

Singapore's Lost Coast: Land Reclamation, National Development, and the Erasure of Human and Ecological Communities, 1822-Present¹

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Singapore's downtown skyline is spectacular. Ultramodern steel and glass skyscrapers jostle with the few remaining colonial-era buildings, bearing physical testament to the nation's meteoric economic rise since achieving independence in 1965. Less apparent than this vertical expansion, but arguably more significant, has been Singapore's horizontal growth. Indeed, much of the downtown core lies on land that did not exist when the British founded the colony of Singapore in 1819. Beginning during the colonial period, and greatly accelerating following independence, Singapore has used land reclamation to increase its national domain by nearly 25-percent, from approximately 58,150 to 71,910 hectares (see Figure 1). Despite being a small country, Singapore has reclaimed the sixth most land from seas and wetlands of any nation on earth.²

The construction of new land was a key component of Singapore's celebrated rise from "third world" to "first world" in the decades following 1965, and by most metrics this transition has been a stunning success. But the economic benefits of remaking Singapore's coastline came at significant ecological and social costs. Nearly all of the original shore, and its attendant mangrove forests and natural beaches, were lost. So too were two-thirds of Singapore's coral reefs. While carrying out this

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² Uta Hassler, "Development Dynamics and Constructed Land: Singapore as a Model for a Purposeful Deceleration" in Uta Hassler, et al. Eds. *Constructing Land in Singapore, 1924-2012* (Zurich: ETH Zurich, 2014), 14; Lim Tin Seng, "Land from Sand: Singapore's Reclamation Story" *BiblioAsia* 13(1) (April 2017), par 1; "Countries with the Most Land Reclaimed from Seas and Wetlands" *World Atlas* <https://www.worldatlas.com/articles/countries-with-the-most-reclaimed-land.html> (accessed 2 May, 2019).

reclamation, the state also erased sites at which people made a living from the sea, including indigenous communities on the outer islands, age-old fishing villages, kelongs (traditional offshore fishing platforms), and prawn farms.³

Over the past few decades, numerous scholars have studied historical land reclamation. In most of these cases, societies have transformed water into land to expand agricultural frontiers. In contrast to these agricultural schemes, though, Singaporean reclamation ventures generally created land to accommodate housing, industry, and transportation infrastructure. These divergent motivations produced distinct histories, offering unique lessons. In some respects, reclamation in Singapore more closely resembles that in New York City as described by Theodore Steinberg, or in colonial Calcutta as related by Debjani Bhattacharyya. But Singapore's unique postcolonial political situation, in which a largely unopposed central government rapidly completed massive reclamation schemes in pursuit of economic development, distinguishes this case from those recounted by Steinberg or Bhattacharyya.⁴

In recent years, Timothy P. Barnard has pioneered the field of Singaporean environmental history, with a few other scholars contributing to the conversation. But this scholarship has focused overwhelmingly on terrestrial themes. It leaves much

³ Loke Min Chou, "Nature and Sustainability of the Marine Environment" in Tai-Chee Wong, Belinda Yuen, Charles Goldblum, Eds., *Spatial Planning for a Sustainable Singapore* (New York: Springer, 2008), 169-171.

⁴ For agricultural schemes, see William H. TeBrake, "Land Reclamation and the Agrarian Frontier in the Dutch Rijnland, 950-1350" *Environmental Review* 5(1) (1981): 27-36; William H. TeBrake, "Land Drainage and Public Environmental Policy in Medieval Holland" *Environmental Review* 12(3) (Autumn 1988): 75-93; R. Keith Schoppa, "State, Society, and Land Reclamation on Hangzhou Bay during the Republican Period" *Modern China* 23(2) (April, 1997): 246-271; Matthew Morse Booker, *Down by the Bay: San Francisco's History between the Tides* (Berkeley: University of California Press, 2013), 71-110; Brian Short, *The Battle of the Fields: Rural Community and Authority in Britain during the Second World War* (Woodbridge, UK: Boydell Press, 2014), 268-297; Young Rae Choi, "Modernization, Development and Underdevelopment: Reclamation of Korean tidal flats, 1950s-2000s" *Ocean and Coastal Management* 102 (2014): 426-436; Katja Bruisch, "Nature mistaken: economics, emotions and the drainage of peatlands in the Russian Empire and the Soviet Union" (forthcoming in *Environment and History*). Elisabetta Novello and James C. McCann, "The Building of the Terra Firma: The Political Ecology of Land Reclamation in the Veneto from the Sixteenth through the Twenty-first Century" *Environmental History* 22(3) (2017): 460-485. Ted Steinberg, *Gotham Unbound: The Ecological History of Greater New York* (New York: Simon and Schuster, 2014); Debjani Bhattacharyya, *Empire and Ecology in the Bengal Delta: The Making of Calcutta* (London, Cambridge University Press, 2018).

room for studies of the nation's marine environmental history, including the process of land reclamation. Researchers from other fields have explored this topic, though, with captivating results. Most notably, architectural scholars Uta Hassler and Milica Topalovic have produced an intelligent and provocative study of land reclamation in Singapore. This work is theoretically sophisticated, but it lacks primary source analysis or detailed attention to historical narrative. Hence, the story of land reclamation in Singapore is a rich topic that has yet to receive significant attention from historians.⁵

The history of land construction in Singapore offers a number of important insights, which form the central theses of this paper. For starters, this history reveals how the tensions between an ideal maritime situation and a challenging terrestrial site, when combined with a forceful, proactive government, can bring about immense environmental transformations. In his environmental history of New Orleans, Ari Kelman discusses this tension between an optimal *situation* (a city or state's relationship to other places) and a problematic *site* (its physical environment). This essay is indebted to his scholarship, but applies this insight in a radically different geographic, cultural, and political context. Related to that, this case sheds light on the ways in which governments—perhaps especially in postcolonial nations—can use environmental transformation, in the name of progress, as a means of expanding and legitimating their authority. This history also reveals a possibly unforeseen consequence of burying sites at which humans derived their livelihood from living oceanic resources: the loss of a cultural connection to the sea, based on knowing

⁵ Lim Tin Seng has produced an article on reclamation in Singapore, entitled "Land from Sand;" he has done a superb job identifying sources and piecing together details of the narrative, but his work contains limited analysis or argumentation and almost no discussion of the human and environmental costs of reclamation. Timothy P. Barnard, *Nature Contained: Environmental Histories of Singapore* (Singapore: NUS Press, 2014); Timothy P. Barnard, *Nature's Colony: Empire, Nation and Environment in the Singapore Botanic Gardens* (Singapore: NUS Press, 2016); Miles Powell, "People in Peril, Environments at Risk: Coolies, Tigers, and Colonial Singapore's Ecology of Poverty" *Environment and History* 22(3) (Summer 2016): 455-482. Hassler, "Development Dynamics," 14-22; Milica Topalovic, "Constructed Land: Singapore in the Century of Flattening" in *Constructing Land in Singapore*, 51-63.

nature through work. Finally, this history speaks to the necessity of, and challenges presented by, preserving organisms in hybrid (neither entirely natural nor entirely artificial) marine environments like Singapore's reclaimed shores.⁶

This essay explores the history of land reclamation in Singapore in four interconnected parts. The first addresses the creation of new land in colonial Singapore. Largely carried out to create an ordered, sanitary landscape that was conducive to trade and demonstrated imperial authority, these projects paled in comparison to postcolonial developments. Yet, colonial reclamation still had significant social and ecological consequences, partly because these reclamation activities largely took place in productive estuarine environments.

The second section addresses land reclamation in independent Singapore. These massive schemes shared the earlier imperial projects' emphasis on order and commerce but differed in crucial respects. Whereas colonial officials were generally unwilling to make local investments beyond those required for imperial aims, independent Singapore's government took the economic advancement of its citizenry as its highest priority. This led to colossal reclamation schemes for the purposes of housing and local industry. These projects were part of a global surge in fossil-fuel-

⁶ Ari Kelman, *A River and Its City: The Nature of Landscape in New Orleans* (Berkeley: University of California Press, 2006), 6; Ari Kelman, "Boundary Issues: Clarifying New Orleans' Murky Edges" *JAH*, 94, 3, (Dec., 2007): 695-703. Steinberg makes a similar point; see *Gotham Unbound*, xvii. Young describes a similar entrenchment of authority through discourses of land reclamation in Korea; see "Modernization," 427. Schoppa notes how reclamation was connected to state making in China; see "State, Society, and Land Reclamation," 266; Marco Armiero describes how Italian fascists linked reclamation to their ideology of environmental and human regeneration; see "Introduction: Fascism and Nature" *Modern Italy* 19(3) (2014): 241-245. Alexander Ronald R. Vidal and Kandasamy Manohar describe how Singapore's People's Action Party (PAP) uses a narrative of vulnerability to entrench and expand control; see "Recent Trends in Land Reclamation in Singapore" (MSc Dissertation, Engineering, Nanyang Technological University, 2001), 8. Hassler notes the symbolic importance of reclamation to the PAP development narrative; see "Development Dynamics," 15. The following works describe this disconnect from the sea: Kim Lee, Ed. *Singapore Waters: Unveiling Our Seas* (Singapore: Nature Society Singapore, 2003) National Library of Singapore (hereinafter NLS) 578.77095957 SIN, 5; Loke, "Nature and Sustainability," 174; Hassler, "Introduction" in *Constructing Land*, 12; Topalovic, "Constructed Land," 51. For a keen discussion of the environmental knowledge that arises from working in nature, see Richard White, "'Are You an Environmentalist or Do You Work for a Living?': Work and Nature" in William Cronon, (ed.) *Uncommon Ground: Rethinking the Human Place in Nature* (New York: W. W. Norton and Co., 1996), 171-185.

and technology-driven economic growth and environmental transformation following World War II that some scholars have labeled the “Great Acceleration.” Land reclamation in independent Singapore thus speaks to the role of decolonization in this worldwide intensification of anthropogenic environmental change.⁷

The third section addresses reclamation’s environmental toll in Singapore, focusing especially on the destruction of mangrove forests, natural beaches, and coral reefs. This analysis reveals that despite significant ecological losses, local conservationists still have reason for cautious optimism. Considerable biodiversity persists in Singapore’s waters, and in recent years policymakers have become more sympathetic to environmental concerns.

The final section examines the human communities displaced by reclamation, with particular attention to groups like fishers and prawn farmers who derived their livelihood from the ocean. This discussion considers how the removal of these communities played a key role in erasing Singapore’s longstanding cultural connection to the sea—a bond present-day environmental activists are attempting to reestablish.

⁷ For an enlightening discussion of this concept, see J. R. McNeill and Peter Engelke, *The Great Acceleration: An Environmental History of the Anthropocene since 1945* (Cambridge, MA: The Belknap Press of Harvard University Press, 2014).



Figure 1: Land Reclamation in Singapore

The pink areas represent completed projects, while the red areas indicate future plans (all locations are approximate)⁸

Reclaiming the Dismal Swamp: Creating New Land in Colonial Singapore

In 1819 Sir Stamford Raffles arrived at the island of Singapore determined to establish a trade outpost that would allow the British to vie with the Dutch for influence in Southeast Asia. Situated on the southern tip of the Malay Peninsula, Singapore lay in an ideal geographic situation to serve as an entrepôt for goods moving between the West and the East. The island had served as a major trade center during the fourteenth century, before—according to Raffles—being razed by invaders and falling into a prolonged period of decline, to the extent that he estimated the entire population of the island at 1000 people in 1819. In promoting this version of Singapore’s early history, Raffles and other British imperialists accomplished two key objectives: first, they demonstrated that the island was a natural trade hub that they

⁸ Adapted from Lim, “Land from Sand.”

needed only restore to its former glory; and second, the British strengthened their claim to the area by suggesting that it lay in a state of decay and near abandonment.⁹

Recent revisionist histories paint a much more complicated picture. They acknowledge a “Golden Age” in early Singapore (then called Temasek or Singapura), spanning approximately the duration of the fourteenth century. During this period, the island’s Malay and archipelagic Southeast Asian rulers established a walled city that became a wealthy and cosmopolitan trade settlement where locals and Chinese settlers lived alongside each other (perhaps for the first time in Southeast Asia). These fortifications may have shielded the city not only from foreign invaders, but also from the region’s indigenous Orang Laut “Sea Nomads”—feared pirates who preyed on the steady flow of ships visiting the island. These revisionist historians accept that Javanese or Tai invaders destroyed Singapura at some point around the end of the fourteenth century, but they emphasize that the settlement was rebuilt. Indeed, Malays and archipelagic Southeast Asians continued rebuilding a trade port at Singapore after each subsequent invasion, the last recorded of which took place in the early seventeenth century. According to historian Peter Borschberg, the island was already undergoing another period of renewal under the leadership of the Temenggong of Johor (a local Malay noble) in the early nineteenth century, prior to Raffles’ arrival.¹⁰

The continual rebuilding of a trade center at Singapore across centuries (some contend Ptolemy’s second-century AD writings reference a port on the island) speaks to its strategic location on shipping routes linking the Indian Ocean and the South China Sea. But if Singapore’s maritime situation was—as recognized by Raffles—

⁹ Peter Borschberg, “Singapore in the Cycles of the Longue Durée” *Journal of the Malaysian Branch of the Royal Asiatic Society* 90(312) (June 2017): 31.

¹⁰ John Miksic, “Ships, Sailors and Kingdoms of Ancient Southeast Asia” in Philip de Souza, et al., Eds., *The Sea in History – The Ancient World* (Suffolk, UK: Boydell Press, 2017), 571; Borschberg, “Singapore in the Cycles of the Longue Durée,” 34, 51; Brian E. Colless, “The Ancient History of Singapore” in Kwa Chong Guan and Peter Borschberg, Eds., *Studying Singapore Before 1800* (Singapore: NUS Press, 2018), 54; Paul Wheatley, “The Century of Singhapura” in *Studying Singapore Before 1800*, 73, 74, 80.

ideal, its site was less so. While the diamond-shaped island offered deep-water ports and good sources of lumber and freshwater, it was also small, hilly, and scattered with rivers and swamps. This tension between site and situation would become a crucial aspect of Singapore's environmental history, manifesting itself, in part, in the extensive reclamation projects that would remake the island's coastline over the next two centuries.¹¹

Land Reclamation commenced in Singapore within a few years of Raffles' founding of the British port city in 1819—a process that involved complex negotiations to win the support of the Temenggong. These early reclamation projects took a number of forms, but all helped create what scholars have labeled a “colonial landscape.” In the words of geographer Brenda Yeoh, such spaces “ideally reflected the power and prestige of the colonialists, were ordered, sanitized, and amenable to regulation, and structured to enhance the flow of economic activities such as trade and communication which were crucial to the entire colonial economy.” As we shall see, the desire to reorganize space along these lines was a unifying theme running through land construction schemes in this period.¹²

Although minor compared to post-colonial developments, Singapore's first reclamation project still had significant environmental impacts because it took place in a major estuarine environment. Raffles did not initially expect trade to occur on the Singapore River, but he anticipated that the settlement would cluster around this waterway. When he first arrived, though, the southern bank of the river consisted almost entirely of mangrove forests extending for several kilometers inland. With a

¹¹ Vidal and Kandasamy, “Recent Trends,” 5; Koh Siang Tan, Enzo Acerbi, Federico M. Lauro, “Marine habitats and biodiversity of Singapore's coastal waters: A review” *Regional Studies in Marine Science* (2016), 1; Colless, “The Ancient History of Singapore,” 62.

¹² Brenda S. A. Yeoh, *Contesting Space in Colonial Singapore: Power Relations and the Urban Built Environment* (Singapore: Singapore University Press, 2003), 16. For negotiations with the Temenggong, see Elinah Abdullah, “Malay/Muslim Patterns of Settlement and Trade in the First 50 Years” in Khoo Kay Kim et al. Eds., *Malays/Muslims in Singapore: Selected Readings in History, 1819-1965* (Singapore: Pelanduk Publications, 2006), 80.

bank nine feet lower than that across from it, this southern shore flooded at high tide to form a sizeable lake; at low tide, it became a muddy swamp. The lone exception was a small hill on the southern side of the river's mouth. Famed Malayan author Abdullah bin Abdul al Kadir (often called Munshi Abdullah) observed the founding of British Singapore. Of the original southern bank he wrote, "There was nothing to be seen but mangrove trees... And in no place was there good ground... but only mud with the mounds cast up by land-crabs [mud lobsters]." Appraising the landscape, Raffles determined in his original plan for the city that Europeans would settle on the better ground north of the river, while Chinese, Malays, and South Asians would make do with the land to the south. Raffles reserved the northern bank for government buildings. He anticipated that European merchants would reside and conduct their trade on a coastal beach just north of the river's mouth in present-day Kampong Glam. To implement this plan while he attended to other imperial business, Raffles left the fledgling colony under the leadership of its first British Resident and Commandant, William Farquhar.¹³

Although Raffles was correct in identifying the island of Singapore as an ideal port location, he was mistaken in thinking that early trade would take place outside the river bearing the same name. Colonial officials ultimately remade this waterway through land reclamation to instill order and facilitate the growth of commerce. Merchants quickly recognized that the beach promoted by Raffles, with its shallow waters and rolling surf, was a poor place to exchange goods, and so they shifted their activities to the more sheltered river. Because the southern bank remained a mangrove swamp, they largely settled on the northern bank that Raffles had reserved for government use. Farquhar permitted this relocation, contributing to a rift that

¹³ Abdullah bin Abdul al Kadir (Munshi Abdullah), *The Autobiography of Munshi Abdullah*, Trans. Rev. W. G. Shellabear, D.D. (Singapore: Methodist Publishing House, 1918 [1849]), 122. Stephen Dobbs, *The Singapore River: A Social History: 1819-2002* (Singapore: Singapore University Press, 2003), 8, 20; Lim, "Land from Sand," par 2-3.

developed between him and Raffles when the latter returned to the settlement in 1822 (Farquhar would be dismissed a year later). Yet even Raffles recognized by this point that the Singapore River would initially serve as the colony's primary site of commerce. In a revised plan, Raffles zoned the river's southern shore as the settlement's business center. He forced merchants who had taken up residence on the government-reserved land on the north bank to relocate across the water.¹⁴

Mangrove forests are ecologically rich habitats, but they make poor sites for docks and warehouses. To address this issue, Raffles resolved to level the small hill at the river's mouth and use the resulting earth to fill in the swamp. A multiracial group of around 300 "coolie" laborers carried out this work. Recalling this act of environmental transformation, Abdullah wrote, "Chinese, Malay, and Tamil laborers, about two or three hundred men... were told to dig away the earth and carry it off...and it all looked like people at war." Eventually called Raffles' Place, the southern shore's new commercial district became a bustling quay packed with godowns (warehouses) and shops. Meanwhile the reclaimed marshland to the rear hosted Chinese, Malay, and South Asian kampongs (villages) organized along ethnic lines. Such racial segregation—between Europeans and non-Europeans, and between various groupings of the latter—was a crucial component of the ordered landscape colonists used reclamation to help achieve.¹⁵

In the mid-nineteenth century, Singapore began further modifying its shorelines to accommodate a major innovation in oceanic trade: steam ships. Junks and other sailing vessels may have preferred to ply their trade in the calm waters of the Singapore River, but steam ships required deeper berths. In 1852, merchants established New Harbour (renamed Keppel Harbour in 1900) on the seashore

¹⁴ Abdullah, *The Autobiography*, 143; Dobbs, *The Singapore River*, 7, 8, 20-21.

¹⁵ Quote from Abdullah, *The Autobiography*, 143. R. Glaser, P. Haberzettl, and R. P. D. Walsh, "Land Reclamation in Singapore, Hong Kong, and Macau" *GeoJournal* 24(4) (August 1991), 367; Dobbs, *The Singapore River*, 8-9, 25-26, 39.

southwest of the Singapore River. This port grew in conjunction with the rise of steam shipping at Singapore, which greatly accelerated with the completion of the Suez Canal in 1869. By the 1880s, New Harbour had overtaken the river as the colony's primary site of trade, but smaller vessels continued to prefer the older quays. This created a challenge for merchants wishing to transfer goods between New Harbour and the river, as hills and a small bay blocked overland transportation.¹⁶

Once again, Singapore used land reclamation to transform its site to better take advantage of its geographic situation. Laborers blasted away portions of the inconveniently placed hills and used the resulting earth and rubble to straighten the shoreline. Officials used this reclaimed land to establish a number of first roads and then rail lines connecting the river to New Harbour. In 1874 an enthusiastic writer for a local paper described the transformation then underway. The author proclaimed that the project had remade “a muddy, dismal, marine swamp, under a cape where no life was save that of a few fishermen who earned a precarious living” into “a busy human anthill where...men from every nation and of every color under the sky earn, according to their state in life, their daily bread.” By the time construction concluded in 1932, workers had reclaimed over 130 acres of land, and port developments spanned nearly uninterrupted from the Singapore River to New Harbour. Such improvements facilitated trade and commerce, but they also demonstrated the competence and authority of the British colonialists to their primarily ethnic Chinese subjects in Singapore.¹⁷

¹⁶ Glaser, et al., “Land Reclamation,” 367; Dobbs, *The Singapore River*, 9-11.

¹⁷ Quote from “Public Works and Private Enterprises in Singapore. No. 1” *Straits Times Overland Journal* (hereinafter *STOJ*) (16 May 1874), 3. “Singapore New Harbour,” National Archives of Singapore (hereinafter NAS), CO273: Colonial Office: Straits Settlements Original Correspondence (hereinafter CO273), volume/number (hereinafter v/n) 63/1124 (Jan 29, 1872); “Satisfactory Sale of Some Reclaimed Land” NAS, CO273, v/n 130/22390 (Nov 27, 1884); “Picturesque and busy Singapore” *Straits Times Weekly Issue* (hereinafter *STWI*) (7 Feb 1887): 7; “Teluk Ayer” *The Straits Times* (hereinafter *ST*) (28 June 1897), 2; “Canal: Singapore River” NAS, CO273, v/n 259/41511 (Nov 24, 1900); “Harbour and town improvement” *SFPMA* (7 Jan 1902): 3; K. Y. Yong, S. L. Lee and G. P. Karunaratne, “Coastal Reclamation in Singapore: A Review” in Chia Lin Sien and Chou Loke Ming, Eds. *Urban Coastal Area Management: The Experience of Singapore: Coastal Resources Management*

It would be a mistake, however, to cast nature as a passive backdrop for this transformation. On multiple occasions, the sea proved stubbornly unwilling to yield to land. In the 1880s, workers deposited “tons upon tons of earth” onto a seafloor that engineers had identified as a “hard coral reef.” This episode speaks to the destruction reclamation wrought on coral, even then. Unfortunately for the engineers, the coral had established itself on a deep layer of soft mud, under which the smooth bedrock sloped seaward. Every stone the workers dropped on the site broke through the coral and sunk to the bottom of the mud before sliding out to sea. This problem persisted for years, and it is not clear how engineers overcame it. A similar challenge arose in the early 1900s when laborers began work on a planned 1500-meter seawall that was a key component of this reclamation scheme. Crews started construction on each end of the wall with plans to meet in the middle. But in 1910, with 1250 meters completed, they realized that earlier engineering reports had overlooked a sinkhole that would prevent them from joining the two sides and reclaiming the land behind it. Engineers elected to reinforce the seawall’s foundation and allow it to settle for a decade. After that, the colony used the incomplete seawall as a breakwater, forming a sheltered harbor for small boats, which entered through the gap in the barrier. Workers finally resumed construction in 1930, completing the project two years later. But by then the cost had exploded from an initial estimate of 2.5 million Straights Dollars to 15 million.¹⁸

Simultaneous to these developments, authorities also initiated reclamation to the northeast of the Singapore River at Beach Road. Today, when tourists flock to Singapore’s iconic Raffles Hotel—a colonial-era luxury establishment and the

Project Conference Proceedings 7 (Manila: International Center for Living Aquatic Resources Management, 1991), 59.

¹⁸ Quotes from “The Teluk Ayer Reclamation Works” *STOJ* (18 April 1881), 2. “The Teluk Ayer Reclamation Scheme” *STWI* (17 September 1884), 6; “Singapore Harbour: Return to an Old Idea” *SFPMA* (15 Dec 1911), 12; “Telok Ayer Scheme” *ST* (23 March 1921), 11; “Telok Ayer Basin: Construction of the Quay Wall” *SFPMA* (24 September 1932): 8; Lim, “Land from Sand,” par 12.

purported birthplace of the Singapore Sling cocktail—they might find its address on Beach Road odd, since the shore is some two kilometers away. This incongruous name owes to an extended, though intermittent, process of land reclamation that commenced in the 1840s. In two separate phases in the 1840s and 1890s colonial authorities conducted land reclamation at Beach Road to provide grounds for military facilities and recreation. The grounds became a popular site for military parades, and it is hard to imagine a more potent symbol of colonial authority than soldiers marching over an expanse of land created by, and for, the empire. In the 1930s, the colonial government commenced further reclamation at Beach Road, partly to create a new waterfront drive. Japanese occupation during the Second World War disrupted progress, but the British completed this project once they regained control of the colony in 1945. Postcolonial reclamation schemes pushed the seashore still further from Beach Road.¹⁹

The final significant act of reclamation during the colonial period occurred when laborers filled in marshlands in the basin of the Kallang River—which drained into the ocean a few kilometers east of the Singapore River—to create land for a new airport. Unveiling the project in 1931, officials celebrated it not only for the greater airline access it would bring to Singapore, but also for its rehabilitation of land deemed worthless and insalubrious. Prior to reclamation this site consisted of a tidal mangrove swamp. At high tide, waters could be three meters deep, but low tide exposed a vast expanse of mud flats intersected by drainage channels. Although fishers and prawn farmers made their homes here (see Figure 2), the government perceived this area as blighted due to the health risks posed by the disease-carrying mosquitoes that bred there (colonial Singapore had long struggled with outbreaks of malaria, and yellow fever was an increasing concern). Officials employed between

¹⁹ “Beach Road Reclamation” CO273, v/n 165/4177, NA (Feb 1, 1890); “Beach Road Reclamation” *ST* (6 February 1900), 2; “Beach Road” *SFPMA* (28 August 1936), 7; “New waterfront scheme may be postponed” *SFPMA* (1940, July 22), 5; Lim, “Land from Sand,” 13.

400 and 500 “coolie” laborers to use earth from leveled hills to fill in the mud flats over an area of nearly 140 hectares. Yet authorities remained fearful that the surrounding area could host buzzing disease vectors. To combat this, when the airport opened in 1937, it became, according to boosters “the first in the world with quarantine and disinfecting facilities for the aeroplane itself.” Investigators boarded every plane arriving from “infected” countries and investigated them “for signs of... fever-bearing insects.” Achieved in large measure through reclamation, Singapore’s colonial landscape was not only to be ordered and conducive to trade and transportation, but sanitary as well.²⁰

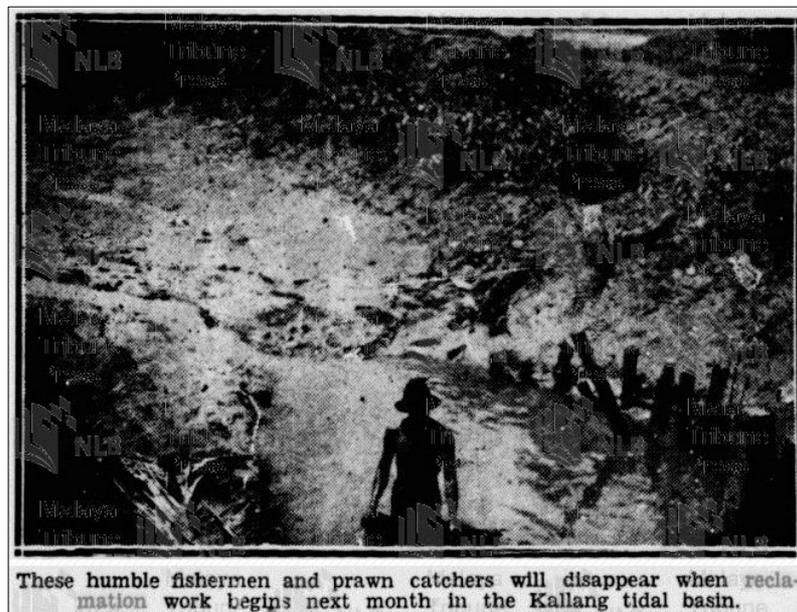


Figure 2: Displaced Inhabitants of the Kallang Basin, from *The Morning Tribune*, 1936²¹

Building a New Nation: Land Reclamation in Independent Singapore

²⁰ Quotes from “Design and Construction of Singapore’s New Civil Aerodrome” *SFPMA* (1 November 1934), 4. “Changing face of Kallang” *ST* (8 April 1961), 13; “Tremendous growth in 1937” *ST* (29 December 1981), 33; Yong, ed. al., “Coastal Reclamation,” 59.

²¹ “Untitled” *Morning Tribune* (28 February 1936), 11.

In total, colonial Singapore added around 300 hectares, or three square kilometers, to the main island's landmass. This reclamation had significant environmental ramifications for the Singapore River, as well as mangrove swamps, coral reefs, and natural beaches within its vicinity, but it paled in comparison to postcolonial developments. This difference in scale owed partly to the divergent objectives of colonial officials and national policymakers. The former sought to create an ordered, sanitary landscape that was conducive to trade and commerce. The latter desired all of this, but also to bring its citizenry rapid economic advancement, and thereby legitimize and entrench the new postcolonial government's authority in a period of volatile regional politics. Singapore's rapid economic growth speaks to the role decolonization played in the Great Acceleration following World War II. As former colonies sought to achieve a standard of living on par with that in so-called developed nations, they became participants in a process of radical global anthropogenic environmental change propelled by technological innovation and the burning of fossil fuels.²²

Singapore attained independence in a somewhat roundabout manner between 1959 and 1965. It achieved internal self-rule in 1959, although Britain still represented it internationally. In 1963, Singapore gained independence from Britain by joining the Malaysian Federation. On 9 August 1965, Singapore split from Malaysia to become a sovereign state. The resulting Republic of Singapore consisted of the main island, plus an additional 63 smaller islands.²³

²² Lim, "Land from Sand," par 15, 26; McNeill and Engelke, *The Great Acceleration*, 141-148.

²³ Chia Lin Sien, Habibullah Khan, and Chou Loke Ming, "The Coastal Environmental Profile of Singapore" Association of Southeast Asian Nations/ United States Coastal Resources Management Project Technical Publications Series 3 (Manila: International Center for Living Aquatic Resources, 1988), 2; Vidal and Kandasamy, "Recent Trends," 5, 9. For a recent and useful general survey of Singapore's history, see John Curtis Perry, *Singapore: Unlikely Power* (London: Oxford University Press, 2017).

Beginning during the period of internal self-rule, Singapore's government embarked on a massive project of land building. Three statutory boards oversaw the vast majority of this reclamation, the Housing and Development Board (HDB), the Jurong Town Corporation (JTC), and the Port of Singapore Authority (PSA) (renamed the Maritime and Port Authority [MPA] in 1995). Together, they represented the three key pillars of Singapore's development plan: housing, industry, and port activities, respectively. In the three decades after 1965, Singapore reclaimed 13,800 hectares, or 138 square kilometers of land, increasing the national domain by more than 20 percent. This activity helped the country achieve its famed rise from "third world" to "first world" in a span of mere decades, enhancing the esteem and authority of the governing People's Action Party (PAP) in the process.²⁴

Considering land reclamation critical to its plans for national development, Singapore's government adopted formal and informal policies intended to expedite the process. In 1965, at the behest of Singapore's first Prime Minister and founding father, Lee Kuan Yew, the government amended the Foreshores Act. The revised bill allowed for reclamation projects within specified size limits to proceed without Parliamentary approval. Throughout the Republic of Singapore's first thirty years of existence, the government also generally neglected to conduct Environmental Impact Assessments (EIAs) for reclamation projects. In 1992, Singapore prepared a report for the United Nations Conference on Environment and Development. While the authors acknowledged the value of EIAs, they emphasized that the state's top priority was to "satisfy the people's economic needs first." By stressing Singapore's extreme housing shortage, and the role of land reclamation in addressing it, the governing PAP justified a forceful approach to remaking Singapore's coastline. Such policies allowed Singapore's government to carry out land reclamation with tremendous rapidity, and

²⁴ Chia, et al., "The Coastal Environmental Profile of Singapore," 2; Glaser, et al., "Land Reclamation," 367; Vidal and Kandasamy, "Recent Trends," 5, 9; Lim, "Land from Sand," par 15, 26.

the nation may not otherwise have achieved its meteoric economic rise. But this hastily deposited sand and rubble buried many longstanding human and ecological communities.²⁵

Formed in 1960 to address Singapore's housing shortage, the Housing and Development Board became one of the most significant drivers of land reclamation in post-independence Singapore. When the HDB came into being, many urban Singaporeans resided in overcrowded, slum-like dwellings, while rural populations often lacked any official claim to the land on which they built their homes. This state of affairs partly reflected the priorities of colonial officials, who had been more concerned with maintaining empire and promoting commerce than with improving the living standards of their subjects. In terms of rapidly providing modern, inexpensive dwellings to Singapore's citizens, the HDB has been extraordinarily successful. Today, just under 80-percent of Singaporeans reside in an HDB flat, and their affordability for Singaporeans has helped contribute to a national home ownership rate of over 90 percent. In order to build dwellings for a population of close to two million in 1960 and nearly four million today, the HDB required land. Singapore's situation as an ideal trade entrepôt had attracted people from around the world—but especially from southern China—for centuries. Yet its physical site as a small, hilly island made it difficult to accommodate them all within modern dwellings. With available properties quickly depleted, and the limits to vertical

²⁵ Quote from Anonymous, *Singapore's National Report for the 1992 UN Conference on Environment and Development Preparatory Committee* (Singapore: Government of Singapore, 1992), 9; also quoted in Patrick A. Hesp, "The Environmental Impact Assessment Process in Singapore with Particular Respect to Coastal Environments and the Role of NGOs," *Journal of Coastal Conservation* 1(2) (1995), 136. For the centrality of reclamation to government plans, see "Self-sufficiency in sight, but land shortage is main problem" *ST* (3 June 1962), 11; Ministry of Culture, Press Release, "East Coast Reclamation Underway" NAS, Mf No. NA1247 (24/05/1965). "Reclaim without prior approval Bill Passed" *ST* (24 October 1974), 9; Kang Ming Hua Clarence, "Land Reclamation in Singapore: A History of Governmental Approaches to Coastal Development and Management" (Final Year Project, Nanyang Technological University, History, 2016), 3-9.

building reached, the HDB turned to land reclamation on a scale dwarfing that of the colonial period.²⁶

Cautious to avoid any of the miscalculations that delayed some of the colonial-era reclamations, the HDB first conducted a small pilot scheme in Bedok on the main island's east coast. Carried out between 1962 and 1963, this project reclaimed just under twenty hectares of land from the sea (see Figure 3). The HDB followed this up by reclaiming 199 hectares of remaining swampland in the Kallang Basin. The Kallang development encountered delays due to difficulties with the clearance of "squatters" (villagers without an official claim to the land). This hinted at an ongoing challenge for the HDB, as not all Singaporeans welcomed the transition from kampongs to HDB flats. Despite such resistance, the HDB completed the Kallang development on schedule in 1967. They sold two thirds of the land to industry and allocated the remaining one third for public housing.²⁷

²⁶ Stats from Department of Statistics Singapore, "Households," <https://www.singstat.gov.sg/find-data/search-by-theme/households/households/latest-data> (accessed July 19, 2018). Housing and Development Board (hereinafter HDB), *Annual Report* (hereinafter *AR*), 1960 (Singapore: Government Printing Office, 1963) NLS 711.4095957 SIN, 23, 33; Vidal and Kandasamy, "Recent Trends," 9; Alan F. C. Choe, "The Early Years of Nation-Building: Reflections on Singapore's Urban History" in Heng Chye Kiang, *50 Years of Urban Planning in Singapore* (Singapore: World Scientific Publishing Co, 2017), 8-10.

²⁷ HDB, *AR, 1965* (Singapore, HDB, 1966) (publication information is identical for all subsequent reports, and thus excluded) NLS 711.4095957 SIN (shelving information is identical for all subsequent reports and thus excluded, 84. "Govt. begins job of reclaiming big swamp for industry" *SFPMA* (24 October 1961), 1; "Land Reclamation in Singapore" *ST* (14 July 1962), 7; "Kallang Basin Industrial Plan to Make area Second Jurong" *ST* (16 July 1964), 9; "Kallang Basin dust Menace" *ST* (24 September 1966), 15; HDB, *AR, 1967*, 48; HDB, *AR, 1970*, 70; Vidal and Kandasamy, "Recent Trends," 9. For a keen discussion of the HDB relocation process and resistance to it, see Loh Kah Seng, *Squatters into Citizens: The 1961 Bukit Ho Swee Fire and the Making of Modern Singapore* (Singapore: NUS Press, 2013).

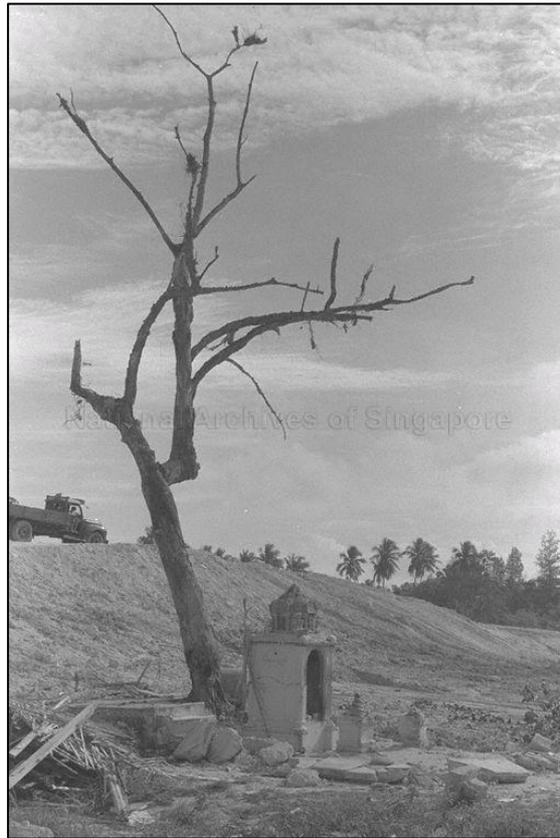


Figure 3: Photo of Land Reclamation Underway at Bedok, 1963²⁸
The concrete structures bear testament to the human communities erased by this and other reclamation projects.

Following on the success of the coastal reclamation pilot project at Bedok, the HDB commenced its largest land-building undertaking, the East Coast Reclamation Scheme, also known as the “Great Reclamation.” Unfolding in seven phases beginning in 1966, this project added 1,525 hectares of land to Singapore’s southeast coast. Initial developments took place at a distance from the city center on a semi-rural patch of coast replete with natural beaches. Here the HDB established land for housing, transportation, and other purposes, while also creating a new 15-kilometer stretch of artificial beaches for recreation.²⁹

²⁸ “Bedok Reclamation Work” NAS, Media Image No. 19990003438 – 0005 (1963) <http://www.nas.gov.sg/archivesonline/photographs/record-details/885ee62f-1162-11e3-83d5-0050568939ad> (accessed 29 July, 2018).

²⁹ “\$44 mil reclamation: Changing the Map of Singapore” *ST* (25 May 1965), 8; HDB, *AR*, 1969, 69; Judith Holmberg, “A Multi-million dollar drive to win over the Sea in this Battle for Land” *New Nation* (14 March 1975), 10-11; HDB, *AR*, 1 April 1976 to 31 March 1977, 46; Vidal and Kandasamy, “Recent Trends,” 10; Lim, “Land from Sand,” par 16-17.

Beginning in the mid-1970s, the HDB extended the East Coast Scheme into the vicinity of the city center to allow for expansion of the downtown core. This 660-hectare development consisted of two peninsulas of reclaimed land that curved together. The first point, today known as Marina South, jutted out from southwest of the Singapore River; the second, now called Marina East, protruded from northeast of the Kallang River. Separated at their tips by a narrow channel, the two landmasses enclosed a body of water dubbed Marina Bay. As planners had hoped, the Marina Bay development is now a key site for business and commerce.³⁰

The East Coast reclamation was an immense undertaking, and the HDB strove to maintain smooth operations. To minimize noise, traffic congestion, and dust pollution while transporting fill from inland sources to the coast, engineers constructed a massive conveyor belt. The HDB reported that this machinery was “so quiet that its operation is hardly audible and the dust nuisance is virtually non-existent.” Once fill reached the coast, the HDB deployed barges to distribute it as needed. This system allowed operations to run around the clock. Although the HDB acknowledged that local coastal communities would resist relocation, it ensured that sufficient housing was in place to accommodate those displaced by the development before commencing work.³¹

Despite these precautions, some citizens had concerns with the project. There seems to have been some disagreement between the HDB and residents over the amount of dust produced. In contrast to official HDB reports, Tan Swee Guan Richard recalled in an oral history interview that the process was “dusty, dusty!” More

³⁰ “The great land reclamation at East Coast” *ST* (Nov 21, 1983), 7; HDB, *AR, 1984/85*, 7; “Sum of \$178 m approved for land reclamation” *Business Times* (7 October 1989), 2; Glaser, et al., “Land Reclamation,” 367; HDB, *AR, 1993/94*, 61; Timothy Auger, *A River Transformed: Singapore River and Marina Bay* (Singapore: TWP Sdn Bhd, 2015), 80.

³¹ Quote from HDB, *AR, 1965*, 46. “Plans to Resettle 1,000 Families” *ST* (30 December 1965), 4; HDB, *AR, 1966*; HDB, *AR, 1967*, 48-49; Lim, “Land from Sand,” par 18.

generally, Tan found the broader transformation of the environment troubling. “What was awful,” he recalled,

was that you see a lot of trees [at fill procurement sites] and then they disappear and they become like, they look like desert land from far, just marshland of sand and dust. And then you see that all being siphoned out into the sea and then you see the sea going further and further away, further and further away. And then the next thing you know, HDB flats start popping up!

In another oral history interview, Safdar Abidally Husain does not recall feeling as though he was “losing anything” at the time, because he did not anticipate the scope of change. But looking back later, he felt nostalgia for the “charming scenery” that disappeared. An employee of the HDB during this era, Lim Kim San gave his own interview, in which he explained the board’s thinking regarding reclamation. He emphasized the desperate need for land for further housing developments. Moreover, he contended that it was “natural” to reclaim land, since the process of leveling hills for inland projects created earth that had “to be [put] somewhere.” He readily acknowledged, “I don’t think we gave much thought to...the ecological side,” but for Lim this was a matter of necessity, not shortsightedness.³²

While carrying out the decades-long East Coast Reclamation, the HDB also conducted a number of other significant land building schemes throughout Singapore. Reclaiming shallow coastal waters and mangrove swamps in the west and north, they created hundreds of additional hectares of land for housing and recreation at sites such as Clementi, Pasir Panjang, Pasir Ris, Punggol, and Seletar. Seeking fill for these projects and the East Coast Reclamation, the HDB relied on earth from inland hills, sea dredging, and increasingly, from the 1980s onwards, imported sand. In the late

³² Tan, Richard Swee Guan “Oral History Interview” Zaleha bte Osman, Interviewer, NAS, Accession Number (hereinafter Acc. No.) 002108, disk/reel number (hereinafter d/r) 4 (14 April 1999); Safdar Abidally Husain, “Oral History Interview,” Zaleha bte Osman, Interviewer, NAS, Acc. No. 002135, d/r 3 (14 May 1999); Lim Kim San, “Oral History Interview” Lily Tan, Interviewer, NAS, Acc. No. 526/21 d/r 12. (3 April 1985).

1990s and early 2000s, this latter practice brought Singapore into conflict with neighboring countries Malaysia and Indonesia, from which developers procured this fill. All told, the HDB created 3,869 hectares of new land between 1965 and 2015. This represented approximately one-third of all reclamation in Singapore.³³

While the HDB carried out reclamation projects aimed primarily at creating land for housing and recreation, the Jurong Town Corporation created land for industrial purposes. Like the HDB, the JTC was exceedingly successful in the targets it set for itself. Singapore's government selected the Jurong region on the western side of the main island as the site for the state's first industrial estate. A hilly, jungle-covered area scattered with fish and prawn ponds and crisscrossed by rivers containing crocodiles and giant monitor lizards, Jurong was not an obvious site for an industrial complex. But it did offer some crucial advantages. Deep offshore waters allowed ships to dock to unload raw materials and pick up finished products. The government already owned much of the land, and other sites were largely rural and inexpensive to acquire. Finally, the undulating landscape helped facilitate reclamation, as workers could use the earth from leveled hills to fill in the swamps.³⁴

As the government agency responsible for developing the Jurong industrial estate, the JTC created much new land for port facilities, factories, warehouses, transportation infrastructure, and worker amenities. This process commenced in 1963 when the JTC reclaimed 46 acres of land for the Jurong Industrial Site. During the 1970s, the JTC created over 2,000 hectares of new land in the combined areas of Jurong and Tuas, the latter of which also lay in the island's rural west. The agency

³³ HDB, *AR, 1967*, 49; "Land reclamation off Punggol" *ST* (March 5, 1983), 17; HDB, *AR, 1983/84*, 7; "Reclamation Project Approved" *ST* (20 October 1984), 15; HDB, *AR, 1984/85*, 7; HDB, *AR, 1999/00*, 62; Yong, et al., "Coastal Reclamation," 64; Vidal and Kandasamy, "Recent Trends," 10; Kog Yue-Choong, "Environmental Management and Conflict in Southeast Asia – Land Reclamation and Its Political Impact" (Singapore: Institute of Defense and Strategic Studies, January 2006), 2-6; Hassler, "Development Dynamics," 15, 18; Lim, "Land from Sand," par 20-22.

³⁴ Vidal and Kandasamy, "Recent Trends," 11.

added another 650 acres to Tuas in the late 1980s, using part of the new land to establish a park and golf course for worker recreation.³⁵

In terms of its transformation of Singapore's coastline, the JTC's most striking reclamation project was its enlargement and merging of several smaller islands off the main island's southwest coast. Known as the Jurong Island Reclamation Project, this scheme ultimately combined the islands of Pulau Merlimau, Pulau Seraya, Pulau Ayer Chawan, Pulau Ayer Merbau, Pulau Sakra, Pulau Pasek, and Pulau Pesek Kechil to form one large landmass dubbed Jurong Island (see Figures 4 and 5). Describing these islands prior to their transformation, the JTC reported "as late as the 1960s...the villagers [there] continued to live the simple, sun-kissed lifestyle of their ancestors...They lived in Malay-style wooden stilt houses with no electric power supply...on their palm-fringed islands." After relocating these inhabitants, the JTC first enlarged three of these islands to provide space for petrochemical developments. Then, between 1993 and 2003, it merged all seven islands with the help of millions of tons of imported sand to produce 3,000 hectares of new land. In so doing, the JTC radically remade the site to better take advantage of its situation. The resulting landmass possessed deep-water ports and a sprawling integrated industrial site where more than 100 petroleum and petrochemical companies came to do business. Jurong Island has helped Singapore become one of Asia's top oil hubs, and a global center for oil refining.³⁶

³⁵ Jurong Town Corporation (hereinafter JTC), *The Making of Jurong Island: The Right Chemistry: Commemorative Edition for the Official Opening of Jurong Island* (Singapore: Jurong Town Corporation, 2000), 19; Vidal and Kandasamy, "Recent Trends," 12, 13; Lim, "Land from Sand," par. 24.

³⁶ Quote from JTC, *The Making of Jurong Island*, 16. Chia, et al., "Coastal Environmental Profile," 42; Glaser, et al., "Land Reclamation," 367; Vidal and Kandasamy, "Recent Trends," 13; Lim, "Land from Sand," par 25.



Figure 4: Photo of Villagers on Beach of Pulau Ayer Merbau, 1961³⁷
Before merging this and other small islands to create a petrochemical hub, government officials gave local villagers goats as a potential source of subsistence and revenue.



Figure 5: Photo of Land Reclamation Work at Jurong Island, 1999³⁸
This photo reveals the massive transformation of a landscape once described as “palm fringed islands.”

Jurong Island included major port facilities, but they were only a small component of a much larger port infrastructure overseen by the Port of Singapore

³⁷ Ministry of Information and the Arts, “Visit to Pulau Ayer Merbau - Boatmen bringing the goats on shore” NAS, Media Image No. 20120000291 – 0035, <http://www.nas.gov.sg/archivesonline/photographs/record-details/613cecd0-42d5-11e4-859c-0050568939ad> (accessed 1 May, 2019).

³⁸ Ministry of Information, Communications, and the Arts, “Official Launch of Jurong Island’s Amenity Center” NAS, Media Image No. 19990005440 – 007, <http://www.nas.gov.sg/archivesonline/photographs/record-details/6abb42f8-1162-11e3-83d5-0050568939ad> (accessed 30 July, 2018).

Authority (renamed the Maritime and Port Authority in 1995). Like the HDB and JTC, the PSA/MPA used land reclamation to create space for its projects. In the case of the latter, both marine and air transportation fell under its purview. Singapore's government established the PSA on 1 April 1964 to replace the colonial-era Singapore Harbour Board. As the PSA dredged local waters to improve port navigability, officials recognized the potential for using the material removed from the seabed for reclamation. By the mid-1960s, the agency had concluded that container shipping represented the future of maritime commerce. Determined to maintain Singapore's regional edge, the PSA rapidly constructed container port facilities, using land reclamation to create the necessary space. Such concerns over maintaining and expanding regional and global competitiveness as a newly independent nation help explain why the postcolonial government generally neglected the environmental consequences of these and other reclamation activities.³⁹

The PSA used land reclamation to create space for infrastructure that allowed Singapore to become, until recently, the busiest port in the world. The first of these projects took place between 1967 and 1968 when the PSA reclaimed just over 22 hectares of land to assist in the construction of a container port at East Lagoon. Officially opened in 1972, this port welcomed the first container ship to Singapore soon after. Over the next several years, the PSA reclaimed over 25 hectares of land in the Pasir Panjang area to build berths and warehouses for lighter cargo operations. In later years, the MPA expanded this into a major container port. These and other projects helped Singapore retain and expand its position as one of the most significant entrepôts in Asia. In 1982, Singapore overtook Rotterdam as the world's busiest port in terms of tonnage—a rank Singapore held until 2013 when Shanghai overtook it.

³⁹ Vidal and Kandasamy, "Recent Trends," 16; Dobbs, *The Singapore River*, 15.

Like colonial officials before them, the PSA/MPA remade Singapore's site to better capitalize on its advantageous maritime situation.⁴⁰

In addition to its reclamation work for port facilities, the PSA/MPA oversaw a massive reclamation project to create Singapore's well-known, ultra-efficient international airport at Changi on the far east coast of the main island. Parliament approved the project in 1975, and construction commenced a year later on what promoters then labeled the largest reclamation scheme ever undertaken in Southeast Asia. In the first phase of this development, the PSA used 40 million cubic meters of sand dredged from the nearby seafloor to reclaim over seven hundred hectares of foreshore. In 1998, the agency now known as the MPA updated its plans. It called for a further 2000 hectares of reclamation at Changi, with 820 intended for airport expansion and the remaining land set aside for military and industrial purposes.⁴¹

Deployed advantageously by the HDB, the JTC, and the PSA/MPA, land reclamation played a crucial role in Singapore's rise to affluence in the postcolonial era. A strategy promoted by Lee Kuan Yew, and seen through to completion by his PAP, which has ruled Singapore since 1965, the creation of new land has taken on a symbolic importance for the government. Promotional materials from the HDB, JTC, and PSA/MPA all highlight this extraordinary remaking of Singapore's coastline. It provides a powerful vindication of the PAP's style of governance, which combines expert leadership with limited public engagement. In terms of per capita income (Singapore now ranks ahead of, for instance, the United States, the United Kingdom, Germany, and Japan), home ownership rates, access to basic amenities, and efficient infrastructure, Singapore's rise has been nothing short of spectacular. But the land

⁴⁰ "55 acres of land from sea by year's end" *ST* (8 August 1967), 22; "Reclaiming of East Lagoon Now Completed" *ST* (6 September 1968), 24; "Port Kelang Reclamation" *ST* (25 March 1974), 9; Vidal and Kandasamy, "Recent Trends," 16; Dobbs, *The Singapore River*, 15; Loke, "Nature and Sustainability," 169; Auger, *A River Transformed*, 42.

⁴¹ "Go-ahead for reclaim land project at Changi" *ST* (30 July 1975), 9; "Biggest Land Reclamation Scheme in Southeast Asia" *ST* (4 March 1976), 15; Vidal and Kandasamy, "Recent Trends," 16; Lim, "Land from Sand," par 26-27.

reclamation that helped facilitate this growth did entail significant environmental and cultural costs.⁴²

What Was Lost, Part I: The Environment

After two centuries of land reclamation, only fragments of Singapore's original coastline remain. The entire southern shore, with the exception of a rocky expanse of less than one kilometer at Labrador Park, has undergone reclamation. So too have large stretches of the northeastern coast, pockets of the northwest, and most of the smaller islands. This process has involved the destruction of multiple natural coastal environments, of which this discussion will address three of the most significant: mangrove forests, sandy beaches, and coral reefs. Yet, conservationists in Singapore can still hold out some hope. Despite extensive habitat loss, and a resulting decline in plant and animal life, biodiversity remains high in Singapore's waters and on its primarily artificial shores. Moreover, in recent years the government has become increasingly willing to incorporate environmental concerns into its policymaking. Given that perhaps none of Singapore's shores remains in a pristine state, this all points to the potential benefits of, and challenges surrounding, the conservation of hybrid environments in Singapore's waters.⁴³

When Raffles arrived in Singapore, the main island possessed approximately 75 square kilometers of mangrove forests, representing about 13-percent of the total land area. By 1978, that total had fallen to 24 square kilometers, and today only a few square kilometers remain. Multiple factors propelled this decline, including logging (primarily for firewood), prawn and fish aquaculture, and the conversion of brackish estuaries into freshwater reservoirs. But reclamation schemes—such as colonial

⁴² Stats from Central Intelligence Agency, "The World Fact Book" <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html> (accessed 15 June 2018). Also see Hassler, "Development Dynamics," 15.

⁴³ Loke, "Nature and Sustainability," 170; Koh, et al., "Marine Habitats," 1.

projects on the Singapore River in the early nineteenth century and the Kallang Basin in the 1930s, HDB schemes on Pulau Ubin in the 1970s, or JTC developments in the west in that same timeframe—also played a central role in this diminution.⁴⁴

Although often dismissed by colonial officials and the post-independence government as useless, unsightly swamps, mangrove forests actually provided a number of benefits. Mangroves' elaborate root structures stabilized the coast by reducing the impact of wave action and encouraging natural sedimentation in their vicinity. These root structures also provided a sheltered habitat for numerous organisms. Researchers have linked some 2000 species of plants and animals to Singapore's mangrove estuaries, and many of these organisms are unique to this environment. While the ecological processes at work in these muddy swamps were not always obvious, mangrove forests were also key sites for the disintegration and decomposition of organic materials. In 1936, an author for Singapore's primary newspaper, *The Straits Times*, wrote that mangrove swamps were "certainly not beautiful" but they contained "an abundance of wildlife." With 95-percent of Singapore's original mangrove forests obliterated by reclamation and other human activities, the nation has suffered a significant ecological loss.⁴⁵

While mangrove forests dominated estuaries, large expanses of Singapore's shores, especially along the southern coast, once consisted of natural sandy beaches. Sandy shores originally stretched along much of the southeast, from Tanjong Rhu to Changi, before the HDB's East Coast Reclamation scheme buried them in the last third of the twentieth century. Natural beaches also occurred in the southwest,

⁴⁴ Chia, et al., "Coastal Environmental Profile," 18; Richard T. Corlett, "The Ecological Transformation of Singapore, 1819-1990" *Journal of Biogeography* 19 (1992), 412; Lee, *Singapore Waters*, 46.

⁴⁵ Quote from "In the Mangrove Forests" *ST* (19 June, 1936), 10. In an oral history interview, Choor Singh recalls the mangrove swamps by the Singapore River as being "filled with crabs" in the 1930s; see "Oral History Interview" Rajandran Supramaniam, Interviewer, NAS, Acc. No. 001323, r/d 5/16 (16 Oct 1991). Chia, et al., "Coastal Environmental Profile," 18; Lee, *Singapore Waters*, 45, 52, 56; Koh, et al., "Marine Habitats," 3-4.

between Telok Ayer and Pasir Panjang, until HDB schemes in the 1960s and PSA projects in the 1970s covered these beaches as well. Other portions of Singapore's original coastline consisted of natural rocky shores, but these too have almost entirely disappeared due to reclamation.⁴⁶

Studies of Singapore's few remaining natural sandy beaches, plus those of nearby countries, and of pioneer ecological communities on older artificial beaches in Singapore, reveal a large range of life organized loosely into bands stretching away from the water. Sandy beaches in Singapore generally hosted little or no true seaweed fauna, but if sufficient mud was present, tapegrass (*Enhalus acoroides*) could grow luxuriantly. Further from the water, a variety of grasses and sedges colonized the upper edge of the sand, consolidating the soil. Beyond this, a strip of beach forest, including sea hibiscus (*Hibiscus tilaceus*), sea almond (*Terminalia catappa*), and coconut (*Cocos nucifera*), took root. In terms of fauna, the most obvious feature of Singapore's sandy beaches were numerous species of ocy-pode crabs along with hermit crabs in the genus *Ceonobita*. Early accounts of Singapore's beaches also note the abundance of starfish visible in what were then crystal-clear waters. Post-colonial land reclamation played the central role in the obliteration of these habitats.⁴⁷

As land reclamation pushed further out from shore, it took a significant toll on another key marine habitat—coral reefs. Before Singapore remade its coastline, its waters contained more than 100 square kilometers of coral, consisting of over 200 species. Researchers estimate that this range has since declined by perhaps 60-percent. Multiple factors account for this decline, including coral collection and sea-lane dredging. But reclamation schemes, like colonial projects around Telok Ayer in the nineteenth century, and works on the smaller outer islands by the JTC and PSA in

⁴⁶ Koh, et al., "Marine Habitats," 5, 9.

⁴⁷ "Lots of Star Fishes" *ST* (7 September 1955), 12; "Youth Get Fun and Money Spearfishing Crabs" *The Singapore Free Press* (8 November 1960), 3; Soh Sin Yan "Oral History Interview" Mark Wong Wen Wei, Interviewer, NAS, Acc. No. 003536, r/d 5, (25 June 2010); Chia, et al., "Coastal Environmental Profile," 18; Lee, *Singapore Waters*, 60; Koh, et al., "Marine Habitats," 5.

the last third of the twentieth century, were the crucial factor. Not only did these schemes bury reefs beneath new land, but also the dredging carried out for fill destroyed reefs and produced siltation that smothered marine organisms and reduced water clarity and light penetration. This latter factor helps explain why coral in the area is now restricted to a shallower range than when monitoring began in the 1980s.⁴⁸

In Southeast Asia, as elsewhere, coral reefs were known for their tremendous ecological productivity and biodiversity. Hence, Singapore's marine conservationists campaigned to limit the impacts of reclamation on them. In 1988, a group of concerned individuals launched the Singapore Reef Survey and Conservation Project to assess the state of coral in Singaporean waters and work to preserve what remained. Between 1991 and 1997, the Nature Society (Singapore)'s Marine Conservation Group commenced the Reef Rescue Project. Divers relocated coral from sites, such as the islets that became Jurong Island, slated for reclamation. Later surveys indicated that only 10-percent of the relocated coral survived, but this was better than none at all. Such setbacks speak to the challenges of mitigating the environmental impacts of state plans already set in motion. But for environmentalists in Singapore, this is often the only available option.⁴⁹

The extensive loss of natural habitat brought about by land reclamation is discouraging, but local conservationists still have reason for cautious optimism. Despite this destruction, biodiversity in Singapore's waters and on its largely artificial shores remains high. This owes partly to the extreme richness of Southeast Asia's tropical waters, and partly to one of the government's greatest environmental achievements: its persistent measures to minimize water pollution resulting from shipping, oil refining, and other activities (even is such pollution can never be entirely

⁴⁸ "Coral Reefs in Danger" *ST* (19 May 1985), 2; Chia, et al., "Coastal Environmental Profile," 30; Loke, "Nature and Sustainability," 171-172; Koh, et al., "Marine Habitats," 9.

⁴⁹ "Second Mission to Rescue Coral" *ST* (13 November 1992), 2; Lee, *Singapore Waters*, 130-132.

contained). Of the three natural habitats described above, mangrove forests may have suffered the most sweeping damage. Yet a few isolated patches remain on the main island's northern shore, as well as on Pulau Tekong and Pulau Ubin. Moreover, researchers have observed greater fish diversity at planted mangrove forests on reclaimed shores, presenting the possibility of restoring some approximation of these lost habitats. Likewise, few of Singapore's natural sandy beaches remain. But some of the artificial beaches created through reclamation are over 50 years old. Scientists have found that many native plants and organisms have colonized these sites, although natural shores retain higher biodiversity. Finally, although the biomass of coral reefs in Singaporean waters has greatly declined, surveys indicate that coral diversity remains high, with 160 extant species. Moreover, coral has begun to colonize some of the artificial substrates created by reclamation, especially the pervasive stone and concrete seawalls. Critics might counter that emphasizing the enduring species variety in a region that has suffered so much habitat destruction and loss of biomass simply highlights the deficiencies of biodiversity as a conservation objective. There is validity to this critique. Nonetheless, it is worth stressing such persistence in a nation where many citizens question the benefits of marine conservation because they believe the surrounding waters are already devoid of life.⁵⁰

Offering further hope, in recent years Singapore's government has proven more willing to incorporate environmental criteria into its planning. Although EIAs are still not mandatory under Singaporean law, beginning in the late 1990s the government has increasingly conducted them in advance of coastal developments. Perhaps this reflects a growing confidence that the nation has achieved sufficient economic progress to begin pursuing other policy objectives. These EIAs have

⁵⁰ Chia, et al., "Coastal Environmental Profile," 18; Lee, *Singapore Waters*, 42, 46, 59; Loke, "Nature and Sustainability," 172, 174; Koh, et al., "Marine Habitats," 2.

generally taken place behind closed doors, though, and so the public has only been able to mitigate the environmental impacts of plans already approved by the state.⁵¹

Two examples illustrate the government's new mindset regarding coastal developments. In 1999, the Ministry of the Environment commenced construction on an offshore landfill project at Semakau. It used reclamation to create a bund enclosing a space into which the state could deposit waste, creating additional land in the process. The state conducted numerous EIAs before commencing the project, took steps to protect nearby coral, and planted the reclaimed land with mangroves. In 2001, in response to public pressure, the government opted to delay indefinitely its reclamation plans for the Chek Jawa wetlands on Pulau Ubin "for as long as [it] is not required for development." This quote demonstrates the enduring centrality of "development" to state planning, even in this era of rising environmental awareness.⁵²

The overwhelming majority of Singapore's coastal environments have undergone anthropogenic transformations, and the state generally continues to make plans first, and then consider ways to limit their environmental impact afterwards. But the growing receptivity of Singapore's government to environmental apprehensions offers hope to conservationists willing to work for the enrichment of hybrid environments. The preservation of pristine or semi-pristine environments may be preferable in many—perhaps most—instances. But on a planet increasingly altered by anthropogenic change, environmental advocates must also learn to appreciate and protect the life present in human-modified spaces.

⁵¹ Hesp, "The Environmental Impact," 137-139; Loke, "Nature and Sustainability," 170.

⁵² Quote from National Parks Singapore, "About Chek Jawa" <https://www.nparks.gov.sg/gardens-parks-and-nature/parks-and-nature-reserves/pulau-ubin-and-chek-jawa/what-to-see/about-chek-jawa> (accessed 20 July, 2018). Loke, "Nature and Sustainability," 170, 176, 178; Vidal and Kandasamy, "Recent Trends," 16-17; Timothy P. Barnard and Corinne Heng, "A City in a Garden" in *Nature Contained*, 302.

What Was Lost, Part II: The Culture

Singapore's extensive land reclamation not only buried coastal environments, but also displaced the human communities that had taken up residence on these sites to exploit the sea's bounty. The removal of these communities imperiled a longstanding cultural connection to the sea based on knowing nature through physical labor. This section will focus on two such groups, who found their communities and livelihoods erased: fishers and prawn farmers.

Today very few Singaporeans earn a living by fishing, but this was not always the case. As late as the 1950s, perhaps 300 *kelongs* were strewn across the main island's coast in the southwest, southeast, and northeast, as well as on the offshore islands of Pulau Ubin and Pulau Tekong. Significant fishing villages persisted along the east coast, stretching from Tanjong Rhu to Changi Point. They included Kampong Terbakar, Kampong Java, Kampong Amber, Kampong Siglap, Kampong Hajijah, Kampong Lim Choo, Kampong Goh Choo, Ayer Gemuroh, Mata Ikan, and Tanah Merah.⁵³

In the 1970s, the Siglap Community Centre Youth Group conducted a study to document the lives of the inhabitants of four local East Coast fishing villages before they vanished due to reclamation. After interviewing all known current or former fishermen (they were overwhelmingly male), the youth found that most of them came from families who had carried on the trade for generations. The fishermen noted that *kelongs* had once been central to their activities, but most of these structures had been cleared to make way for reclamation. The government had already relocated some members of these communities into HDB flats, and not surprisingly, the majority of those who remained believed that land construction was detrimental to their trade. The youth concluded their report with an oral history interview entitled "The Story of

⁵³ Lee, *Singapore Waters*, 26, 30.

An Old Fishermen.” Hassan Bin Dengkal was one of the oldest fishermen at Siglap. Blind, but otherwise healthy, his identity card showed him to be 87, a number he disregarded. “I am about 120 years old,” he began. “My father, myself and my children were all born in this very house in Kampong Hajijah.” Dengkal recounted, “Fishing has always been a family trade which was handed down by my forefathers.” He learned his craft well. “I was a good fisherman,” he stated. “I knew all the good fishing grounds off Siglap and Bedok.” Attuned to the patterns of the tides and the weather, and aware of the distribution of marine resources, fishermen like Dengkal knew the sea in a way that those who have never relied on it for their livelihood probably cannot. Within a few years, his fishing village would cease to exist.⁵⁴

Multiple factors propelled the decline of fishing in Singapore, including greater access to education and increased employment opportunities. But land reclamation also played a role. By the 1980s, few of the approximately 300 kelongs reported in 1952 persisted. The decline continued unabated. In just five years, between 1980 and 1985, the reported number of fishermen in Singapore dropped from 2,025 to 1,321. The destruction of fishing villages through land reclamation had actually commenced in the colonial era by at least the 1870s with projects at Tanjong Pagar. This process accelerated during the postcolonial period, owing especially to the East Coast Reclamation. To its credit, the government arranged meetings with displaced fishermen and strove to make the transition as smooth as possible. But the state’s disinterest in maintaining this way of life was apparent. In an oral history interview, James Cher Siang Koh reflected on his time working for Singapore’s Ministry of National Development. “We are not encouraging fishermen,” he recalled. “In other words, Singaporeans as fishermen... I think you can’t earn a living that

⁵⁴ Chou Loke Ming, Ed. “A Report on the Fishermen of Siglap” (Singapore: Siglap Community Centre Youth Group, 1977) NLS 301.35095957 SIG, 11, 22, 40, 43. For other accounts of fishing villages destroyed by reclamation, see Tan, Lawrence Eng Soon “Oral History Interview” Jesley Chua Chee Huan, Interviewer, NAS, Acc. No. 002231, r/d 5 (22 June 2009); Lee Liang Hye, “Oral History Interview” Zaleha bte Osman, Interviewer, NAS, Acc. No. 002186, r/d 10 (26 Oct 1999).

way.” In part, the PAP’s disinterest in fishing probably reflected an enduring desire—present since the colonial era—to create a structured and ordered space that was conducive to trade and commerce. Traditional fishing vessels did not mix well with modern container ports.⁵⁵

As with fishing, the traditional livelihood of shrimp farming dwindled in independent Singapore, in part because of land reclamation. While fishermen had clustered along the sandy beaches of the East Coast, shrimp farmers preferred coastal swampland and mangrove estuaries in the north and the west. During this profession’s heyday in the 1950s and 1960s, shrimp ponds covered an estimated 810 hectares of territory, primarily in Jurong, West Coast Road, Tampines, Serangoon, Punggol, Chua Chu Kang, Pulau Ubin and Pulau Tekong.⁵⁶

A traditional form of aquaculture introduced to Singapore by Chinese settlers in the early 1900s, shrimp farming depended on the careful exploitation of tidal patterns. By constructing a bund, shrimp farmers enclosed a span of fifteen to twenty hectares of swampland—ideally, shielded from the surf by an outer rim of mangroves—with a sluice gate controlling the entrance or exit of tidal waters. Shrimp farmers opened the gate during the start of a high tide, so that juvenile shrimp would flow into the swamp. The aquaculturalists then closed the gate as the tide was receding to maintain a desired depth. To supplement natural food sources, shrimp farmers fed the prawns until they reached an appropriate size for harvest. This the aquaculturalists accomplished by opening the sluice, and netting prawns as they were washed out to sea. Traditional shrimp farming all but vanished when land reclamation and the construction of reservoirs largely eliminated Singapore’s mangrove forests in

⁵⁵“Public Works and Private Enterprises,” 3; “Untitled,” 11; “Minister to see fishermen” *ST* (3 February 1968), 11; HDB, *AR, 1969*, 68; “Fishing Industry Now in Deep Waters” *New Nation* (21 February 1972), 3; “Reclamation Project Approved” *ST* (20 October 1984), 15; Chia, et al., “Coastal Environmental Profile,” 59; Koh, James Cher Siang “Oral History Interview” Jason Lim, Interviewer, NAS, Acc. No. 002847, r/d 4 (6 June 2008).

⁵⁶ Chia, et al., “Coastal Environmental Profile,” 60; Lee, *Singapore Waters*, 26.

the post-independence period. Another cultural connection to the sea based on knowing and appreciating nature by working in it had disappeared.⁵⁷

By erasing sites at which people had long derived their livelihood by exploiting living oceanic resources, land reclamation schemes had a profound social and cultural impact on Singapore. This process could be traumatic for those relocated—a fact attested to by government agency reports acknowledging the challenges of moving “squatters” into HDB flats. But this development also helps explain an attribute of Singapore that has baffled numerous recent observers: for a small island nation, Singapore seems profoundly culturally disconnected from the sea. As Singaporean lawyer and diplomat Tommy Koh put it, “In the past 30 years, due to extensive land reclamation, the sea has receded from the lives and memories of our people.” Singapore appears to have lost a connection to the sea based on understanding and appreciating nature through personal labor. We might contrast this with the enduring centrality of the sea to the culture of other developed nations, such as Japan or Norway, that have retained industries based on the exploitation of living marine resources. Those concerned with the health of Singapore’s coastal environments need to find a way to reestablish this bond. People are more likely to conserve things they hold dear.⁵⁸

Singapore’s 200-year history of building new land provides us with a number of lessons concerning our relationship to the natural world. It reveals how human efforts to resolve tensions between site and situation can produce radical

⁵⁷ “Prawn Farming Project Scrapped” *ST* (1 November 1984), 17; Chia, et al., “Coastal Environmental Profile,” 61; Lee, *Singapore Waters*, 26; Barnard, *Nature’s Colony*, 228.

⁵⁸ Koh quoted Lee, *Singapore Waters*, 6. The following works note this disconnect: Lee, *Singapore Waters*, 5; Loke, “Nature and Sustainability,” 174; Hassler, “Introduction,” 12; Topalovic, “Constructed Land,” 51.

environmental transformations. It speaks to the manner in which governments can use such reconstruction of the natural world, in the name of progress and development, to bolster their appeal and entrench their authority. It highlights the cultural disconnections to nature that can result when livelihoods based on working in and knowing living environments vanish. Finally, it demonstrates the benefits of, and challenges surrounding, the conservation of hybrid environments—a prospect that will become increasingly common in an era some scholars have taken to calling the Anthropocene, or for the period since 1945, the Great Acceleration. With regards to the latter, the history of land reclamation in Singapore also reveals how the struggle for economic advancement in postcolonial societies has contributed to our intensifying impact on the planet. As evermore countries join the ranks of so-called “developed” nations, the environmental consequences of behaviors and attitudes long entrenched in the West are being brought into sharper relief.