To Build a Nation: Growing Singapore with Land Reclamation

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ABSTRACT

The island of Singapore has grown significantly through the use of land reclamation, with its landmass expanding nearly 25% since Sir Stamford Raffles arrived in 1822. British colonizers of Singapore reclaimed land with relatively limited scope — to recreate the physical environment and to maintain colonial order. In post-colonial Singapore, the People's Action Party has deployed land reclamation on a massive scale — creating public housing, promoting industry, facilitating maritime trade — and in the process, becoming one of the most livable cities in the world. Led by Singapore's founding father, Lee Kuan Yew, land reclamation is closely tied to national ambition. Recent history of land reclamation in Singapore has been distinctly state-driven, and its physical transformation highlights the tensions between environmental degradation and uplifting of the masses.

"A city is an environment made by the people to provide whatever is necessary for their varied activities. It may develop in two ways: either by integration with the natural environment or by expansion into and destruction of, the natural environment."

Tai Ching Ling and Peter S.J. Chen, 1977. *Life and Living Environment in Kampongs and HDB Public Housing Estates in Singapore*

When asked to characterize the "ingredients of a good city" in a 2012 interview, Lee Kuan Yew drew upon his memories of world travels. The ideal city should be unpolluted, free of the fumes he had smelled from chemical factories in Osaka, and the soot from lorries in Malaysia. It should create a sense of safety, unlike how he had felt walking in New York City's Central Park. Its streets should be uncongested, unlike Bangkok's; its buildings uncrowded, leaving space for greenery, unlike Hong Kong's.[1] In so many words, Singapore's founding father took pride in the many negative things that the city-state was decidedly not. One can imagine that, once Singapore had gained its independence from Britain and separated from Malaysia in 1965, a younger Lee saw the country as a clean slate — an island to be rebuilt and transformed into the ideal city he so clearly envisioned.

Indeed, to become what it is today, the island of Singapore has physically transformed an impressive amount. From the point of Sir Stamford Raffles' arrival in 1819, Singapore's landmass has increased by nearly 25 percent through the creation of new coastal land reclaimed from swamplands and the sea.[2] The vast majority of land reclamation has been undertaken in the post-colonial state, for housing, industry, and recreation.[3] Singapore's southeastern shore exemplifies this, with 4,885 hectares or nearly 50 square kilometers added in the four decades after independence.[4] Today, a visitor could deplane in Changi International Airport, drive past high-rise public housing on the East Coast Parkway, arrive in the central business district for a meeting, spend a night in the Marina Bay Sands, lounge at the East Coast Park beach the next day, return to the Changi and depart Singapore, all while unknowingly and exclusively on reclaimed land. The Singaporean case of land reclamation merits serious consideration as its limits may soon be approaching. In its latest Master Plan, Singapore's Urban Redevelopment Authority focuses less on additional reclamations and more on innovative approaches for new underground spaces. So, the island may soon expand downward, rather than outward, as it faces rising sea levels. As Singapore and all nations face the challenges of building sustainable cities and addressing climate change, the "ingredients of a good city" also become more and

1 Centre for Liveable Cities Singapore, A Chance of a Lifetime: Lee Kuan Yew and the Physical Transformation of Singapore, (Singapore: Editions Didier Millet, 2016), 18-19.

2 Miles Alexander Powell, "Singapore's Lost Coast: Land Reclamation, National Development and the Erasure of Human and Ecological Communities, 1822–Present", (Winwick: Environment and History [Fast Track], 2019), 1, https://doi.org/10.3197/096734019X15631846928710.

3 Ibid, 5.

4 Powell, "Singapore's Lost Coast," 16.

more complex. Thus, in the context of climate resiliency, understanding the Singaporean case of long-term reclamation and land use planning may be useful and important for other island nations and cities around the world.

This paper explores land reclamation in Singapore from the lenses of environmental history, nation-building, and trade. Bringing together state narratives, local environmental histories, and the transnational sand trade in conversation shows how Singapore's skill for planning and its many reclamation projects have shaped the city-state and its surrounding region. Like in Debjani Bhattacharya's scholarship of Kolkata but in its own way, Singapore also possesses a "history of forgetting" — erasing mangroves, coral reefs, and coastal kampongs (villages) in favor of packed sand to provide public housing and promote economic development.[5] Many of Singapore's signature successes, and some of its present challenges, are borne out of its sheer capacity to reimagine and recreate its physical environment. The story of land reclamation in Singapore highlights the complexities of environmental degradation when conducted by the state; it challenges the typical narrative that destruction of the environment is driven by greed and profit for a small number. Rather, land reclamation was a key lever in Singapore's process of decolonization and pursuit of its dreams of a better future for its citizens.

Singapore's first documented land reclamation had the dual purpose of facilitating trade and promoting the social order desired by the British. In 1822, at the behest of Raffles, roughly 300 Chinese, Malay, and Tamil "coolie" laborers were paid a wage of one rupee a day to raze a small hill and transport the material to fill the mangrove swamp at the southern bank at the mouth of the Singapore River. Famed Malayan writer Munshi Abdullah described the spectacle of the months-long project in his autobiography: "[The laborers] were told to dig away the earth and carry it off... there were some men breaking the rocks, for there were a great many large rocks there, and everyone had work to do; there were dozens of overseers, and it all looked like people at war."[6] Raffles' Place, as the new land came to be known, provided more space for not just *godowns*, or warehouses, for ships to load and store cargo, but also kampongs segregated on ethnic lines by the British's plans. In his account of Singapore's history of land reclamation, Miles Powell observes that this "[racial] segregation... was a crucial component of the ordered landscape colonists used reclamation to help achieve."[7] Ironically, the land jointly created by Chinese, Malay, and Tamil laborers served to segregate their communities.

Both Singapore's population and importance as an entrepôt continued to grow through the 19th century. The British found inexpensive labor migrant inflows from China, India, Southeast Asian countries, seeking opportunity in the free port city and often fleeing poverty in their home countries.[8] The advent of steamships, which required deeper berths than the Singapore River could provide, prompted the establishment of New Harbour on the southwest coast in 1852 (known as Keppel Harbour since 1900).[9] In 1869, the opening of the Suez Canal enabled a rapid acceleration in steamship traffic. By opening a waterway through the Red Sea and bypassing the circuitous journey around the African Cape, the Suez Canal cut travel time between Europe and Asia by one-third.[10] The impact of this in Singapore was immediate; in the one year following the opening of the Suez Canal, trade volume through Singapore increased by 55 percent.[11] Spurred on by their desire to create an environment conducive to growing trade and commerce, the colonial government in total added roughly 300 hectares to the island of Singapore, largely to improve connectivity to the harbors and build military facilities and an airport.[12] The technological advances and increasing economic connectivity of the 19th and early 20th centuries cemented Singapore's centrality to trade in the British empire and established a precedent for the island's continued expansion.

In post-colonial Singapore, both the role and scale of land reclamation projects have expanded dramatically. Since becoming independent in 1965, Singapore has added more than 14,420 hectares of land, 48 times the total amount colonial Singapore did.[13] Both colonial and post-colonial Singapore share the desire to strengthen its situation as a trading hub, but the driving motivation fundamentally changed. The British expanded Singapore to advance imperial aims, to provide an "ordered, sanitary, landscape… conducive to trade and commerce," and were not so much concerned about the livelihoods of their subjects.[14] But under the People's Action Party (PAP), post-colonial Singapore made advancing the nation's economic status and improving Singaporean citizens' living standards its paramount goal.

In the southwest of Singapore, the Jurong Town Corporation (JTC) and Port of Singapore Authority (PSA) (renamed Maritime and Port Authority [MPA] in 1995) undertook vast reclamation efforts to further develop the city state's industrial and port activities. Beginning in 1963 and through the late 1980s, the JTC reclaimed roughly 2,700 hectares of Singapore's rural west to raise the Jurong Industrial Site and expansion in Tuas, flattening the once hilly jungle and using that material to fill in swampland to do so.[15] The historical islands off the southwestern have been described as "lost," their mangrove forests eliminated, residents resettled, and coastlines expanded to make room for chemical refineries, factories, and deep seaports. Jurong Island is the starkest example, created by merging seven smaller islands together in the 1990s and 2000s.[16] Today, as the Ministry of Trade and Indus-

5 Debjani Bhattacharyya, Empire and Ecology in the Bengal Delta: The Making of Calcutta, (Cambridge: Cambridge University Press, 2018), 1-42.

6 Abdullah A Kadir, The autobiography of Munshi Abdullah, trans. William G. Shellabear, (Singapore: Methodist Publishing House, 1918), 148.

7 Powell, "Singapore's Lost Coast," 9.

8 Stephen Dobbs, The Singapore River: a social history 1819-2002, (Singapore: Singapore University Press, 2003), 10, https://catalog.hathitrust.org/Record/003873005.

9 Powell, "Singapore's Lost Coast," 9.

10 Dobbs, The Singapore River, 10.

11 Dobbs, 10.

12 Powell, "Singapore's Lost Coast," 9-12.

13 Ibid 18, "Total Land Area of Singapore," Data.gov.sg, 2020, https://data.gov.sg/dataset/total-land-area-of-singapore.

14 Powell, "Singapore's Lost Coast," 12-13.

15 Powell, "Singapore's Lost Coast," 18.

16 HistorySG, "Jurong Island is officially opened," National Library

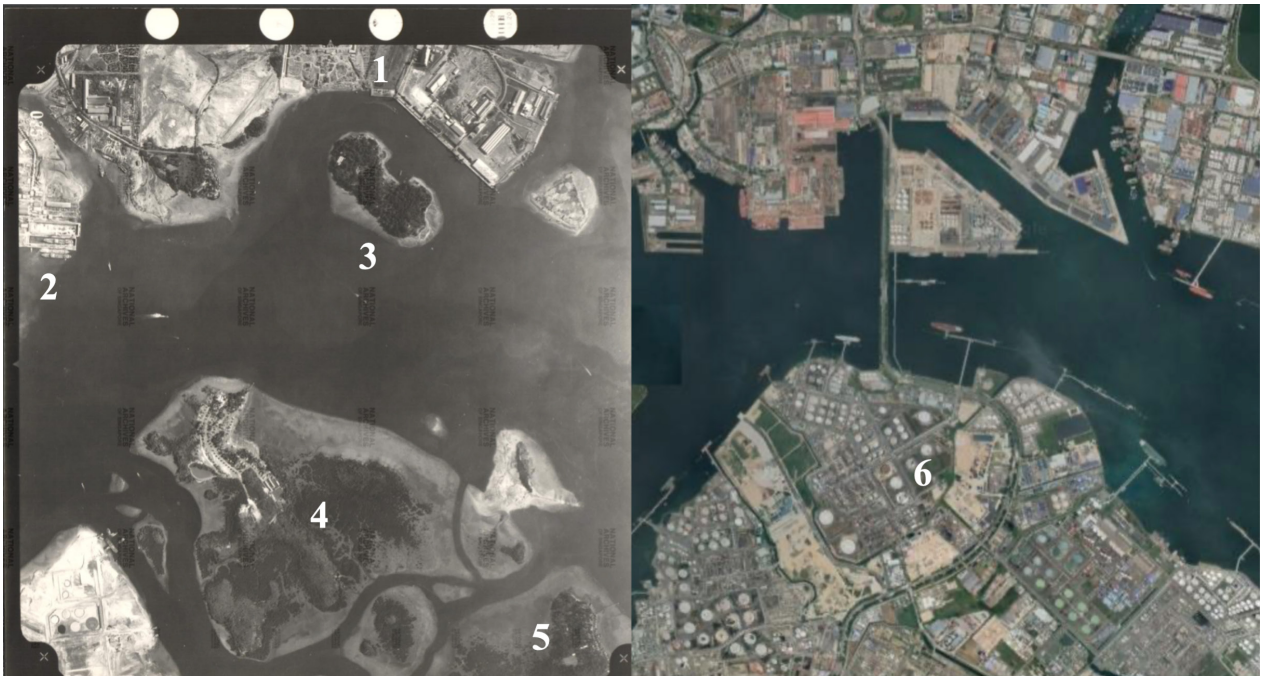

FIGURE 1. *Aerial views of Singapore's main island (1), Pulau Semulun (2), Pulau Damar Laut (3), Pulau Merlimau (4), Pulau Seraya (5), in the 1970s and present day Jurong Island (6) in 2021.*[1]

1 British Royal Air Force, "Part Of A Series of Aerial Photographs From East To West Showing: Marine Parade Land Reclamation, Sungei Kallang, Singapore River, Fort Canning, Pasir Panjang, Juron,." (Singapore: National Archives of Singapore, 1970s), https://www.nas.gov.sg/archivesonline/photographs/record-details/ebc08bab-9ac1-11e4-859c-0050568939ad. Google Maps, 2021, https://www.google.com/maps/.

try writes, Jurong Island is "the heart of Singapore's energy and chemicals industry, ...home to almost 100 leading global petroleum, petrochemicals, and specialty chemical companies."[17] North of Jurong Island is another small island named Pulau Damar Laut, now connecting the two via a causeway. Recalling memories of visiting Pulau Damar Laut during his childhood, local writer Julian Davison described the island as a tropical idyll with a vibrant coastal ecosystem:

> *Back then, in the shallow waters that surrounded Pulau Damar there were coral reefs which one could wade out to at low tide and standing thigh-deep in water observe all manner of interesting marine life at one's feet — little shoals of brilliant-blue damsel fish or brown and white "clowns" threading their way in and out of sea anemones… Fat sea cucumbers littered the bottom like large turds and sometimes a blue spotted ray in its distinctive polka dot attire would suddenly rise up in a cloud of sand, to flit across the shallows like the shadow of a bird in flight.*[18]

Today, Pulau Damar Laut houses four container and cement terminals, and as recently as the early 1980s, communities resided there. "There were kampungs about seven years ago," recalled one boatman in 1988. "The villagers moved out, some to nearby Pulau Seraya and Pulau Merlimau, because of the government resettlement program."[19] It's worth noting that Pulau Merlimau and Pulau Seraya were among the seven islands "lost" in the reclamation of Jurong Island — meaning then in a few decades those villagers would have been resettled once again. A similar account in the 1971 annual issue of *The Straits Times* shares this chronology for the fishing communities of Pulau Semulun, the island west of Pulau Damar Laut: "Although uprooted from familiar surroundings, the islanders benefitted from the move… Soon they will have to shift once more as [Pulau] Merlimau is in turn to be developed into an oil refinery complex. This time, the islanders will probably move for good to modern flats at Jurong Town on the main island."[20] On other southern islands, villagers were provided "jetties, schools, water tanks, community centres, and other facilities," along with goats for "an added source of income" — but again, were moved away by the government as the land was taken up by the arrival of industry.[21]

Unfortunately, the voices of those most impacted by government reclamation projects are often the least common in the historical record. One account, from Siglap on the east coast, helps to

Board of Singapore, 2015, https://eresources.nlb.gov.sg/history/events/a27a6821-9ee6-45c1-b3d1-0dce19252eed.

17 Jurong Town Corporation, "Jurong Island," Ministry of Trade and Industry Singapore, 2011, https://www.mti.gov.sg/Resources/feature-articles/2011/Jurong-Island.

18 Julian Davison, One for the road: and other stories, (Singapore: Topographica, 2001), 78, https://catalog.hathitrust.org/Record/003816755.

19 Abdul Hadhi, "Now a jungle, but soon to be a port" The New Paper , August 29, 1988, 2, https://eresources.nlb.gov.sg/newspapers/Digitised/Article/newpaper19880829-1.2.3.4.

20 William Campbell, "New Roles for Tropical Isles." Straits Times Annual, January 1, 1971, 114-115, https://eresources.nlb.gov.sg/newspapers/Digitised/Article/stannual19710101-1.2.52.

21 Campbell, "New Roles for Tropical Isles," 114-115.

explain the scope and nature of the impact of government reclamation schemes on Singapore's fishing villages. In 1976, the Siglap Community Youth Group published the 64-page *Report on the Fishermen of Siglap*, the culmination of interviews with all 100 remaining fishermen in Kampong Siglap, Kampong Hajijah, Kampong Lim Choo, and Kampong Goh Choo. Abdul Rahim Ishak, Member of Parliament and minister to the constituency of Siglap, had requested that the group undertake this study to understand the socio-economic activities of Siglap's fishermen, the effect of land reclamation on them, and how they adapt to the changing physical environment.[22] As it turns out, by the time of the study, the majority of fishermen interviewed no longer fished as their primary occupation; 49 out of the 100 had retired, were unemployed, or changed occupations, and another 14 only fished part-time. Of the remaining full-time fishermen, the majority were in an aging demographic, with 33 out of 37 between the ages of 41 and 65.[23] A brief oral history of one of the oldest fishermen of Siglap concluded the report. Now blind but "otherwise healthy," Hassan Bin Dengkel was 87 according to his identity card but told the interviewers that he was "about 120 years old." He described his family's mixed ancestry, connection to fishing, and an intimacy with the ocean that came from 40 years on the water:

> *My father, myself and my children were all born in this very house in Kampong Hajijah, which was originally known as Kampong Bahru. My grandfather came from Johore and my grandmother migrated from Sumatra… Fishing has always been a family trade which was handed down by my forefathers. I started my fishing career in a kelong at the age of thirteen… I fished practically every day, except during the very stormy periods. The work was hard, the hours long. But I was a good fisherman. I knew all the good fishing grounds off Siglap and Bedok… The fisherfolk in Siglap called me a 'Pawang' — a magical expert, though I really did not possess any magical powers. I used my brain, skill and experience effectively.*[24]

By the time the *Report on the Fishermen of Siglap* published, Dengkel had passed away.[25] Fishermen like Dengkel possessed expertise of the coastal environment that is hard to achieve without a livelihood that relies on day-in-day-out interaction with it.[26] No doubt, particularly on Singapore's reclaimed shores—where nature is increasingly enmeshed with the manmade—the relationships between residents and their environments have become less straightforward.

A decade prior to the Siglap report, Abdul Rahim Ishak had envisioned that with enough capital investment, Singapore would become "a great fishing port worthy of its name as a 20th century maritime nation."[27] "You can be sure that the Singapore Government will always have your interests at heart," he said to the fishermen of his constituency. A year after that speech, Abdul assuaged fears of reclamations' potential impact on fishing: "We were… assured that when reclamation was completed your fishing activities need not be interrupted."[28] But — as he must have anticipated when requesting the report be made — by the 1980s the fishing kampongs of Siglap had ceased to exist. Socioeconomic factors such as greater access to education and increasing employment opportunities precipitated the decline of fishing in Singapore, but the dramatic physical transformation of the nation's coastline and islands certainly accelerated the process.[29] The erasure of Singapore's local fishing villages reflected the national priorities to elevate trade and commerce as Singapore's primary oceanic industries and redevelop kampongs into high-rise public housing. National rhetoric reveals the state's attitude toward the idea of Singaporeans as small-scale fishermen. "When Stamford Raffles came 150 years ago, there was no organised human society in Singapore" — Lee Kuan Yew said in 1969 — "unless a fishing village can be called a society."[30]

Alongside the development of ports and industry, the need for housing was a crucial driver for land reclamation in post-colonial Singapore. In 1960, the HDB was created to replace the colonial-era Singapore Improvement Trust (SIT), whose public housing initiatives struggled to keep pace with a growing population with many living in squalid, crowded conditions. The 1947 Census Report lamented Singapore's density, which would worsen with the post-war baby boom: "about a third of the population is living, not scattered over the 200 square miles of the island, but herded into about 1,000 acres in the heart of the city."[31] Outside of the urban core, wealthy Europeans and locals held large estates while the majority resided in kampongs with farmland.[32] An estimated 100,000+ squatters lived in "huts made of attap, old boxes, rusty corrugated iron, etc. with no sanitation, water or any of the elementary health requirements."[33] By 1958, the SIT estimated

22 Siglap Community Centre Youth Group, A Report on the Fishermen of Siglap, (Singapore: Siglap Community Centre Youth Group, 1977), 1.

23 Ibid, 11-12.

24 Siglap Community Centre Youth Group, A Report, 43.

25 Ibid, 14.

26 Ibid, 27.

27 Abdul Rahim Ishak, "Text of Speech by the Minister of State and Assemblyman for Siglap, Inche A. Rahim Ishak, at the Distribution of Rice and Mee to 209 Fishermen in the Siglap Constituency at the Siglap Community Centre on Sunday, September 19, at 10 A.M.," Ministry of Culture, 1965, https://www.nas.gov.sg/archivesonline/speeches/record-details/79cc7906-115d-11e3-83d5-0050568939ad.

28 Abdul Rahim Ishak, "Speech by Inche a Rahim Ishak, Minister of State for Education, at the Siglap Fishermen and Villagers Dinner to Celebrate the Ending of Sea – Curfew on Fishermen etc. Held at the Siglap Community Centre on Friday, 28th October, 1966, at 7.30 P.M.", Ministry of Culture, 1966, https://www.nas.gov.sg/archivesonline/speeches//record-details/79d84870-115d-11e3-83d5-0050568939ad.

29 Powell, "Singapore's Lost Coast," 27.

30 Lee Kuan Yew, "Speech by the Prime Minister at the Banquet given by the Singapore International Chamber of Commerce to Mark the 150th Anniversary of the Founding of Singapore – February 6, 1969," Ministry of Culture, 1969, https://www.nas.gov.sg/archivesonline/speeches/record-details/73aa79de-115d-11e3-83d5-0050568939ad.

31 Housing & Development Board, First decade in public housing, 1960-69, 1970, Singapore, 7, https://eresources.nlb.gov.sg/printheritage/detail/4b635549-0652-4580-b80f-846a055e42e7.aspx.

32 Tan Shin Bin and Vignesh L. Naidu, "Public Housing in Singapore: Examining Fundamental Shifts," ed. Donald Low, Lee Kuan Yew School of Public Policy, NUS, 1, https://lkyspp.nus.edu.sg/docs/default-source/case-studies/public-housing-in-singapore.pdf?sfvrsn=abc1960b_2.

33 Housing & Development Board, First decade, 7. Tan Shin Bin, and

that 16,000 new homes would be needed annually to keep up with the current rate of population increase, but over the entire span of its existence, it had built just 23,000 units.[34] The housing crisis that self-governing Singapore inherited in 1959 thus animated the new HDB's mandate. Driven by the PAP, the HDB was to become a "dynamic organisation with wide powers to construct and redevelop, to clear slums and resettle people, to manage the new housing estates."[35] And within its first 5 years, the HDB constructed 51,031 flats for rent — with one-room units from just S$20 a month — relieving much of the housing pressures of the time.[36] By the end of the decade, HDB flats (HDBs) provided homes for roughly 30 percent of the population, and today, that figure hovers around 80 percent.[37]

The Singapore government has used the HDB as a powerful lever for its social and economic goals. Where Raffles had used land reclamation to divide races, Lee Kuan Yew used it to deliberately mix Singapore's ethnic groups. Lee saw the creation of brand new HDB flats as an opportunity to reverse the British order that "prevented [races] from congregating," and instead guarantee that the new HDBs would be racially integrated.[38] At the time, this was accomplished by vast resettlement programs, tearing down the often racially segregated kampongs and compensating residents to move into new public housing blocks. Today, these guarantees persist in law via the Ethnic Integration Policy (EIP) of 1989, which formally established ethnic quotas for HDB neighborhoods and blocks aiming to "nip the problem in the bud" before racial enclaves inevitably returned.[39] And while the colonial government was content with a largely itinerant population with low-quality housing, the PAP ensured its HDBs would be desirable and affordable to own for the masses. Explaining the motivation for Singapore's Home Ownership Scheme, launched in 1964, Lee Kuan Yew said: "My primary preoccupation was to give every citizen a stake in the country and its future. I wanted a home owning society. I had seen the contrast between the blocks of low-cost rental apartments, badly misused and poorly maintained, and those of house-proud owners, and was convinced that if every family owned its home, the country would be more stable."[40] Today, 90 percent of HDB residents today own the flat they live in.

FIGURE 2. *The earliest Marine Parade HDBs under construction after land reclamation in the East Coast, 1972.*[1]

1 "HDB Estates of the past," Facebook group, March 28, 2018, https://www.facebook.com/hdbhousessg/posts/589071531447814.

To reach the level of success that it has, the HDB has relied, quite literally, upon reclaimed land as the foundation for its communities. Since its inception, the HDB has been responsible for the reclamation of 3,915.3 hectares of land, a figure that approaches a third of the total increase in Singapore's land area.[41] This number includes Singapore's largest reclamation to date, the East Coast Reclamation Scheme, which was a seven-phased undertaking from 1966 to 1985 that added a total of 1,525 hectares of land to Singapore. Atop it, the HDB constructed public housing, hawker centers, and a park for recreation along with fifteen-kilometers of artificial beaches.[42] To transport some 45 million cubic meters of fill material from inland to the coast, Japanese engineers hired for the project built a specialized conveyor belt that could operate around the clock and ideally minimize traffic congestion, dust, and noise.[43] Indeed, the noise and dust from construction vehicles aggrieved those living along the East Coast, who lodged complaints to the Public Works Department, HDB, and local police stations.[44] In November 1975, *The Straits Times* reported that 24 households had organized a petition to the National Development Ministry in protest of the disturbances. Eight drivers had already

Vignesh L. Naidu, "Public Housing in Singapore: Examining Fundamental Shifts," ed. Donald Low, NUS Lee Kuan Yew School of Public Policy, 2014, 1.

34 Tan and Naidu, "Public Housing in Singapore," 2. Housing & Development Board, First decade, 11.

35 Housing & Development Board, First decade, 12.

36 "HDB story year by year," New Nation, December 15, 1981, https://eresources.nlb.gov.sg/newspapers/Digitised/Article/newnation19811215-1.2.77. "$20 One-Room Flats House 20,000 People," The Straits Times, March 25, 1961, https://eresources.nlb.gov.sg/newspapers/Digitised/Article/straitstimes19610325-1.2.36.

37 Housing & Development Board, First decade, 7. Housing & Development Board, "Annual Report 2019/2020," 8.

38 Centre for Liveable Cities Singapore, A Chance of a Lifetime: Lee Kuan Yew and the Physical Transformation of Singapore, (Singapore: Editions Didier Millet, 2017), 26.

39 Suppiah Dhanabalan, "Speech by Mr S Dhanabalan, Minister for National Development, at the 1989 New Year Gathering for Community Leaders at the People's Association Auditorium on Friday, 6 January 1989 at 7.30 PM," 1989, https://www.nas.gov.sg/archivesonline/speeches/record-details/7929bb0b-115d-11e3-83d5-0050568939ad.

40 Lee Kuan Yew, From Third World to First: The Singapore Story 1965-2000, (Singapore: Singapore Press Holdings, 2000), 117.

41 Housing & Development Board, "Annual Report 2019/2020," 6.

42 Powell, "Singapore's Lost Coast," 16.

43 "Long belt of earth for the East Coast," New Nation, November 1, 1979, https://eresources.nlb.gov.sg/newspapers/Digitised/Article/newnation19791101-1.2.20.

44 "Plea to end noise, dust pollution," The Straits Times, November 8, 1975, https://eresources.nlb.gov.sg/newspapers/Digitised/Article/straitstimes19751108-1.2.77.

been cited for spilling earth onto the road, and the residents' petition stated that "dust continues to pollute our estate."[45] "The noise level remains intolerable," it continued, "and this is not improved by the fact that there is virtually no break in the movement of the lorries even on Sundays."[46] Others withheld their complaints at the time, despite suffering material losses. In an oral history interview, Lee Ket Yam said he felt that "it was such a pity" that his father's home lost its view of the ocean. He described the impact that the initially vacant East Coast reclamations had on his community:

> *At that time, there was a sense of abandonment… Because, after the land was reclaimed, there was a period of time where [the government] didn't do anything at all with it. It was just sitting vacant there. During the weekends, people had no place to go because the coastline was gone, you know? And you couldn't go out on the reclaimed land because it was sealed off, and the sea was too far away.*[47]

At that time, Lee said that most neighbors and residents did not organize or resist the changes: "We all understood the land reclamations were government plans. It was for the common good, right?"[48] Despite destroying the original coastline, the outcome that the HDB achieved of relatively rapidly housing the masses

45 Ibid.

46 Lee Ket Yam and Wai Fong Chiang, Story of Joo Chiat Changing Landscapes and Community, #002069, Disc 3 of 3. ed. Yuke Fion Foo, trans. Chian Chin Cheong and Brandon Liu, Oral History Centre, November 2, 1998, 11:57-12:56, www.nas.gov.sg/archivesonline/oral_history_interviews/record-details/4b585a2d-115e-11e3-83d5-0050568939ad.

47 Ibid.

48 Ibid.

TABLE 1

Land Reclamation Projects Completed by the HDB since 1960 [1]

1 Housing & Development Board, "Key Statistics: HDB Annual Report 2019/2020," (Singapore: Housing & Development Board, 2020), 6, https://services2.hdb.gov.sg/ebook/AR2020-keystats/html5/index.html.

HBD ENGINEERING PROJECTS: COMPLETED LAND RECLAMATION	AREA RECLAIMED (HECTARES)
East Coast (Phases 1-7)	1525
North-Eastern Coast (Phases 1-4)	598.1
Punggol	276
Kallang Basin	199
West Coast	86
Pasir Ris	44
Marina Bay	38
Tuas	20
Woodlands Checkpoint	9.7
Tanjong Rhu	5.6
Pasir Panjang Terminal (Phases 3 & 4)	198
Southern Islands	34
Pulau Tekong	833.4
Changi East	48.5
Total Cumulative Land Reclaimed by the HDB	**3915.3**

in affordable and high-quality flats is indeed popularly viewed as both necessary given the circumstances and a success. In 2010, the United Nations Human Settlements Programme conferred its Scroll of Honour award to the HDB for "providing one of Asia's and the world's greenest, cleanest and most socially conscious housing programmes."[49] The trend of rapid urbanization — with significant leaps in standards of living — epitomized the broader trend in the late 20th century across many, particularly Asian, nations. In "The Asian Anthropocene," Elizabeth Chatterjee relates the development of conceptions of grid electricity as a national good and entitlement to be demanded from the state.[50] Applying her lens of "fossil developmentalism" to Singapore, rather than just electricity, it was the desire for equitable, affordable housing that propelled the state to transform its environment. In this way, by strategically creating new land for itself, Singapore has created a modern public housing system—and in turn, helped realize Lee Kuan Yew's vision of the ideal city—with remarkable success.

As much as the Singapore story of land reclamation is about nation-building, it also has had unmistakable transnational effects through the regional sand trade. As early as 1978, shortages of fill material for reclamation were reported in Singapore. A *Business Times* article in June of that year described the Singapore government's collaboration with a seven-man team of Japanese experts to find viable ocean sand deposits as a "hunt," as if searching for buried treasure.[51] As Singapore also began to run out of inland hills to demolish, developers increasingly turned toward imported sand to provide fill material.[52] By the 1980s, local dredging companies looked to Indonesia and Malaysia for sources for sand, especially from nearby islands such as Batam.[53] The purchase and import of sand for reclamation projects are left to the private companies contracted by the Singapore government and not made public at a granular level, and over time, many of Singapore's neighbors did not welcome this trade. In 2002, 50 Malaysian fishermen staged a protest on the Tebrau Strait between Singapore and Johor, demanding compensation for the lost income from fish that they perceived to have been scared away by Singapore's coastal expansions.[54] In the same year, a journalist for the Indonesian news outlet Antara reported seeing multiple vessels from the Riau islands unloading sand at the Jurong Island project.[55] "As some islands are reduced to islets," former head of Indonesian State Intelligence Abdullah Mahmud Hendropriyono reflected, "Singapore is expanding."[56] And in Myanmar and Cambodia, mismatches between export and import numbers imply significant amounts of illegal or unreported trade. According to data from the UN, between 2007-2016, Singapore reported importing 27.62 million metric tons of sand from Myanmar, but for the same period, Myanmar reported exporting just 2.2 million metric tons to Singapore.[57] From Cambodia during that period, Singapore reported importing 80.33 million metric tons while Cambodian figures put that figure at just 2.77 million metric tons.[58] Today, Indonesia, Malaysia, and Cambodia all have instituted bans on sand exports to Singapore.[59]

Historically, imported sand for land reclamation reportedly came at a premium of three to four times the cost of using local fill materials.[60] So, as the price of raw materials rises, so does inflation of reclamation and construction costs, and ultimately prices of the HDB flats built on the land.[61] Reducing reliance on imported sand thus reduces these costs and consequently has been a constant pressure for innovation in the development of reclamation materials and technologies in Singapore. In 1985, a Straits Times touted National University of Singapore (NUS) researchers' breakthrough that could cut reclamation costs by 10 to 50 percent, and today, the government continues to invest heavily in ideas to reduce sand usage when creating land, with a S$135 million in recent funding to help researchers get there.[62] By 2030, the Ministry of National Development projects 3,770 additional hectares of land will be required to support the growing population.[63]

49 "The 2010 Scroll of Honour Award Winners," UN-Habitat, 2010, https://mirror.unhabitat.org/content.asp?typeid=19&catid=827&cid=8816.

50 Elizabeth Chatterjee, "The Asian Anthropocene: Electricity and Fossil Developmentalism," The Journal of Asian Studies, Vol. 79, No. 1, February 2020, 3-4, https://doi.org/10.1017/S0021911819000573.

51 "Sand deposit hunt," Business Times, June 26, 1978, http://eresources.nlb.gov.sg/newspapers/Digitised/Article/biztimes19780626-1.2.8.

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54 "We want money," Today, May 17, 2002, https://eresources.nlb.gov.sg/newspapers/Digitised/Article/today20020517-1.2.5.4.

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56 Abdullah Mahmud Hendropriyono, "The Shifting Sands of Statesmanship," TODAY, March 8, 2007, https://eresources.nlb.gov.sg/newspapers/Digitised/Article/today20070308-2.2.9.1.

57 Vanessa Lamb, Melissa Marschke, and Jonathan Rigg, "Trading Sand, Undermining Lives: Omitted Livelihoods in the Global Trade in Sand,"Annals of the American Association of Geographers, 1518, https://doi.org/10.1080/24694452.2018.1541401.

58 Ibid.

59 Fathin Ungku and Rozanna Latiff, "In blow to Singapore's expansion, Malaysia bans sea sand exports," Reuters, July 3, 2019, https://www.reuters.com/article/us-malaysia-singapore-sand-exclusive-idUSKCN1TY0C4.
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63 "A High Quality Living Environment for all Singaporeans: Land Use Plan to Support Singapore's Future Population," Ministry of National Development, January 2013, https://www.mnd.gov.sg/docs/default-source/mnd-documents/publications-documents/land-use-plan.pdf.
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For Singapore, land reclamation is inextricably tied with national ambition. In many ways, the vast additions to its islands and shores have become societal yardsticks with which the Singaporean government measures its success. Post-colonial Singapore's environmental transformations have been distinctly state-driven. They are capitalistic, too, spurring private companies' importation of sand and raw materials, construction, the growth of industries, and multinational corporations' investments on new grounds. But ultimately it was through the JTC, HDB, and MPA, that Singapore meticulously charted out its plans for its land, allocated prodigious amounts of capital, and commenced construction in great feats of nation-building — particularly for such a small city-state. Like many other Asian nations during the "Great Acceleration," modern Singapore has exploited and augmented its natural environment for the sake of improving its citizens' lives in ways that its colonial government never previously permitted.

As the history of land reclamation in Singapore is still being written, it leaves many open questions. For starters: with virtually all of Singapore's original coastlines erased, to what extent is it possible for pre-reclamation ecosystems to recover and coexist? Sand is a non-renewable resource; will new materials and techniques be able to replace Singapore's reliance on it? With Singapore's wealth and its capacity to grow and protect itself, what does equity look like, particularly in the age of global climate change? If only "some islands will rise" — as Matthew Schneider-Mayerson has noted — what is Singapore's role as its drastically poorer or less prepared peers face similar threats?[64] In simplest terms, it's still not clear whether a ceaselessly expanding Singapore is sustainable. While successful in the short term, Singapore's growing ambitions beg the question of whether or not, in the long term, their associated environmental harms will undermine aspects of human welfare.[65] Perhaps this question has already been answered; at a bare minimum, there are clear harms to the welfare of those in reclamation's path, both at home and abroad. However, the story of land reclamation in Singapore is unique in that it challenges the typical narrative of environmental degradation — that it is driven by greed and profit for the few. Instead, given Singapore's will and capacity for environmental pragmatism to uplift the masses, precisely how the state will navigate the real trade-offs presented by land reclamation is a question worth asking as the island continues to grow.

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