Waste in the tropics: Urban environments and (post)colonial infrastructure in Kochi, India

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Thesis submitted for the degree of Doctor of Philosophy in the Department of Anthropology and Development Studies, School of Social Sciences, Faculty of Arts at The University of Adelaide.

April 2023

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Barlow, M & Georgina Drew. 2020. Slow infrastructures in times of crisis: Unworking speed and convenience. *Postcolonial Studies*. 24(2): 212-233. DOI: 10.1080/13688790.2020.1804105

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Abstract

In 2015, the Kochi government—the Cochin Corporation—announced it was planning to replace a controversial landfill on the outskirts of the city with a waste-to-energy incinerator. This incinerator was to stop unscientific landfill practices from leaching into nearby waterways and to solve the issue of plastic waste accumulating in Kochi's famous backwaters—a series of brackish canals and lakes that the city rests within. These plans coincided with a national agenda of waste reform promoted by the Prime Minister Narendra Modi during his successful election campaign in 2014. However, when I arrived in Kochi in January 2018 the waste-to-energy incinerator was still yet to be installed, caught between a dilapidated landfill, a national policy promoting waste-to-energy infrastructure, and a wet tropical environment that made this infrastructure illogical and unviable. In this thesis I critique the claim to the universality of infrastructures to solve waste management crises and suggest that situated environmental conditions need to be front and centre of discussions about urban governance.

Through an ethnographic study of this controversy, I draw on scholarship in environmental anthropology, science and technology studies, and the burgeoning field of discard studies to explain why Kochi continues to attempt to adopt incineration infrastructure to solve a waste crisis despite its ill-suitedness to the tropical conditions of coastal South India. I expand on discussions within these fields by drawing together the (post)colonial history of infrastructure in Kochi and the specific material and capitalist histories of plastics. I also work with the situated concepts of wet and dry—as the categories of both tropical weather and waste systems—to extend ethnographic attention to tropical environments that includes the affective atmospheres and experiences of those environments. I argue that there is a need to expand what is relevant to discussions about urban governance to include specific (post)colonial histories of environmental change, the capitalist and material history of disposable plastics, and the ideological functioning of infrastructure. Part of this reckoning with colonial and material histories requires reimagining relationships between environment and infrastructure. This reimagining involves an unworking of the colonial inheritances of speed and convenience associated with infrastructural development that promotes capitalist growth.

Informed by 16 months in India, and 10 months of ethnographic fieldwork in Kochi between January 2018 and April 2019, my observations are drawn primarily from participant observation with waste activists in their advocacy throughout the city. I also draw on over 100 semi-structured interviews with environmental activists, waste workers, architects, academics, politicians, artists, and everyday citizens. Together these methods help to tell the story of a city grappling at once with the toxicity of a plastic waste crisis, the inheritances of large-scale environmental change from British rule in the early 20th century, and decades of postcolonial urban development based on extractive and polluting industries. Ultimately, the thesis provides a timely contribution to the pressing issue of plastic waste management in (post)colonial cities, while also extending recent debates on the intersection of environment and infrastructure.

Thesis Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint award of this degree.

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Matt Barlow

Date: April 11

Acknowledgements

This project spanned seven years and multiple continents. Ethnographic research is only achieved through the generosity and curiosity of countless people, yet it remains largely a lonely endeavour. It is simultaneously a reaching in and out, and I owe a lot to the people who supported me through that process. In particular, I am continually astounded at the depth of the embrace I felt from India and the people who call it home. I was met only with encouragement and support from everyone I met in India, and for that I am so grateful. This thesis is a testament to the generosity and playfulness at the heart of everyone I met along the way, who contributed to this thing happening even if only through a fleeting encounter.

It is impossible to thank everyone, but there are also specific people with whom this thesis would not have happened. Firstly, I must thank my primary supervisor Georgina (Gina) Drew. In many ways, I would simply not be where I am today if it were not for her belief in me as a person and a scholar. I owe much of what I know about anthropology, about doing research, and about being an academic to Gina. This project would not have happened without Gina and her endless wisdom and good humour. Huge thanks are also due to Susan Hemer, my secondary supervisor who came to this project well after it had been established. I am particularly appreciative of Susan's attention to detail and generous spirit.

To the rest of the Department of Anthropology and Development Studies in the School of Social Sciences at Adelaide Uni, particularly Dianne Rodger, Megan Warrin, William Skinner, and Tanya Zivkovic, my deepest thanks for being so supportive of me over the years. To my fellow PhD students at the University of Adelaide, especially Hetty, Pallavi, Shosh, Jaye, Luke, Aisha, Danielle, Sarah, Johnny, Claire, Leda, Michael, Carina, and everyone else I have bumped into at the tearoom or in the corridors, your solidarity and support over the years has meant more than I showed. And to my comrades in the broader PhD world: Maya Weeks, Michael Dunford, Harshavardan Bhat, Prerna Srignan, Ankit Bhardwaj, Anthony Powis, Tanya Mathan, Mel Ford, Aadita Chaudhury, Coral O'Brien, and countless more. Meeting you all has been one of the highlights of this process.

I have received so much support from the Australian anthropology and STS communities, especially the crew at Deakin University including Tim Neale, Thao Phan, Emma Kowal, David Boarder Giles, and many more. Being a part of the AusSTS community that sprung out of the 2019 conference at Deakin has been one of the most generous and enjoyable parts of my PhD life over the last few years. I also owe a big thanks to the wider Australian academic community of which I've been a part, especially Tess Lea, Anne Galloway, Sophie Chao, Eve Vincent, Malini Sur, Laura McLaughlin, Astrida Neimanis, Jennifer Hamilton, and Eben Kirksey.

I have been fortunate enough to be part of two amazing collectives throughout my time as a PhD candidate. While being a member of these collectives no doubt delayed my completion, I would not have it any other way. To the Conversations in Anthropology team, Tim Neale, David Boarder Giles, Cameo Dalley, Mythily Meher; and the TopEndSTS collective Michaela Spencer, Kirsty Howey, Jen Macdonald, Kelly Lee Hickey, Leonie Norrington, and

Chapter 1: Introduction: "Kochi is a big house without a toilet"

On a quiet side street in a dilapidated building in downtown Kochi lies the Centre for Heritage, Environment, and Development. C-HED, as it was referred to, is the research and development wing of the Cochin Municipal Corporation responsible for spearheading development projects that would showcase Kochi's unique environment and cultural history. I visited these offices on my second week in Kochi, on January 23, 2018. The three-story building was discoloured with rain damage on the outside, and dark and musty inside. The building was empty except for the three of us there for the meeting. As we walked the corridors, we passed doorways leading to empty rooms filled with cobwebs, the lightbulbs flickering, the mosquitoes out in force, and the windows left open. It was as though the building had been abandoned.

We made our way to a room on the second floor, no different from the gloomy rooms we had just passed except that it had a desk and some metal chairs in it. Waiting for us there was the director of C-HED. He had two of his research assistants with him, and I was with my research collaborator, Dr Georgina Drew, and an academic from Amrita Vishwa Vidyapeetham University, who was our host at the time. The conversation centred on resource management before I steered the topic to waste and water management within the city. The C-HED director then explained that alongside the development of Kochi since the 1990s the condition of the water in the city had deteriorated so much that residents could no longer drink from wells. He suggested that the local government was more interested in spending money on new roads rather than water infrastructure, and that poor waste

management practices were contaminating water sources. According to him, no one was taking this problem seriously. He provided some context for us, explaining that while there were plenty of toilets in Kerala, only 5% of Kochi had a sewage connection. So, the problem wasn't framed around open defecation like elsewhere in India at the time (R. Desai, Mcfarlane, and Graham 2015; Doron and Jeffrey 2018), but that there was no adequate sewage system to transfer waste safely from toilet to treatment center. Instead, most of Kochi's sewage made its way directly into the series of lakes and canals that Kochi sits within known as the Backwaters. The director of C-HED went on to say: "Kochi is a big house without a toilet… You know why we have all these mosquitoes?" his hands gesturing around the room, "it's because there is no sewage management. The canals of Kochi are the lifeline of this city, and yet all of them are filled with sewage, with filth."

This initial interaction, while very informative and affirming of my research interests, presented me with a problem. I had arrived in Kochi to learn more about how colonial forms of sewage infrastructure were contributing to water scarcity in urban India. How was I going to do research about postcolonial sewage infrastructure when there was none? The director mentioned that while no one was engaging seriously with the issue of a lack of sewers, there was considerable work being done on reforming waste management in relation to plastics accumulating and leaching into the environment—particularly into Kochi's famous backwaters. As many newspaper headlines at the time indicated, there was growing political tension around the proposal to install a waste-to-energy (WTE) facility where the current dysfunctional landfill stood on the outskirts of Kochi at a place called Brahmapuram. The tensions arose from speculations about the infrastructure's viability in the tropical conditions

of South India. As the months of fieldwork went by in Kochi, my attention drifted from the lack of sewage infrastructure throughout the city to the contestations over the WTE facility. My initial attention to sewage infrastructure was instructive as I shifted my focus to solid waste because it drew my attention to the colonial forms of infrastructure that are not compatible with Kochi's coastal tropical environment.

The three main aims of this thesis are as follows. Firstly, I aim to shift the object of analysis from water to wetness in order to hold space for a tension that runs between situated environmental conditions and aspirations of development through infrastructure in Kochi. By shifting the analytical register from water to wetness a few things happen. Water is a resource, a discrete object in distinction from dry land. I show how this separation is not pregiven or "natural", but rather, is socially constructed to produce environmental imaginaries in service of colonial extraction and capitalist accumulation. Wetness on the other hand, is an affective quality and experiential condition of tropical life. It does not exist on a surface but is below and above ground in various manifestations. I demonstrate how being enveloped in Kochi's coastal tropical environment changes the way infrastructure can be done in the city. Through ethnographic attention to the experience of flooding in Kochi, I demonstrate the affective dimensions of both wetness and infrastructure, and how they collide in efforts to address a 'waste crisis' by environmental activists in the city.

Secondly, I provide insights into the ideological functioning of both infrastructure and waste management by analysing the contestations over how waste is managed throughout the city. In particular, I show how efforts to evaporate Kochi's wetness through a proposed WTE

incinerator make this infrastructure unviable in Kochi's tropical conditions. Through participant observation with environmental activists advocating for a single-use plastics ban throughout the city, I situate these contestations about waste management in a broader discourse about environment, urban development, and capitalist accumulation. Here, the materiality of plastics, the specificity of environmental conditions, and the claims to universally appropriate infrastructural projects clash with the desires of (post)colonial sustainable development. I highlight that by investing in better ways of processing discarded plastics, investments in WTE are investments in the production and consumption of more plastics. I then show how the two prevailing approaches to managing plastic waste in the city—WTE or a single-use plastics ban—are evident in the way that two urban parks manage their waste. It is in this way I demonstrate how the ideological functioning of waste and its management is bound up in the production, and subsequent experience, of Kochi's environment. Not only does the environment matter to how waste can be managed, but how waste is managed contributes to the production of certain understandings and experiences of urban environments.

Finally, I aim to reimagine infrastructure in the tropics through the unworking of the speed and convenience they are so often associated with. If infrastructures in Kochi have historically been about extraction, speed, and the creation and maintenance of dry land, and the infrastructures that are currently being invested in to manage a waste crisis are patently *evaporative*, what chance does infrastructure have for being more responsible to the wet environmental conditions of Kochi? I suggest that one way to reimagine infrastructure from within the "wet ontology" of Kochi is with focused attention to slowness (Peters and

Steinberg 2019). I do so with ethnographic attention to the practice of composting. As a form

of waste management, composting requires attention and care to a multispecies assemblage

that flourishes in the hot, wet, humid conditions of South India. This reimagining will require

an unworking of attachments to the convenience of plastics, an unworking that is already

being done by a select few institutions in Kochi, from hospitals to hotels. It is within these

meso-level spaces of public life that I find the most promise for an infrastructure that is

responsive to the complex urban ecologies of this enchanting place.

Figure 1: Kochi Backwaters

Backwater ethnography

When I first told friends of mine in Kolkata that I was headed to Kochi to explore the possibility of doing research there, the first thing they mentioned were the famous Keralan backwaters. The backwaters are a series of brackish lakes, canals, and rivers that run parallel to the Arabian Sea, and which envelop the city of Kochi. The biggest of these is Lake Vembenad, the longest lake in India and the largest lake in Kerala. Kochi rests at the northern most point of Lake Vembenad. At the southern end is Kuttanad, a rice cultivating area that is located at the lowest altitude in India and is one of the few places in the world where rice cultivation takes place below sea level. This lake is of ecological importance and is recognized by the RAMSAR convention for the conservation and utilization of wetlands. The lake forms a natural harbour for boats to dock and has been important for inland transport for centuries. More recently, it has been popular with both domestic and international tourists for cruises on houseboats. The lake is fed by the Periyar river which flows west down from the Western Ghats and toward the Arabian Sea. At the western edge of the lake, it opens to the Arabian Sea, forming an estuary which has seen traders and merchants cross from the Arab states, and subsequently Europe, to South Asia on the monsoonal winds for centuries. As such, Kochi is the gateway to the Keralan backwaters. It is perhaps for this reason that it is known colloquially as the 'Queen of the Arabian Sea'. Due to the location on the sea, the natural harbour primed for the loading and unloading of cargo, and proximity to waterways that acted as highways further inland for spices and other valuable goods, Kochi has been a strategically important port city on the southwest coast of India for a long time, with rich pre-colonial, colonial, and postcolonial history.

The popular history of Cochin[1] begins with the arrival of Vasco De Gama in 1498 on the west coast of India at a city just north of Cochin called Calicut. A Portuguese merchant with African slaves aboard his ship, De Gama's fleet was the first to link Europe and Asia by sea. This voyage changed the course of global history and set the foundations for the centuries of colonial rule in India that would follow. After humiliating himself with unsatisfactory gifts to the Zamorin in Calicut[2], De Gama and his fleet turned toward Cochin where they found allies in their plight against the Zamorin. In 1503, during De Gama's second and Portugal's fourth arrival in India, a war broke out between the Arab traders under the rule of the Zamorin, and De Gama and his allies from Cochin. Despite losing this battle, the Portuguese managed to gain control over the trading routes and settle in Cochin. During the subsequent decades, the Portuguese established Fort Cochin as their base in India and built factories and warehouses to store and trade spices. Many buildings from this period remain in Fort Kochi and are popular with domestic and international tourists. Meanwhile, the Dutch had been building their own empire steadily, mostly through the extraction of spices from what is now known as South East Asia (Ghosh 2021). When they arrived in Cochin in 1663, they wrested control over the port and its harbor from the Portuguese and ruled over the city until the Anglo-Dutch

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[1] I use the term Cochin here when describing this history.

[2] The story goes that Vasco de Gama produced "twelve pieces of lambel, four scarlet hoods, six hats, four strings of coral, a case containing six wash-hand basins, a case of sugar, two casks of oil, and two of honey. And as it is the custom not to send anything to the king without the knowledge of the Moor, his factor, and of the bale, the captain informed them of his intention. They came, and when they saw the present they laughed at it, saying that it was not a thing to offer to a king, that the poorest merchant from Mecca, or any other part of India, gave more, and that if he wanted to make a present it should be in gold" (Ravenstein 2010, 60).

treaty on 13 August 1814, which ceded the city to the British[3]. While they were in command of Fort Kochi, the Dutch East India Company (VOC) controlled the spice trade coming down from the Western Ghats. The rivers and canals acted as "pepper highways", while the many warehouses in Fort Kochi stored the spices before they were shipped out to Europe across the Arabian Sea (Singh 2010, 13). Pepper was an increasingly desired and profitable spice in Europe at the time, and from 1663 onward, the VOC established a pepper monopoly from the Malabar coast. The rise of the British Empire in the 18th century led to the arrival of the British East India Company on the Malabar Coast around the start of the 19th century. After they blew up the Dutch Fort at Fort Kochi in 1803, they set about changing the environment to facilitate the accelerated extraction of spices and teas from deeper into the Western Ghats. Through the direction of Sir Robert Bristow, a British engineer, they dredged a deeper harbor, built many canals through the city, and cleared forested land for cultivation that had previously been inaccessible. These machines that enabled the encroachment of colonial forces further into the forests, and deeper into the sea, are evidence of the impact the industrial revolution was having throughout the British empire. A surprising but important point to note throughout this history is that the people of Cochin became relatively quick allies with numerous European colonisers in an effort to establish their own kingdom that could challenge the Zamorin in Calicut. British rule in India even offered some emancipation from the entrenched caste system, though at other times their presence fuelled anti-colonial

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[3] This is obviously a very abbreviated history of a time of great turmoil. Various alliances between the Portuguese and the Cochin Raja, and then the Dutch and the Cochin Raja, meant there were often quarrels and discontent.

sentiments (M. Desai 2005). The strategic and amenable nature of Cochites throughout colonial rule is emblematic of the cosmopolitan nature of the city today.

However, that is just the colonial history of this place. There is a semi-mythical history to Cochin that begins prior to the arrival of Vasco De Gama. It involves an ancient port city called Muziris, and a devastating flood that wiped it away in 1341. This flood also literally moved the mouth of the Periyar river south to where it is now at Fort Kochi, creating the natural harbor that was so useful for the spice trade. This semi-mythic past is so central to the "psychogeography" of Cochin and its residents today that Muziris is recognized in the title of the Kochi-Muziris Biennale, India's largest arts festival that takes place in Fort Kochi every two years (Nandy 2000). Kochi's history is quite literally written in flood and colonial infrastructure built for extraction and commerce. May Joseph describes Kochi as a "nerve of the world", connecting places far and wide through time and space (M. Joseph 2006).

Like many other ancient port cities, this history of trade and successive colonial rulers has generated a cosmopolitan feel to the city, with multiple influences from China, the Middle East, and Europe nestled in its streets and through its urban environment. One of the more noticeable remnants of this cosmopolitanism are the hundreds of massive fishing nets used by Chinese merchants as far back as the 14th century that line the banks of the backwaters. Most are left unused today, and lay hovering like spiders waiting to be lowered into brackish waters below. This cosmopolitanism is further reflected in the way that Christian, Hindu, and Islamic believers each have equal representation within the city, with surprisingly little religious tension between different faiths. Fort Kochi is also home to a beautiful synagogue

with stunning blue tiles lining its floors, a symbol of the once important but now diminished Jewish influence on the city. Ashish Nandy suggests that this cosmopolitanism is at least in part due to a deeply anchored affective attachment to the sea and to water which holds different groups of people together who might in other circumstances find reason to quarrel (Nandy 2000). It is this shared sense of both watery belongings, cosmopolitanism, and aspirations for grandeur that gives rise to the popular saying that "Kochi is a *feeling*".

I lived in Fort Kochi throughout my fieldwork, and often travelled across Lake Vembenad to Ernakulam for meetings and interviews. As a city, Kochi is an amalgamation of numerous islands which can be synthesised into three areas connected by the backwaters: Fort Kochi, Willingdon Island, and Ernakulam. As I describe above, Fort Kochi is the historic centre of colonial Kochi. It houses many famous buildings, including the Church of Saint Francis, built in 1503, and the Indo-Portuguese Museum. It is popular with both domestic and international tourists and is traversed mostly by foot or auto-rickshaw. Willingdon Island is the largest artificial island in India, created by the dredging of the harbor floor by the British in the 1920s. The island now houses the Southern Indian Naval Command, the Customs House and the Port of Kochi. Willingdon Island was also the home of the first airstrip and the first landfill in Kochi. Nowadays, its wide streets are mostly quiet, and the train lines that would have once transported people and goods from the island to the rest of the state now lay abandoned, covered over by lush tropical greenery. It would make an interesting place to live, but as I learnt on one trip to Willingdon Island in which my research assistant and I were invited to lunch at a friend's house nearby, one must work on Willingdon Island to acquire a permit to live there. Further east from Willingdon Island, across the lake, is Ernakulam.

Ernakulam is the mainland section of Kochi and is more characteristic of a sprawling Indian city than the other two parts of Kochi. Its bustling streets are some of the most congested in India and a cause of constant consternation by those who live there and the local government. The attention to building new roads with which I started this introduction was not without warrant. Most of Kochi's colleges, hospitals, and government buildings are in Ernakulam, so even if one lives in Fort Kochi, it is likely they will need to travel to Ernakulam on a regular basis, as I did throughout my fieldwork. A typical journey would involve a short auto-rickshaw (or a 15-minute walk if I had the time and energy to deal with the heat or rain), followed by a passenger ferry across the lake which would stop briefly at Willingdon Island before crossing to Ernakulam. The ferry cost 4 rupees each way (about five US cents), cheap even by Indian standards. It was a slow journey, about 30 minutes all up, and certainly not fashionable. The ferry itself was well seasoned and ran off a loud and smokey diesel engine that caused me to notice the life jackets stuffed into the edges of ceiling of the vessel. Catching the ferry was therefore not for the faint hearted. It also involved making the precarious hop from the platform down into the ferry without bumping one's head on the roof which was quite low[4]. Once on the ferry, there was a rush to get the best seats along the unforgiving wooden benches—the ones next to the open windows that look out over the calming backwaters. Once on board a calm overcame the passengers, despite the noisy engine putting away. I enjoyed these daily trips across the backwaters, contemplating my various ethnographic interests and digesting the day's events from the buoyancy of the boat.

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[4] The alternative to this ferry ride was a dusty, noisy, and often expensive journey via a series of windy roads and bridges that could take even longer than the ferry if one was to encounter traffic.

The ferry ride also provided an insight into a palpable sense of place that once you become attuned to it, is very difficult to ignore. Kochi is a surprisingly early instance of a node in a global web of connections facilitated in large part by the winds of the monsoon and connections to the sea. It is oceanic through and through. In many ways, this ethnography is a tribute to the watery ways of Kochi's past, and a calling to embrace this past in the future.

Figure 2: Rudimentary map of Kochi with trainlines and airport.[5]

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[5] I am including this map reluctantly, as part of my argument in this thesis is that two-dimensional maps such as these do political work and create artificial separations between land and water. However, in order to orient the reader to the spatial dynamics of Kochi I am including this map here.

Today, Kochi is the commercial and industrial capital of Kerala, a coastal state nestled between the Arabian Sea and the Western Ghats. Kerala is known for palm lined beaches, national parks home to elephants and tigers, and as the last remaining bastion of communist politics in contemporary India. It is affectionately known as 'God's Own Country', in reference to its warm tropical climate and cosmopolitan atmosphere. After India achieved independence from the British in 1947, Kerala was thought to be a development marvel—a place where investment in education and health has led to the alleviation of poverty, longer life expectancy, and a host of other development metrics. And while Kerala can boast these achievements, scholars have shown that there are many paradoxes to the kind of development Kerala has achieved, especially when gender and agriculture are considered (Jeffrey 1992). One of Kerala's issues is precisely this: how can it grow an economy based on tourism and industry while protecting its fabled environment of lush tropical green and flowing waters?

Popular novels such as Arundhati Roy's *The God of Small Things* and Sarah Joseph's *Gift in Green*, both set in Kerala, are about nothing less than the abandonment of a watery life in favor of industrialization and extraction, and the masculinity that is wound up in that transformation. Take this passage from Roy, describing the changing hydrology of the region in the chapter called God's Own Country:

> Downriver, a saltwater barrage had been built, in exchange for votes from the
> influential paddy-farmer lobby. The barrage regulated the inflow of salt water
> from the backwaters that opened into the Arabian Sea. So now they had two

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harvests a year instead of one. More rice, for the price of a river. (Roy 2009,

124)

Other novels, such as Salmon Rushdie's *The Moor's Last Sigh* and George Thundiparambil's *Maya*, both set in Kochi, discuss the various ways in which a cosmopolitanism, marked by colonialism and resource extraction, contributes to the experience of living in Kochi today. While published as fiction novels, these tales are inspired by very real attachments to a place. They tell a collective story of loss, where an abandonment of watery beginnings in favor of a drier, more terrestrial life of extraction wreak havoc for the environment and the wider society. Joseph gets to the heart of this when she asks of the main protagonist in *Gift in Green*, a man enticed by the world that industrial development offered, "how and where had he developed this aversion to the water-life?" (S. (Trans. V. T. Joseph 2011, 21). Together, these novels tell the stories of how humans and the environments they live in are deeply entwined and how caring for one is often caring for the other. I tell a similar story, through attention to waste, and what waste can tell us about the intersection of infrastructure and wetness.

Enveloped in wetness

The colonial history of Kochi I have introduced here was at least partially facilitated through environmental imaginaries that privilege flat surfaces and control over land. This, as da Cunha and others have highlighted, is premised on a cartographic and two-dimensional imaginary aimed to produce planes which are consistent and stable from which to extract resources and build infrastructures (da Cunha 2019). The primacy of development achieved

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through roads and metros is testament to the endurance of this (post)colonial environmental imaginary. But the environment in Kochi is anything but stable. It is fluid, muddy, and enveloped in wetness both above and below the ground.

Kerela is notoriously wet, the first place to receive the SW monsoon, and the last to receive the returning NE monsoon. In August 2018, in the middle of my ethnographic fieldwork in Kochi, Kerala experienced one of the worst floods in a century. Over 400mm of rain fell in just three days in a state that typically receives 3000mm of rain in a year. Newspapers reported that a third of the state was underwater with satellite imagery showing the devastation. The rain was intense, and the floods were bad, especially for those living near the Periyar river. But they were made worse by decisions about how to manage water with large-scale infrastructures. At the peak of the flooding, a decision was made to open to gates of the Idukki dam, one of the largest arch dams in Asia that rests in the Western Ghats at the headwaters of the Periyar[6]. Built to contain water, this infrastructure was not able to contend with the immense wetness of this particularly intense monsoon. It was by living through these devastating floods, and seeing how efforts to contain water were part of the problem, that the ethnographic object and my analysis shifted from water to *wetness*.

Wetness is an affective condition of place: it is an experience, not an object. Kochi, by way of being situated among the backwaters, on the coast, and in tropical monsoon Kerala, is an intensely wet place. My analysis then is not about how water is controlled, but how people

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[6] https://idukki.gov.in/tourist-place/idukki-arch-dam/

come to both inhabit *and* inhibit a wet ontology amid material and economic changes that abandon that very wetness. My call to attune to wetness is as much an *affecive* shift as it is a methodological and theoretical one. To speak of wetness is more faithful to the subject matter (waste management), as well as the materiality and—to invoke Nandy again—the psychogeography of Kochi. Kochi is wet, and efforts to make it dry in various ways, whether through investing in roads rather than canals, or by investing in evaporative technology that will incinerate the plastic blocking those canals, are part of the current status quo of infrastructural thinking occurring in the city. Wetness on the other hand is an embodied affect and earthly condition. Wetness is everywhere, in different amounts, in different material relations, and producing different affects, especially in the coastal tropics of South India. With this in mind, I begin to articulate what an infrastructuring of wetness might look like, and how it is important for Kochi to reimagine its infrastructure with wetness in mind. When thinking with wetness, colonial forms of sewage infrastructure and capitalist modes of incineration to generate energy no longer make sense or seem desirable. Yet, during my time in Kochi, they continued to be pursued by the municipal officials at the Cochin Corporation.

Relationships to water in Kochi are less about symbolic forms of power or ritual purity that water brings elsewhere in India, and more about an affective attachment to wetness through orientations to the backwaters and the sea[7]. Despite these attachments, the rivers, lakes and

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[7] There is a robust literature on religion and ecology that explores the ritual and symbolic relations to water and the environment in India. Due to the cosmopolitan nature of Kochi, and my focus on infrastructure and urban development, I do not engage with those contributions directly in this thesis.

canals in Kochi continue to deteriorate in front of people's eyes, as the backwaters continue to be the receptacle of trash, industrial effluent, and sewage. The deterioration of Kochi's water bodies can largely be attributed to the adoption of misguided infrastructural projects either carried out by previous colonial governments or (post)colonial governments attempting to achieve a universal idea of urban development. I highlight that there are colonial and capitalist assumptions about urban development that render environment and infrastructure in opposition to one another.

Importantly, waste management in Kochi was categorised into a system of wet waste and dry waste. Wet waste consisted of organic compounds, mostly food waste, while dry waste was anything in-organic that didn't have value in the long-established informal recycling markets. This system of waste management mirrors the climatic condition of tropical South India which can be (roughly) understood as a wet season (June-November) and a dry season (December – May). The wet season is characterised by the monsoon which moves in a NE direction across the subcontinent before moving west along the base of the Himalayas, and back SW out to the Arabian Sea. The dry season, while much less wet in terms of precipitation, is incredibly humid. Temperatures hover around 32 degrees centigrade, accompanied by 80% humidity. Many residents leave Kochi in April to try to escape this brutally hot and humid time of the year. I use these mirrored systems of weather and waste as a launching point into the environmental politics of infrastructure in Kochi. They are not only real material systems generating political action and shaping experiences of the urban environment, but wet and dry are generative metaphors for the situated, slower approaches to infrastructure on the one hand, and the extractive and capital-intensive infrastructure of urban

development on the other. Humidity on the other hand moves across these seasonal patterns, so even when something is classified as 'dry', as in the dry weather or the dry waste such as plastic, wetness is ever-present. It is in this way that environment, infrastructure, and waste are intimately entangled in Kochi. In many ways, this ethnography is a love letter to Kochi's watery past, present and future, and how plastics are in many ways incompatible with that wetness.

Kochi's problem with waste

Kochi was facing a 'waste crisis' throughout my time there, and the amount of waste accumulating in the urban environment, and along Kochi's famous shorelines, was alarming for most residents I spoke with. The controversies surrounding the WTE facility, and the dilapidated landfill it was to replace, were in the newspaper almost on a daily basis. These headlines supported the director for C-HED's claim that not enough attention was being given to sewage. Yet at the same time, activists working against the installation of WTE facility claimed there was too much attention being given to sewage and not enough being done about plastic. One such activist was Dr. Manoj, who I spent a considerable amount of time with throughout my fieldwork. We met at the Cochin University of Science and Technology (CUSAT) relatively early in my fieldwork. Georgina had met him in the days prior, and together they had organized a workshop to faculty and students about waste management on campus. I was subsequently invited due to my interest in waste in the city, and Dr. Manoj and I quickly became friends. According to Dr. Manoj, "shit" was a natural substance that would decompose in the environment and therefore did not warrant the amount of attention it was receiving in the environmental activist circles he was embedded within. He

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argued that more attention should be given to the disposal and accumulation of plastics which presented a much more difficult problem to overcome due to their chemical and material properties. Dr. Manoj was a chemist by training, and through his days working in a chemistry lab, had become familiar with the chemical toxicity of plastics. He recognized, and understood at a chemical level, that plastics do not "assimilate" in the same way as organic compounds, such as feces (Liboiron 2021, 5). What was crucial to this understanding was intimate knowledge of the relationship between plastics and the humid tropical environmental conditions in Kochi, which, as Dr. Manoj says in Chapter 7 is an "incubation climate", where all one needs to do is hold out their hand in order for microbes to grow. I argue in this thesis that these contextualised understandings of waste and the need for new procedures of management were informed by intimate understandings of the relationship between specific environmental conditions, and therefore required a reimagining of the kinds of infrastructure suitable for urban development in Kochi.

In many ways, the contestations over waste in Kochi that I explore in this thesis were contestations over development, and what kind of development was desired and suitable for the city. Kochi has seen rapid development in recent years, and was included as one of the first 20 cities in the country to be awarded Smart City status (Drew 2020; Kuriakose and Philip 2021). This was largely due to recent investments in a transport sector geared toward renewable energy that involved an above ground metro line designed by the same firm that designed the New Delhi metro, and the Kochi International Airport which ran entirely off solar energy. However, not all of Kochi's development plans were as environmentally conscious. In 2013 Kochi opened one of the biggest shopping malls in India—Lulu Mall—in

Edappally, a central suburb of Ernakulam. I visited Lulu on many occasions throughout my fieldwork to do grocery shopping, to eat ice cream, or to visit the cinema inside the complex. It offered boutique clothing shops, organic produce, high end jewelry stores, and buffered visitors from the heat and rain with air-conditioning underneath a transparent roof to watch the weather pass. Astoundingly, there was also an ice-skating arena on the top floor nestled between dozens of arcade games and the international food court. One could, in theory, spend some time ice-skating while watching the monsoonal rains rolled over, before eating a Subway sandwich for lunch. The activists I spent time with spoke negatively of Lulu and the kind of consumerist development it was promoting. Dr. Manoj and I would often meet at a small organic café in central Kochi that offered simple but delicious thali and where there were no disposables. There was a small store attached to the café that sold locally grown organic fruit and vegetables. The distinction between this cafe and the Lulu mall could not be greater. He and the other activists I engaged with were concerned about the amount and types of waste generated at Lulu mall, and what the government was doing to address that outcome from a consumerist development model. During the initial interview with the director of C-HED, we were told the Mayor might be interested in our research and that we should reach out to her. We tried to reach her many times, but were told she was busy working on the metro expansion. I was, however, able to meet with other senior government officials about waste management on a number of occasions, often accompanied by Dr. Manoj and my research assistant. While it seemed as though those conversations were generative in addressing waste management issues, the more obvious urban development projects remained top priority for the government throughout my fieldwork.

The metro line, mentioned above as part of the smart city designs of Kochi, also represented the high-tech modernity in the city and demonstrated allegiance to technological solutions to urban problems. During my fieldwork the metro line was in the process of being extended out to the Airport, enabling solar powered connectivity from downtown Ernakulam to the fully solar powered airport. This was commendable, and I am a supporter of low carbon public transit, but it did symbolise the kind of city Kochi was aiming to become. The WTE plant at Brahmapuram was part of these aspirational politics of modernity, and therefore had a lot of currency with the general population. To the general public, the WTE plant was the answer to all the waste problems in the city and aligned with environmental and social imaginaries of the future of the city. These sentiments were fuelled by several occasions during my fieldwork when Brahmapuram erupted into flames due to methane trapped in the landfill, resulting in toxic smoke and haze engulfing the city. Part of Kochi's attraction as a tourist destination was the relatively good air quality compared to cities in North India such as Delhi, Mumbai, and Kolkata. In order to keep Kochi's urban tropical oasis image, waste accumulating in waterways and toxic smoke in Kochi's air needed to be solved. This was an opportunity to solve it in technologically advanced ways that aligned with Kochi's growing reputation as a 'smart city'.

These urban development contexts to Kochi's waste crisis are further demonstrated through their relation to wider national initiatives and debates about waste. Prime Minister Narendra Modi was elected in 2014 in part due to his focus on waste reform. His Swachh Bharat (Clean India) campaign aimed to eradicate open defecation and promote technologies such as WTE as solutions to urban waste crises. The insignia of the campaign was Mahatma

Gandhi's famous glasses, which emphasised social and political pressure to be seen to be doing the right thing by your country to clean up after oneself.

Given the urban development context, this is not an ethnography of the everyday life of waste, or of household waste practices in a particular cultural setting, or of the lives of those who labor with waste. Rather, it is an ethnography of how particular environmental conditions, and different understandings of those conditions, come to matter to waste management and infrastructure in (post)colonial Kochi. I ask, how do the wet tropical conditions of Kochi and the material history of disposable plastics come to be in relation? What are the affordances and limitations of claims to the universality of urban infrastructure, and how do tropical conditions confound these claims? How do the particular tropical and wet conditions of coastal South India come to figure in negotiations about waste and infrastructure, and how can reimagining infrastructure from these conditions shape more equitable futures? Remaining faithful to these diverging threads has meant that I have resisted the temptation to create a neologism or new theory of waste in this thesis, and instead used waste as a means of examining the often-conflicting stories about infrastructure in the specific (post)colonial environment of a tropical South Indian port city.

Kochi's unique history, its location within and among the brackish backwaters, and its strategic importance as the commercial and industrial capital of Kerala make it an insightful place to think through some of the contradictions of urban development in the tropics. There was also a specific "matter of concern" in Kochi that caught my attention and my heart: the amount of waste accumulating in the backwaters and the controversies over the installation of

the WTE facility and the deteriorating state of the landfill it was to replace (Latour 2004; Pathak and Nichter 2019). WTE is an umbrella term that refers to a suite of technologies that incinerate plastic waste in order to extract energy. As a form of waste management, WTE has been relatively successful in Europe and North America, despite environmentalists calling attention to risks of air pollution and other externalities from the process. However, what I learnt from engaging with these debates in Kochi is that their efficacy as waste management infrastructures are flawed, regardless of the efficiency of the incineration determined by specific environmental conditions. What I highlight is that an investment in WTE infrastructure is an investment in the future of plastics. Dr. Manoj and others like him understood that there was no adequate way of disposing of plastics, because their production was also problematic. The assumptions about the environment implicit in WTE infrastructure were that the waste stream could be adequately manipulated to be less wet. In Kochi, this meant devising complex drying technologies in order to transform the waste stream into one that is compatible with incineration and gasification technology. These extra measures not only required extra maintenance and were shown to fail elsewhere, but they also meant there were extra costs involved in the process. These complexities meant that it was not only ecologically fraught but economically unviable, as Dr. Manoj and others like him would often repeat to me.

Figure 3: Clean Fort Kochi Foundation cleaning Mahatma Gandhi Beach, Fort Kochi.

The contestation over waste management win Kochi was brought about not only through

governmental decisions about infrastructure, but also city-wide concerns over what do to do

about the accumulation of plastics in the urban environment—particularly the once thriving

backwaters. For example, my neighbours in Fort Kochi were aware of the dangers of burning

plastics and only burnt piles of leaves. Nearby at the Mahatma Gandhi beach in Fort Kochi a

group of volunteers[8] called the Clean Fort Kochi Foundation (CFF) met every Saturday to

clean a section of the popular tourist beach of plastic waste. I encountered the CFF soon after

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[8] The organizing group were volunteers, but it should be noted that a group of day laborers were employed to

help collect the waste from the beach.

shifting from Ernakulam to Fort Kochi and joined them on numerous Saturday mornings for their beach cleans. Once the sun was too high in the sky, the group retreated to the esplanade to wait for a garbage truck to arrive and take away the collected rubbish. During this time, I discussed the contestations over waste management in the city with the group, who I would learn were mostly homestay operators in Fort Kochi. They understood that cleaning the beach was not the longterm solution to the problem of waste accumulating on the beach, but they also wanted their guests to experience a clean beach during their stays in Kochi and felt that it was important to clean the beach. If the government was not going to clean the beach, then who would? The importance of a clean beach was recognised by the government only in the lead up to the popular end of year celebrations and the inauguration of the 2018 edition of the Kochi-Muziris Biennale in December. The pressure of swathes of tourists descending into Fort Kochi saw the local councillor send tractors down onto the beach to clear away mounds of weeds and plastic waste that had accumulated since the floods in August that year.

As this example helps to demonstrate, waste management in Kochi was less about ritual purity based on caste or religious associations (Alley 2002; Butt 2020b; Teltumbde 2014), and more about the pursuit of urban development that involved infrastructure that, as I will argue throughout this thesis, was incompatible with Kochi's wetness. Amita Baviskar calls these aspirations of urban development the "the dream machine" (Baviskar 2007); an affliction of contemporary urban India that pits an abstract notion of urban development against situated ecologies. Urban development in this sense was at once the cause of the concern (accumulation of discarded plastics) and it aimed to solve that conundrum (through

investments in innovative large-scale infrastructures that have been shown to be effective in cities elsewhere such as waste-to-energy).

Figure 4: Tractor cleaning Mahatma Gandhi Beach, Fort Kochi.

As Mary Douglas highlighted over half a century ago, materials become waste through their relation to a system (Douglas 1966), and in Kochi that system was organised around urban development aspirations and complex and contradictory relations to the wetness of the environment that envelops the city. While the contestations I explored in Kochi were very specific to the environmental conditions and infrastructural histories of that place, they are emblematic of a broader system of waste management that surfaced within India during the 21st century. In the 1990s India made two collective and entangled movements: an embracing

of urbanization, and a liberalization of the economy that involved opening up to international markets. These shifts announced a political economic narrative that moved away from Mahatma Gandhi's dreams of a self-sufficient country based on a primarily agricultural economy. They also saw a flood of new products and materials—primarily readily available and cheap commodities made of or wrapped in plastics—being circulated and disposed of in India's rapidly growing cities (Pathak 2020a; Doron and Jeffrey 2018). This ethnography is therefore quite specific to Kochi, while at the same time emblematic of a larger national, and international problem at the intersection of waste, infrastructure, and environment.

Organisation of thesis

This thesis is divided into eight chapters. Chapters 2 and 3 situate the thesis both theoretically and methodologically while chapters 4-7 form the substantive ethnographic chapters of the thesis, before I conclude the thesis in Chapter 8. Chapters 4, 5 and 7, are published articles, while Chapter 6 is accepted for publication. I present these articles here as chapters of the thesis. As such, they are word for word copies of the published articles, including an abstract at the top of each chapter. They should read as internally coherent while also contributing to a larger narrative which I set out in the first three chapters and return to in Chapter 8. The published articles are attached as pdfs at the end of the document as appendices.

In chapter 2, I provide a detailed account of my fieldwork and the methodologies I used throughout this research project. Part of this orientation is to show how and why I moved my research from Darjeeling to Kochi, and how I managed to shift my ethnographic focus from postcolonial sewage infrastructure, to the contestations over solid waste management in the

city. I discuss the often uncomfortable positionality of being a white male doing engaged research in India, and include some discussion on the benefits and failures involved in Participatory Action Research. This chapter ultimately highlights the messiness and liveliness of ethnographic fieldwork.

In chapter 3, I situate my theoretical orientations within environmental anthropology, the anthropology of infrastructure, and the growing field of discard studies. I demonstrate that the history of environmental anthropology in India has generally been engaged with the community protection of forests and the sacredness of rivers (Agrawal 2005; Alley 2002). While my research is inspired by these efforts, and in particular the robust literature on pollution and sacred rivers, the environmental politics of waste management in Kochi that I discuss in the thesis provide different insights for environmental anthropology in the region. I highlight the major insights from the thesis, including how wetness comes to matter to infrastructure, how the material specificities of plastics require the evaporation of that wetness in order to be managed, how the management of waste contributes to the production of urban environments, and how slowness might be one way to reimagine infrastructure in Kochi. By bringing environmental anthropology and the anthropology of infrastructure together in these ways, and looking to other disciplines such as geography and architecture, I demonstrate that while the waters around Kochi do not host the same sacred rituals as the Ganges, they do hold the city together in many ways. I argue that there is an affective attachment to both wetness and infrastructure in Kochi, and that these attachments intersect around the issue of waste.

Chapter 4 is the first of my published articles that make up the substantive parts of the dissertation. It is titled 'Floating Ground: Wetness, Infrastructure and Envelopment in Kochi, India', and is published in in *Shima*, a Q1 cultural studies journal. In it, I grapple with Kochi's immense wetness and how this wetness changes the way that infrastructure can operate in Kochi. I explain how Kochi does not have a functioning sewage system due to the high water table, and how there are assumptions about access to a stable underground when planning urban sewage infrastructure. I tell the story of sewage infrastructure as it was first conceived in Paris and London, and the social and political effects of that infrastructure on urban development. I draw the article together with reflections on my experiences of the devastating floods that hit Kerala in August 2018, and the infrastructural disarray in the aftermath of those floods. This article establishes wet and dry as both an empirical imperative due to the way waste is segregated into wet and dry in India, but also part of my analysis that follows throughout the thesis. Drawing on the work of architect Dilip da Cunha (da Cunha 2019) I suggest that attention to wetness rather than water is necessary for understanding and reimagining infrastructures in tropical south India.

In chapter 5, titled 'Burning wet waste: Material specificity, environmental particularity, and the universality of infrastructure', published in *The Asia Pacific Journal of Anthropology*, I turn to the issue of the municipal solid waste crisis in Kochi. I discuss the proposal of the installation of a waste-to-energy incinerator at the only landfill in the city, known as Brahmapuram. I analyse the WTE proposal as an evaporative infrastructure that carries with it Eurocentric assumptions about materials and environments. Despite Kochi's incredible wetness, the Cochin Corporation (the local government) continued to pursue a waste-to-

energy incinerator to address the issue of waste accumulating in water bodies around the city. I highlight how the particular environmental conditions of Kochi and the material specificity of plastics confound infrastructural developments such as incinerators that are invented and designed elsewhere often for European contexts. I also demonstrate that by investing in better ways of disposing of plastics, the Kochi government risked investing in the production and consumption as plastics as well.

In chapter 6, titled 'Waste and its masquerades: On the production of urban natures in Kochi, India' and has been accepted for publication in *Anthropology Today*, I analyse how different approaches to waste management in the city contribute to the production and experience of green spaces in the city. By comparing waste management strategies at two places of urban nature, the Mangalavanam Bird Sanctuary, and Subhash Bose Park, alongside the ambient experience of those places, I argue that waste and its management is crucial to promoting certain kinds of environmental imaginaries that are woven into urban development projects. This leads to a critical discussion of the visibility of waste infrastructure in relation to the national Swachh Bharat (Clean India) movement that began in India in 2014. I argue that there is deeper ideological work at play in these places that hinges on the in/visibility of waste and the infrastructures that manage it that can unveil broader relations to the non-human urban environment.

Chapter 7 is a co-authored article written with Georgina Drew titled 'Slow infrastructures in times of crisis: Unworking speed and convenience' and is published in *Postcolonial Studies*, a Q1 history journal. In it, I draw attention to the practice of composting as a form of slow

infrastructure that holds promise for environmentally and socially responsible waste management initiatives in the tropical environments of Kochi. Composting works with, rather than trying to remove, the highly microbial hot and wet conditions in coastal South India. It also offers a practical means for citizen and institutions to process their own waste at scale. By drawing attention to the embodied care involved in composting and rainwater harvesting (Puig de la Bellacasa 2015), we highlight the capacity for such practices to unwork the speed and convenience associated with infrastructural development and urban failure (Amin 2016). We argue that Kochi is an instructive place to situate such inquiries, as it is a (post)colonial city with centuries of infrastructural development geared toward the acceleration of extractive industries.

I conclude the thesis by drawing the chapters together around the concept of weathering (Neimanis and Hamilton 2018; Collins 2020). I show how weather matters to waste, and how waste matters to weather. I also demonstrate how to weather, as in to endure, highlights two things: that bodies—both human and non-human—weather differently, and that collectively we can take actions to weather differently. By drawing together weather and waste in this way, I not only bring the thesis together, but also highlight avenues for further research. In particular, I demonstrate that waste matters not only in relation to situated environmental concerns in Kochi, but to larger issues including anthropogenic climate change.

Chapter 2: Anthropology of urban environments, infrastructure, and waste

Introduction

I first became drawn to the complexities and contradictions of urban environments and what anthropology had to offer the study of those environments during my honours project about urban beekeeping in 2015. Following the bees, and their invitations into urban spaces from which they had previously been excluded, I was plunged into questions about how the distinction between wild and domestic animals was bound up in the very definition of a city. Despite the "undomesticatable" nature of bees, they were, in certain few instances, welcomed into urban environments, challenging these entrenched dichotomies. In this study, I also looked to the ways in which humans who spent time with bees needed to adjust their movements and actions in order to be with the bees (what I termed 'bee-ing). This involved slowing down one's bodily movements and breathing, to attune to the hive in a somatic way that for those doing it was akin to a spiritual experience (Barlow 2017).

My research into beekeeping put me at the intersection of environmental anthropology, multispecies ethnography, and urban studies. I carried these orientations into this project on waste in the urban environments of India. While this project is not one that engages with multispecies ethnography (Kirksey and Helmreich 2010), the disposition of being with bees, adjusting ones behaviour in order to match a different affective, material, and immersive environment, and looking to the constructed (and often colonial and capitalist) history of the

definitions that categorise those experiences, prepared me for the immersive experience of ethnographic research in the monsoonal tropics of South India.

Waste offers another entry point into these conversations about definitions and categories that animate urban life. A distinctly human problem that has more-than-human consequences (Chao 2022), waste is, in a lot of ways, the flipside to the urban experience of being with bees. Waste, and its cousin pollution, seemed to reinforce the urban experience, rather challenge it. And as I quickly learnt, the colonial history of urban planning was in many ways a reaction to waste accumulating in urban areas (Gandy 1999). Infrastructure, and "the rationalisation of urban space" in the 19th century in Paris and London became the material coordinates of those definitions and categorisations across the British Empire and beyond (ibid.). By studying how situated and immersive environments come into relation with urban life and the waste that animates it so compellingly, I am inspired by an attempt to better understand how humans relate to the world around them, and how colonisation continues to impact those relations in postcolonial India. The connections and disconnections between environment, infrastructure, and waste, offer a generative point to explore such lofty questions.

In this chapter I situate the thesis theoretically by drawing on literature across the social sciences, science and technology studies, urban studies, and cultural studies. I group this literature into three categories: environment, infrastructure, and waste. I do so to build what Melody Jue calls a "milieu specific analysis", where one's conceptual and analytical orientations are generated from the (more-than-human) environment from which the research

was conducted (Jue 2020). For me, that was with the monsoonal rhythms of tropical south India, and also the categorization of Kochi's waste into both wet and dry. It was also a city continuing to grapple with its postcolonial infrastructural inheritances that was determined to lead the way for sustainable urban development in South Asia. In what follows, I demonstrate that while there has been substantial work done between any two of these three categories, there has been less that floats in between, particularly within the anthropological scholarship in South Asia.

Urban environmental anthropology: the tropical city

Anthropologists have long been attentive to the environments within which human societies exist. Much of this work was concerned with systems of production and social structure through attention to animal husbandry (Evans-Pritchard 1940), agriculture (Gupta 1998), and the extraction and distribution of natural resources (Murray Li 2000). Adjacent and more recent work demonstrates the deep entanglements between religion and environment (Alley 2002; Drew 2017), Indigenous and animist ontologies (Cruikshank 2005; Kohn 2013; Cadena 2015), conservation and activism (West 2006; Hoover 2017), attention to the multiple entanglements humans find themselves in with other species (Kirksey and Helmreich 2010; Raffles 2010; Govindrajan 2018), and the intersection between energy and the environment (Howe 2019; Boyer 2019). The major conceptual threads to come out of this work challenge the European and patriarchal ideology of a nature-culture binary and the associated notion of human exceptionalism that places humans and human worlds in distinction and hierarchical opposition to non-human beings (Plumwood 1993). By demonstrating that this separation of nature and culture into discrete forms of life is socially constructed, environmental

anthropologists have shown that this division is not universal, has its origins in many continental philosophies, and is often leveraged by colonial and capitalist practices of extraction and dispossession (West 2016). Research in this vein also demonstrates how some humans were not considered to be human at all, relegated into the organising principle of "nature" in order to justify the colonisation and possession of Indigenous lands and waters (Moreton-Robinson 2015). Our differently situated yet ongoing entanglement and co-constitution with the more-than-human world is a source of ongoing discussion within the field (Roberts 2017; Giraud 2019; Chao 2022), amplified by recent debates over the concept of the Anthropocene (Kawa 2016; Howe 2019; D. Haraway et al. 2016; J. Davis et al. 2019).

The Anthropocene is a proposed new geological era that acknowledges the scale of human impacts on the Earth, including evidence of human activity in rock strata (D. Haraway et al. 2016). At the heart of the concept is the question of human agency: If human practices are causing planetary changes—often through large infrastructures—what does that mean for social and cultural theories of humanity as something that is separate from the environment? While this development and the discussions around it are quite concerning in its own right, anthropologists and geographers have highlighted that the practices that have led to the scale of more-than-human change on Earth were only possible through the processes of trans-atlantic slavery, colonialism, and extractive capitalism (Yusoff 2016). This has led to an expansion of the concept to include alternatives such as the capitalocene and the plantationocene (J. Davis et al. 2019), as well as efforts to decentre the European subject through an exploration of an African Anthropocene (Hecht 2018).

While the Anthropocene provides one compelling way of holding the unprecedented planetary distribution of human impacts on Earth, I do not use this as a framing device for the thesis due to its inability to grapple with human differences, and the tendency to flatten the human experience to one overarching narrative (H Davis and Todd 2017). As I discuss above, not all humans were responsible for colonial and capitalist expansion, and many humans were thought to lead inconsequential lives primarily due to their proximity and meaningful relationship to the more-than-human world (Chao 2018). What I do draw attention to in this section are recent and adjacent shifts to the Anthropocene, which explore the elemental within environmental anthropology—particularly the anthropology of water, anthropological approaches to the affective and immersive qualities of wetness and dryness, and an increasing amount of scholarship that engages with the somewhat counterintuitive subject of urban environments.

Anthropology of water

There has been a recent shift in environmental anthropology (and other fields such as the Environmental Humanities and Media Studies) that investigates human relations to the four fundamental elements of life on Earth (Adam 2017; Alaimo 2015; Engelmann and Mccormack 2021; Neale, Zahara, and Smith 2019; McCormack 2018). Philosophical inquiry into the four elements can be drawn back as far as history takes us, but it was Gaston Bachelard who provided an elemental foundation if you will, building a discourse around the "fundamental material elements that is best suited for showing the relationship among poetic souls" (Bachelard 1983, 3). In the wake of philosophers such as Bachelard there is a growing amount of ethnographic research on human relationships with earth or soil (Kawa 2016; Puig

de la Bellacasa 2015; Lyons 2016), fire (Chance 2015; Petryna 2018; Neale 2016) and air (Frazier 2019; Tim Choy 2011; Negi 2020; Howe 2019), however the element that has garnered the most anthropological attention is water. Water is life, without water humans and their more-than-human companions cannot survive for long. It is ephemeral and eternal, as Bachelard states, "water is also a type of destiny that is no longer simply in the vain destiny of fleeting images and a never-ending dream but an essential destiny that endlessly changes the substance of the being" (Bachelard 1983, 6). Relationships with water constitute our—that is human—existence on Earth in deeply profound ways and ethnographic attention to water has generated a fruitful discussion about the politics of nature (Raffles 1999; Ogden 2008). The anthropology of water reminds us of the multitude of human entanglements with more-than-human nature, at the same time as it steers us toward considerations of ephemerality, relationality, and movement (Strang 2005; Ballestero 2019b).

In the climate change era, rainfall patterns are changing, and rapid urbanisation has led to intensifying demand on water as a resource. As such, anthropologists have investigated the role of water in human worlds is through its scarcity. An early example of this can be found in Nancy Scheper-Hughes' heralded epic ethnography of violence in Brazil (Scheper-Hughes 1993, 65–97). Scheper-Hughes describes the place of her research, a suburb of Brazil known as Bom Jesus, through the metaphor of thirst. She summarizes by stating: "To understand life in Bom Jesus de Mata is to understand the ambiguity and contradictions of dominance and dependency and to develop a keen sensitivity to thirst as a generative metaphor of frustrated longings and unmet human needs" (ibid., 97). Struggles over access to water, particularly in rapidly expanding cities, often revolve around and reinforce social hierarchies and the

maintenance of power (Strang 2016; Swyngedouw 2004; Truelove 2016). This is particularly

true in places where potable water is increasingly scarce, and therefore access to it is highly

controlled (Heynen, Kaika, and Swyngedouw 2006; Barnes 2009). It is well known that India

has a massive population, and it is well documented how scarcity is less a natural occurance

and more a product of the political economy of water infrastructure in India (Agarwal and

Narain 1997; Aiyer 2007; Drew and Rai 2016; Anand 2017). Furthermore, it has been

demonstrated that in both urban and rural India, access to drinking water is not only

determined by weather and politics, but also through caste, class, gender, and religion

(Ahmed 2005).

Another mode of ethnographic attention to water comes from the various material, political

and spiritual relations humans have with rivers. From the Mississippi, to the Yangtze,

Murray-Darling, Nile, Amazon and Ganges, rivers are a source of life around the world and

over the last two decades anthropologists and other social scientists have begun to turn their

attention to these complex relationships (Raffles 2002; Rademacher 2011; Barnes 2014;

Hoover 2017; Drew 2017). Of these riverine ethnographic accounts, the one that has been

most influential on my work is Hugh Raffles' *In Amazonia* (Raffles 2002). In it, Raffles

draws on the poetic environmental philosopher Gaston Bachelard to demonstrate how a

group of people in the Brazilian Amazon have intervened in "natural" processes for centuries.

He does so by describing how what is now considered a river was once just a small canal. In

the process, Raffles highlights how human and more-than-human life is deeply entwined in

the fluvial environment of the Amazon. And while the Amazon River no doubt holds a

spiritual relevance to the people who live with it, Raffles and others doing research in the

Amazon basin have drawn attention to the ways in which more-than-human relations curtail any efforts to keep nature and culture as separate ontological realms (Kohn 2005; 2013; 2015; Descola 2013).

Alternatively, the anthropology of water in India and South Asia more broadly has primarily been concerned with the sacredness of rivers, in particular, the Ganges River, or simply Ganga. This river system which flows from high in the central Himalayas across North India and east to Kolkata where it empties into the Bay of Bengal, is revered by Hindu practicing citizens in particular as the 'Mother Ganga' and understood to have purifying qualities. It is the lifeline of (Hindu) Indian culture, and a source of sustenance for more 460 million people living in its catchment—close to half of India's population. Tributaries of the Ganges, such as the Yamuna which flows through central New Delhi, and the Hooghly which flows through Kolkata, have also been integral to the development of those cities. The Hooghly was essential for the transport and trade of spices and teas coming down from the eastern Himalaya during the colonial period, and vital to the establishment of Kolkata as the capital of British India (Bear 2015; Bhattacharyya 2018).

Building on Mary Douglas' work on pollution and taboo (which I elaborate on below), Kelly Alley was perhaps the first anthropologist to explore the relationship between wastewater and the sacred River Ganga (Alley 2002). In her book *On the Banks of the Ganga*, Alley demonstrated that people who interacted with the Ganga were linked by a common set of material relations, but that the existence of the river could not be reduced to those relations. The Ganga was understood as a purifying goddess that absorbs pollution *and* carries it away,

"inside, yet above the powers of humans and the ecologies they live in" (Alley 2002, 231). Through its material relations and symbolic and spiritual power, the Ganga was and still is, in many respects, quite similar to the hegemonic infrastructures of waste management today—the receptacle of waste and the mover of waste to somewhere else. It's symbolic and spiritual power however was due to a historical relevance to the origins of a Hindu identity and ongoing spiritual practice particularly evident in Banaras (Varanasi), whereas the modern infrastructures of India's cities today gain their symbolic power from promises about the future.

Prior to the 1990s, India was defined by its predominantly rural population and agricultural economy that was idolised by the founding father of the country Mahatma Gandhi (Ghertner 2014; Doron and Jeffrey 2018). The shift to a national focus on *urban* development happened at the same time as environmental reform that matched global standards largely set by governments in the global north. It wasn't until the Water Act of 1974 and the Environmental Protection act of 1984 that India began to shift its thinking and practices toward environmental governance that mirrored what was happening in the United States and Europe. The Ministry for Urban Development was created in 1985. As such, this urban development model gained its relevance and popularity from western science and technology and the associated aspirations of modernity attached to international agreements and funding agencies and that adhered to global standards for environmental governance. The shift to urban and environmental governance was in many ways, what Asher Ghertner has described as "rule by aesthetics" (Ghertner 2014; 2015), where world-class city making through attention to urban cleanliness and advanced technology was the top priority. The desecration

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and subsequent attempts to protect the sacred rivers on which many of India's cities exist formed a major part of these developments and controversies. While Kochi lies in the estuary of a river (the Periyar River), and the Periyar is used by industries on its banks as a receptacle of waste, the affective and spiritual attachments to water in Kochi were less directed at the Periyar River, and more toward the brackish lakes and canals that form the Kochi backwaters, and to the Arabian Sea.

Beyond the flows of rivers, anthropologists have recently turned their attention to cultural life in the ocean (Helmreich 2009; Teaiwa 2014; M. Joseph 2019), as well as the multiplicity of ways that water and land are entangled in the amphibious worlds of wetlands, swamps, deltas and coastlines (Subramanian 2009; Ogden 2011; Morita and Jensen 2017; Scaramelli 2019; Cons 2020). Much of this scholarship demonstrates the ways in which colonial practices of land ownership and land reclamation projects have had disastrous effects on the unique coastal areas that house mangrove forests and other endangered ecosystems. I build on this scholarship to demonstrate how projects of land reclamation and waste management projects both share colonial inheritances and logics on the south coast of India.

Broader scholarship of water that includes these different material relations has been collected under a new rubric of the Blue Humanities (Jue 2020). At the same time, we have seen increasing scholarship from the humanities and the social sciences that engages with the South Asian monsoon. Rather than a discrete form, the monsoon shifts between these different material and textural registers in a cycle. The monsoon moves; it is a relationship of all the elements that brings rainfall to the Indian subcontinent every July. Architect Dilip da

Cunha has emphasised the creation of rivers as lines on a map in his recent book *The Invention of Rivers* (da Cunha 2019). As such, through a deeply historical and rich analysis of how the Ganges is conceptualised and represented across different media, Da Cunha argues that rivers as they are conceived of today, were invented by Europeans as a way of controlling land. In order for land to be tenable, that is, owned and profitable, a separation between land and water was needed. In this fabrication, the immense wetness of the Indian monsoon was rendered into water that flows in particular places on land.

Environmental historians of India and South Asia have recently taken up a similar challenge, to write a monsoonal history of the nation and its cities that recognises both water and its separation from land as integral to the colonisation of the continent (Amrith 2018; Bhattacharyya 2018). For Sunil Amrith, the monsoon is figured as the source of all life in South Asia, and as such the development of India as a nation must be traced through its negotiations with water. For Bhattacharyya, the scope is a little narrower, focusing on Kolkata and the expansion of that place from a regional centre to the capital of colonial India. In the colonial expansion of Kolkata, the wetlands that surrounded the city and form part of the Ganga delta needed to be controlled, contained, and in many places reclaimed as dry land. It is within and against these territorialisation processes that the on-going development of (post)colonial India as a nation, particularly its cities, is most convincingly read. As such, I join these scholars and writers in foregrounding the material, cultural, and spiritual relationships with the monsoon in its various materialisations as rain, wind, water, and the seasonal patterns of wet and dry.

From water to wetness

These monsoonal approaches to environment in India find affinity with a lesser-known thread of environmental anthropology that attunes to the rhythms and textures of the wet and the dry seasonality of tropical places. The tropics have enticed white anthropologists for some time, perhaps most famously through Claude Levi-Strauss' confessional tome *Tristes Tropiques* originally penned in 1955 (Lévi-Strauss 1976). Another ethnography that tackles environment in the tropics is Peter Redfield's ethnography of technological development and colonisation in French Guiana (Redfield 2000). More recently, I am deeply inspired by Tim Choy's research on the everyday and expertise laden processes of environmental knowledge production in Hong Kong (Choy 2011). However, none of these ethnographies of environment, people, and place in the tropics take seriously the analytical value of the ontological, epistemological, and metaphorical force of the climatic seasonality of wet and dry.

One surprisingly early example is from Clifford Geertz in his comparative analysis of irrigation practices between Morocco and Bali (Geertz 1972). In this article, Geertz astutely points to not only the quantitative difference between wet and dry climates (in this instance Bali and Morocco), but also the qualitative, such as the variable rhythmic patterns and predictability of weather. In relation to the year-to-year variation of weather between to the two places, he states, "to be a weatherman in monsoon Indonesia, all you *do* need to know is which way the wind is blowing; in Morocco, to be one you need to be able to penetrate the mind of God" (Geertz 1972, 25). The wet/dry seasonality of the tropics here is presented as very predictable and provides little variation year-to-year, while the dry deserts of Morocco

are much more difficult to forecast. This is of course beginning to change with global climate change effecting the monsoonal winds which is in turn having drastic effects on India's agricultural production (Matthan 2022). Geertz continues,

> Where Bali, from this point of view, is a kind of giant outdoor aquarium, or, rather, a multitude of little aquariums pressed tightly up against one another, Morocco is… a collection of scattered (or anyway discontinuous) oases, garden spots in a dessicate landscape… Environment is, therefore, and long has been, more than a passive, residual, limiting sort of factor in shaping Moroccan and Balinese life. It is and has been an active, central, and creative one. (Geertz 1972, 26)

Interestingly, Geertz seems to predict one of the central claims of the Anthropocene, that in the pursuit of separation from Nature through technology, we might actually be tied more closely to it. For example, this sentence was written three decades prior to any mention of the Anthropocene in academic literature: "it may be that advanced technology ties us in even more closely with the habitat we both make and inhabit, that having more impact upon it we in turn cause it to have more impact upon us" (ibid., 38).

While there is not a lot of anthropological literature that builds on these insights, social scientists in geography, architecture, and media studies have been turning their attention to wetness and the cyclical rhythms of wet and dry seasonality (Yates 2015; Steinberg and Peters 2015; Krause 2017; da Cunha 2019; Peters and Steinberg 2019; Cavallo, Vallerani,

and Visentin 2021). By exploring a wet ontology, these scholars provide one way of moving beyond the flat ontology of land-based territoriality and toward a volumetric understanding of space (Steinberg and Peters 2015). Beyond the spatial contributions of such thinking, a wet ontology also pushes us away from the discretely materialistic understanding of objects and toward the understanding of wetness as an affective atmosphere (B. Anderson 2009; Mathur and da Cunha 2014). It is here that I find a useful stopover in affect theory is helpful to thinking through some of the socio-material entanglements of monsoonal India (Stewart 2007; Berlant 2011; Finkelstein 2019). Affect here is a way of describing encounters with the world through lived experiences of sensation and feeling that animate "an energetic field of shifting common concerns" (Stewart 2017, 193). In this way, wetness is not only a socio-material condition brought on by particular climatic relations, but also a feeling that one experiences whenever in the humid tropics of coastal South India. I analyse these experiences by drawing on Dereck McCormack's concept of envelopment, where the materiality of an object and its affective atmosphere are not easily reduced to the terms of each other (McCormack 2018). In Kathleen Stewart's terms, exploring atmospheres and their affects requires "an attunement of the senses, of labors, and imaginaries to potential ways of living in or living through things" (Stewart 2011, 452). Contending with these distributed yet specific encounters with wetness as an affective atmosphere take us away from the political ecology of water as a resource, and towards a more experiential and phenomenological account of urban environmental anthropology. I carry this sensibility into my ethnographic account of contestations over waste and infrastructure in Kochi.

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Urban wetness

Anthropologists have attempted to address the parochial and colonial foundations of the discipline in many ways, including through more attention to history (Wolf 1982), the colonial project (Anderson 2006), and global processes of interconnection (Tsing 2005). Part of this reckoning has meant turning the ethnographic gaze away from rural agricultural groups in the Global South and towards the lived experience of people in cities (Hannerz 1980). These disciplinary shifts have in the last couple of decades mirrored an unprecedented shift of humans around the world from hinterlands to cities. The United Nations estimates that 2007 was the first time in history that more people lived in cities than in rural areas. These spatial and demographic shifts have encouraged anthropologists to begin crafting new methodologies, interdisciplinary collaborations, and points of focus in an attempt to understand the diverse range of experiences and lifeworlds of people who live in within increasingly complex webs of social, material, and technical urban relations (A. Simone 2013; Amin 2016; Barua and Sinha 2017; Harvey, Jensen, and Morita 2017; Bhan 2019). In India, urban ethnographies have largely focused on public health and illness (Solomon 2016), advocacy in the wake of disaster (Fortun 2001), aspirations of capitalist development (Cross 2014), and the subjectivities of those pushed to the margins by development agendas (Appadurai 2000; Ghertner 2015; Finkelstein 2019; Bhan 2019). These varied examples show how the city can be the locus of ethnographic research or the focus of ethnographic attention itself. Increasingly, anthropologists are looking to the ways in which the non-human environment is invited into urban spaces (or not), particularly in the wake of climate change and the myriad of ecological crises the planet faces (Rademacher and Sivaramakrishnan 2013) .

Tracing the convergence of environmental and urban anthropology brings us to a number of seemingly contradictory places, both methodologically and theoretically. If cities are, by definition, human spaces without the presence of a wild Nature[9], what does it mean to study non-human beings within cities? Urban environmental anthropology then is a fruitful line of study that tends to provide critical reflection on a subset of nature-culture binaries such as urban-rural and wild-domestic. These dichotomies make it "seem like common sense that parks must be set aside from people. And that real nature is not found in cities" (Dove and Carpenter 2008, 2). If cities are inherently human oriented places, what does it mean to study the myriad human-environment relations that nevertheless continue to shape urban life?

For Timothy Choy, to study urban environments was to compare the knowledge making practices through which Hong Kong's future was understood to be in danger from air pollution, bulldozing trees, or a waste incinerator (Tim Choy 2011). For Anne Rademacher, it was to investigate how the pollution of the Bagmati river in Kathmandu "had come to signify democracy's general failure to live up to its promise" (Rademacher 2011, 2). And for geographer Matthew Gandy, it was Nature itself that was capable of taking back the city, in various entangled ways that are influenced by human histories as much as plant and animal biology and interactions (Gandy 2013). I extend these contributions to urban environmental anthropology by describing and analysing wetness (rather than water) in an urban context. The geographers I mention above who present new theories of 'wet ontologies' do so by

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[9] Following Jason Moore, I often capitalise Nature to show its social construction and avoid a reified non-human nature (Moore 2017a; 2017b).

drawing from remote oceanic places or life on tropical islands. What I present here is a grappling with a wet ontology within the context of rapid (post)colonial urban development that I apprehended through attention to waste and contestations over its management. At the heart of this thesis is a series of questions about the shortcomings of urban development through infrastructure, and the promise of infrastructure that attends of the affective, immersive, and atmospheric qualities of wetness without reducing those qualities to water. One way that anthropologists have begun understanding how people in cities continue to be in relation to non-human environments is through the infrastructures that mediate the relationships between the two.

Anthropology of infrastructure: A matter of relations

The anthropology of infrastructures begins with the work of Susan Leigh Star, Karen Ruhleder and Geoffrey Bowker in the 1990s. Together, they theorised infrastructures as embedded and invisible technical apparatus that helped to organise large information systems. They point to the emergent quality of infrastructure, adapting to its climate through experimentation and improvisation, stating that developing infrastructure is "like building the boat you're on while designing the navigation system and being in a highly competitive boat race with a constantly shifting finish line" (Star and Ruhleder 1996, 112). Anthropologists have since used this way of theorizing about the nature of information systems through their standardization and customization to understand the metabolic flow of cities (Gandy 2004; Mehta et al. 2014; Demaria and Schindler 2016). Infrastructures are, as Brian Larkin has now famously stated "matter that enable the movement of other matter" and their peculiarity as ethnographic objects "lies in the facts that they are things and also the relation between

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things" (Larkin 2013, 329). They move people and their objects around (think of trains and roads), but they also move non-human matter around, albeit generally in service of human needs and desires (water and waste for example). They are technological and engineered ways of organising the increasingly complex and entangled worlds humans have both designed and find themselves in. They simultaneously enable the distribution of more-than-human worlds over time and space in ever new ways, and facilitate that distribution (Star 1999).

Through an etymology of infrastructure, we see its first use in the English language around the turn of the 19th century (Carse 2017, 30). This supports Matthew Gandy's claim that the redesigning of Paris through hydraulic removal of waste underneath city streets in the mid 19th century marked a new rationalisation of (urban) space that was nothing short of a "process of redefining nature" (Gandy 2014, 45). In other words, infrastructures bring humans into relation with Nature in a way that tends to separate humans from Nature. As Gandy explains further, the infrastructures of 19th century Europe created a "new set of relationships between the body, technology, and urban architecture" (ibid., 45). These new sets of relationships were largely built around the nature-culture binary, where humans lived in mechanized cities free of 'wild' nature, and mediated their relationships to Nature through the use of infrastructures.

It seems to me that the recent boom of anthropological interest in infrastructures is due first and foremost to their shared orientation toward *relations*. Marilyn Strathern has recently argued that anthropological enquiry is primarily concerned with relations, and that there is a

need to be more precise about what is meant by the term *relation* (Strathern 2020). As she explains, Anthropologists "take it as self-evident that everywhere people … are drawn into relations with the things, beings, and entities that form their environment. Above all, the specific capacity of persons to relate to one another is taken as a fundamental truth of human existence. Social life is what goes on between them" (ibid., 4). However, historically, the etymology of relations shows that there was a directionality to the Latin term *relatio*, "it was a substantive for a motion or narration" (ibid., 5), and it wasn't until "an emerging sense of a world that rested on explaining discrete phenomena by reference to the forces, logics, or structures that held them together" that relations came to be understood as something that happens between discrete entities (ibid., 6). So here we see that if infrastructures are relational in this sense, and they create distinctions between two discrete things, the infrastructures of modernity might be re-enforcing dualisms such as nature-culture. *Part of my contribution to the study of infrastructures in this thesis is to suggest that there is a need to reimagine infrastructures in ways that acknowledge the multiplicity of a more-than-human world, while holding space for the differences that matter*. This reimagining is informed by situating and thinking about infrastructures from the tropical monsoonal conditions of urban South India.

Rather than simply discussing the different types of infrastructures that anthropologists have engaged with, in the rest of this section, I discuss some of the characteristics of infrastructures that anthropologists have analysed while paying particular attention to what kinds of political claims these characteristics enable. It is worth quoting Penny Harvey in full here:

While infrastructure might appear as an ethnographic concept in contexts of either

planning or breakdown, the investment of contemporary anthropology in the

analysis of infrastructural formation probably has as much to do with its analytic

purchase as with its empirical salience. From an analytic perspective,

infrastructure is an exemplary relational form, and furthermore a form that

mediates diverse theoretical concerns and speaks to contemporary debates on the

relationship between human and nonhuman agency, on material politics, event

and duration, past and future, space and time. In short, infrastructural forms offer

a focus for the analysis of contemporary social life that side-steps the limits of

humanism without erasing the human, and allows for a dynamic and open sense of

scale that does not assume a singular perspective. (Harvey 2018, 83)

Infrastructure provides a way of approaching the study of contemporary urban life across

different scales but defining infrastructure in the abstract is quite a fraught exercise. The

analytical purchase of infrastructures as subjects of empirical observation rests on the

particular social and material relationships it is embedded within. To help draw out some of

the ways in which infrastructure has been theorized, I now turn to several recent ethnographic

examples from Mumbai. I do so because Mumbai shares many qualities with Kochi as a port

city on the west coast of India, and there are several great ethnographies on the

infrastructures in Mumbai, whereas there is a dearth of ethnographic writing from Kochi,

particularly on environmental issues. First, I discuss the material relationality of

infrastructures, then the affective qualities of infrastructures, and finally the (post)colonial nature of infrastructures.

Material Infrastructures

Recent ethnographic attention to infrastructures has occurred at the same time as a retheorisation of materialism to social and political thought. Housed under the auspice of 'new materialism', this discourse, which incorporates elements of posthumanism (Barad 2007; 2018; Alaimo 2016), feminist phenomenology (Neimanis 2017), and affect theory (Chen 2011), suggests that matter is inherently withdrawn, in the sense that there is something innate to different materials that prevents them from being entirely known or controlled. There is vital internality to things, whether humans are part of that life or not. In this theorisation, matter has agency through its phenomenological and affective presence. Matter is, in Jane Bennett's terms, "vibrant" (Bennett 2010). While these theories have a lot to offer the study of infrastructures and more-than-human worlds, throughout this thesis I stop short of describing and analysing materials though their animacy. Nevertheless, attention to the materiality of infrastructure does provide a way into describing how the different material properties matter to how infrastructures are imagined, designed, maintained, and used. It also leads to an analysis of their aesthetic experience and their physical form. Brian Larkin describes form as "a relation between humans and technology as well as a thing in itself, the medium where infrastructure and users meet" (Larkin 2018, 175). As material forms, infrastructures are designed and built by someone and for something, and ethnographic attention is drawn to how material qualities translate into political and aesthetic regimes. As such, rather than work toward a vitality of infrastructure, in this thesis I tend to

steer toward an atmospherics of infrastructure which brings together their materiality and their affect (which I develop in the following section). To situate this discussion of the materiality of infrastructure I now look to some examples from ethnographic research conducted into the water infrastructures of Mumbai.

Through ethnographic attention to ways in which citizens access water in an outer suburb of Mumbai, Nikhil Anand has demonstrated the materiality of many urban infrastructures leaves them open to tinkering of various kinds (Anand 2011; 2015). The orientation and directionality of the pipes, along with the keys that are able to turn water on and off, create the materiality of what Anand calls "hydraulic citizenship" (Anand 2017). However, in this case the materiality of the infrastructure—colonial era pipes, above ground pipes, and underground ground pipes—means that engineers are able to intervene in the service delivery in various ways, often in service of political or economic desires. Their materiality also provides insights into the ways in which water infrastructures decay and leak when they are not properly maintained. Furthermore, the politics of infrastructure and the technical expertise required to operate them were contingent on the material relation between the pipes and the water. As Anand states, "the repair of pipes also required water engineers to recognize that their authority was compromised by the soaking, uncertain materialities that the city's water infrastructure was situated in" (Anand 2015, 321). The ephemeral nature of water's materiality is here transposed onto the infrastructures that move it around, demonstrating that the technical and political aspects of infrastructure are always bound to the material forms in which they are invested.

Lisa Björkman's investigation of water infrastructure in Mumbai makes similar observations to Anand in that social categories are contingent on the discursive effects of infrastructural practice. But she also suggests that those categories also produce the objects which they are contingent upon. In this way Bjorkman demonstrates how urban infrastructures are co-constitutive of relations between people and environments in an "elaborate choreography" (Björkman 2015, 31). It is through this iterative material play that "macroeconomic shifts become inscribed in the fabric of the city itself" (ibid., 2015, 4). The form and aesthetic experience of Mumbai is literally a product of the ever-changing material relations. This includes the corruption that becomes possible through the "constantly reconfigured constellations that might be responsible for making water appear or disappear" (ibid., 179). This ability to intervene in infrastructures through material practices is evident not just in water infrastructures, but in other large urban networks such as waste, electricity, and roads. However, an exclusively material analysis of infrastructure struggles to incorporate the lived experience of infrastructures.

Affective Infrastructures

There is a tendency when studying infrastructure for the analysis to become too mechanistic. The information systems first analysed by Star and Bowker have led to the use of the metaphor of the computer or technical system in place of the moving parts that make up a city (Easterling 2014). So, while the anthropology of infrastructure might lead to insights about how expertise is generated and reproduced (Harvey and Knox 2015), theorizing infrastructure in this way risks sidelining the many different lived experiences of those infrastructures and the more-than-human relations they enable or foreclose. To be more

faithful to the affective atmospheres generated by wetness, I began to look for ways of grappling with the affective atmospheres of infrastructures. Maura Finkelstein's ethnography of mill workers in Mumbai is exemplary in this regard. By sharing stories of how the infrastructure of the city *feels* to her research participants, she "draws urban anthropology away from city planning and back to ethnography" (Finkelstein 2019, 22). In doing so, Finkelstein unveils how rapid urban development generates complicated feelings of loss among the forgotten mill workers of Mumbai. But more than this, the infrastructures that fill our cities are born of desires, often of more prosperous futures, the tragedy being that they rarely attain those futures, at least not for everyone and especially not equally.

Further afield, Hannah Knox has also turned to the affective dimensions of infrastructure to discuss the development of a transcontinental road in Peru. It was here that "the process of engagement or negotiation with authorities appeared to be preceded by an experiential relationship with the material environment within which people were living that was central to the fermentation of political action" (Knox 2017, 374). In contrast to the sadness and malaise felt among the mill workers of Mumbai, the affective dimension of infrastructure is here expressed through desires for mobility that the road would bring. The experience of the smooth road once it was built provided a glimpse of what their future might look like, demonstrating how specific "material conditions were enfolded into the flow of life" (ibid., 375). Many others have also drawn our attention to the aspirational and hopeful nature of infrastructures, as they promise prosperous futures through technical innovation, accelerated economic activity, and broader connectivity (Cross 2015). So, while the material and the affective dimensions of infrastructure cannot be fully separated, ethnographic attention to the

lived experience of infrastructure—whether the loss of a way of life or the excitement for new possible futures—is necessary if anthropologists are to account for the complexities of contemporary urban life.

Another way that infrastructure and affect have been brought together is through a recognition of the ways in which infrastructures are woven through everyday lives with different kinds of intimacy (Wilson, 2016; Berlant 2016; Meher, Trnka, and Dureau 2018; Datta and Ahmed 2020). Drawing on various discourses within queer theory and feminist thought, these authors highlight how "infrastructure offers a useful category for illuminating how intimate relations are shaped by, and shape, materializations of power: it offers a vehicle for translating broader theories of power, system, materiality, space, ideology, and discourse into observations of concrete situations" (Wilson, 2016, 263). Studying how things such as sewers, roads, and telecommunications provide not only the "ambient background to everyday life", but also quite literally touch us in various ways, provides experiential and phenomenological insights into the systems of thought and action that inspired their materialization. Yet, in more-than-material ways, these systems of thought are often emblematic of larger institutions and institutionalised patterns of discrimination such as sexism, racism, and ageism. I characterise these as affective atmospheres of infrastructure— the remnant emotional, psychological, and aesthetic generated by the material relations that infrastructure set in motion (B. Anderson 2009). These atmospheres are intimate in the sense that they influence senses of belonging and identity (Ahuja 2015). The intimate, affective, and atmospheric natures of infrastructure that I explore in this thesis are the residual forms of centuries of colonial rule in India.

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(Post)colonial Infrastructures

In many ways, infrastructures such as roads, railways, and canals formed the arteries of colonial modernity throughout the 19th and 20th centuries. Prior to this in South India, the Dutch and Portuguese colonial rulers were more concerned about controlling existing trade networks, rather than building up new frontiers of resource extraction. That changed with the arrival of the British (M. Desai 2005; Drew 2014). To facilitate this kind of extractive colonialism, and on the back of innovations from the industrial revolution, the British began building large scale infrastructure in India. The most obvious example of this in India was the Indian railway, built through the 19th century to facilitate faster movement of people and goods around the subcontinent in the service of colonial extraction of timber, spices, tea, and other valuable commodities (Bear 2020). So while infrastructure is currently being touted as the solution to many of the (urban) development problems in contemporary India, there is a reckoning with how infrastructure marked the arrival of colonial modernity which brought with it the destruction of environments as well as social and cultural ties throughout the nation.

To acknowledge the material and affective residue of these infrastructures and the environments they irreversibly damaged, I add the parentheses around the "post" in (post)colonial. This indicates that while India has been an independent state since 1947, it continues to grapple with the discursive, iterative, and lasting effects of colonisation through broken bureaucratic systems and the maintenance of colonial infrastructures of extraction (Gupta 2018; 2012). There has been much written about the postcolonial condition in India

(Chakrabarty 2000), and as I have shown here, a wealth of scholarship on the social life of infrastructure, however, surprisingly little has been written about the relation between the two. Laura Bear has recently argued that the Indian railways began as public works, and only became infrastructure in the neoliberalisation of the Indian economy in the 1990s and that a distinction between the two is necessary (Bear 2020). She suggests that in its recent proliferation within the social sciences, infrastructure has largely been deployed as a neutral theoretical term. By situating infrastructure in distinction from the early forms of public works, Bear aims to cleave some space between the planetary urbanism of neoliberal economic power, and the colonial developments that occurred throughout the 19th and 20th centuries. While this is a valuable contribution to the study of infrastructures and the postcolonial condition, in this thesis, I situate both colonial and postcolonial infrastructure together through the signifier of (post)colonial, to demonstrate the ongoing material and affective relations that colonial infrastructures imbue (Collins 2019; Enns and Bersaglio 2020). This is perhaps more faithful to the specific kinds of infrastructure that were built to attend to relations of water and waste.

Situating infrastructure in this way also highlights their temporal nature. Within a global development framework, infrastructure represents linear time and progression toward European ideals of modernity (Howe et al. 2016; Duclos, Criado, and Nguyen 2017). They also speed things up, moving commodities and people faster and faster in order to be as profitable as possible. In Chapter 7 of this thesis, I build on scholarship that explores the temporality of infrastructure to suggest an unworking of these attachments toward slower more intentional ways of relating to urban environments (Gupta 2018; Carse and Kneas

2019). By highlighting the speed and convenience associated with toxic infrastructures, I join scholars working on the slow food, slow fashion, slow tourism, and slow water movements (Shove 2003; Gies 2022; Navarro 2022; Huang, Chen, and Ramos 2023), who also highlight that by prioritising slowness one can change their relationship to waste (Giles 2023).

Anthropological notions of waste: Pollution and disposability

In this, the final section of the chapter, I discuss different approaches to the social study of waste. Waste takes on different material forms such as faeces or plastics, and also occupies different ontological positions as pollution or resource for example. It also is distinct from other materials that are moved around by infrastructural relations in the sense that it is generally taken away from users, rather than brought to them. Water, electricity, and other services are needed within homes and businesses, waste on the other hand, must be excised and taken away. The directionality of waste infrastructure is important in discussions about its relation to the environment, primarily because waste in its various disguises is not a finite resource with its origins in a pristine non-human Nature. Rather, waste is generated by human worlds, as a result of extractive and consumptive practices, and has been transported to non-human places such as landfills and the ocean.

My discussion of waste takes on a kind of chronology of the field as it moved from the earlier studies of ritual and symbolic pollution to the recognition of waste and disposability as the underbelly of capitalist accumulation and a legacy of the industrial revolution. I then consolidate this discussion by introducing the emerging field of discard studies and how

insights from Kochi contribute to this field. Throughout, I draw links to the anthropology of (urban) environments, water and infrastructure which I have covered earlier in this chapter.

Pollution, bodies, and the environment

Ethnographic attention to waste often invokes social theories of pollution, which can be traced back to Mary Douglas' seminal book *Purity and Danger* (Douglas 1966). Her work established the theory that something only becomes dirt, or pollution, in relation to a social system. As she states, "Reflection on dirt involves reflection on the relation of order to disorder, being to non-being, form to formlessness, life to death" (ibid., 5). What Douglas highlights when she claims "where there is dirt there is system" is that attuning to dirt, pollution, and taboo, provides researchers an avenue into studying social and political systems and their values (Douglas 1966, 34). To do research about dirt, waste, or pollution is to do research about the power to determine what is and isn't part of a system—political, religious, scientific, or otherwise. Put another way, critical attention to waste and pollution is always relational. Waste is a relation.

A recent collective of social science researchers have begun to revitalise this method of researching systems that produce pollution, excess, and externalities. Grouped under the title of Discard Studies, this emergent hub of researchers highlight that Douglas' theory of pollution was a theory about *power*. They recognise that waste is not produced by individuals and is not automatically disgusting or offensive. In other words, waste is not natural, but rather a product of economic, political, and cultural systems. For example, rather than asking how much people recycle and why they don't recycle more, Discard Studies asks why

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recycling is considered good in the first place. It challenges the assumptions around responsibility and offers alternatives to normative notions of waste. In this thesis, I engage with and am influenced by scholars working within this emerging field, but I do not claim to make any significant contributions to it. I align with their principles of focusing not on individual waste practices and instead to the ideological and social functions of things like waste infrastructure, but my analysis and ethnographic contributions are directed toward human-environment relations within the context of postcolonial India.

Examples of this kind of research range from plasticizers in plastics causing harm to human and more-than-human bodies (Liboiron 2016; Pathak 2020a), a symbolic violation of social systems such as caste and race (Doron and Raja 2015; Butt 2020b; Resnick 2021), the presence of harmful materials in the urban environment (Véron 2006), or the roar of airplane noise over suburban Darwin or Los Angeles (Lea 2014; Peterson 2021). In each case, something has the power and social license to continue to pollute (plastics and oil industries predominantly), or the power to maintain social hierarchies through culturally embedded concepts of pollution and purity. In these ways, the systems that generate pollution are also the systems that determine what pollution is, and in the process re/produce access and control over land and bodies. There is a permitted level of pollution, what might be thought of as threshold limits, that is generally accepted as necessary for processes of urbanisation, development, and growth to happen. The assumed access to land and bodies, and the regulation of pollution through threshold limits are why Max Liboiron makes the compelling argument that pollution is colonialism (Liboiron 2021). Controlling the exact number of particles in the air, plastics in the ocean, or migrants in a city, is a fraught way of approaching

urban and environmental governance. It is a system that assumes there is an "away" that is able to process unwanted excesses, and that there are humans willing to do the difficult, dangerous, and under-compensated labor of collecting, transporting, and processing that excess. In fact, most of the recent ethnographies on waste focus on the marginalised lives of those who toil with waste (Nagle 2013; Reno 2016; Millar 2018; Fredericks 2018). These accounts tend to demonstrate the economic and political struggles of waste labourers despite their labour being vital to the functioning of contemporary cities.

Comparatively less attention has been given to the way this fictive away is re-enforced by the ideology of a non-human Nature and its ontological opposite (culture) that environmental anthropologists have engaged with for some time. There are only a few examples of ethnographic attention to how waste infrastructures produce environments and how specific environments influence how waste is managed. One valuable contribution comes from Myra Hird's work on the environmental ethics of "landfills as ubiquitous places of forgetting" in Canada (Hird 2013, 107). Another is seen in V Chitra's exploration of the entanglement of plastics and coastal life in Mumbai, where "waste becomes the shore" (V. Chitra 2021, 354). Jacob Doherty has also explored the ways that marabou storks become "waste with wings", interrupting the class structures that are produced through a political geography of waste in Kampala (Doherty 2019). This thesis contributes to these examples by demonstrating how Kochi's immersive wet environment is incompatible with both waste and the hegemonic ways that waste is managed through large-scale infrastructures. Another way that anthropologists have approached these questions of waste is through attention to disposability and the infrastructures that facilitate disposal.

While humans have been disposing of things since the dawn of time, it is only really since the end of World War 2 that disposing of synthetic things that do not decompose in the environment was woven into economies built on extractive capitalism. This expansion of plastic economies into capitalist markets was mirrored by developments in synthetic technologies that were invented during WW2. It was in the 1950s that the future of a plastic economy was promoted to exist in turnover rather than durability (Liboiron 2016; Hawkins 2018). Prior to this, the value of plastics was in their durability. However, this was not a great marketing strategy. Research into how to make plastics more ephemeral and disposable led to the invention of chemical compounds called plasticizers. These were added to the durable plastics, creating a new much more malleable material called thermoplastics that could be reshaped again and again. Rather than highlight their utility, Discard Studies scholars have demonstrated that these compounds were invented to make more profits, and that they also cause serious health issues that disproportionately effect women (Liboiron, Tironi, and Calvillo 2018).

In focusing on how plastics are woven into capitalist, colonial, and patriarchal systems, these scholars demonstrate different forms of financial, social, and organisational value. This, in turn, has been theorised as the waste-value dialectic through which urban governance has been analysed (Gidwani and Maringanti 2016; Butt 2020a). This theory claims that something becomes waste when it is no longer valued, and that in order to address waste crises in cities there is a need to influence people to value waste in new ways. Gidwani and Reddy call this "waste switching", where what was once categorised as waste within a

system, turns back into a valuable commodity. I draw on this theory in trying to better understand how WTE appeals to urban governments as a form of infrastructure that turns waste into fuel. These theories also bring us to an understanding of waste that is similar to how to how governments provide access to safe drinking water and electricity. The state determines when and what disposal services are available, and how different people in the city can access those services. Here we have the other side of the same coin of waste. Where attention to pollution highlights a rupture in a system according to certain values, attention to waste infrastructure draws attention to the ways in which those values become codified in a system of governance that is then built into the materiality and experience of a city.

Drawing on her ethnographic research with garbage men in Dakar, Rosalind Fredericks states, "Whether viewed through its rollout as a symbolic manifestation of modern development, analyzed at the point of breakdown, or understood through spaces and processes of abjection, disconnection, or disrepair, infrastructure is a key site for the ordering of society by the state" (Fredericks 2018, 32). In his discussion of postcolonial waste management in Kampala, Jacob Doherty explains how maintaining cleanliness demonstrates a kind of ubiquitous development and builds legitimacy of local governments. In publicizing their infrastructures of disposability, Kampala's government "founded its authority on garbage" (Doherty 2019b, 36). This is similar to what Prime Minister Narendra Modi has attempted to do in India since his election in 2014, and I turn now to a discussion of waste in India to close out the chapter.

Theorizing Waste in India

Discussions of waste in India have historically centred on the act of open defecation and the re/production of the caste system through the collection and removal of shit from urban areas. Many of Mary Douglas' observations about the symbolic nature of pollution were drawn from ethnographic fieldwork in India in the 1960s. Take this passage from her discussion of boundaries and classifications in relation to open defecation and the caste system: "Rather than oral or anal eroticism it is more convincing to argue that caste pollution represents only what it claims to be. lt is a symbolic system, based on the image of the body, whose primary concern is the ordering of a social hierarchy" (Douglas 1966, 126). By examining how substances carried polluting or purifying forces, Douglas claimed that rules of purity provided a sound entry to the study of religious practice. For example, attention to the social life of shit in India can provide insights into everything from social hierarchies to human animal relations (as shit becomes purified when in the hands of God who takes the form of cows). Douglas articulates an analysis of waste that privileges transformation, transgression, and movement. This continues to be central to ethnographic attention to waste today. And while these observations were made prior to India's urban revolution and widespread use of disposable plastics, open defecation remains a topic of considerable attention to both policy makers in India and anthropologists concerned with waste in the subcontinent (R. Desai, Mcfarlane, and Graham 2015; Doron and Raja 2015; Coffey et al. 2017).

In 2014 Narendra Modi was elected as Prime Minster of India on a platform of economic development and cleanliness. One of his election promises was to eradicate open defecation by Mahatma Gandhi's 150th birth anniversary in 2019. He planned to achieve this gargantuan

task by installing millions of toilets around the country, despite already existing problems with sewage infrastructure like those articulated by Kelly Alley described earlier. Narendra Modi's attention to waste mirrors that of anthropologists within India and more broadly, indicating a global awareness of waste that was becoming articulated and addressed in various regionally specific ways. Demonstrating this trend, anthropologists Assa Doron and Robin Jeffrey recently devoted an entire book to the confluence of waste and economic growth in contemporary India. They ask, "why would a new prime minster, elected with a surprising majority, choose to stake so much of his reputation on a program as difficult as cleaning up India?" (Doron and Jeffrey 2018, 6). Building on Doron's previous work on the cultural politics of shit in India (Doron and Raja 2015) and Jeffrey's work on gender and politics in Kerala (Jeffrey 1992), the book takes on the mammoth task of the various ways that waste manifests throughout India in a way that is legible to policy makers and the general public, while also providing ethnographic nuance and anthropological insights. The authors frame their conceptual contributions through the concept of the 'binding crisis'. They do so by referring to the plague that swept through Surat, a city in the state of Gujarat, in 1994 and the mobilisation that occurred in the efforts to rid the city of the disease. As such, the book concedes that the waste crisis unfolding in India will only be addressed if enough people are affected by it, at which point they will be bound together in their resolve toward a solution. Unfortunately, as I demonstrate in the chapters that follow, the cooperation Doron and Jeffrey point to continues to elude India.

Other scholars of waste in India have pointed to the nature of waste as a result of India's entry into global capitalist markets (Gidwani and Reddy 2011; Gidwani 2013; 2015; Gidwani

and Maringanti 2016). This transformation, which occurred most clearly in the 1990s, happened at the same time as India's adoption and promotion of urbanisation, indicating a shift away from Gandhi's dream of an economy driven by village-based agriculture. This double movement of both international influence and rural-urban migration of people meant that the new materials in the lives of urban citizens were being consumed at an ever-increasing rate. The most noticeable material change during this period was the adoption of single-use plastics. Gauri Pathak has recently suggested that these plastics were largely adopted due to the "advances in hygiene and convenience" that they offered to everyday citizens (Pathak 2020a, 753). However, their disposability and the inability of urban governments to adequately manage this surge of plastic waste has led to waste crises in most Indian cities throughout the 21st century. I begin to unpack the material histories of disposable plastics in chapter 5, while I demonstrate how the conveniences associated with plastics might be unworked through attention to the microbial practice of composting in chapter 7. I argue that this unworking requires slowing down akin to the slow food movement that prioritises situated ecologies and local practices for a more sustainable food web .

Lifelines

As I have demonstrated in this chapter, the following thesis is situated within and contributes to current debates in the social sciences around the intersections of a tropical monsoonal environment and (post)colonial infrastructure, and what attention to waste and its management can contribute to these debates. At the heart of these debates are the contradictions inherent to contestations over urban environments, and infrastructures that are at once conceived as the cause of and solution to urban problems such as waste management.

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In the chapters that follow, I bring the scholarship in these fields together to suggest that one's approach to these contradictions depends on different spatial, temporal, and scalar imaginaries. These imaginaries come from a place, and to reimagine infrastructure in Kochi, one needs to reimagine it from the specific environmental and social histories of that place.

This reimagining involves grappling with how the monsoonal "wet ontology" of Kochi comes to matter to both infrastructure and waste. By situating waste in relation to wetness in this way, I critique colonial geographic imaginaries about waste and how it gets moved "away' through infrastructures that contain its movement to lines. Infrastructures literally produce the lines by which we often, in implicit ways, live our lives. As Sara Ahmed states, "following lines also involves forms of social investment", where "subjects reproduce the lines they follow" (Ahmed 2006, 17). If you recall the vignette that I began this thesis with, Kochi's waterways were once the lifelines of the city, but now lay neglected and full of filth. They have been replaced by lifelines that are made of concrete and clay, the urban infrastructures that define modern life (Gandy 2002). Ahmed goes on to suggest that "a lifeline can also be something that expresses our identity" (Ahmed 2006, 18). What I highlight in this thesis are the many ways that this material and social change from the lifelines of water to the lifelines of land are a kind of colonial inheritance that informs the dominant approaches to waste management in the city.

Put another way, these lines might also be what Deleuze and Guatarri refer to as "striated space", where "one closes off a surface and "allocates" it according to determinate intervals, assigned breaks" (Guattari and Deleuze 1987, 481). But, as da Cunha and others have

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demonstrated, and what I emphasise throughout this thesis, the monsoon doesn't occur in lines and surfaces but rather emerges through an ocean of rain above and below the ground (da Cunha 2019). For Deleuze and Guatarri, this might be what they consider "smooth space" of "affective intensities", in contrast to the bounded movement of striated space (Guattari and Deleuze 1987, 479). They suggest that the sea, prior to its cartographic mapping into routes was "smooth space par excellence" (ibid., 480). The challenge for those contending with waste in Kochi was how to rearrange the spatial, political, and affective attachments to urban development away from those same dynamics that created the problem in the first place. The problem begins when successive colonial occupations ignored or sidelining the wet ontology of the monsoon and the cultures and environments that thrived in that milieu. In the chapters that follow, I introduce Kochi as a city afloat in monsoonal wetness, before demonstrating how waste and this wetness collide in efforts to solve a waste crisis through WTE infrastructure, and in approaches to waste management in two of Kochi's urban parks. I then suggest slowing down might be the first step toward rearranging these environmental attachments in ways that acknowledge and work with Kochi's monsoonal wetness. But first, I provide some deeper reflections on the fieldwork process and my researcher positionality.

Chapter 3: From the mountains to the sea: fieldwork, research methods, and positionality

When I think back to when this project began, my mind drifts to the experience of watching Matthew Barney's 6 hour long epic piece of theatre and film titled *The River of Fundament* at the 2014 edition of the Adelaide Festival. In it, the American dream of capitalist growth, philosophy, sewage, art, and eroticism come together into a poignant and disturbing commentary on purity, defilement, life, death, and rebirth. Skip forward to November 2015 when I had recently completed my honours thesis on urban beekeeping and, inspired by my supervisor Dr. Georgina Drew[10], started becoming interested in what anthropology had to say about the environmental politics of waste in Indian cities. Preliminary research into water in Indian cities quickly showed me that access to clean drinking water was often tempered by inadequate, broken, or simply absent sewage and waste infrastructures. As such, the initial purpose of my research was to look at the intersections of waste, water, and urban aesthetics in postcolonial India. I became interested in waste as a "matter of concern" in urban India,

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[10] Georgina was awarded a Development Early Career Research Award (DECRA) by the Australian Research Council (ARC) just weeks after I had completed my honours thesis and offered me the opportunity to formulate a PhD project that would complement her research into the cultural politics of rainwater harvesting in urban India. The ensuing mentor-mentee relationship between myself and Georgina influence and supported the research that I turned into this thesis in substantial ways. I have now been a student and a collaborator of Georgina's for nearly a decade. While we did conduct some fieldwork together in India, the research presented in this thesis is entirely my own except where indicated.

and took that as a starting point to explore meso-level public culture in Kochi (Latour 2004; Pathak and Nichter 2019; Rinaldo and Guhin 2019). The question of what 'waste' is, changed throughout the course of research, particular through my relocation from Darjeeling to Kochi which I detail below. As such I do not seek to describe a bounded group of people, a particular culture, or provide a holistic account of a city. Instead, I offer a "relational ethnography" (Desmond 2014) between environment and infrastructure through attention to waste and how it was managed in Kochi.

This chapter provides a detailed account of the changes that occurred through the fieldwork process, both thematically and methodologically, and the ways in which my research settled into a rhythm of sorts once in Kochi. Throughout the descriptions of the fieldwork process I weave critical reflections on the research methods I used. I close the chapter with a reflection on researcher positionality and reflexivity. Ultimately, this chapter highlights the messy and emergent nature of ethnographic research, the openness to serendipity (Pink 2022) and failure of 'being there', and the evolving processes of self-reflection that are crucial to engaged and reflexive ethnographic research. The 'field' here emerges as a mosaic of experiences that coalesce around an interest in an emergent form of urban environmental politics. It is at once a place (Kochi, India), my movement between places (Darjeeling, Kochi, New Delhi, Paris), conference rooms, urban parks, waste depots, film screenings, arts festivals, and government offices, as well as my practices of reading, writing, and teaching. As Anand Pandian states, "the field of anthropology may be found wherever we are in the company of someone or something that focuses and kindles this "more", that pushes us beyond ourselves in novel and unexpected ways" (Pandian 2019, 74). The field is then a place of encounter, experience, and

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learning. Some of these moments are captured in the chapters that follow, many of them aren't. I try to hold space for those experiences that shaped the atmosphere of my fieldwork here in this chapter.

Fieldwork Part 1: Finding the field and first trip to Darjeeling

Between April 2016 and April 2019, I spent 16 months in India, and between January 2018 and April 2019, I spent a total of 10 months in Kochi. The story of how I came to be in Kochi is a complicated one, but it is one worth telling if ethnographic writing is to show the trials and tribulations of ethnographic research. As Lila Abu-Lughod states at the beginning of her influential ethnography *Veiled Sentiments*, "the nature and quality of what anthropologists learn is profoundly affected by the unique shape of their fieldwork; this should be spelled out" (Abu-Lughod 1986, 10). The shape of my fieldwork was unique indeed, as I encountered everything from political violence in the Himalayas to the most severe floods in a century on the Malabar coast of Kerala. How I came to experience these things shaped everything from who I met and how I met them, to what we spoke about, and to how my analysis unfolded around particular themes.

April 2016: Darjeeling

My first trip to India occurred in April 2016. I tagged along with my doctoral supervisor Georgina, who had a small research project to continue in Darjeeling, West Bengal. The plans for this trip were for Georgina to conduct some interviews with her collaborator Roshan Rai, and for me to start exploring Darjeeling as a potential field site for my doctoral fieldwork. Darjeeling is a busy but small hill station in the northeast Himalayas of India—a

location often referred to as the "chicken neck" as it occupies a narrow section of Indian territory nestled between Nepal and Bangladesh that provides the only land access to the geopolitically tense North-eastern states of Meghalaya, Assam, and Nagaland. It is known for its world-famous tea and as a popular destination for domestic and international tourists. During this trip I aimed to begin conversations with a local educational institution to explore options to obtain an institutional affiliation in India to secure a research visa and begin to develop research connections and networks. Doing research in India while on a tourist visa is officially not permitted, and tourist visas are only 90 days in length for Australian citizens, so an institutional affiliation leading to a 12-month research visa was my best chance at doing long-term engaged ethnographic fieldwork.

While Georgina and Roshan's research was focused on water (in)security in Darjeeling (Drew and Rai 2016), Roshan was also very interested in the problems of environmental and social justice in Darjeeling, and was, and still is, centrally involved in environmental activism in the region including the Zero Waste Himalayas initiative[11]. He was interested in my research, and we quickly became close friends and stay in touch to this day. I stayed with Roshan and his family for this three-week trip and learnt a lot from him about waste management in Darjeeling, and in India more generally. I recall one day in particular, when the three of us visited the waste depot in Darjeeling, which is more of an open landfill on the side of the hill that Darjeeling rests upon. There were flowers on the side of the street leading up to the waste depot, a young mother with her daughter collecting recyclables from a pile of

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[11] http://darjeelingprerna.com/

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trash, and a few dogs sniffing around for food—aesthetics, waste, labour, and more-than-human life were already pressing upon me and my ethnographic sensibility. At one point, when moving around to the other side of the depot we had to hop over a small drain from a warehouse nearby. It turned out that the warehouse was a slaughterhouse and the dark fluid in the drain was blood. These confronting scenes, filled with what might be thought of as the atmospherics of waste such as the smoke from the burning waste piles nearby, were my introduction to ethnographic fieldwork in India. It was also during this time that I began to notice the spatial organisation of urban infrastructures, following water pipes through town and paying attention to where water was flowing, and waste was accumulating (and where it was not). At the end of our day trip to the dump, we found ourselves at the edge of a large open sewer cascading down the side of the hill. I remember thinking about Matthew Barney's film, and how in a sense, I had found my own river of fundament. The three of us agreed that there was an issue here for me to research, and Roshan was glad to have another researcher around to help tackle the issue of waste.

Figure 5: Darjeeling's river of fundament.

April - June 2017: Return to Darjeeling

Once I had completed my research proposal and had ethics approval from the Human Research Ethics Committee at the University of Adelaide, I travelled to Darjeeling for what would be the second and longer stint of preliminary fieldwork. I did not have an institutional affiliation yet, but I was confident I would be able to secure one and planned to spend from April 2017 - June 2017 in Darjeeling. During these three months I moved into my own apartment and was beginning to join local NGO workers, researchers, and environmental activists on their trips within Darjeeling and to nearby towns. This was, in hindsight, the beginnings of my Participatory Action Research (PAR) practice[12], where I would develop a rapport with, and subsequently offer my skills and advocacy to, a local NGO with whom I shared political affinities (Langan and Morton 2009). During this time, I also began taking Nepali classes as Nepali was the language spoken by most residents of the Darjeeling Hills. Efforts to learn the language were noticed and appreciated by local shopkeepers who were happy to learn that I wasn't a tourist, and that I was taking the time and effort to speak their language. I would soon learn that this attention to language was more political than I had initially realised.

On June 8, 2017, the Chief Minister of West Bengal, Mamata Banerjee, and other state officials were due to hold their first state cabinet meeting in Darjeeling in 45 years. During the weeks leading up to this symbolic meeting, there was increasing suspicion that the chief minister had plans to make Bengali compulsory in all West Bengal schools, including in the

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[12] More on this below.

Darjeeling Hills where Nepali is spoken in homes and English and Hindi taught at schools. This fuelled deeply held sentiments about the creation of a Nepali speaking state in the Darjeeling hills called Gorkhaland[13]. Gorkhaland supporters saw the move to make Bengali compulsory in all West Bengal schools as a sign of further Bengali nationalism from Mamata Banerjee and the leading Trinamool Congress Party. A protest was then organised to coincide with Mamata Banerjee's cabinet meeting on June 8th to show Mamata Banerjee and her party that people in Darjeeling were not happy about this recent decision and did not appreciate her visit to Darjeeling. I decided to attend the protest as I wanted to understand the changing regional politics at a grassroots level, and to continue to establish myself as an engaged researcher within the Darjeeling community.

The day of the protest was typical of Darjeeling in early June, it was clear but not quite clear enough to see Mount Kanchenjunga from the hilltop. That only happened after rain, with the sky clear of cloud and smog. I wandered from my apartment down to the main street of town for the protest soon after lunch. Around 200 people were gathered on the streets outside a heritage hall where the meeting was to take place. Some people were waving Gorkhaland flags balanced atop fences, but most were sitting quietly on the street in small groups. I stayed for around half an hour before I decided to turn back home. If anything, I was surprised by the apparent calmness and lack of drama, it was peaceful for the duration of my time there. But as I walked back up the steep Darjeeling streets to my apartment, I started to hear shouting, and then gunshots, and then explosions. I started walking a little faster. I

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[13] For more on the Gorkhaland movement see Besky (2017).

noticed people beginning to come out of their homes and shops to see what was happening. There was a small lookout near my apartment—probably the roof of someone else's apartment, where a small crowd had gathered. I joined them, watching the smoke fill the sky and the commotion in the streets below as it travelled from the original protest location down into the main street of Darjeeling (figures below). I lingered for a few minutes before returning to my apartment and getting in touch with my friends who lived closer to town. I later learnt that several people had been killed and dozens injured during the violence.

The ensuing days were anxious with uncertainty and more violence. The national military was called in, the internet to the region was shut off, and a bandh[14] was called. Around 4500 tourists and a handful of NGO workers including a group from the USA I had recently met, were stranded, with limited contact to the rest of the country or our loved ones. I stuck close to the NGO workers from the USA, and after one failed attempt to get a bus out of town, we bunkered down together at Roshan's house for two nights, before eventually finding someone willing to drive us down to Siliguri[15] in twilight of dawn. As we swerved our way down the hills toward Siliguri, the figures began to emerge with the light of day, of dozens of people

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[14] The term used across India for a general strike. Shops are shut, businesses and schools closed. This bandh turned into a political maneuver, as those in Darjeeling attempted to use it as a lever for political power by withholding their labour. Unfortunately, the state and national government did not come to the table, and despite the bandh lasting more than three months, virtually nothing was gained.

[15] A dusty city at the bottom of the Darjeeling Hills home to the airport that provides access to the region, Bagdogra. The journey from Siliguri to Darjeeling is about 60km via a notoriously steep and windy road through a number of tea plantations.

with no option but to walk from their homes to their jobs down in the city. As the sun rose over the hills that morning, I knew it was going to be difficult for me to return to Darjeeling to continue my research, but my thoughts remained fixed on the injustice that Darjeeling community continued to face in their search for recognition[16], and the precarity of living deep in the Himalayas with only one road in and out.

Figure 6: Smoke rises over Darjeeling after riots break out.

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[16] It's difficult to provide the context needed to understand the complexities of this situation. Suffice to say that the vast majority of the tea plantations and hotels in Darjeeling are owned by Bengali families in Kolkata, and this incident was the latest in many decades of hardship for those who call the Darjeeling Hills home. For more on this see Middleton's *The Demands of Recognition* (2016), Besky's *The Darjeeling Distinction* (2014), and Shneiderman's *Rituals of Ethnicity* (2015).

Fieldwork interlude: Europe

After evacuating Darjeeling, I made my way from Siliguri to New Delhi, and then to London. I had a paper accepted to present at a conference at the University of Tübingen, Germany, in July, and my cousin had a spare room in her apartment in London which she generously offered to me. So, with a tourist visa about to expire in India, it seemed like my best option to shift my flights forward and spend a month in London prior to the conference. I spent my days working from the British Library reflecting on my time in Darjeeling and conducting some archival research into the colonial history of water, waste, and infrastructure in the Darjeeling Hills[17]. At this point in time, returning to Darjeeling was still an option, even if the situation in Darjeeling was still precarious and uncertain. Being in Europe also gave me the opportunity to explore some of the European origins of sewers and urban infrastructure, including a trip to the Musée des égouts (Museum of sewers) in Paris. As I explain further in chapter 3 (*Floating Ground*), the invention of underground, networked sewers in Europe in the late 19th century became a precursor to urban transformation around large infrastructure projects. The Paris sewers were one of the largest urban infrastructure projects at the time of their making, and are often referred to as the precursor of a new age of urban modernity achieved through spatial governance of cities and are a sign of technological and engineering prowess (Gandy 1999). Experiencing these sewers, and the museum created around them, was an important part of the process of coming to terms with waste and infrastructure in a historical context, though I do not discuss my visit ethnographically within the thesis.

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[17] This archival research did not make its way into the final dissertation, so I do not elaborate on the archival methods here.

As the days and weeks went by while in Europe it became clear that returning to Darjeeling

would be difficult, and I was eventually presented with an ultimatum by my university[18]:

return to Darjeeling on the condition that if I had to evacuate again, I would not be permitted

to return throughout the rest of my PhD; or to change fieldwork location. It was about this

time that Georgina entered some fortuitous conversations with acquaintances of hers about

the option of both of us becoming affiliated to Amrita Viswa Vidyapeetham University, a

private university in South India with campuses in Kochi, Amritapuri, Bangalore, and

Coimbatore[19]. The serendipity of this moment seemed to steer both of our thinking toward

this opportunity, and I began to consider what continuing my project in South India would

look like. I recall vividly a phone call with Georgina, while I stood outside a bakery in Berlin

in the days after the conference at Tübingen, when I decided that of these three cities in South

India, Kochi seemed like the best place to focus my energy for reasons that I discuss below.

Changing the field, finding resonance

Through some preliminary research about Kochi, I came to understand it as a historic port

city with a growing arts culture. Its location on the Malabar Coast of the Arabian Sea

intrigued me, particularly as the city was situated among the famous Keralan backwaters and

had a rich and complicated colonial and pre-colonial history. As I began to read more about

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[18] This ultimatum was in line with the risk assessment we agreed upon prior to my commencement of fieldwork.

[19] Amrita is currently ranked the 16th overall university in the country according to the NIRF

(https://www.nirfindia.org/2022/Ranking.html).

Kochi, I noticed numerous newspaper articles discussing the waste management problems in the city, with canals full of plastic waste and increasing amounts of toxic pollution found in the backwaters. It was at this time I began to see the connections between an abundance of water and waste management problems that were not too dissimilar from what I had begun to learn about in Darjeeling. I also began to notice points of connection between the complex colonial history of Kochi as a critical node in ancient and colonial spice trading routes, and how the city was tackling contemporary waste and water problems. In particular, I became interested in how the history of colonial infrastructures such as sewers, railroads, land reclamation projects, and the construction of a large harbour for the Cochin port, impacted environmental politics in the city today.

As such, despite their location at opposite ends of the country, one deep in the Himalayas 8000 feet above sea level, and the other close to the bottom of the country on the coast of the Arabian Sea, some affinities between Darjeeling and Kochi started to emerge. The process of noticing these affinities helped quite substantially in narrowing the themes developing in my research, and what I was to subsequently focus on throughout the rest of my fieldwork. The thought did cross my mind on multiple occasions to embark on a comparative ethnography between Darjeeling and Kochi about their different waste struggles, highlighting these affinities and divergences. However, the situation in Darjeeling remained precarious, and travel between the two cities is quite long and arduous. For these reasons I present a thesis about Kochi that nevertheless holds parts of Darjeeling in it.

The first affinity I noticed was that both Darjeeling and Kochi are intensely wet places. The northeast and the southwest of India are the wettest places in the country. This is largely due to the topography of each area, with the Western Ghats and the Himalayas pushing annual monsoonal clouds higher into the atmosphere, causing large downpours that last for weeks. Darjeeling averages 3,092mm of rain per year, while Kochi averages 2,882mm. Despite this wetness, both Kochi and Darjeeling face annual water shortages during the dry months, often due to contamination from inadequate waste infrastructure. In Darjeeling, this was largely due to altitude and verticality—shit flowed downhill while drinking water flowed up. Those who lived at the top of the hill were often the wealthier, and those who lived down below were poorer laborers and farmers (Drew and Rai 2016). In Kochi, it was an immense wetness that was not only monsoonal but also hot and coastal: it was tropical. Water was everywhere, and it pooled rather than flowed. Kochi sits *within* a series of lakes, canals, and lagoons simply referred to as the 'backwaters', and much of the state of Kerala actually rests *below* sea level (see *Chapter 4: Floating Ground*).

The second affinity centred around my realisation that both Darjeeling and Kochi were in the middle of what was referred to in local media outlets as a 'waste crisis'. This is not unique to urban India, as many cities around the country continue to face a dire waste situation, but it was notable none-the-less in my preliminary research. Both cities had one major waste depot, that was in technical terms, a dump, and were battling the accumulation of waste on streets, and contamination of water from errant wastewater. These crises were due in large part to the incommensurability of colonial (waste) infrastructures, specific environmental conditions, and aspirational urban economies centred on consumerism and tourism. The abundance of

wetness and waste made the infrastructures that were positioned as solutions to the crises, such as waste-to-energy incinerators, economically unviable and practically ineffective (see *Burning Wet Waste*). Part of the problem of the abundance of wetness and waste is that water used to carry away all discarded things, especially when those things were biodegradable such as leaf litter and manure. The material shift to plastics in Kochi, and in India, since the 1990s, has meant that previous waste management strategies no longer work. Instead of throwing a paper container or piece of wrapping into the nearby canal or backwaters, bins must be used to transport (plastic) waste *away* from the water. I reflect on the use and design of bins—shaped as charismatic species to attract users—in Kochi's public parks in *Chapter 6: Waste and its Masquerades*.

The third affinity has to do with the colonial histories and colonial aesthetics of these two places. Darjeeling and Kochi are known colloquially as the 'queen of the hills' and the 'queen of the Arabian Sea' respectively. These colonial and patriarchal names emphasise the strategic importance of these places for the spice and tea trades throughout the colonial era and signalled their exquisite 'natural' beauty, as places of reverence and leisure. Noticing the cooler climates and abundant vegetation of the eastern Himalayas, the British turned Darjeeling into a sanitorium, a retreat from the bustling hot dusty cities of the plains. This notion of Darjeeling as a retreat, a place for wealthy folks to escape Kolkata, continues today, albeit primarily for domestic and international tourists rather than colonial rulers. The British also transformed large parts of the Darjeeling Hills into tea estates using migrant Nepali labourers, quickly turning the region into a landscape that produced some of the most desired teas in the world (Besky 2014). As I highlight in the introduction, Kochi was one of the first

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colonial cities in what is now known as India, witness to Portuguese, Dutch and British rule between 1498–1949. Prior to this the merchants of Kochi were part of extensive exchange networks with traders from Arabia and China (Nandy 2000; M. Joseph 2006). While Darjeeling was integral to the extraction of tea, Kochi was integral to the extraction of spices such as pepper and cardamom from the Western Ghats was facilitated through the Cochin port and exported to the rest of the world. This strategic importance of Kochi as a major port was only accelerated by British engineering in the 20th century and continues today in (post)colonial India. As such, infrastructures in both Darjeeling and Kochi carry with them the residue of the extractive frontier of colonial capitalism, and some of the efforts underway in the city to imagine infrastructure otherwise required a slowing down to match situated environmental and social milieus.

These three affinities—particularly wet environmental conditions, waste crises due to urbanisation and the introduction of plastics, and (post)colonial infrastructures that continue to shape the direction of urban development and environmental imaginaries—remained the central focus of my research as I shifted from Darjeeling to Kochi. Below, I provide details of the ways in which the research developed once in Kochi, with a particular focus on research methods and the people I engaged with as collaborators and participants.

Fieldwork Part 2: Kochi

As someone who grew up in the temperate coastal areas of Southern Australia, stepping out of the airport in Kochi for the first time was a memorable experience. There was less chaos than stepping out of the airport in New Delhi or Kolkata that I had become used to from my

travel to Darjeeling. Instead of people and smog, the dense, hot, moist air engulfed me. It was as if I had stepped into a sauna. The local university had kindly arranged for a driver to collect me and drop me to the university accommodation closer to the city centre where I was to be based for the next 10 weeks. As we drove through the surprisingly calm streets, I was struck by two things: infrastructure and environment. Admittedly, these were the things I was interested in, but it felt as though the city was immediately throwing these things back at me. I found myself focusing on the elevated metro line that runs above the median strip of the highway that leads from the airport to the city. But upon reflection, the airport itself was telling me about environment and infrastructure, as it promoted itself as the first airport in the world to run entirely off solar energy, facilitated by a huge solar farm directly next to the airport. Despite the setbacks of my time in Darjeeling, and grief of abandoning a project I was quite invested in through such intense circumstances, I was excited to be in Kochi and to turn my attention to the intersection of waste, environment, and infrastructure in the tropics of South India.

My first trip to Kerala was from January-March 2018, during which time I stayed in a university owned block of apartments in the suburbs of Ernakulum, the business district of Kochi. Most days I would walk the 2km from my apartment to the Amrita Institute of Medical Sciences (AIMS), a large hospital and medical research centre on the same campus as the Amrita university campus which I was to become affiliated to. At AIMS, I began meeting with one of my key research participants in the early days of my time in Kochi. She was the head of the house keeping department at the hospital and we were introduced by faculty at the university who thought it would be beneficial for us to meet due to our similar

interests. Most days we would spend about an hour together, often discussing Keralan politics, particularly around gender, class, and caste, and how they related to cleanliness in an institutional setting. Our conversations were my first informal interviews in Kochi, they were semi-structured and open ended. I recorded them all on my phone unless asked not to. Together, we also learnt about the wider waste management practices happening at the hospital, including a large composting facility and one of the best wastewater treatment plants in Kerala (see *Chapter 7: Slow Infrastructures*).

During this time, Georgina and I also visited the other three Amrita University campuses, in Amritapuri, Bangalore and Coimbatore. Georgina's research into urban rainwater harvesting was multi-sited, and she was interested in building networks with scholars in Bangalore in particular. These visits were part of the process of us becoming affiliated to the university as visiting research scholars, to meet local researchers working on similar topics, and to learn more about the university in general. Of particular interest to me and my research was the waste management practices in operation at the ashram in Amritapuri.

Amritapuri is a beachside ashram and university campus about 3-hours' drive south of Kochi. It is the birthplace of Mata Maritanandamayi Devi, a spiritual leader affectionately known by her followers as 'Amma' (and popularly known as 'the hugging saint'), who is also the founder and Chancellor of Amrita University[20]. Mata Maritanandamayi Devi is known across India as a Hindu spiritual leader who supports work that aims to address environmental and

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[20] https://www.amrita.edu/amma

social issues, and our projects aligned with the broader environmental practices of the institutions. Part of our onboarding process of becoming affiliates of the university was to meet with and receive a blessing by Amma to do our research. This was less a formal blessing of our research, and more a spiritual blessing of our presence within the institution. On the more formal side of things, we met with university directors to discuss the direction of our research and what we would spend our time doing while affiliated to the university. During these onboarding processes we also had a chance to meet with an American born devotee of Amma who championed waste management in the ashram during the decade she had lived there. Georgina and I interviewed her during this initial visit, and I subsequently interviewed her on the numerous occasions I visited the ashram throughout my fieldwork. The ashram was peaceful and mostly quiet, despite the thousands of regular visitors, and besides being a place to learn more about spirituality and waste management, it was also a great place to reflect and write. During these visits I became part of the team responsible for waste management in the ashram through the devotional practice of *seva*.

Seva is a form of selfless service. It is what residents of the ashram did in order to keep the ashram functioning. Though not formally required, everyone living in the ashram was expected to practice seva as part of their daily routine. My seva involved waking up at 6am to help collect waste from the designated waste stations and then transport the waste to the waste facility by the beach. We would then take a short break for breakfast, before returning to the waste facility to begin sorting the waste, which would often take us to lunch. Doing this work gave me insights into the feeling of the labor involved in waste management, and the meticulous and time-consuming practice of segregating materials into their separate

categories for recycling or repurposing. I recall vividly one morning where I sat with another

resident of the ashram while washing used plastic milk packets, many of which had housed

wriggling maggots and noxious smells. This practice is essential for recycling soft plastics in

Kerala, and helped the ashram in recovering recycling fees from the milk producers. These

and other experiences at Amritrpuri, a deeply devotional and calm place, informed and

pressed upon my subsequent research in Kochi, however I decided it would not become a

primary focus of the project. As my fieldwork progressed, I became more interested in

tropical *urban* life, and Amritapuri was quite isolated and removed from the environmental

challenges and (post)colonial infrastructures of Kochi.

June 2018-April 2019: Kochi

Returning to Kerala in June 2018 with a research visa in hand, my attention began to settle on

the relationships between environment and infrastructure that were highlighted through

attention to waste and its management in Kochi. This was aided through two fortuitous

encounters with people who would significantly shape the remainder of my fieldwork. The

first was Dr. Manoj, an environmental activist and chemist who was primarily concerned

with plastics pollution in Kochi. We met at Cochin University of Science and Technology

during a participatory research appraisal (PRA) workshop that Georgina and Dr. Manoj had

organised with another professor at the university. This workshop was aimed at building

awareness among staff and students regarding the life cycle of materials used on campus, to

encourage a shift toward a zero-waste university campus. This workshop then became a

model for how Dr. Manoj, myself, and my research assistant would engage in environmental

activism in Kochi through our advocacy work. We visited schools and colleges throughout

Kochi in an attempt to build awareness but also to gather up like minded students who would be interested in carrying this message further within their communities. This advocacy work became part of my participatory action research (PAR) into the zero-waste movement in Kochi, including engagement with the Cochin Corporation (the local governing body) about the development of a waste-to-energy plant at the dilapidated landfill known as Brahmapuram (see *Chapter 5: Burning Wet Waste*).

Participatory Action Research (PAR) is a method of qualitative research practiced by a diverse cohort of social scientists whereby "participants become researchers and researchers become participants"[21]. It is generally thought of as a way to work with local communities where they have an opportunity to contribute to research knowledge, and the researcher is offered an opportunity to contribute to community goals. Instead of the research agenda determining the shape of the collaboration, the researcher shares their research interests and asks participants is they can join them in their efforts, to try to help them achieve their goals. The visibility and intentions of the research are up front, and the community decides whether the researcher is valuable to them. This has some overlaps with ethnographic methods more generally, as interviews and participant observation are key to both, however with PAR, the research aims are somewhat suspended, and insights are then drawn through participation, reflection, and dialogue with the community members in relation to their goals.

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[21] https://discardstudies.com/discard-studies-compendium/#PAR

According to Hale, activist research is "a method through which we affirm a political alignment with an organized group of people in struggle and allow dialogue with them to shape each phase of the process, from conception of the research topic to data collection to verification and dissemination of the results" (Hale 2006, 97). On the other hand, cultural critique is "an approach to research and writing in which political alignment is manifested through the content of the knowledge produced, not through the relationship established with an organized group of people in struggle" (ibid., 98). The shape of my research and dissemination of writing falls somewhere between these two modes. The dialogue I had with activists in Kochi certainly did shape the fieldwork process, and I have verified my writing with key participants throughout the writing process. The dissemination of results however, has been more traditionally academic. I have, where possible, suspended my alignment with the politics of those I conducted fieldwork throughout the writing process. This has not been in an attempt to find anthropological objectivity, but instead to hold space for the creative, generative, and reflexive practice of analysis and writing.

The second encounter that significantly shaped the trajectory of my fieldwork was with the Kochi Biennale Foundation (KBF). The KBF organises the Kochi Muziris Biennale (KMB), the largest contemporary arts festival in Asia. I knew of the festival and was intrigued as to whether it would become part of my research as I have a background in the music and arts writing. In June the KBF began hosting public talks with some established scholars in the lead up to the festival. I decided to go to a talk, which happened to be by historian Ajay Skaria. At the end of the seminar, someone approached me asking about who I was and what I was doing in Kochi. As the only white person in the room, and with the festival still months

away, my presence had evidently drawn some attention. This person was friendly and encouraged me to attend a conference that was happening the following week by the Backwaters Collective and sponsored by the KBF. The conference was at the Marriot hotel, one of the premiere hotels in Ernakulam, and a hotel that my research assistant and I would return to later in my fieldwork to discuss their composting and other waste management practices.

Attending this conference was a strange experience, but one that had a significant impact on the not only the direction of my research but my entire fieldwork experience. Attendance to the conference seemed to be invite only, or perhaps just not advertised so that only those who heard of it through word of mouth would be aware of it. Subsequently, attendance was quite low considering the notoriety of many of the presenters, and my presence was again noticed. The conference presentations were centred on south Indian politics and philosophy and was my introduction to contemporary conversations that orbited around the life and work of 19th century philosopher, spiritual leader, and anti-caste social reformer Sri Narayana Guru. All presenters were men in senior academic positions, many from American institutions, but with familial ties to Kerala. The few women in the room were employees of KBF, they had all moved down to Kochi from New Delhi or Mumbai to work for the KBF from June 2018 – April 2019. They had each visited Kochi during previous editions of the KMB, but this was the first time they had lived there. As such, we found ourselves in similar positions, temporarily learning the rhythms of the city, becoming familiar with new people and new working relationships. In many ways, this group was my support network in Kochi throughout my fieldwork. We became friends, and these friendships led to me finding

accommodation in Fort Kochi. They also, quite fortuitously, introduced me to the person who would become my research assistant, Anupriya, or simply, Anu.

I was aware I would need a research assistant as soon as my project shifted from Darjeeling to Kochi. I had spent months learning basic Nepali, and I did not have the time (or the brain power) to learn Malayalam prior to returning to the field. Malayalam is a beautiful and notoriously difficult language to learn. It is written in a Dravidian script, quite different from Nepali which is written in Devanagari (the same script as Hindi). Anu had initially applied for a job with the KBF, and when she was not successful, a friend of mine at KBF passed on Anu's details, seeing that she had listed experience in the waste sector on her CV. I then emailed Anu, and we arranged to meet. She was enthusiastic to learn about my project and was excited about the prospect of becoming my research assistant.

Anu and I met for the first time at the Durbar Hall Ground in central Ernakulam. We walked around the large open grassed area a few times before we decided to get a chai nearby at a popular student café. We got along well from the start, and as I was soon to learn, Anu not only had experience in the waste sector in Kochi, having worked for several environmental consultancy organisations, but was also fluent in Malayalam, Hindi, Tamil, and English. From the café we took a walk to Maharaja's College, where Anu had recently finished her Bachelor of Science. Established in 1885, Maharaja's is one of the oldest colleges in India. It is known as the focal point of student politics in Kerala and for its sprawling green campus with rare old trees. Walking around the college Anu and I talked about how the college was

changing from the radical politics of previous generations to a more conservative neoliberal atmosphere.

This initial meeting established a pattern that Anu and I developed, where we would walk and talk often through Kochi's urban natures (Gandy 2005). Social scientists refer to this kind of ethnographic method in a number of ways, including the "go-along" (Carpiano 2009; Schwanhäußer 2016), the "walk and talk", and the "walking interview" (Evans and Jones 2011). Here, "walking affords an experience of embodiment to the extent that it is grounded in an inherently sociable engagement between self and environment" (Lee and Ingold 2006, 68). Through this practice of "ambulatory knowing" (Ingold 2010), we came to share a sensibility toward these places, appreciating their serenity, while also keeping in mind their 'constructed' nature. We would often meet at Subhash Bose Park, a large popular park on the banks of Lake Vembenad, where Anu would reflect on—among other things—how the park had changed from a wild and unkept forest that students would be able to hide in, to a pristine, designed, and well-maintained urban park with non-native trees, grass, and wide concrete paths. We became interested in the ways Kochi as a city was presenting its non-human Nature in particular ways, and how cleanliness, waste management, and other urban infrastructures were integral to the kind of natural environment on display. We would also meet at one of the last remaining 'wild' places in Kochi, the Mangalavanam Bird Sanctuary, that was tucked away behind the Kerala High Court. It was known as the 'green lungs' of Kochi because it housed one of the last remaining native mangrove forests in the city. It was also one of the only 'plastic free zones' in the city, but we both knew that urban development

and polluted water didn't adhere to the human logics of containment that plastic free zones embody (see *Chapter 6: Waste and its masquerades*).

Further to my use of PAR and walking as methods, semi-structured and open-ended interviews were used throughout my time in Kochi, particularly within bureaucratic spaces such as government offices and colleges. I conducted over 100 formal and informal interviews with politicians, activists, artists, architects, engineers, homestay operators, restaurant owners, members of the forestry department, and waste sector employees. Many of these were conducted in English[22]. The interviews that were conducted in Malayalam or Hindi occurred when my research assistant Anu was present and were then translated and transcribed by Anu. Interviews generally took place with bureaucrats in their offices, though we also interviewed some waste management staff at hospitals and hotels, as well as some secondary school teachers. Questions tended to focus on how waste was managed within that particular workplace or institution. For government bureaucrats, the questions steered toward the management of waste at city level. Many of these interviews do not make their way into remaining chapters of this thesis, but they did inform the ways that I came to know the city and the problem of waste management in the city. The conversations I had with Anu and with Dr Manoj feature more prevalently throughout, as my research focus and my research

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[22] Fortunately for me, Kerala is a very English literate state and much of the population can converse in English. Though of course, Malayalam is the first language and there were times when Malayalam was spoken, and I would take a back seat. In these instances, either Anu or Dr. Manoj would quickly translate the general flow of the conversation to me, or we would debrief afterward, or, if recording was possible Anu would translate and transcribe at a later date.

practice settled into the environmental politics that was central to waste activism in the city. As such, this dissertation is not about the everyday life of waste at a domestic level, or the bureaucracy of waste management, but rather the ways in which environmental considerations and sensibilities were articulated and mobilised by those involved in waste advocacy and waste practices in the city.

A typical day would have me travelling from my apartment in Fort Kochi to Ernakulam via the public ferry across Lake Vembenad (a public ferry that cost 20 rupees each way) to meet with Anu. On the occasions we had plans in Fort Kochi Anu would travel across the lake to me and we would spend the day there. We would then travel somewhere together to conduct an interview or to explore a particularly interesting field site, such as the parks mentioned above, Willingdon Island, or Fort Kochi Beach. About mid-morning I would often receive a phone call from Dr. Manoj informing us of a development regarding his advocacy work and we would rush off to join him. After a few weeks of this happening, Anu, Dr. Manoj and I began to develop what might be best thought of as an advocacy and consultancy network. We visited colleges to conduct workshops on the hazards of discarded materials and environmental governance, we sat together at symposiums, we met with government officials and other institutions to advocate for different waste management practices. We floated between the everyday life of waste and its management, and the bureaucratic and institutional processes of deciding what waste was and how it was to be managed. I did my best to record the process through detailed fieldnotes, audio recordings, and photographs.

Outside of my life as an anthropologist, I am also a musician and an amateur film photographer. These penchants for creative practice influenced how I went about doing

fieldwork in Kochi, and the ways I was able to make connections with folks in the city, particularly artists and arts workers. During my time in Darjeeling, I took photos on a Pentax KM SLR. This is a relatively bulky all manual 35mm camera with interchangeable lenses that emits a very satisfying shutter sound. I took three rolls worth of photos while in Darjeeling (approximately 75 individual photos), kept the film safe in my luggage, and developed it once I got to London. From April to June 2018, in between trips to Kochi and while my research visa was processed, I was based in Melbourne, where my brother lived at the time. One afternoon, after visiting our ailing grandparents, we visited a large warehouse full of second hand and antique goods and furniture near Geelong, about an hour south of Melbourne. It was my lucky day, as behind the counter was an Olympus XA3 in near new condition. The XA3, part of the XA family of point and shoot 35mm cameras, is beautiful and compact. Manual enough for my interests, but with only three focus settings. It would prove perfect for carrying around with me in Kochi.

The decision to use 35mm cameras was guided by my aesthetic preference for DIY and analogue creative practice, something I developed as a teenager. But it was also a choice made as a commitment to quality over quantity, and to an ethic of patience and care. I tend to take one photo, trusting that I got the settings right, and not finding out for sometimes months at a time until the film was developed. It is in this way that I agree with Brian Luvaas who recently argued that the cameras we use do matter, and while not fully agentive beings in the same was as humans or other animals, do help shape the kind of visual practices anthropologists engage in throughout their fieldwork (Luvaas 2019). As such, my use of 35mm photographs throughout the thesis should not only be understood as an aesthetic

decision, but a political one. My creative practices also led me to engage directly with the biggest contemporary arts festival in South Asia, the Kochi-Muziris Biennale, which I now elaborate on.

Kochi-Muziris Biennale and the promise and perils of PAR

The Kochi-Muziris Biennale is a bi-annual arts festival that began in 2012 held in warehouses and streets throughout Fort Kochi. It is now the largest contemporary arts festival in South Asia and is commonly regarded as the "people's biennale" in reference to the way the biennale is interwoven with the lives of people living in Fort Kochi, and the broader historical elements of Fort Kochi (Su zhen Pocock 2013). It attracts thousands of domestic and international tourists, and some of the world's leading contemporary artists and art critics. It is an incredible event, and one that formed the backdrop to much of my ethnographic research in Kochi as I lived in Fort Kochi just a few hundred metres away from many of the biennale venues. The art, and the production of the biennale, became a way of orienting my exploration of Kochi as a city. As I mentioned above, some of the employees of the biennale became my friends throughout my fieldwork. I also collaborated with one of the visiting artists on a sound installation about mosquitoes for the Safina Radio Project[23], hosted the Indian premiere screening of geographer Matthew Gandy's *Natura Urbana* which I wrote about for the online multi-modal ethnography website *entanglements*, and wrote a reflective piece about the 2018 edition of the biennale for Adelaide based art magazine *fine print* (Barlow 2019a; 2019b).

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[23] https://www.mixcloud.com/Safina_Radio_Project/vivian-caccuri-matt-barlow/

During one of my visits to the main site of the biennale in the weeks leading up to the festival opening, I noticed a huge pile of waste on fire in the yard. No one seemed to be paying any attention to it. When I raised my concerns about this with some of the artists and employees who were by that time my friends, they told me that some of the local production assistants had also been throwing plastic waste from the installation process directly into the backwaters. With encouragement from those closer to the organisation, I decided to email the founders of the biennale, to formally introduce myself and draw attention to the poor waste practices I had witnessed, offering to volunteer my assistance if that was helpful. I was subsequently invited to a meeting with one of the senior KMB staff to discuss how I might assist the festival in dealing with its waste. I saw this as a great opportunity to extend my PAR practice, though I was also very conscious of the fact that I was still quite new to the city and did not have the necessary networks established to take leadership and responsibility of waste management for the festival. Fortunately, my research assistant Anu did have some of those connections, and we together began formulating plans for how to help the biennale with their waste management.

Initially, the KMB asked us to devise a public display which would act as an infographic, detailing the importance of composting and how the biennale would be composting their food waste throughout the festival. We assisted in this task before it was taken over by the organisation. We also attempted to assist site production teams in linking them up with local scrap dealers who would be interested in taking the waste from the installation process. Unfortunately, despite our efforts, and the efforts of many others including the architects

involved in the festival construction and day labourers involved in the collection and transport of waste, the intervention in waste management that we were a part of with KMB was largely a failure. I this discuss below in an effort to demonstrate the risks involved when doing participatory action research.

By early January 2019 the KMB had established their public facing composting facility and employed a few day labourers to collect the waste from around the festival and collect it there. The festival organisers had engaged with an expert in compost management to educate the site managers about how to do composting in a particular way. I then left Kochi to return home for my brother's wedding. On my way, I stopped in Colombo for a week to volunteer at another art's festival that was investigating oceanic infrastructure and creative research methods[24]. Before my return to Kochi, I flew to London to participate in a symposium at the University of Westminster with the interdisciplinary research group Monsoon Assemblages. Participation in this group was instrumental in my thinking about wetness, and the paper I presented at this symposium eventually became *Chapter 4: Floating Ground*.

I was away from Kochi for about 6 weeks all together, and when I returned the KMB was nearing its end. I went to the main pavilion, where there were food vendors next to a large amphitheatre built specifically for this edition of the KMB, and the composting station that I

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[24] I was told about this festival—Colomboscope—by my friends working at the KMB, and after contacting the director of Colomboscope I was invited to volunteer in a production role. Volunteering at this festival was an incredible experience, the parallels between Kochi and Colombo were many. To read more about the 2019 edition of the festival see: https://www.frieze.com/article/what-can-we-learn-water-report-colomboscope

had helped to design. As I approached one of the food vendors who I had become familiar with throughout my fieldwork they asked if I had seen the composting yard. They emphasised that they were asking just out of curiosity. When I said I hadn't, she told me I should go and look with a concerned and slightly amused look on her face. Now quite apprehensive, I walked over to see how it was going. To my dismay there was waste piling up and overflowing directly behind the infographic that we had helped to design. I was not necessarily surprised by this outcome as I knew there were some serious financing issues for the KMB, and I also knew that maintaining waste management initiatives is one of the key challenges for urban India (Doron and Jeffrey 2018; Mattern 2018). I felt I had failed, partly as a researcher, but also as a person who had an opportunity to influence things for the better but ultimately could not, due to other commitments.

This experience demonstrates some of the conundrums I faced when doing participatory action research. In my attempts to make connections and be involved in multiple projects at once—and to prioritise being at my brother's wedding back in Australia—I had let one of those projects fall short of its potential and ultimately damaged an ongoing relationship with the KMB. Another example of the risks of PAR occurred earlier in my engagements with the KMB. After Anu and I had set up good working relationships with the management of the festival, I invited Dr. Manoj to meet with them to see if we could expand the operation. After some stressful liaising on the ground, Anu and I were able to accompany Dr Manoj to meet with one of the founders of the KMB in the courtyard of one of the main venues. Unbeknownst to me, they had met before at a previous edition of the festival and did not like each other and were unable to work together. As the meeting progressed, I was filled with a

sinking feeling, like all the work I had put in to establishing a good working relationship with the KMB was crumbling in front of my eyes. I had stepped into a set of relations that I did not understand, and my reputation had suffered because of it. Fortunately my PAR and advocacy work with Dr. Manoj and Anu was slightly more successful. As Mary Douglas states, "writing about cooperation and solidarity means writing at the same time about rejection and mistrust" (Douglas 1987, 1). So while my ethnographic research was conducted mostly through an implicit notion of solidarity between myself and my closest research participants and collaborators, this approach also left me and my collaborators vulnerable to rejection and mistrust.

Trip to New Delhi

One of the ways that I showed solidarity with my collaborators such as Dr Manoj and Anu was by travelling to educational and networking opportunities with them and by myself throughout fieldwork. In my attempt to learn more about how Kochi's waste governance fit with national ideas of waste governance and urban green spaces, and to explore anthropologically the institutional scale of environmental discourse in India, I made several trips to both Bangalore and New Delhi throughout my fieldwork. In July 2018 I participated in a 'International Training on Tools and Approaches for Citywide Water and Sanitation Management' course at the Centre of Science and Environmental (CSE), in New Delhi. CSE is India's leading environmental research institution, and provides advice to national state government bodies in regards to environmental issues. This course focused on Sustainable Development Goals (SDG's) and the use of Geographical Information Systems and other mapping tools to track waste and water through cities. We learnt how to make 'shit flow

diagrams', which calculated the percentage of sewage making its way safely to wastewater treatment plants. We were then encouraged to create a shit flow diagram for our research sites. While I did make an initial shit flow diagram for Kochi during the training program, my plans to continue with this form of GIS and mapping research was interrupted by the floods that I returned to in Kochi.

As part of this training program we visited Neela Hauz Biodiversity Park in southern suburbs of New Delhi, as well as the suburb of Nizamuddin East which has installed 17 rainwater catchments within small neighbourhood parks. Fortuitously, this trip to New Delhi coincided with a trip that Dr. Manoj had planned to New Delhi to continue his environmental advocacy work there. As such, I tagged along with Dr. Manoj in the days leading up to the training program. During which time we visited government offices, had meetings with some of Dr. Manoj's contacts in New Delhi, and visited Jawaharlal Nehru University (JNU) to learn about how environmental waste government was occurring on campus. Outside one government office where Dr. Manoj had installed a vertical garden on the side of the building, we bumped into Mrs. Sarada Muraleedharan[25], who was then head of the National Institute of Fashion Technology, and who was former head of Kudumbashree is now the Additional Chief Secretary of the Local Self Government Department, Government of Kerala. During this brief interaction under a particularly intense July sun, Mrs. Muraleedharan suggested I send her an email and arrange a time to meet. After following up via email, I visited her house in New Delhi two weeks later and interviewed her for an hour

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[25] I use the honorific Mrs. here as a translation of the standard Smt. (Shrimati) for many Indian languages.

about the history of Kudumbashree and decentralisation in Kerala. After this interview Mrs. Muraleedharan generously invited me to stay for lunch where I met her teenage son who was on holidays from studying in Bangalore. This interview, while not something I draw at length in the following articles, was very helpful in coming to better understand the institutional and bureaucratic mechanisms through which environment, social, and political movements occurred in Kerala, and was indicative of the kinds of interviews I was able to arrange with government officials and politicians just by spending time with someone like Dr. Manoj.

Hundred-year Flood

While I was in New Delhi for the training program at CSE, the monsoon arrived with full force in Kerala. Just a few days after my return to Kochi, a state of emergency was called, and the Kochi International Airport was closed. Over 400mm of water had fallen in a three day period and one third of the state was under water. The Idukki dam, one of the largest dams in South Asia that rests at the top of the Periyar river, reached capacity and was opened, causing even more flooding. Hundreds of people died, and thousands of homes were lost or damaged. My partner, who was with me in Kochi at the time, had to reroute her flight back to Australia to depart from Trivandrum, rather than Kochi, and we joined the thousands of people trying to evacuate Kerala amid the chaos of roads, railways, and airports being closed. We managed to find enough space to stand in the doorway of a train from Kochi to Trivandrum and slowly watched the flooded fields go by beneath us on a long and tiresome journey.

In the weeks that followed, I became involved in numerous recovery efforts in Kochi, and in the smaller coastal city of Alleppey about 50km south of Kochi. The trip to Alleppey was part of a large student volunteer effort coordinated by the Kerala finance minister T. M. Thomas Isaac. Along with hundreds of other students, I travelled to flood affected areas in more rural areas to document the scale of the damage through an electronic survey that would be uploaded to a central server. Once back in Kochi I visited the Cochin University of Science and Technology (CUSAT), where they had established a flood refuge centre, housing dozens of people who lost their homes. The army was called in to oversee the management of the centre, including cooking and waste management. On another occasion I travelled to Aluva, near the Cochin airport, to help a family clean their house and sort their belongings after flood waters had reached the second floor of their house. These experiences were fundamental to my research and provided the atmosphere under which I conducted the research that was to follow. In particular, they helped to shape my thinking about the futile attempts to contain water in this incredibly wet place, often through colonial forms of infrastructure (See *Chapter 4: Floating Ground*).

Figure 7: Smouldering flood waste accumulating street side in Ernakulam.

Conclusion: Reflections on positionality and reflexivity

The twists and turns of my fieldwork in India throughout 2017-2019, from the beginning a project in the Himalayas, to evacuating political violence in Darjeeling, to re-establishing myself in Kochi, only to encounter the worst floods in a century there, demanded my flexibility and attention to interruption and chance as much as sustained practice. Doing ethnographic research with waste in particular throws up many methodological challenges, especially as a white male scholar doing fieldwork for the first time in India. When I began my fieldwork, I had the idea I would follow-the-waste, tracing it from source through collection and transportation, and eventually to the landfill or material recovery facility.

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It's worth noting that gender and positionality mattered to how my fieldwork played out, particularly as Anu and I entered bureaucratic spaces such as universities and government offices. As a white male from an Australian university, who I might add, due to the lack of hair on my head, was probably taken to be slightly older than I am, I was given privileges and affordances that Anu would not have been granted if she were by herself. Similarly, with Anu at my side, we were received quite well by women workers in the waste industry. And, it should be noted, that in Kerala most of the waste work is done by women. In addition to this dynamic, Dr Manoj was doing his higher-level advocacy work and bringing us in when he thought it appropriate or helpful. Together we made quite a good team, and without them this thesis would not have been possible.

In a lot of ways, I was reflexively studying how we worked as a ragtag group of waste activists. But in another sense, the sense that is most apparent throughout the rest of the thesis, I was attending to the texture of the environmental politics that we (primarily Dr Manoj and Anu) were articulating and what we were encountering. To avoid what Eve Tuck has called "damage centred research" (Tuck 2009) that focuses exclusively on marginalised and disenfranchised others, I made a conscious effort to study how Kochi's hot, wet and humid environment, and it's particularly rich colonial history, played into conversations about, and practices of, waste management processes. One way that anthropologists have attempted to shift the ethnographic gaze is by turning attention to those in powerful positions through a method of "studying up" (Gusterson 1997). Counterintuitively, this term re-enforces a social hierarchy of class and power, situating some people above others. And while I did interview bureaucrats and other people in positions of power throughout this

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research, I found myself floating somewhere in between everyday life and those exclusive arenas of political decision making. This allowed me to follow my intuition and leave room for chance and improvisation through a dynamic mixture of participant observation, interviews, and other creative and embodied methods. It is this flexibility that Ulf Hannerz emphasises as important if anthropologists are to develop insights into local specificities *and* global processes (Hannerz 2006; see also Tsing 2005).

As is evident from this chronology of fieldwork, my ethnographic research was patchy, iterative, improvisational, and messy, while it was also situated and responsive. I adapted my methodologies to the circumstances I found myself in, including unprecedented environmental catastrophes and outbreaks of political violence. I also held onto my engaged and creative anthropological sensibilities, finding ways to make myself useful, while also learning about the subjects I was interested in learning about—human-environment relations, infrastructure, aesthetics, waste management, and the affects and atmospheres of urban natures.

Statement of Authorship

Title of Paper	Floating Ground: Wetness, infrastructure, and envelopment in Kochi, India
Publication Status	☒ Published ☐ Accepted for Publication ☐ Submitted for Publication ☐ Unpublished and Unsubmitted work written in manuscript style
Publication Details	Barlow, M. 2022. Floating Ground: Wetness, infrastructure, and envelopment in Kochi, India. Shima. 16(1): 26-44.

Principal Author

Name of Principal Author (Candidate)	Matt Barlow
Contribution to the Paper	I am the sole author of this paper.
Overall percentage (%)	100%
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.
Signature	Date 11/4/2023

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

   i.   the candidate's stated contribution to the publication is accurate (as detailed above);

   ii. permission is granted for the candidate in include the publication in the thesis; and

   iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	
Contribution to the Paper	
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Please cut and paste additional co-author panels here as required.

Chapter 4: Floating ground: Wetness, infrastructure, and envelopment in Kochi, India

Abstract

The oceanic city of Kochi on the southwest coast of India is known for its abundance of water and as a hub of tourism and urban development. It is unique, however, in that it does not have a piped sewage system due to its high water table. This in itself is not necessarily a problem, but the continued attempts to install sewage infrastructure in Kochi highlight some taken for granted assumptions about urban infrastructures, and indeed the experience of tropical urban life. In this article, I suggest that infrastructures tend to separate water from land, thereby containing one to produce the other. In doing so, they render solid surfaces from which urban infrastructures, such as sewers and roads, are imagined. To imagine infrastructure otherwise, I attune to wetness, rather than water. Attuning to wetness as an affective quality, changes the way one conceptualises infrastructure. To bring wetness and infrastructure together, I turn to the concept of envelopment. By drawing on ethnographic fieldwork in Kochi, this discussion provides insights into how infrastructures might be reimagined in tropical urban settlements.

Introduction

The oceanic city of Kochi (formerly Cochin) on the southwest coast of India is defined more by its water bodies than its land bodies. When I first told friends of mine in Kolkata that I was travelling to Kochi to embark on ethnographic fieldwork, the first thing they mentioned were the famous Kochi backwaters. These waters which envelop Kochi are a popular destination for tourists visiting the south of India looking for picturesque houseboat cruises along coconut palm lined waterways, a glimpse of the watery life that is largely absent from South Indian cities like Chennai and Bangalore. I came to know these waters as a series of canals, rivers, and lakes that cut across the various smaller land masses that together form the urban agglomeration of Kochi. Each of these islands—West Kochi, Willingdon Island, and Ernakulam—have their own feeling, and each is connected and disconnected by waters that seem to house an affective attachment to place more so than any of these slightly dryer dwelling places.

Kochi's canals and backwaters were once the lifelines of the city, essential for the movement of people, goods, and ideas inland from the coast or back out to the Arabian Sea. These waters were also vital for subsistence on a diet that revolved around fish and coconut, and for recreation as they provided respite from the insistent heat of tropical South India. The management of the abundance of water—and Kochi's importance as a spice trading port throughout the ages—was central to infrastructural developments, and a kind of tropical flourishing, encapsulated in the popular reference to Kochi as the "Queen of the Arabian

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Sea"[26]. Today, however, Kochi's famous backwaters lie mostly abandoned due to their use as drains and less as a form of sustenance and transport. In other words, as they became lines on land in service of development as drains, their material, social, and affective significance shifted. This development narrative is largely based on a conceptual and physical separation between water and land. This is achieved through infrastructures that rely on and produce that separation.

Urban landscapes, as well as urban waterscapes, are constructed and maintained by infrastructures that have their roots in colonial logics of extraction and property ownership (Gómez-Barris 2017; M. Joseph 2013). In their separation, water is often in service of land, acting as a sink for unwanted wastes and a container for industrial runoff (Gabrys 2009). This is a familiar story and is not too dissimilar from what has happened to the Yamuna and Ganges rivers in Northern India (Alley 2002; Haberman 2006; Drew 2017; Bhattacharyya 2018), or indeed many other rivers and waterways around the world (Rademacher 2011; Barnes 2014; Hoover 2017). This management of land and water as separate entities was underway prior to European colonisation of India but was accelerated through that process. As historian Sunil Amrith states: "Along the Ganges, as everywhere else in India, the infrastructure of water control long preceded British rule. But in the nineteenth century, British engineers turned the Ganges valley into one of the most "thoroughly engineered" landscapes in the world" (Amrith 2018, 42). Turning this attention to urban South India, what

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[26] Invoking the popular reference to Venice as the 'Queen of the Sea'. Kochi and Venice share a wetness and an appreciation of the arts.

I want to focus on in this article is how both the landscape and waterscape of Kochi has been constructed through (post)colonial infrastructural developments that create an abundance of water from intense *wetness*.

In what follows I draw on 10 months of ethnographic fieldwork in Kochi between January 2018 and April 2019. During this time, I engaged with environmental activists throughout the city, leaders of waste management initiatives at educational and medical institutions, government officials, civic groups mobilised around waste such as the 'Clean Fort Kochi Foundation', architects, and artists. I also experienced the full force of the South Asian monsoon as it arrived in Kochi in July 2018, causing one of the worst floods in Kochi's history. Firstly, I shift the analysis from water to wetness. Wetness here is a relational affect, distinct from water as a discrete object. As an affect, wetness is something that is felt, not controlled. I then explore Kochi through the lens of its underground sewage infrastructure— or lack thereof. Only 5% of Kochi is serviced by underground sewage networks despite continued attempts to expand the network in order to prevent pollution entering Kochi's waterways and revitalise the city's waterbodies. This is largely due to the incredibly high water-table, and the disruption that laying sewage pipes would cause to already congested road networks. To compliment this section on sewers, I also situate roads as part of the same infrastructural logic that sees straight lines and hard surfaces as necessary to increased productivity and urban development. I then turn to the concept of envelopment as a way of engaging infrastructures and their atmospheres—in this case Kochi's incredible wetness— before closing the article by reflecting ethnographically on the affective register of Kochi as a city longing for both wetness and a future that is in many ways incompatible with that

wetness. By shifting the mode of analysis from water to wetness in a place as oceanic and as infrastructural as Kochi, I hope to open new ways of thinking about the affective qualities of infrastructure and wetness *together*.

Figure 8: A city afloat.

Wetness

The similar yet distinct social practices that humans craft with water have intrigued anthropologists for a long time (Strang 2005; 2014). It's mutability and utility across different mediums has inspired people from around the world, and has been the subject of deep philosophical pondering about the ephemerality of life (Bachelard 1983). As anthropologist Stefan Helmreich states, "water is not one thing", and takes many different

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material forms (Helmreich 2011, 95). But what is lost in this materialist rendering of one of life's most crucial elements? Wetness. Here, I want to reflect on Kochi's wetness, and how that might change the way infrastructures can be imagined in the city. Wetness is not a *thing*, but an affect or a quality. To draw again from Helmreich, if water is a "theory machine" for the environmental or 'blue' humanities, wetness might be a *feeling* machine (Helmreich 2011, 132). This involves an expansive atmospheric thinking that takes seriously the various qualities of wetness: soaking, seeping, evaporating, and condensing.

The estuary that Kochi now rests upon was the result of the cataclysmic flood of 1341 that redrew history and place in one epic deluge. Prior to this flood, then Cochin was a small port city, overshadowed by the now semi-mythic ancient trading port of Muziris. Annihilated by the flood, there are only a few excavated remains of Muziris that point to its once central figure in ancient trading routs between Southeast Asia, the Middle East, and the Mediterranean (Nandy 2000). It is estimated that Muziris was somewhere near what is known currently as Kodungallur, and historically as Cranganore, about 20km north of present-day Kochi on the banks of the Periyar River. It wasn't until nearly 200 years later, in 1498, when Vasco de Gama, a Portuguese merchant, explorer, and missionary famously anchored in the Cochin harbour and began what became the European colonisation of the Indian subcontinent[27]. Since then, Cochin, and now Kochi, has been a major port city in South India, now host to the Southern Indian Naval Command, an IT Hub, and a large trans-shipment

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[27] For more on the official history of Cochin and the arrival of the Portuguese, see Subrahmanyam (1997).

international container terminal. Kochi is then a colonial city, historically and presently. Part of this colonization of place involved a separation between land and water.

The deluge that annihilated Muziris was brought across the Arabian Sea by seasonal monsoonal winds. These winds travel in a North Easterly direction across the Indian subcontinent each June until they hit the Himalayan mountains. But before they reach the Himalayas, these winds must travel over the Western Ghats, a long mountain range on the eastern border of the state of Kerala, creating a downpour that acts as a precursor to what is come for the larger north India cities. Over one half of the world's population draws their water from this seasonal downpour. Such is the importance and reverence of this "ocean of rain" that life in South Asia is deeply entangled with the rhythms of the monsoon (da Cunha 2019). As the monsoon travels back across the continent, Kerala is the first and last place to receive annual monsoonal rains and Kochi is the recipient of over 3000mm of rain each year, making it one of the wettest places in South Asia. And it is here that I find thinking about the monsoon in terms of water is insufficient to the task at hand. Water, in its distinction from land, is a part of a colonial imaginary, an imaginary that contributes to the desecration of rivers as sinks useful to urban infrastructures. *Water*, as a discrete and separable entity, as a resource, does little service to the marvellous qualities of *wetness* as a relational affect and condition for life.

In writing of wetness rather than water, I am indebted to the scholarship and generosity of Dilip da Cunha & Anuradha Mathur, who have been writing about wetness from their discipline of architecture for over a decade (Mathur and da Cunha 2009; 2014; 2016; 2020). I

met Dilip early on during my fieldwork in Kochi, before I knew his work, at a conference hosted by the Backwaters Collective, a group of established scholars with an interest in or connection to Kerala who meet every two years to discuss politics and philosophy. The 2018 conference that I attended was co-hosted by the 2018 edition of the Kochi-Muziris Biennale, the largest arts festival in Asia. It was a private event, but fortunately I had received an invite a few days earlier at a public seminar by historian Ajay Skaria. Unfortunately, I missed Dilip's presentation at the conference. However, we did meet over a glass of red wine while watching a memorable FIFA World Cup final between France and Croatia which became the evening's entertainment during the conference dinner. This conference was a pivotal moment in my fieldwork experience as it was not only my first foray into a quite exclusive and progressive discourse of Indian philosophy[28], but also led to my engagement with the Kochi Biennale Foundation, the organization behind the Kochi-Muziris Biennale. It also happened to be in the middle of Kochi's monsoonal rains as I vividly remember being enveloped in rain as I squeezed into the back seat of a car already full of people to hitch a ride home to my accommodation.

Dilip's presentation, which I subsequently accessed online through the Monsoon Assemblages archive[29], was about his most recent work titled, *The Invention of Rivers*. In it, Dilip theorizes rivers as the colonization of rain. In this designation, (post)colonial India has

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[28] Some of the other delegates were scholars such as Ashish Nandy and Vinay Lal.

[29] Monsoon Assemblages are a collective of researchers based at Westminster University, London, that seek to investigate the multiple realities of the South Asian monsoon. http://monass.org/

come to inhabit a cartographic imaginary of a surface, where maps are divided into 'land' and 'water' to (re)produce rivers. To move beyond this binary, da Cunha and Mathur suggest engaging with a relational ontology of *wetness*. In South Asia, this wetness is intrinsically tied to the ebbs and flows of the monsoon. It also shifts the analysis away from an object-oriented ontology, and toward an affective phenomenology of existence[30]. In this way, wetness is a quality, an affect, a *feeling*, rather than an object. In doing so, da Cunha and Mathur put forth an engagement with a monsoonal aesthetics that is less meteorological and more affective, and is to be explored through song, dance, poetry, art, and other qualitative and phenomenological accounts[31]. Da Cunha and Mathur help us think about this by highlighting that the reality from which maps are drawn and infrastructures are made, is only one part of the hydrological cycle. The hydrological cycle moves from rain, to flow, to evaporation, and finally condensation. Cities are designed through an infrastructural thinking has been primarily concerned with the time of flow formation on the Earth's surface. This means that the monsoon comes and goes, and that it can be conceived of as water landing and flowing on a surface. It is discrete. In this separation, a surface is made, and a line is drawn between land and water. From the complexity of wetness, came a rendering of the monsoon

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[30] Object-Oriented Ontology (OOO) is a recent turn in the continental philosophical tradition of materialism (or new materialism), championed by the likes of Graham Harman and Timothy Morton, which aims to reject human exceptionalism by flattening the ontological analysis to include all things, human and non-human. This turn has been critiqued for its lack of attention to power and subjectivities. For a critique of OOO relevant to this paper, see (Hepach 2021).

[31] Here I am also indebted to the Monsoon Assemblages research group at the University of Westminster, where I first presented this research in 2019.

as a series of flows that needed to be contained. And in its containment, water in a line, on a

surface, creates *land*. Water was in this way, in service of a (colonized) land.

This engagement with wetness rather than water has recently found companionship, primarily

with geography, media studies, and island studies scholars (Candiani 2014; Baldacchino

2012; Krause 2017; Cavallo, Vallerani, and Visentin 2021) . Kimberly Peters and Philip

Steinberg suggest thinking with a wet ontology, where "the sea's material and

phenomenological distinctiveness can facilitate the reimagining and re-enlivening of a world

ever on the move" (Peters and Steinberg 2019, 248; Steinberg and Peters 2015). They find a

wet ontology helpful to move beyond some of the ways in which geography has been stymied

by land-based thinking of linearity, solidity, and territory. Similarly, Melody Jue proposes a

milieu-specific analysis that "figures as a general conscientiousness of the environmental

conditions in which scholars produce theories" (Jue 2020, 13). She does so to bring seawater

into an analytical framework that "focuses on the relationship (and tension) between the

interpreter's normative environment of interpretation and the ocean as an environment of

interpretation" (ibid, 20). Kochi might even be thought of as an urban variation of what Philip

Hayward has proposed as an *aquapelago,* where "a social unit existing in a location in which

the aquatic spaces between and around a group of islands are utilised and navigated in a

manner that is fundamentally interconnected with and essential to the social groups'

habitation of land and their senses of identity and belonging" (Hayward 2012, 5). However,

while this concept draws attention to watery attachments and envelopments, rather than land-

based ones, it continues to operate within the framework of land and water as separate

material entities. These approaches to both wetness and oceanic interpretation contribute to

the emerging field of 'Blue Humanities' or 'Critical Ocean Studies' that aims to put water at the front of contemporary concerns in environmental scholarship and literature (DeLoughrey 2019). While I draw inspiration from these efforts, I am less interested in the various excesses of the oceanic, or sea water as a medium for ecological thinking, and more interested in how Kochi as a place and as a city, contends with the (colonial) distinctions between land and water through the relationships that have formed there between wetness and infrastructure.

Infrastructure

The history of Kochi and its wetness can be read through ways in which infrastructure has been imagined in the city. Famous as a port city, Kochi has struggled with its more typical colonial infrastructures, especially those that assume access to solid ground (and indeed, a solid underground). In this section, I focus is on two infrastructures in particular: sewers and roads. But first, I need to share how I think about infrastructures and why I think that is important.

I am yet to find a definition of infrastructure that I like. What the term 'infrastructure' captures is as unruly as the lifeworlds they create as physical entities. Infrastructure is more than just public works. People are infrastructure (A. M. Simone 2004), nature is infrastructure (Carse 2012). The fact that the concept defies definition is a kind of testament to the mutability of the term, but if everything (and therefore nothing) is infrastructure, then what is the use? Conceptually, infrastructure provides a useful way of engaging and analysing the relationality of things. Infrastructures are socio-material configurations that bring things into relation, which is distinct from bringing them together. Separation and containment are also

relations[32]. Sewers aim to contain bodily wastes through separation and excision. In their relational capacities, infrastructures might be thought of as "matter that enable the movement of other matter" (Larkin 2013, 329) pushing "ethnographers to address the instabilities of the contemporary world, to highlight movement, contingency, process, and conflict in and through the study of particular infrastructural formations" (Harvey and Knox 2015, 4).

It is perhaps through their relational capacities that infrastructures re-enforce a kind of imaginary surface, a solidity that renders some things wet and some things dry in order to keep things contained and separated[33]. They actually produce this separation of wetness and dryness as much as they rely on it to function. In their separating, they produce straight lines and a rigid surface. In this separation, they also generate something more than physical by contributing significantly to an affect or an atmosphere of a place[34]. And while some will no doubt enjoy the "surface pleasures" that present themselves through these infrastructural fabrications (Anjaria 2020), I'm curious about what other kinds of pleasures might have been lost along the way, and how what is both present and what has been lost contribute to the feeling of Kochi as a city today.

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[32] For more on separation see Liboiron (2021, 48).

[33] In thinking of infrastructures through their relational capacities, I am drawing on the work of anthropologist Atsuro Morita and Casper Bruun Jensen (Jensen and Morita 2017), but also the work of Martinique philosopher Edouard Glissant (Glissant 1997).

[34] I am particularly inspired by anthropologist Maura Finkelstein as she suggests, "to feel infrastructure may not be to 'know' it (in the sense of engineering), but in focusing on affect, my work challenges this framing of expertise and draws urban anthropology away from city planning and back to ethnography" (Finkelstein 2019, 22).

The invention and adoption of sewers in 19th century Europe, and the pathologizing of human excrement has had a surprisingly profound effect on the development of cities around the world (W. Anderson 1995; 2006; Gandy 1999; Chaplin 1999; Levine 2007; Gerling 2019). In their influential book *History of Shit,* Dominique Laporte goes as far to say that the intervention of Victorian era sewers and the politics of waste they embodied "branded the subject to his body, and prefigured, not so insignificantly perhaps, the Cartesian ideology of the *I*" (LaPorte 1978, 31). They did so by formalising relations between the state and public and private ownership of (urban) land. Involved in this was separation of land and water as a way of designing cities, with the control of water as resource (and waste as contaminant) enabling the ownership of land as private property in cities[35]. The assumption that is relevant here is that the ground beneath one's feet is solid, and that one can dig into it, place a pipe in it, and assume that pipe will remain in place and that it won't leak. There is also an assumption that there is an away, someplace else, where the unwanted wastes can go where it becomes someone or something else's problem. This 'away' is often a wastewater treatment plant, but can also be a river, a lake, or the ocean. In Kochi, this away is the backwaters. But the flow of sewage in Kochi doesn't happen through pipes, it happens on roads and in canals.

Due to Kochi's incredible wetness, most of the population rely on above ground or cement-lined underground septic tanks, rather than sewers to dispose of domestic and commercial wastes. These tanks require emptying, something that is done by manual laborers and septic

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[35] This is often referred to as the Haussmanization of Paris, a prototype for urban development the world over, see Gandy (1999).

trucks in the cover of night. Together with my research assistant, I interviewed a group of these septic tank cleaners one afternoon early on in my fieldwork as they were getting ready to start their shift. They told us that many of the tanks they service were overflowing or damaged, that many residents use makeshift septic tanks that leak instead of the commercial tanks with government approval. Because of the high-water table, a leaking septic tank means that it is likely that the septage has contaminated nearby sources of drinking water such as wells. In a densely populated city such as Kochi, the tightly packed residential houses mean it is increasingly difficult to keep sufficient separation between septic tanks and drinking water. Furthermore, I was told that many septic trucks, once full of domestic waste, often empty their collected septic waste directly into the backwaters to avoid driving across town on congested roads to the one wastewater treatment facility that charges a service fee[36]. The use of roads thus enables different forms of politics to emerge around the containment and treatment of sewage.

Sewers and roads are two sides of the same coin. This is especially so in Kochi. One of the reasons I was given for why Kochi didn't have more sewage networks was the disruption it would cause to the already congested roads that require constant maintenance due to Kochi's wetness. Kochi's roads are some of the most congested in India. Adopted through many years of colonization, the roads initially sped up the transport of spices and other goods coming down from the Western Ghats and to the Arabian Sea to be shipped to Europe and other parts

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[36] I was also witness to, and heard mention of, wastewater pipes diverted directly from properties to water bodies where the opportunity arises.

of the world. These goods would have once been transported on water, but the invention of automobiles and the shift to a petro-modernity (Daggett 2019; Howe 2019) quickly surpassed these humbler means of transport. As Penny Harvey and Hannah Knox note about the adoption of roads in Peru, they "shifted the axis of activity away from the river [and] brought about a different kind of opportunity and created a new kind of settlement" (Harvey and Knox 2015, 35). As roads were adopted in Kochi, transport along the many lakes and canals in the city reduced. As more people used the roads, more roads needed to be built, and the canals—no longer used for transport or pleasure—gradually turned into drains for domestic and commercial runoff. Many of Kochi's canals are now clogged with discarded plastics and weeds including hyacinth introduced from South America.

Today, Kochi's roads are in a constant state of disrepair, with large potholes developing each time there is a downpour. The constant 'roadworks' to make a floating ground solid create traffic jams that rival cities ten times bigger like Bangalore and New Delhi. To understand why roads continue to be the normalised and naturalised mode of transport infrastructure in the city, it is useful to understand infrastructures as being more than just a technical apparatus. As Brian Larkin explains: "a road's technical function is to transport vehicles from one place to another, promoting movement and realizing the enlightenment goal of society and economy as a space of unimpeded circulation. But it can also be an excessive fantastic object that generates desire and awe in autonomy of its technical function" (Larkin 2013, 333). The abandonment of the wetness in Kochi is not just a technical issue, it is also about complex histories of colonial rule and how they resonate in the present as (post)colonial aspirations and desires. Kochi has been changing rapidly since the liberalization of the Indian economy in the 1990s, and like many other mid-sized coastal cities in South Asia, has dreams

of becoming the next Singapore. A reproducible model of development which hinges on large infrastructural projects creates an atmosphere of what cultural studies scholar Lauren Berlant calls "cruel optimism", where "a relation of attachment to compromised conditions of possibility whose realization is discovered either to be impossible, sheer fantasy, or too possible, and toxic" (Berlant 2011, 24). The legislated aspirational attachments in this oceanic city are to legible and standardized ideas of what progress and success are, often determined by technologically driven state based funding schemes, like the 'smart cities' program currently underway across India (Drew 2020). This attachment requires a kind of forgetting, and in Kochi, that forgetting has something to do with the way an abundance of wetness above, below and around oneself conditions the possibilities of life, forging fluid relations. Roads, and other colonial infrastructures like sewers sever that relation.

Envelopment

To hold the affective qualities of infrastructure and wetness together, I turn to what geographer Dereck McCormack terms envelopment. Here, envelopment is "a process that shapes the relation between forms of life and their elemental milieus … a way of thinking through atmospheres and entities without reducing one to the terms of another" (McCormack 2018, 32). The example that McCormack often refers to in his book, *Atmospheric Things*, is an aerostatic balloon. Hot air balloons, weather stations, and other spherical floating objects provide inspirational ground to theorize about atmospheres and the things that exist in relation to those atmospheres. As such, as it is presented here, envelopment is situated as a way of engaging with things that are airborne. This example reproduces a tendency when

discussing atmospheres to fix attention to the sky and that which is encompassed by *air*. As anthropologists Tim Choy and Jerry Zee elaborate:

> "*This form of thought looks up and around, at plumes, clouds, and sky. It looks inward through the vital interiors that render bodies channels, containers, and filters for airs and the things they hold. More significant than the directionality of its gaze, however, is its manner of attunement to the potentials of substances to shift from states of settlement or condensation to ones of airborne agitation, to settle again in time, or to activate a reaction, somewhere else. The wrong air of the Anthropocene trains our attention to the mechanics of suspension, to how things lift and settle in mediums, to how things exist in atmospheres.*" (T Choy and Zee 2015, 211)

I would like to extend this assertion by pointing out that clouds, plumes, and bodies, are mostly containers of *wetness* in its various manifestations, rather than of air. Envelopment is not just related to being suspended in things that are skyward or airborne, it can also "move bodies to become more or less responsive to their conditions, and to modulate their capacities to act into and within these conditions", regardless of their elemental milieu (McCormack 2018, 19). As I've highlighted above, the fluvial nature of Kochi does not just manifest as water flowing alongside land, but occupies space below, around, and above the human and more-than-human inhabitants of this place (often manifesting as sweat on my forehead, for instance). Kochi's wetness is an atmosphere that is more than rain falling on land then rendered useful to carry away unwanted things. It is something that continues to emerge amid the everyday lives of Kochites, significantly shaping the affective experience of the city, and

the ways in which infrastructures can (or cannot) function. Kochi's roads and (lack of) sewers are enveloped in wetness.

Thinking about envelopment in relation to Kochi reminds us that paying attention to atmospheres doesn't just mean looking up, it means looking down and around as well. Suspension is not a skyward attachment, but an Earthly and aqueous condition. To bring atmospheric attention to wetness and infrastructures together, in a way that privileges an (under)ground, disrupts the surface thinking inherent in infrastructural projects such as sewers and roads that produce water and land. Indeed "attending to atmospheric attunements means chronicling how incommensurate elements hang together in a scene that bodies labor to be in or to get through" (Stewart 2011, 452). To be in relation to the ground in Kochi is to be in relation to wetness. To be in Kochi, is to be enveloped in wetness.

"Kochi is a feeling"

I started this essay by stating that Kochi is a city historically defined by its relation to water. This slippage turns Kochi's wetness into water, as a manageable resource in opposition to land, in a kind of cartographic negation. To show how this plays out in the city today I used both sewers and roads as examples of surface thinking, and how Kochi's wetness exceeds those infrastructural materiality's. To move beyond these seemingly incommensurate elements, I have suggested Kochi is enveloped in a wetness, and that this wetness has significant influences on the ways in which infrastructural development can play out in the city, even if roads and sewers continue to be constructed. From the historic flood of 1341 that flattened the city of Muziris to the backwater's tourism and modern infrastructures that fill

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the city today, Kochi is constituted by *wetness* and *infrastructure* in many ways. Moving the analysis away from water as an *object* toward wetness as an *affect* centres the embodied experiences of the infrastructures mediating that wetness in a rapidly changing city.

Wetness and infrastructure interrupt one another as they exist together at the same time in Kochi, and I want to now turn to how that *feels*. I do so by drawing on a popular saying in Kochi that I came across during my engagements with the Kochi-Muziris Biennale: "Kochi is a feeling". The promotional posters with this slogan written across the top feature two fish enveloped in waves, enveloped in wetness. With this as my inspiration, my wager here is that the feeling that Kochi generates – it's ontological affect – has something to do with its envelopment in wetness and infrastructure, and the relation between the two. If infrastructures tend to separate water from land, and turn wetness into water, how does the enduring wetness of Kochi, and the way it interrupts those infrastructures, shape the experience of the city? To ground a contemplation of these queries within the final discussion, I share some personal experiences of the devastating floods that enveloped Kerala in August 2018.

Figure 9: Kochi is a feeling.

The floods that killed hundreds of people in Kerala in August 2018 were caused by intense wetness and failures of (post)colonial infrastructural thinking. Initially, most of Kochi was largely spared the devastating flooding that hit lower parts of the state. That was until the intense rain led to the decision to open the overflow gates of the Idukki dam, one of the largest dams in South Asia. This decision caused the Kochi International Airport, which was built on land reclaimed from the Periyar river, to turn back into a river, disrupting international flights for over two weeks. It also made the flooding much more devastating for those who live near the banks of the Periyar river, including those living in Ernakulam. In some parts of the city, the entire ground floor of houses was under water. The trains stopped operating as the water from the floods was up to the height of the platform. Once the waters had receded slightly, I caught a train from Kochi to Trivandrum with my friend who had changed the departure of their international flight from Kochi to Trivandrum. We had to

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wade through knee high water in the backstreets of Ernakulam to reach the train station. The train was intensely overcrowded with others whose travel plans changed at short notice and were desperate to reach Trivandrum. We spent the 5-hour long train ride standing in the doorway of the train compartment with about 7 others, the doors open, occasionally swapping positions to sit with our legs dangling out of the train just inches above the flooded plains below the tracks. On some sharper corners that emerged through the engulfing green, it felt as though the train would topple into the wetness below.

A few days after the treacherous train ride to Trivandrum, on August 22nd 2018, six days after the flooding began, I tried to get from my apartment in Fort Kochi to Ernakulam to visit the Cochin University of Science and Technology (CUSAT). I was heading there to meet some research participants and to visit a large flood relief camp for those who had to evacuate their houses. In my typically stubborn (and on this occasion, foolish) resistance to private car rentals, I set out from my apartment in an autorickshaw to the Fort Kochi-Ernakulam ferry, anticipating that water-based transport might be safer and more reliable in a flood. To my dismay, the ferry was not running because of the volatile waters. I decided to find an auto driver willing to drive me across to Ernakulam, where I hoped to catch the above ground metro to CUSAT assuming that an above ground metro would be unaffected by the flood waters. Once again, I was wrong. The metro train yard was flooded. By this point I was hungry and starting to get frustrated, so I waved down another auto and asked the driver to take me to Lulu Mall, a large shopping mall not too far from CUSAT, where I could take a moment to reassess my day. As I walked up to Lulu Mall, I realised it too had succumbed to the floods, and was not open to the public. Upon this realisation, I had no option left but to

get another auto from Lulu Mall to CUSAT and hope that those I was meeting would accept my dishevelled arrival and have something for me to eat. Eventually, after meeting with the professor I had been in contact with, I was taken to a small canteen, operated on the ground floor of someone's house, tucked in behind the university. I remember it being one of the best thali's I ate while in India. After lunch we visited the flood relief camp, where some 3000 people where sheltering. Whole families gathered in large classrooms, aunties and uncles resting against walls, children playing together under tables and chairs. One woman told us the flood had changed her, and that she doesn't need anything anymore; it had taught her a valuable life lesson. On another occasion, a few days later, one of my closest collaborators in Kochi summarised the 2018 floods by saying "we are used to floods, but we have forgotten that we are used to them".

The inconvenience I experienced was nothing compared to those living closer to the Periyar riverbanks. Three days later I visited some houses in Aluva, near the airport. Most houses were still standing, but the flood waters had risen so high that I struggled to find the high-water mark when I reached the house of a family member of a friend who lived in the area, only to find out that it was on the second floor. Everything in the house was coated in a film of silt, a visible reminder of the entangled nature of wetness and earth. We spent the day sorting belongings into piles and pressure spraying down the walls and floors in the house. Controlled water was being used to clean errant water. We were not sorting belongings into piles of what was to be kept, we were sorting them into piles of how things needed to be disposed. Virtually nothing was salvageable. Meanwhile, the house next door had managed to

find a pump with which to drain the well in their front yard. It seemed that folks were scared their well water had been contaminated by the floods.

Figure 10: Belongings coated in silt after the flood.

These were my only two firsthand experiences of the flooding in Kochi. Much of this time was spent in Fort Kochi where I was living, which was largely spared inundation from the floods due to its location on the other side of the backwaters at the edge of the sea. I spent these days reading the local newspapers and continuing to build relationships with the staff I'd met from the Kochi-Muziris Biennale as they planned the upcoming event. One headline in popular Indian newspaper The Hindu read "Trial by Water", while further down the article the author states "the river has claimed its lost self" (Anandan and Praveen 2018). Another from 'livemint', a popular online news outlet, read "In rapidly urbanizing India, it's time to reimagine water in cities" (Srinivasan 2018). It is this reimagining that I have been attending

to here, by suggesting that envelopment in wetness might be a starting place for thinking through the future of more ecologically sensitive infrastructure in this city. This way of approaching wetness through envelopment was inspired by many of the artworks at the 2018 edition of the Kochi-Muziris Biennale that responded to the floods in their installations. One piece was particularly inspirational, the work of Bangladeshi artist Marzia Farhana titled *Ecoside and the Rise of Freefall.* This artwork, on the ground floor of a building that had a solitary window with a view of the backwaters, envelops the audience in the remnants of the floods that had occurred just months beforehand. With painstaking detail to shape, size, and embodied associations, Farhana spent weeks collecting ruined goods—from appliances such as fridges to bookshelves with hundreds of books—from people's houses that were devastated by the floods. Farhana then hung these from the ceiling in such a way as to create the sensation that one was floating among these items, stolen by the floods, each one coated in the familiar film of grey-brown silt. Art is important in crafting new futures because it "can make a conversation" as another participating artist would later tell me. In this instance, Marzia's work started a conversation not only about the devastation of increasingly frequent and disastrous floods, but also the affective atmosphere, the feeling, of being enveloped in wetness.

Conclusion

Terrestrial and land-based thinking continues to be disastrous for urban settlements as water bodies remain as reservoirs for unwanted things. Putting water at the centre of conversations about infrastructural development has proved to be both promising and difficult as it disrupts the spatial ordering of the city. As geographer Matthew Gandy describes, "the very fluidity of

water as both biophysical and symbolic agency serves to disrupt and challenge simplistic understandings of how complex urban societies function, and the degree to which social and spatial order can ever be achieved under the contradictory dynamics of capitalist urbanization" (Gandy 2014, 54). What I have highlighted here, is that the very framing of land and water as separate entities to be managed is bound up in the problem. In Donna Haraway's now famous words inspired by Marilyn Strathern, "it matters what matters we use to think other matters with" (D. J. Haraway 2016, 12). Attuning to wetness rather than water, is one way to rethink the work that infrastructures are doing.

Envelopment gives us a conceptual framework to begin thinking through wetness and infrastructure *together*. The kind of envelopment I have described goes beyond turning attention to skyward atmospheres to engage with wetness as it surrounds above, alongside, and below. To say that Kochi's ground is floating is both metaphor and literal, the solid surface from which to begin designing and building infrastructures has been constructed and is temporary. The ancient floods of Muziris and the recent floods in Kochi in 2018 attest to this. Attuning to wetness instead of water to grapple with this reality opens thought and feeling up to an existence in the world beyond enduring colonial binaries and separations on which most urban infrastructure is built. As Kath Weston states, the challenge is to "reorganize (our) affective attachments, and with those attachments, the capital-intensive regimes of production designed to elicit them" (Weston 2017, 198). How might a reorganization of affective attachments to an envelopment in wetness change the ways that infrastructures are imagined in urban south India? This question seems increasingly relevant

as anthropogenic climate change continues to accelerate, putting low-lying settlements at further risk of being submerged.

While these insights are grounded in ethnographic attention to Kochi, they are relevant to monsoonal and tropical cities elsewhere. In Darwin, Australia for instance, the movements of the city are incredibly entangled with the wet and dry seasons. Turning these rhythmic patterns into land and water to be managed by state institutions is bound up in the colonization of place. It is in the undoing of this colonial separation that I join da Cunha and Mathur to propose that 'if water separated to be *somewhere* is in crisis today, wetness negotiated *everywhere* holds the way forward" (Mathur and da Cunha 2020, 139). Negotiating wetness everywhere requires a fundamental shift in not only urban design practices, but in philosophical and narrative literature; it requires a conceptual shift. And while my research participants and collaborators in Kochi did not use these exact terms, I believe this (re)conceptualisation heeds their call to reimagine infrastructure otherwise in ways that takes seriously the city's situated ecological and social conditions. Attuning to the affective experience of moving through wetness is key to this reimagining.

Statement of Authorship

Title of Paper	Burning Wet Waste: Material specificity, environmental particularity, and the universality of infrastructure.
Publication Status	☒ Published ☐ Accepted for Publication ☐ Submitted for Publication ☐ Unpublished and Unsubmitted work written in manuscript style
Publication Details	Barlow, M. 2023. Burning Wet Waste: Material specificity, environmental particularity, and the universality of infrastructure. The Asia Pacific Journal of Anthropology. 24(2): 134-152.

Principal Author

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Contribution to the Paper	I am the sole author of this paper.
Overall percentage (%)	100%
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.
Signature	Date: 11/4/2023

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Chapter 5: Burning wet waste: Environmental particularity, material specificity, and the universality of infrastructure

Abstract

The problem of plastic waste accumulating in the environment has become ubiquitous in recent years. One way in which urban governments are looking to solve this issue is by investing one of several thermodynamic technologies that fall under the umbrella term of 'waste-to-energy'. The drawback of such technologies is that the waste stream must be consistent in quality and quantity. By drawing on ethnographic research with environmental activists in Kochi, South India, I demonstrate that particular environmental and material conditions—in this case Kochi's immense wetness—confound the supposed universality of such infrastructures. Querying waste infrastructures in this way also leads to insights that suggest that investing in infrastructures to address issues of plastic waste often deepen attachments to plastic economies of capitalist accumulation. I ultimately argue that addressing environmental and social concerns about plastic waste means broadening what is relevant to infrastructural interventions in urban environmental governance.

Introduction

Capitalism is an enormous smelter, shovelling into its furnace the living and the dead.

(Povinelli 2016, 167)

I had just hopped into my new friend Dr. Manoj's red Maruti 800 as he began telling me about the Kochi government's plans to install a waste-to-energy incinerator on the outskirts of town. As he explained with a characteristic cheek that I would come to know well: 'Now, the waste-to-energy plant is very simple: it's a burner, it burns everything, and they claim it as plasma, blah, blah'. On this predictably hot and humid morning, Dr. Manoj and I were heading to a popular coastal town a few hours' drive south of Kochi to meet with some government officials. As Dr. Manoj manoeuvred between buses and around scooters, he went on to explain the problems he saw with the proposed rollout of waste-to-energy (henceforth WTE) infrastructure in Kerala between blasts of his car horn:

> 60 per cent of [our] waste is biodegradable waste, of which 80 per cent is water, so if you take 100 tonnes of waste, literally 50 tonnes is water… incinerating this waste [means] you need to evaporate water, the heat required to raise the temperature from 35 degrees to 100 degrees—then you have this latent heat right? So, every kilogram of waste will take 4.6 kilojoules of energy, just latent heat, it's a huge [amount of] energy ... And when we start calculating this latent heat and the energy required, the whole quantity of energy produced, if it is like 10 kilojoules, 8.5 kilojoules are required for [the] evaporation of water. So, you end up with 15 per cent of net energy.

Dr. Manoj and I had met the previous day at the Cochin University of Science and Technology (CUSAT) where, together with Georgina Drew[37], we had hosted a life-cycle-analysis workshop for staff and students interested in tackling the issue of waste on campus. A chemist by training and now one of Kerala's leading environmental activists, Dr. Manoj was explaining to me the environmental particularities of Kochi and the material specificity of its waste, and how those two things highlight problems with the supposed universality of WTE infrastructures built to address the accumulation of plastics in the environment. Burning waste is illogical in Kochi because the waste 'profile' is too wet; it does not match the kind of waste that incineration infrastructures require to make energy—waste that is low in moisture and high in calories (e.g., plastics). Further to that, the environmental conditions of Kochi, hot and humid year-round, and intensely wet during the monsoon season, do not make for a conducive environment for incineration as a form of waste management or energy generation. More infrastructure to evaporate moisture means more energy is used in the process and the returns in the form of energy are greatly reduced. Despite these inefficiencies WTE continues to be pursued by the local government in Kochi due to economic incentives to keep plastic economies afloat and the political benefit of being perceived to be solving the problem of waste accumulating in the city. How to both make plastic waste go away and invest in plastic's future hinges on its disposability, which, as I highlight, is quite problematic in Kochi. In other words, the future of plastics depends on the ability of plastic manufacturers to find suitable ways for it to be disposed of and reused. WTE in the form of gasification—more on this later—is just one in a suite of different

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[37] Associate Professor Georgina Drew, my PhD supervisor, was conducting research into the cultural politics of rainwater harvesting in Kochi at the time.

technologies currently being pursued as part of the frontier of plastics recycling (Mangold and von Vacano 2022).

Despite their opposition to the installation of a WTE plant in Kochi, Dr. Manoj and allies recognised the problem of waste accumulating throughout the city. Headline after headline during my ethnographic research in Kochi between January 2018 and March 2019 pointed to clogged canals, sewage-infested waters, and the ongoing mismanagement and deterioration of the only waste depot in the city: Brahmapuram[38]. The increasing toxicity of the famous Keralan backwaters that Kochi rests within has led to mass fish kills and a declining biodiversity, making this a serious environmental and social justice issue, particularly as fish is an indispensable part of the Keralan diet. Municipal solid waste (MSW) had also been increasing drastically since the turn of the century. During an interview at the Cochin Corporation (the local government offices), one government official told me that the total quantity of waste received at Brahmapuram had more than doubled from 120 tonnes per day, to 272 tonnes per day, in the ten years since it opened (2008–2018). In the middle of my fieldwork, in November 2018, the Cochin Corporation received a substantial fine from India's largest environmental regulation authority, the National Green Tribunal (NTG). The fine was not only due to the 'unscientific' landfilling at Brahmapuram leading to the leaching of toxins into nearby waterways but also because the Cochin Corporation had not yet built a WTE plant. For the duration of my fieldwork, the Cochin Corporation was

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[38] For a detailed history of the social and environmental justice issues of the installation of Brahmapuram in 2008, see Ganesan (2017).

simultaneously being fined by the NTG for not yet having installed the WTE plant *and* waiting for governmental approvals for the installation of the WTE plant. There was immense political pressure to fix the 'menace of waste' accumulating around Kochi, and WTE provided a technological solution that matched aspirations of urban development aligned with growing patterns of consumption, but it did not meet environmental standards.

While the maelstrom of bureaucracy surrounding waste management in Kochi is interesting and insightful in its own right, in this article I focus on the underlying assumptions about infrastructures and environments that inform the proposal of WTE as a solution to the waste crisis enveloping the city. By emphasising the evaporative nature of WTE infrastructure, I demonstrate how specific environments—in this instance the intensely wet and humid tropics of coastal South India—give lie to the supposed universality of infrastructures such as WTE. In doing so, I suggest that WTE was not only economically unviable due to this abundance of wetness but that it also deepens attachments to plastic economies and extractive capitalism. Instead of promoting a future with *less* plastics that is responsible and accountable to local environmental and social milieus, WTE accelerates and obscures the plastic economy. This is true of an investment in WTE anywhere, but due to the environmental particularity of Kochi and the material specificity of its waste, the investment in WTE here is particularly illogical and misplaced. While Andrea Ballestero has suggested 'the distribution and structure of the financial universe does not match the hydraulic universe', here the intensity of the hydraulic universe is curtailing the financial universe (Ballestero 2019a, 20). In critiquing the plans to install WTE in Kochi, I aim to put 'water at the heart of the narrative' (Amrith 2018, 9), rather than as a problem to be solved through

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evaporative infrastructures. To do this, I first provide some context to the wet/dry nature of Kochi's climate and waste infrastructures. I then briefly describe the ways in which plastics were designed to be profitable through their disposability in the twentieth century before I turn ethnographically to the proposal of WTE in Kochi. Focusing on the making-dry of Kochi's waste demonstrates the lengths to which investors and governments will go to pursue seemingly universal urban development through large-scale infrastructural projects that ultimately prop up the plastics industry.

Wet and Dry Waste

Kochi is the industrial and commercial capital of Kerala, a communist state in the southwest of India nestled between the Arabian Sea and the Western Ghats. It has been the site of infrastructural development since the installation of the Cochin Port by Lord Willingdon in the early twentieth century during the British colonial period, to the recent completion of India's first fully solar powered airport, an above ground metro, and a large transhipment container terminal. In January 2016, Kochi was named by the Indian government as one of the first 20 cities to receive funding as a 'Smart City' (Drew 2020). One of the primary goals of this smart city project was to address the growing waste crisis in Indian cities through technologically advanced means.[39] This recent confluence of waste management and urban development comes on the back of Prime Minister Nerendra Modi's Swachh Bharat campaign to clean up India's cities (Jeffrey 2015; Alley, Barr, and Mehta 2018). As such, the WTE facility proposed at Brahmapuram is part of a larger national narrative that engages

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[39] 'Journey towards a waste-free smart city', 2018. *The Hindu*, 31 December, https://www.thehindu.com/news/cities/Kochi/journey-towards-a-waste-free-smart-city/article25867971.ece (accessed May 23, 2022).

waste management issues through urban development that aspires to global standards, 'prizing the aesthetics of a global modernity over issues of social justice, public health and sanitation, or even environmental laws' (Pathak 2020, 4; see also Rademacher 2008; Ghertner 2014; Kornberg 2019; Chitra 2021). What is often overlooked in these processes are India's very specific social and environmental milieus and, in this instance, Kochi's wet disposition as a tropical city situated on an estuary and among the famous Keralan backwaters and its wet waste profile.

It is no secret that life in South Asia begins with the monsoon (Amrith 2018; da Cunha 2019), and for mainland India the monsoon begins in Kerala. Kochi receives the southwest monsoon in June and the northeast monsoon in October. As such, Kochi (and the rest of Kerala) is one of the wettest places in India—averaging over 3000mm of rain annually—and regularly experiences large flooding events. The city itself is surrounded—or perhaps more accurately *constituted*—by rivers, lakes, and canals, and is bordered to the west by the Arabian sea. This abundance of water used to carry away unwanted things. Yet, as Assa Doron and Robin Jeffrey highlight, 'volume has outstripped capacity' (Doron and Jeffrey 2018, 151). Furthermore, while these water bodies are Ramsar[40]-protected wetlands of

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[40] The Convention on Wetlands is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. It is named after the Iranian city of Ramsar, where the convention was fist signed in 1971. India signed the convention in 1982, and currently has 64 sites designated as Wetlands of International Importance, one of which being the Keralan backwaters that surround Kochi. See https://www.ramsar.org/wetland/india.

ecological significance, due to these ongoing urban development issues—including waste management—they are under serious threat (Figure 4).

Much like the seasons, waste in India is segregated into wet and dry. Wet waste can be broadly understood as organic waste such as food stuffs and other compostable materials and, as Dr. Manoj highlighted, accounts for around 60 per cent of Kerala's waste. Dry waste on the other hand can be considered as non-organic waste, such as plastics and other non-compostable materials. This segregation of waste is crucial to the ongoing composting initiatives throughout Kochi, and for the formal and informal recycling networks to access valuable items with dry waste stream. Segregation of waste is also a central figure in the Solid Waste Management Rules of 2000 (revised in 2016). However, in an effort to convince Kochi to adopt WTE technology and to put sceptical minds at ease, *GJ Eco*—the company installing WTE in Kochi—proposed the collection of unsegregated waste that would then be segregated using a conveyer belt at Brahmapuram. Part of this promise was to monopolise the waste stream towards the WTE plant in an attempt to maximise profits. It would also increase the ease with which the citizens of Kochi could dispose of things, shifting the responsibility of segregation from the home to the waste depot. The company, and by association the municipality, promised a future of less waste pilling up in streets and along canals, and a future where residents could easily dispose of waste without complicated processes of segregation.

Figure 11: A plastic-clogged canal in suburban Kochi.

It is important to note that there is a history of failed WTE projects throughout India (Luthra 2017; Demaria and Schindler 2016; Kornberg 2019). These attempts at solving urban India's waste woes failed due to environmental particularities, community resistance, and difficulties in maintaining the infrastructure. In other words, they highlight that the vision of

what that infrastructure represents is incompatible with specific and situated environmental and social conditions. This is not a new phenomenon for scholars of infrastructure, who have shown how infrastructures 'are important not just for what they do in the here and now, but for what they signify about the future' (Anand, Gupta, and Appel 2018, 19). And waste management, as a particular form of urban infrastructure, 'is more than a by-product of a distinctly human demand for order, but a process actively involved in reshaping our ideals and imaginations in turn' (Reno 2015, 558). Attending to these qualities of waste and infrastructure help us understand why something like WTE is pursued in Kochi despite how illogical and harmful it may be to current environmental and social specificities.

What the pursuit of WTE in India signifies about the future is that there is significant interest in, and anticipation of, waste streams becoming less wet and more dry. As Aman Luthra has noted in relation to WTE developments in New Delhi, WTE represents the 'hope that even if Indian waste might not be suitable for thermal treatment technologies today, it will become so in the near future' (Luthra 2017, 52). WTE is an investment in the fact that India's trash is changing; this is also an investment in a cultural shift towards a more consumerist and clean India (Rademacher and Sivaramakrishnan 2013; Pathak 2020b). Furthermore, as Rosalind Fredericks has demonstrated, determining what people consume and how they discard is increasingly a 'primary form of state power' (Fredericks 2018, 32). I add to this dialogue by highlighting how environmental particularity is simultaneously ignored by aspirations to address a waste crisis through infrastructural development (WTE) *and* is the cause of insurmountable economic and material problems in the implementation of the project. The considerations of Kochi's wetness came *after* the decision to engage with

WTE as a solution to the problem because urban development that mirrored global standards and national aspirations was more important than situated environmental and social processes. Further afield, anthropologist Amy Zhang has shown how a wet waste profile in urban China led to localised innovation and opposition to WTE projects, even if those projects inevitably reproduced capitalist logics through their attempts to meet the 'contradictory demands of ecological urbanism' (Zhang 2020, 96). I take a step further back to suggest that the material specificity of plastics, and their entanglement with capitalist structures, means that any attempts to address their accumulation in a specific environment while not curbing their production will inevitably reproduce capitalist (and colonial) logics (Liboiron 2021). Understood in this way, WTE emerges as what Jacob Doherty calls the 'waste frontier': where new forms of value are sought *through* managing the crises of capitalism (in this case addressing an abundance of waste through infrastructures of disposability) towards supposedly abundant futures (Doherty 2019a, 326).

In the following discussion, I draw on 10 months of ethnographic fieldwork in Kochi, where I explored the connections between the tropical environment of south India, the coloniality of urban infrastructure, and local resistance to waste. During this time, I engaged with over 100 environmental activists, engineers, waste workers, teachers, students, government officials, artists, and curators. Through my associations with waste activists in the city I became involved in efforts to attempt to persuade the local government to stop the transformation of the landfill to a WTE facility and to instead focus on community-scale reduction and reuse of plastics, alongside the implementation of single-use plastics bans and composting initiatives at institutions such as hospitals and colleges. Below I share two

ethnographic vignettes: a public consultation at a sustainability fair in central Kochi I

attended with Dr. Manoj where a representative of GJ Eco explained the proposal of WTE,

and a site visit to Brahmapuram I took with Dr. Manoj on one of the last days of my

fieldwork. Together they help to demonstrate the vexed problem of waste management in

Kochi and the ways that ill-suited infrastructures are promoted as solutions.

A Brief History of Plastics and Disposability

Plastics were not always made to be disposed of. The ephemeral and ubiquitous plastics that

accumulate in environments today are largely thermoplastics. These plastics emerged in the

post-war period as the plastics industry shifted from materials designed for durability and re-

use, to packaging that was designed for single use and disposability. Thermoplastics, such as

polyethylene and polystyrene, could be melted and reshaped again and again, 'their

molecular flows made anything seem possible' (Hawkins 2018, 98). In order to make

thermoplastics, chemical compounds called 'plasticisers' are added to plastics in order to

render them more flexible. These plasticisers are also harmful endocrine disruptors once

ingested by (human) bodies and can cause a range of issues from cancer to miscarriage

(Liboiron 2016).

The shift from durable and reusable plastics to single-use plastics was primarily taken up in

pursuit of profit. As Gay Hawkins explains, 'low cost, high volume packaging was going to

realize the plastic industry's real economic potential: the future of this material was in

turnover, not durability' (Hawkins 2018, 98). This turn by the plastics industry consolidated

a turn towards disposability that had become part of North American and British domestic

dispositions throughout the twentieth century. The waste crisis in Kochi today is in many ways a result of this shift to high turnover materials and their eventual entry into India in the 1990s through processes of neoliberal economic reform that supported entrepreneurialism and global consumerism based on convenience (Irani 2019; Pathak 2020a). Plastics are now ubiquitous in Kochi, both in consumer practices and as environmental pollution in Kochi's many clogged waterways, although as I highlighted above, the waste profile still maintains a high portion of wet waste.

For the WTE infrastructure to operate in Kochi it requires a certain amount of high calorific waste. In one local newspaper article it was explained that the 295-crore rupee (close to $40 million USD) WTE plant would have a 300-tonne capacity, and that the Cochin Corporation would be responsible for supplying the WTE plant with all 300 tonnes every day.[41] If the Corporation did not supply 300 tonnes per day, it would have to pay compensation to the WTE company (GJ Eco). As such, it is not possible to imagine a scenario where the volume of consumed and discarded plastics is reduced *alongside* the installation of WTE infrastructure. An investment in WTE is therefore an investment in plastics *through* their streamlined disposability. WTE is an infrastructuring of plastics' disposability. As I mentioned above, this involves the monopolisation of the waste stream, taking other flows of revenue away from informal economies of recycling, consolidating economic power in the plastics industry, and making this a social justice issue as much as an environmental one. Specificities of place, both environments and social relations, matter to how waste should be

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[41] M.K. Sunil Kumar. 2017. 'Kochi Work on Waste to Energy Project to Begin this Month in Kochi', *Times of India*, May 19. https://timesofindia.indiatimes.com/city/kochi/work-on-waste-to-energy-project-to-begin-this-month-in-kochi/articleshow/58726947.cms (accessed October 28, 2022).

managed. How waste is managed, however, has planetary consequences, and attention to the

material specificities of plastics teaches us that they are geological in their production and

their disposal (Hecht 2018; Liboiron 2020). Plastics are not able to be contained as easily as

WTE proposes. To unpack this further, I now consider WTE as an evaporative infrastructure

that turns Kochi's waste into what it needed to be in order to become fuel.

Evaporative Infrastructures

I learnt of the history of GJ Eco by coincidentally attending a speech given by a GJ Eco

representative at a sustainability fair I attended in Kochi on August 12, 2018. Throughout

the speech the representative—a Keralite now based in the UK—repeatedly addressed

concerns raised in public discourse about the viability and long-term sustainability of the

proposed WTE project. Kerala has a fraught history with incineration technology as a form

of waste management dating back to 2012. In the state's capital, Thiruvananthapuram, local

protests around the adoption of incineration and a lack of technical expertise in operating the

incinerator forced it to close after less than two weeks of operation (Choudhury 2017). The

speech thus had a defensive tone to it; he was explaining why it was necessary for the WTE

plant to go ahead despite the criticisms and previous unsuccessful attempts. Below I provide

a detailed account of the GJ Eco proposition as it was presented during this public

seminar—no doubt part of their public consultation processes—ultimately highlighting the

allure of WTE as a means of addressing the waste crisis.

The first announcement of a WTE facility to be constructed at the Brahmapuram site came

in 2015 when the Cochin Corporation approved the project. However, GJ Eco's 'journey'

started back in 2012 when they began 'continuous waste studies' to analyse the characteristics of Kochi's waste. Their findings were that WTE had failed in India previously because the waste had not been *adequately converted into fuel*. The key characteristic of gasification technology, and the reason why it had failed elsewhere—according to the GJ Eco representative—was that the fuel put into it needs to be within a specific envelope. If the waste content does not fall within that envelope, the aim of generating a surplus of energy will likely fail. What was implicit in the way this representative presented the company's findings was that Kochi's waste profile does not fit that envelope. He went on to explain that the first 'hurdle' when trying to fit WTE technology to Kochi's waste profile is its moisture content, which he told the audience—around 50 eco-conscious citizens and stakeholders—was about 50 per cent. The second hurdle, according to the representative, was ensuring that the waste that entered the incinerator was adequately segregated, noting that there was a lot of contamination of the waste profile through mostly unsegregated collections throughout the city. Rather than work with the Kochi population to encourage segregation at source—a requirement of the 2016 municipal solid waste management rules and something that waste activists were working towards during my fieldwork—GJ Eco proposed to accept unsegregated waste in an attempt to monopolise the market and then to segregate the waste at Brahmapuram. The representative then went on to explain the details of the two technological solutions to these fuel preparation problems.

GJ Eco understood Kochi's wet environment as a problem that could be overcome through innovative evaporative technology. The problem of moisture in the waste profile would be

solved through a patented vortex membrane that would encourage a process that the representative referred to as 'bio-drying'. The function of this membrane would allow moisture to evaporate from the waste and prevent it from being absorbed into the waste, facilitating a one-way movement of moisture. According to the representative, it was estimated that over a period of 21 to 28 days the moisture in the waste profile would be reduced to 27–30 per cent and, therefore, within the envelope of what counts as the right kind of 'fuel' to extract energy from waste through incineration. At this point in the presentation, the representative introduced an example of a WTE plant on the coast of Turkey, where there was a similar waste profile. In this example, air is pumped into the waste covered in the membrane, encouraging the growth of thermophilic bacteria, and pushing the temperature of the matter up toward 80 degrees Celsius. Once the moisture levels are within the correct envelope, the combustibles need to be segregated from the non-combustibles. This leads to the second solution, an automated conveyer belt, three kilometres in length, with density and magnetic separators. High density plastics, metals, and construction materials which have either no calorific value or a high recycling market value of their own are segregated out. What is left then, is 'the organic factions' and the low-density plastics. Once isolated, these are chopped into 3mm particles and put into the 'bunkering system' as 'refuse derived fuel'. The preparation stage finished, the gasification process then takes over—the start of the combustion process. The gasification process referred to by the representative is Plasma Gasification Melting (PGM). It is claimed that this technology may not be as harmful as previous waste incinerators due to the preparation of plastics into small pieces and the intense heat at which it is melted using plasma technology. But according to a recent edited volume about the gasification of waste

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materials, it does generate fly ash,[42] which consists of PM10 and other miniscule particles that can cause respiratory illness (Ciuta 2018). So, while leachate from the landfill at Brahmapuram poses an environmental justice issue, so too does the WTE infrastructure posed to solve it. Both of these infrastructures replicate colonial and capitalist logics, highlighting the need for solutions to the plastics crisis to go beyond disposability and to address the production of plastics (Zhang 2020; Inverardi-Ferri 2018; Liboiron 2021). To further understand these relations between WTE, plastics, and the proliferation of social and environmental injustice, it is instructive to briefly explore the social history of thermodynamics.

Thermodynamics is a scientific process of heat transfer which transforms high calorific material (such as oil and oil derivative products such as plastics) into energy. The process was invented in Glasgow in the nineteenth century, and through the power of steam, rather than water, quickly overtook hydropower as a means of energy generation throughout the British empire and then around the globe. This invention set in motion the course for the petro-modernity we are currently in, and in no small way enabled the expansion of imperialism and capitalism around the globe (Malm 2016). However, the revolutionary impact that thermodynamics generated was not due to some kind of intrinsic technological prowess or mechanistic efficiency; rather, it was because it consolidated expanding capitalist

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[42] Dr. Manoj mentioned to me a few times about research being conducted into efficient use of fly ash as bricks and other valuable materials, but his opinion was that once it was in the environment, it was very difficult to avoid its toxicity.

modes of re/ production and re/arranged labour relations in the United Kingdom in favour of capitalist accumulation (Daggett 2019; Malm 2016).

Through the invention and consolidation of thermodynamics into capitalist modes of production, 'the British empire' thus perfected the double manoeuvre—the acceleration of work and the concealment of waste—upon which industrial governance still depends' (Daggett 2019, 154). WTE, as an evaporative infrastructure in Kochi, aims to perfect this very same manoeuvre through innovation geared towards capital accumulation. Key MacFarlane refers to this manoeuvre as 'waste switching' (MacFarlane 2019, 227) (MacFarlane 2019, 227), where the incentive of turning the 'political other' (Gidwani and Reddy 2011, 1625) of capital (waste) back into the capitalist system (as wealth, or energy) is too great—even if the environmental conditions mean little social or economic benefits to this process in tropical places like Kochi. As such, pitched as a 'socioecological fix' to urban governments' increasingly dire waste woes, WTE infrastructure continues to lock the city into a system of consuming and disposing of plastics, accelerating ecologically disastrous capitalist modes of production and consumption in the process (Behrsin 2019). In fact, my interlocutors—including Dr. Manoj—often claimed that plastic manufacturers were behind the promotion of the WTE plant in Kochi as it would halt the adoption of single-use plastics bans and essentially commit Kochi to a consumption pattern that fit their 'predatory and violent economic relations' (Daggett 2019, 30).

In relation to the history of thermodynamics, WTE emerges as the logical progression of this energy regime entrenched in capitalist reproduction and urban environmental governance.

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Engineering away the problems of both waste and water is a technologically complex yet politically convenient answer to Kochi's waste crisis, as it promises to clear the canals and the streets by turning plastics into fuel. This is deemed easier, more innovative, and more productive than alternatives that include plastics bans and community scale initiatives. As Assa Doron and Robin Jeffrey state in relation to the incineration of waste in urban India: 'Bringing waste collectors and waste makers into effective cooperation to minimize waste and treat most of it close to home offers more beneficial possibilities for making India cleaner; but the quick-fix efficiency of mechanized mass destruction seems easier and more tempting than achieving such cooperation' (Doron and Jeffrey 2018, 151). These sentiments echo what anthropologist Chloe Ahmann has noted on the disposition of WTE infrastructure whereby 'cashing in on modernist desires to engineer away problems without behavioural change, incinerators thus offered grand solutions to some of humankind's most common nuisances' (Ahmann 2019, 331). Exploring WTE as an evaporative infrastructure from the vantage of Kochi highlights how one of the problems to be engineered away is the wetness of tropical South India. The other problem is the accumulation of waste leaching into the waterways at the defunct waste depot Brahmapuram, which is where I now turn my attention.

Legacy Waste

On what was effectively my last day of fieldwork in Kochi in April 2019, I was finally able to visit Brahmapuram after many previous attempts were refused by local authorities.[43] The

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[43] There is a long and recently revived literature on the intersection of anthropology and refusal. Carole McGranahan, building on the seminal work of Marcel Mauss, takes the stance that a refusal is not necessarily a severing of social ties, but instead can be thought of as 'a generative act, a rearrangement

circumstances of my visit were somewhat obscure, as I was under the impression Dr. Manoj

and I would be venturing via boat to a position close to the waste facility so as to see what

was going on from the water—because we had still not received official permission to

actually enter the facility. But once I arrived at Dr. Manoj's house and had been fed some

very peppery eggs and a thickly fermented ginger and curd miracle drink—what he referred

to as 'gruel'—I was told we were actually driving into the Brahmapuram facility. This was

thanks to Dr. Manoj's friend and close sustainability ally who, I was told, had a good

relationship with the relevant ward councillor. With this news, I simultaneously felt both

excited and frustrated. While I was thrilled to be finally headed into the waste depot, I was

relatively unprepared for the excursion—evident by the fact I had intentionally chosen to

wear sandals for what I expected to be a wet adventure. If I had known we would be

venturing inside the depot, the least I could have done was put on some closed toe shoes.

After collecting our Bramapuram contact in Dr. Manoj's trusty Maruti, we made our way

across the industrial petrochemical belt on the eastern edge of Ernakulam where Indian Oil

tankers line the roads and men drink toddy[44] seated under trees or large umbrellas. About 15

minutes later we arrived at the entrance to Brahmapuram.

We met the local councillor upon arrival. He was a thin senior man, with a serious

demeanour. He seemed either slightly unimpressed or simply not bothered by my presence.

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of relations rather than an ending of them' (Mcgranahan 2016, 335). This is the spirit in which I took
these refusals. I am also reminded here of Mary Douglas' *How Institutions Think*, where she states,
'Writing about cooperation and solidarity means writing at the same time about rejection and mistrust'
(Douglas 1987, 1).

[44] A slightly alcoholic drink made from the fermented sap of coconut palms.

We hopped into his car and drove further into the facility. Immediately we started noticing GJ Eco signage on billboards and the entrances to buildings. Up until this moment, Dr. Manoj and I were under the impression that GJ Eco had only been given access to the site, not that they had already *moved in*. We drove past a lane that led down to the Sewage Treatment Plant (STP), then past the Material Recovery Facilities (MRF), before stopping at the section of land dedicated to Flood Waste.[45] As we gathered around the car some dogs, coated up to their chins in mud, noticed our presence and briefly stopped chasing each other to inspect us, ears pointing towards the sky.

Figure 12: Walking through Brahmapuram's legacy waste.

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[45] Our visit came six months after Kerala was subject to the worst floods in a century, where over a third of the state was underwater. For a more ethnographic description of this flood, see Barlow (2022).

Our host now took us by foot further into the facility. Here, I began really wishing I had worn closed toe shoes. The dirt path slowly transformed into an expanse of plastic and other discarded things (see Figure 5). Then the mountains of refuse emerged from around the corner. The 3- to 5-metre-high piles of waste covered a large parcel of land that meandered down to the nearby river. Paths wide enough for tractors to drive through had been created, but there was no material separation between path and pile—all was waste. As we moved into the landfill area, walking across compacted plastics and other discards, we came across a young man operating a tractor that was shifting a small part of the waste pile (on which the tractor was perched) to a spot a few metres away. While I was trying to figure out why he would be doing that, I noticed he was listening to a techno remix of Aqua's 1997 hit 'Barbie Girl', the opening lyrics of which are 'I'm a Barbie girl, in a Barbie world, life is plastic, it's fantastic!' At that moment, I burst into laughter. While the inappropriateness of the laughter was a little jarring, the rest of the group understood the irony of the situation and even joined in for a short giggle. Here I was, watching a young man operating a tractor, shifting tonnes of plastic around, listening to a song by the band Aqua (the title of the band seems relevant here) about a fantastic plastic life. He even had tinsel and lights attached to the front of his tractor and gave me a wave and a smile as I watched him (see Figure 3). As we walked through the rest of the facility, looking at the disrepair and the leachate flowing into the nearby backwaters, I could not stop myself from smiling, thinking about this chance encounter with the abject, yet playful, realities of life in Brahmapuram.

Figure 13: Decorated excavator moving legacy waste.

Accumulated plastics like those at Brahmapuram are referred to as 'legacy waste' within the

discards industry. These are the discarded objects leaching into waterways through

'unscientific' landfills, and the Kochi government was under increasing pressure to do

something about it. As my time wrapped up in Kochi, my collaborators, Dr. Manoj included,

conceded that WTE would likely go ahead and at least be able to remove these leaching

mountains of legacy waste and transform them into energy. While we walked through Brahmapuram, Dr. Manoj was surprised at the material make-up of the legacy waste, explaining with enthusiasm that it was quite well segregated and almost entirely made up of plastics that would be suited for thermal treatment. But the question remained as to what would happen to the WTE plant *after* the legacy waste had all been incinerated. Two futures seemed probable: Kochi would continue down this path of development facilitated by the WTE plant that deepens attachments to plastic economies or, like so many other ambitious and misguided infrastructural projects, the WTE facility would lie in disrepair waiting to itself become a legacy *of* waste (Gupta 2018).

Fidelities

I conclude by taking you back to the public consultation seminar with GJ Eco that I attended a few months prior to our visit to Brahmapuram. As the representative of the company finished his speech and started walking through the crowd, he moved towards Dr. Manoj and I. Anticipating Dr. Manoj's questioning gaze, he said 'we are on the same side' before walking further into the crowd and eventually outside. How is it that someone looking to invest in WTE could think he was on the same side as someone committed to the fight against it? This question reminds me of Tim Choy's exploration of the environmental politics of a waste incinerator in Hong Kong in which expertise hinged on different interpretations of pollution (Tim Choy 2011, 76–105). While Dr. Manoj and the GJ Eco representative were both interested in addressing Kochi's waste crisis, they had very different ideas about *how* to achieve this. Thinking with Tim Choy's theorising around the difference between universalism and particularity in approaches to environmental expertise,

GJ Eco was committed to investing in a universal approach to waste management through WTE infrastructure and evaporation—something that had been proven achievable elsewhere. On the other hand, Dr. Manoj was committed to a zero-waste future that prioritised Kochi's environmental particularities through single-use plastics bans in conjunction with investments in decentralised methods of composting (Barlow and Drew 2021). Depending on one's fidelities, Kochi's immense wetness made WTE infrastructure unviable and highlighted predatory economic relations and environmental justice concerns embedded within the specific materiality of plastics, or it signalled an opportunity to demonstrate technological prowess that aligned with global aesthetics of environmental governance alongside aspirations of capital growth and urban development.

The three ethnographic vignettes I have shared here—a conversation with Dr. Manoj in his car, the public consultation seminar with GJ Eco, and the site visit to Brahmapuram—provide insights into the ways in which advocacy against WTE was happening in Kochi. As infrastructures connect the state to its citizens, ethnographic attention to infrastructures must operate in this meso-scale, between the everyday and bureaucracy. One of the lessons that Science and Technology Studies (STS) has imparted on the study of infrastructures is that they are embedded, 'sunk into, inside of, other structures, social arrangements, and technologies', and therefore invite analysis that moves beyond the material and the social, to a relation between those two things (Star and Ruhleder 1996, 113). By highlighting the relation between the tropical environment of Kochi and evaporative infrastructures, I have demonstrated how the material qualities of waste, and the environment within which it is situated, call into question the supposed universality of the infrastructures that

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simultaneously cause and claim to solve the problem of waste. Infrastructures carry with them embedded assumptions about the material and social relations which they seek to transform. The evaporative infrastructures of WTE in Kochi highlight just how much work is done in an attempt to render environmental particularity irrelevant to infrastructure, demonstrating how environments only matter to infrastructure through their negation. I have demonstrated the need to foreground environmental particularity in efforts to address the accumulation of plastics through infrastructural developments. And while 'waste infrastructure can help us to realize our dependence on nonhuman life forms and forces with which we share our bodies, environments, and, ultimately, our planet', the particularity of those environments and the specific material relations of waste in different places matter to how those dependencies unfold (Reno 2015, 558). I emphasise these qualities of infrastructures not to draw attention away from the deeply embedded cultural contexts of caste, class, and gender in relation to waste and pollution in South Asia (Devika 2016; Doron and Raja 2015; Butt 2020b), but, instead, to suggest how environmental particularity, material specificity, and the supposed universality of infrastructure also matter to such conversations.

At the time of writing this article (September 2022), the WTE project at Brahmapuram is still being negotiated, delayed and in limbo between a government proposed solution, private investment, and an unviable infrastructural project.[46] My argument here has in part been inspired by the efforts on the ground in Kochi towards reimagining the conversation

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[46] M.K. Sunil Kumar. 2022. 'Kochi: Waste-to-energy Plant Inches Closer to Reality'. *Times of India*, April 28. https://timesofindia.indiatimes.com/city/kochi/waste-to-energy-plant-inches-closer-to-reality/articleshow/91136566.cms (accessed October 25, 2022).

about waste management from the point of view of the very specific environmental conditions. According to Dr. Manoj and others like him, plastics cannot be disposed of responsibly in Kochi, and they should therefore not be produced or consumed in the city. This belief is tied to intimate understandings of the materiality of plastics, Kochi's tropical environment, the unevenness of global exploitative systems built on the universal logics of infrastructural development, and the relation between those things. Attention to these multiple specificities is crucial if efforts to address environmental justice issues are to avoid investing in the very things causing harm in the first place.

Statement of Authorship

Title of Paper	Waste and its masquerades: On the production of urban natures in Kochi, India
Publication Status	☐ Published ☒ Accepted for Publication ☐ Submitted for Publication ☐ Unpublished and Unsubmitted w ork w ritten in manuscript style
Publication Details	Barlow, M. fourthcoming. Waste and its masquerades: On the production of urban natures in Kochi India. Anthropology Today.

Principal Author

Name of Principal Author (Candidate)	Matt Barlow	
Contribution to the Paper	I am the sole author of this paper.	
Overall percentage (%)	100%	
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.	
Signature		Date 11/4/2023

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

     i.   the candidate's stated contribution to the publication is accurate (as detailed above);

     ii.   permission is granted for the candidate in include the publication in the thesis; and

     iii.   the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Chapter 6: Waste and its masquerades: On the production of urban natures in Kochi, India

Abstract

Much ethnographic attention has been drawn to the systems which help people to dispose of things, and how those systems represent broader political and economic aspirations. Less attention has been given to the aesthetic and ideological character of waste and its management in relation to the production of urban natures. In this essay, I compare the convergence of environmental aesthetics, infrastructural (in)visibility, and the production of sanitized urban space, in two parks in the South Indian city of Kochi. Through this comparison I demonstrate how different approaches to waste management are instructive of broader ideologies about urban environments and their place in urban development projects. I argue that waste and its management is not marginal to the production of urban natures, it is constitutive of it.

Introduction

In 2014, the newly elected Prime Minister of India, Narendra Modi, launched the Swachh Bharat (Clean India) campaign, the largest pursuit of waste reform in its history, and potentially the largest waste movement in global history (Doron and Jeffrey 2018). Part of this campaign placed the duty on citizens to appropriately dispose of their waste with the slogan "my waste my responsibility". In a nod toward Foucault's panopticon of state surveillance the insignia for the campaign was the image of Mahatma Gandhi's glasses. Being seen to do the right thing, was paramount in this milieu of urban development and nation building through direct attention to waste reform and cleanliness and invites an analysis of these waste reforms through critical attention to the visual. It was in this context that I pursued my ethnographic research into waste and its management in Kochi, Kerala throughout 2018-2019. In this article, I explore two different approaches to waste management in two sites of urban nature: the Mangalavanam Bird Sanctuary and Subhash Bose Park. Specifically, I call attention to the ways that waste and its management are central

to the production of urban natures, and how environmental imaginaries are important to how waste is managed. By examining the intersection of the visibility of waste and its management in relation to the production of urban natures, I provide insights into how cities continue to present green space as urban development projects while continuing to pollute the broader environment in more insidious ways.

Kochi is a rapidly developing port city on the southwest coast of India. While not the official capital of the state of Kerala, it is commonly known as the commercial and industrial capital, home to the Southern Indian Naval Command and popular with tourists as well as migrant labourers, health care workers, and increasingly IT engineers and artists. It is also situated among the famous Keralan backwaters, with lakes and canals meandering through the city toward the picturesque Cochin Harbour in Lake Vembenad. This harbour has been the site of colonial and (post)colonial infrastructural development primarily for the extraction of tea and spices from the fertile lands of the Western Ghats[47]. As such, much of the swampy wetland that would've once been covered in mangrove forests is now a sprawling urban centre. There are two remaining sites of green space in the city: the Mangalavanam Bird Sanctuary, and Subhash Bose Park. They offer on the one hand a renewed effort to provide green space to city dwellers for their leisure, and on the other, an effort to conserve biodiversity through the protection of the last remaining mangrove forest in the city area.

In what follows, I analyse how waste is managed in these sites by demonstrate how the production of urban nature—materially and aesthetically—is intimately tied to the ideological functioning of waste infrastructures which hinges on environmental aesthetics. I compare the experience of being in these parks, their use by other patrons, and the way waste is managed (or not) within their boundaries. What comes to light is that attention to individual disposal practices diverts attention away from the much deeper issue of industrial waste management and broader infrastructural relations to the more-than-human urban environment. I argue that there is ideological work being done through the production of different kinds of urban environmental imaginaries, and that attention to waste and its management provides insights into these ideological functions.

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[47] A hilly range that forms the eastern border of Kerala with Tamil Nadu.

Figure 14: Gandhi's glasses.

Waste and the production of urban natures

The importance of waste and its management to the production of urban natures can be traced back to 18th century Europe (Gandy 1999). The debates over waste and the production of urban nature have thus far been centred on the marginal, the places left to decay and grow on the outskirts of the city. These places are also often where landfills and other waste infrastructures are located. In this formulation, there are two common types of urban nature, the marginal places where waste interacts with different species to produce surprisingly resilient and improvisational, or what Bettina Stoetzer refers to as "ruderal", urban ecologies (Stoetzer 2018); and the more sanitised places of urban leisure and entertainment such as urban parks (Sivaramakrishnan 2017). It is here that "specific social expectations, whether made explicit or simply implied, nearly always accompany urban environmental interventions" (Rademacher and Sivaramakrishnan 2013, 12). These insights help to demonstrate that what is commonly presented as "urban nature" is often a product of deep human involvement.

These discussions of urban nature intersect with recent scholarship on the role of infrastructures in mediating urban environmental governance. This literature situates infrastructures as sites of state power often understood as the territorialising projects of empire (Carse 2014; Fredericks 2018). Infrastructures have been characterised as possessing both form and function, which is to say their metabolic function is to move things around, but that their physical presence also does representational and ideological work (Larkin 2013). More recently, it has been demonstrated that through their co-production, the distinctions between environment and infrastructure have become increasingly blurred (Hetherington 2019). This paper builds on these insights by showing how waste and its management are key sites where the co-production of urban space and urban nature is mediated. Sites of non-human nature in cities are anything but natural, but rather the result of spatial planning and governance, often with social and political outcomes—especially when waste is involved (Dillon 2014; Ahmann 2018). Of particular relevance is the visibility of certain kinds of waste (and its management) in relation to the invisible toxicity of slow violence in these places (Davies 2018). Attention to the optics of waste management in this way highlights the ideological function of what Matthew Gandy calls an "ecological aesthetics" (Gandy 2013), where what sites of urban nature look and feel like are more important to urban development than the actual material make up of those places. As such, in the following discussions I compare not only the optics of waste and its management, but also to the ambient experience of these two places of urban nature in relation to the context of the broader urban experience.

Mangalavanam Bird Sanctuary

Known as the "green lungs" of Kochi, the Mangalavanam Bird Sanctuary (MBS) is one of the few remaining mangrove forests in the city, and the last remaining in downtown Kochi. The MBS was established in 2004 but as one employee told me, the forestry department had been "conserving (it) as a sanctuary" since 1954. It is the only bird sanctuary in Kerala located in a mangrove forest. Mangroves are widely known as vital parts of coastal ecosystems as they provide stability to otherwise errant soils, and they act as a carbon sink (Badarudeen et al. 2014). They are vital to the integrity of coastal ecosystems, biodiversity, and regulating atmopsheres. As Laura Ogden has highlighted in her book *Swamplife*, there is a logic to mangroves that operated above and below the surface and does not obey terrestrial boundaries (Ogden 2011). Mangroves like those at the MBS would have once existed along

all of this coastline and through the Keralan backwaters but have been removed over the last 500 years to make the city of Kochi as we know it today through a process of terrestrialisation. The remaining mangroves at the MBS are increasingly under threat from nearby industrial pollution and the presence of microplastics in the water (Badarudeen et al. 2014; Sarika and Chandramohanakumar 2008; Chitra 2016; Kannankai et al. 2022) as toxic water flows through and beyond coastal regulation zones (CRZ) that attempt to prevent these mangroves from being encroached upon even further.

My research assistant and I would often meet at the MBS to discuss my project before carrying on with the day of meetings and interviews about waste management in the city. I recall the first time we met at MBS in August 2018, at their suggestion. It was a warm sunny day in late September, just a few weeks after Kerala had just experienced the heaviest flooding in a century. To get to the sanctuary, I needed to leave the main roads of downtown Ernakulam and veer off around to a road that services the rear entrances of the Kerala High Court. It almost felt as though I had taken a wrong turn and had entered a road that was not accessible to the public. The sactuary was noticeably out of the way, hidden from the main streets of downtown Kochi, with only the one dead end road leading to the entrance. But as I took the final turn north and away from the Kerala High Court, I was greeted with signs alerting me to the fact I had reached Mangalavanam Bird Sanctuary, which eased the sense I had that I was lost. The most notable of which were the signs that read 'PLASTIC FREE ZONE: please co-operate' (Figure …) and the one across the road from it that announced the biodiversity of the sanctuary: 25 plant species (with 5 species of mangroves), 51 spider species, 98 bird species, 17 butterfly species, and so on. The production of this space as a site of urban nature was achieved through these relationships between environment and waste.

Just beyond the signage, my research assistant was waiting for me on the road just outside the entrance to the sanctuary, on a small bridge that went over a small channel that facilitated the tidal movement of water. As we walked into MBS, we were greeted by a forestry official, and an older man sitting in a small booth and who was responsible for taking the registration details of visitors to the MBS. To the left of the registration booth was an old homestead, which I later learnt was the headquarters of the sanctuary. There was also a small hall that could be hired for educational purposes. Despite only being a short walk from the Kerala High Court and the bustling downtown of Kochi, once inside the sanctuary it was distinctly

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quiet and cool. The atmosphere was calm, and I felt invited to slow down, to take my time. The sanctuary consisted of two pathways, one headed north and one south, each only about 20 meters long. At the fork between the two paths was a bird watching tower with a small landing at the top—a place to be in canopy. The paths were narrow, and the paving was patchy or simply not there. Along the edges of these paths were small placards that depict engraved drawings of species that are part of biodiversity showcased in the sanctuary, and beyond which was the mangrove swamp.

Despite the MBS officially being a plastic free zone, waste continued to make its way into the sanctuary through the ebb and flow of the backwaters. As I have discussed elsewhere, much of Kochi's sewage flowed directly into the backwaters (Barlow 2022). A recent study also determined that there was an alarming amount of microplastics in the water of MBS (Kannankai et al. 2022). Earlier in my fieldwork, a group of us including another waste activist and my research collaborator visited the nearby Eloor Industrial Area. It was here that we were told about effluent from tanneries and other petro-chemical industries flowing directly into the Periyar river through covert underground pipes. One newspaper article referred to this place as a "toxic keg", while another described it as a "toxic hotspot" worthy of international environmental concern. These investigative pieces have since been substantiated by a recent study by the Centre for Development Studies in Trivandrum (Devika 2019). In other words, despite the 'plastic free zone' notice at the entrance, my research assistant and I were acutely aware that the water that flowed through the MBS was likely to be quite toxic. During a later visit, a forestry department employee conceded he knew that pollution was coming from the backwaters themselves. When asked about the pollution he said:

> "Pollution is coming from the backwaters… the High Court and other nearby buildings… Actually, most of our sewages are opening to the Vembenad Lake, there is no treatment".

Here the borders of green spaces, even if protected from disposal of solid waste and disposable plastics on site, were transgressed by polluted water which travelled either through pipes, along canals, or through the vast interconnectedness of the backwaters that the MBS was connected to. The life and death of the sanctuary was most acutely tied to the on-going

pollution that was affecting the quality and depth of the lake, which would subsequently reduce fish numbers and then reduce the likelihood of birds arriving to feed and nest. The parks functioning as a bird sanctuary was intimately tied to the quality of the water in the backwaters. As the forestry official went on to tell us:

> "We want to increase the depth of the lake, otherwise the lake will be closed. There are some works being done, the Cochin Corporation wants to do something, but it is not enough. Because (only when) sludge will be taken (from) here and removed outside, then the depth will increase, then only fish sustain here, then birds here for nesting."

These observations of sewage being dumped into the backwaters were supported by other conversations I had throughout the city with government departments, local market stall holders, and waste workers themselves. The attention to individual disposal practices here—and in the Swachh Bharat campaign more generally—did nothing to stop the industrial sewage and toxic effluent from entering this sanctuary. So, while the sanctuary was largely free of plastic litter, and the plastic free quality helped to create an environment amenable to the aesthetics of a wildlife sanctuary, it did little to protect the sanctuary from what is a much more insidious problem. It acted more in an aesthetic register to help produce certain environmental imaginaries and associations, and in a similar way to how the Swachh Bharat campaign placed responsibility on individuals, rather than corporations or industries, to help protect the environment from waste.

Figure 15: PLASTIC FREE ZONE sign at the entrance to Mangalavanam.

Figure 16: Biodiversity of Mangalavanam sign at entrance.

Figure 17: Wooden boats docked among the mangroves at Mangalavanam.

Figure 18: One of many stone tablets showcasing important species in Mangalavanam (note the name in English and Malayalam script).

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Subhash Bose Park

In distinction to MBS, Subhash Bose Park (SBP) is located on the popular esplanade of downtown Kochi, directly next to the main ferry terminal and directly across the road from both the Cochin Corporation municipal building and Maharaja's College—one of India's oldest universities. Instead of being a plastic free zone, plastic consumption seems to be encouraged in SBP, with stalls selling sweets and snacks at the entrances to the park. The park had wide paved boulevards that take visitors around its circumference and down to the edge of the backwaters. The border of the park, which faced the Kochi harbor, was the most popular place for people to rest. It offered views of the backwaters, and if one is lucky, a cool breeze off the water. Between the paths were large lawned areas where children play, and families relaxed. There was a sound system scattered throughout the park playing Hindustani classical music and famous Bollywood songs. And while these aesthetic experiences of the park were notable, I found myself drawn to the numerous bins throughout the park shaped as animals with large lettering on the front exclaiming "USE ME". They were distinctly devoid of situated context in relation to India or Kerala, as generic and mundane as they were universal and playful. As such, they were—like many other urban infrastructures—aesthetic (Ghertner 2015; Menon 2022).

Subhash Bose Park was not always as manicured. One day in October 2018, my research assistant took me for a walk to Maharaja's College. The college, which was named after the famous painter Maharaja Rama Varma, is a cultural icon for Kerala, and the birthplace of contemporary Keralan politics. But as my research assistant told me, prior to the sanitised boulevards of current SBP, this parcel of land between the college and the brackish backwaters used to be unkept park that provided a nice hideaway for college students on break from class. Early depictions of the college showed it surrounded by sandy open land, suggesting this park was likely propagated by the British during the early 20ᵗʰ century. My research assistant recalled fondly the time spent in the park with college mates, where they would wind down after class. She said the straight lines, lawn, and sanitized space of the new SBP didn't appeal to the college students as much as before and lamented the loss of the autonomy associated with the wildness of an unkept space of urban nature. This was the context with which the animal bins have arrived in Kochi, where something that resembled a forest had been replaced by a generic, lawn heavy, family friendly, and increasingly sanitized

and policed site of urban nature. The bins were an extension of this form of governing urban nature, indicated to citizens that the government was fulfilling their duty of adequately managing waste. So what ideological work was going on here, and what does it represent about the use and abuse of nature in contemporary India more generally (Gadgil and Guha 1994)?

Much ethnographic attention has been drawn to the systems which help people to dispose of things, and how those systems represent broader political and economic aspirations. Joshua Reno has demonstrated how these systems of disposal are often producers of a fictive "away", making invisible modernity's detritus in an 'out of sight out of mind' manoeuvre (Reno 2016). Picking up after people is also characterised as vital work essential to keeping cities functioning, part of the metabolic flow of urban life, and sites of political contestations over the power to govern, but also the power to decide what kind of place a city is (Fredericks 2018; Nagle 2013). It has also been shown that waste labour is often emblematic of existing social inequalities, often reinforcing caste, class, and gender discrimination, revealing how power works through material and affective relationships forged through engagements with waste (Teltumbde 2014; Butt 2020). Less attention has been given to the aesthetic and ideological qualities of bins as the initial receptacles of trash. Less still has been given to the way disposal practices are related to the production of urban nature. One exception is Jacob Doherty's recent photo essay which explores how technologically advanced bins called "big bellies" deployed in the affluent parts of Brooklyn and Philadelphia demonstrate "new eras in public life and… conjure new urban publics that are clean, green, and smart" (Doherty 2018, 96). According to Doherty, the big bellies typify what Steve Graham and Simon Marvin call "splintering urbanism", where "urban infrastructural services are unbundled, privatized and differentially made available to narrow populations and targeted niche markets" (ibid.). However, in Kochi the opposite of was happening. The use of decontextualised and rudimentary animal bins did not invoke explicit cultural or environmental specificities of this place, or appeal to technological innovation that many other forms of urban infrastructure did. What I argue here is that they are part of a broader production of urban nature that was increasingly important for the political aesthetics of the local government. By making the bins hyper-visible, playful, and generic, this site of urban nature projected a specific kind of urban development through producing a quotidian form of urban ecological aesthetics.

Social theories of waste suggest that waste management is often committed to keeping it out of sight (Davies 2019; Reno 2016). The Kochi government's approach to the waste crisis in the city more generally was mostly about keeping waste hidden rather than stopping it from being created in the first place. However, since the Swachh Bharat national movement on waste, the infrastructures built to manage waste needed to be seen in order for the government to demonstrate they were doing something about the problem. By shifting the analysis to what waste can tell us about the production of urban natures I build on Joshua Reno's formulation of waste as a sign of life (Reno 2014). Here, Reno looks to conservation ecology, where animal scats provide useful data about animal behaviours, to suggest waste offers new insights for social theory. Taking this lesson and applying it to the urban context opens up new modes of analysis of the visibility of urban infrastructures and their relationship to environmental knowledge practices and imaginaries. These optics of waste management are highlighted through a conversation with one of the women collecting leaves at SBP. My research assistant asked about how waste was managed in the park, and in response we were told that while there are separate collection points for plastics and leaves by the entrance of the park (strategically placed for patrons to see) but that they were collected (at night) by the same truck, and presumably dumped together at the city's main landfill which has come under increasing scrutiny for its mismanagement. Visibility was also useful in the task of policing those who did *not* use the bins through new monitoring technology. One park goer told us that the monitoring is crucial to the cleanliness of the park:

> "(I'm) not concerned about shapes, (I) just care about cleanliness, and the
> monitoring system. I don't want to see any kind of anti-social behaviour in
> the park, drug dealers and such. So, the monitoring is good."

Here we see one of the more insidious aspects of the ideological function of waste and the production of urban natures. The conflation of cleanliness with safety, and the presence of rubbish with a presence of danger and "antisocial behaviour", was actually produced through the infrastructure in place to make the park "clean". Attention in SBP was drawn not only to the grandeur of the harbor, but also to the cleanliness with which the park was kept. In other words, the production of urban nature was wound up in the ideological functions of urban development. The park produced an aesthetic experience of a clean and green Kochi, while

the pollution of the backwaters and the debates over the mismanagement of the city's landfill continued.

Figure 19: Bin in the shape of a penguin at Subhash Bose Park.

Figure 20: Segregation of wet and dry waste near the entrance of Subhash Bose Park.

Figure 21: The boulevard with harbour views at Subhash Bose Park.
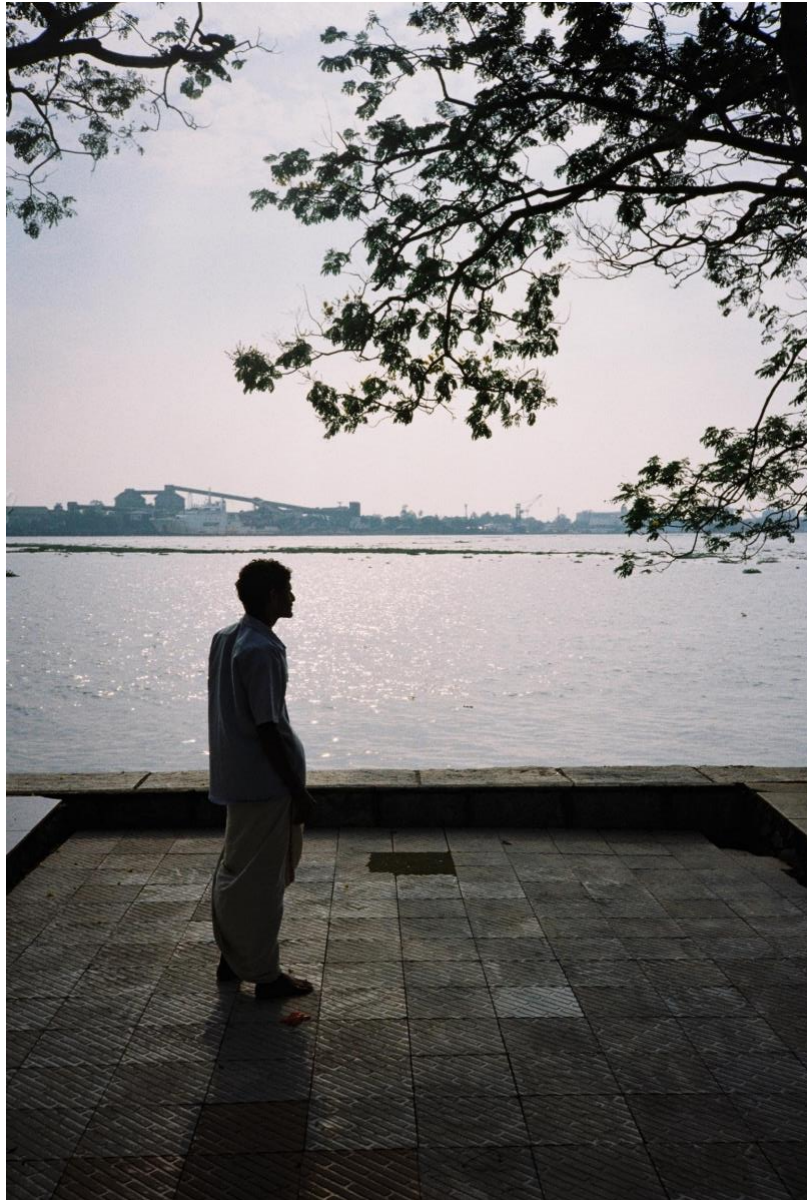
Figure 22: Man gazing into the backwaters from Subhash Bose Park.

Conclusion

The ecological aesthetics of these two sites of urban nature are produced explicitly through an assortment of infrastructures that have consequential, if implicit, outcomes. One part of the ways in which these places are produced is through the different ways that waste is managed. What I have highlighted is that the waste management practices of Kochi's urban natures are performative. Waste infrastructures are not just vital to the consolidation of state power (Fredericks 2018), but also important processes in the production of the urban natures which are increasingly important to urban development agendas. They also distract from the

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pressing ecological issue of the increasing toxicity of the backwaters, as issue that is more consequential for the future of the MBS. Waste management at the SBP showcases Kochi as a modern city with wide boulevards, functioning infrastructure, and a leisurely atmosphere. At MBS on the other hand, the plastics ban contributes to an atmosphere of an educational experience, where the visitor is shown what might be lost if Kochi is to continue down the path of urban development it is currently on, the path that the SBP tends to promote. Waste and its management are not just marginal to urban development projects that shape experiences of urban nature and environmental imaginaries, it is central to those projects.

Statement of Authorship

Title of Paper	Slow infrastructures in times of crisis: unworking speed and convenience
Publication Status	☒ Published ☐ Accepted for Publication ☐ Submitted for Publication ☐ Unpublished and Unsubmitted w ork w ritten in manuscript style
Publication Details	Barlow, M & Georgina Drew. 2021. Slow infrastructures in times of crisis: unworking speed and convenience. Postcolonial Studies. 24:2, 212-233, DOI: 10.1080/13688790.2020.1804105

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Name of Principal Author (Candidate)	Matt Barlow	
Contribution to the Paper	Georgina and I collaborated on this paper throughout the conception and writing phase. We presented it to a conference together prior to its submission and publication. I spearheaded the writing phase of the paper, and contributed the majority of the historical content within the paper, as well as the entire section on composting as slow infrastructure.	
Overall percentage (%)	60%	
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.	
Signature		Date 11/2/2023

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Chapter 7: Slow infrastructures in times of crisis: unworking speed and convenience

Abstract

The (post)colonial logics of speed and convenience are manifest in many of today's infrastructural projects, creating what we consider to be 'fast infrastructures'. These infrastructures create ease for some and harm for others while exacerbating social and environmental crises around the world. Addressing these crises requires, we argue, a slowing down. Enter the role of 'slow infrastructures'. In this paper, we highlight two forms of slow infrastructure that provide possibilities for rearranging our infrastructural orientations: composting and rainwater harvesting. Drawing on fieldwork conducted throughout 2018 and 2019 in Kochi, Kerala, this research asserts that in order to do infrastructure differently, an unworking of convenience and speed is required. This unworking can be achieved through an attunement to multi-species and more-than-human relations, matched with a distributed ethic of maintenance and care. Our ethnographic examples, one from a hospital and another from a hotel, suggest that slow infrastructures can meaningfully offset the threat of disfunction and 'urban failure' that confronts cities increasingly marked by turbulence and uncertainty. While these examples draw from the tropics of urban South India, they offer lessons helpful to unworking the harm caused by fast infrastructures in other parts of the globe.

Keywords: infrastructure, crisis, speed, convenience, care, India.

Introduction

Many of the environmental crises the planet faces have origins in colonial and capitalist logics of speed and convenience. And for most of the world's population, the crises that began with settler colonialism have deepened and accelerated on the heels of the industrial revolution and, more recently, the impacts of neoliberal capitalism.[48] These dispositions are now worked into the rhythms of human and more-than-human lives and have fueled what anthropologist Cymene Howe refers to as a 'petromodernity' that sees land, water and energy rendered as resources to be extracted, used and disposed of with little regard for flow-on effects (Howe 2019). Physical infrastructures such as roads, container vessels, dams, and sewers, create the logistics of that project, built on the premise of progressionist linear time, and endless growth. These infrastructures are generally built quickly – using cheap labour and cheap energy – with the aim of moving people and goods quickly[49]. Convenient for a few, and increasingly harmful to many, they constitute fast infrastructures.

Due to their problematic nature, we contend that fast infrastructures require an 'unworking' to be more equitable and ecological – an unworking that requires revisions of the predominant orientation towards speed, convenience, and endless growth. Such an unworking might involve a slowing down, and a turn towards slow(er) infrastructures. These slower

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[48] Here, we draw inspiration from scholarship that critiques the term *Anthropocene*. We avoid using the term because of its unwillingness to 'stay with the trouble'. See (D. J. Haraway 2016; Yusoff 2016; Heather Davis and Todd 2017)

[49] For more on cheap labour and cheap energy see (Moore and Patel 2018).

infrastructures can offset the threat of disfunction and 'urban failure' that confronts cities increasingly marked by turbulence and uncertainty (Amin 2016).

In this article, we present two examples of viable slow infrastructures that, building on the important work of feminist science and technology studies scholars such as Max Liboiron, "offer a material ethics at the immediate scale": composting and rainwater harvesting (Liboiron, Tironi, and Calvillo 2018, 341). We suggest that these practices hold particular promise for the more equitable distribution of resources and power in places such as (post)colonial India[50]. We do so with the recognition that these processes and practices are deeply situated in the social and environmental fabric of India and may not work everywhere for everyone. And while there are key conceptual insights to be elicited from the promise of slow infrastructures, we draw these out by grounding the discussion in examples from a collective thirteen and a half months of fieldwork from 2018-2019 that was conducted in a South Indian city known as Kochi. Situated on the Malabar coast of Kerala, this burgeoning metropolis faces overlapping environmental challenges that replicate and reflect the problems of fast infrastructures in other parts of India, and in other (post)colonial cities undergoing rapid change. In what follows, we highlight the scope of these challenges in Kochi while also featuring lessons gained from repeat site visits at locations where slow infrastructures are being maintained to a considerable degree of success.

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[50] Throughout this article we employ the parenthesized "post" in (post)colonial to emphasize the enduring affects and materiality's of the colonization process that continue today despite the fact that India gained independence in 1947.

This work engages the insights and appeals selected from over one hundred key interlocutors who shared their motivations for building slow(er) infrastructures via interviews, focus groups, site visits, participant observation, and collaborative efforts to promote environmentally sound practice in Kochi. The initial networks we built in Kochi were forged through our institutional affiliations to Amrita Vishwa Vidyapeetham University, and particularly the waste management initiatives on the various campuses of that institution. These initial networks were then expanded upon to include environmental activists working throughout the city, with whom we undertook collaborative learning of environmental and sustainability initiatives by way of participant observation. Through these methods and our empirical focus on ways in which people in Kochi are engaging with slow infrastructures, we provide an alternative narrative to the slow violence that fast infrastructures often entail.[51]

Over the last two decades, many social scientists have been turning to infrastructures as a way of investigating the "flow of goods, people, or ideas" across space and time (Larkin 2013, 328). Framed as such, infrastructures have their history in large public works such as the Paris sewers, the Indian railways, and the Panama and Suez Canals.[52] More recent analysis led by anthropologists such as Ashley Carse contends that infrastructures are more

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[51] It is important to recognize the often slow and invisible violence associated with fast infrastructures. See (Nixon 2011; Davies 2018).

[52] In *Lines of a Nation: Indian Railway Workers, Bureaucracy, and the Intimate Historical Self* Laura Bear has argued that developments such as the Indian railways were not infrastructures but rather 'public works for the material and moral progress of the subject nation'. As we later argue in this discussion, these projects live on as infrastructure through the ways they (dis)connect human and more-than-human life in (post)colonial India (Bear 2007). For more on the Paris sewers see (Gandy 1999); for more on the Panama Canal see (Carse 2014).

than matter that moves other matter, they are processes "embedded in and constitutive of social relations" (Carse and Kneas 2019, 12). They constitute relations between citizens and the state, the public and the private, that rearrange relationships between humans and the materials that make their lives possible. In this way, infrastructures "create a process by which the body, as much as the mind, apprehends what it is to be modern, mutable, and progressive" (Larkin 2013, 337). Yet, as these infrastructures promise speed, connection, progress and prosperity, they also trap citizens in highly centralised and increasingly privatised uneven systems of capital accumulation and resource distribution. We aim to advance these conversations around the social and temporal nature of infrastructures by bringing ethnographically derived insights about slow infrastructures into conversation with scholars working on feminist science and technology studies and postcolonial theory. A further aim is to highlight how speed and convenience are both embedded in the fabric of the (post)colonial city.

To ground our discussion and its insights, we situate both fast and slow infrastructures in (post)colonial Kochi, providing evidence to suggest how the Keralayan city has been transformed through colonial expansions and large infrastructural projects in the name of economic growth. This helps to explain how progressive states such as Kerala – heralded as a model for international development on the basis of access to health and education – nevertheless continue to struggle with the contradictions of economic growth through infrastructural development (Jeffrey 1992). We then look ethnographically at two slow infrastructures, composting and rainwater harvesting, framing them as ethical practices that work against the centralisation and privatisation of public resources and materials. We suggest they hold promise for a more ethical, and less destruction-oriented approach to infrastructures. We claim them as infrastructures due to their relational capacities between

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and beyond the human. By prioritising a decentralised and distributed ethics of everyday maintenance and care, slow infrastructures involve reworking relationships between fellow humans and to the more-than-human world, while also unworking attitudes toward speed and convenience.

As a further prelude to what follows, we note that speed and convenience are intertwined. Indeed, convenience "legitimizes and sustains specific forms of (fast) consumption" (Shove 2003). Such accelerated forms of consumption can have the 'paradoxical effect of fragmenting activity, inadvertently exacerbating the (everyday) sense of harriedness' while also generating demand for yet more convenient solutions (ibid.). We also recognise, however, that convenience has both 'good and bad' connotations and that as a phenomenon it has "multiple realities depending on (the) different knowledges, spaces, circumstances and relationships" in which it is analysed (Warin, Jay, and Zivkovic 2019, 1–2). When it comes to convenient or fast foods, for instance, these goods offer speed in terms of preparation and consumption, but they also create expanding waistlines, additional health concerns, and a surfeit of environmentally harmful wastes once their packaging is discarded. And, yet, when convenience is done through food it can also be 'done through care' by time-pressed and hardworking parents who are doing their best to keep their children fed (ibid.). So, while there is an element of 'convenience as care' in such an example, there is also an element of convenience as uncaring in terms of the secondary and tertiary ripple effects it can create. It is the undoing of these ripple effects that we want to take seriously by highlighting the work that can be achieved by slow infrastructures.

The time of infrastructures

Infrastructures are not as rigid as their structure-centred nomenclature might suggest. Time, maintenance, decay, and labour are attached to infrastructures because they are *processual*. As objects of ethnographic attention, they are "a relational space of investigation, where researchers can explore fluctuations, or trace the dynamic shape of what thrives and what dies" (Venkatesan et al. 2018, 5). As relational entities, infrastructures are more accurately described as "temporary lines across active environments that erode, rust, and fracture" (Carse 2014, 204). This observation places emphasis on not just the creation but also the destruction that is part of the life of infrastructure. As such, infrastructures are not just "a thing"; rather, they are a "thing-in-motion, ephemeral, shifting, elusive, decaying, degrading, becoming a ruin but for the routines of repair, replacement, and restoration (or in spite of them)" (Gupta 2018, 62). While new and emerging infrastructures invoke teleology, futurity, and techno-mobility they do not necessarily incorporate plans for their own lifecycle and ultimate demise. Nor do they, as Ara Wilson highlights, address the power differentials or the intimate injustices that these new material relations often generate (Wilson, 2016). Wilson states: 'just as the installation of infrastructure has never been equitable, the decay of public infrastructure is not a homogeneous decay' (ibid., 272). In other words, new does not equal better or everlasting – and yet, that is often how the surfeit of fast infrastructures are embraced.

The colonial logics of extraction and capital accumulation are often wound up in infrastructural projects and their associated promises of economic and social development. One of the clearest realisations of this are the aforementioned Indian railways, built by the British throughout the 19th century as a series of public works that also served as a "vector of capitalist modernity" benefitting foreign merchants and colonial rulers (Bear 2007, 1). Over

time, and particularly in their contemporary use, such public works became infrastructures – following from the definitions provided above – as they continue to significantly alter socio-material networks and more-than-human relations in (post)colonial India.

The "anticipatory good" of infrastructure obscures the ecological destruction and social inequality accelerated by those same infrastructures (Howe 2019, 6; Cross 2015). We contend that this anticipation is often promised under the guise of convenience and speed and that the fast infrastructures in our midst are crisis-ridden. They are crisis-ridden because they offer quick and temporary solutions to problems that have their origins in colonial logics of linear time, endless growth, and human exceptionalism (Mbembe 2001). As Hannah Appel so beautifully writes, 'under Anthropocene skies, petro-fueled infrastructures inflate like life jackets for a regime that otherwise should have drowned in its own violence and excess' (Appel 2018, 59). In their inflation, fast infrastructures create uneven relations across different scales, materials, and times. As infrastructures continue to disperse and complicate relations to environments at increasingly problematic scales, there is a need to re-imagine our relationships to infrastructures and to re-distribute their effects in a way that prioritises reciprocal relations.

We use the heuristic of speed to suggest that slow infrastructures might be viable alternatives to the extraction-centred colonial disposition of fast infrastructures. Slow infrastructures may not increase the mobility of people or things, but instead represent a shared responsibility for putting the world back together though more equitable distributions of maintenance and care (Mattern 2018). By sharing examples of slow infrastructure, we join Eve Tuck in moving away from 'damage-centered research' and instead focus on modes of practice that push back against the power structures that so often cause that damage (Tuck 2009). We do so not in an

attempt to suggest a scaling up of activist interventions nor to provide easy solutions to complex issues, but instead to highlight how ethical actions "are not necessarily about changing the system, so much as existing in it" (Liboiron, Tironi, and Calvillo 2018, 42). We want to foreground the ways in which slow infrastructures like composting and rainwater harvesting might make more ethical (post)colonial futures possible amongst the decay and maintenance of fast infrastructures.

(Post)colonial infrastructures of Kochi

Kochi is a city where new and old, slow and fast collide, not only with each other, but with the lush, humid tropics of South India. Known as the 'Queen of the Arabian Sea', Kochi is oriented toward the ocean through the mediation of a port, in ways that matter to contemporary waste and water infrastructures in the city. Kochi has a long cosmopolitan history of maritime exchange with people from China, Europe and the Arab states going back centuries. The hundreds of Chinese fishing nets scattered around the edges of the backwaters are a lasting testament to this history.

Figure 23: Map of Kochi.[53]

The colonial, that is *extractive*, history of Kochi (and, in fact, what we now call India) begins

with the arrival of Vasco de Gama, a Portuguese explorer, near Calicut just north of Kochi

(then Cochin) in 1498. With African slaves aboard the ship, the Portuguese began trading for

spices, and eventually made inroads into life throughout the region, primarily through

building houses, forts, and churches (Nandy 2000, 299). A century and a half later, the Dutch

wrested control of this increasingly important port town in 1663. They also built many large

houses in the distinctively Dutch fashion, including many 'go-downs' (warehouses) which

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[53] Kochi Map. 2010. Wikimedia Commons:

https://upload.wikimedia.org/wikipedia/commons/thumb/4/4b/Kochi_map.png/435px-Kochi_map.png

stored precious spices and other valuable goods, many of which are still standing today. Both the Dutch and the Portuguese were also ship builders, able to utilise a large workforce of able-bodied Indian men to assist the African slaves they travelled with in expanding their fleet. The influence of this period on Fort Kochi and Mattancherry in particular cannot be overstated. A walk through this historic township is littered with reminders of a past entrenched in colonisation, African slavery, and the spice trade – in many ways the precursors to the fast infrastructures continue to cause havoc in the city. Even today, popular stops on a tour of Fort Kochi include the St Francis Church (the first European church in India built by the Portuguese in the 16th century), the adjacent Dutch cemetery, the Dutch Palace (which was actually built by the Portuguese in 1555), the Santa Cruz Cathedral Basilica originally built in the 1500's, and the Indo-Portuguese Museum showcasing artefacts from the Portuguese era.

Figure 24: Godown on the edge of the backwaters in Mattancherry. Note the stained walls, remnants of the hundreds of years of spice trade through the city, and the Dutch architecture of the buildings.

The British arrived in Kochi 1795. And while the everyday effects of this rule were arguably not as pronounced in Kochi as they were in northern India, due to the perseverance of the princely states of both Cochin and Travancore, 'indirect British rule' remained in the region until partition in 1947 (M. Desai 2005). During the British colonial period, the infrastructural development of the region rapidly expanded to facilitate the extraction and exportation of spices and tea from the Western Ghats. Through their determination to turn the Western Ghats "into a plantation district", the British managed to open up what was until then "entirely inhospitable terrain" (Pillai 2015, 228). Before the British arrived, those who traded in goods on the coast of Kerala had little to do with the "ancient tribes of the forest" who only "ventured out occasionally to exchange their cardamom and honey for salt and textiles, but for the most part… remained an enigma" (ibid.). The scale of the infrastructure was such that the ecology began to change along with the desires of colonial rulers and the dreams of prosperity held amongst the Cochin and Travancore elite. First, canals were dredged through the city between 1840-1860 to increase the flow of goods. Then, with the invention of the combustion engine by scientists in Glasgow, attention moved to automotive transport and the construction of roads in the 1850's. The speed and convenience associated with roads is bound up in the 'promise of political freedom' and in the kind of economic connection that lead to what has been called the 'enchantments of infrastructure' (Harvey and Knox 2012). In this instance, the roads built in Kochi were part of a larger set of infrastructures geared to extract and export spices.[54]

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[54] To be clear, these developments were largely orchestrated to fulfil the growing desire for tea back in Britain, but they also provided opportunities for the Indian elite to begin redistributing wealth into education and welfare programs.

By the 1920's, the priority became turning the Cochin Port into a major node for industrial and international trade on the western coast of India. This was orchestrated by Sir Robert Bristow, under the guidance of the Governor of Madras Presidency, Lord Willingdon, and was conducted in a three-way collaboration between the two princely states and British controlled Madras. The seafloor had to be dredged to make way for larger ships, and subsequently Willingdon Island was created with the dredged seafloor in the 1930's. Willingdon Island, named after Lord Willingdon, is the largest artificial island in India and was home to Kochi's first airport. It is now the home of the Cochin Port Trust and the Southern Indian Naval Command. Other parts of the island now lay neglected as the railway that once transported goods across the island has been superseded by road transport. The development of roads during the British era caused a shift from a watery way of life to a terrestrial way of life, at the same time as there was increasing infrastructural development of the Cochin port.

Figure 25: Pre-colonial Chinese finishing nets (now a tourist attraction), with the shipping container terminal in the background. Fort Kochi.

Even as "exposure to the wider world is an ancient feature of Kerala's heritage", the nature of that exposure has changed over time through colonisation, independence, and onset of neoliberal capitalism in the late 20th century (Pillai 2015, 8). These developments have often been infrastructural in nature, as "new infrastructures make old ways of life difficult to maintain" (Carse 2014, 52). The infrastructural developments by the British transformed the entire ecology of the region in the name of speed and extraction, reshaping social relations along the way. The infrastructural developments above were mirrored by two social movements. The first was a caste based and pro-British movement in the late 19th and early 20th century. The lower castes were pro-British as they understood them to have 'a greater sense of justice than the princely states' (M. Desai 2005, 480). The second was a Marxist workers movement that was distinctly anticolonial and raised for the first time 'connections between colonial capital, British rule, and class-based exploitation' (ibid.). What was initially recognised as a welcome disruption to the cruel caste system, the extractive and exploitative capacities of the British empire were realised as the speed and scale of the extraction and capital accumulation grew. These examples provide a historical account of the social nature of infrastructures – an important narrative to consider when we turn to the transformative potential of slow infrastructures below.

Despite the complex history of these infrastructural developments and the social movements that mirrored them, Kochi continues down a path of speed, convenience, and economic growth, to the detriment of the environment and the health of human and more-than-human populations. The many canals, once the lifelines of the city, are now odorous drains filled with water hyacinth (an invasive weed from South America), sewage, and industrial pollution. Drinking water is increasingly scarce despite the abundant rainfall, and many Kochites are now reliant on the distribution of purified water in the form of 20 litre cans.

Figure 26: British era sewer, Mahatma Gandhi Beach. Fort Kochi.

The neglected and blocked canals, together with Kerala's notoriously congested road network (which now work in contradiction to their emergence as a vector of speed), also significantly contribute to increasingly violent annual monsoonal floods. In August 2018, during the worst floods Kerala had experienced in a century, Kochi's international airport built 20km north east of the city in the 1990's turned back into the river that used to be in its place. Consequently, the airport was shut for three weeks, causing chaos for the vital tourist economy and Kochi's increasingly mobile middle-class. In other words, the techno-optimism of the 'smart city' could not cope with the increasingly "demanding environments" in which it was embedded, and which are further threatened by rising temperatures, changing monsoon cycles and sea level rise (Carse 2014, 220). But there are two ways, discussed in what follows, that people in Kochi are looking beyond the breakneck speed of development by embracing slow infrastructures. The ethnographic examples below provide insights into how simpler, slower infrastructures might circumvent the disposition left by the violence of this extractive history by reshaping more-than-human social relations in surprising ways.

Composting as slow infrastructure

While composting is an age-old practice evident in relationships to the soil going back hundreds of years, it has recently gained traction among urban communities looking for sustainable solutions to an increasingly prevalent global 'waste crisis' (Kawa 2016). As the infrastructures built to eliminate waste quickly and conveniently either breakdown or reach capacity, composting has become a slower, simpler method of waste management that offers an efficacious way of getting ones' hands dirty. Through an emphasis on maintenance, care, responsibility, and cooperation amongst and beyond humans, composting helps to unwork convenience and speed by connecting people to each other and to the rhythms of the more-than-human world. As a daily practice, it helps with the practicalities of segregating waste at

source – highlighting the dangers of non-degradable wastes such as plastics – and promotes a degree of self-reliance in uncertain times. This self-reliant (*swaraj*) practice takes seriously the call of 'my waste, my responsibility'– a motto which can be seen on roadside signs throughout India since Prime Minister Modi's Swachh Bharat (clean India) campaign began in 2014.

In urban (post)colonial India, the responsibility for managing waste often falls to either the urban local bodies (ULB) with the seventy-third and seventy-fourth amendments to the constitution, or to lower caste manual scavengers. ULB's are often under-funded and under resourced (Doron and Jeffrey 2018). This means that waste management in urban India is often patchy and unequal, reflecting social and ethnic hierarchies, and reliant on particular groups of peripheral communities who have managed to address the issue at a grassroots level. These local clusters of knowledge and practice create friction with the local government, whose official responsibility it is to handle waste. Unable or unwilling to negotiate this patchwork of national, state and community level policies, the Indian government has often failed to deliver adequate waste infrastructures. In interviews with politicians and residents of Kochi, both pointed the finger at the other as holding the primary responsibility for adequate waste management. The desired speed and convenience of the infrastructure breaks down through a lack of cooperation across scales, overly bureaucratic (post)colonial government procedures, the enduring caste associations of purity and pollution, and the endless pursuit of economic growth.

Waste management infrastructure generally refers to processes that transport waste away from a private dwelling.[55] Most contemporary cities employ a centralised waste management system, where waste will be taken to a processing facility, usually a landfill, on the edge of town[56]. This requires a network based on convenience and speed to collect, transport, and dispose of waste. These processes then require the maintenance of trucks and roads, the availability of cheap fuel and access to land – the infrastructures of wastes' fast movements. In (post)colonial India, many landfills and the infrastructures that serve them are far over capacity due to a rapidly urbanising population and a growing and highly aspirational middle-class that is consuming more than ever before. As Assa Doron and Robin Jeffrey emphatically state "Never in history have so many people had so much to throw away and so little space to throw it as the people of India in the second decade of the 21st century" (Doron and Jeffrey 2018, 43).

Due in large part to its infrastructural history, Kochi, unlike the rest of Kerala which has adopted decentralised waste management practices throughout the 21st century, continues to pursue centralized (that is, convenient and fast) waste management (Ganesan 2017). Since 2012, it has attempted to address the city's waste crisis – including an over-capacity landfill, piles of waste accumulating roadside, waterways and canals full of rubbish and industrial pollution – by pursuing a transnational public-private-partnership to replace the landfill with a waste-to-energy (WTE) plant. Pitched as a renewable energy source and a solution to the

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[55] One of the key lessons from the concept of the Anthropocene is that there is no such thing as *away*: the landfill on the outskirts of town continues to alter life on Earth in small yet significant ways. See (Morton 2016).

[56] This is at least true of municipal solid waste, including plastics and other hard wastes, as well as organics such as food and paper. There are overlapping and divergent tactics for other wastes such as sewage.

waste crisis, this effort mirrors yet another fast, convenient and highly problematic practice imported from Europe.[57] One of the key arguments against the development of WTE in Kochi is the large percentage of organic material in the waste profile, which some waste management experts in Kochi claim to be as high as sixty percent. Given the high moisture content of the organic waste, the abundance of monsoonal rains and the tropical humidity of south India, you have the conditions that are extremely difficult for generating energy from the incineration of waste. These conditions, however, are perfectly suited to the microbial activity required for composting. In support of composting, one research participant poetically described Kochi's extremely warm and wet climate as an 'incubation climate' where you don't have to do anything to nourish and sustain microbial activity.

Despite the ripe environmental conditions for composting in Kochi, the practice is difficult to implement at the household level, and difficult to scale up to the city level. The problems lie in the "requirements of space, cooperation, relentless application, and systematic maintenance" needed to make composting viable (Doron and Jeffrey 2018, 144). These problems are particularly problematic in India where household labour is often gendered, and association with waste is intimately tied to the inequities of the caste system (Doron and Raja 2015). Furthermore, they are also particularly difficult to implement due to Kochi's deeply colonial and extractive infrastructural history. Despite these constraints, there is a growing movement of activists helping environmentally conscious institutions in Kochi turn to decentralised composting as a way to gain traction in the fight against waste. As such, while household composting is rare, and large scale composting initiatives have failed due to a lack

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[57] For more on the transition to waste-to-energy infrastructure in India and beyond see (Ahmann 2019; Behrsin 2019; Demaria and Schindler 2016; Luthra 2017).

of maintenance and political cooperation, there are promising instances of decentralised composting at the small to medium institutional level that are useful examples of how slow infrastructure can begin to unwork convenience and speed amongst the disposition of fast infrastructures in the city.

Some of the more impressive composting efforts in Kochi are enacted by businesses and even hospitals. The Amrita Institute of Medical Sciences (AIMS) is a case in point. AIMS sits in the heart of suburban Ernakulam, the bustling city center of Kochi (see the central quadrant of Figure 1 for illustration). It is an educational and medical facility run by a spiritual leader known as Mata Amritanandamayi Devi. Referred to as Amma by her devotees, she runs a number of charities, universities, and hospitals across all of India. In the spirit of Amma's teachings, AIMS is designed in the shape of a mandala and it has an open feel enhanced by the abundance of trees and plants populating numerous courtyards. Amma's institutions pride themselves on being environmentally conscious, and AIMS is no different. AIMS is host to one of Kerala's best waste-water treatment plants, and across the other side of the river behind the hospital, on a small island, is a large composting facility. The short boat ride to the facility is a healthy reminder of the tropical conditions of Kochi, the vital connection to water for those who live here, and the benefits of decentralised waste management processes. The putrid smells and darkened waters that one encounters on the ride to the island are also reminders of the uncontrolled wastes that continue to enter the waterways throughout this delta city.

On one particular visit to AIMS, the operator of the compost facility took the first author and a hospital staff member of AIMS across the river to share the work being done on the island. According to the composting manager, the island used to be 'a waste dump filled with

syringes, snakes and wild plants,' until a visitor from the United States helped turn the island into a composting facility. He went on to explain that before they built the composting facility together 'no one knew anything about waste segregation or composting.' They subsequently spent months clearing the land and building the facility after gaining permission from Amma. Now as he told us, 'the environment is very pleasant', 'there is no smell', and it is a 'good climate'.

The composting facility processes all of the hospital's organic wastes each day. Large tubs of food waste are mixed with piles of organic matter from around the facility, mostly leaves and other garden debris. After a few days, once the pile begins generating heat, it is moved to the adjacent composting area that relies upon multispecies relationships. Here, rows of compost bays line the cement floor under a large corrugated iron ceiling with open sides. The process is sped up by the introduction of worms – turning this in a vermi-composting facility – and within 20 days the final product is ready to be used in garden maintenance and other environmental aesthetics projects around the property. The work is time intensive and constant, yet fulfilling, as the manager explains:

> When I do this work, no other thoughts come to my mind. Once upon a time I wanted to be a well-connected man in the hospital. Now I am so focused on this work that I feel no interest to come to the main hospital site.

If waste infrastructures like landfills and WTE tend to speed things up, accelerating the crises through their promise of convenience and technological advancement, composting holds the promise of earthly flourishing through an unworking of speed and convenience. As an elemental and multi-species practice that requires close attention to matter, moisture, heat,

and time, it extends care and attention beyond the human. It does so by being a particularly affective practice, which often challenges and expands the olfactory and haptic senses through an intimacy with more than human relations to plants, soils, worms and other vermin. These kinds of multispecies and sensorial relations that composting entails "facilitates a reconsideration of infrastructure's relationship with nature" (Morita 2017, 739). This kind of reconfiguration of attention and attunement beyond the human requires patience and a willingness to get dirty, as it challenges the implicit human exceptionalism and entitlement tied up in many fast infrastructures. In this way, composting acts as a bridge between death and life, helping recognise that life feeds on life. Through turning disposed or left-over biological matter with soil and other critters to make fertile ground, composting aids in food production, soil health, and helps to create "relations of care" that push back against the convenience and speed of fast infrastructures (ibid., 747). In this way composting is a transcendent form of care-work that is "simultaneously 'ordinary' and surpassing the 'ordinary'" (Meher, Trnka, and Dureau 2018).

The relations of care that emerge amongst slower infrastructures – the unworking of speed and convenience – extend to the fellow humans with which compost is made. A number of composting staff interviewed readily expressed satisfaction and even 'happiness' in doing their work. Supporting their statements, the chief operator boasted that the facility had a higher retention rate of employment than other similar jobs in the city. In other circumstances, manual labour employment would be inconsistent and seasonal. Furthermore, by taking the time to visit the composting facility, composting also challenged implicit social hierarchies amongst other staff in the hospital.

The hospital staff member who joined the tour, for example, found the experience to be quite transformative in ways that she did not anticipate. A woman of advancing age and many years of service in management at the hospital, she who would normally be stationed in the house keeping department where she orchestrated staff administration while also joining in on the cleaning duties that arose. She joined the tour of the composting facility out of a curiosity after the first author expressed interest in the facility during an earlier meeting to discuss waste management practices at the hospital. Despite her long tenure at the hospital, she had never ventured to the composting area or visited the other waste management facilities on site (outside the hospital wards). After arriving on the fresh aired island and learning from the operator of the compost facility's practices, she later reflected on how moving it was for her to see the composting work firsthand. As she described:

> I must say that having been here (at the hospital) for so many years, that's the first time I've really got to know what's happening here… I just realised that even I don't know the big picture… (but after seeing this) I feel very proud…

Building relations of care that extend to fellow humans as well as plants, soils, and other critters, composting "puts practitioners not so much "in charge" of ecological management and food production, but sees them as attentive members of a specific ecological, soil foodweb community" (Puig de la Bellacasa 2015, 706). The vermi-composting that the staff described, for instance, has the potential to enact a world premised on multi-species flourishing through "solidarities among diverse communities, human and otherwise" (Apffel-Marglin 2012; Liboiron, Tironi, and Calvillo 2018, 341). In other words, the daily practice of composting helps to reshape our relations among humans through "possibilities of solidarity with nonhumans", turning composting yards into places that inspire moments of pride and

wonder (Morton 2017, 25). In this way, through its unworking of speed and convenience and it's disposition toward medium scale initiatives, composting holds the potential to rupture and reconfigure existing fast infrastructures as well as political and social categorisations built on inherited and culturally re-enforced hierarchies – such as colonial rule, caste and gender norms. It also has the potential to build more responsible and ecological futures. Another slow infrastructure that holds particular promise in this tropical south Indian city is the simple yet effective practice of capturing rain where it falls.

Rainwater harvesting as slow infrastructure

The fortunate among us experience split-second infrastructural speed every time we turn on the tap. The expectation that water should flow forth, backed by hydraulic pressure and an underground grid of municipal pipes, is itself an anticipation and a demand for hydrological speed and convenience (Anand 2011). The 'modern' convenience of indoor plumbing, in fact, is intended to save "time as well as reducing toil and trouble" (Shove 2003, 171).

In most urban zones, tap water is transmitted from faraway locations where it can be processed and transferred in bulk (Anand 2017). Most often, this water comes from rural watersheds where the water has competing demands for ecosystem services and agriculture (Gandy 2008). In the parts of the world where these rural watersheds are heavily inhabited by human and more-than-human populations, urban water demands can be complicit in removing vital resources needed to support livelihoods. And, despite the daily crises of water access that such rural areas can experience, news articles predominantly focus upon water stress when piped flow to urban settlements becomes jeopardised. The media attention to recent 'water crises' in Cape Town, South Africa and Chennai, South India are a case in point.

There is an alternative, but it requires frequent care, upkeep, and a sense of responsibility for managing one's own water resources. This alternative is urban rainwater harvesting. It involves catching water where it falls on rooftops, roads, parks, and playgrounds. This water is then transferred into underground storage tanks (which are paved) or recharge wells and recharge pits (which are unpaved). The former captures and contains the water for immediate use whereas the latter allows for the percolation of rainwater into the subsoil where it recharges the groundwater.

Based on the specific subset of fieldwork that focused on rainwater harvesting in Kochi, the technology appears to offer a viable and effective practice for urban infrastructural overhaul. That said, its widespread implementation is proving to be a challenge given the acceleration of time-restricted tasks and demands in everyday life (Drew 2020). For while it is straightforward to implement at a relatively low cost (Said 2014; Drew 2019), it is a practice that requires regular maintenance – and attention to acts of maintenance is "not so much about defective infrastructural objects" as it is about understanding the social and political relationships in which they are embedded (Barnes 2017, 148).

In the case of rainwater harvesting, the amount of care and labour required to maintain systems in working order can be extensive. Before the rains arrive, rooftops, roads, and courtyards need to be cleared of debris. When the rains arrive, a 'first flush' must let this first dose of (often acid) rain slip away, clearing and cleaning the grounds upon which it falls in the process. Then comes the period of capture and storage while the rains are falling. Once they stop, drains, pipes, filters, and storage containers must be repaired for the inevitable damage caused by the deluge. And before too long, the cycle must be repeated.

These are all time intensive practices. And this time intensivity is processual and cyclical. It requires values of care for equitably sourced and managed water as well an ethical commitment to the slow infrastructures that help to harvest and store these rains directly. So why bother? For one, harvested rainwater has an immense potential to meet the current and rising water demands of many South Asian cities. In Kochi, a total water wealth of 3000 millimetres falls annually and is spread over the course of not one but two seasonal monsoons. Another reason is that rainwater harvesting is a long-standing practice for inhabitants of the region as it was formerly part of the common-sense tactics of survival in everyday life, as Michel de Certeau might argue (Certeau 1988), prior to the installation of piped water infrastructures. Typical acts of water harvesting included the use of artificial lakes created from rain (*madaka*)[58] along with well recharge practices and the filling of pots and barrels to meet household water needs. As older generation residents explained to us in interviews, knowledge of how to harness the rain for water security used to be passed down through generations. This knowledge is being lost as people become increasingly reliant upon piped water supplies, and as the elderly pass on without the transmission of their expertise.

One group, however, is working concertedly to revive knowledge of rainwater harvesting practices and to expand its installation and use across a range of topographies within Kochi, and Kerala more broadly. Known as Inspire India, this group is composed of architects, project managers, infrastructure engineers, structural engineers, and landscape designers. Their work is guided by core principles for all of their project designs. These include: the

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[58] 'Kerala and Karnataka's lesser known rainwater harvesting structures', *India Water Portal*, https://www.indiawaterportal.org/articles/kerala-and-karnatakas-lesser-known-rainwater-harvesting-structures, accessed 14 February 2020.

concept of 'environmentally sustainable development', the need for conserving energy and switching to renewable sources when possible, and the 'need to be socially responsible amidst often over built and obsolete governmental and societal systems and norms'.[59] To achieve this, they offer a set of key services featuring 'home grown progressive sustainable concepts' that target 'total water management' via the installation of rainwater harvesting lakes combined with anaerobic waste water treatment and recycling systems.[60] These technologies offer what one member of Inspire India – an architect and hotelier who we will call Govinda – called an 'integral approach' to infrastructural design that 'appeals to your conscience straightaway.'

For people like Govinda, an 'integral' approach to architecture involves thinking of more than the initial structure to be built. It also entails thinking of how and where the water comes from, how to take care of the waste that the users inside a building generate, and how to landscape a property with the regionally appropriate plants and species that will help to encourage water retention and flourishing green spaces. Given the overall challenges of water access and management in a place like Kochi, rainwater harvesting has taken pride of place in many of Govinda's buildings. Yet, as he explained in our first of two interviews in February of 2018, not everyone in his profession is as enthusiastic about the promise of such environmentally-minded technologies. At first, he confessed, 'we were considered odd people' because very few in his professional networks saw value in using 'local materials and eco-friendly architecture'. As a result, they faced 'lots of difficulties' as well as 'unnecessary accusations' that he portrayed with a wave of a hand saying – in the role of a fictional third

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[59] About Us (Inspire India), http://inspire-india.com/aboutus.html, accessed 10 February 2020.

[60] Our Services (Inspire India), http://inspire-india.com/strengths.html, accessed 10 February 2020.

person – 'all these things don't work' and 'it doesn't make any sense'. But, he continued, 'we somehow managed to survive' after a rocky start in the late 1980's and early 1990's. Given the scope of impressive 'eco-friendly' projects that he has built, people like Govinda appear to have thrived rather than just survived. And the use of rainwater harvesting is a cornerstone technology for many of their projects.

The trick to successful rainwater harvesting, as Govinda explained, is that you have to capture and 'hold' the water in order to make use of it. This imperative for water retention is easier said than done, and there are various strategies and technologies that can be applied depending on the geomorphology and topography of a given location. One earlier mentioned option is to direct harvested rainwater into recharge wells and natural ponds that percolate it back into the groundwater over time. 'But,' he cautioned, 'in some places these ponds and wells have already become contaminated – (they are) all saline'. To work around this problem, Govinda and his colleagues have created cement-lined artificial lakes in a number of their projects. The size of these lakes depends on a calculation that they call the 'consumption recharge profile', which is the estimated amount of water use at a given location along with the amount of water that can be harvested over the two regional monsoons, minus estimates for evaporation. To keep the water free of mosquitoes, fish are also required to keep the artificial lakes healthy – and they too need a minimum amount of water after both consumption and evaporation. The end result of a successful project, he stressed with drawn out pronunciation, is the creation of a '*totally new ecosystem*'.

To see firsthand what such efforts can achieve, we toured on three separate occasions a flagship hotel, and self-acclaimed 'eco-resort', designed and run by Govinda and his colleagues. Built in the early 1990's and situated just off a main highway in the heart of

Ernakulam, the establishment features a network of two to three story buildings finished with red brick exteriors. Driving or walking into the complex after following a slope down from the adjacent highway, one quickly gets the impression of entering into quieter and calmer environs.

Figure 27: Hotel rainwater harvesting lake. Photo by Georgina Drew. 2018.

To a visitor, the eco-resort feel of the hotel is heightened by an abundance of trees and gardens, a green playground, a spacious pool and, of course, the serene presence of an artificial lake that sources 20,000 litres per day of the hotel's water requirements. Since the lake semi-circles the exterior of the property, its presence is subtle and it feels more like a landscape accent than a high functioning and self-sufficient water management system. One might imagine, in fact, that most guests have no idea of its purpose or the fact that the water

running through their taps and showers is caught, filtered, and circulated on site. Such obliviousness is part and parcel of the design and functioning of infrastructure. After all, "the normally invisible quality of working infrastructures only becomes visible when it breaks: the server is down, the bridge washes out, there is a power blackout" (Star 1999, 382).

Given the success of the property, even from a budget savings perspective alone, it is striking that more hoteliers and businesses have not taken on a similar model. According to Govinda, the lack of similar buildings is no longer due to a dearth of interest but, poignantly, due to time management constraints that further underscore the importance of speed and convenience. During the driest season from February to March, claims Govinda, the offices of Inspire India now get overwhelmed with requests for their expertise to overhaul buildings and to install rainwater harvesting units. Parroting the typical inquiry, he explained that the request was often along the lines of 'Why don't you come and install it tomorrow?' As that is usually impossible, especially since it can take 'at least' one to two months for such projects to be completed, the initial interest often dissipates. For the projects that do get completed, there are also disappointments because by the time a rainwater harvesting unit is installed, the dry season might have ended, and the taps might be flowing freely again. 'And then the crisis goes away – and then they forget it, they won't maintain it,' he quipped. Reflecting on this cyclical process, he made a disclaimer that he knows 'a few people who are sincere' and who do understand the importance of taking the time to both install and care for rainwater harvesting infrastructures. 'But it has not come to the stage where there is a mass awareness – enough for people to make a collective action. That has not yet come to (fruition).'

While lack of uptake for rainwater harvesting is undoubtedly a source of consternation for the environmentally minded, as well as for the municipality (which has tried to raise public

awareness of the need for decentralised acts of rain capture),[61] there are indications that the

growing resource constraints in cities like Kochi might force change in the coming years.

And as it becomes increasingly inconvenient to source water from stressed river basins, there

emerge opportunities to reorient ourselves to the value of slowing down, and to embracing

slow(er) infrastructures such as the technologies associated with urban rainwater harvesting.

The added bonus that such technology presents is that, once installed, it sits at the ready to

receive the cyclical bounty of the rains, even in times of municipal breakdown and urban

turmoil. So, while it might appear to be another "boring" and "singularly unexciting"

infrastructural technology, rainwater harvesting offers the thrilling potential for water self-

sufficiency – enhancing our ability to manage present and pending resource crises (Star 1999,

377).

Finally, and as other ethnographers of this practice point out, these everyday acts of "mutual

constitution" with rainwater can have significant subjective implications as people learn to

become better, and more ethical, resource stewards and urban citizens (Radonic 2019, 292).

Once people reframe their relationships to water as one of 'commensalism rather than

parasitism' (ibid., 298), they also reshape their relationships with other water users since all

technologies of water management are embedded in social and political systems

(Swyngedouw 2009). They do this by diminishing their role in the perpetuation of unequal

water access – which as earlier noted marks the rural-urban resource divide as well as the

economically-driven resource disparities within South Asian cities – and by showing others

how they, too, can care for water in better ways. So, while rainwater harvesting is distinct

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[61] Water Policy: Kochi Municipal Corporation (2015), http://www.c-hed.org/wp-

content/uploads/2019/09/KochiWaterPolicy_Oct2015.pdf (accessed 17 February 2020).

from composting as a technology and a set of practices, it has similar potential to transform how people see themselves and how they connect with, and to, others.

Unworking fast infrastructures

As Cymene Howe and her colleagues write, 'the infrastructures of modernity are killing us' (Howe et al. 2016, 556). In the pursuit of convenience and speed, the contemporary surfeit of 'modern' infrastructures continue to introduce new hazards (ibid.). And yet, the more these infrastructures are taken for granted – and assumed as superior – the more difficult it is to prepare for, and to anticipate, their failure. The risk of infrastructural 'urban failure' is all too possible, of course, because cities are 'imperfect machines of coordination' poised on the edge of collapse (Amin 2016, 779). When they are able to stave off this looming decline, it is because of the distributed intelligence of 'diverse kinds of knowledge, lay and expert' (ibid.). Said differently, the ability of (post)colonial cities to remain nimble in the face of failure requires infrastructural adaptability along with an embrace of technologies that have weathered the test of time.

To do infrastructure differently, in a way that responds to contemporary risks and anticipates future crises, we have argued for a re-embrace of slower moving infrastructures. We also acknowledged that it takes *time* to care and to maintain slow infrastructures in ways that do not involve exploitation. Furthermore, these acts of care and maintenance require an embrace of the kinds of infrastructures that can thrive and flourish over circular time since these slower infrastructures are often designed to weather natural and human-made seasons of expansion and contraction. Such infrastructures can help to reconfigure our relationships with time and temporalities in other words, even as they create material forms that allow for new/old possibilities of movement and exchange over space (Appel 2018; Larkin 2013).

The challenge of upscaling alternative infrastructures, however, remains the need for perceptual and ideological change. After all, what we value in everyday life is reflected in our built environments because 'infrastructure decisions are a commitment' (Howe et al. 2016, 555). A key to the required shift in values is a reorientation to predominant attitudes that elevate speed and convenience as social goods. To date, the reliance on convenient solutions has had the cumulative effect of defining what people value, and what they take for granted (Shove 2003, 170). What is needed, then, are efforts to illuminate the externalities of socio-temporally accelerated convenience *alongside* examples of how slowing down can create the nimbleness required to reduce these externalities. And while some of the solutions on offer do require more time and more labour-intensive maintenance at the cost of the speed to which many have become accustomed, they also offer a possible reordering and re-specification of what we might consider to be 'normal and necessary ways of life' (ibid.).

It is here that we get to the issue of, and the need for, unworking. The move from fast to slow infrastructures will unlikely be seamless or absolute because it requires an unworking of entrenched values alongside the embrace of simple desires. This unworking, then, is also a 'pedagogy of unlearning' that will continue to run into our own 'aspirational ambivalence' (Berlant 2016, 414). According to Lauren Berlant, this aspirational ambivalence exists and persists due to our 'aggressive need' for the world to accommodate us *and* (original emphasis) due to our own resistance to adaptation (ibid.). Even at a time of intense global turmoil—such as the forced slowing down we have collectively experienced in response to the crises caused by the Covid-19 pandemic—we see vocalised in the public and political discourse twin desires to work with our 'new normal' as well as a hope for a swift return to

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the fast-paced lives that several of us so desperately railed against. When the world spins too fast, it seems, we seek to slow down; and when it slows, we aspire to speed up.

The point of underscoring the effort to work with, and to unwork, our aspirational ambivalence to acknowledge that, like infrastructures themselves, the effort to move towards slow(er) ways of doing and being in the world will be a process that ebbs and flows. Slow infrastructures are, nonetheless, a meaningful pursuit because they serve as a potential antidote to the many perils we face. Due to the significant human and more-than-human connections that they enable, and the ethics of care and the maintenance that they require, they come with the important promise of lives more connected to others, and to the cycles of life itself. If adopted and adapted in similar settings, these slow infrastructures might even yield accelerated action for addressing the multitude of environmental challenges we presently face.

Chapter 8: Conclusion: Weathering Waste

During the last few months of my fieldwork, in early 2019, the landfill at Brahmapuram erupted into flames on numerous occasions, enveloping the city in a cloud of toxic smoke. There were allegations over the fire being deliberately lit, and in the immediate aftermath there was increasing pressure on the Cochin Corporation to address the issue of not only toxic smoke but the deteriorating conditions at Brahmapuram. Whether it was deliberately lit or not, what became clear was that the culpability lay squarely with the local government due to the mismanagement of the landfill. As Dr Manoj and others working in the field knew, poorly managed landfills harbor gases such as methane, and when the pressure from these gases accumulate, they can cause spontaneous combustion. The mismanagement of Brahmapuram was now causing serious health concerns not only through leachate into the nearby backwaters, but into the air which everyone in Kochi was breathing. Was this the "binding crisis" that Doron and Jeffrey point to as necessary for collective action on waste in this city (Doron and Jeffrey 2018, 11)? The literal and figurative heat on Brahmapuram cooled before long, but it did encourage me to scale up my thinking, to consider how waste and its management was related to weather more broadly, especially within a global climate that is warming and which low-lying areas, like those around the backwaters, are increasingly at risk of being submerged by sea-level rise. It is here, between weather and waste that I want to conclude this thesis, but before I do, I will summarise my main contributions.

This thesis contributes to contemporary debates on environment, infrastructure, and waste in three related ways. Firstly, I critique terrestrial and land-based approaches to urban development in tropical south India by introducing wetness as an affective and material condition of Kochi. The turn to wetness is grounded in the categorization of tropical weather

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patterns and waste infrastructures into both wet and dry. I draw on geographers, architects, and environmental anthropologists to demonstrate that the fluidity of wetness that the Indian monsoon provides, confounds modern urban development projects based on infrastructural imaginaries founded on stability and the allocation of dry land (Gandy 2008; Björkman 2018; da Cunha 2019). The subterranean sewage infrastructures of Paris and London are simply incompatible with Kochi's wetness, though there are plans to pursue these kinds of urban infrastructures despite that incompatibility. I suggest thinking of water itself—as being contained and separate from drier land—is a product of these kinds of imaginaries, and present wetness as a more faithful and compelling analytic based on the lived reality of being in Kochi. In doing so, I contribute to a growing field of research oriented around the 'wet ontology' of seascapes by demonstrating what a wet ontology might mean within an urban development context (Peters and Steinberg 2019).

To bring both the stabilising nature of infrastructures and the fluid and emergent qualities of wetness together, without reducing one to the terms of the other, I turn to the concept of envelopment. I suggest that recognising Kochi as being enveloped in wetness, is a good place to start thinking about the infrastructural problems of waste management in the city. In other words, I argue that there is no 'away' in Kochi because everything floats together in an abundance of wetness. How does one do waste management better, while acknowledging that waste cannot go someplace else where it becomes someone else's problem? This is a crucial issue for not only Kochi, but most urban governments across the globe as a plastic waste crisis continues to prove exceedingly problematic and disastrous. Crucially, the turn to both wetness and envelopment is open to an analysis that is alive to the affective qualities of both wetness and infrastructure. Wetness is not an object; rather, it is a feeling and a quality, and

therefore I argue that wetness holds the capacity for rearranging affective attachments to the more extractive and polluting kinds of urban development.

Secondly, I build on this foundation of wetness to demonstrate how infrastructures built to process discarded plastics are incompatible with Kochi's environment. I do this in two ways: by highlighting the evaporative quality of waste-to-energy infrastructure as the proposed solution to the waste crisis engulfing the city, and by exploring how the two approaches to waste management in the city—streamlining disposal or single-use plastic bans—are evident in the production of two sites of urban nature in Kochi. The city was awash in the controversies surrounding its one dilapidated and toxic landfill—Brahmapuram. Proposed solutions to both the landfill and the issue of plastic accumulating in the backwaters centred on large investments in WTE. In turn, this infrastructure streamlined the production, consumption, and disposal of plastics by claiming to be able to evaporate Kochi's wetness through innovative new technology. I argue that this technology is likely to fail, based on similar scenarios elsewhere in India and because of Kochi's immense wetness. I also argue that by investing in waste management infrastructure of this kind, that required as much plastic input as possible to become an efficient source of energy, the Kochi government was effectively investing in the future of disposable plastics. Through a brief history of the capitalist nature of plastics and their disposability, I demonstrate that an investment in WTE is only the latest in a number of technological developments geared toward capital gains without much thought of the unintended consequences. These arguments echo what several of Kochi's leading environmental activists were raising in their advocacy for a single-use plastics ban across multiple institutions throughout the city.

To show how these different approaches to waste management are related to political ideologies and imaginaries of broader ecological aesthetics, I analyse the production of urban nature in two sites in the city: The Mangalavanam Bird Sanctuary and Subhash Bose Park. The MBS has a plastics ban and is the last remaining mangrove forest in downtown Ernakulam. Despite the plastics ban, the swamp was under threat from pollution entering it from the surrounding buildings through the movement of the backwaters. The assumptions about infrastructures being able to keep pollution out, while wetness brings it in, highlight not only how the management of waste makes assumptions about the environment, but also how waste and its management is often performative—reinforcing ideas of spatial segregation through discrete separation between human and non-human spaces.

The performative and ideological nature of waste management is further on display at SBP, a recently developed park in the centre of Ernakulam that provides a vantage over the bustling Kochi harbour. Here, instead of a plastics ban, the numerous bins designed in the shape of animals such as penguins and goldfish and the stalls at the entrance to the park selling snacks and drinks housed in single-use plastics suggest consumption and disposal of plastics is encouraged. Together with the spatial layout of the parks, and the ambient experience of them including the use of a sound system in SBP, different ideas are being conveyed to patrons about the city and its relationship to the environment. One suggests plastics are bad for the environment, the other promotes a clean and green city where waste management is on display as an *achievement* of the local government that is aligned with national ideas of urban development. But once you look beyond both of these narratives, at the pollution entering MBS and the mismanagement and controversy at Brahmapuram, it becomes apparent that the pollution of the environment continues.

Finally, I argue that to rearrange collective imaginaries about infrastructure and waste in Kochi in ways that remain harmonious with its wet tropical environment one must embrace something akin to slowness. The efforts to install a WTE facility were aligned with other urban development projects in the city, all designed to speed things up. Whether it was transport, commerce, or waste management, there was a desire to centralise and streamline the process to create frictionless movement and growth. These fast infrastructures have their precedence in the extractive and accumulative infrastructure of successive colonial forces in Kochi. To counter this, I propose, along with my co-author Georgina Drew, the notion of slow infrastructure.

The numerous institutions in Kochi practicing composting provided a generative example of slow infrastructure. I argue that as a form of inter-species collaboration, composting cannot easily be hastened or scaled up to suit capitalist or extractive processes. It is more suited to the humid and highly microbial environment of tropical South India. Those who practice composting found it inspirational, it gave their life meaning and provided a means for the unworking of not only speed and convenience, but also social stigmas. It might be a good example of what Michael Taussig has recently referred to as the mastery of non-mastery (Taussig 2020). Composting, and the rainwater harvesting we also discuss, find similarities with the slow food movement where locally grown produce accessible to the nearby community provides an alternative to the fast food provided by global capitalism. Erica Gies has recently called for cities to embrace a 'slow water' movement that reflects "a willingness to work with local landscapes, climates and cultures rather than try to control or change them" (Gies 2022, 13), can we think here of composting as a 'slow waste' movement?

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Together, my analyses contribute to debates over urban development in (post)colonial tropical cities by showing how situated environmental conditions manifest around the issue of waste and its management. I show how an abundance of wetness affects how waste can be managed, but also that how waste is managed changes urban environments. These insights are increasingly important as governments continue to ignore environmental concerns in the pursuit of technological solutions to problems that arise from rapid urban development. The contestations over waste are further complicated by complex histories of colonial and (post)colonial development that altered the physical landscape in pursuit of extraction and wealth. They are also further complicated by the current planetary condition we find ourselves in, anthropogenic climate change, something that was not lost on my interlocutors. I now conclude this thesis by tying these multiple threads together around the concept of weathering. My hope is that this final section of the thesis gathers up what I have written on the pages above and demonstrates generative avenues for further research.

Weathering Waste

Weathering has emerged in the environmental humanities literature in recent years as a way to understanding how "bodies, places and the weather are all inter-implicated in our climate-changing world" (Neimanis and Hamilton 2018, 80). It has proven to be a generative heuristic in approaching political ecologies of colonial geology (Collins 2020), the socio-political atmospheres of lives lived in the wake of trans-Atlantic slavery (Sharpe 2016), and the increasingly complex ways in which human worlds are both affected by weather and generating weather (Zee 2020). Furthermore, as Tim Ingold has highlighted, European philosophical imagination about humans and their place on the world was often trapped in terrestrial biases. He summarized by stating, "they have shut out the weather" (Ingold 2010,

131). These philosophical imaginations have, as I have argued in this thesis, had infrastructural consequences.

Weather has become not only a form of meteorological knowledge, but also a metaphor for the atmosphere of planetary changes. It is in this way that Joseph Masco has also explored how various instances of planetary crisis, from the threat of nuclear war to climate change, constitute what he refers to as "bad weather" (Masco 2010). Plastic accumulating in the environment might constitute another planetary crisis, as it becomes increasingly difficult to find anywhere on Earth without the presence of microplastics. Weathering is at once about how the climate changes us, how we change the climate, but also about how we might "weather differently" (Neimanis and Hamilton 2018, 81). In other words, how do different bodies weather differently, and how might we collectively change our relationship with weather toward more harmonious futures.

To weather is also to endure, to find ways of getting on together through the storm despite the toxicity of our present planetary condition. Michelle Murphy refers to this as "alterlife", where acknowledging "collectivities of life recomposed by the molecular productions of capitalism in our own pasts and the pasts of our ancestors" does not negate the "contradictions of existing in worlds that demand chemical exposures as the conditions for eating, drinking, breathing" (Murphy 2017, 497). The activists I conducted research with throughout this thesis understood that the end goal, the greater purpose of their advocacy, was to address these larger collective conditions, including climate change. What might weathering waste offer as a way of holding together the threads of wetness and slowness, amid the contestations over waste infrastructure, in the context of a changing climate?

At a fundamental level, to consider weathering in India is to consider the monsoon. As I highlighted in Chapter 1, scholars are starting to rethink the monsoon as more than just a meteorological event, but as something that is fundamental to politics, economy, ecology, culture, and more throughout South Asia. For example, Beth Cullen has shown how the monsoon is bound up in the production and distribution of bricks in Bangladesh (Cullen 2020). The monsoon, however, is now changing along with other global weather systems, affecting seasonal crop yields across India (Matthan 2022). In the concluding section of this thesis, I bring weather into the fold to reiterate and reframe what I have done throughout this thesis. I do this by addressing four key questions, some of the answers to which are in this thesis, and some are generative sites of future research:

1. How does weather matter to waste management?
2. How does waste and its management matter to weather?
3. In what ways does Kochi continue to weather the effects of hundreds of years of colonization in the city?
4. How do bodies in Kochi weather differently, and how might those in Kochi collectively weather differently toward more harmonious futures?

Firstly, as I have demonstrated throughout this thesis, weather matters to waste and its management. To show how wetness matters to waste management in Kochi is to prioritise specific ecological conditions to a particular place. In Kochi, this was the backwaters but also the monsoon, the wet-dry seasonality of weather patterns, and the hot humid microbial conditions. It is impossible to think about, or experience, the Kerala backwaters without the monsoon. To be enveloped in the wetness of the monsoon, and to work from there in addressing infrastructural problems within the city, including how waste is managed, is one

example of weathering. Further to this, there is now increasing evidence to suggest that climate change will affect how waste is managed, especially in the Global South, and especially in low lying coastal areas (Kalina 2020; Beaven et al. 2020). These affects will be worse in places like Kochi where the environment has been drastically changed by (post)colonial infrastructures, and will likely reproduce and accelerate existing social inequalities, most obviously felt along gender and caste lines.

The flip side of that notion, is that waste and its management matters to weather. There is a substantial amount of evidence to suggest that waste accumulating in landfills, along with the combustion of waste, is the third largest contributor to climate change behind agriculture and energy. As far back as 1987, Paul Crutzen, who has since become famous for coining the term the 'Anthropocene', was involved in a study that established that between 6-18% of the total emissions of methane at the Earth's surface could attributed to municipal solid waste (Bingemer and Crutzen 1987). There is also a growing amount of evidence to suggest that plastics production significantly contributes to greenhouse gases and global warming (Ford et al. 2022). While I do not contribute to these claims in this thesis, many of my interlocutors and research participants, including Dr. Manoj, did understand their activism in relation to climate change. Two of his other projects on the ground were titled 'Zero Carbon Kochi Metro', and 'Change Can Change Climate Change' based in Trivandrum. And if the floods that I experienced in August 2018 are any indication, Kochi, and Kerala more broadly, will be one of the more severely impacted by sea level rise from a warming planet. Drawing the dots together between waste management and climate change in Kochi in this way would be a fruitful avenue for further research.

Thirdly, it could be said that Kochi has weathered numerous colonial and (post)colonial environments. The (post)colonial condition of living in Kochi, surviving hundreds of years of colonial rule and now enduring the damaged ecological conditions left in its wake. The dredging of the Kochi harbor—which began with the British engineer Sir Robert Bristow—continues to have a drastic effect on the backwater ecosystem, disturbing the waters that have been used for subsistence fishing for centuries. Most of the Chinese fishing nets scattered around the shorelines of the backwaters lay unused, or when they are used, pull up weeds and plastics. The (post)colonial condition of living in Kochi is itself a kind of socio-political weathering. To continue this line of thinking even further, in line with Christina Sharpe's writing on the weather as endurance in an anti-Black world (Sharpe 2016), one could look to the ways in which transatlantic slavery was vital to the earlier colonial outposts in Kochi and along the Malabar coast.

Weathering also draws our attention to how different bodies weather differently. Here I want to draw attention to how different bodies are affected by waste. As I mentioned in Chapter 5, women are disproportionately affected by the chemicals involved in creating plastics such as polyvinyl chloride and other polymers. In Kerala, and in India more generally, much of the waste work is done by women. Drawing attention to how bodies weather differently in different places, highlights these gender dynamics to waste and its management in India. Furthermore, as I have shown throughout this thesis, Kerala's backwaters—as bodies of water—have become the recipient of wastes for decades. Once in water, plastics disintegrate into microplastics, affecting marine life and entering human food webs. The chemicals in microplastics then bioaccumulate, which means they get *more* toxic as they pass through from water bodies to animal bodies, to human bodies. Tracing the abundance of plastic waste in environments as an instantiation of patriarchal—and human centric—technoscience is a

practice of weathering. Plastics matter differently to different kinds of human and more-than-human bodies, even as those bodies are linked through patterns of movement and metabolism (Gandy 2004).

And finally, I suggest that the slower more-than-human and collaborative practice of composting, might be one way to consider how to weather better. The unworking of the speed and convenience associated with infrastructural extraction and capital accumulation is also an unworking of the poor waste management practices that contribute to climate change such as landfilling and incineration. The slower infrastructures of composting (and rainwater harvesting) disperse the responsibility for weathering. It is also an embodied practice that requires slowing down to the speed of microbial life, not too dissimilar from the slowing that occurs to beekeepers when tending their hives. Weathering better is less about becoming more resilient to the ecological devastation that faces life on Earth, and more about working together toward more prosperous, if humble, futures through embodied practices.

Ultimately, the reimagining of urban environments and (post)colonial infrastructure I have proposed in this thesis hinges on the willingness to participate in slowing down together in concert with specific environmental conditions and in relation to global circumstances. This slowing requires an unworking of the attachments to the straight paths promising fast growth inherited from colonial capitalism (Ahmed 2006, 20). This slowing will help to mediate a necessary changing of directions, not with the certainty of any particular outcomes, but with the understanding that one is no longer being directed toward catastrophe.

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Appendices

FLOATING GROUND

Wetness, infrastructure, and envelopment in Kochi, India

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ABSTRACT: The oceanic city of Kochi on the southwest coast of India is known for its abundance of water and as a hub of tourism and urban development. This abundance of water effects the ways in which urban infrastructures, often designed in the temperate climates of the Global North, can operate, and be maintained. In this article, I suggest that infrastructures such as sewers, roads, and rivers tend to separate water from land, thereby containing one to produce the other. In doing so, they render solid surfaces from which urban infrastructures are imagined. To imagine infrastructure otherwise, I attune to wetness, rather than water. I argue that attuning to wetness as an affective quality, changes the way one conceptualises infrastructure. To bring wetness and infrastructure together, I turn to the concept of envelopment where an object and its atmosphere can be brought into conversation. By drawing on ethnographic fieldwork in Kochi during the devastating floods of 2018, this article provides insights into how infrastructures might be reimagined in tropical urban settlements.

KEYWORDS: Kochi, affect, atmosphere, city, flood, monsoon

Introduction

The oceanic city of Kochi (formerly Cochin) on the southwest coast of India (Figure 1) is defined more by its water bodies than its land bodies. When I first told friends of mine in Kolkata that I was travelling to Kochi to embark on ethnographic fieldwork, the first thing they mentioned were the famous Kochi backwaters. These waters which envelop Kochi are a popular destination for tourists visiting the south of India looking for picturesque houseboat cruises along coconut palm lined waterways, a glimpse of the watery life that is largely absent from South Indian cities like Chennai and Bangalore. I came to know these waters as a series of canals, rivers, and lakes that cut across the various smaller land masses that together form the urban agglomeration of Kochi. Each of these islands – West Kochi, Willingdon Island, and Ernakulam – have their own feeling, and each is connected and disconnected by waters that seem to house an affective attachment to place more so than any of these slightly dryer dwelling places.

Kochi's canals and backwaters were once the lifelines of the city, essential for the movement of people, goods, and ideas inland from the coast or back out to the Arabian Sea. These waters were also vital for subsistence on a diet that revolved around fish and coconut, and for recreation as they provided respite from the insistent heat of tropical South India. The management of the abundance of water – and Kochi's importance as a spice trading port throughout the ages – was central to infrastructural developments, and a kind of tropical flourishing, encapsulated in the popular reference to Kochi as the

"Queen of the Arabian Sea"[1]. Today, however, Kochi's famous backwaters lie mostly abandoned due to their use as drains and less as a form of sustenance and transport. In other words, as they became lines on land in service of development as drains, their material, social, and affective significance shifted. This development narrative is largely based on a conceptual and physical separation between water and land. This is achieved through infrastructures that rely on and produce that separation.
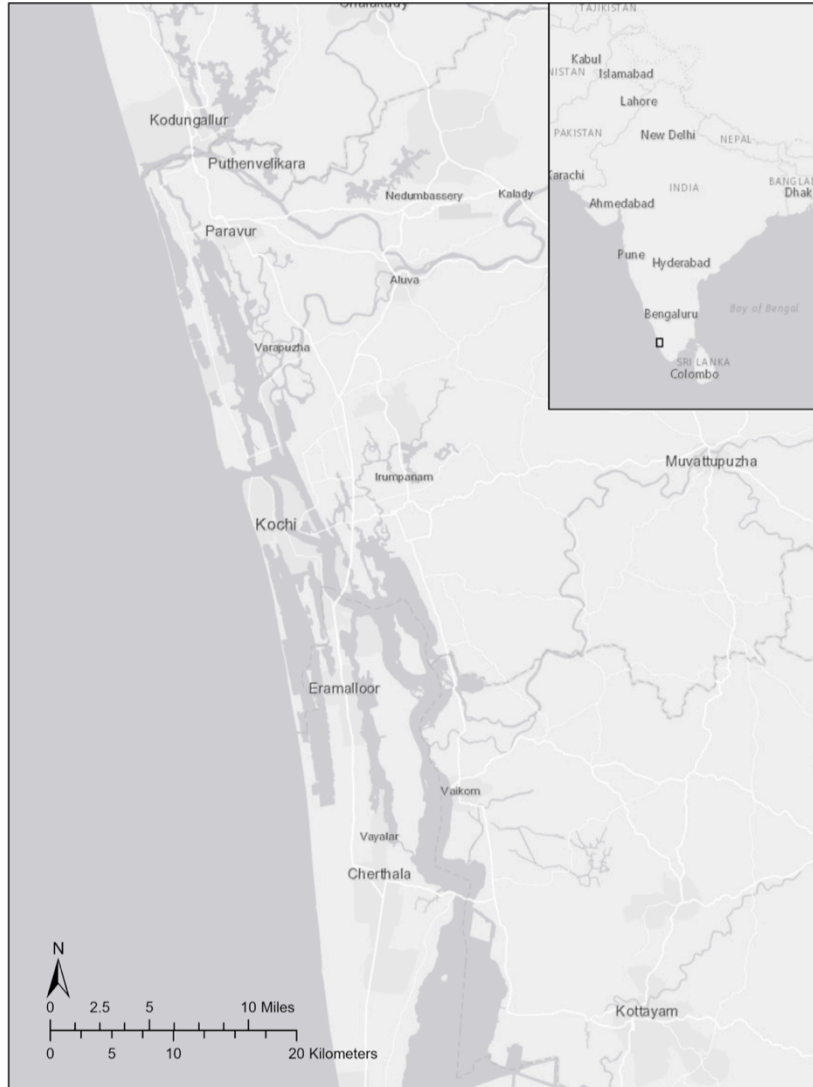

Figure 2- Map of Kochi and adjacent areas[2] (Justin McCulloch, 2021).

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[1] Invoking the popular reference to Venice as the 'Queen of the Sea'. Kochi and Venice share a wetness and an appreciation of the arts.
[2] Maps like this work against my argument that the colonial cartographic imagination is unable to accurately represent wetness. However, it may be useful to see how Kochi is situated amongst the backwaters in this way, particularly for those who have not been to this place.

Urban landscapes, as well as urban waterscapes[3], are constructed and maintained by infrastructures that have their roots in colonial logics of extraction, property ownership, and state making (Gómez-Barris, 2017; Joseph, 2013; Rademacher, 2008). In their separation, water is often in service of land, often acting as a sink for unwanted wastes and a container for industrial runoff (Gabrys, 2009). This is a familiar story and is not too dissimilar from what has happened to the Yamuna and Ganges rivers in Northern India (Alley, 2002; Bhattacharyya, 2018; Drew, 2017; Haberman, 2006), or indeed many other rivers and waterways around the world (Barnes, 2014; Hoover, 2017; A. Rademacher, 2011). This management of land and water as separate entities was underway prior to European colonisation of India but was accelerated through that process. As historian Sunil Amrith states:

> Along the Ganges, as everywhere else in India, the infrastructure of water control long preceded British rule. But in the nineteenth century, British engineers turned the Ganges valley into one of the most "thoroughly engineered" landscapes in the world. (2008, p. 42)

Turning this attention to urban South India, what I want to focus on in this article is how both the landscape and waterscape of Kochi (Figure 2) has been constructed through (post)colonial infrastructural developments that create an abundance of water from intense *wetness*.

In what follows I draw on 10 months of ethnographic fieldwork in Kochi between January 2018 and April 2019. During this time, I engaged with environmental activists throughout the city, leaders of waste management initiatives at educational and medical institutions, government officials, civic groups mobilised around waste, architects, and artists. I also experienced the full force of the South Asian monsoon as it arrived in Kochi in July 2018, causing one of the worst floods in Kochi's history. To begin with, I shift the analysis from water to wetness. Wetness here is a relational affect, distinct from water as a discrete object. As an affect, wetness is something that is felt, not controlled. I then explore Kochi through the lens of its underground sewage infrastructure – or lack thereof. Only 5% of Kochi is serviced by underground sewage networks despite continued attempts to expand the network in order to prevent pollution entering Kochi's waterways and revitalise the city's waterbodies. This is largely due to the incredibly high water-table, and the disruption that laying sewage pipes would cause to already congested road networks. To compliment this section on sewers, I also situate roads as part of the same infrastructural logic that sees straight lines and hard surfaces as necessary to increased productivity and urban development. I then turn to the concept of envelopment as a way of engaging infrastructures and their atmospheres – in this case Kochi's incredible wetness – before closing the article by reflecting ethnographically on the 2018 floods and the ongoing pollution of the Periyar River that flows through the city. Here I emphasise the affective register of Kochi as a city that cherishes its wetness while grappling with infrastructures that are often incompatible with that wetness. By shifting the mode of analysis from water to wetness in a place as oceanic and as infrastructural as Kochi, I hope to open new ways of thinking about the affective qualities of infrastructure and wetness *together* that displace the dispositions of colonial urban imaginaries.

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[3] For more on the construction of waterscapes and city making, the growing literature in urban political ecology will be instructive, see in particular Heynen, Kaika, & Swyngedouw (2006).

Figure 2 – Kochi, a city afloat (author's photo, 2018).

Wetness

The similar yet distinct social practices that humans craft with water have intrigued anthropologists for a long time (Strang, 2005, 2014). It's mutability and utility across different mediums has inspired people from around the world, and has been the subject of deep philosophical pondering about the ephemerality of life (Bachelard, 1983[1942]). As anthropologist Stefan Helmreich states, "water is not one thing", and takes many different material forms (2011, p. 133). But what is lost in this materialist rendering of one of life's most crucial elements? Wetness. Here, I want to reflect on Kochi's wetness, and how that might change the way infrastructures can be imagined in the city. Wetness is not a *thing*, but an affect or a quality. To draw again from Helmreich, if water is a "theory machine" for the environmental or 'blue' humanities, wetness might be a *feeling* machine (2011, p. 132). This involves an expansive atmospheric thinking that takes seriously the various qualities of wetness: soaking, seeping, evaporating, and condensing.

The estuary that Kochi now rests upon was the result of the cataclysmic flood of 1341 that redrew history and place in one epic deluge. Prior to this flood, then Cochin was a small port city, overshadowed by the now semi-mythic ancient trading port of Muziris. Annihilated by the flood, there are only a few excavated remains of Muziris that point to its once central figure in ancient trading routs between Southeast Asia, the Middle East, and the Mediterranean (Nandy, 2000). It is estimated that Muziris was somewhere near what is known currently as Kodungallur, and historically as Cranganore, about 20km north of present-day Kochi on the banks of the Periyar River. It wasn't until nearly 200 years later, in 1498, when Vasco de Gama, a Portuguese merchant, explorer, and missionary famously anchored in the Cochin harbour and began what became the European colonisation of the Indian subcontinent[4]. The region was devastated again in 1928 with the 'great flood of 99' (referring to the year 1099 in the Malayalam calendar), which would have influenced British infrastructural development at the time, and may have even influenced the communist and anti-caste emancipation movement throughout the 1930s

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[4] For more on the official history of Cochin and the arrival of the Portuguese, see Subrahmanyam (1997).

(Houtart & Lemercinier, 1978). Since then, Cochin, and now Kochi, has been a major port city in South India, now host to the Southern Indian Naval Command, an IT Hub, the Eloor industrial belt, and a large trans-shipment international container terminal. Kochi is then a colonial city, historically and presently. Part of this colonisation of place involved a separation between land and water, despite the abundance of wetness.

These deluges that shaped Kochi were brought across the Arabian Sea by seasonal monsoonal winds. These winds travel in a North Easterly direction across the Indian subcontinent each June until they hit the Himalayan mountains. But before they reach the Himalayas, these winds must travel over the Western Ghats, a long mountain range on the eastern border of the state of Kerala, creating a downpour that acts as a precursor to what is to come for the larger north India cities. Over one half of the world's population draws their water from this seasonal downpour. Such is the importance and reverence of this "ocean of rain" that life in South Asia is deeply entangled with the rhythms of the monsoon (da Cunha, 2019, p. 205). After watering the Himalayas, the monsoon travels back across the continent, making Kerala the first and last place to receive annual monsoonal rains. As such, Kochi is the recipient of over 3000mm of rain each year, making it one of the wettest places in South Asia. And it is here that I find thinking about the monsoon in terms of water is insufficient to the task at hand. Water, in its distinction from land, is a part of a colonial imaginary, an imaginary that contributes to the desecration of rivers as infrastructures of capitalist extraction. *Water*, as a discrete and separable entity, as a resource, does little service to the marvellous qualities of *wetness* as a relational affect and condition for life.

In writing of wetness rather than water, I am indebted to the scholarship and generosity of Dilip da Cunha and Anuradha Mathur, who have been writing about wetness from their discipline of architecture for over a decade (Mathur & da Cunha, 2009, 2014, 2016, 2020). I met Dilip early on during my fieldwork in Kochi, before I knew his work, at a conference hosted by the Backwaters Collective, a group of established scholars with an interest in or connection to Kerala who meet every two years to discuss politics and philosophy. The 2018 conference that I attended was co-hosted by the 2018 edition of the Kochi-Muziris Biennale, the largest arts festival in Asia. It was a private event, but fortunately I had received an invite a few days earlier at a public seminar by historian Ajay Skaria. Unfortunately, I missed Dilip's presentation at the conference but we did meet later. This conference was a pivotal moment in my fieldwork experience as it was not only my first foray into a quite exclusive and progressive discourse of Indian philosophy[5], but also led to my engagement with the Kochi Biennale Foundation, the organisation behind the Kochi-Muziris Biennale. It also happened to be in the middle of Kochi's monsoonal rains as I vividly remember being enveloped in rain as I squeezed into the back seat of a car already full of people to hitch a ride home to my accommodation.

Dilip's presentation, which I subsequently accessed online through the Monsoon Assemblages archive[6], was about his most recent work titled, *The Invention of Rivers*. In it, Dilip theorises rivers as the colonisation of rain. In this designation, (post)colonial India has come to inhabit a cartographic imaginary of a surface, where maps are divided into 'land' and 'water' to (re)produce rivers. To move beyond this binary, da Cunha and Mathur suggest engaging with a relational ontology of *wetness*. In South Asia, this wetness is intrinsically tied to the ebbs and flows of the monsoon. It also shifts the analysis away

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[5] Some of the other delegates were scholars such as Ashish Nandy and Vinay Lal.
[6] Monsoon Assemblages are a collective of researchers based at Westminster University, London, that seek to investigate the multiple realities of the South Asian monsoon. http://monass.org/

from an object-oriented ontology, and toward an affective phenomenology of existence[7]. In this way, wetness is a quality, an affect, a *feeling*, rather than an object. In doing so, da Cunha and Mathur put forth an engagement with a monsoonal aesthetics that is less meteorological and more affective, and is to be explored through song, dance, poetry, art, and other qualitative and phenomenological accounts[8]. Da Cunha and Mathur help us think about this by highlighting that the reality from which maps are drawn and infrastructures are made, is only one part of the hydrological cycle. The hydrological cycle moves from rain, to flow, to evaporation, and finally condensation. Cities are designed through an infrastructural thinking has been primarily concerned with the time of flow formation on the Earth's surface. This means that the monsoon comes and goes, and that it can be conceived of as water landing and flowing on a surface. It is discrete. In this separation, a surface is made, and a line is drawn between land and water. From the complexity of wetness, came a rendering of the monsoon as a series of flows that needed to be contained. And in its containment, water in a line, on a surface, creates *land*. Water was in this way, in service of a (colonised) land.

This engagement with wetness rather than water finds companionship amongst Pacific Studies scholars (Hau'ofa, 1994; Teaiwa, 2017), and has recently been explored in broader fields of research such as geography, media studies, and island studies (Baldacchino, 2012; Candiani, 2014; Cavallo, Vallerani, & Visentin, 2021; Krause, 2017). Kimberly Peters and Steinberg and Peters suggest thinking with a wet ontology, where "the sea's material and phenomenological distinctiveness can facilitate the reimagining and re-enlivening of a world ever on the move" (2015, p. 248). They find a wet ontology helpful to move beyond some of the ways in which geography has been stymied by land-based thinking of linearity, solidity, and territory. Similarly, Melody Jue proposes a milieu-specific analysis that "figures as a general conscientiousness of the environmental conditions in which scholars produce theories" (2020, p. 15). She does so to bring seawater into an analytical framework that "focuses on the relationship (and tension) between the interpreter's normative environment of interpretation and the ocean as an environment of interpretation" (ibid, 20). Kochi might even be thought of as an urban variation of what Philip Hayward has proposed as an *aquapelago*, where "a social unit existing in a location in which the aquatic spaces between and around a group of islands are utilised and navigated in a manner that is fundamentally interconnected with and essential to the social groups' habitation of land and their senses of identity and belonging" (Hayward 2012, p. 5). However, while this concept draws attention to watery attachments and envelopments, rather than land-based ones, it continues to operate within the framework of land and water as separate material entities. These approaches to both wetness and oceanic interpretation contribute to the emerging field of 'Blue Humanities' or 'Critical Ocean Studies' that aims to put water at the front of contemporary concerns in environmental scholarship and literature (DeLoughrey, 2019). While I draw inspiration from these efforts, I am less interested in the various excesses of the oceanic, or sea water as a medium for ecological thinking, and more interested in how Kochi as a place and as a city, contends with the (colonial) distinctions between land and water through the relationships that have formed there between wetness and infrastructure.

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[7] Object-Oriented Ontology (OOO) is a recent turn in the continental philosophical tradition of materialism (or new materialism), championed by the likes of Graham Harman and Timothy Morton, which aims to reject human exceptionalism by flattening the ontological analysis to include all things, human and non-human. This turn has been critiqued for its lack of attention to power and subjectivities. For a critique of OOO relevant to this paper, see Hepach, 2021.
[8] Here I am also indebted to the Monsoon Assemblages research group at the University of Westminster, where I first presented this research in 2019.

Infrastructure

The history of Kochi and its wetness can be read through ways in which infrastructure has been imagined in the city. Famous as a port city, Kochi has struggled with its more typical colonial infrastructures, especially those that assume access to solid ground (and indeed, a solid underground). The Periyar river, which flows through Kochi to the backwaters, often changes colour due to nearby chemical industries dumping their wastes illegally through underground pipes in lieu of a functioning sewage system. This caused major fish-kill events on numerous occasions throughout my fieldwork. In this section, I focus on how immense wetness changes the relationship between two colonial infrastructures in Kochi: sewers and roads. But first, I need to share how I think about infrastructures and why I think that is important.

What the term 'infrastructure' captures is as unruly as the lifeworlds they create as physical and affective entities. Infrastructure is more than just public works. People are infrastructure (Simone, 2004), nature is infrastructure (Carse, 2012). The fact that the concept defies definition is a kind of testament to the mutability of the term, but if everything (and therefore nothing) is infrastructure, then what is the use? Conceptually, infrastructure provides a useful way of engaging and analysing the relationality of things. Infrastructures are socio-material configurations that bring things into relation, which is distinct from bringing them together. Separation and containment are also relations[9]. Sewers aim to contain bodily wastes through separation and excision, embodying the colonial and capitalist disposition of disposability. In their relational capacities, infrastructures might be thought of as "matter that enable the movement of other matter" (Larkin, 2013, p. 329) pushing "ethnographers to address the instabilities of the contemporary world, to highlight movement, contingency, process, and conflict in and through the study of particular infrastructural formations" (Harvey & Knox, 2015, p. 4).

It is perhaps through their relational capacities that infrastructures re-enforce a kind of imaginary surface, a solidity that renders some things wet and some things dry in order to keep things contained and separated[10]. In this instance, Kochi's many rivers and canals, produced through the colonial imaginary as water separate from and in service of land, act as infrastructures carrying away unwanted wastes. They produce this separation of water and land from wetness and dryness as much as they rely on it to function. And in this separation, they also generate something more than physical by contributing significantly to an affect or an atmosphere of a place[11]. And while some will no doubt enjoy the "surface pleasures" that present themselves through these infrastructural fabrications (Anjaria, 2020), I'm curious about what other kinds of pleasures might have been lost along the way, and how what is both present and what has been lost contribute to the feeling of Kochi as a city today.

The invention and adoption of sewers in 19th century Europe, and the pathologising of human excrement has had a surprisingly profound effect on the development of cities around the world (Anderson, 1995, 2006; Chaplin, 1999; Gandy, 1999; Gerling, 2019; Levine,

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[9] For more on separation see Liboiron (2021, 48).

[10] In thinking of infrastructures through their relational capacities, I am drawing on the work of anthropologist Atsuro Morita and Casper Bruun Jensen (Jensen & Morita, 2017), but also the work of Martinique philosopher Edouard Glissant (Glissant, 1997).

[11] I am particularly inspired by anthropologist Maura Finkelstein as she suggests, "to feel infrastructure may not be to 'know' it (in the sense of engineering), but in focusing on affect, my work challenges this framing of expertise and draws urban anthropology away from city planning and back to ethnography" (Finkelstein, 2019, 22).

2007). In the influential book *History of Shit,* Dominique Laporte goes as far to say that the intervention of Victorian era sewers and the politics of waste they embodied "branded the subject to his body, and prefigured, not so insignificantly perhaps, the Cartesian ideology of the *I*" (1978, p. 31). They did so by formalising relations between the state and public and private ownership of (urban) land. Involved in this was separation of land and water as a way of designing cities, with the control of water as resource (and waste as contaminant) enabling the ownership of land as private property in cities[12]. The assumption that is relevant here is that the ground beneath one's feet is solid, and that one can dig into it, place a pipe in it, and assume that pipe will remain in place and that it won't leak. There is also an assumption that there is an away, someplace else, where the unwanted wastes can go where it becomes someone or something else's problem. This 'away' is often a wastewater treatment plant, but can also be a river, a lake, or the ocean. In Kochi, this away is the backwaters. But the flow of sewage in Kochi doesn't happen through pipes, it happens on roads and in canals.

Due to Kochi's incredible wetness, most of the population rely on above ground or cement-lined underground septic tanks, rather than sewers to dispose of domestic and commercial wastes. These tanks require emptying, something that is done by manual laborers and septic trucks in the cover of night. Together with my research assistant, I interviewed a group of these septic tank cleaners one afternoon early on in my fieldwork as they were getting ready to start their shift. They told us that many of the tanks they service were overflowing or damaged, that many residents use makeshift septic tanks that leak instead of the commercial tanks with government approval. Because of the high-water table, a leaking septic tank means that it is likely that the septage has contaminated nearby sources of drinking water such as wells. In a densely populated city such as Kochi, the tightly packed residential houses mean it is increasingly difficult to keep sufficient separation between septic tanks and drinking water. Furthermore, I was told that many septic trucks, once full of domestic waste, often empty their collected septic waste directly into the backwaters to avoid driving across town on congested roads to the one wastewater treatment facility that charges a service fee[13]. On another occasion at a popular market in downtown Kochi, one of the stall holders told us trucks often dump their waste into river right behind the market. The use of roads thus enables different forms of politics to emerge around the containment and treatment of sewage.

Sewers and roads are two sides of the same coin. This is especially so in Kochi. One of the reasons I was given for why Kochi didn't have more sewage networks was the disruption it would cause to the already congested roads that require constant maintenance due to Kochi's wetness. Kochi's roads are some of the most congested in India. Adopted through many years of colonisation, the roads initially sped up the transport of spices and other goods coming down from the Western Ghats and to the Arabian Sea to be shipped to Europe and other parts of the world. These goods would have once been transported on water, but the invention of automobiles and the shift to a petro-modernity (Daggett, 2019; Howe, 2019) quickly surpassed these humbler means of transport. As Penny Harvey and Hannah Knox note about the adoption of roads in Peru, they "shifted the axis of activity away from the river [and] brought about a different kind of opportunity and created a new kind of settlement" (Harvey & Knox, 2015, p. 35). As roads were adopted in Kochi, transport along the many lakes and canals in the city reduced. As more people used the roads, more roads needed to be built, and the canals – no longer used for transport or

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[12] This is often referred to as the Haussmanisation of Paris, a prototype for urban development the world over, see Gandy (1999).
[13] I was also witness to, and heard mention of, wastewater pipes diverted directly from properties to water bodies where the opportunity arises.

pleasure –gradually turned into drains for domestic and commercial runoff. Many of Kochi's canals are now clogged with discarded plastics and weeds including water hyacinth (*Eichhornia crassipes*) introduced from South America.

Today, Kochi's roads are in a constant state of disrepair, with large potholes developing each time there is a downpour. The constant 'roadworks' to make a floating ground solid create traffic jams that rival cities ten times bigger like Bangalore and New Delhi. To understand why roads continue to be the normalised and naturalised mode of transport infrastructure in the city, it is useful to understand infrastructures as being more than just a technical apparatus. As Brian Larkin explains:

> *a road's technical function is to transport vehicles from one place to another, promoting movement and realising the enlightenment goal of society and economy as a space of unimpeded circulation. But it can also be an excessive fantastic object that generates desire and awe in autonomy of its technical function.* (2013, p. 333).

The abandonment of the wetness in Kochi is not just a technical issue, it is also about complex histories of colonial rule and how they resonate in the present as (post)colonial aspirations and desires. Kochi has been changing rapidly since the liberalisation of the Indian economy in the 1990s, and like many other mid-sized coastal cities in South Asia, has dreams of becoming the next Singapore. A reproducible model of development which hinges on large infrastructural projects creates an atmosphere of what cultural studies scholar Lauren Berlant calls "cruel optimism", where "a relation of attachment to compromised conditions of possibility whose realization is discovered either to be impossible, sheer fantasy, or too possible, and toxic" (2011, p. 24). The legislated aspirational attachments in this oceanic city are to legible and standardised ideas of what progress and success are, often determined by technologically driven state based funding schemes, like the 'smart cities' program currently underway across India (Drew, 2020). This attachment requires a kind of forgetting, and in Kochi, that forgetting has something to do with the way an abundance of wetness above, below and around oneself conditions the possibilities of life, forging fluid relations. Roads, and other colonial infrastructures like sewers sever that relation.

Envelopment

To hold the affective qualities of infrastructure and wetness together, I turn to what geographer Dereck McCormack terms envelopment. Here, envelopment is "a process that shapes the relation between forms of life and their elemental milieus… a way of thinking through atmospheres and entities without reducing one to the terms of another" (2018, p. 32). The example that McCormack often refers to in his book, *Atmospheric Things*, is an aerostatic balloon. Hot air balloons, weather stations, and other spherical floating objects provide inspirational ground to theorise about atmospheres and the things that exist in relation to those atmospheres. As such, as it is presented here, envelopment is situated as a way of engaging with things that are airborne. This example reproduces a tendency when discussing atmospheres to fix attention to the sky and that which is encompassed by *air*. As anthropologists Tim Choy and Jerry Zee elaborate

> *This form of thought looks up and around, at plumes, clouds, and sky. It looks inward through the vital interiors that render bodies channels, containers, and filters for airs and the things they hold. More significant than the directionality of its gaze, however, is its manner of attunement to the*

potentials of substances to shift from states of settlement or condensation to ones of airborne agitation, to settle again in time, or to activate a reaction, somewhere else. The wrong air of the Anthropocene trains our attention to the mechanics of suspension, to how things lift and settle in mediums, to how things exist in atmospheres. (2015, p. 211)

I would like to extend this assertion by pointing out that clouds, plumes, and bodies, are mostly containers of *wetness*, or in Astrida Neimanis' terms "bodies of water", in their various manifestations, rather than of air (Neimanis, 2017). Envelopment is not just related to being suspended in things that are skyward or airborne, it can also "move bodies to become more or less responsive to their conditions, and to modulate their capacities to act into and within these conditions", regardless of their elemental milieu (McCormack, 2018, p. 19). As I've highlighted above, the fluvial nature of Kochi does not just manifest as water flowing alongside land, but occupies space below, around, and above the human and more-than-human inhabitants of this place (often manifesting as sweat on my forehead, for instance). Kochi's wetness is an atmosphere that is more than rain falling on land then rendered useful to carry away unwanted things. It is something that continues to emerge amid the everyday lives of Kochites, significantly shaping the affective experience of the city, and the ways in which infrastructures can (or cannot) function. Kochi's roads and (lack of) sewers are enveloped in wetness.

Thinking about envelopment in relation to Kochi reminds us that paying attention to atmospheres doesn't just mean looking up, it means looking down and around as well. Suspension is not a skyward attachment, but an Earthly and aqueous condition. To bring atmospheric attention to wetness and infrastructures together, in a way that privileges an (under)ground, disrupts the surface thinking inherent in infrastructural projects such as sewers and roads that produce water and land. Indeed "attending to atmospheric attunements means chronicling how incommensurate elements hang together in a scene that bodies labor to be in or to get through" (Stewart, 2011, p. 452). To be in relation to the ground in Kochi is to be in relation to wetness. To be in Kochi, is to be enveloped in wetness.

These critical theories of atmosphere, including envelopment, draw on a growing body of literature and research on *volume* (Elden, 2013; McNeill, 2020; Steinberg & Peters, 2015). This research aims to displace the two-dimensional territoriality of cartography and the nation-state, in favour of thinking through depth and verticality as increasingly central to what Keller Easterling calls *extrastatecraft* (Easterling, 2014). Influenced by philosopher Peter Sloterdijk and his theories of *atmoterrorism*, the volumetric turn tends to look back to the advances of military technologies in the first half of the 20th century as the beginning of attempts to claim sovereignty over the sky and the underground (Sloterdijk, 2009). However, if one is to think through the history of bodily wastes and contagion – particularly the theory of miasma which, until germ theory surpassed it, suggested that illnesses travelled through "bad air" (Cole, 2010; Corburn, 2004) – thinking with volumes was critical to public health measures and the eventual invention of underground sewage systems in the mid 19th century. I turn to envelopment rather than volume here as volume is an attempt to incorporate three-dimensional measurement into theories of space, while envelopment involves and an affective register, it is a feeling.

"Kochi is a feeling"

I started this essay by stating that Kochi is a city historically defined by its relation to water. This slippage turns Kochi's wetness into water, as a manageable resource in

opposition to land, in a kind of cartographic negation. To show how this plays out in the city today I used both sewers and roads as examples of surface thinking, and how Kochi's wetness exceeds those infrastructural materiality's. To move beyond these seemingly incommensurate elements, I have suggested Kochi is enveloped in a wetness, and that this wetness has significant influences on the ways in which infrastructural development can play out in the city, even if roads and sewers continue to be constructed. From the historic flood of 1341 that flattened the city of Muziris to the backwater's tourism and modern infrastructures that fill the city today, Kochi is constituted by *wetness* and *infrastructure* in many ways. Moving the analysis away from water as an *object* toward wetness as an *affect* centres the embodied experiences of the infrastructures mediating that wetness in a rapidly changing city.

Wetness and infrastructure interrupt one another as they exist together at the same time in Kochi, and I want to now turn to how that *feels*. I do so by drawing on a popular saying in Kochi that I came across during my engagements with the Kochi-Muziris Biennale: "Kochi is a feeling". The promotional posters with this slogan written across the top feature two fish enveloped in waves, enveloped in wetness (Figure 3). With this as my inspiration, my wager here is that the feeling that Kochi generates – its ontological affect – has something to do with its envelopment in wetness and infrastructure, and the relation between the two, particularly as domestic, commercial, and industrial wastes continue to soak, seep, and leak between bodies, human and non-human. If infrastructures tend to separate water from land, and turn wetness into water, how does the enduring wetness of Kochi, and the way it interrupts those infrastructures, shape the experience of the city? To ground a contemplation of these queries within the final discussion, I share some personal experiences of the devastating floods that enveloped Kerala in August 2018.

The floods that killed hundreds of people in Kerala in August 2018 were caused by intense wetness and failures of (post)colonial infrastructural thinking. Initially, most of Kochi was largely spared the devastating flooding that hit lower parts of the state. That was until the intense rain led to the decision to open the overflow gates of the Idukki dam, one of the largest dams in South Asia. Subsequently, the Periyar River burst its banks and the Kochi International Airport, which was built on land reclaimed from the river, to turn back into a river, disrupting international flights for over two weeks. It also made the flooding much more devastating for those who lived downstream including those living in Aluva and Ernakulam. In some parts of the city, the entire ground floor of houses was under water. The trains stopped operating as the water from the floods was up to the height of the platform. Once the waters had receded slightly, I caught a train from Kochi to Trivandrum with my friend who had changed the departure of their international flight from Kochi to Trivandrum. We had to wade through knee high water in the backstreets of Ernakulam to reach the train station. The train was intensely overcrowded with others whose travel plans changed at short notice and were desperate to reach Trivandrum. We spent the 5-hour long train ride standing in the doorway of the train compartment with about 7 others, the doors open, occasionally swapping positions to sit with our legs dangling out of the train just inches above the flooded plains below the tracks. On some sharper corners that emerged through the engulfing green, it felt as though the train would topple into the wetness below.

Figure 3 - Kochi is a feeling (author's photo, 2018).

A few days after the treacherous train ride to Trivandrum, on August 22nd 2018, six days after the flooding began; I attempted to commute from my apartment in Fort Kochi to Ernakulam to visit the Cochin University of Science and Technology (CUSAT). I was heading there to meet some research participants and to visit a large flood relief camp for those who had to evacuate their houses. In my typically stubborn (and on this occasion, foolish) resistance to private car rentals, I set out from my apartment in an autorickshaw to the Fort Kochi-Ernakulam ferry, anticipating that water-based transport might be safer and more reliable in a flood. To my dismay, the ferry was not running because of the volatile waters. I decided to find an auto driver willing to drive me across to Ernakulam, where I hoped to catch the above ground metro to CUSAT assuming that an above ground metro would be unaffected by the flood waters. Once again, I was wrong. The metro train yard was flooded. By this point I was hungry and starting to get frustrated, so I waved down another auto and asked the driver to take me to Lulu Mall, a large shopping mall not too far from CUSAT, where I could take a moment to reassess my day. As I walked up to Lulu Mall, I realised it too had succumbed to the floods, and was not open to the public. Upon this realisation, I had no option left but to get another auto from Lulu Mall to CUSAT and hope that those I was meeting would accept my dishevelled arrival and have something for me to eat. Eventually, after meeting with the professor I had been in contact with, I was taken to a small canteen, operated on the ground floor of someone's house, tucked in behind the university. I remember it being one of the best thalis I ate while in India. After lunch we visited the flood relief camp, where some 3000 people where sheltering. Whole families gathered in large classrooms, aunties and uncles resting against walls, children playing together under tables and chairs. One woman told us the flood had changed her, and that she doesn't need anything anymore; it had taught her a valuable life lesson. On another occasion, a few days later, one of my closest collaborators in Kochi summarised the 2018 floods by saying "we are used to floods, but we have forgotten that we are used to them".

The inconvenience I experienced was nothing compared to those living closer to the Periyar riverbanks. Three days later I visited some houses in Aluva, near the airport. Most

houses were still standing, but the flood waters had risen so high that I struggled to find the high-water mark when I reached the house of a family member of a friend who lived in the area, only to find out that it was on the second floor. Everything in the house was enveloped in a film of silt, a visible reminder of the entangled nature of wetness and earth. We spent the day sorting belongings into piles and pressure spraying down the walls and floors in the house. Controlled water was being used to clean errant water. We were not sorting belongings into piles of what was to be kept, we were sorting them into piles of how things needed to be disposed. Virtually nothing was salvageable. Meanwhile, the house next door had managed to find a pump with which to drain the well in their front yard. It seemed that folks were scared their well water had been contaminated by the floods.

These were my only two firsthand experiences of the flooding in Kochi. Much of this time was spent in Fort Kochi where I was living, which was largely spared inundation from the floods due to its location on the other side of the backwaters at the edge of the sea. I spent these days reading the local newspapers, keeping in touch with friends and research participants on WhatsApp, and continuing to build relationships with the staff I'd met from the Kochi-Muziris Biennale as they planned their upcoming event. In the days immediately after the flood, footage began to circulate on WhatsApp of a truck clearing a bridge of the debris that had been deposited by the flood waters. Unfortunately, and to the dismay of those I was in touch with, the truck was clearing the debris straight back into the water below. One headline in popular Indian newspaper The Hindu read "Trial by Water", while further down the article the author states "the river has claimed its lost self" (Anandan & Praveen, 2018). Another from 'livemint', a popular online news outlet, read "[in] rapidly urbanizing India, it's time to reimagine water in cities" (Srinivasan, 2018). It is this reimagining that I have been attending to here, by suggesting that envelopment in wetness might be a starting place for thinking through the future of more ecologically situated infrastructure in this city. This way of approaching wetness through envelopment was inspired by many of the artworks at the 2018 edition of the Kochi-Muziris Biennale that responded to the floods in their installations. One piece was particularly inspirational, the work of Bangladeshi artist Marzia Farhana titled 'Ecoside and the Rise of Freefall'. This artwork, on the ground floor of a building that had a solitary window with a view of the backwaters, envelops the audience in the remnants of the floods that had occurred just months beforehand. With painstaking detail to shape, size, and embodied associations, Farhana spent weeks collecting ruined goods – from appliances such as fridges to bookshelves with hundreds of books – from people's houses that were devastated by the floods. Farhana then hung these from the ceiling in such a way as to create the sensation that one was floating among these items, stolen by the floods, each one coated in the familiar film of grey-brown silt. Art is important in crafting new futures because it "can make a conversation" as another participating artist would later tell me. In this instance, Marzia's work started a conversation not only about the devastation of increasingly frequent and disastrous floods, but also the affective atmosphere, the feeling, of being enveloped in wetness.

Figure 4 - Belongings coated in silt after the flood (author's photo, 2018).

Two months after the floods hit Kerala, I visited the Eloor-Edayar industrial belt with my research assistant, my research collaborator Dr. Georgina Drew, and an environmental activist from Kochi. This place—a small island between two tributaries of the Periyar river and only a short distance from downtown Kochi – has been described as a "toxic keg" by a local newspaper and is known as one of the most polluted places in the world (Devika, 2019). It is home to some 282 industries, of which almost half are chemical industries (Anjusha et al. 2020). All use the abundance of water nearby as a vital resource and as a sink for their wastes – it is used as infrastructure (Carse, 2012). As a result, this stretch of river is prone to mass fish-kill events, and periods of red, green, or black water caused by an alchemical reaction between river life and industrial chemical substances. Fortunately for the broader population, most of Kochi's drinking water is sourced *upstream* from Eloor, however the residents in the area and those that live downstream who rely on well-water for drinking are forced to endure high levels of contamination. Here an atmospheric attention to wetness above and below the ground helps to demonstrate how water moves in ways beyond the colonial imaginary of the river, and with it the toxins from nearby industries.

As we approached Eloor, we came to a bridge over the river and asked our driver to stop so we could get out and look around. Standing on a bridge overlooking the river on this warm October day, I noticed the smokestacks that rose into the sky and the material remnants of the floods hanging in branches of trees on the banks of the river. The water was a deep brown but according to the environmental activists we were with, the water was looking cleaner than usual due of the floods (Figure 5). We were told how some of the industries had illegal underground pipes that disposed their effluent straight into the river. The activists had been involved in a Save the Periyar campaign for a few years, but still nothing had been done to stop these industries from dumping wastes The rest of the day was spent exploring the Eloor area, noting down names of industries and talking to residents whenever the opportunity arose. Many explained how they were resigned to the conditions of their situation, enveloped in the toxicity of the nearby industries. At one point we stopped at a school, which had a large pile of industrial waste covered in tropical plants behind it (Figure 6). The kids playing in this yard, are playing in toxic wetness.

Destroying a river and a suburban island with industrial waste is one thing, but how does turning to wetness and envelopment help to broaden what becomes relevant in such scenarios? The Eloor-Edayar industrial belt is situated on an island for a reason. It uses the river not only as water and waste infrastructure, but also as a container for toxic industries (Figure 5). The activists we spent time with told us how the general population of Kochi don't know about this place because they don't have any reason to visit it. The only people we encountered were people who lived and worked there, stuck in the mess of industrial extraction and toxicity. For them, Kochi is a feeling of being enveloped in not only wetness, but also toxicity. As I have shown, wetness seeps, soaks, and evaporates beyond the confines of colonial infrastructures, including rivers. To be in relation to wetness in Kochi, is for many, to be in relation to varying degrees of toxicity.

Figure 5 - Periyar River and the Eloor industrial area (author's photo, 2018).

Figure 6 - Schoolyard with a forest of industrial waste behind it (author's photo, 2018).

Conclusion

Terrestrial and land-based thinking continues to be disastrous for urban settlements as water bodies remain as reservoirs for unwanted things. Putting water at the centre of conversations about infrastructural development has proved to be both promising and difficult as it disrupts the spatial ordering of the city. As geographer Matthew Gandy describes, "the very fluidity of water as both biophysical and symbolic agency serves to disrupt and challenge simplistic understandings of how complex urban societies function, and the degree to which social and spatial order can ever be achieved under the contradictory dynamics of capitalist urbanization" (2014, p. 54). What I have highlighted here, is that the very framing of land and water as separate entities to be managed is bound up in the problem. In Donna Haraway's now famous words inspired by Marilyn Strathern, "it matters what matters we use to think other matters with" (2016, p. 12). Attuning to wetness rather than water in a place as wet as Kochi, is one way to rethink the work that infrastructures are doing. Envelopment gives us a conceptual framework to begin thinking through the material and affective qualities of wetness and infrastructure *together*. The kind of envelopment I have described goes beyond turning attention to skyward atmospheres to engage with wetness as it surrounds above, alongside, and below.

To say that Kochi's ground is floating is both metaphor and literal, the solid surface from which to begin designing and building infrastructures has been constructed and is temporary. The ancient floods of Muziris and the recent floods in Kochi in 2018 attest to this. Attuning to wetness instead of water to grapple with this reality opens thought and feeling up to an existence in the world beyond enduring colonial binaries and separations on which most urban infrastructure is designed and built. As Kath Weston states, the challenge is to "reorganize (our) affective attachments, and with those attachments, the capital-intensive regimes of production designed to elicit them" (2017, p. 198). How might a reorganisation of affective attachments to an envelopment in wetness change the ways that infrastructures are imagined in urban south India? This question seems increasingly relevant as anthropogenic climate change continues to accelerate, putting low-lying settlements at further risk of being inundated or submerged.

While these insights are grounded in ethnographic attention to Kochi, they are relevant to monsoonal and tropical cities elsewhere. In Darwin, Australia for instance, the movements of the city are entwined with the wet and dry seasons. Separating these rhythmic patterns into land and water to be managed by state institutions and public infrastructures is bound up in the colonisation of place. It is in the undoing of this colonial separation that I join da Cunha and Mathur to propose that "if water separated to be *somewhere* is in crisis today, wetness negotiated *everywhere* holds the way forward" (Mathur & da Cunha, 2020, p. 16). Negotiating wetness everywhere requires a fundamental shift in not only urban design practices, but in philosophical and narrative literature; it requires a conceptual shift. And while my research participants and collaborators in Kochi did not use these exact terms, I believe this (re)conceptualisation heeds their call to reimagine infrastructure otherwise in ways that takes seriously the city's situated ecological and social conditions. Attuning to the affective experience and material politics of moving through wetness is key to this reimagining.

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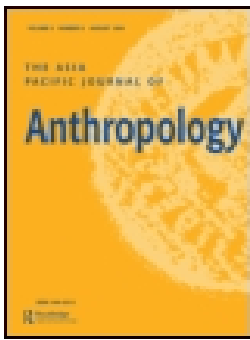Alley, K. D. (2002). *On the banks of the Ganga : when wastewater meets a sacred river*. University of Michigan Press.

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Burning Wet Waste: Environmental Particularity, Material Specificity, and the Universality of Infrastructure

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Burning Wet Waste: Environmental Particularity, Material Specificity, and the Universality of Infrastructure

Matt Barlow

The problem of plastic waste accumulating in the environment has become ubiquitous in recent years. One way in which urban governments are looking to solve this issue is by investing one of several thermodynamic technologies that fall under the umbrella term 'waste-to-energy'. The drawback of such technologies is that the waste stream must be consistent in quality and quantity. By drawing on ethnographic research with environmental activists in Kochi, South India, I demonstrate that particular environmental and material conditions—in this case Kochi's immense wetness—confound the supposed universality of such infrastructures. Querying waste infrastructures in this way also leads to insights that suggest that investing in infrastructures to address issues of plastic waste often deepen attachments to plastic economies of capitalist accumulation. I ultimately argue that addressing environmental and social concerns about plastic waste means broadening what is relevant to infrastructural interventions in urban environmental governance.

Keywords: Environment; Infrastructure; Plastics; Wetness; Waste

Introduction

> Capitalism is an enormous smelter, shovelling into its furnace the living and the dead. (Povinelli 2016, 167)

I had just hopped into my new friend Dr Manoj's red Maruti 800 as he began telling me about the Kochi government's plans to install a waste-to-energy incinerator on the outskirts of town. As he explained with a characteristic cheek that I would come to know well: 'Now, the waste-to-energy plant is very simple: it's a burner, it burns everything, and they claim it as plasma, blah, blah'. On this predictably hot and humid morning, Dr Manoj and I were heading to a popular coastal town a

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few hours' drive south of Kochi to meet with some government officials. As Dr Manoj manoeuvred between buses and around scooters, he went on to explain the problems he saw with the proposed rollout of waste-to-energy (henceforth WTE) infrastructure in Kerala between blasts of his car horn:

> 60 per cent of [our] waste is biodegradable waste, of which 80 per cent is water, so if you take 100 tonnes of waste, literally 50 tonnes is water … incinerating this waste [means] you need to evaporate water, the heat required to raise the temperature from 35 degrees to 100 degrees—then you have this latent heat right? So, every kilogram of waste will take 4.6 kilojoules of energy, just latent heat, it's a huge [amount of] energy … And when we start calculating this latent heat and the energy required, the whole quantity of energy produced, if it is like 10 kilojoules, 8.5 kilojoules are required for [the] evaporation of water. So, you end up with 15 per cent of net energy.

Dr Manoj and I had met the previous day at the Cochin University of Science and Technology (CUSAT) where, together with Georgina Drew,[1] we had hosted a life-cycle-analysis workshop for staff and students interested in tackling the issue of waste on campus. A chemist by training and now one of Kerala's leading environmental activists, Dr Manoj was explaining to me the environmental particularities of Kochi and the material specificity of its waste, and how those two things highlight problems with the supposed universality of WTE infrastructures built to address the accumulation of plastics in the environment. Burning waste is illogical in Kochi because the waste 'profile' is too wet; it does not match the kind of waste that incineration infrastructures require to make energy—waste that is low in moisture and high in calories (e.g. plastics). Further to that, the environmental conditions of Kochi, hot and humid year-round, and intensely wet during the monsoon season, do not make for a conducive environment for incineration as a form of waste management or energy generation. More infrastructure to evaporate moisture means more energy is used in the process and the returns in the form of energy are greatly reduced. Despite these inefficiencies WTE continues to be pursued by the local government in Kochi due to economic incentives to keep plastic economies afloat and the political benefit of being perceived to be solving the problem of waste accumulating in the city. How to both make plastic waste go away and invest in plastic's future hinges on its disposability, which, as I highlight, is quite problematic in Kochi. In other words, the future of plastics depends on the ability of plastic manufacturers to find suitable ways for it to be disposed of and reused. WTE in the form of gasification—more on this later—is just one in a suite of different technologies currently being pursued as part of the frontier of plastics recycling (Mangold & von Vacano 2022).

Despite their opposition to the installation of a WTE plant in Kochi, Dr Manoj and allies recognised the problem of waste accumulating throughout the city. Headline after headline during my ethnographic research in Kochi between January 2018 and March 2019 pointed to clogged canals, sewage-infested waters, and the ongoing mismanagement and deterioration of the only waste depot in the city:

Brahmapuram.[2] The increasing toxicity of the famous Keralan backwaters that Kochi rests within has led to mass fish kills and a declining biodiversity, making this a serious environmental and social justice issue, particularly as fish is an indispensable part of the Keralan diet. Municipal solid waste (MSW) had also been increasing drastically since the turn of the century. During an interview at the Cochin Corporation (the local government offices), one government official told me that the total quantity of waste received at Brahmapuram had more than doubled from 120 tonnes per day, to 272 tonnes per day, in the ten years since it opened (2008–2018). In the middle of my fieldwork, in November 2018, the Cochin Corporation received a substantial fine from India's largest environmental regulation authority, the National Green Tribunal (NTG). The fine was not only due to the 'unscientific' landfilling at Brahmapuram leading to the leaching of toxins into nearby waterways but also because the Cochin Corporation had not yet built a WTE plant. For the duration of my fieldwork, the Cochin Corporation was simultaneously being fined by the NTG for not yet having installed the WTE plant *and* waiting for governmental approvals for the installation of the WTE plant. There was immense political pressure to fix the 'menace of waste' accumulating around Kochi, and WTE provided a technological solution that matched aspirations of urban development aligned with growing patterns of consumption, but it did not meet environmental standards.

While the maelstrom of bureaucracy surrounding waste management in Kochi is interesting and insightful in its own right, in this article I focus on the underlying assumptions about infrastructures and environments that inform the proposal of WTE as a solution to the waste crisis enveloping the city. By emphasising the evaporative nature of WTE infrastructure, I demonstrate how specific environments—in this instance the intensely wet and humid tropics of coastal South India—give lie to the supposed universality of infrastructures such as WTE. In doing so, I suggest that WTE is not only economically unviable due to this abundance of wetness but that it also deepens attachments to plastic economies and extractive capitalism. Instead of promoting a future with *less* plastics that is responsible and accountable to local environmental and social milieus, WTE accelerates and obscures the plastic economy. This is true of an investment in WTE anywhere, but due to the environmental particularity of Kochi and the material specificity of its waste, the investment in WTE here is particularly illogical and misplaced. While Andrea Ballestero has suggested 'the distribution and structure of the financial universe does not match the hydraulic universe', here the intensity of the hydraulic universe is curtailing the financial universe (Ballestero 2019, 20). In critiquing the plans to install WTE in Kochi, I aim to put 'water at the heart of the narrative' (Amrith 2018, 9) rather than as a problem to be solved through evaporative infrastructures. To do this, I first provide some context to the wet/dry nature of Kochi's climate and waste infrastructures. I then briefly describe the ways in which plastics were designed to be profitable through their disposability in the twentieth century before I turn ethnographically to the proposal of WTE in Kochi. Focusing on the making-dry of Kochi's waste demonstrates the lengths to which investors and governments will go to pursue seemingly

universal urban development through large-scale infrastructural projects that ultimately prop up the plastics industry.

Wet and Dry Waste

Kochi is the industrial and commercial capital of Kerala, a communist state in the southwest of India nestled between the Arabian Sea and the Western Ghats. It has been the site of infrastructural development since the installation of the Cochin Port by Lord Willingdon in the early twentieth century during the British colonial period, to the recent completion of India's first fully solar powered airport, an above ground metro, and a large transhipment container terminal. In January 2016, Kochi was named by the Indian government as one of the first 20 cities to receive funding as a 'Smart City' (Drew 2020). One of the primary goals of this smart city project was to address the growing waste crisis in Indian cities through technologically advanced means.[3] This recent confluence of waste management and urban development comes on the back of Prime Minister Nerendra Modi's Swachh Bharat campaign to clean up India's cities (Jeffrey 2015; Alley, Barr, & Mehta 2018). As such, the WTE facility proposed at Brahmapuram is part of a larger national narrative that engages waste management issues through urban development that aspires to global standards, 'prizing the aesthetics of a global modernity over issues of social justice, public health and sanitation, or even environmental laws' (Pathak 2020b, 4; see also Rademacher 2008; Ghertner 2014; Kornberg 2019; Chitra 2021). What is often overlooked in these processes are India's very specific social and environmental milieus and, in this instance, Kochi's wet disposition as a tropical city situated on an estuary and among the famous Keralan backwaters, and its wet waste profile.

It is no secret that life in South Asia begins with the monsoon (Amrith 2018; Cunha 2019), and for mainland India the monsoon begins in Kerala. Kochi receives the southwest monsoon in June and the northeast monsoon in October. As such, Kochi (and the rest of Kerala) is one of the wettest places in India—averaging over 3000 mm of rain annually—and regularly experiences large flooding events. The city itself is surrounded—or perhaps more accurately *constituted*—by rivers, lakes, and canals, and is bordered to the west by the Arabian Sea. This abundance of water used to carry away unwanted things. Yet, as Assa Doron and Robin Jeffrey highlight, 'volume has outstripped capacity' (Doron & Jeffrey 2018, 151). Furthermore, while these water bodies are Ramsar[4]-protected wetlands of ecological significance, due to these ongoing urban development issues—including waste management—they are under serious threat (Figure 1).

Much like the seasons, waste in India is segregated into wet and dry. Wet waste can be broadly understood as organic waste such as food stuffs and other compostable materials and, as Dr Manoj highlighted, accounts for around 60 per cent of Kerala's waste. Dry waste on the other hand can be considered as non-organic waste, such as plastics and other non-compostable materials. This segregation of

Figure 1 A plastic-clogged canal in suburban Kochi. Photo by Matt Barlow.

waste is crucial to the ongoing composting initiatives throughout Kochi, and for the formal and informal recycling networks to access valuable items with dry waste stream. Segregation of waste is also a central figure in the Solid Waste Management Rules of 2000 (revised in 2016). However, in an effort to convince Kochi to adopt WTE technology and to put sceptical minds at ease, GJ Eco—the company installing WTE in Kochi—proposed the collection of unsegregated waste that would then be segregated using a conveyer belt at Brahmapuram. Part of this promise was to monopolise the waste stream towards the WTE plant in an attempt to maximise profits. It would also increase the ease with which the citizens of Kochi could dispose of things, shifting the responsibility of segregation from the home to the waste depot. The company, and by association the municipality, promised a future of less waste piling up in streets and along canals, and a future where residents could easily dispose of waste without complicated processes of segregation.

It is important to note that there is a history of failed WTE projects throughout India (Luthra 2017, 2019; Demaria & Schindler 2016; Kornberg 2019). These attempts at solving urban India's waste woes failed due to environmental particularities, community resistance, and difficulties in maintaining the infrastructure. In other words, they highlight that the vision of what that infrastructure represents is incompatible with specific and situated environmental and social conditions. This is not a new phenomenon for scholars of infrastructure, who have shown how infrastructures 'are important not just for what they do in the here and now, but for what they signify about the future' (Anand, Gupta, & Appel 2018, 19). And waste management, as a particular form of urban infrastructure, 'is more than a by-product of a distinctly human demand for order, but a process actively involved in reshaping our ideals and imaginations in turn' (Reno 2015, 558). Attending to these qualities of waste and infrastructure help us understand why something like WTE is pursued in Kochi despite how illogical and harmful it may be to current environmental and social specificities.

What the pursuit of WTE in India signifies about the future is that there is significant interest in, and anticipation of, waste streams becoming less wet and more dry. As Aman Luthra has noted in relation to WTE developments in New Delhi, WTE represents the 'hope that even if Indian waste might not be suitable for thermal treatment technologies today, it will become so in the near future' (Luthra 2017, 52). WTE is an investment in the fact that India's trash is changing; this is also an investment in a cultural shift towards a more consumerist and clean India (Rademacher & Sivaramakrishnan 2013; Pathak 2020b). Furthermore, as Rosalind Fredericks has demonstrated, determining what people consume and how they discard is increasingly a 'primary form of state power' (Fredericks 2018, 32). I add to this dialogue by highlighting how environmental particularity is simultaneously ignored by aspirations to address a waste crisis through infrastructural development (WTE) *and* is the cause of insurmountable economic and material problems in the implementation of the project. The considerations of Kochi's wetness came *after* the decision to engage with WTE as a solution to the problem because urban development that

mirrored global standards and national aspirations was more important than situated environmental and social processes. Further afield, anthropologist Amy Zhang has shown how a wet waste profile in urban China led to localised innovation and opposition to WTE projects, even if those projects inevitably reproduced capitalist logics through their attempts to meet the 'contradictory demands of ecological urbanism' (Zhang 2020, 96). I take a step further back to suggest that the material specificity of plastics, and their entanglement with capitalist structures, means that any attempts to address their accumulation in a specific environment while not curbing their production will inevitably reproduce capitalist (and colonial) logics (Liboiron 2021). Understood in this way, WTE emerges as what Jacob Doherty calls the 'waste frontier': where new forms of value are sought *through* managing the crises of capitalism (in this case addressing an abundance of waste through infrastructures of disposability) towards supposedly abundant futures (Doherty 2019, 326).

In the following discussion, I draw on 10 months of ethnographic fieldwork in Kochi, where I explored the connections between the tropical environment of south India, the coloniality of urban infrastructure, and local resistance to waste. During this time, I engaged with over 100 environmental activists, engineers, waste workers, teachers, students, government officials, artists, and curators. Through my associations with waste activists in the city I became involved in efforts to attempt to persuade the local government to stop the transformation of the landfill to a WTE facility and to instead focus on community-scale reduction and reuse of plastics, alongside the implementation of single-use plastics bans and composting initiatives at institutions such as hospitals and colleges. Below I share two ethnographic vignettes: a public consultation at a sustainability fair in central Kochi I attended with Dr Manoj where a representative of GJ Eco explained the proposal of WTE, and a site visit to Brahmapuram I took with Dr Manoj on one of the last days of my fieldwork. Together they help to demonstrate the vexed problem of waste management in Kochi and the ways that ill-suited infrastructures are promoted as solutions.

A Brief History of Plastics and Disposability

Plastics were not always made to be disposed of. The ephemeral and ubiquitous plastics that accumulate in environments today are largely thermoplastics. These plastics emerged in the post-war period as the plastics industry shifted from materials designed for durability and re-use, to packaging that was designed for single use and disposability. Thermoplastics, such as polyethylene and polystyrene, could be melted and reshaped again and again, 'their molecular flows made anything seem possible' (Hawkins 2018, 98). In order to make thermoplastics, chemical compounds called 'plasticisers' are added to plastics in order to render them more flexible. These plasticisers are also harmful endocrine disruptors once ingested by (human) bodies and can cause a range of issues from cancer to miscarriage (Liboiron 2016).

The shift from durable and reusable plastics to single-use plastics was primarily taken up in pursuit of profit. As Gay Hawkins explains, 'low cost, high volume packaging was going to realize the plastic industry's real economic potential: the future of this material was in *turnover*, not durability' (Hawkins 2018, 98, original emphasis). This turn by the plastics industry consolidated a turn towards disposability that became part of North American and British domestic dispositions throughout the twentieth century (Lucas 2002). The waste crisis in Kochi today is in many ways a result of this shift to high turnover materials and their eventual entry into India in the 1990s through processes of neoliberal economic reform that supported entrepreneurialism and global consumerism based on convenience (Irani 2019; Pathak 2020a; Shove 2002). Plastics are now ubiquitous in Kochi, both in consumer practices and as environmental pollution in Kochi's many clogged waterways, although as I highlighted above, the waste profile still maintains a high portion of wet waste.

For the WTE infrastructure to operate in Kochi it requires a certain amount of high calorific waste. In one local newspaper article it was explained that the 295-crore rupee (close to $40 million USD) WTE plant would have a 300-tonne capacity, and that the Cochin Corporation would be responsible for supplying the WTE plant with all 300 tonnes every day.[5] If the Corporation did not supply 300 tonnes per day, it would have to pay compensation to the WTE company (GJ Eco). As such, it is not possible to imagine a scenario where the volume of consumed and discarded plastics is reduced *alongside* the installation of WTE infrastructure. An investment in WTE is therefore an investment in plastics *through* their streamlined disposability. WTE is an infrastructuring of plastics' disposability. As I mentioned above, this involves the monopolisation of the waste stream, taking other flows of revenue away from informal economies of recycling, consolidating economic power in the plastics industry, and making this a social justice issue as much as an environmental one. Specificities of place, both environments and social relations, matter to how waste should be managed. How waste is managed, however, has planetary consequences, and attention to the material specificities of plastics teaches us that they are geological in their production and their disposal (Hecht 2018; Liboiron 2020). Plastics are not able to be contained as easily as WTE proposes. To unpack this further, I now consider WTE as an evaporative infrastructure that turns Kochi's waste into what it needs to be in order to become fuel.

Evaporative Infrastructures

I learnt of the history of GJ Eco by coincidentally attending a speech given by a GJ Eco representative at a sustainability fair I attended in Kochi on August 12, 2018. Throughout the speech the representative—a Keralite now based in the UK—repeatedly addressed concerns raised in public discourse about the viability and long-term sustainability of the proposed WTE project. Kerala has a fraught history with incineration technology as a form of waste management dating back to 2012. In the state's capital, Thiruvananthapuram, local protests around the adoption of incineration and

a lack of technical expertise in operating the incinerator forced it to close after less than two weeks of operation (Choudhury 2004). The speech thus had a defensive tone to it; he was explaining why it was necessary for the WTE plant to go ahead despite the criticisms and previous unsuccessful attempts. Below I provide a detailed account of the GJ Eco proposition as it was presented during this public seminar—no doubt part of their public consultation processes—ultimately highlighting the allure of WTE as a means of addressing the waste crisis.

The first announcement of a WTE facility to be constructed at the Brahmapuram site came in 2015 when the Cochin Corporation approved the project. However, GJ Eco's 'journey' started back in 2012 when they began 'continuous waste studies' to analyse the characteristics of Kochi's waste. Their findings were that WTE had failed in India previously because the waste had not been *adequately converted into fuel*. The key characteristic of gasification technology, and the reason why it had failed elsewhere—according to the GJ Eco representative—was that the fuel put into it needs to be within a specific envelope. If the waste content does not fall within that envelope, the aim of generating a surplus of energy will likely fail. What was implicit in the way this representative presented the company's findings was that Kochi's waste profile does not fit that envelope. He went on to explain that the first 'hurdle' when trying to fit WTE technology to Kochi's waste profile is its moisture content, which he told the audience—around 50 eco-conscious citizens and stakeholders—was about 50 per cent. The second hurdle, according to the representative, was ensuring that the waste that entered the incinerator was adequately segregated, noting that there was a lot of contamination of the waste profile through mostly unsegregated collections throughout the city. Rather than work with the Kochi population to encourage segregation at source—a requirement of the 2016 municipal solid waste management rules and something that waste activists were working towards during my fieldwork—GJ Eco proposed to accept unsegregated waste in an attempt to monopolise the market and then to segregate the waste at Brahmapuram. The representative then went on to explain the details of the two technological solutions to these fuel preparation problems.

GJ Eco understood Kochi's wet environment as a problem that could be overcome through innovative evaporative technology. The problem of moisture in the waste profile would be solved through a patented vortex membrane that would encourage a process that the representative referred to as 'bio-drying'. The function of this membrane would allow moisture to evaporate from the waste and prevent it from being absorbed into the waste, facilitating a one-way movement of moisture. According to the representative, it was estimated that over a period of 21–28 days the moisture in the waste profile would be reduced to 27–30 per cent and, therefore, within the envelope of what counts as the right kind of 'fuel' to extract energy from waste through incineration. At this point in the presentation, the representative introduced an example of a WTE plant on the coast of Turkey, where there was a similar waste profile. In this example, air is pumped into the waste covered in the membrane, encouraging the growth of thermophilic bacteria, and pushing the temperature of

the matter up toward 80 degrees Celsius. Once the moisture levels are within the correct envelope, the combustibles need to be segregated from the non-combustibles. This leads to the second solution, an automated conveyer belt, three kilometres in length, with density and magnetic separators. High density plastics, metals, and construction materials which have either no calorific value or a high recycling market value of their own are segregated out. What is left then, is 'the organic factions' and the low-density plastics. Once isolated, these are chopped into 3mm particles and put into the 'bunkering system' as 'refuse derived fuel'. The preparation stage finished, the gasification process then takes over—the start of the combustion process. The gasification process referred to by the representative is Plasma Gasification Melting (PGM). It is claimed that this technology may not be as harmful as previous waste incinerators due to the preparation of plastics into small pieces and the intense heat at which it is melted using plasma technology. But according to a recent edited volume about the gasification of waste materials, it does generate fly ash,[6] which consists of PM10 and other miniscule particles that can cause respiratory illness (Ciuta 2018). So, while leachate from the landfill at Brahmapuram poses an environmental justice issue, so too does the WTE infrastructure posed to solve it. Both of these infrastructures replicate colonial and capitalist logics, highlighting the need for solutions to the plastics crisis to go beyond disposability and to address the production of plastics (Zhang 2020; Inverardi-Ferri 2018; Liboiron 2021). To further understand these relations between WTE, plastics, and the proliferation of social and environmental injustice, it is instructive to briefly explore the social history of thermodynamics.

Thermodynamics is a scientific process of heat transfer which transforms high calorific material (such as oil and oil derivative products such as plastics) into energy. The process was invented in Glasgow in the nineteenth century, and through the power of steam, rather than water, quickly overtook hydropower as a means of energy generation throughout the British empire and then around the globe. This invention set in motion the course for the petro-modernity we are currently in, and in no small way enabled the expansion of imperialism and capitalism around the globe (Malm 2016) However, the revolutionary impact that thermodynamics generated was not due to some kind of intrinsic technological prowess or mechanistic efficiency; rather, it was because it consolidated expanding capitalist modes of re/production and re/arranged labour relations in the United Kingdom in favour of capitalist accumulation (Daggett 2019; Malm 2016).

Through the invention and consolidation of thermodynamics into capitalist modes of production, 'the British empire thus perfected the double manoeuvre—the acceleration of work and the concealment of waste—upon which industrial governance still depends' (Daggett 2019, 154). WTE, as an evaporative infrastructure in Kochi, aims to perfect this very same manoeuvre through innovation geared towards capital accumulation. Key MacFarlane refers to this manoeuvre as 'waste switching' (MacFarlane 2019, 227), where the incentive of turning the 'political other' (Gidwani & Reddy 2011, 1625) of capital (waste) back into the capitalist system (as wealth, or energy) is too great—even if the environmental conditions mean little social or

economic benefits to this process in tropical places like Kochi. As such, pitched as a 'socioecological fix' to urban governments' increasingly dire waste woes, WTE infrastructure continues to lock the city into a system of consuming and disposing of plastics, accelerating ecologically disastrous capitalist modes of production and consumption in the process (Behrsin 2019). In fact, my interlocutors—including Dr Manoj—often claimed that plastic manufacturers were behind the promotion of the WTE plant in Kochi as it would halt the adoption of single-use plastics bans and essentially commit Kochi to a consumption pattern that fit their 'predatory and violent economic relations' (Daggett 2019, 30).

In relation to the history of thermodynamics, WTE emerges as the logical progression of this energy regime entrenched in capitalist reproduction and urban environmental governance. Engineering away the problems of both waste and water is a technologically complex yet politically convenient answer to Kochi's waste crisis, as it promises to clear the canals and the streets by turning plastics into fuel. This is deemed easier, more innovative, and more productive than alternatives that include plastics bans and community scale initiatives. As Assa Doron and Robin Jeffrey state in relation to the incineration of waste in urban India:

> Bringing waste collectors and waste makers into effective cooperation to minimize waste and treat most of it close to home offers more beneficial possibilities for making India cleaner; but the quick-fix efficiency of mechanized mass destruction seems easier and more tempting than achieving such cooperation. (Doron & Jeffrey 2018, 151)

These sentiments echo what anthropologist Chloe Ahmann has noted on the disposition of WTE infrastructure whereby 'cashing in on modernist desires to engineer away problems without behavioural change, incinerators thus offered grand solutions to some of humankind's most common nuisances' (Ahmann 2019, 331). Exploring WTE as an evaporative infrastructure from the vantage of Kochi highlights how one of the problems to be engineered away is the wetness of tropical South India. The other problem is the accumulation of waste leaching into the waterways at the defunct waste depot Brahmapuram, which is where I now turn my attention.

Legacy Waste

On what was effectively my last day of fieldwork in Kochi in April 2019, I was finally able to visit Brahmapuram after many previous attempts were refused by local authorities.[7] The circumstances of my visit were somewhat obscure, as I was under the impression Dr Manoj and I would be venturing via boat to a position close to the waste facility so as to see what was going on from the water—because we had still not received official permission to actually enter the facility. But once I arrived at Dr Manoj's house and had been fed some very peppery eggs and a thickly fermented ginger and curd miracle drink—what he referred to as 'gruel'—I was told we were actually driving into the Brahmapuram facility. This was thanks to Dr Manoj's friend and close sustainability ally who, I was told, had a good relationship with the relevant ward

councillor. With this news, I simultaneously felt both excited and frustrated. While I was thrilled to be finally headed into the waste depot, I was relatively unprepared for the excursion—evident by the fact I had intentionally chosen to wear sandals for what I expected to be a wet adventure. If I had known we would be venturing inside the depot, the least I could have done was put on some closed toe shoes. After collecting our Bramapuram contact in Dr Manoj's trusty Maruti, we made our way across the industrial petrochemical belt on the eastern edge of Ernakulam where Indian Oil tankers line the roads and men drink toddy[8] seated under trees or large umbrellas. About 15 min later we arrived at the entrance to Brahmapuram.

We met the local councillor upon arrival. He was a thin senior man, with a serious demeanour. He seemed either slightly unimpressed or simply not bothered by my presence. We hopped into his car and drove further into the facility. Immediately we started noticing GJ Eco signage on billboards and the entrances to buildings. Up until this moment, Dr Manoj and I were under the impression that GJ Eco had only been given access to the site, not that they had already *moved in*. We drove passed a lane that led down to the Sewage Treatment Plant (STP), then past the Material Recovery Facilities (MRF), before stopping at the section of land dedicated to Flood Waste.[9] As we gathered around the car some dogs, coated up to their chins in mud, noticed our presence and briefly stopped chasing each other to inspect us, ears pointing towards the sky.

Figure 2 Walking through Brahmapuram's legacy waste. Photo by Matt Barlow.

Our host now took us by foot further into the facility. Here, I began really wishing I had worn closed toe shoes. The dirt path slowly transformed into an expanse of plastic and other discarded things (see Figure 2). Then the mountains of refuse emerged from around the corner. The 3- to 5-metre-high piles of waste covered a large parcel of land that meandered down to the nearby river. Paths wide enough for earthmoving machines to drive through had been created, but there was no material separation between path and pile—all was waste. As we moved into the landfill area, walking across compacted plastics and other discards, we came across a young man operating an excavator that was shifting a small part of the waste pile (on which the excavator was perched) to a spot a few metres away. While I was trying to figure out why he would be doing that, I noticed he was listening to a techno remix of Aqua's 1997 hit 'Barbie Girl', the opening lyrics of which are 'I'm a Barbie girl, in a Barbie world, life in plastic, it's fantastic!' At that moment, I burst into laughter. While the inappropriateness of the laughter was a little jarring, the rest of the group understood the irony of the situation and even joined in for a short giggle. Here I was, watching a young man operating an excavator, shifting tonnes of plastic around, listening to a song by the band Aqua (the title of the band seems relevant here) about a fantastic plastic life. He even had tinsel and lights attached to the front of his excavator and gave me a wave and a smile as I watched him (see Figure 3). As we walked through the rest of the facility, looking at the disrepair and the leachate flowing into the nearby back-waters, I could not stop myself from smiling, thinking about this chance encounter with the abject, yet playful, realities of life in Brahmapuram.

Accumulated plastics like those at Brahmapuram are referred to as 'legacy waste' within the discards industry. These are the discarded objects leaching into waterways through 'unscientific' landfills, and the Kochi government was under increasing pressure to do something about it. As my time wrapped up in Kochi, my collaborators, Dr Manoj included, conceded that WTE would likely go ahead and at least be able to remove these leaching mountains of legacy waste and transform them into energy. While we walked through Brahmapuram, Dr Manoj was surprised at the material make-up of the legacy waste, explaining with enthusiasm that it was quite well segregated and almost entirely made up of plastics that would be suited for thermal treatment. But the question remained as to what would happen to the WTE plant *after* the legacy waste had all been incinerated. Two futures seemed probable: Kochi would continue down this path of development facilitated by the WTE plant that deepens attachments to plastic economies or, like so many other ambitious and misguided infrastructural projects, the WTE facility would lie in disrepair waiting to itself become a legacy *of* waste (Gupta 2018).

Fidelities

I conclude by taking you back to the public consultation seminar with GJ Eco that I attended a few months prior to our visit to Brahmapuram. As the representative of the company finished his speech and started walking through the crowd, he

Figure 3 Decorated excavator moving legacy waste. Photo by Matt Barlow.

moved towards Dr Manoj and I. Anticipating Dr Manoj's questioning gaze, he said 'we are on the same side' before walking further into the crowd and eventually outside. How is it that someone looking to invest in WTE could think he was on the same side as someone committed to the fight against it? This question reminds me of Tim Choy's exploration of the environmental politics of a waste incinerator in Hong Kong in which expertise hinged on different interpretations of pollution (Choy 2011, 76–105). While Dr Manoj and the GJ Eco representative were both interested in addressing Kochi's waste crisis, they had very different ideas about *how* to

achieve this. Thinking with Choy's theorising around the difference between universalism and particularity in approaches to environmental expertise, GJ Eco was committed to investing in a universal approach to waste management through WTE infrastructure and evaporation—something that had been proven achievable elsewhere. On the other hand, Dr Manoj was committed to a zero-waste future that prioritised Kochi's environmental particularities through single-use plastics bans in conjunction with investments in decentralised methods of composting (Barlow and Drew 2021). Depending on one's fidelities, Kochi's immense wetness made WTE infrastructure unviable and highlighted predatory economic relations and environmental justice concerns embedded within the specific materiality of plastics, or it signalled an opportunity to demonstrate technological prowess that aligned with global aesthetics of environmental governance alongside aspirations of capital growth and urban development.

The three ethnographic vignettes I have shared here—a conversation with Dr Manoj in his car, the public consultation seminar with GJ Eco, and the site visit to Brahmapuram—provide insights into the ways in which advocacy against WTE was happening in Kochi. As infrastructures connect the state to its citizens, ethnographic attention to infrastructures must operate in this meso-scale, between the everyday and bureaucracy. One of the lessons that Science and Technology Studies (STS) has imparted on the study of infrastructures is that they are embedded, 'sunk into, inside of, other structures, social arrangements, and technologies', and therefore invite analysis that moves beyond the material and the social, to a relation between those two things (Star & Ruhleder 1996, 113). By highlighting the relation between the tropical environment of Kochi and evaporative infrastructures, I have demonstrated how the material qualities of waste, and the environment within which it is situated, call into question the supposed universality of the infrastructures that simultaneously cause and claim to solve the problem of waste. Infrastructures carry with them embedded assumptions about the material and social relations which they seek to transform. The evaporative infrastructures of WTE in Kochi highlight just how much work is done in an attempt to render environmental particularity irrelevant to infrastructure, demonstrating how environments only matter to infrastructure through their negation. I have demonstrated the need to foreground environmental particularity in efforts to address the accumulation of plastics through infrastructural developments. And while 'waste infrastructure can help us to realize our dependence on nonhuman life forms and forces with which we share our bodies, environments, and, ultimately, our planet', the particularity of those environments and the specific material relations of waste in different places matter to how those dependencies unfold (Reno 2015, 558). I emphasise these qualities of infrastructures not to draw attention away from the deeply embedded cultural contexts of caste, class, and gender in relation to waste and pollution in South Asia (Devika 2016; Doron & Raja 2015; Butt 2019) but, instead, to suggest how environmental particularity, material specificity, and the supposed universality of infrastructure also matter to such conversations.

At the time of writing this article (September 2022), the WTE project at Brahmapuram is still being negotiated, delayed and in limbo between a government-proposed solution, private investment, and an unviable infrastructural project.[10] My argument here has in part been inspired by the efforts on the ground in Kochi towards reimagining the conversation about waste management from the point of view of the very specific environmental conditions. According to Dr Manoj and others like him, plastics cannot be disposed of responsibly in Kochi, and they should therefore not be produced or consumed in the city. This belief is tied to intimate understandings of the materiality of plastics, Kochi's tropical environment, the unevenness of global exploitative systems built on the universal logics of infrastructural development, and the relation between those things. Attention to these multiple specificities is crucial if efforts to address environmental justice issues are to avoid investing in the very things causing harm in the first place.

Notes

[1]   Associate Professor Georgina Drew, my PhD supervisor, was conducting research into the cultural politics of rainwater harvesting in Kochi at the time.

[2]   For a detailed history of the social and environmental justice issues of the installation of Brahmapuram in 2008, see Ganesan (2017).

[3]   'Journey Towards a Waste-free Smart City', 2018. *The Hindu*, 31 December, https://www.thehindu.com/news/cities/Kochi/journey-towards-a-waste-free-smart-city/article25867971.ece (accessed May 23, 2022).

[4]   The Convention on Wetlands is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. It is named after the Iranian city of Ramsar, where the convention was fist signed in 1971. India signed the convention in 1982, and currently has 64 sites designated as Wetlands of International Importance, one of which being the Keralan backwaters that surround Kochi. See https://www.ramsar.org/wetland/india.

[5]   Sunil Kumar (2017).

[6]   Dr Manoj mentioned to me a few times about research being conducted into efficient use of fly ash as bricks and other valuable materials, but his opinion was that once it was in the environment, it was very difficult to avoid its toxicity.

[7]   There is a long and recently revived literature on the intersection of anthropology and refusal. Carole McGranahan, building on the seminal work of Marcel Mauss, takes the stance that a refusal is not necessarily a severing of social ties, but instead can be thought of as 'a generative act, a rearrangement of relations rather than an ending of them' (McGranahan 2016, 335). This is the spirit in which I took these refusals. I am also reminded here of Mary Douglas' *How Institutions Think*, where she states, 'Writing about cooperation and solidarity means writing at the same time about rejection and mistrust' (Douglas 1987, 1).

[8]   A slightly alcoholic drink made from the fermented sap of coconut palms.

[9]   Our visit came six months after Kerala was subject to the worst floods in a century, where over a third of the state was underwater. For a more ethnographic description of this flood, see Barlow (2022).

[10]   Sunil Kumar (2022).

Acknowledgements

Disclosure Statement

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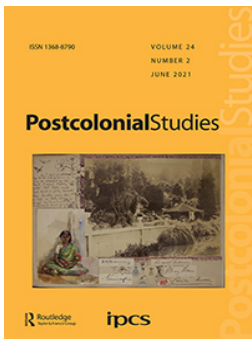
Slow infrastructures in times of crisis: unworking speed and convenience

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Slow infrastructures in times of crisis: unworking speed and convenience

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ABSTRACT

The (post)colonial logics of speed and convenience are manifest in many of today's infrastructural projects, creating what we consider to be 'fast infrastructures'. These infrastructures create ease for some and harm for others while exacerbating social and environmental crises around the world. Addressing these crises requires, we argue, a slowing down. Enter the role of 'slow infrastructures'. In this paper, we highlight two forms of slow infrastructure that provide possibilities for rearranging our infrastructural orientations: composting and rainwater harvesting. Drawing on fieldwork conducted throughout 2018 and 2019 in Kochi, Kerala, this research asserts that in order to do infrastructure differently, an unworking of convenience and speed is required. This unworking can be achieved through an attunement to multi-species and more-than-human relations, matched with a distributed ethic of maintenance and care. Our ethnographic examples, one from a hospital and another from a hotel, suggest that slow infrastructures can meaningfully offset the threat of disfunction and 'urban failure' that confronts cities increasingly marked by turbulence and uncertainty. While these examples draw from the tropics of urban South India, they offer lessons helpful to unworking the harm caused by fast infrastructures in other parts of the globe.

Many of the environmental crises the planet faces have origins in colonial and capitalist logics of speed and convenience. And for most of the world's population, the crises that began with settler colonialism have deepened and accelerated on the heels of the industrial revolution and, more recently, the impacts of neoliberal capitalism.[1] These dispositions are now worked into the rhythms of human and more-than-human lives and have fuelled what anthropologist Cymene Howe refers to as a 'petromodernity' that sees land, water and energy rendered as resources to be extracted, used and disposed of with little regard for flow-on effects.[2] Physical infrastructures such as roads, container vessels, dams and sewers create the logistics of that project, built on the premise of progressionist linear time, and endless growth. These infrastructures are generally built quickly – using cheap labour and cheap energy – with the aim of moving people and goods quickly.[3] Convenient for a few, and increasingly harmful to many, they constitute fast infrastructures.

Due to their problematic nature, we contend that fast infrastructures require an 'unworking' to be more equitable and ecological – an unworking that requires revisions of the predominant orientation towards speed, convenience and endless growth. Such an unworking might involve a slowing down, and a turn towards slow(er) infrastructures. These slower infrastructures can offset the threat of disfunction and 'urban failure' that confronts cities increasingly marked by turbulence and uncertainty.[4]

In this article, we present two examples of viable slow infrastructures that, building on the important work of feminist science and technology studies scholars such as Max Liboiron, 'offer a material ethics at the immediate scale'[5]: composting and rainwater harvesting. We suggest that these practices hold particular promise for the more equitable distribution of resources and power in places such as (post)colonial India.[6] We do so with the recognition that these processes and practices are deeply situated in the social and environmental fabric of India and may not work everywhere for everyone. And while there are key conceptual insights to be elicited from the promise of slow infrastructures, we draw these out by grounding the discussion in examples from a collective thirteen and a half months of fieldwork from 2018 to 2019 that was conducted in a South Indian city known as Kochi. Situated on the Malabar coast of Kerala, this burgeoning metropolis faces overlapping environmental challenges that replicate and reflect the problems of fast infrastructures in other parts of India, and in other (post)colonial cities undergoing rapid change. In what follows, we highlight the scope of these challenges in Kochi while also featuring lessons gained from repeat site visits at locations where slow infrastructures are being maintained to a considerable degree of success.

This work engages the insights and appeals selected from over one hundred key interlocutors who shared their motivations for building slow(er) infrastructures via interviews, focus groups, site visits, participant observation, and collaborative efforts to promote environmentally sound practice in Kochi. The initial networks we built in Kochi were forged through our institutional affiliations to Amrita Vishwa Vidyapeetham University, and particularly the waste management initiatives on the various campuses of that institution. These initial networks were then expanded upon to include environmental activists working throughout the city with whom we undertook collaborative learning about environmental and sustainability initiatives by way of participant observation. Through these methods and our empirical focus on ways in which people in Kochi are engaging with slow infrastructures, we provide an alternative narrative to the slow violence that fast infrastructures often entail.[7]

Over the last two decades, many social scientists have been turning to infrastructures as a way of investigating the 'flow of goods, people, or ideas' across space and time.[8] Framed as such, infrastructures have their history in large public works such as the Paris sewers, the Indian railways and the Panama and Suez Canals.[9] More recent analysis led by anthropologists such as Ashley Carse contends that infrastructures are more than matter that moves other matter, they are processes 'embedded in and constitutive of social relations'.[10] They constitute relations between citizens and the state, the public and the private, that rearrange relationships between humans and the materials that make their lives possible. In this way, infrastructures 'create a process by which the body, as much as the mind, apprehends what it is to be modern, mutable, and progressive'.[11] Yet, as these infrastructures promise speed, connection, progress and prosperity, they also trap citizens in highly centralised and increasingly privatised uneven systems of capital accumulation and

resource distribution. We aim to advance these conversations around the social and temporal nature of infrastructures by bringing ethnographically derived insights about slow infrastructures into conversation with scholars working on feminist science and technology studies and postcolonial theory. A further aim is to highlight how speed and convenience are both embedded in the fabric of the (post)colonial city.

To ground our discussion and its insights, we situate both fast and slow infrastructures in (post)colonial Kochi, providing evidence to suggest how the Keralayan city has been transformed through colonial expansions and large infrastructural projects in the name of economic growth. This helps to explain how progressive states such as Kerala – heralded as a model for international development on the basis of access to health and education – nevertheless continue to struggle with the contradictions of economic growth through infrastructural development.[12] We then look ethnographically at two slow infrastructures, composting and rainwater harvesting, framing them as ethical practices that work against the centralisation and privatisation of public resources and materials. We suggest they hold promise for a more ethical and less destruction-oriented approach to infrastructures. We claim them as infrastructures due to their relational capacities between and beyond the human. By prioritising a decentralised and distributed ethics of everyday maintenance and care, slow infrastructures involve reworking relationships between fellow humans and to the more-than-human world while also unworking attitudes toward speed and convenience.

As a further prelude to what follows, we note that speed and convenience are intertwined. Indeed, convenience 'legitimizes and sustains specific forms of (fast) consumption'.[13] Such accelerated forms of consumption can have the 'paradoxical effect of fragmenting activity, inadvertently exacerbating the (everyday) sense of harriedness' while also generating demand for yet more convenient solutions.[14] We also recognise, however, that convenience has both 'good and bad' connotations and that as a phenomenon it has 'multiple realities depending on (the) different knowledges, spaces, circumstances and relationships' in which it is analysed.[15] When it comes to convenient or fast foods, for instance, these goods offer speed in terms of preparation and consumption, but they also create expanding waistlines, additional health concerns and a surfeit of environmentally harmful wastes once their packaging is discarded. And, yet, when convenience is done through food it can also be 'done through care' by time-pressed and hardworking parents who are doing their best to keep their children fed.[16] So, while there is an element of 'convenience as care' in such an example, there is also an element of convenience as uncaring in terms of the secondary and tertiary ripple effects it can create. It is the undoing of these ripple effects that we want to take seriously by highlighting the work that can be achieved by slow infrastructures.

The time of infrastructures

Infrastructures are not as rigid as their structure-centred nomenclature might suggest. Time, maintenance, decay and labour are attached to infrastructures because they are *processual*. As objects of ethnographic attention, they are 'a relational space of investigation, where researchers can explore fluctuations, or trace the dynamic shape of what thrives and what dies'.[17] As relational entities, infrastructures are more accurately described as 'temporary lines across active environments that erode, rust, and fracture'.[18] This observation

places emphasis on not just the creation but also the destruction that is part of the life of infrastructure. As such, infrastructures are not just 'a thing'; rather, they are a 'thing-in-motion, ephemeral, shifting, elusive, decaying, degrading, becoming a ruin but for the routines of repair, replacement, and restoration (or in spite of them)'.[19] While new and emerging infrastructures invoke teleology, futurity and techno-mobility they do not necessarily incorporate plans for their own lifecycle and ultimate demise. Nor do they, as Ara Wilson highlights, address the power differentials or the intimate injustices that these new material relations often generate.[20] Wilson states: 'just as the installation of infrastructure has never been equitable, the decay of public infrastructure is not a homogeneous decay'.[21] In other words, new does not equal better or everlasting – and yet, that is often how the surfeit of fast infrastructures are embraced.

The colonial logics of extraction and capital accumulation are often wound up in infrastructural projects and their associated promises of economic and social development. One of the clearest realisations of this are the aforementioned Indian railways, built by the British throughout the nineteenth century as a series of public works that also served as a 'vector of capitalist modernity' benefitting foreign merchants and colonial rulers.[22] Over time, and particularly in their contemporary use, such public works became infrastructures – following from the definitions provided above – as they continue to significantly alter socio-material networks and more-than-human relations in (post)colonial India.

The 'anticipatory good'[23] of infrastructure obscures the ecological destruction and social inequality accelerated by those same infrastructures.[24] We contend that this anticipation is often promised under the guise of convenience and speed and that the fast infrastructures in our midst are crisis-ridden. They are crisis-ridden because they offer quick and temporary solutions to problems that have their origins in colonial logics of linear time, endless growth, and human exceptionalism.[25] As Hannah Appel so beautifully writes, 'under Anthropocene skies, petro-fueled infrastructures inflate like life jackets for a regime that otherwise should have drowned in its own violence and excess'. [26] In their inflation, fast infrastructures create uneven relations across different scales, materials and times. As infrastructures continue to disperse and complicate relations to environments at increasingly problematic scales, there is a need to re-imagine our relationships to infrastructures and to re-distribute their effects in a way that prioritises reciprocal relations.

We use the heuristic of speed to suggest that slow infrastructures might be viable alternatives to the extraction-centred colonial disposition of fast infrastructures. Slow infrastructures may not increase the mobility of people or things but instead represent a shared responsibility for putting the world back together though more equitable distributions of maintenance and care.[27] By sharing examples of slow infrastructure, we join Eve Tuck in moving away from 'damage-centered research' and instead focus on modes of practice that push back against the power structures that so often cause that damage.[28] We do so not in an attempt to suggest a scaling up of activist interventions nor to provide easy solutions to complex issues but instead to highlight how ethical actions 'are not necessarily about changing the system, so much as existing in it'.[29] We want to foreground the ways in which slow infrastructures like composting and rainwater harvesting might make more ethical (post)colonial futures possible amongst the decay and maintenance of fast infrastructures.

(Post)colonial infrastructures of Kochi

Kochi is a city where new and old, slow and fast collide, not only with each other but with the lush, humid tropics of South India. Known as the 'Queen of the Arabian Sea', Kochi is oriented toward the ocean through the mediation of a port, in ways that matter to contemporary waste and water infrastructures in the city. Kochi has a long cosmopolitan history of maritime exchange with people from China, Europe and the Arab states going back centuries. The hundreds of Chinese fishing nets scattered around the edges of the backwaters are a lasting testament to this history (Figure 1).

The colonial, that is *extractive*, history of Kochi (and, in fact, what we now call India) begins with the arrival of Vasco de Gama, a Portuguese explorer, near Calicut just north of Kochi (then Cochin) in 1498. With African slaves aboard the ship, the Portuguese began trading for spices, and eventually made inroads into life throughout the region, primarily through building houses, forts and churches.[30] A century and a half later, the Dutch wrested control of this increasingly important port town in 1663. They also built many large houses in the distinctively Dutch fashion, including many 'go-downs' (warehouses) which stored precious spices and other valuable goods, many of which are still standing today. Both the Dutch and the Portuguese were also ship builders, able to utilise a large workforce of able-bodied Indian men to assist the African slaves they travelled with in expanding their fleet. The influence of this period on Fort Kochi, and Mattancherry in particular, cannot be overstated. A walk through this historic township is littered with reminders of a past entrenched in colonisation, African slavery and the spice trade – in many ways the precursors to the fast infrastructures that continue to cause havoc in the city. Even today, popular stops on a tour of Fort Kochi include the St Francis Church (the first European church in India built by the Portuguese in the sixteenth century), the adjacent Dutch cemetery, the Dutch Palace (which was actually built by the Portuguese in 1555), the Santa Cruz Cathedral Basilica originally built in the 1500s, and the Indo-Portuguese Museum showcasing artefacts from the Portuguese era (Figure 2).

The British arrived in Kochi 1795. And while the everyday effects of this rule were arguably not as pronounced in Kochi as they were in northern India, due to the perseverance of the princely states of both Cochin and Travancore, 'indirect British rule' remained in the region until partition in 1947.[31] During the British colonial period, the infrastructural development of the region rapidly expanded to facilitate the extraction and exportation of spices and tea from the Western Ghats. Through their determination to turn the Western Ghats 'into a plantation district', the British managed to open up what was until then 'entirely inhospitable terrain'.[32] Before the British arrived, those who traded in goods on the coast of Kerala had little to do with the 'ancient tribes of the forest' who only 'ventured out occasionally to exchange their cardamom and honey for salt and textiles, but for the most part … remained an enigma'.[33] The scale of the infrastructure was such that the ecology began to change along with the desires of colonial rulers and the dreams of prosperity held amongst the Cochin and Travancore elite. First, canals were dredged through the city between 1840 and 1860 to increase the flow of goods. Then, with the invention of the combustion engine by scientists in Glasgow, attention moved to automotive transport and the construction of roads in the 1850s. The speed and convenience associated with roads is bound up in the 'promise of political freedom' and in the kind of economic connection that led to what has been called the 'enchantments of

Figure 1. Map of Kochi, South India. Kochi Map. 2010. Wikimedia Commons:. Available at: https://upload.wikimedia.org/wikipedia/commons/thumb/4/4b/Kochi_map.png/435px-Kochi_map.png

infrastructure'. [34] In this instance, the roads built in Kochi were part of a larger set of infrastructures geared to extract and export spices.[35]

By the 1920s, the priority became turning the Cochin Port into a major node for industrial and international trade on the western coast of India. This was orchestrated by Sir

Figure 2. Godown on the edge of the backwaters in Mattancherry. Note the stained walls, remnants of the hundreds of years of spice trade through the city, and the Dutch architecture of the buildings. Photo by first author. 2018.

Robert Bristow, under the guidance of the Governor of Madras Presidency, Lord Willingdon, and was conducted in a three-way collaboration between the two princely states and British controlled Madras. The seafloor had to be dredged to make way for larger ships, and subsequently Willingdon Island was created with the dredged seafloor in the 1930s. Willingdon Island, named after Lord Willingdon, is the largest artificial island in India and was home to Kochi's first airport. It is now the home of the Cochin Port Trust and the Southern Indian Naval Command. Other parts of the island now lay neglected as the railway that once transported goods across the island has been superseded by road transport. The development of roads during the British era caused a shift from a watery way of life to a terrestrial way of life, at the same time as there was increasing infrastructural development of the Cochin port (Figure 3).

Figure 3. Pre-colonial Chinese finishing nets (now a tourist attraction), with the shipping container terminal in the background. Fort Kochi. Photo by first author. 2018.

Even as 'exposure to the wider world is an ancient feature of Kerala's heritage',[36] the nature of that exposure has changed over time through colonisation, independence and onset of neoliberal capitalism in the late twentieth century. These developments have often been infrastructural in nature, as 'new infrastructures make old ways of life difficult to maintain'.[37] The infrastructural developments by the British transformed the entire ecology of the region in the name of speed and extraction, reshaping social relations along the way. The infrastructural developments above were mirrored by two social movements. The first was a caste based and pro-British movement in the late nineteenth and early twentieth century. The lower castes were pro-British as they understood them to have 'a greater sense of justice than the princely states'.[38] The second was a Marxist workers movement that was distinctly anticolonial and raised for the first time 'connections between colonial capital, British rule, and class-based exploitation'.[39] What was initially recognised as a welcome disruption to the cruel caste system, the extractive and exploitative capacities of the British Empire were realised as the speed and scale of the extraction and capital accumulation grew. These examples provide a historical account of the social nature of infrastructures – an important narrative to consider when we turn to the transformative potential of slow infrastructures below.

Despite the complex history of these infrastructural developments and the social movements that mirrored them, Kochi continues down a path of speed, convenience and economic growth, to the detriment of the environment and the health of human and more-than-human populations. The many canals, once the lifelines of the city, are now odorous drains filled with water hyacinth (an invasive weed from South America), sewage and industrial pollution. Drinking water is increasingly scarce despite the abundant rainfall, and many Kochites are now reliant on the distribution of purified water in the form of 20 litre cans (Figure 4).

The neglected and blocked canals, together with Kerala's notoriously congested road network (which now work in contradiction to their emergence as a vector of speed), also significantly contribute to increasingly violent annual monsoonal floods. In August 2018, during the worst floods Kerala had experienced in a century, Kochi's international airport built 20 km north-east of the city in the 1990s turned back into the river that used to be in its place. Consequently, the airport was shut for three weeks, causing chaos for the vital tourist economy and Kochi's increasingly mobile middle class. In other words, the techno-optimism of the 'smart city' could not cope with the increasingly 'demanding environments' in which it was embedded,[40] and which are further threatened by rising temperatures, changing monsoon cycles and sea-level rise. But there are two ways, discussed in what follows, that people in Kochi are looking beyond the breakneck speed of development by embracing slow infrastructures. The ethnographic examples below provide insights into how simpler, slower infrastructures might circumvent the disposition left by the violence of this extractive history by reshaping more-than-human social relations in surprising ways.

Composting as slow infrastructure

While composting is an age-old practice evident in relationships to the soil going back hundreds of years,[41] it has recently gained traction among urban communities looking for sustainable solutions to an increasingly prevalent global 'waste crisis'. As the

Figure 4. British era sewer, Mahatma Gandhi Beach. Fort Kochi. Photo by first author. 2018.

infrastructures built to eliminate waste quickly and conveniently either breakdown or reach capacity, composting has become a slower, simpler method of waste management that offers an efficacious way of getting one's hands dirty. Through an emphasis on maintenance, care, responsibility and cooperation amongst and beyond humans, composting helps to un-work convenience and speed by connecting people to each other and to the rhythms of the more-than-human world. As a daily practice, it helps with the practicalities of segregating waste at source – highlighting the dangers of non-degradable wastes such as

plastics – and promotes a degree of self-reliance in uncertain times. This self-reliant (*swaraj*) practice takes seriously the call of 'my waste, my responsibility', a motto which can be seen on roadside signs throughout India since Prime Minister Modi's Swachh Bharat (clean India) campaign began in 2014.

In urban (post)colonial India, the responsibility for managing waste often falls to either urban local bodies (ULB), with the seventy-third and seventy-fourth amendments to the constitution,[42] or to lower caste manual scavengers. ULBs are often under-funded and under-resourced. This means that waste management in urban India is often patchy and unequal, reflecting social and ethnic hierarchies and reliant on particular groups of peripheral communities that have managed to address the issue at a grassroots level. These local clusters of knowledge and practice create friction with the local government, whose official responsibility it is to handle waste. Unable or unwilling to negotiate this patchwork of national-, state- and community-level policies, the Indian government has often failed to deliver adequate waste infrastructures. In interviews with politicians and residents of Kochi, both pointed the finger at the other as holding the primary responsibility for adequate waste management. The desired speed and convenience of the infrastructure breaks down through a lack of cooperation across scales, overly bureaucratic (post)colonial government procedures, the enduring caste associations of purity and pollution, and the endless pursuit of economic growth.

Waste management infrastructure generally refers to processes that transport waste away from a private dwelling.[43] Most contemporary cities employ a centralised waste management system via which waste will be taken to a processing facility, usually a landfill, on the edge of town.[44] This requires a network based on convenience and speed to collect, transport and dispose of waste. These processes then require the maintenance of trucks and roads, the availability of cheap fuel and access to land – the infrastructures of wastes' fast movements. In (post)colonial India, many landfills and the infrastructures that serve them are far over capacity due to a rapidly urbanising population and a growing and highly aspirational middle class that is consuming more than ever before. As Assa Doron and Robin Jeffrey emphatically state, 'Never in history have so many people had so much to throw away and so little space to throw it as the people of India in the second decade of the 21st century'.[45]

Due in large part to its infrastructural history, Kochi, unlike the rest of Kerala, which has adopted decentralised waste management practices throughout the twenty-first century, continues to pursue centralised (that is, convenient and fast) waste management.[46] Since 2012, it has attempted to address the city's waste crisis – including an over-capacity landfill, piles of waste accumulating roadside, waterways and canals full of rubbish and industrial pollution – by pursuing a transnational public-private-partnership to replace the landfill with a waste-to-energy (WTE) plant. Pitched as a renewable energy source and a solution to the waste crisis, this effort mirrors yet another fast, convenient and highly problematic practice imported from Europe.[47] One of the key arguments against the development of WTE in Kochi is the large percentage of organic material in the waste profile, which some waste management experts in Kochi claim to be as high as sixty per cent. Given the high moisture content of the organic waste, the abundance of monsoonal rains and the tropical humidity of south India, these conditions are extremely difficult for generating energy from the incineration of waste. These conditions, however, are perfectly suited to the microbial activity required for composting. In

support of composting, one research participant poetically described Kochi's extremely warm and wet climate as an 'incubation climate' where you don't have to do anything to nourish and sustain microbial activity.

Despite the ripe environmental conditions for composting in Kochi, the practice is difficult to implement at the household level, and difficult to scale up to the city level. The problems lie in the 'requirements of space, cooperation, relentless application, and systematic maintenance' needed to make composting viable.[48] These problems are particularly problematic in India where household labour is often gendered, and association with waste is intimately tied to the inequities of the caste system.[49] Furthermore, they are also particularly difficult to implement due to Kochi's deeply colonial and extractive infrastructural history. Despite these constraints, there is a growing movement of activists helping environmentally conscious institutions in Kochi to turn to decentralised composting as a way to gain traction in the fight against waste. As such, while household composting is rare, and large-scale composting initiatives have failed due to a lack of maintenance and political cooperation, there are promising instances of decentralised composting at the small to medium institutional level that are useful examples of how slow infrastructure can begin to un-work convenience and speed amongst the disposition of fast infrastructures in the city.

Some of the more impressive composting efforts in Kochi are enacted by businesses and even hospitals. The Amrita Institute of Medical Sciences (AIMS) is a case in point. AIMS sits in the heart of suburban Ernakulam, the bustling city center of Kochi (see the central quadrant of Figure 1 for illustration). It is an educational and medical facility run by a spiritual leader, Mata Amritanandamayi Devi. Referred to as Amma by her devotees, she runs a number of charities, universities and hospitals across all of India. In the spirit of Amma's teachings, AIMS is designed in the shape of a mandala and it has an open feel enhanced by the abundance of trees and plants populating numerous courtyards. Amma's institutions pride themselves on being environmentally conscious, and AIMS is no different. AIMS is host to one of Kerala's best waste-water treatment plants, and on the other side of the river behind the hospital, on a small island, is a large composting facility. The short boat ride to the facility is a healthy reminder of the tropical conditions of Kochi, the vital connection to water for those who live here, and the benefits of decentralised waste-management processes. The putrid smells and darkened waters that one encounters on the ride to the island are also reminders of the uncontrolled wastes that continue to enter the waterways throughout this delta city.

On one particular visit to AIMS, the operator of the compost facility took the first author and a hospital staff member of AIMS across the river to share the work being done on the island. According to the composting manager, the island used to be 'a waste dump filled with syringes, snakes and wild plants', until a visitor from the United States helped turn the island into a composting facility. He went on to explain that before they built the composting facility together 'no one knew anything about waste segregation or composting'. They subsequently spent months clearing the land and building the facility after gaining permission from Amma. Now, as he told us, 'the environment is very pleasant', 'there is no smell', and it is a 'good climate'.

The composting facility processes all of the hospital's organic wastes each day. Large tubs of food waste are mixed with piles of organic matter from around the facility, mostly leaves and other garden debris. After a few days, once the pile begins generating

heat, it is moved to the adjacent composting area that relies upon multispecies relationships. Here, rows of compost bays line the cement floor under a large corrugated iron ceiling with open sides. The process is sped up by the introduction of worms – turning this in a vermi-composting facility – and within 20 days the final product is ready to be used in garden maintenance and other environmental aesthetics projects around the property. The work is time intensive and constant, yet fulfilling, as the manager explains:

> When I do this work, no other thoughts come to my mind. Once upon a time I wanted to be a well-connected man in the hospital. Now I am so focused on this work that I feel no interest to come to the main hospital site.

If waste infrastructures like landfills and WTE tend to speed things up, accelerating the crises through their promise of convenience and technological advancement, composting holds the promise of earthly flourishing through an unworking of speed and convenience. As an elemental and multi-species practice that requires close attention to matter, moisture, heat and time, it extends care and attention beyond the human. It does so by being a particularly affective practice, which often challenges and expands the olfactory and haptic senses through an intimacy with more than human relations to plants, soils, worms and vermin. These kinds of multi-species and sensorial relations that composting entails 'facilitate[…] a reconsideration of infrastructure's relationship with nature'.[50] This kind of reconfiguration of attention and attunement beyond the human requires patience and a willingness to get dirty, as it challenges the implicit human exceptionalism and entitlement that is tied up in many fast infrastructures. In this way, composting acts as a bridge between death and life, helping people to recognise that life feeds on life. Through turning disposed or left-over biological matter with soil and other critters to make fertile ground, composting aids in food production an soil health, and helps to create 'relations of care' that push back against the convenience and speed of fast infrastructures.[51] In this way composting is a transcendent form of care-work that is 'simultaneously "ordinary" and surpassing the "ordinary"'.[52]

The relations of care that emerge amongst slower infrastructures – the un-working of speed and convenience – extend to the fellow humans with which compost is made. A number of composting staff interviewed readily expressed satisfaction and even 'happiness' in doing their work. Supporting their statements, the chief operator boasted that the facility had a higher retention rate of employment than other similar jobs in the city. In other circumstances, manual labour employment would be inconsistent and seasonal. Furthermore, by taking the time to visit the composting facility, composting also challenged implicit social hierarchies amongst other staff in the hospital.

The hospital staff member who joined the tour, for example, found the experience to be quite transformative in ways that she did not anticipate. A woman of advancing age and many years of service in management at the hospital, she would normally have been stationed in the house-keeping department, where she orchestrated staff administration while also joining in on the cleaning duties that arose. She joined the tour of the composting facility out of curiosity after the first author expressed interest in the facility during an earlier meeting to discuss waste-management practices at the hospital. Despite her long tenure at the hospital she had never ventured to the composting area or visited the other waste-management facilities on site (outside the hospital wards). After arriving on the fresh-aired island and learning from the operator of the compost facility's practices,

she later reflected on how moving it was for her to see the composting work firsthand. As she described:

> I must say that having been here [at the hospital] for so many years, that's the first time I've really got to know what's happening here … I just realised that even I don't know the big picture … [but after seeing this] I feel very proud …

Building relations of care that extend to fellow humans as well as plants, soils and other critters, composting 'puts practitioners not so much "in charge" of ecological management and food production, but sees them as attentive members of a specific ecological, soil foodweb community'.[53] The vermi-composting that the staff described, for instance, has the potential to enact a world premised on multi-species flourishing through 'solidarities among diverse communities, human and otherwise'.[54][55] In other words, the daily practice of composting helps to reshape our relations among humans through 'possibilities of solidarity with nonhumans', turning composting yards into places that inspire moments of pride and wonder.[56] In this way, through its unworking of speed and convenience and it's disposition toward medium-scale initiatives, composting holds the potential to rupture and reconfigure existing fast infrastructures as well as political and social categorisations built on inherited and culturally re-enforced hierarchies – such as colonial rule and caste and gender norms. It also has the potential to build more responsible and ecological futures. Another slow infrastructure that holds particular promise in this tropical south Indian city is the simple yet effective practice of capturing rain where it falls.

Rainwater harvesting as slow infrastructure

The fortunate among us experience split-second infrastructural speed every time we turn on the tap. The expectation that water should flow forth, backed by hydraulic pressure and an underground grid of municipal pipes,[57] is itself an anticipation and a demand for hydrological speed and convenience. The 'modern' convenience of indoor plumbing, in fact, is intended to save 'time as well as reducing toil and trouble'.[58]

In most urban zones, tap water is transmitted from faraway locations where it can be processed and transferred in bulk.[59] Most often, this water comes from rural watersheds where the water has competing demands for ecosystem services and agriculture.[60] In the parts of the world where these rural watersheds are heavily inhabited by human and more-than-human populations, urban water demands can be complicit in removing vital resources needed to support livelihoods. And, despite the daily crises of water access that such rural areas can experience, news articles predominantly focus upon water stress when piped flow to urban settlements becomes jeopardised. The media attention to recent 'water crises' in Cape Town, South Africa and Chennai, South India are a case in point.

There is an alternative, but it requires frequent care, upkeep and a sense of responsibility for managing one's own water resources. This alternative is urban rainwater harvesting. It involves catching water where it falls on rooftops, roads, parks and playgrounds. This water is then transferred into underground storage tanks (which are paved) or recharge wells and recharge pits (which are unpaved). The former captures and contains the water for immediate use whereas the latter allows for the percolation of rainwater into the subsoil where it recharges the groundwater.

Based on the specific subset of fieldwork that focused on rainwater harvesting in Kochi, the technology appears to offer a viable and effective practice for urban infrastructural overhaul. That said, its widespread implementation is proving to be a challenge given the acceleration of time-restricted tasks and demands in everyday life.[61] For while it is straightforward to implement at a relatively low cost,[62] it is a practice that requires regular maintenance – and attention to acts of maintenance is 'not so much about defective infrastructural objects' as it is about understanding the social and political relationships in which they are embedded.[63]

In the case of rainwater harvesting, the amount of care and labour required to maintain systems in working order can be extensive. Before the rains arrive, rooftops, roads and courtyards need to be cleared of debris. When the rains arrive, a 'first flush' must let this first dose of (often acid) rain slip away, clearing and cleaning the grounds upon which it falls in the process. Then comes the period of capture and storage while the rains are falling. Once they stop, drains, pipes, filters and storage containers must be repaired for the inevitable damage caused by the deluge. And before too long, the cycle must be repeated.

These are all time-intensive practices. And this time intensity is processual and cyclical. It requires values of care for equitably sourced and managed water as well an ethical commitment to the slow infrastructures that help to harvest and store these rains directly. So why bother? For one, harvested rainwater has an immense potential to meet the current and rising water demands of many South Asian cities. In Kochi, a total water wealth of 3000 millimetres falls annually and is spread over the course of not one but two seasonal monsoons. Another reason is that rainwater harvesting is a long-standing practice for inhabitants of the region as it was formerly part of the common-sense tactics of survival in everyday life, as Michel de Certeau might argue,[64] prior to the installation of piped water infrastructures. Typical acts of water harvesting included the use of artificial lakes created from rain (*madaka*)[65] along with well-recharge practices and the filling of pots and barrels to meet household water needs. As older generation residents explained to us in interviews, knowledge of how to harness the rain for water security used to be passed down through generations. This knowledge is being lost as people become increasingly reliant upon piped water supplies, and as the elderly pass on without the transmission of their expertise.

One group, however, is working concertedly to revive knowledge of rainwater harvesting practices and to expand its installation and use across a range of topographies within Kochi, and Kerala more broadly. Known as Inspire India, this group is composed of architects, project managers, infrastructure engineers, structural engineers and landscape designers. Their work is guided by core principles for all of their project designs. These include: the concept of 'environmentally sustainable development', the need for conserving energy and switching to renewable sources when possible, and the 'need to be socially responsible amidst often over built and obsolete governmental and societal systems and norms'.[66] To achieve this, they offer a set of key services featuring 'home grown progressive sustainable concepts' that target 'total water management' via the installation of rainwater harvesting lakes combined with anaerobic waste water treatment and recycling systems.[67] These technologies offer what one member of Inspire India – an architect and hotelier who we will call Govinda – called an 'integral approach' to infrastructural design that 'appeals to your conscience straightaway'.

For people like Govinda, an 'integral' approach to architecture involves thinking of more than the initial structure to be built. It also entails thinking about how and from where the water comes, how to take care of the waste that the users inside a building generate, and how to landscape a property with those regionally appropriate plants and species that will help to encourage water retention and flourishing green spaces. Given the overall challenges of water access and management in a place like Kochi, rainwater harvesting has taken pride of place in many of Govinda's buildings. Yet, as he explained in our first of two interviews in February 2018, not everyone in his profession is as enthusiastic about the promise of such environmentally minded technologies. At first, he confessed, 'we were considered odd people' because very few in his professional networks saw value in using 'local materials and eco-friendly architecture'. As a result, they faced 'lots of difficulties' as well as 'unnecessary accusations', which he portrayed with a wave of a hand saying – in the role of a fictional third person – 'all these things don't work' and 'it doesn't make any sense'. But, he continued, 'we somehow managed to survive' after a rocky start in the late 1980s and early 1990s. Given the scope of impressive 'eco-friendly' projects that he has built, people like Govinda appear to have thrived rather than just survived. And the use of rainwater harvesting is a cornerstone technology for many of their projects.

The trick to successful rainwater harvesting, as Govinda explained, is that you have to capture and 'hold' the water in order to make use of it. This imperative for water retention is easier said than done, and there are various strategies and technologies that can be applied, depending on the geomorphology and topography of a given location. One earlier mentioned option is to direct harvested rainwater into recharge wells and natural ponds that percolate it back into the groundwater over time. 'But', he cautioned, 'in some places these ponds and wells have already become contaminated – (they are) all saline'. To work around this problem, Govinda and his colleagues have created cement-lined artificial lakes in a number of their projects. The size of these lakes depends on a calculation that they call the 'consumption recharge profile', which is the estimated amount of water use at a given location along with the amount of water that can be harvested over the two regional monsoons, minus estimates for evaporation. To keep the water free of mosquitoes, fish are also required to keep the artificial lakes healthy – and they too need a minimum amount of water after both consumption and evaporation. The end result of a successful project, he stressed with drawn-out pronunciation, is the creation of a 'totally new ecosystem'.

To see firsthand what such efforts can achieve, we toured on three separate occasions a flagship hotel and self-acclaimed 'eco-resort', designed and run by Govinda and his colleagues. Built in the early 1990s and situated just off a main highway in the heart of Ernakulam, the establishment features a network of two- to three-storey buildings finished with red-brick exteriors. Driving or walking into the complex after following a slope down from the adjacent highway, one quickly gets the impression of entering into quieter and calmer environs.

To a visitor, the eco-resort feel of the hotel is heightened by an abundance of trees and gardens, a green playground, a spacious pool and, of course, the serene presence of an artificial lake that sources 20,000 litres per day of the hotel's water requirements. Since the lake semi-circles the exterior of the property, its presence is subtle and it feels more like a landscape accent than a high functioning and self-sufficient water-management system. One might imagine, in fact, that most guests have no idea of its purpose or the

Figure 5. Hotel rainwater harvesting lake. Photo by second author. 2018.

fact that the water running through their taps and showers is caught, filtered and circulated on site. Such obliviousness is part and parcel of the design and functioning of infrastructure. After all, 'The normally invisible quality of working infrastructures only becomes visible when it breaks: the server is down, the bridge washes out, there is a power blackout' (Figure 5).[68]

Given the success of the property, even from a budget savings perspective alone, it is striking that more hoteliers and businesses have not taken on a similar model. According to Govinda, the lack of similar buildings is no longer due to a dearth of interest but, sadly, due to time-management constraints that further underscore the importance of speed and convenience. During the driest season from February to March, claims Govinda, the offices of Inspire India now get overwhelmed with requests for their expertise to overhaul buildings and to install rainwater harvesting units. Parroting the typical inquiry, he explained that the request was often along the lines of 'Why don't you come and install it tomorrow?' As that is usually impossible, especially since it can take 'at least' one to two months for such projects to be completed, the initial interest often dissipates. For the projects that do get completed, there are also disappointments because by the time a rainwater harvesting unit is installed, the dry season might have ended, and the taps might be flowing freely again. 'And then the crisis goes away – and then they forget it, they won't maintain it', he quipped. Reflecting on this cyclical process, he made a disclaimer that he knows 'a few people who are sincere' and who do understand the importance of taking the time to both install and care for rainwater harvesting infrastructures. 'But it has not come to the stage where there is a mass awareness – enough for people to make a collective action. That has not yet come to [fruition].'

While lack of uptake for rainwater harvesting is undoubtedly a source of consternation for the environmentally minded, as well as for the municipality (which has tried to raise public awareness of the need for decentralised acts of rain capture),[69] there are indications that the growing resource constraints in cities like Kochi might force change in coming years. And as it becomes increasingly inconvenient to source water from stressed river basins, there emerge opportunities to reorient ourselves to the value of slowing down

and to embracing slow(er) infrastructures such as the technologies associated with urban rainwater harvesting. The added bonus that such technology presents is that, once installed, it sits at the ready to receive the cyclical bounty of the rains, even in times of municipal breakdown and urban turmoil. So, while it might appear to be another 'boring' and 'singularly unexciting' infrastructural technology,[70] rainwater harvesting offers the thrilling potential for water self-sufficiency – enhancing our ability to manage present and pending resource crises.

Finally, and as other ethnographers of this practice point out, these everyday acts of 'mutual constitution' with rainwater can have significant subjective implications as people learn to become better, and more ethical, resource stewards and urban citizens.[71] Once people reframe their relationships to water as one of 'commensalism rather than parasitism',[72] they also reshape their relationships with other water users since all technologies of water management are embedded in social and political systems.[73] They do this by diminishing their role in the perpetuation of unequal water access – which as earlier noted marks the rural–urban resource divide as well as the economically driven resource disparities within South Asian cities – and by showing others how they, too, can care for water in better ways. So, while rainwater harvesting is distinct from composting as a technology and a set of practices, it has similar potential to transform how people see themselves and how they connect with, and to, others.

Un-working fast infrastructures

As Cymene Howe and her colleagues write, 'the infrastructures of modernity are killing us'.[74] In the pursuit of convenience and speed, the contemporary surfeit of 'modern' infrastructures continues to introduce new hazards.[75] And yet, the more these infrastructures are taken for granted – and assumed as superior – the more difficult it is to prepare for, and to anticipate, their failure. The risk of infrastructural 'urban failure' is all too possible, of course, because cities are 'imperfect machines of coordination' poised on the edge of collapse.[76] When they are able to stave off this looming decline, it is because of the distributed intelligence of 'diverse kinds of knowledge, lay and expert'.[77] Said differently, the ability of (post)colonial cities to remain nimble in the face of failure requires infrastructural adaptability along with an embrace of technologies that have weathered the test of time.

To do infrastructure differently, in a way that responds to contemporary risks and anticipates future crises, we have argued for a re-embrace of slower moving infrastructures. We also acknowledged that it takes *time* to care and to maintain slow infrastructures in ways that do not involve exploitation. Furthermore, these acts of care and maintenance require an embrace of the kinds of infrastructures that can thrive and flourish over circular time since these slower infrastructures are often designed to weather natural and human-made seasons of expansion and contraction. Such infrastructures can help to reconfigure our relationships with time and temporalities in other words,[78] even as they create material forms that allow for new/old possibilities of movement and exchange over space.[79]

The challenge of upscaling alternative infrastructures, however, remains the need for perceptual and ideological change. After all, what we value in everyday life is reflected in our built environments because 'infrastructure decisions are a commitment'.[80] A key to the required shift in values is a reorientation to predominant attitudes that elevate

speed and convenience as social goods. To date, the reliance on convenient solutions has had the cumulative effect of defining what people value, and what they take for granted.[81] What is needed, then, are efforts to illuminate the externalities of socio-temporally accelerated convenience *alongside* examples of how slowing down can create the nimbleness required to reduce these externalities. And while some of the solutions on offer do require more time and more labour-intensive maintenance at the cost of the speed to which many have become accustomed, they also offer a possible reordering and re-specification of what we might consider to be 'normal and necessary ways of life'.[82]

It is here that we get to the issue of, and the need for, un-working. The move from fast to slow infrastructures will unlikely be seamless or absolute because it requires an un-working of entrenched values alongside the embrace of simple desires. This un-working, then, is also a 'pedagogy of unlearning' that will continue to run into our own 'aspirational ambivalence'.[83] According to Lauren Berlant, this aspirational ambivalence exists and persists due to our 'aggressive need' for the world to accommodate us *and* (original emphasis) due to our own resistance to adaptation.[84] Even at a time of intense global turmoil – such as the forced slowing down we have collectively experienced in response to the crises caused by the Covid-19 pandemic – we see vocalised, the twin desires of public and political discourse to work with our 'new normal' and a hope for a swift return to the fast-paced lives that some have desperately railed against. When the world spins too fast, it seems, we seek to slow down; and when it slows, we aspire to speed up.

The point of underscoring the effort to work with, and to un-work, our aspirational ambivalence is to acknowledge that, like infrastructures themselves, the effort to move towards slow(er) ways of doing and being in the world will be a process that ebbs and flows. Slow infrastructures are, nonetheless, a meaningful pursuit because they serve as a potential antidote to the many perils we face. Due to the significant human and more-than-human connections that they enable, and the ethics of care and the maintenance that they require, they come with the important promise of lives more connected to others, and to the cycles of life itself. If adopted and adapted in similar settings, these slow infrastructures might even yield accelerated action for addressing the multitude of environmental challenges we presently face.

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Notes

1. Here, we draw inspiration from scholarship that critiques the term *Anthropocene*. We avoid using the term because of its unwillingness to 'stay with the trouble'. See Donna Haraway, *Staying With the Trouble: Making Kin in the Chthulucene*, Durham & London: Duke University Press, 2016; Kathryn Yusoff, 'Anthropogenesis: Origins and Endings in the Anthropocene', *Theory, Culture, & Society* 33, 2016, pp 3–28; Heather Davis and Zoe Todd, 'On the Importance of a Date; Or Decolonizing the Anthropocene', *ACME: An International Journal for Critical Geographies* 16(4), 2017, pp 761–780.
2. Cymene Howe, *Ecologics: Wind and Power in the Anthropocene*, Durham & London: Duke University Press, 2019, p 2.

3. For more on cheap labour and cheap energy see: Raj Patel and Jason Moore, *A History of the World in Seven Cheap Things: A Guide to Capitalism, Nature, and the Future of the Planet*, London: Verso Books, 2018.

4. Ash Amin, 'On Urban Failure', *Social Research: An International Quarterly* 83(3), 2016, p 779.

5. Max Liboiron, Manuel Tironi and Nerea Calvillo, 'Toxic Politics: Acting in a Permanently Polluted World', *Social Studies of Science* 48(3), 2018, p 341.

6. Throughout this article we employ the parenthesised 'post' in (post)colonial to emphasise the enduring affects and materiality's of the colonisation process that continue today despite the fact that India gained independence in 1947.

7. It is important to recognise the often slow and invisible violence associated with fast infrastructures. See Rob Nixon, *Slow Violence and the Environmentalism of the Poor*, Cambridge: Harvard University Press, 2011; and Thom Davies, 'Toxic Space and Time: Slow Violence, Necropolitics, and Petrochemical Pollution', *Annals of the American Associations of Geographers* 108(6), 2018, pp 1537–1553.

8. Brian Larkin, 'The Politics and Poetics of Infrastructure', *Annual Review of Anthropology* 42, 2013, p 328.

9. In *Lines of a Nation: Indian Railway Workers, Bureaucracy, and the Intimate Historical Self* (New York: Columbia University Press, 2007) Laura Bear argues that developments such as the Indian railways were not infrastructures but rather 'public works for the material and moral progress of the subject nation'. As we later argue in this discussion, these projects live on as infrastructure through the ways they (dis)connect human and more-than-human life in (post)colonial India. For more on the Paris sewers see Matthew Gandy, 'The Paris Sewers and the Rationalization of Urban Space', *Transactions of the Institute of British Geographers* 24(1), 1999, pp 23–44; for more on the Panama Canal see Ashley Carse, *Beyond the Big Ditch: Politics, Ecology, and Infrastructure at the Panama Canal*, Cambridge: MIT Press, 2014.

10. Ashley Carse and David Kneas, 'Unbuilt and Unfinished: The Temporalities of Infrastructure', *Environmental and Society: Advances in Research* 10, 2019, p 12.

11. Larkin, 'Politics and Poetics of Infrastructure', p 337.

12. Robin Jeffrey, *Politics, Women, and Well-being: How Kerala became a 'Model'*, Basingstoke: Palgrave Macmillan, 1992.

13. Elizabeth Shove, *Comfort, Cleanliness and Convenience: The Social Organisation of Normality*, Oxford: Berg, 2003.

14. Shove, *Comfort, Cleanliness and Convenience*.

15. Megan Warin, Bridget Jay and Tanjya Zivokvic, '"Ready-made" Assumptions: Situating Convenience as Care in the Australian Obesity Debate', *Food and Foodways* 27(4), 2019, pp 1–2.

16. Warin, Jay and Zivokvic, '"Ready-made" Assumptions', pp 1–2.

17. Soumhya Venkatesan, Laura Bear, Penny Harvey, Sian Lazar, Laura Rival and AbdouMaliq Simone, 'Attention to Infrastructure Offers a Welcome Reconfiguration of Anthropological Approaches to the Political', *Critique of Anthropology* 38(1), 2018, pp 3–52.

18. Carse, *Beyond the Big Ditch*, p 204.

19. Akhil Gupta, 'The Future in Ruins: Thoughts on the Temporality of Infrastructure', in *The Promise of Infrastructure*, Durham & London: Duke University Press, 2018, p 62.

20. Ara Wilson, 'The Infrastructure of Intimacy', *Signs: Journal of Women in Culture and Society* 41(2), 2016, pp 247–280.

21. Wilson, 'Infrastructure of Intimacy', p 272.

22. Laura Bear, *Lines of a Nation*, p 1.

23. Howe, *Ecologics*, p 6.

24. Jamie Cross, 'The Economy of Anticipation: Hope, Infrastructure, and Economic Zones in South India', *Contemporary Studies of South Asia, Africa, and the Middle East* 35(3), 2015, pp 424–437.

25. See also Achille Mbembe, *On the Postcolony*, Berkeley: University of California Press, 2001.

26. Hannah Appel, 'Infrastructural Time', in *The Promise of Infrastructure*, Durham & London: Duke University Press, 2018, p 59.

27. Shannon Mattern, 'Maintenance and Care', *Places Journal*, November 2018. Available at: https://doi.org/10.22269/181120 (accessed 8 March 2020).
28. Eve Tuck, 'Suspending Damage: A letter to Communities', *Harvard Educational Review* 79 (3), 2019, pp 409–427.
29. Liboiron, Tironi and Calvillo, 'Toxic Politics', p 42.
30. Ashish Nandy, 'Time Travel to a Possible Self: Searching for the Alternative Cosmopolitanism of Cochin', *Japanese Journal of Political Science* 1(2), 2000, p 299.
31. Manili Desai, 'Indirect British Rule, State Formation, and Welfarism in Kerala, India, 1860-1957', *Social Science History* 29(3) (2005): 457–488.
32. Manu Pillai, *The Ivory Throne: Chronicles in the House of Travancore*, Noida: Harper Collins, 2015, pp 227–228.
33. Pillai, *Ivory Throne*, p 228.
34. Penny Harvey and Hannah Knox, 'The Enchantments of Infrastructure', *Mobilities* 7(4), 2012, pp 512–536.
35. To be clear, these developments were largely orchestrated to fulfil the growing desire for tea back in Britain, but they also provided opportunities for the Indian elite to begin redistributing wealth into education and welfare programs.
36. Pillai, *Ivory Throne*, p 8.
37. Carse, *Beyond the Big Ditch*, p 52.
38. Desai, 'Indirect British Rule', p 480.
39. Desai, 'Indirect British Rule', p 480.
40. Carse, *Beyond the Big Ditch*, p 220.
41. Nicholas Kawa, *Amazonia in the Anthropocene: People, Soils, Plants, Forests*, Austin: University of Texas Press, 2016.
42. Assa Doron and Robin Jeffrey, *Waste of a Nation: Garbage and Growth in India*, Cambridge & London: Harvard University Press, 2018.
43. One of the key lessons from the concept of the Anthropocene is that there is no such thing as *away*: the landfill on the outskirts of town continues to alter life on Earth in small yet significant ways. See Timothy Morton, *Dark Ecology: For a Logic of Future Coexistence*, New York: Columbia University Press, 2016, pp 46, 125.
44. This is at least true of municipal solid waste, including plastics and other hard wastes, as well as organics such as food and paper. There are overlapping and divergent tactics for other wastes such as sewage.
45. Doron and Jeffrey, *Waste of a Nation*, p 43.
46. Prathiba Ganesan, 'Landfill Sites, Solid Waste Management and People's Resistance: A Study of Two Municipal Corporations in Kerala', *International Journal of Environmental Studies* 74 (6), 2017, pp 958–978.
47. For more on the transition to waste-to-energy infrastructure in India and beyond see Chloe Ahmann, 'Waste-to-Energy: Garbage Prospects and Subjunctive Politics in Late Industrial Baltimore', *American Ethnologist* 46(3), 2019, pp 328–342; Ingrid Behrsin, 'Rendering Renewable: Technoscience and the Political Economy of Waste-to-Energy Regulation in the European Union', *Annals of the American Association of Geographers* 109(5), 2019, pp 1–17; Federico Demaria and Seth Schindler, 'Contesting Urban Metabolism: Struggles Over Waste-to-Energy in Delhi, India', *Antipode* 4(2), 2016, pp 293–313; and Aman Luthra, 'Waste-to-Energy and Recycling: Competing Systems of Waste Management in Urban India', *Economic & Political Weekly* 52(13), 2017, pp 51–58.
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56. Timothy Morton, *Humankind: Solidarity with Nonhuman People*, London: Verso, 2019, p 25.
57. Nikhil Anand, 'Pressure: The PoliTechnics of Water Supply in Mumbai', *Cultural Anthropology* 26(4), 2011, pp 542–564.
58. Shove, *Comfort, Cleanliness and Convenience*, p 171.
59. Nikhil Anand, *Hydraulic Citizenship: Water and the Infrastructures of Citizenship in Mumbai*, Durham & London: Duke University Press, 2017, p 47; Georgina Drew, *River Dialgoues: Hindu Faith and the Political Ecology of Dams on the Sacred Ganga*, Tuscon: University of Arizona Press.
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Acknowledgements

Disclosure statement

Funding

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