

## Frontier Terrain

Riton and I are in the cabin of a dredger on Mongla River. The dredger is operated by the Bangladesh Inland Waterway Transportation Authority (BIWTA)—an organization with the daunting task of keeping Mongla River, along with Bangladesh's thousands of kilometers of inland rivers and canals, open and flowing. In a region where travel by road is circuitous at best, these channels form a vital system that allows for the movement of people and, especially, goods. Waterways are key to the working of this frontier. To that end, this dredger is constantly on the move.

The dredger resembles nothing so much as a massive, metallic water bug, painted in the green and red hues of the Bangladesh flag. It is a barge-like vessel with a long and thick trunk—the cutter pipe—extending from its fore. At the tip of this pipe is a bladed cone called the cutterhead. When lowered onto the riverbed, the cone spins at high speeds, breaking up the sludgy silt deposited on the river's bottom. As the cutter does its work, dredge spoils—a mix of river water, silt, and anything else that has grown or settled on the riverbed—are sucked up into the pipe. The spoils are, in turn, pumped through the dredger and spit out a long discharge hose. This snakes across the river, supported by large orange buoys, and up the steep embankment that marks the river's edge. The muddy silt completes its journey from the riverbed as it is sprayed into viscous discharge pools that line the river's banks.

The dredger prowls the channel, engaged in a Sisyphean project of holding back the silt. But today, work has ground to a halt. Something is lodged in one of the pulleys that allow the dredge operator to raise and lower the cutter pipe into the river depths. A repair barge has pulled alongside, and a group of men are trying to un-foul the cutter pipe's cable. We watch from the cabin, looking over the shoulder of the dredge operator, as they disconnect the pulley. This allows the



FIGURE 10. Dredger, Mongla River.

operator to raise the wire and see what is caught in it. As the cable comes up, something is pulled from the depths: a lumpy object the size of a large goat. The workers look at it quizzically, prodding it with a metal rod, trying to identify what it is.

Receiving a hand signal from the workers, the dredge operator uses his joystick-like controls to dunk the object into the water. With each dunk, mud sluices off. After a few minutes, the object begins to change form, to dematerialize. Far from being solid, it reveals itself to be an old fishing net, its days of catching fish long over. Rather than marine life, enough silt has been captured by the net for it to snag in and slow the dredge's plodding progress. Net exposed, the workers shake their heads and laugh. Then they cut it away, untangle its remains, and reconnect the cable. The dredge operator lowers the pipe back into the water and engages the cutterhead. He is back in business.

The net poses only a minor problem for the dredger. But it is emblematic of a broader challenge that has historically dogged projects of managing and controlling delta space. Production, transportation, and statecraft hinge on land and water being predictably in place. Yet in the delta, matter stubbornly refuses to remain fixed in space and time. It even refuses to remain in a single material state. Dimensional transformation is a fact of life. Things are constantly in flux, en route from wet to dry, from solid to liquid, from sweet water to saltwater. And back

again. In a world where much of policy, management, and imagination classify things as either/or, the delta stubbornly refuses to comply. It remains recalcitrantly mutable, inexorably damp.

The story that I tell in this chapter is of this productive tension—the articulation between damp terrain and the delta’s frontier dynamics. The delta’s history and present can be narrated as a series of attempts to capture land and property back from transient dampness—to fix material in time and space. These material fixes try to make the delta into a zone of absolute distinction between wet and dry. Yet such projects are always in a state of flux, failure, and reinvention. The delta is constantly foiling projects that seek to make land, property, and capital by fixing terrain—keeping the wet wet and the dry dry.<sup>1</sup> But damp matter also forms the basis of new projects that emerge from the muck of the old—that conjure new ways to link the delta to capital flows and forge new capitalist relations within it.<sup>2</sup> Life, commerce, and politics do not happen *on* delta terrain but rather *through* it. The delta’s transient materiality thus provides the mutable grounds for the constant reinvention of the delta as a frontier.

To call the delta a “climate frontier” is not to identify climate change as the singular causal element in shaping relations of extraction, opportunity, and exploitation in delta terrain. Rather, it is to say that much of what happens in delta space unfolds against a projected future of environmental change—of potentially catastrophic shifts in delta life that demand interventions in the present. Such imaginations are one way of assembling the delta as frontier space—as a zone that is open to a rapidly proliferating set of projects ordering life and political economy anew. If the previous chapter outlines the imaginative terrain against which this unfolds, this chapter charts the material. Frontiers are often described as things with life cycles: they emerge as opportunities in moments of time but are eventually settled, capitalized, and closed. Not so the delta, which is recursively reimagined and remade as frontier space.<sup>3</sup> While the dynamics of frontierization (what is open for exploitation and how) may change over time, the delta appears to be good frontier material. One of the reasons why is its materiality, the damp transience of delta space. To understand the ways that imaginations of delta space mix with water and silt to form a potent, if mutable, frontier admixture, we must begin by exploring the delta’s fundamental material interface. That is to say, we must begin by stepping into the ooze.

#### DELTA SILTSCAPES

As the previous chapter argues, global imaginations of the Bengal Delta are framed through the lens of catastrophic inundation. Yet to think of climate change in the delta *only* as a storm is to miss the fact that vulnerabilities (human and environmental) more often emerge out of the viscous encounter between attempts to make the delta into a productive space and slow intrusive processes that unfold

over time (though which often lead up to sudden and devastating effects). These transformations happen at much less perceptible temporalities and volumes than imaginations of catastrophic inundation would suggest. If sudden inundation is the public face of crisis, seeping intrusion is its hidden accomplice. Changes might, and sometimes do, come in a flood. But more often they ooze into and through, eroding infrastructures and imperiling production, governance, and life. The insidious movement of matter—the non-fixity of delta terrain—is often the condition of possibility for the catastrophic event.<sup>4</sup>

Understanding this relationship—rebalancing our attention from inundation to seepage—requires a shift in perspective: it demands that we abandon the propensity to think of things like “landscape.” The delta is not composed of “land” in the stable, fixed sense of the term. It is composed of silt—something much more protean in character, a matter prone to phase shifts, movements, and transformations at both gradual and (occasionally) rapid rates.<sup>5</sup> Silt might one moment be particulate suspended in water, en route to a riverbed or to the ocean. The next it might be a semi-solid that collects in a fishing net to foul the lines of a dredger trying to maintain circulation in and through delta canals. The next it might be part of an island’s muddy embankment, helping to keep outside water at bay and to facilitating property relations and accumulation within. The delta, the islands within it, the waterways that course through it, and the mangroves that grow at its mouth are all composed, and occasionally decomposed, by this transient material. To think of the delta as a “landscape” is misleading. It is more aptly described as a “siltcape.”<sup>6</sup>

The delta siltcape demands a certain flexibility in imagining not only space but also time.<sup>7</sup> Matter within the siltcape builds up and accumulates and erodes and dematerializes. Yet it does so at uncertain and nonlinear paces. Things gather to unpredictable thresholds and then give way. Insidious buildups become sudden transformations as discarded fishing nets capture enough silt to foul dredger lines and undercut embankments suddenly collapse into the water. Multiple temporalities—relationships between matter and time—characterize the delta siltcape as much as phase shifts in the terrain.<sup>8</sup> Like silt itself, they trouble conventional narratives of development, growth, and progress.

Exploring this siltcape requires taking material and temporal composition seriously—as part of a hydrological, geological, and atmospheric system that circulates matter through delta space. The delta is nested within a broader system that Sunil Amrith and Daniel Smyer Yü term the “Monsoonal Clime”—a region composed of environments that are linked together by a monsoon-driven water cycle.<sup>9</sup> Here, moisture from the Bay of Bengal is carried as water vapor to the mountains by the monsoonal winds, where it is deposited in the form of rain, snow, and ice. Snow and glaciers subsequently melt (at increasing rates as the earth warms), and their water flows back from peak to bay.<sup>10</sup> The water does not return empty-handed. Water and wind wear away rocks and topsoil in the mountains, turning them into particulate suspended in watery flow. This particulate is washed

downstream in monsoonal floodwaters and the many rivers and streams running out of the Himalayan massif. As these sediments are swept along, they abrade, swirling in eddies and rapids, bouncing along riverbeds, lodging and dislodging in banks. Constant agitation grinds the particulate matter into fine sedimentary powder called “silt”—*patla* in Bengali.<sup>11</sup> Rivers in the delta carry the highest proportion of silt of any rivers system in the world.<sup>12</sup>

The delta is the outcome of this continuous transfer of sediment from the Himalayas to the Bay of Bengal—the millennia-long rendering of alpine vertical as delta horizontal. Bangladesh, as Willem van Schendel notes, “is the Himalayas flattened out.”<sup>13</sup> As mountain flows reach the plains, they slow and become more dispersed. They begin to alluviate—to deposit silt across the delta. The regular and persistent flooding of alluvial islands (provided they are unbanked) leaves a new layer of fertile silt on agricultural fields. Silt is also deposited in delta waterways that, without and sometimes because of human intervention, occasionally transform into mud flats. Downstream flow carries silt out into the sea, where it deposits on the seabed to make the Bay of Bengal, a bay whose shallow depth facilitates the solar warming of seawater and its transformation into the water vapor that subsequently fuels the monsoon. The scale of passage of silt is enormous—as much as two billion tons of sediment annually flow into the bay.<sup>14</sup> The flow is clearly visible in satellite images of the Sundarbans that capture the turbid silt/water mixing with seawater to form a putty-colored outline of the coast as it flows out of rivers and into the ocean (see figure 2 in the introduction).

Silt, at different moments, can be liquid or solid. But it is more often somewhere in-between: a damp, oozing, and omnipresent mud. As mud, it coats the feet, legs, and arms of peasants and fishermen as they work the delta’s fields, rivers, canals, and embankments. It paints them and their clothes in a putty-gray hew. It forms a layer on buildings, steps, and concrete structures, seeping into the smallest nooks and crannies, smoothing out porous concrete surfaces, causing buildings to blend into their surroundings. In its damp muddy state—*kadda*—silt is a primary building material for homes, embankments, and roads in the delta zone. It is used to shape the raised mounds that serve as property boundaries around fields and plots of land. It holds water in canals and ponds. Buildings, infrastructure, land—silt in its various forms is a material basis of delta life.

Silt is a fundamentally uncertain matter. While exposure to the delta sun transforms mud into a solid-seeming material (walls, embankments, ground), silt can quickly dematerialize, shifting phase to mud and liquid with exposure to water. The seeping processes that turn liquid into land can turn it back again. This happens in many ways. But perhaps most dramatically, it occurs in riverbank erosion. Like siltation, riverbank erosion is the outcome of a combination of factors. Human-made embankments are slowly eroded by the subterranean hydraulic action of water flowing downstream. Through this action, water intrudes into and undermines embankments until they give way and collapse into the water. People living

in the delta regularly recount stories of waking in the middle of the night to find their homes being swept into the river beneath them.

Such erosion is nothing new and has long been part of life along Bangladesh's many rivers.<sup>15</sup> But a range of environmental factors have accelerated erosion in recent decades. Amongst these, decreased downstream flows have allowed silt to accumulate in the deepest parts of river channels—often the middle—a process that pushes currents toward river edges, where they can increase rates of erosion. Erosion is also an outcome of the intensification of rain and flooding—both effects of changing monsoonal patterns in a warming world. Between 1973 and 2017, erosion engulfed 160,000 acres on the banks of Bangladesh's three primary rivers—the Padma, the Meghna, and the Jamuna.<sup>16</sup> Projections of climate change suggest that greater monsoonal flooding—something likely to be a feature of life as warmer air over the Bay of Bengal carries more moisture inland—may cause increased rates of erosion and subsequent environmental displacement.

The seeping processes that turn land into liquid can also turn it back. Land accretion is a central hydrodynamic feature of the delta.<sup>17</sup> Silt washed away from the riverbanks can reemerge downstream as siltation islands, or chars.<sup>18</sup> These new islands are often temporary and unstable but quickly accrue populations seeking to transform silty accretions into productive agricultural land and property.<sup>19</sup> The disappearance and reemergence of these islands can pose both opportunities and conundrums for political rule in the delta.<sup>20</sup> For example, the hastily drawn Radcliffe Line, which divided West Bengal and East Pakistan (now the border between India and Bangladesh) at Partition in 1947, used deltaic rivers as lines of demarcation for almost a fourth of the new border.<sup>21</sup> Chars—spits of land emerging in the midst of these rivers—have been flashpoints in border disputes, as it is unclear to which state the new land belongs.<sup>22</sup>

Such shifts highlight a paradox of the delta borderland that is emblematic of the delta at large: despite efforts to fix territory through demarcating and policing, the land itself refuses to stay put, seeping back and forth across the boundary.<sup>23</sup> These small-scale movements of land mirror processes unfolding at broader scales and temporalities. The Sundarbans itself is seeping out of India and into Bangladesh as plate-tectonic tilt causes a gradual eastward flow of the mangroves, as well as the flora and fauna within them.<sup>24</sup> The fugitive siltscape of the India-Bangladesh borderlands refuses to be fixed in place.<sup>25</sup>

If an examination of silt troubles a fixed understanding of land, it also troubles a fixed notion of waterways and rivers. Dilip Da Cunha, rethinking waterways in South Asia, notes that rivers themselves are best understood as “inventions”—elements of design rather than elements of nature.<sup>26</sup> Such inventions are implicated in projects of rule and accumulation. Rivers in the delta are not primordial things but cartographic creations conceived on colonial maps in advance of their production in place.<sup>27</sup> Their fixing allowed for the expansion of colonial property relations through programs such as the 1793 Permanent Settlement which enshrined the

zamindari system (a landlord/tenant relationship) in law and established a land revenue system in Bengal.<sup>28</sup> Yet rivers in the delta fail to remain fixed in place.<sup>29</sup> Seasonal shifts, changes in monsoon rainfall, upstream development, erosion control measures, and more mean that rivers in the delta can and do shift location from year to year.

The delta's "rivers," like its "lands," have recent and contingent histories that are bound to empire, territory, and capital. Embankments, canals, dredging operations, barrages, borders, and fences are all technologies designed to make unruly water, land, and people remain in place—in the predictable locations where they are found on the map.<sup>30</sup> The delta siltscape defies such management. Matter—geological, biological, and hydrological—is constantly on the move, defying easy categorization and fouling technologies that seek to anchor them in place. Yet accumulation and rule in the delta itself cannot be reduced to a simple opposition between human technologies and the delta siltscape. The story of the delta's recursive frontiers is also a tale of the ways that opportunity and exploitation emerge as much from the breakdown of projects anchoring wet and dry as the projects themselves. To provide an example of this dynamic, it is useful to explore the recent history of the delta's siltscape—the postcolonial entanglement of embankments, rice, and shrimp.

#### GHER FRONTIER

The delta siltscape is a palimpsest of frontier projects.<sup>31</sup> New projects seep out of the damp remains of the old. This is nowhere more apparent than in the turbulent history of the delta's embankments. For much of recorded history in the delta, people have been embanking islands to at least temporarily protect homes and fields—allowing for things like the planting of rice paddies and fields, harvests, and the growth of human communities of varying size.<sup>32</sup> Prior to the colonial period, embankments were often raised to protect land during the dry season and then opened during parts of the year to allow for the flooding of rice fields and the deposition of alluvial soil on agrarian land. That is to say, delta residents saw land not as something that was permanently dry but rather something that itself changed phase from season to season as part of the rhythm of agrarian delta life.<sup>33</sup> Embanking projects in the colonial era, in contrast, increasingly sought to partition water and land more formally and permanently.<sup>34</sup> Embankments became essential tools of frontierization in the delta, enabling the implementation of revenue-generating property regimes, the integration of agrarian rice economies into circuits of commodities and capital, and the enclosure and clearing of swampy mangrove spaces—the transformation of unproductive "wastelands" into productive agrarian zones.<sup>35</sup>

The postcolonial history of embankments follows a similar pattern—integrating the delta siltscape into broader networks of accumulation and



extraction. But if colonial embankments sought to provide a material fix, the post-colonial history of embankments is somewhat muddier. Rising out of the delta siltscape, postcolonial frontiers in the delta weave together the geopolitics of the Green Revolution, the political economy of structural adjustment, and the rise of new export markets in brackish water aquaculture.<sup>36</sup>

In the 1960s, the Pakistan government—aided by World Bank funding and Dutch engineering—launched the Coastal Embankment Project (CEP), a massive infrastructural endeavor meant to create high, durable, and stormproof embankments around many of the islands in the delta.<sup>37</sup> This project set about building concrete-reinforced embankments known as *polders*—the Dutch word for embankment—in 108 islands throughout the delta.<sup>38</sup> The CEP was meant to provide a permanent material fix in the delta. In doing so, it would facilitate migration and settlement into delta space by allowing for the profitable adoption of Green Revolution high-yielding varieties (HYVs) of rice. In other words, it would make the delta into a breadbasket for Pakistan at large.<sup>39</sup>

Durable embankments were particularly important in the adoption of HYVs. HYVs were engineered so that each plant would grow more kernels of grain (rice, wheat, maize) on each stalk. The challenge of HYVs was that the additional weight of these grains would often cause the plants to collapse. The plants would thus die before harvest. The solution was to engineer varieties with shorter, thicker stocks—less likely to collapse under the additional weight. These shorter varieties may have been good for bearing weight; however, their short height and the need for intensive inputs, especially fertilizer, to facilitate their growth made them problematic in regions subject to periodic saltwater inundation, such as the islands in the Bengal Delta. CEP embankments addressed that issue by notionally making these spaces permanent freshwater land where HYV cultivation could happen year-round. In doing so, it helped to produce the delta as a postcolonial rice frontier in the 1960s and 1970s.

If CEP embankments ushered in land transformations of the Green Revolution, they soon became central to implementing a new revolution, this one blue. The CEP assemblage of rice and embankments began to undergo a shift in the late 1980s and 1990s. During this period, in response to the cascading debt crises of the 1970s and 1980s, the International Monetary Fund began to implement a suit of policy initiatives collectively known as “structural adjustment programs.” The goal of structural adjustment was to liberalize the economies of developing countries, opening them up to export-driven growth. In Bangladesh, two sectors targeted for liberalization were ready-made garments and seafood, specifically shrimp. Bangladesh, and particularly its delta region, were to play a role in and capitalize on the exploding global seafood market, a sector fueled by both advances in aquaculture techniques and in refrigeration.

Tiger prawns—*bagdachingri*—are indigenous to the delta region. But the mangrove ecology of the delta siltscape proved ideal for industrializing their growth



by adopting new Blue Revolution technologies to grow them in brackish water ponds—ghers, a word which can tellingly be translated as “enclosure.” Gher owners would stock these ponds with prawn fry—baby prawns—caught either in mangrove waterways during the spawning season or, latterly, imported from elsewhere. In the protected gher, the fry would grow to a profitable size before being harvested and sold in local markets.

The rise of the Blue Revolution heralded a sea change in land and land use throughout the delta.<sup>40</sup> Landholders began to move away from pure agricultural production (rice) and to adopt brackish water aquaculture for export to Europe, North America, and East Asia.<sup>41</sup> Throughout Bangladesh’s coastal zone, often-absentee landlords began to flood fields with brackish water pumped in from rivers. This rapid transformation of land use was accompanied by government regulations that reconfigured land access laws to help encourage the adoption of the highly profitable shrimp—“white gold,” as it came to be known.<sup>42</sup> The rise of shrimp aquaculture was accompanied by land grabbing and land consolidation throughout the delta. It also resulted in local and national movements, often led by landless groups, to oppose the expansion of shrimp, an industry that not only threatened agrarian employment but also agrarian ecologies.<sup>43</sup> Despite such protest, shrimp expanded to occupy 171,500 hectares of land in the delta over a twenty-year period.<sup>44</sup> Today, much of the delta’s agricultural land is covered in shrimp gher. These stretch toward horizons, covering land often right up to the very thresholds of courtyards and entrances to homes. The advent of shrimp turned the interiors of islands in the delta back into wet spaces, further undoing the material fix of colonial and CEP embankments, if not the logics of property and accumulation that drove their construction.

Shrimp transformed the delta siltcape in other ways as well. Saline intrusion into aquifers and the seepage of brackish water into surrounding fields and lands have made it difficult to pursue agriculture in many of the more heavily ghered regions of the delta. In spaces that previously were agriculturally abundant, little remains of fruit trees and gardens. Saline seepage has sped the consolidation of land around shrimp. As agriculture becomes less viable in the delta, many smallholders either have shifted toward shrimp or simply sold their land to larger holders already engaged in the shrimp business. As Kasia Paprocki and I have documented, shrimp aquaculture in the delta entailed huge social costs.<sup>45</sup> It transformed agrarian diets and eliminated access to spaces previously used for grazing, playing, and other social activities. Much *khas* land—government-owned land on which landless families have constitutionally protected usufruct rights—has been enclosed by shrimp producers. The loss of access to *khas* land closed off key spaces where landless families grew crops, foraged for plants to supplement their diets, and grazed livestock.

But, perhaps most significantly, shrimp transformed the delta’s agrarian labor market. Shrimp requires little labor compared to rice. Its spread has, thus, led to a



FIGURE 11. Shrimp *ghers*, Polder 23.

contraction of off-farm labor opportunities—a contraction with particularly significant implications for landless families who rely on such work. Much of the labor required for maintaining ghers is often done by women who clean the ponds before fresh batches of shrimp fry are seeded within them. This low-wage labor often leads to health complications related to standing for hours in the brackish water amid the many chemicals that are added to help shrimp grow. Beyond this, few opportunities are available for landless families in agrarian space. Shrimp has thus heralded migration—on both permanent and circular bases. Families have moved en masse to urban areas in Bangladesh. Others migrate across the India-Bangladesh border, searching for work in the construction industry in Kolkata.<sup>46</sup> Some take work in brick factories.<sup>47</sup> Still others have taken to fishing in the Sundarbans and the bay at the precise moment that climate change-related conservation programs are attempting to reduce fishing in the delta (something we will return to in subsequent chapters).

Shrimp, crucially, has also had impacts on embankments themselves. Shrimp gher owners, rather than pumping water from outside over embankments, find it more expedient and cost-effective to let the water in. In many islands, the transition to shrimp was facilitated by landholders gaining control over sluice gates that they could use to open island interiors to outside rivers. In others, shrimp farmers simply drilled through embankments. This constant drilling sped seepage,

weakening embankments and increasing the likelihood of their collapse in the face of storms.

The interaction between shrimp and embankments is illustrative of a range of relationships. It is a Schumpeterian tale of creative destruction in service of accumulation—the collision between a delta siltscape and new imperatives of capital.<sup>48</sup> Yet it is also illustrative of recursive frontier-making in the delta. The CEP facilitated the rise of a new rice frontier by embanking islands to keep them dry. This produced new capitalist relations in the delta, signaling a shift toward integrating the delta into broader national networks of rice production and distribution. The imperatives of shrimp aquaculture transformed this relationship, making dry land into damp and muddy ponds to access emerging export markets in frozen seafood. In doing so, shrimp again reconfigured social and capitalist relations in delta space. It did this by undermining existing agrarian labor markets and transforming not only what was grown in agrarian space but what *could* be grown there. Shrimp—and the projects of frontier-making that it represents—are thus fundamentally embedded in an emergent delta siltscape, where the dimensional and material transformations of aquaculture production shape and are imperiled by the broader delta siltscape itself. To better understand this dynamic—and to see the entanglements of projects of accumulation and circulation—it is useful to look outside the delta embankments, to look at the dynamics of siltation in delta waterways.

#### SILTED CHANNELS

How does the siltscape trouble imaginations of a more orderly partitioned zone? One of the many possible answers to this question can be found in the struggle to keep things circulating through the ooze—to overcome the tendency for silt to transform liquid rivers into damp ground.

Siltation has long been a central challenge for those seeking to tame and manage the delta.<sup>49</sup> The challenges of siltation are only increasing in scope and urgency. Today, minor canals and major shipping channels alike struggle to cope with alluvial deposits that threaten to transform fluid channels into impassable muddy sludge. An important cause of this siltation is the construction of upstream dams and barrages in India on major rivers that subsequently flow into Bangladesh. Most notable of these is the Farakka Barrage, built in Murshidabad in West Bengal on the Ganges. The Farakka Barrage diverts water that would otherwise have flown into Bangladesh to the Hooghly River, which courses downstream through Kolkata and enters the Bay of Bengal squarely on the Indian side of the border. It has long been a flashpoint of tension between the two states and an icon of the difficulty of ironing out cross-border water management strategies.<sup>50</sup> In these debates, India has historically had the upper hand, not just because of its comparative size and power but because all of Bangladesh's major rivers flow through India before entering the country. Geopolitically and geographically, Bangladesh

is distinctly downstream—constantly forced to negotiate access to waters that are vital but beyond sovereign control.

The decreased downstream flow of water has two pressing implications for life in the delta. First, decreased flow in tidal waterways means saltwater from the Bay of Bengal flows farther upstream on flood tides. The Sundarbans region has long been an area where the dynamics of downstream and upstream flow have created a brackish ecology. Saltwater, *labonpani*, from the bay mixes with fresh water, *mishtipani*, as it flows downstream. The balance of salinity fluctuates over the course of the year. The water is mostly fresh in the monsoon period, when rain and meltwater flow down into the delta, and salty in the dry season. But now, the saltwater period seems to be growing in length. Many older residents of the Sundarbans observe that when they were younger saltwater would remain in the river for three months of the year, and for the rest of the time the water would be fresh. Today, they report, that ratio has reversed. Increasingly, this saltwater penetrates islands of the delta, seeping into freshwater aquifers and creating a severe shortage of *mishtipani* for drinking and agricultural production. Second, decreased downstream flows lead to growing volumes of sediment in waterways. Instead of flowing out into the Bay of Bengal, this accumulates in the delta itself, depositing in the waterways that carry them. This deposition on river and canal beds slowly strangles passageways as the silt sinks to the bottom of rivers that no longer move fast enough to carry particulate to the ocean. These deposits produce a positive feedback loop—the more silt deposits, the less water flows, turning waterways into solids at ever-increasing rates.

Upstream damming is only one cause of siltation. Another is embankments themselves. Embankments protect residents of islands in the delta from water. But they also prevent the deposition of silt on large parts of the delta floodplain, containing it, instead, within the waterway. This leads to dimensionally transformative effects. As canals and rivers receive ever more deposition, they become shallower, making it harder to navigate them in barges, boats, and other water-going vessels. Conversely, inside of islands, land appears to be sinking. This is in part due to subsidence as freshwater aquifers are depleted by agricultural production. But it is also due to embankments preventing islands from receiving new alluvial deposits. This leads to problems such as water logging—a condition where water is trapped in island interiors. Once there, it can be extremely difficult to get out again. Much of the displacement following Cyclone Aila in 2009, for example, was caused not during the storm itself but by water logging that, over time, prevented residents from returning to agrarian production.

Outside of the embankments, the accumulation of silt in waterways poses other challenges—the transformation of fluid passages into damp and muddy zones impassible by boat. This threatens not only transportation in the delta but also its fragile ecologies. In 2014, for example, the oil tanker *Southern Star VII* sank in the Shella River in the midst of the Sundarbans, spilling 350,000 liters

of toxic furnace oil into the ecologically sensitive mangroves. For weeks, delta residents drafted into cleanup crews worked to scrub the sticky, toxic goo from the mangroves and its animal inhabitants. The tanker had been traveling out of shipping channels in a protected forest zone when it foundered and sank. The reason for this was that Ghashiakhali, one of the main shipping channels connecting Mongal and Bagerhat, had become so clogged with silt that no water flowed through. The canal bed was little more than a muddy plain that residents could walk directly across. Blockage of safer passage had forced ships like the *Southern Star VII* to seek alternative, more perilous routes to keep goods flowing in the delta. The slow accretion of gooey silt blocking channels and waterways thus led to the spilling of gooey petroleum into the Sundarbans itself. Similar accidents, if less environmentally catastrophic, are not uncommon. Indeed, the foundering of vessels transporting everything from finished goods to coal and petroleum products has become a somewhat regular feature of life in the delta as waterways become harder to navigate.<sup>51</sup>

The silting of the canal that caused the *Southern Star VII* to detour was due to more than just geopolitics, climate change, or diminished downstream flow. More proximately, it was linked to political ecologies of shrimp. In the years leading up to the accident, eighty-three feeder canals that flowed into Ghashiakhali had been dammed by shrimp farmers, eager to use the valuable water to fill their ghers. This had dramatically reduced flow into Ghashiakhali by cutting off a range of tributaries to the channel, speeding the silting process.

#### VITALIST WATERWAYS

In 2015, the government of Bangladesh began work to reopen Ghashiakhali, a project we visited in 2016, as the guest of an engineer working for BIWTA named Titumir. We met Titumir on a winter afternoon in his office in Rampal, not far north of Mongla Port and adjacent to where Ghashiakhali branches off the Pasur River on its way to Bagerhat City. Over a late afternoon lunch, we spoke about the dredging of the canal. Titumir was a garrulous, neatly dressed man still in the early stages of his career. As we spoke, he shared a blizzard of figures and statistics about the process of dredging, before and after photos of the canal, and his thoughts on the practicalities of running a massive dredging operation to resurrect what he described as a “dead” waterway. As Titumir explained, the planning and funding appropriations for the dredging process had preceded the *Southern Star VII* disaster. But the oil spill had lent urgency to the process, ensuring the funds would not be reappropriated to other pressing concerns. Using a range of dredging machines—some part of BIWTA’s aging workhorse fleet, some newly leased from a Chinese company that had recently entered the dredging business in Bangladesh—BIWTA shifted thousands of tons of silt, largely onto the banks of the Ghashiakhali. The canal was dredged to a depth of fifteen feet, though Titumir

told us that there were hopes to increase the depth to allow for bigger vessels to pass through. By almost any measure, the dredging project at Ghashiakhalī was a success. In a matter of months, the canal had gone from impassable muddy land to a working waterway. Since the canal had tentatively reopened in February of 2015, less than a year before our visit, more than fifty thousand vessels had safely navigated it.

After lunch, Titumir took us on a field trip to see the work in action. A short rickshaw ride from his office brought us to the BIWTA repair launch on the canal—the staging ground for much of the dredging work. From the launch, we hitched a ride on a supply boat headed upstream to visit one of the working dredgers. As we rode up the canal, Titumir pointed out evidence of dredging all along the banks, shouting in my ear to be heard over the noise of the launch's motor. The canal's embankments rose steeply up from the water. They ranged from approximately three to six meters in height. They had all been reinforced with new silt and looked muddy and fresh. A few small landless shelters had sprung up on the embankments since the initial stages of canal repair, perching precariously on the fresh muddy banks. Beyond the embankments lay a series of discharge pools—large ponds containing the sludgy spoils dredged from the bottom of the canal. These pools sat, often, on top of private land.

This was my first visit to a dredge site. But such scenes are common along many of the delta's waterways. Constant siltation requires constant dredging.<sup>52</sup> Dredgers fan out from the region's main port, Mongla, and crawl up and down the channels and canals, pumping millions of gallons of silt from the waterways. The dredger was anchored on a river bend, perhaps five kilometers from the launch. From a distance, we could see the arc of the dredge spoils shot high into the air as they were pumped over the embankment. The dredger itself was a comparatively small machine, connected to the shore by a long discharge pipe, supported by floating buoys. We were warmly greeted when we arrived and tethered our boat to the side. As Titumir gave us a tour of the operation, I struggled to stay out of the way of the crew, who were busily completing the day's labor. They had little time to stop and chat. After a brief stay, we climbed back into the boat, headed to the shore, and scrambled up the embankment to see the discharge pool. It resembled nothing so much as a pit of petroleum, vast and viscous, shimmering in the evening light. One of many similar pools along Ghashiakhalī's banks, it stretched out from the embankment, covering an area equivalent to several large agricultural fields. Curious, I stuck my finger into the muddy pool. The spoils were viscous, coating my finger in putty-colored mud. Rubbing my fingers together, I could feel the fine particulate silt, a velvety ooze in transition from liquid back to solid.

On our return journey, we watched a stream of heavily laden barges move along the canal, transporting goods, sand, and other materials between Mongla and Bagerhat. Despite the steady stream of traffic, Titumir explained, the work was far from over. Keeping Ghashiakhalī running required vigilant and ongoing





FIGURE 12. Dredge discharge pool, Ghashiakhali.

maintenance. This was in part because BIWTA had limited authority to manage the causes of siltation, proximate or remote. They were only tasked with managing its effects. Despite the urgency lent to the project by the *Southern Star VII* disaster, for example, the feeder canals dammed by shrimpers were still blocked. There was little BIWTA could do about this, highlighting a tension of capital and accumulation on this climate frontier. As important as waterway transportation is, the export market in shrimp—the second-largest source of foreign direct investment in Bangladesh after garments—remains critical to national economic growth. The shrimp industry thus remains largely unregulated and unmonitored. Moreover, shrimp producers, typically comparatively wealthy landholders in their communities, often are closely associated with local government officials and elected members of local governing bodies, Union Parishads. They are, thus, often able to do what they like with their ghers, whether formally in violation of laws or not. This posed a potentially existential threat to Ghashiakhali. As Titumir explained to me in vitalist terms: “To keep a river alive, you have to always keep the flow in the canal correct. Water must run through it smoothly and quickly. If the flow of the river isn’t working properly, siltation will increase, and problems will begin to happen everywhere.” In the delta frontier, competing imperatives of accumulation produce their own forms of viscous friction, occasionally swamping each other in oozing matter.



We finished our journey with Titumir as the winter sun set. He graciously dropped us on the other side of the canal, not far from where we had left Riton's motorcycle. We walked from the bank through a small village. Dredging was everywhere in evidence. Fine silt, blown into the village by wind and spray during the dredging process, covered walls, streets, gardens, and even the interiors of mosques and schools. Heading east from the village, we could see the remains of filled discharge pools. As water evaporates from these pools, the spoils slowly turn into muddy plains, which in turn dry into a cracked, hardened surface. This leads many who live near the canal to note that dredging had turned the region into a desert.<sup>53</sup> Such observations complicate Titumir's vitalist metaphors of canal life and death. To keep waterways alive (flowing) requires the spray of a muddy goo onto otherwise productive land—transforming the dry, at least temporarily, into the damp, with grave implications for the things living and growing there.

On our way out of town, we stopped for a tea and fell into conversation with a man who was a shrimp farmer in the region. Several of his ghers had been positioned along the banks of Ghashiakhali. We asked him about the dredging process, and he angrily told us that the spoil had been deposited on top of his shrimp ghers. "There is no removing that mud," he told us. "Who will do it? The government has done this to us, but they are now not doing anything to fix the situation." I asked him if, given the layers of fresh silt now deposited on his land, transitioning from shrimp back to rice or vegetables was possible. With a look of disgust, he told me that there was far too much salt in the soil to consider that. "My land is totally ruined." Whether, with time, dredge spoils can be transitioned to other uses is an open question.<sup>54</sup> But what should be done with the excess matter is a challenge for those who live near riverbanks. Dredging dramatizes another classic frontier challenge: how to live with the literal spoils of accumulation.

The fact that the man we were chatting to was, himself, a shrimp farmer—a practitioner of the very profession that had caused, at least in part, the silting of Ghashiakhali to begin with—was ironic, but not, in and of itself, surprising. Neither is the appropriation of property through the act of dumping spoils on private land, particularly in a country where the imperatives of infrastructural development often trump property rights. But the articulation between shrimp and transportation was revealing of the dynamics of this damp frontier. The siltscape draws different kinds of accumulation, opportunity, and terrain into viscous relations with each other. On the delta frontier, discrete seeming projects such as transportation infrastructure and export-oriented aquaculture prove no more discrete than water and land themselves.

#### EMBANKED POLITICS

Embankments, like the waterways that flow past them, are "vital systems" of the delta siltscape—infrastructures critical for life that are fundamentally vulnerable to



FIGURE 13. Gabura's embankment road, 2020.

human and more-than-human threats.<sup>55</sup> These earthen mounds surround islands, protecting residents from high tides, cyclones, and other watery intrusions. More than just bulwarks against inundation, embankments are also the surface upon which main roads are built. They make islands navigable for motorbikes, rickshaws, and other modes of wheeled transport. Embankments are subject to the inexorable forces of erosion and, occasionally, to more overt and human forms of degradation, such as shrimp producers drilling through them to access water outside. They are in a state of perpetual decay. The embankment roads in Gabura, for example, are constantly crumbling into the surrounding river. The roads built on top of them are often so worn that they necessitate complex maneuvers simply for two motorbikes to pass each other. Wider vehicles, such as rickshaw vans, often must back up for dozens of meters when they meet each other on the road. This situation is worsened during the monsoons, when embankment roads quickly become impassable fields of mud.

Embankments are at risk of being washed away in the event of storms, not only opening islands to storm surges but also displacing those on and around them. In Gabura, for example, large portions of the island's embankment were washed away during Cyclone Aila in 2009. Residents with homes near the breached embankments have vivid memories of losing crops and livestock as the waters rose, often while they scrambled to rescue family members and whatever goods they could

save from their homes. It took several years for these embankments to be rebuilt. In the interim, those living near damaged embankments had their land repeatedly flooded with saltwater, particularly during lunar high tides. Despite repair projects, Gabura's embankments, like many embankments in the delta, are constantly at risk of collapse. The ability of the embankments to hold in the event of storms is a question of contingency. As several residents of Gabura pointed out to us in 2020, they had been spared harm during the 2019 cyclone season only by virtue of storm surges hitting the island at low tide.

Embankments thus illustrate the ways that vulnerabilities in the delta emerge not on but through the delta siltscape—a space fundamentally shaped by histories of frontier-making projects. The permeability of these structures makes them focal points for local politics. In Gabura, there are constant calls to rebuild failing embankments. The organization in charge of this construction—the Bangladesh Water and Power Development Authority (WAPDA)—is a subject of rumor, frustration, and speculation. The organization is so synonymous with embankment policy that many refer to government-built embankments not by their Bengali name—*baad*—but simply as “Wapda.” They make no distinction between the agency and the infrastructure it is tasked with maintaining. Questions of grave import for residents include when construction will begin, whether there will be adequate funds allocated to reinforce embankments with concrete blocks that can slow (though not stop) erosion, and what parts of the island's embankments will be rebuilt first (and consequently, what regions will gain immediate benefit from reconstruction). Local elections often hinge on claims by candidates to be able to deliver on government promises about embankment reconstruction.

Embankments have become markers of a feeling that residents of Gabura have been abandoned by the central government—reduced from citizens to mere victims of environmental devastation. Such feelings have been particularly marked since the devastation of Cyclone Aila in 2009. Aila was a moment when the island became not only a disaster zone but also a place that many NGOs began to treat as a laboratory for producing climate security. It was, thus, a moment that marked the acceleration and densification of programs designed to produce adaptive and resilient individuals like those described in the previous chapter. Such programs, as residents of Gabura were typically quick to point out, did not offer durable solutions to reduce vulnerability within the island at large. Instead, they typically identified a small number of individuals and families that qualified as “needy” and helped them through cash loans and climate adaptive technologies like the climate-smart house occupied by Nazma and Akkas. But, as many who live on the island note, weakened embankments are a source of collective, not individual, vulnerability. And NGO interventions, even climate-smart houses, can do little to keep people in place if their land is permanently or semi-permanently flooded. As our friend Musa, whose small field had once been used as a test plot

for climate-smart vegetables by a local NGO, put it, “These bloody NGOs give this or that. But how will this help if the Wapda fails and our land is under water?”

The growing frustration with the lack of infrastructural investments by the government poses problems not just for residents but also for local politicians who residents often—and often rightly—see as the arbiters of who benefits from NGO aid. Local politicians have a significant say in who receives benefits. But they are also acutely aware of the political difference between interventions that benefit the few versus those that benefit the many. As a member of Gabura’s Union Parishad told us in 2020, “I pray to God, ‘Keep the NGOs away from here.’ They produce nothing but bother. I want the embankment from WAPDA.” As he continued, “Sometimes people give aid, but aid is not a solution. In Gabura, now, people are repeating a single sentence: ‘We don’t want aid, we want embankments!’ [*Tran chai na, baad chai!*].”<sup>56</sup> This call of “*tran chai na, baad chai*” has become the signature phrase of a movement in Gabura calling for embankment reconstruction. It appears as slogans on placards and chants in demonstrations held throughout the island in the wake of each subsequent storm. Residents are increasingly adamant that the solution to their vulnerabilities lies not in resilient development but in infrastructural intervention. And, indeed, such calls appear to have had some success. In 2022, the government allocated funds for the construction of a new WAPDA embankment. The embankment, scheduled for completion in 2026, will be eighteen feet high, four feet higher than the island’s current crumbling embankment. Like all such interventions, the embankments will be subject to the slow, insidious transformations of the delta siltscape. But they promise, at least for a time, to protect Gabura’s residents from rising tides and increasingly frequent storms.

While the outcomes of this project remain unknown at the time of writing, the struggles over embankments in Gabura and similar areas throughout the delta appear to tell an almost paradigmatic story of biopower and political society. The embankments are unquestionably biopolitical technologies—things that governments deploy to make live or to let die, in Michel Foucault’s famous formulation.<sup>57</sup> To build on Partha Chatterjee’s arguments about political society, residents of Gabura negotiate inclusion not around rights but around demands for the state to fulfill its pastoral, biopolitical duties. Calls to reject aid—a form of assistance that marks residents as potential footloose victims rather than as members of the nation—and instead demand durable embankments are also demands for inclusion and recognition as a deserving population by the Bangladeshi state.<sup>58</sup> Residents of Gabura are not biding their time as waters rise. They see their home not as a wasteland but as viable, if imperiled, land. The tension between *tran* and *baad*, then, appears to map a terrain of struggle over the delta’s possible futures. On the one hand, *tran* charts the imagination of the delta as crisis and its residents as future refugees who may (or may not) be able to survive with the aid of resilient development. *Baad*, in contrast, implies a terrain where places like Gabura and its residents are not lost causes but populations deserving of inclusion within and protection by the state both despite and because of a worsening climate.

If embankments highlight the ways life and politics emerge not on but through the delta siltcape, they also illustrate a basic principle of political ecology. Vulnerabilities to climate perturbations, such as cyclones, are not accidental. They are forged in and through a suite of projects that not only make the climate but the very frontier terrain of the delta. The biopolitics of the delta siltcape are intertwined with projects that constitute life and economy and undermine the very material conditions necessary for survival within the delta siltcape.

#### CRAB RECURSIONS

Today, the long shrimp boom seems to be coming to an end. A persistent problem in shrimp monoculture has been the spread of disease, especially white spot syndrome. Typically referred to in the delta simply as “virus,” white spot syndrome will kill shrimp in an infected gher within a matter of days. Virus, thus, can quickly wipe out an entire season’s profits for shrimp farmers, leading to devastating financial losses. Virus has long been an issue in the delta for shrimp production, leading many shrimp farmers to dump illegal antibiotics and pesticides into ghers. While such measures once provided a modicum of security (even as they raised questions about food safety and the seafood export market in Bangladesh at large), virus appears to be seeping from gher to gher at ever-increasing rates.<sup>59</sup> Shrimp farmers complain that they now often harvest their tiger prawns early, before they reach a size big enough to sell for the best prices in the market. They must weigh the risk of lower profits from smaller shrimp against the possibility of losing their entire harvest.

But as with the rise of shrimp, the collapse of one frontier economy in the delta siltcape gives rise to another. Over the past decade, people in Gabura and surrounding areas have begun to move away from shrimp and turn to crab. Many have converted unproductive shrimp ghers into ponds for fattening hard-shell crabs. These are caught in the Sundarbans and grown to full size—fattened—in the ponds where they are protected from other predators. Crabs fattened in these ponds can grow to between four hundred and six hundred grams and fetch high prices in the local markets, from which they are often exported to East Asia. Prices are particularly high around festivals and holidays such as Lunar New Year.

As the hard-shell crab business has grown, a more recent and parallel business of soft-shell crabs has begun to take over even more gher land.<sup>60</sup> This has been facilitated, in the Munshiganj region, by the arrival of a new Japanese-owned export business called Japan Fast Trade. From its offices in Nildumur, across the river from Gabura, Japan Fast Trade has begun training landowners to transition their unproductive ghers to profitable soft-shell crab. Soft-shell crabs are also captured from the Sundarbans and left in plastic boxes, half-submerged in former ghers until they molt—a process that can be, and often is, forced by the clipping of a crab’s claw. When the crabs molt, they are sold to the export business for shipment to East Asian and Australian crab markets.





FIGURE 14. Soft-shell crab *gher*, Nildumar.

When I visited the region in 2020, there had been an explosion in the number of soft-shell crab farms compared to my visit the year before. People who could convert their *ghers* increasingly were doing so. Others were purchasing unproductive *ghers* as fast as they could. Business was booming. This was, in part, because the arrival of the exporter had made the business both more reliable and safer, especially for women. This was explained to me by Shefali, a woman who had begun organizing a soft-shell crab collective in her village. Shefali had previously been involved in the hard-shell crab business, but soft-shell crab offered significant advantages. As she explained,

If I keep the hard-shell crabs, I rely on the price in the market. One day, some people might inform me at noon that the price is going up. I will need to get the crabs to market. But my husband might be in the *jangal*, my son might also be there. So I will need help from day laborers to collect the crabs, as I can't collect them on my own. . . . But now the soft-shell factory sends someone to collect the crabs two times a day. . . . If I have any unsold product that I cannot sell today, I can sell it tomorrow.

The business is not without its own set of risks. Crab farms are subject to the same kinds of vulnerabilities faced by anyone living in embanked islands in the delta. Moreover, the business was, at least in 2020, still contingent on the capture of live crabs from the mangroves. Such practices are in tension with new initiatives that

seek to regulate, and ultimately reduce, fishing and crabbing in the Sundarbans. As Shefali put it, “Our main risk is getting permission to go inside the jangal. If the jangal is closed, it will be hard to get crabs.”

Shrimp, as Kasia Paprocki argues, has been reinterpreted within the logics of climate adaptation not as the cause of environmental degradation but rather as a response to it.<sup>61</sup> If nascent, the soft-shell crab business also promises to be similarly incorporated into the logics of the delta as climate frontier. As with shrimp, the soft-shell crab business is increasingly heralded by organizations such as the United Nations Development Programme as a livelihood alternative that could provide a viable means of income in the face of climate change, particularly for women.<sup>62</sup> Crabs have become a central pillar of new development programs seeking to build adaptive capacities and resilient populations. The outcomes of this latest round of frontierization are unclear. Soft-shell crab relies on the same architecture as shrimp. Moreover, it relies on ongoing access to the Sundarbans—something that, as we shall see, is very much in question. Regardless of the outcomes, crab appears to be the latest recursive wave of frontierization in the delta siltscape.

This chapter has dealt, primarily, with the material/human interfaces of life and frontier-making in the delta. To that end, it has concentrated on the ways that capital, circulation, and life are inextricably bound to the material affordances of delta matter. Yet the siltscape is not the only medium through which frontier relations are conditioned. If imagination is intermixed with silt in the delta, it is equally tied to questions of biology and conservation. To explore this, we now turn to the delta’s most charismatic resident—the Sundarbans tiger.