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Geoanthropology and the variations of (land) loss: Counter currents of anthropogenic erosion in the Bengal Delta

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An island named Ghoramara in the Bay of Bengal has lost 84 percent of its landmass over the last 100 years. Climate change-induced sea-level rise, however, does not explain the reason behind the extent of land lost from Ghoramara Island to the sea. What then, if not the rising waters, explains this erosion? This essay dwells on other causations. I draw on Kathryn Yusoff and Nigel Clark's (2017) notion of the "geosocial"—that is, an invitation for the social to meet the geologic—as a means to understand this loss. I acknowledge the surprises of the earth's strata and what cannot be controlled: shifts in the tectonic plates, the Bengal Delta's eastward tilt that changed the course of the river, tides, and the forcefulness of sediments that make and unmake islands. At the same time, I reveal how the earth's surface is being transformed through what Sheila Jasanoff (2015) calls "sociotechnical imaginaries." Dams and barrages change the course of the rivers, trap sediments, and lead to downstream erosion; ports and shipping vessels that require dredging break new land formations; heavy and tall concrete embankments weigh the muddied coastlines down and often collapse with large chunks of land. Each of these mega-infrastructures (and many more) are responsible for the loss of land and act as impediments to the flourishing of humans and nonhumans on these watery lands. In a time of totalizing climate change narratives, in what is indeed an ongoing climate emergency, this essay hopes to move away from large abstractions toward regional ecological variations. Understanding the scars imposed on land and water by dams, ports, embankments and commercial shipping corridors provides the grounds upon which actors, interventions, infrastructures, and policies at regional, national, and deltaic levels can be held accountable for their direct attribution to erosion of land, lives, and life-worlds. Ultimately, pinpointing geosocial variations of land (and other) losses is one step towards reparative climate justice.

THINKING WITH AN ISLAND

An island named Ghoramara in the Bay of Bengal has lost 84 percent of its landmass over the last 100 years. The commonsensical cause: climate change. If there is a part of the world where sea-level rise is a particularly urgent concern, it is indeed the Bengal Delta. Climate change-induced sea-level rise, however, does not explain the extent of land lost from Ghoramara Island to the sea. What then, if not the rising waters, explains this erosion? This essay dwells on other causations. One might ask why we should care? Why is it important, at all, to dwell on these other causations? After all, and at the rate at which our planet continues to consume carbon, climate change will indeed, eventually, inevitably, submerge Ghoramara and other islands in their entirety. Climate change is totalizing. It is everything. As Naomi Klein[1] puts it, it changes everything. Yet, it is precisely this totalizing force of climate change that obfuscates the specific. It takes away accountability from the regional causes of anthropogenic erosion, scapegoating problems onto the global, all-encompassing, and immense force of an abstracted climate change. This essay highlights the regional causes of land and other losses as a step towards reparative justice. It creates the grounds upon which actors, interventions, infrastructures, and policies at regional, national, and deltaic levels can be held accountable for their direct attribution to erosion, that of land, lives, and life-worlds.

In what follows, I explore three infrastructural interventions, or what one might think of as "sociotechnical imaginaries"[2], to explore the counter-currents of anthropogenic erosion in the Bengal Delta. The first is the Farakka barrage, built to divert water from the Ganges into the Hooghly River; the second is the expansion of the Kolkata and Haldia port complex; and lastly, the expansion of the commercial ship-vessel corridor between India and Bangladesh, carrying vessels laden with fly ash[3]. In positioning these infrastructural interventions as 'counter' currents to climate change, this essay does not deny the devastation caused by global warming, both globally and in the Bengal Delta. Instead, alongside climate change-induced sea-level rise, several more specific and singular events—often eclipsed—continue to destroy landscapes and livelihoods, and it is these interventions that this essay highlights. These infrastructures of erosion, which cause environmental degradation, are both unique to the Bengal Delta and prevalent across a range of other coastlines, deltas, and fragile ecosystems.

In other words, thinking with Ghoramara can act as a precedent for attribution science to disaggregate causation by paying attention to regional specificities of loss (related to land and lifeworlds), working towards climate justice in the form of reparations. Reparations are both insufficient and yet the only path forward. They are insufficient because what is lost is not just land, but all that is attached to and emerges from land. This includes livelihoods, relationships, skills, stories, notions of home, identity, and much else that cannot be mapped through Landsat data or reduced to percentages or numbers. What is lost is immeasurable. Despite this and the acknowledgment of the narrowness of this project, locating the specific causations of loss, that is, attributing damage to certain infrastructures and actors might act as a a step towards monetarily compensating families and households living on these coastal

1 Klein, 2014
2 Jasanoff, 2015
3 In a forthcoming chapter titled "Climate of Poor Governance: Vote-bank politics and Profit-driven climate "adaptation" in Coastal Bengal," I focus on other infrastructural interventions such as the transition from mud to concrete embankments, as a lens with which to view what I argue is a climate of poor governance.
4 Táiwò, 2025

peripheries. As Olúfémi Táiwò[4] has argued, our political and economic system distributes risk and vulnerability according to the patterns developed by the history of empire as well as that of contemporary capitalism. Pinpointing responsibility in relation to erosion is the first step towards reparations.

MUDDYING THINKING WITH THE SUNDARBANS

The island of Ghoramara is located in the Bay of Bengal delta, adjacent to the Sundarbans Forest. This is a region of the world that reminds us, perhaps more than any other, that human life — and perhaps life in general—is indebted to sedimentary processes. The inhabited islands of the region are made and unmade through the processes of erosion and accretion. Nigel Clark, referencing the earth geologist Jan Zalasiewicz, says, "so significant is fluvially transported particulate matter to shaping the Earth," that in relation to other planets on the solar system "one might...denote this planet as the muddy planet, for it is the only one to be encased in a thick shell of mud and mudrock."[5] The Sundarbans are the largest contiguous mangrove forests in the world, the last of their kind, and the only such forests home to tigers. Due to the twice-daily tides, even visually, for half the day, one can see these forests encased in mud. The region is formed by three forceful rivers that carry the world's largest sediment load down from the Himalayas to the sea. Submergence has been a feature of the muddy land historically. It is a low-lying region, 3 meters above mean sea level, but high tides go up to 5 meters[5]. Geomorphologically, the Sundarbans is located in the southern part of the delta, which is an active delta —i.e., one still forming[6].

The history of cities and civilizations, if seen through the lens of sediments, is that they are indeed formed through "intercepting a tiny proportion of the planet's vast muddy traffic"[7]. As Nigel Clark reminds us, "early floodplain civilizations succeeded in fashioning worlds that were relatively enduring – and in some cases remarkably long-lasting – out of mud's inherent transience and formlessness" (ibid). The inhabited islands of the Sundarbans are surrounded by brackish water, a mixture of seawater from the Bay of Bengal and freshwater from the Ganges River system.

Land on inhabited islands, ever since they were cleared for the cultivation of agriculture, is defined by the means through which brackish water can be kept out. As a result of the tidal ecology, the inhabited islands are lined with a collective perimeter of approximately 3,500 kilometres of mud embankments (bandhs). The aqueous terrain accompanies a set of material and affective realities in relation to water's scarcity, abundance, its ability to overflow, and the quality of it, its sweetness or salinity. The twice-daily tides dictate rhythms of labor and leisure, the movement of the fishing boats, and the socio-religious calendar of festivals and pujos.

The Bengal Delta is also emblematic of the inhumanity and injustice of the ongoing climate emergency. It is home to approximately 5-7 million people (the last census was 2011), all of whom belong to some of the most vulnerable and disenfranchised groups. The majority of the inhabitants of the region made these islands their home because of political upheavals or ecological calamities in the late 19th and early 20th centuries[8]. Households either have small landholdings on which they cultivate paddy or are entirely landless. Landless households either partake in fishing, crab collecting, or honey collecting, whilst cobbling together live-

5 Zalasiewicz 2008: 22 as cited in Clark 2021: 179

6 Rudra, 2018

7 Clark, 2021, p. 180

8 Historian Joya Chatterji estimates that a total of 3.9 million people came from East Bengal, renamed East Pakistan, to modern-day West Bengal between 1946 and 1970 (Chatterji 2007: 111). Most of the newcomers were Hindus; some were upper caste, but the majority belonged to a scheduled caste (SC)—such as the Namasudras, Pods, Rajbongshis, and Jalia Kaibartas—and were peasants, labourers, and fishers (ibid). For a more detailed ecological, agrarian and sociological history of the region read Eaton (1996), Iqbal (2014), Jalais (2010).

lihoods through a combination of working in India's informal economy across the country and undertaking wage-labor within the village. In the words of Jan Breman[9], they might be conceived of as "wage-hunter gatherers." In other words, the Sundarbans epitomize how the impacts of the current epoch of the Anthropocene are highly racialized, in that they most adversely impact the lowest caste groups, men and women who have already been marginalized through histories of oppression, and those who are least responsible for global warming.

The Sundarbans muddies our thinking. It does so both literally and conceptually. It makes us think with and think through sediment, soil, water, salt, mangroves, and their entanglements, both literal and metaphorical. It is a region whose history has propelled us to denaturalize any notion of "nature" or "geo" by reminding us of the several acts of dominion from colonial expansion[10] to modern engineering projects on rivers and forests that are the cause of what Martin Savransky[11] might call a "civilizational collapse." With this as backdrop, in what follows, I explore one of the many infrastructures that cause erosion in the delta. The first is the Farakka Barrage.

SHIFTING RIVERS, TRAPPING SEDIMENTS: THE FARAKKA BARRAGE

In the village of Farakka, just 15 kilometers from East Pakistan, construction of a dam commenced in 1961. It would take a decade to complete, and when it did, it was thought of as a huge triumph. The motivation of the barrage was to allow for and improve the navigability of the Calcutta Port. The Calcutta Port was one of the major ports of the Indian subcontinent and the gateway to sea-borne trade for India. It was the port and its free trade that allowed Calcutta to become the most important city for the British in colonial India. Ever since the establishment of the port, there have been concerns about the river Hooghly silting up. The freshwater of the Hooghly came from the Ganga and its three tributaries, known as the Bhagirathi, the Jalangi, and the Matabhanga. Historically, the removal and filtration of the silt occurred through these freshwater sources and through the tidal inflow of saltwater.

The course of the rivers shifted several times over the past few centuries. This shift is primarily because of tectonic plate movements. The Bengal Delta and the fact that the three rivers drain into the sea are the result of tectonic shifts that can be traced back several million years, when the North East portion of the Indo-Australian plate fractured and sank below sea level. This depressed basin created the conditions for all the rivers to meet the sea. With time, this depression filled up with sediments to form what is at present the Bengal Basin. In the late 18th century, the delta tilted eastward, and the Brahmaputra River underwent an avulsion, with repercussions for the shifting course of the Damodar River. The eastern delta was supported by the Brahmaputra River and its sediment. We know from geomorphologists that the combined flow of the Ganges and the Brahmaputra Rivers is prograding the eastern part of the delta—an active delta—rendering the western part moribund and implicating erosion as the governing process[12]. In a long sequence of river dances, the Damodar River has now rejoined the Hooghly near its junction with the Roopnarayan, 35 miles below Calcutta[13].

9 Breman, 1994
10 See for example Bhattacharyya, 2018
11 Martin Savransky, 2022
12 Akter, Haque, Sarker et al., 2016
13 Ivermee, 2020, p. 163

In other words, the building of the Farakka was prompted by geological shifts. In the ways that there are calls to 'socialize the Anthropocene'[14], there is the need to 'geologize the social'[15]. Nigel Clark and Kathryn Yusoff[16] argue in their writing that while "most social thought has taken the earth to be the stable platform upon which dynamic social processes play out," the Anthropocene epoch is forcing social thought to engage more closely with the geological movements of the earth, be it fluvial or igneous, as social and political agency is constrained, made possible and emergent with earth forces. Clark alerts us to think with and through, and be surprised by, "the elemental forcefulness of the earth itself"[17]. As a result of these slow tectonic movements that have shifted the course of the river, over the years, the Hooghly River became shallower and started to dry up.

Why does this geomorphological history matter? It matters because these elemental forces of the earth—tectonic movements and shifts in the flow of the river courses—leave scars on the Earth's surface. They create both the conditions for cities to emerge and for them to collapse. However, alongside these geological scars, other human-induced scars also shape the Earth's surface. Often, these human-induced scars are a response to the shifts in the strata. One such gash is the Farakka Barrage. The Farakka Barrage was introduced to keep the Calcutta port alive. Viewed differently, it was introduced to counteract the repercussions of the dances of the earth, its river waters, and its sediments. River surveyors, from the colonial era to now, continue to work to keep the Hooghly navigable. For the past three hundred years, there have been fears that water levels will diminish to the point of threatening the survival of the Calcutta and Haldia ports. The fear of losing the port's navigability launched a mega-infrastructural project to dam the Ganges and divert a great proportion of its water to the Hooghly. Assisting the natural flow of water into the Hooghly from the Ganges, it was believed, would prevent the build-up of silt in the Hooghly, lessen the need for dredging, reduce the salinity of the river in its lower reaches and in turn benefit agriculture and maintain a permanently navigable river route between Upper India, Bengal and the sea, guaranteeing the port of Calcutta's future [18].

Very soon after the construction of the Farakka, problems emerged. In fact, even before the building of Farakka, there were lively debates about the disastrous consequences this would have on the ecology and ecosystem of both India and Bangladesh[19]. The concerns were not just political (with water-sharing tensions between Bangladesh and India) but also ecological (with repercussions for the Sundarbans forest) and geological (it trapped thousands of tonnes of mud that created land). The Farakka's geopolitical implications were immense. For several decades, the water-sharing treaty has caused tensions between India and Bangladesh, which have been well documented[20]. Environmental scholars, geomorphologists, and policy bureaucrats have written piles of papers and reports issuing warnings regarding the adverse consequences of the Farakka on the biodiversity of the rivers and on the Sundarbans. However, the port was and continues to be of such financial importance that those warnings were unheeded. Among its devastating consequences, the sediments that the Barrage traps are of most concern to scientists studying erosion. As mentioned, the Bengal Delta is formed by three formidable rivers—the Ganga, Brahmaputra, and Meghna—which carry the largest sediment

14 Lovbrand et al., 2015
15 Clark, 2017
16 Cark & Yusoff1, 2017: 3
17 Clark, 2017b, p. 223
18 Ivermee, 2020, p. 207
19 There is a large and excellent body of literature from a range of disciplines on the Farakka Barrage see Jenia Mukherjee (2011) for a review and for a detailed, historical and political perspective see Kurshida Begum (1987).
20 Begum, 1987 and Crow, Lindquist, Wilson 1995

load in the world, exceeding 1.4 to 2.4 billion tons annually[21]. To contextualize the scale of this, this is 1000 times more than, for example, the Rhine delta in the Netherlands[22].

Accretion and erosion are a part of the deltaic geomorphology. As land is lost from one area, new riverine *chars* are formed nearby. The northern region of the delta is accreting as the southern region is eroding. This is a result not just of the sediments brought down by the rivers but also because of the sediments that the high tide brings in from the sea. The Farakka barrage interrupted this deltaic ecology of erosion and accretion. Trapped sediments can be attributed to erosion. What began in the 1960s as "temples of development"—dams and barrages—has, in the past six decades, led to a host of environmental complications[23].

Dams not only trap sediments, leading to coastal erosion, but also curtail the flow of freshwater. The beheading of rivers by dams has meant that negligible fresh water enters the delta, leading to increased salinity in the waters that embrace the inhabited islands of the Sundarbans. Rivers that have traditionally met the Bengal Delta at the mouth of the sea have largely been diverted, with one river, the Hooghly, being the only one that still brings fresh water into the delta. High levels of salinity in what is meant to be a brackish-water delta, that is, a delta with an admixture of fresh-water and sweet-water, have had a range of adverse repercussions, from stunted mangrove trees to the loss of several species of fish, crabs, and microorganisms. Floods and storm surges that have been endemic to the region are now more saline than they have ever been.

We know from geologists and geomorphologists that during the Holocene, sediment supply exceeded what was required to maintain the delta[21]. As the Earth's crust moved, rivers shifted course. The fear of the Hooghly silting up posed an existential threat to the port, and this was the motivation for building the Farakka barrage. The implications are that sediment starvation due to reduced freshwater flow indicates a reduced capacity to counteract the rising sea[22]. A greater quantity of sediment is required to compensate for sea-level rise. Tectonic plate shifts changed the course of the river, and similarly, sociotechnical infrastructures are engineering shifts on the earth's surface that are leading to erosion. Even as the only viable long-term solution to the delta's woes is to create the means for sediment delivery, contemporary technosocial imaginaries are to build more dams, interlink rivers, and create larger ports for more ship traffic. All of these projects will further starve the delta of sediments. By 2100, the delta will have a huge sediment deficit, which will threaten its sustenance. Shifts in tectonic plates and the forceful nature of sediments make and unmake the delta. Alongside the geological, the sociotechnological is reengineering our landscapes too. Climate change induced by global warming has little to do with the processes through which sediments are being trapped upstream, leading to downstream erosion. Next, let us turn to the root cause for the creation of the Farakka—the sustenance of the port.

21 Raff et al., 2023; Akter et al., 2016
22 Rudra, 2018
23 D'Souza 2008

It is forecasted that 90% of the world's trade will be carried by sea[24]. The expansion and privatization of ports is creating several changes in the ecology for those who live alongside these coastlines. South Asian coastlines, despite being highly vulnerable to rising sea levels, are witnessing aggressive port development, driven by a complex network of private players, nation-states, regional bodies, and foreign investors (ibid). The construction of ports and their operations have reshaped coastlines for centuries through dredging, creating channels, constructing artificial quays, jetties, and harbours, often at the expense of the coastline's biodiversity. As Nikhil Anand reveals, "the project of making coasts has been a fundamentally racial and colonial project." He says, "Coloniality, coasts, and racial capitalism are entangled projects of separation and demarcation made in relentlessly amphibious terrains"[25].

Ports have been the gateway for colonial extraction. Today, ports play a crucial role not only as economic trade hubs but also as geopolitical tools for national expansion. Ports on both of the coasts—the Indian Ocean and the Arabian Sea—have historically acted as a gateway to global trade for centuries. The Mumbai Port—on the Arabian Sea coastline—serves as a prime example of how urban expansion has historically extended into the sea[26], reinforcing the city's economic and infrastructural dependence on maritime spaces. Its colonial port was a key node in British imperial trade, and today, Mumbai continues to rely on the sea for food, energy, minerals, and waste disposal. However, the environmental consequences of port operations are severe. The construction of rigid infrastructure creates a stark boundary between land and sea, leading to contamination, effluent discharge, and the destruction of fragile coastal ecosystems. Much like Mumbai's maritime spaces, Kolkata Port has also been a site of capitalist expansion, even under regimes of austerity[27], eviscerating mangroves and river biodiversity and disturbing the deposition of sand banks, both in the colonial era and continuing into Modi's India[26].

As Nikhil Anand and Lalitha Kamath[26] reveal, India's Sagarmala project is a prime example of a large-scale initiative that seeks to boost economic growth through port-led development. Modelled after China's Belt and Road Initiative, the project aims to reduce logistics costs by expanding port infrastructure, deepening channels, and integrating transport networks. The ambitious plan envisions over 802 projects worth $473.7 billion, though its execution has faced challenges, with only 172 projects completed thus far (ibid). Despite its economic promise, Sagarmala raises significant environmental concerns. Anand and Kamath write that the shift from impermanent, adaptable infrastructure to rigid, concrete-based structures has intensified environmental vulnerabilities such as waterlogging, flooding, and rising sea levels. Efforts to control river behaviour through techniques like "river training" attempt to mitigate natural volatility but often lead to unintended ecological consequences. Pollution from port activities, such as oil spills and tar balls washing up on Mumbai's beaches, further underscores the environmental costs of these expansive infrastructural projects.

In a similar vein, the Haldia port complex was built in 1968 to ease the congestion at the Kolkata Port. It was inaugurated in 1977 and has become a pivotal port for international trade with a capacity of handling

24 Anusha, Omer, Shankar, 2024
25 Anand, 2025: 2020
26 Anand & Kamath, 2024
27 Bear, 2018

over 40 million tonnes of cargo annually. To make the rivers navigable for the container ships and barges, there is regular dredging of the riverbed and its silt deposition. Dredging entirely disturbs the sedimentation patterns of islands, and the breaking of newly formed sandbanks is attributed to the movements of these vessels. Another massive intervention was the building of several guide walls to enhance the navigability of the Haldia port. This was proposed by Dutch experts, and a total of seven walls were meant to be built[28]. All were begun, but only two were completed, and the other five were abandoned, leading to a massive disruption in the flow of the water. The activities of the port complex—regular dredging and the building of guide walls—have shifted the flow of the water and patterns of sediment deposition. Furthermore, increased austerity measures by the government of India since the 1980s have meant that there is very little financial investment in the running of the port and the navigation of the ships[29], despite the desire to expand the cargo capacities. This has resulted in accidents and increased pressures on workers. The Haldia Port Complex (and the Syama Prasad Mookerjee Port) has planned to increase cargo to boost trade and transport, but this comes at the cost of not just poor safety for workers at these ports but also widespread erosion and disturbance to the fluvial dynamics of the region. Policy makers, government officials, engineers, and oceanographers are all aware of these disturbances and the fact that land erosion taking place on islands such as Ghoramara is directly caused by the activities of the port.

Nevertheless, these ports are further fortified and expanded as shipping routes and ship vessels expand. In the fluvially dynamic and amphibious terrain of the Bengal delta, the formation of new coastal landmasses, sandbanks *(chars)* are influenced by the tidal flow, the elevation of the land, and the natural fluvial dynamics. It is these port activities, particularly dredging and the building of guide walls, that disrupt the natural processes of the formation of land and irreversibly and consistently alter coastal environments. The further advancements and expansions of the Haldia port complex aim to facilitate trade, but in doing so, they have entirely reshaped the movement of the tides, the formations of the char, and act as one of the major regionally specific causes of erosion and land loss from the Ghoramara island. Instead, however, and once again what is blamed for erosion is solely an overarching narrative of climate change. Connected to the port is the commercial shipping to which I turn next. Fly ash is exported via a trade route that hugs the fragile conservation hotspot of the Sundarbans forests and passes through several islands whose residents depend on the rivers and forests for their livelihoods. These ports and vessels promise national growth, are based on logics of profit, and despite their disastrous ecological consequences, continue to expand. The long history of ports as instruments of empire and capitalism continues to define contemporary maritime infrastructure, raising critical questions about sustainability, governance, and environmental justice.

28 Tuhin Ghosh, personal communication
29 Bear, 2018

COMMERCIAL SHIPPING

The movement of ships has increased exponentially as India has attempted to expand the National Waterway 1 (NW1), which operates as the sole route to sell and transport fly ash to Bangladesh, a business agreement that is hugely profitable for both countries. The Indian Government has recently invested upwards of 770 million USD to expand the NW1[30]. This is a part of India's Jal Marg Vikas project, which aims to enhance shipping in more than 100 waterway routes throughout the country. Every week, hundreds of barges carry fly ash from the Indian ports of Kolkata and Haldia in West Bengal to ports in Bangladesh like Khulna, Mongla, and Chattogram. India exports fly ash to Bangladesh, where it serves as a raw material for cement production. Erosion is caused by the frequent wave action of barges, which impede the formation of new sandbanks and prevent the growth of new mangroves. In addition to the erosion caused by the movement of these barges, these vessels often capsize with tonnes of fly ash polluting the riverine ecosystem, as well as the islands that are a global conservation hotspot for the tiger and a nursery and breeding ground for fish.

These ship vessels have bypassed maritime pollution checks as they are used in what is a bilateral agreement between India and Bangladesh that serves to be profitable for both countries. As a retired member of the Kolkata port trust told me, "These vessels are timebombs waiting to explode." The barges are are old, decrepit, and have no navigational technologies as a result of decades of austerity measures[29]. Accidents are inevitable, and yet the profits accrued are so high that the governments of the two countries would rather continue their operations in the full knowledge of the environmental destruction these vessels cause. Fly ash is the residual waste from burning coal for power plants and contains toxic materials such as dioxins, heavy metals, and chloride salts. The navigation route of the cargo vessels cuts across the ecologically fragile mangrove forests in both India and Bangladesh. On the Indian side, at least over a million coastal residents are directly or indirectly dependent on the Hooghly River as well as its several tributaries that make up the Sundarbans forests for their livelihoods. The movement of vessels as well as the capsizing of fly ash into the rivers is not only causing ecological damage but also has severe health and livelihood ramifications for coastal residents. There have been concerns regarding the movement of these old vessels, their loud and rusted anchors, which, when dropped, cause noise pollution and disturb the breeding cycles of fish and crabs. The dredging and the movement of these vessels also impact the endangered Gangetic dolphins, crocodiles, as well as a huge variety of fish species, crustaceans, and microorganisms. The expansion of commercial shipping as well as the capsizing of barges carrying fly ash, pesticides, fertilizers, and oil too, is yet another regional cause for loss—both land loss, the catastrophic loss of biodiversity and its accompanying impacts on coastal livelihoods.

Ghoramara lies in the pathway of these ship vessels. Its erosion and sinking can be attributed rather directly to the expansion of the Haldia Port Complex and its accompanying activities. Furthermore, in this already fragile delta, there are new mega-infrastructural projects that are being proposed, such as the construction of a bridge connecting the nearby Sagar Island to the mainland. Recently, the Public Works Department

sanctioned a 3.3-kilometre bridge, costing 1,438 crores, that will connect Kakdwip to Kachuberia in Sagar Island in order to promote and ease tourism for the Ganga Sagar mela, an annual pilgrimage at the nearby island of Sagar, that takes place annually. The base of the bridge will once again be the riverbed surrounding Ghoramara. This will cause further disturbances to Ghoramara's land-water ecosystem and will disrupt the flow of the river and the processes of sedimentation. Such infrastructural projects benefit contractors but relegate already marginalized communities to further immiseration. Rivers are being transformed into waterways for the sole purpose of expanding trade and water transport. All their other uses and the life-worlds and forms of life they sustained are ignored entirely. Echoing colonial processes that reclaimed land for paddy cultivation, built embankments, and ports in order to generate revenue, in contemporary Bengal, too, rivers are being further industrialized and entirely enclosed.

PINPOINTING BLAME: COUNTER CURRENTS OF ANTHROPOGENIC EROSION IN THE BENGAL DELTA

Located at the mouth of the Hooghly River, Ghoramara has lost 84 percent of its land in the last 100 years. Today, it is less than 4 square kilometres in area. In the last census of 2011, the number of households in Ghoramara was 1,125, with a total population of approximately 5000 residents only. This is an alarming rate of land lost to the sea. The IPCC predicts that because of greenhouse gases trapped in the atmosphere, the current rates of warming could raise the ocean's surface as much as 23 inches, or nearly 0.6 of a meter, by 2100[31]. It is an undeniable fact that the coastlines of Bengal are threatened by sea-level rise. However, not all the change can be blamed on the climate. Through the example of Ghoramra and thinking through this island, this essay has tried to spotlight specific anthropogenic causes of loss. If we scratch beneath the surface—or in fact just pay attention to the lively surface of sediments itself—we learn that Ghoramara represents another set of challenges. While residents who have been displaced are often perceived as "climate refugees," these displaced populations are refugees because of the technosphere[32]. Ghoramara is an island located 44 km inland at the mouth of the Hooghly River. There are many other islands, much more exposed to the open sea of the Bay of Bengal's Indian Ocean, such as Jambudwip, which, while facing erosion, are comparatively stable and not experiencing such rapid rates of erosion as Ghoramara.

Sea-level rise as a result of climate change caused by the consumption of fossil fuels is undeniable threat, yet this does not fully explain the reason behind the extent of land lost on Ghoramara. The causes of Ghoramara's erosion are linked to the desire to accrue profit. More dams are being planned. There is a disastrous proposal to interlink rivers. Ports are being expanded. Commercial shipping has increased. The depletion of the groundwater is causing the land to subside. These technological advancements repeat older histories of colonial expansion. There are preventative measures, but those go against the discourse of racial capitalism. Resuscitation of sediments might be possible through the undoing of dams and barrages. A control on the aquifers and how much groundwater is drawn could prevent land subsidence rates. Instead of concrete

31 https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level

32 Zalasiewicz 2017; Otter, 2017

embankments that take the riverbed with it, there are other possibilities that range from bio-protection to bio-construction designs. Tidal river management (TRM) has been seen as a solution in neighboring Bangladesh and could allow for sediments to return. The rivers and canals that have been diverted and beheaded could be rejuvenated adding much needed freshwater to the delta. Instead of these specific solutions, the discourse of generalized climate change acts as a scapegoat for the lack of any intention to transform the material conditions of coastal inhabitants or the inevitability of mega-infrastructures and their designs.

Kathryn Yusoff and Nigel Clark[33] put forward the idea of "geosocial formations" as a means through which to understand our current epoch of the Anthropocene. In their view, the "geosocial" allows for the social to meet the geologic. This essay takes inspiration from their call to meld the two. It acknowledges the surprises of the earth's strata and what cannot be controlled. The Bengal Delta is shaped by the shifts in the tectonic plates, the eastward tilt that changed the course of the river, and the means through which sediments make and unmake islands. At the same time, it reveals how the earth's surface has been transformed through the 'technosphere'. Dams and barrages change the course of the river; they trap sediments and lead to downstream erosion. Ports and ship vessels that require dredging break new land formations, and each of these infrastructures (and many more) are equally responsible for destroying the flourishing of humans and nonhumans on these watery lands. While we cannot control the movement of tectonic plates, human societies have controlled sediments from the beginning of time. Our first cities were because of being able to interrupt the flow of sediments. Today, what we are witnessing is that the extent and scale of geological controlling, trapping, and forcing have adverse repercussions and might very well be the beginning of the end.

Yusoff and Clark ask, "What is it about the earth that makes it responsive to different kinds of social 'forcing'? With what specific geological processes or properties have different social actors joined forces in order to acquire their geologic agency?" [34]. The technosphere—infrastructures that geoengineer landscapes—is one answer to this question from the Bengal Delta. Why does this matter? This essay has tried to show that it matters because these specific sociotechnical imaginaries could be held responsible as a move towards climate justice. This is not about one island in the Bengal Delta. Ghoramara represents many other parts of the world. It represents those parts of the world where marginal communities are sacrificed at the altar of a particular kind of self-devouring growth[35]. Ghoramara's residents are poor SC and Muslim households. It represents parts of the world where the totalizing discourse of climate change acts as a scapegoat for the lack of political will to change policies that are indeed causing erosion. The trapping of sediments, the increase in salinity, the erosion of land due to the diversion of rivers, the building of dams, ports, and expanding shipping corridors are all a part of a complex yet highly particularized set of causations of loss that have little to do with global climate change but everything to do with a climate of profit-driven governance. These are visible in many parts of the world.

33 Clark and Yussof, 2017
34 Clark and Yussof, 2017: 5
35 Livingston, 2019

The building of dams, ports, and the expansion of commercial shipping routes that I write about in this essay find themselves playing similar roles in many other parts of the world. Context, regional specificity, and an attunement to ecosystems and their singular forms of flourishing and the causes of their degradation are crucial if we are to disaggregate the regional causations of a global environmental crisis. In a time of totalizing climate change narratives, in what is indeed an ongoing climate emergency, what this essay hopes for is to move away from large abstractions to regional ecological variations. The hope of this essay is to think with Ghoramara: an island sinking because of very specific, localised, "socio-technical imaginaries" and not, as common knowledge and popular media would understand it, generalized sea-level rise due to global warming. Ultimately, locating geo-ecological variations of loss is an acknowledgement of the geological forces that shape our muddy planet, while at the same time, it is one step towards climate justice and holding those responsible accountable.

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01 - 07 The Sundarbans is an ecology encased in mud. With twice daily tides, the pneumatophores, protruding roots of the mangroves, are submerged in water during hightides only to re-appear 8 hours later. Crab collectors, fishers and honey collectors enter the mangrove creeks—teeming with hundreds of species of birds and fish—on their wooden boats to collect crab, fish and honey.

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08 - 11 In the same ecosystem, barges carrying fly ash traverse the rivers hugging the forests and Sundarbans inhabited islands. Government policies are transitioning the multiple and myriad uses of these rivers to be converted into a trade and transport corridor for commercial shipping. These vessels are causing erosion and polluting the rivers.

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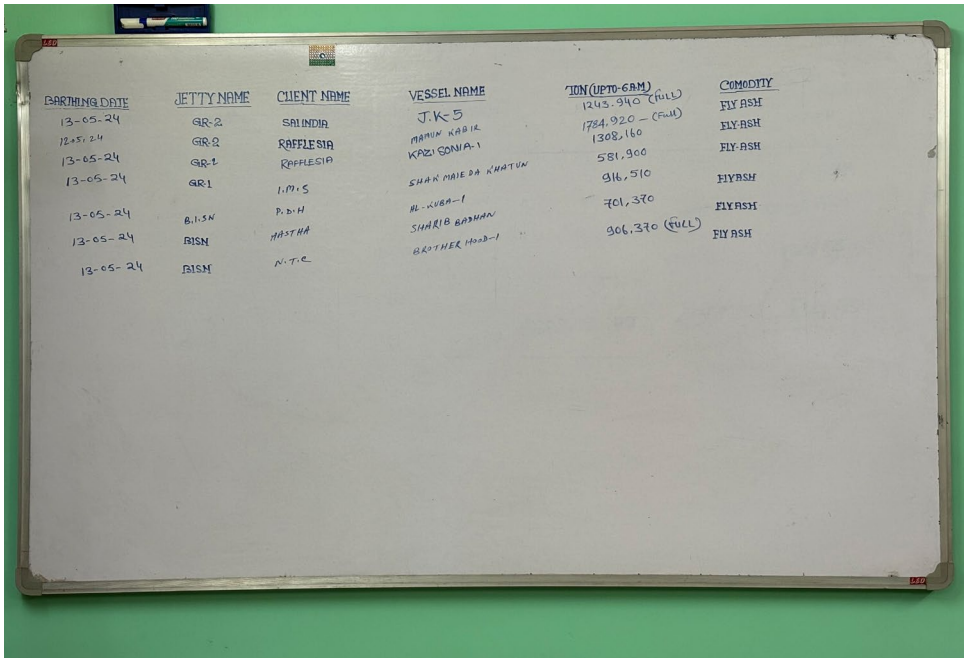

12

13

12 - 14 Port activities in Calcutta began on the Hooghly river as early as the late 1600s under the British East India Company. It was officially established as a port authority in the 1970s as the Calcutta Port Trust. For the past two decades, the Kolkata Port primarily loads fly ash—carried by road tankers from coal mines—which are transported on barges to ports in Bangladesh. Fly ash is a toxic byproduct of coal. It is used to make cement.

14

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