherigunj Gram Panchayat; it has a population of 24,754.⁶

Map 3: Nirmal Char



Source: Authors

Agriculture is the major occupation there; however, people have other livelihoods as well. Some women are involved in cultivation and livestock rearing (Table 1). The women also take part in manufacturing fuel wood (using jute sticks and cow dung) and in small-scale agro-based production (Figure 2). Floods and erosion are common phenomena during the monsoon (between June and September) every year. The oscillating river downstream of the Farakka Barrage claims acres of the char and impacts the lives and livelihoods of choruas. Crops are destroyed and the quality of yield is reduced, which further lowers the market selling price of crops.

⁶ Interview conducted with the village resource person (VRP) in January 2020. The VRP is a contractual post which was created in 2013. VRPs are recruited by the district social unit of the state government.

After every disaster, people suffer from diarrhoea, fungal infections, snakebites, etc. and cannot afford to go to the health sub-centre of the Akherigunj GP, as communication gets disrupted.

Table 1: Occupations in Nirmal Char

Sex	Occupation	Percentage
Male	Farming	78
	Livestock	10
	Fishing	11
	Other jobs	1
Female	Farming	2
	Livestock	1
	Cooking (midday meal)	5
	Housewives/domestic help	92

Source: Records provided by the VRP (29 January, 2020)

Nirmal Char shares a boundary with the Rajshahi District of Bangladesh. Due to acute poverty, especially after floods, competing claims among the farmers of the two countries intensify, and choruas become desperate to set up farming operations in the “zero point”. As such, this is highly risky, as it is illegal to farm on this “no-man’s land”. Indeed, there are strict security restrictions imposed by the Bangladesh BSF.

Figure 2: Women engaged in work



Source: Authors (28 January 2020)

A series of field explorations between 2011 and 2020 captured changes in this char in terms of availability and access to public infrastructures. Nine primary schools, seven Integrated Child Development Services (ICDS) centres, one primary health centre, and one flood centre now operate here. The people receive benefits under various government welfare schemes: National Rural Employment Guarantee Act (NREGA), *Swachh Bharat Abhiyan* (Open Defecation Free Village), etc.

There was a dearth of disaster awareness and response until quite recently. AID USA distributed food (rice, pulses, potatoes, etc.) to 367 families and polythene tent materials to 70 families during the 2011 floods. Since 2015, an NGO called Future Achievement has implemented local disaster mitigation measures. Moreover, the choruas pursue adaptive practices using intergenerational social skill sets to combat the lack of adequate policy-driven initiatives. The ecosystem services not only allow the choruas to sustain themselves in this fragile landscape, but they are also significant flood resilient mechanisms (Annexure).

When the char is waterlogged, choruas live on their *machas* (rooftops) for several days until the water recedes. They arrange wooden cots on bamboo poles and use polythene tents as covers. Their houses are made from *jijal*

Figure 3: Houses made from *jijal* trees



Source: Authors (19 November 2011)

Figure 4: *Donga* or *chui nouka*



Source: Authors (19 November 2011)

trees, the roots of which are deeply entrenched in the soil, making the houses storm resistant (Figure 3). Boats made of tin sheets called *donga* or *chui nouka* can accommodate up to two persons (Figure 4). These act as effective modes of communication between char villages; they connect families during times of disrupted communication.

6. Conclusion

“Human technology, livelihoods, social relations and power equations are just as imbricated with river sediment processes as they are with simply water” (Baruah and Mukherjee 2018, 335). While the global discourse of the Anthropocene presents islands as “hazardscapes” that are vulnerable to climate change (particularly sea-level rise), the social analysis of local realities in shifting sediment across historical and political dimensions depict chars as “not lines of separation but zones of interaction...transformation, transgression and possibility” (Howitt 2001, 240). While these ephemeral and transient river islands are exposed to erosion and the far-flung impacts of climate change, the intensity of vulnerability is lower, as it depends on a combination of factors, including

the community's exposure and sensitivity to hazards and their adaptive capacity and collective resilience (Das 2012; Das and D'Souza 2020). The embodied experience, knowledge, and capabilities of the choruas are forged by and aligned to the chars. The livelihood capabilities, cultural practices, and perceptions of the choruas await detailed documentation; these can shed light on the array of coping mechanisms that can be considered significant from the climate change perspective. Sediment-enriched hydrosocial realities have to be incorporated into policy formulation related to floods, climate change, etc., making way for neither solid nor liquid but "fluid governance", especially within tropical-estuarine-deltaic contexts.

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REFERENCES

- Appadurai, Arjun and Carol A. Breckenridge. 2009. "Foreword." In *Soak: Mumbai in an Estuary*, edited by Anuradha Mathur and Dilip Da Cunha, 1–3. New Delhi: Rupa Publications.
- Baruah, Mitul and Jenia Mukherjee. 2018. "Rivers and Estuaries." In *The Routledge International Handbook of Island Studies*, edited by Godfrey Baldacchino, 324–338. Oxon and New York: Routledge.
- Basu, Madhurilata, Rajat Roy, and Ranabir Samaddar. 2018. *Political Ecology of Survival: Life and Labour in the River Lands of East and North-East India*. New Delhi: Orient Blackswan.
- Das, Saudamini. 2012. "The Role of Natural Ecosystems and Socio-economic Factors in the Vulnerability of Coastal Villages to Cyclone and Storm Surge." *Natural Hazards* 64 (June): 531–546. <https://doi.org/10.1007/s11069-012-0255-9>.
- Das, Saudamini and Nisha Maria D'Souza. 2020. "Identifying the Local Factors of Resilience during Cyclone Hudhud and Phailin on the East Coast of India." *Ambio* 49 (September): 950–961. <https://doi.org/10.1007/s13280-019-01241-7>.
- D'Souza, Rohan. 2006. "Water in British India: The Making of a 'Colonial Hydrology.'" *History Compass* 4 (4): 621–628.
- Howitt, Richie. 2001. "Frontiers, Borders and Edges: Liminal Challenges to the Hegemony of Exclusion." *Australian Geographical Studies* 39 (2): 233–245. <https://doi.org/10.1111/1467-8470.00142>.
- Krause, Franze. 2017. "Towards an Amphibious Anthropology of Delta Life." *Human Ecology* 45 (3): 403–408. <https://doi.org/10.1007/s10745-017-9902-9>.

- De Micheaux, Flore Lafaye, Jenia Mukherjee, and Christian A. Kull. 2018. "When Hydrosociality Encounters Sediments: Transformed Lives and Livelihoods in the Lower Basin of the Ganges River." *Environment and Planning E: Nature and Space* 1 (4): 641–663. <https://doi.org/10.1177/2514848618813768>.
- Lahiri-Dutt, Kuntala. 2014. "Beyond the Water-Land Binary in Geography: Water/Lands of Bengal Re-visioning Hybridity." *ACME: An International E-Journal for Critical Geographies* 13 (3): 505–529.
- Lahiri-Dutt, Kuntala, and Gopa Samanta. 2013. *Dancing with the River: People and Life on the Chars of South Asia*. Yale: Yale University Press.
- Linton, Jamie and Jessica Budds. 2014. "The Hydrosocial Cycle: Defining and Mobilizing a Relational-Dialectical Approach to Water." *Geoforum* 57 (November): 170–180. <https://doi.org/10.1016/j.geoforum.2013.10.008>.
- Mukherjee, Jenia. 2011. *No Voice, No Choice: Riverine Changes and Human Vulnerability in the "Chars" of Malda and Murshidabad*. Occasional Paper 28. Kolkata: Institute of Development Studies. <http://idsk.edu.in/wp-content/uploads/2015/07/OP-28.pdf>.
- Mukherjee, Jenia. 2018. "From Hydrology to Hydrosociality: Historiography of Waters in India." In *Routledge Handbook of the History of Sustainability*, edited by Jeremy L. Caradonna, 254–272. UK: Routledge.
- Rudra, Kalyan. 2003. *The Encroaching Ganga and Social Conflicts: The Case of West Bengal, India*. West Bengal: Department of Geography, Habra H.C. Mahavidyalaya.

ANNEXURE

Table: Ecosystem services

Types	Services	Benefits
Provisioning	Food crops: rice (varieties: <i>ayush</i> and <i>boro</i>), wheat, pulses (<i>kalai</i>), vegetables (gourd, eggplant, cauliflower, etc.) Cash crops: jute, corn, chillies, turmeric Fruit: watermelon, banana, cucumber, etc.	Subsistence; surplus sold in mainland markets
	Livestock: cow, buffalo, goat, sheep, poultry	Subsistence; transportation; agriculture; assets during times of crises (floods and erosion)
	Fish: <i>rui</i> , <i>tangra</i> , <i>boal</i> , <i>katla</i> , <i>chingri</i> , <i>ritha</i> , <i>chital</i> (indigenous names)	Subsistence; surplus sold in the market against cash income
	Medicines (herbs): <i>kesbra</i> (a grass variety)	Locally used by <i>ojhas</i> (traditional healers) or non-certified rural healthcare providers
	Fuel wood: cow dung (<i>ghunte</i>), dried jute sticks and cow dung (<i>lodha</i>)	Natural energy resource for cooking, lighting, etc.
	Water: groundwater (accessed through tube wells), the river (and its sediment)	Drinking; cultivation; transportation
	Housing: mud (floor), straw (roofs), bundles of jute sticks (walls), <i>jjyal</i> trees (pillars), etc.	Flood resistant makeshift houses
Regulating	Water regulation: recharged floodplains after every flood	Fertile soil for agriculture Recharged groundwater
	Pollution control: flushing of waste and pollutants after heavy floods	Regenerated soil
Supporting	Navigation	Transportation
	Natural resource for livestock feed: <i>kaishas</i> (a local variety of grass)	Livestock nutrition
Cultural	Water festivals and rituals; folk songs; lores by the Chais (a local ethnic community)	Cultural bonding, collective living, resilience

Source: Field explorations by the authors (2011/2017/2020)