INTERNATIONAL JOURNAL OF URBAN AND REGIONAL RESEARCH
DOI:10.1111/1468-2427.13363

– SAND, PLANTATION URBANISM AND THE EXTENDED POLITICAL ECOLOGY OF INFRASTRUCTURES IN INDIA

SIDDHARTH MENON

Abstract

Recently, large parts of India and the global South have witnessed widespread sand extraction from rural sites for urban infrastructure projects, causing extensive environmental damage. Critical scholarship has theorized these sites as new extractive frontiers that facilitate the needs of green energy transitions and planetary urbanization. In this article, I offer a postcolonial decentering of this narrative by examining the commodity chain of 'm-sand' or manufactured sand, which binds urban infrastructures in Kochi city in Kerala, India to sand extraction sites in the rural Western Ghat mountain ecologies of southwest India. I argue that sand extraction sites are better analyzed through the lens of 'plantation urbanism', a concept that accounts for the failure of colonial-era Western Ghat plantation economies in the free-market era and their ensuing conversion to sand extraction sites. Plantation urbanism also foregrounds how colonial plantation logics shape the production of urban space in Kochi via sand's commodity chain.

Introduction

It was an overcast morning in June 2022. Moisture-laden clouds were meandering across the Arabian Sea towards the coastal state of Kerala in south India, signaling the arrival of the annual monsoons. I was at the construction site of a 17-storey condominium. The building was being constructed by a private real-estate developer to house the city's middle-class and elite residents. But construction work was progressing slowly due to a city-wide shortage of sand, a key ingredient for concrete construction. Site manager Satheesh informed me that more than two weeks had passed since he had run out. With his outstretched finger he pointed to two conical mounds of gray granules lying in a corner saying, 'This is my last batch of *mannal* (sand)'.

The ubiquity of sand for infrastructure projects is not unique to Kochi or Kerala—neither is its scarcity. Over the last few decades, cities across India and the global South have witnessed the widespread construction of urban infrastructures, including roads, flyovers, malls and condominiums (Menon, 2023). These infrastructures are built with concrete—the de facto 'materiality of urbanization' (Abourahme, 2015: 213)—and require around 50 billion tons of sand per year or 18 kilograms of sand per person per day (UNEP, 2019). This means that sand extraction accounts for 85% of all

This article has benefited from generative discussions at the Sawyer Seminar on 'Interrogating the Plantationocene' at UW-Madison in April 2019, the eighth Annual PhD Workshop at IIHS in Bangalore in January 2022, the AIIS Junior Fellows Annual Conference in New Delhi in December 2022, a seminar at the Center for Development Studies in Kerala in April 2023, the 'Material as method' symposium at the 51st Annual Conference on South Asia in Madison in October 2023, and an invited lecture at NYU Shanghai in December 2024. I would like to thank all the participants at these discussions for sharing ideas that have strengthened the article. I am grateful to Jagdish Krishnaswamy, Chandni Singh, Radhika Govindrajan, Sumathi Ramaswamy, J. Devika, Anamika Ajay, Sajai Jose, Curt Gambetta, Ateya Khorakiwala, Dwight Carey, Thomas Oommen, Rachel Sturman, Asha Surma, Yifei Li, M. Yunus Rafiq, Sangeeta Banerji, Travis Klingberg and Kanging Huang for their suggestions for improving the article—particularly to Matt Turner and Stephen Young for their comments on the final draft. Lastly, I would like to thank Lisa Weinstein, Mel Goodsell, Stephen Curtis and two anonymous IJURR reviewers for their academic labor in getting this article published. The fieldwork was funded by an IJURR Foundation Studentship, a US NSF DDRI Award (#2113938), an AIIS Junior Fellowship, and has benefitted from an academic affiliation with the Center for Development Studies in Thiruvananthapuram, India from 2022 to 2023.

mining activity on earth, making it the *world's most extracted natural resource* after water (*ibid*). Global demand for sand, dredged primarily from freshwater riverbeds, floodplains and riverbanks, is causing environmental issues in several countries of the global South, including Ghana (Dawson, 2021), Indonesia (Miller, 2022), Cambodia (Lamb *et al*., 2019), Myanmar (Lamb and Fung, 2022) and India (Jeyaranjan, 2019), prompting scholars to pay more attention to its 'granular geographies' (Jamieson, 2021).

In India some state governments have responded to environmental degradation caused by river sand dredging by promoting the use of 'm-sand' or manufactured sand, as a more environment-friendly alternative (Srivastava, 2023). M-sand refers to sand-like granules that are made by mechanically crushing mountain rocks into fine granules, thereby eliminating the need for river dredging and its associated environmental destruction. However, not much is known about how m-sand is produced, who the actors involved in its production are and the socio-spatial implications of its increasing use in infrastructure construction.

To study m-sand's spatial economy, I deploy a 'follow the thing' (Cook, 2004; Choplin, 2023) methodology to track granules of m-sand from infrastructure construction sites in Kochi city, Kerala back to stone quarries in remote rural regions of the Western Ghat mountains in southwest India. Recent scholarship has highlighted how new dispersed 'extractive frontiers' are produced by the material demands of green energy transitions (Andreucci *et al*., 2023; Bruna, 2023) and planetary urbanization (Barua, 2024b; Bathla, 2024). This framing has received pushback from scholars who emphasize the mutual constitution of rural and urban regions (Gillen *et al*., 2022; Wang *et al*., 2023). In this article, I extend these debates by arguing that m-sand's extended commodity chain not only mediates rural–urban interdependencies but also indicates the workings of 'plantation urbanism' (Poe and Bellamy, 2020). I do this by showing how m-sand extraction sites in the Western Ghats are deeply entwined with plantation logics that unevenly incorporated this region into the colonial world system in the nineteenth century. I further argue that these colonial plantation logics do not remain restricted to rural Western Ghat regions but extend to Kochi city and shape the uneven production of its urban space through m-sand's commodity chain.

This article is divided into six sections. In the next, I situate my research in relation to debates about rural–urban entanglements within global urban studies and urban political ecology. In the third section I discuss how the Western Ghats mountains of southwest India were incorporated into the colonial world economy through the establishment of export-oriented plantations in the nineteenth century. In the fourth, I draw on ethnographic data to illustrate how rural plantation owners are converting plantations to sand extractions sites due to the failure of colonial plantation economies in the contemporary free-market era and thus reproducing colonial plantation logics in the m-sand economy. In the penultimate section, I reveal how these plantation logics do not remain restricted to rural extraction sites but extend to and shape the uneven development of Kochi's built environment through m-sand's[1] supply chain. In conclusion, I reflect on the implications of studying rural–urban entanglements by using a materiality-infused lens and what it tells us about new patterns of urban transformation and green extractivism in the global South.

Plantation urbanism and the extended political ecology of infrastructures

Since the late twentieth century, an increasing number of scholars in the humanities and social sciences have tried to highlight the complexity of rural–urban interactions by moving beyond simple binaries (see Williams, 1973; Cronon, 1992; Harvey, 1996; Swyngedouw, 1996). Critical urban scholars have renewed this effort in

1 Henceforth, I shall use the words 'sand' and 'm-sand' interchangeably to refer to manufactured sand from stone quarries. I use 'river sand' when referring to sand dredged from rivers.

recent years by mobilizing Lefebvre's ([1970] 2003) concept of 'planetary urbanization' to examine cities not as spatially bounded units, but as specific morphological forms along the extended geographies of global capitalist urbanization that lie somewhere along the rural–urban spectrum (Brenner, 2019; Schmid and Topalovic, 2023). Urban political ecologists have deployed this framework, along with its foundational emphasis on urban metabolisms and circulations, to show how the extended trails of contemporary urbanization create extractive resource frontiers in distant non-urban spaces (Arboleda, 2016; Fenton, 2021). In doing so, they have used new vocabulary to account for the extended spatialities of contemporary urbanization, including 'political ecology of urbanization' (Angelo and Wachsmuth, 2015: 23), 'more-than-urban political ecology' (Tzaninis *et al*., 2020: 4), 'spatialized political ecology' (Keil, 2020), 'landscape political ecology' (Connolly, 2019), 'megapolitan political ecology' (Gustafson *et al*., 2014) and 'exurban political ecology' (McKinnon *et al*., 2019).

While this work has been useful in further unsettling rural–urban binaries, it has come under criticism for its tendency to read all socio-spatial phenomena as signs of urbanization, that is, 'methodological urbanization' (Jazeel, 2018: 407). Some critics have argued that it reproduces colonial logics of developmentalism and modernization that viewed rural regions of the global South as backward and non-agential (Roy, 2016; Ghosh and Meer, 2021). Others have contended that this urban-centric gaze privileges socio-spatial phenomena emanating outwards from city centers while completely eclipsing processes of agrarian transformation, rural land regimes, and land-use change that deserve analytical attention on their own accord (He and Zhang, 2022; Wang *et al*., 2023). For these scholars, cities are also experiencing processes of 'reverse ruralisation' (Walker, 2015: 188). In other words, the rural is not an empty spatial container waiting to be unidirectionally transformed by the marauding forces of global capitalism and planetary urbanization. Instead, rural spaces have agency and dynamism and coproduce the urban in multiple ways (Krause, 2013; Mishra, 2020).

Scholars have highlighted the complex relationalities between rural and urban spaces in several global South contexts. Mercer (2024) has shown how suburban houses in Dar es Salaam, Tanzania are oriented towards the rural countryside rather than the city center because house-building practices are shaped by pastoral social, cultural, and legal practices that have produced 'landscapes of extended ruralisation'. For Ortega (2020), suburban transformations at the fringes of Metro Manila, Philippines are better understood through the lens of 'desakota 2.0' rather than planetary urbanization, because the former situates rural–urban fringes in the global South as sites of dynamism, learning and theorization, thus disrupting the totalizing narrative of the latter. Similarly, Gururani (2020) has demonstrated how new housing projects in Gurgaon, India are embodiments of 'agrarian urbanism', in which the relationship between caste hierarchy and land ownership, traditionally associated with the village, is reworked and restructured rather than being completely erased in the city. These case studies highlight how agrarian economies, governance and land tenure structures, rural forms of sociality and cultural practices are also driving the transformation of cities and their peripheries.

In this article, I contribute to these debates by incorporating a methodological focus on the mundane materiality of cities and their infrastructures. I draw theoretical inspiration from science and technology studies and the material turn in the social sciences to argue that a materiality-infused approach provides a more empirically grounded, coarse and 'gritty' (Kirsch, 2013: 434) understanding of rural–urban entanglements as compared to an emphasis on social, economic and aesthetic concerns as outlined by the above scholars. The infrastructural materiality I examine in this article is sand. I deploy a 'follow the thing' (Cook, 2004; Choplin, 2023) methodology to trace the translocal networks through which sand travels during its extraction, distribution, and consumption for urban infrastructure projects in Kochi. Much like Hecht (2018), I use sand as an 'interscalar vehicle' to follow its journey from rural stone quarries and

sand production plants in the Western Ghat mountains to sand distribution yards and intermediary suppliers in Kochi's peripheries, and finally to infrastructure construction sites in Kochi city. I also draw on Hutton's (2019) concept of 'reciprocal landscapes', to show how the production of urban infrastructures in one place (Kochi) is predicated on the transformation of a landscape elsewhere (Western Ghats). A 'follow the thing' methodology to trace the intimate ties between these two places not only dismantles rural–urban binaries, but also indicates the workings of 'plantation urbanism' (Poe and Bellamy, 2020).

Recent scholarship at the intersection of human geography, cultural anthropology and critical race studies has foregrounded how colonial plantation logics are 'no longer confined exclusively to the agricultural enclave' (Paredes *et al*., 2024) but are found in everyday spaces we think of as modern (Tsing, 2012). As McKittrick (2013: 3) notes, 'in agriculture, banking, and mining, in trade and tourism, and across other colonial and postcolonial spaces—the prison, the city, the resort—a plantation logic characteristic of (but not identical to) slavery emerges in the present both ideologically and materially'. Similar plantation logics can be observed in the Western Ghat mountains. The emergence of sand extraction sites in this region are deeply tied to the failure of colonial plantations economies, that unevenly incorporated this region into the colonial world system in the nineteenth century, in the contemporary free-market era. In this article I argue that the sand economy is the reproduction of a plantation economy with its own distinct plantation logic, that relies on the extraction of surplus value from both mountain ecologies and differentiated lower-caste labor. I further show that these plantation logics do not remain spatially restricted to rural sites of sand extraction in the Western Ghats but extend to Kochi city via sand's commodity chain and shape the uneven production of its urban space, hence my use of the term plantation urbanism.

Plantation urbanism is a useful concept to frame my findings because it enables a clearer understanding of how Kochi's urban transformation is being facilitated by rural plantation logics. Importantly, it brings together two spatially disconnected sites: the 'plantation', typically associated with surplus value extraction from rural ecologies or 'factories in the fields' (McWilliams, 2000), and 'urbanism' which denotes a 'distinct kind of site (the city), separable from other (rural) places' (Sheppard *et al*., 2013: 893). By doing so, it holds the rural and urban in tension together, highlighting how urban and peri-urban transformations are produced not only by unidirectional urban-driven processes but also by reverse rural-driven processes, like colonial dispossession, plantation failures, post-colonial land use change, caste and ethno-religion-based landownership patterns and subaltern livelihood struggles.

Second, plantation urbanism foregrounds how the exploitation of lower-caste workers and the hierarchical relations of production witnessed in colonial-era plantations are restructured and reworked in contemporary sand and construction economies in Kochi. As Poe and Bellamy (2020: 143) foreground, the 'legacy of plantation regimes reproduces a particular social management system that reinvents itself through economic diversification in real estate, planning, policing and surveillance'. While Poe and Bellamy's use of the concept is tied to racial capitalism and settler-colonialism due to its geohistorical setting in the US south, my use of plantation urbanism highlights how other kinds of social difference, like caste, indigeneity and ethno-religion, are implicated in the reproduction of plantation logics in global South urbanization processes. Scholars have highlighted the problems of blindly applying theoretical frameworks developed in global North contexts to global South cases (Ghertner, 2014). While I acknowledge these concerns, my use of 'plantation urbanism' is inspired by Roy's (2009) provocation to use mid-level theories as 'conceptual vectors' that travel across different geohistorical contexts but are reconstructed by the situated particularities of specific places and regions.

Lastly, plantation urbanism orients our attention to the root causes of large-scale environmental destruction during our current climate crisis. Plantation scholars

have noted how the colonial establishment of plantations around the world altered indigenous landscapes into monocrop export-oriented plantation ecologies that maximized the extraction of value from ecology. As Barua (2024a: 14) argues, through such plantation legacies the 'colonial past continues to operate as a duration, combining with the present in novel ways and bursting through to create fraught combinations and arrangements'. Some of these 'fraught combinations and arrangements' include global environmental issues, like human–animal conflict, extreme weather events, biodiversity loss, water scarcity, soil fertility loss, desertification, toxic environments and illicit criminal political economies (Besky, 2013; Li and Semedi, 2021). Similar processes can be observed in Kochi's urban transformation, where the conversion of colonial Western Ghat plantation landscapes into sand extraction sites for infrastructure construction in Kochi is creating new rounds of environmental destruction and ecological vulnerabilities in the Anthropocene, which have been implicated in exacerbating extreme climate events, like recurring floods and deadly landslides in Kerala. However, as Ferdinand and Davis (2022: 3) argue, an analysis of these new rounds of environmental destruction must contend with the 'double fracture' of modernity, by tracing the root causes of contemporary environmental degradation to the colonial history of forest enclosure and the violent creation of plantations. The use of plantation urbanism addresses this 'double fracture' by decentering 'green extractivism' away from mechanisms of contemporary global capitalism and planetary urbanization towards a postcolonial understanding of extractive frontiers that account for the encounter of the Western Ghats with colonial plantation capitalism. Before illustrating my argument, I first discuss how colonial plantation economies were established in the Western Ghats in the nineteenth century.

Plantations in Kerala's Western Ghats

Traditionally, all buildings in Kerala and India were built with locally sourced materials like mud, laterite, stone and wood (Menon, 2025a). The British first introduced concrete in India in the late nineteenth century but it was only used to construct large buildings and infrastructures for the colonial and post-colonial state (Tappin, 2002). This changed in the 1970–80s during the 'Gulf boom' when there was a mass migration of workers from Kerala to Arabian Gulf countries to partake in the oil economy (Wright, 2021). The backflow of remittances from these workers saw the emergence of the state's first 'Gulf houses': large palatial houses built with concrete, which needed sand (Gopikuttan, 1990). If cement is the binder that holds concrete together, sand is the skeleton that defines its form, shape and physicality. Sand is found in riverbeds, coastlines and deserts. However, the smooth edges of desert sand give poor bonding with cement, making its use unsuitable. The salinity of coastal sand induces cracking in concrete making it also unsuitable. In short, concrete needs river sand for its structural integrity.

Initially, this was not a problem in Kerala because 44 freshwater rivers crisscross the state. One could find a *kadavu* (riverbank) near most construction sites from where *puzha mannal* (river sand) was dredged by sand contractors. But things changed from the 1990s onwards when India's adoption of neoliberal economic policies triggered a construction boom in Indian cities (Rehman *et al*., 2023). Soon private real estate developers were constructing large infrastructures, like luxury condominiums, shopping malls, IT parks and hotels for elite consumption in cities like Kochi, Kerala's largest city with around 3.5 million inhabitants (Cushman & Wakefield and the Confederation of Real Estate Developers' Associations of India (CREDAI), 2023). This infrastructure boom accelerated river sand dredging and caused widespread environmental issues, like depleting ground water tables, the intrusion of salinity into freshwater sources, the destruction of riverine flora and fauna ecosystems, changing river flow patterns, fisherfolk livelihood concerns, dam regulation issues and persistent flooding. In response to large-scale grassroot environmental protests, the Kerala government introduced new

regulations in 2001 which curtailed river sand dredging, triggering a sand scarcity that hit the state's economy. To tide over this scarcity, in 2004 Kerala became India's first state to actively promote the production of *paazha mannal* (m-sand) as an environment-friendly alternative to river sand (Bhoopathy and Subramanian, 2022). Since then, other state governments, like Rajasthan, Uttar Pradesh and Tamil Nadu, have announced similar policies promoting the use of environment-friendly m-sand (Srivastava, 2023).

Today, most infrastructures in Kerala are built with m-sand extracted from the Western Ghats (also called Sahyadri), a mountain range that runs parallel to India's west coast traversing more than 1,000 miles across six states (Menon, 2025b). However, almost 40% of the mountains lie in Kerala, thus covering over half of the state's landmass. They serve as a key watershed region for the State's 44 rivers, supporting agriculture, irrigation, fisheries, industrial production and electricity generation (Gadgil, 2011). Spices like pepper, cloves and cardamom are native to these mountains and have been historically foraged by the Ghats' *Adivasi* or indigenous inhabitants, like the Kadar, Paliyan, Karumba, Hill Pandaram, Nayadi, Kannikar, Muthuvan and Urali Ulladan communities (Morrison, 2002). These foraged products were traded with coastal merchants who then shipped them from ancient port cities, like Muziris (near present-day Kochi), to Graeco-Roman towns along the Mediterranean coast. In this way, the Western Ghats have formed the bedrock of the Indian Ocean spice route for thousands of years.

Due to Kerala's centrality to Indian Ocean trade networks, it has experienced religious and cultural influences from around the world. These influences have given the state a heterogenous demographic profile which is unlike the rest of India: the state's 34 million inhabitants comprise Hindus (54.90%), Muslims (26.60%), Christians (18.40%), Scheduled Caste/SC groups (9.10%), and Scheduled Tribe/ST groups (1.45%) (Chandramouli, 2011). Since ancient times, the Kingdom of Travancore, much like the other two Malayalam-speaking[2] regions that formed the modern state of Kerala in 1956, has been governed by the caste system where the highest Hindu caste group, Namboodiri Brahmins, controlled access to religious knowledge while Nairs, just below them in the social hierarchy, controlled administration, revenue collection, and agricultural production for different principalities (Sakthidharan, 2019). These upper-caste groups used SC communities, like Pulayas, Parayas, Velars and Kuravas, as agrestic slaves until slavery was officially abolished in the mid-nineteenth century (Saradamoni, 1980). Other lower-caste groups, like Ezhavas, Shanars, Nadars and Thiyyas, worked as indentured laborers and tenant farmers for upper-caste landlords (Namboodiripad, 2010). Travancore's Christians were divided into Syrian and Latin Christian groups. Syrian Christians, said to be the descendants of Thomas the Apostle, were influential merchants and entrepreneurs, considered on a par with upper-caste Nairs in the social hierarchy. Latin Christians consisted of later low-caste Hindu converts from agricultural and fishing communities and were thus considered lower in the social hierarchy. Mappila Muslims were also low-caste Hindu converts from small-scale trading communities, thus occupying a similar marginalized social position to lower-caste Latin Christians (Chandramohan, 2016).

This complex social milieu was transformed in the mid-nineteenth century when plantations were established in Travancore when it became a vassal state of the British Empire. British planters cleared forests in the Western Ghats regions of Travancore to grow commodity crops, like tea, coffee, rubber and cardamom, for the colonial export economy which brought substantial foreign exchange earnings for plantation owners (Suresh and Suchitra, 2021). For example, the British brought natural rubber saplings from the Brazilian Amazon for Western Ghat plantations because rubber was an extremely profitable global commodity through the nineteenth and twentieth

2 Malayalam, Kerala's official State language, is one of 11 classical languages officially recognized by India.

centuries (Tully, 2011). Since slavery had been abolished in the mid-nineteenth century, landless SC, ST and lower-caste communities were absorbed as indentured and low-waged workers on labor-intensive plantations (Raj, 2022). In this way nineteenth-century British planters transformed the Western Ghats landscape from diverse tropical forests to large-scale monocrop plantations for the colonial export economy. Furthermore, the injection of British capital into Western Ghat plantations also offered lower-caste communities a partial escape from feudal caste-based hierarchies of the region, as many were employed as low-waged laborers in the new plantation economy (Chandramohan, 2016).

Things changed again in the 1940s when the Syrian Christian community took over control of the Western Ghats plantation economy from British planters (Rammohan, 2008). While Travancore's economy boomed in the early twentieth century due to plantation exports, it became increasingly dependent on imported Burmese rice for daily subsistence. When Japan invaded Burma in 1942, Travancore lost its key source of rice triggering a devastating famine that claimed more than 90,000 lives (Balasubramanian, 2023). In response, the state promoted settlement schemes which granted ownership rights to farmers who could grow food crops in the Ghats. This policy triggered a mass migration of Syrian Christian families from coastal areas of Travancore to the mid and high ranges of the Ghats to cultivate rice, tapioca and coconut. When the food shortage was overcome, food crop farms were converted to commodity crop plantations which continued to be a lucrative industry. Thus, while the injection of British capital into Western Ghat plantations in the mid-nineteenth century had provided a temporary escape from caste-based occupations for lower-caste communities, mid-twentieth-century changes saw these communities again working as indentured and low-wage laborers on upper-caste Syrian Christian plantations, reproducing the feudal caste hierarchy (Nair and Moolakkattu, 2017). In other words, the mid-twentieth-century Western Ghats plantation economy was an amalgamation of both global plantation capitalism that extracted value from ecology and caste-based agrarian feudalism that extracted value from differentiated lower-caste labor, thus representing the complexities of post-colonial economies (Sanyal, 2007; Gidwani and Wainwright, 2014).

The condition of Kerala's oppressed agricultural and plantation laborers improved, to some extent, in the 1970s when the post-colonial Kerala government implemented land reforms by setting a 15-acre-per-person land ceiling. Surplus land was taken by the state and distributed to landless lower-caste communities. However, plantations were exempted from the Act because of their economic importance to the State. For example, in the post-second world war era of import substitution industrialization and trade protectionism, India was one of the world's largest rubber producers (Tharian George and Sethuraj, 1996). Since Kerala accounted for more than 80% of India's rubber output, it brought significant revenue to the State economy. This exemption allowed upper-caste Syrian Christian plantation owners to continue accumulating wealth and power by extracting surplus value from the alpine ecology and the labor of poorly paid lower-caste workers (Koothanady, 2020).

Further changes occurred in the 1990s when India's adoption of neoliberal economic policies severely hit the plantation sector by exposing it to global competition. For instance, India's entry into the World Trade Organization in 1995 saw an initial increase in domestic rubber prices, but soon major Indian rubber consumers were importing cheaper rubber from southeast Asia precipitating a fall in domestic rubber prices (Sajitha, 2023). India's signing of the ASEAN-India Trade in Goods Agreement in 2009 triggered another dip in rubber prices. The vagaries of global markets, along with rising input costs and recurring extreme weather events, have made plantation cultivation untenable for most Western Ghat planters (Suchitra, 2015). In this structural context, plantation owners have been seeking alternative ways of generating value from

their land, which include growing exotic fruits, building luxury resorts, and establishing educational and religious institutions (Suresh and Suchitra, 2021). Importantly, many have begun converting plantation land to stone quarries and m-sand production centers while actively promoting the use of m-sand as a superior alternative to river sand for infrastructure construction. Research participants told me that some quarry owners had also financially supported environmental protests against river sand mining, thus accelerating the construction sector's shift to m-sand.

To understand how the conversion of plantation land to m-sand extraction sites occurs and its socio-spatial implications, I conducted two years of ethnographic fieldwork from 2021 to 2023 beginning from Kochi city in Kerala, India. I commenced fieldwork at two building construction sites in Kochi from where I deployed a 'follow the thing' (Cook, 2004) methodology to trace the commodity chain of sand from urban construction sites back to rural stone quarries in the Western Ghats, some more than 100 miles away. Like Choplin (2023), I used the methodology to trace m-sand's extended supply chain and 'tell the story of the different stages, spaces, and actors involved in its production, distribution, and consumption' (*ibid*.: xxxix). This process led me to stone quarries from where rocks are blasted and to sites where rocks are crushed into m-sand granules in remote regions of the Western Ghat mountains, to tipper drivers and intermediary sand vendors based in peri-urban regions who distribute sand across the region and to urban construction sites in Kochi where sand is consumed in infrastructure projects. At these different sites along sand's commodity chain, I observed everyday practices and conducted interviews in Malayalam and English with 41 actors involved in sand's commodification, including quarry owners, sand production managers, intermediary sand suppliers and vendors, tipper drivers, building contractors and construction site managers. While some actors were reluctant to be interviewed, I was able to leverage my caste, class and gender positionality,[3] along with my decade-long construction-sector experience,[4] to develop research relationships with other interlocutors. I discuss data from these observations and interviews in the following two sections.

Plantation logics in the Western Ghats sand economy

One morning in February 2023, I travelled 42 miles southeast of Kochi to Kottayam district in the mid ranges of the Western Ghats, the heartland of India's rubber industry. Quarry owner Thomas[5] met me in the town center[6] and whisked me away to his quarry in a chauffeur-driven electric SUV. After winding through dense rubber plantations for around 20 minutes we arrived at an imposing gate beyond which stood a gigantic wall of gray granite towering 100 feet above us (see Figure 1). Stepped terraces interrupted the sheer verticality of the wall. On the topmost terrace, a team of laborers, wearing orange helmets and fluorescent vests, were busy drilling holes in the rockface in preparation for the day's blasting. Like most quarry owners in the Western Ghats mountains of south-central Kerala, Thomas belonged to the upper-caste Syrian Christian community.[7] I asked him about his foray into the sand business. Dressed in a spotless white *mundu* (wraparound garment worn around the waist) and a matching half-sleeved shirt, the sexagenarian replied with a disarming smile:

3 I am a male researcher from the dominant caste Nair community. All my research participants were male, and many of the quarry owners I interviewed were also from dominant caste communities. This made it slightly easier for me to gain access to them and collect data.
4 I have ten years (2006–16) of architectural training and practice experience in India's construction industry.
5 All names are pseudonyms.
6 I have not revealed town names because they would give away the quarry owners' identities.
7 In the plantation economy of south-central Kerala, the upper-caste Syrian Christian community owns extensive plantation land in the Western Ghats, which they have recently begun converting to stone quarries and sand extraction sites. Other mid-level and subaltern castes, like Ezhavas, Pulayas, Parayas, Latin Christians and Mappila Muslims own no plantation land and thus occupy lower-value positions in the sand economy.

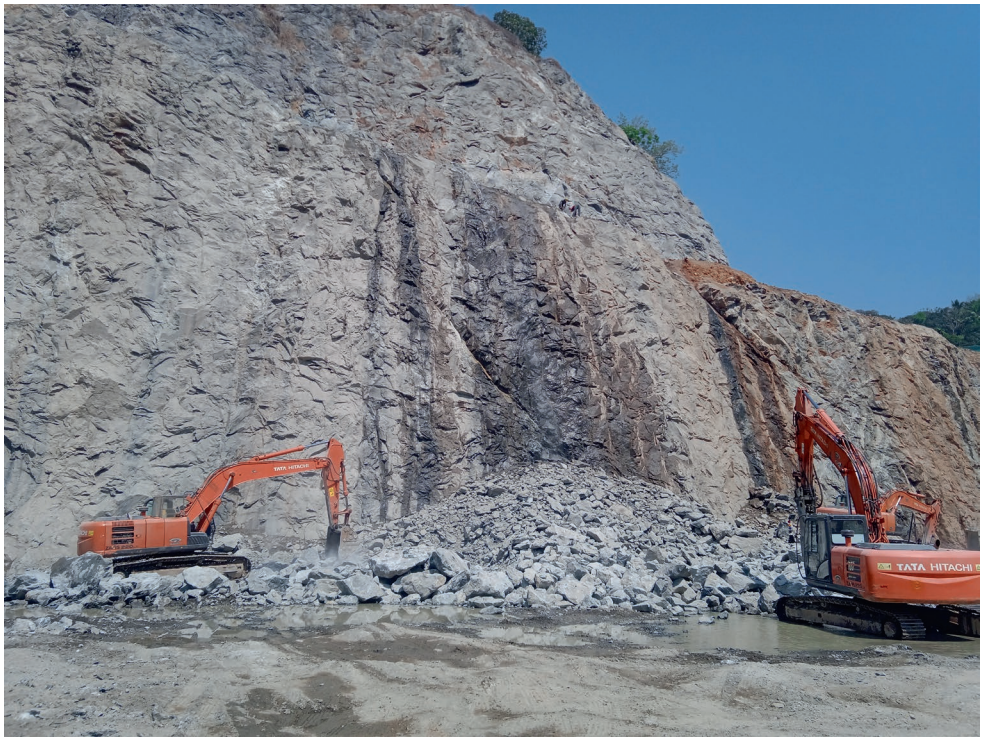

FIGURE 1 Stone quarry in the Western Ghats (photo by the author, February 2023)

> All this is my family land. It was a rubber plantation earlier. Then in 1992, I started a concrete block manufacturing facility because rubber was giving poor returns. That's when I realized I could make sand for concrete right here from the rocks on my plantation land. I then started a stone quarry and sand production unit. I have made more money selling sand than I would have ever made cultivating rubber (Thomas, quarry owner, interviewed February 2023).

Thomas's response reveals why plantation owners are converting their plantations into stone quarries. While rubber cultivation was not giving good returns, the layer of bedrock three feet below the ground on which rubber trees were growing held immense value as an untapped source of rocks for sand production. Naturally occurring granite and basalt outcrops found in the Western Ghats are made from prehistoric geological processes (Viju, 2019). Due to the extensive manual labor involved in quarrying, breaking and transporting rocks, historically they have only been used for building iconic architecture in Kerala, like temples, palaces and forts. However today, m-sand is used for almost all construction projects because it is produced by mechanized crushing processes which pulverize ancient mountains rocks into fine granules within hours.

Thomas proceeded to explain the production process. First, land is cleared of rubber trees and topsoil using excavators to reveal the rock substratum. Then, rockfaces are drilled and blasted with non-electric detonators and ammonium nitrate to form an open-pit quarry. From here, large boulders are blasted and transported via tipper trucks to the primary crusher unit, usually located in a nearby building, where they are crushed into smaller rocks. These rocks are then carried to the secondary crusher via a conveyor belt where they are broken again into even smaller aggregates which are sorted and

FIGURE 2 Crusher producing m-sand (photo by the author, March 2023)

stored in large silos. Around 30% of all aggregates are transferred via a final conveyor belt to the sanding plant to make m-sand and p-sand,[8] measuring 0-4.75 mm and 0-2.36 mm respectively, which are graded, washed and sold to construction sector actors (see Figure 2). Thus, while plantation products had been giving dwindling returns in the free-market era, sand extracted from the same ecology has become profitable. These circumstances encouraged Thomas to convert his rubber plantation to a stone quarry.

Similar experiences of plantation failure were recounted by Ranjit, a 43-year-old Syrian Christian quarry owner from the Cardamom Hills regions of Idukki district, around 90 miles east of Kochi. Situated in the high ranges of the Western Ghats more than 2,000 feet above sea level, the Cardamom Hills produce more than 90% of India's small cardamom output. However, much like rubber plantations, cardamom plantations started becoming unprofitable around the turn of twenty-first century (Krishna, 2014). As Ranjit explains, it was during this time that his father converted their cardamom plantation to a stone quarry:

> My father began quarrying here sometime in the 2000s because cardamom plantations were not profitable. Today sand is more valuable than gold. There is a lot of money in this business. But a lot of it is also illegal. I don't have all the quarrying permissions, but I have my ways of getting things done. Sometimes locals create issues. But I give them jobs and support their businesses so that they don't create problems for me in the future (Ranjit, quarry owner, interviewed March 2023).

8 P-sand or plastering sand is finer than m-sand and is used only for cement plastering purposes.

Here Ranjit confirms the economic logic that underpinned his father's decision to convert their unprofitable cardamom plantation to a profitable stone quarry. Importantly, Ranjit also reveals that he routinely conducts illegal quarrying activities that require the mobilization of historically accrued caste and class power. While plantations were exempted from the land ceiling regulations of the Kerala Land Reforms Act 1969, the conversion of plantations to non-agricultural purposes, like stone quarries, is considered illegal and would invite proceedings under the Act. These conversions have been legally challenged in recent years, leading to pitched battles between plantation owners and environmentalists (Menon, 2025b). Furthermore, the widespread conversion of plantations to stone quarries has also been implicated in precipitating deadly landslides in Kerala (Viju, 2019). Illegal quarrying activities alter steep alpine ecologies such that they become more prone to mud slips during bouts of extreme rainfall, the frequency of which has been increasing in recent years due to climate change. In fact, between 2015 and 2022, Kerala witnessed more than 1,000 landslides, the highest anywhere in India. Most landslides occurred within a 10 km radius of stone quarries (Shaji, 2022). Multiple high-profile environmental protection committees have mooted stricter policies for regulating unfettered quarrying activities in the Ghats. Yet, widespread illegal quarrying continues unabated under the aegis of the powerful 'sand mafia' (John, 2016).

This is because the quarry sector is a huge cash cow for the state as it contributes more than Rs.5,000 crores (USD 600 million) to its exchequer through taxes, license fees and royalties (Kumar, 2023). For example, Kerala's Revenue Department makes Rs.24/ton (USD 0.30/ton) as royalty, which itself is a paltry sum considering it sells for Rs.1,400-1,600/ton (USD 16–19/ton) in Kochi's construction market. However, a lot more money is lost to illegal quarrying activities because only 750 out of the nearly 6,000 quarries in the state have valid licenses (Sajeev and Alex, 2017). To facilitate illicit operations, quarry owners routinely bribe government officials in village panchayats, the Department of Mining and Geology, Kerala Police, Revenue Department and Road Transport Office. They also make significant cash donations to local political parties during elections to secure their business interests (Thomas, 2022). Some elected representatives even have equity in quarrying companies operated by friends and family members, highlighting a clear conflict of interest. Quarrying activities are also vociferously supported by the Syrio-Malabar Church leadership further confirming the ethno-caste identity of the quarry lobby (Nair and Moolakkattu, 2017). In these ways, upper-caste Syrian Christian plantation owners have been able to convert plantation land to stone quarries and sand production centers by mobilizing their caste and class power to accrue tremendous profits in the new sand economy. As Ranjit noted (see interview above), they have also provided jobs to many locals in this economy. But not everyone has benefitted equally from sand production. For lower-caste communities, who have historically borne the brunt of poorly paid plantation work, the new sand economy has reproduced their exploitation under upper-caste plantation landlords.

This fact was made clear by Suresh, a 41-year-old tipper truck driver from a small town in Ernakulam district, around 25 miles from Kochi. This is another site along m-sand's extended commodity chain. Most mid-level sand vendors and tipper drivers I interviewed operated out of interstitial spaces between Kochi city and the Western Ghats, which allowed them to be mobile and transport sand across the wider city-region (see Figure 3). We met outside his house where his shiny new tipper truck was parked. Suresh belongs to the lower-caste Ezhava community. His father and grandfather had worked on rubber plantations as tappers, but Suresh wasn't interested in following this path because of its overt caste connotations. Instead, he became a tipper driver in the sand economy. Now he spends most days on the road transporting sand from quarries deep in the Western Ghats to construction sites in Kochi. But things have not been smooth. As he explained:

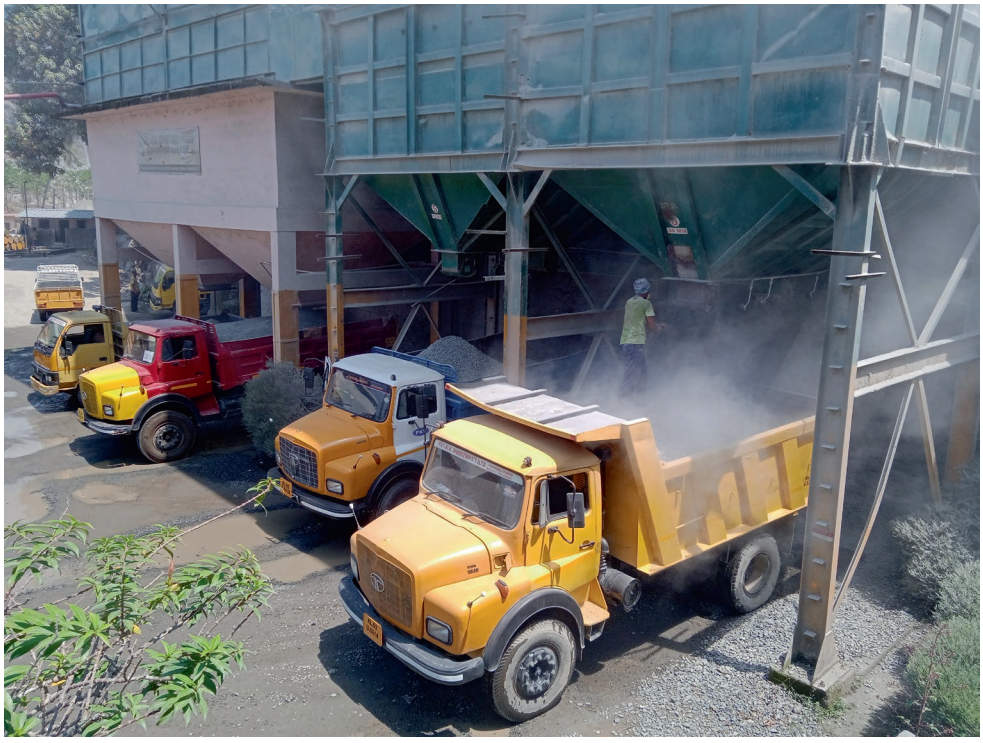

FIGURE 3 Tipper trucks collecting sand from a crusher (photo by the author, February 2023)

> Most illegal quarries are run by upper-caste Syrian Christian families with political links. I don't have those networks. Small-timers like me are most vulnerable to being harassed by the police. Nobody cares to check where I got the illegally quarried sand from. There are huge profits to be made in this industry if you have the right connections and deep pockets to absorb financial setbacks like fines and bribes (Suresh, tipper truck driver interviewed January 2023).

While the twentieth century witnessed a mass youth migration from Kerala's coastal areas to the mid and high ranges of the Western Ghats to work in the booming plantation economy, the twenty-first-century plantation crisis has triggered a 'reverse migration' from the mountains back to coastal cities, like Kochi (Thomas, 2021). Those unable to migrate, many of whom belong to lower-caste communities, are forced to work in the few productive sectors in the Western Ghats, like sand production. Today Kerala's sand economy employs more than four million people (Kumar, 2023). While the production process is mostly mechanized, human labor is still required for precarious drilling and blasting work, performed mainly by circular migrants from north India (Peter and Narendran, 2017). Other mid-level work, like managing north Indian workers, operating heavy machinery and driving tipper trucks, is performed by lower-caste Malayali workers, like Suresh (see Figure 3). However, as Suresh explained, this work not only creates financial burdens but also puts him at the mercy of upper-caste landlords, a situation he was trying to escape in the first place.

To participate in the sand economy, Suresh mortgaged his house and his wife's gold jewelry to buy two tippers. He now earns around Rs.1.50 lakh (USD 1,800) per

month from each tipper by doing daily rounds from rural quarries to urban construction sites. But he also pays the bank a monthly installment of Rs.1.30 lakh (USD 1,500) for each tipper. Within those margins, he pays for diesel and vehicle maintenance. There is not much leftover profit once all expenses have been paid. To tide over financial uncertainties, Suresh borrowed money from an upper-caste quarry owner at exorbitant interest rates. Unable to repay his loan on time, he is now forced to work off his debt by transporting sand only for the quarry owner at subsidized rates. Thus, while Suresh joined the sand economy to escape the caste hierarchies of the plantation economy, he now occupies a similar position in the new dispensation.

Similar experiences were recounted by Naufal, an intermediary sand supplier from the Mappila Muslim community who I met at his sand stockyard on the outskirts of Kochi. Naufal had previously worked as a river sand contractor but had shifted to selling m-sand when Kochi's construction industry changed to the latter. When I asked him about his role in the sand trade, Naufal responded while gently stroking his henna-dyed beard:

> I'm just a supplier. I don't make much profit like quarry owners. My margins are slim. All quarry owners are part of an association which suppliers like me cannot join. They control the whole sand economy. They also try to undercut suppliers by selling directly to big real-estate developers and construction companies in Kochi. Financially, I can't compete with them (Naufal, sand supplier, interviewed March 2023).

Here, Naufal explains his relative marginal status in sand's commodity chain. The change from river sand to m-sand has shifted the balance of power in favor of upper-caste Syrian Christian communities who own plantation land in the Western Ghats. Earlier almost anyone could become a river sand contractor. All you needed was some basic dredging equipment and permission from the local administrative body in charge of the riverbank. But now, to start a stone quarry and sand production center, you need land in the Western Ghats. You also need specialized quarrying and crushing equipment, imported from overseas, which costs around Rs.10 crore (USD 1.2 million). Not all communities had access to these resources. To continue in the sand trade, Naufal had to become a mid-level sand vendor. Now he buys sand at cheaper rates (Rs.42/USD 0.5 per cubic foot) from Western Ghat quarries and sells it to builders and contractors in Kochi at slightly higher rates (Rs.62/USD 0.75 per cubic foot). He must also pay for tipper transportation, lease stockyard land for storing sand, and procure earth movers for un/loading purposes. Things are not easy for him.

Through the above vignettes I have argued that the contemporary Western Ghats sand economy is in fact a plantation economy because plantation logics are being reproduced, reworked and restructured here. Plantation logics are characterized by an exploitative relationship between capital, ecology and socially differentiated labor that was first witnessed under European colonialism a few centuries ago (McKittrick, 2013; Moore *et al*., 2019). The land on which Western Ghat stone quarries are located is not terra nullius that just appeared as an untapped 'extractive frontier' in the context of sand demand and supply equations. Rather, it is deeply entangled with historic flows of transnational capital into plantation production systems that unevenly incorporated it into the colonial world system in the mid-nineteenth century. These flows of transnational capital radically altered the Western Ghats through violent dispossession of indigenous people and private enclosure of common lands, and the large-scale conversion of biodiverse tropical rainforests into monocrop plantation farms catering to the colonial export economy. It was underpinned by a logic of maximizing value extraction from tropical alpine ecology by transforming the native landscape. We see a similar logic in the Western Ghats sand economy today. Not only are stone

quarries and sand production centers located on former plantation lands, but they are also characterized by the extraction of as much value from the alpine ecology as possible regardless of the ecological costs involved. It is no wonder that stone quarries and sand production sites are routinely implicated in triggering deadly landslides during extreme weather events in Kerala, thus creating new rounds of environmental vulnerabilities in the Anthropocene for communities living in precarious mountainous regions.

Furthermore, I have also shown how the caste-based social relations of the colonial plantation economy have been reworked and restructured in the contemporary sand economy. While the British first established Western Ghat plantations in the mid-nineteenth century, by the mid-twentieth the plantation economy was controlled mainly by upper-caste Syrian Christian families. Similarly, while slavery in Kerala was officially abolished in the mid-nineteenth century, former slaves from lower-caste communities continued working on upper-caste Syrian Christian plantations as indentured and low-paid laborers well into the twentieth. Today, most quarry owners are former plantation owners from the dominant Syrian Christian community while lower- and mid-tier workers in the sand economy belong to lower-caste communities, like Ezhavas, Latin Christians, Pulayas, Parayas and Mappila Muslims, whose forefathers toiled in the plantation economy. Not only do these communities face financial difficulties and criminalization, they also rely on Syrian Christian quarry owners for their livelihoods, thus locking themselves into intergenerational caste-based dependency relations which look very much like plantation social relations. This shows how plantation logics 'underline a range of contemporary social and spatial arrangements, not solely in terms of production but as a persisting form of community, characterized by inequality and immiseration' (Barua *et al*., 2023). In the next section, I discuss how these plantation logics do not remain spatially restricted to rural mountainous regions but extend to and shape the uneven production of space in Kochi city through the extended commodity chain of sand.

Plantation logics in Kochi's construction economy

One morning in February 2023, I visited the construction site of a small house in Kochi where I met Joshy. Joshy belonged to the Latin Christian community. His father had worked as a daily wage laborer in the coir industry, but Joshy didn't want to pursue this path. Instead, he apprenticed himself to a mason on large infrastructure projects before taking on small-scale house construction contracts on his own. I asked Joshy about his experiences working with m-sand. He replied:

> There are many quality-control tests to be conducted for m-sand. I don't have money to follow all of them. Only big construction companies and real estate developers can do so. When they reject a batch of m-sand, suppliers sell it to smaller contractors like me. I have no choice but to work with poor-quality sand. It impacts the quality of my projects, but what can I do? I can't compete with them (Joshy, builder, interviewed May 2023).

Here, Joshy highlights how m-sand's materiality has changed construction practices in Kochi much to the detriment of small-time independent contractors. When river sand was dredged from riverbeds, it was accompanied by impurities like silt, gravel, clay and organic matter. But once these impurities were sieved and removed, it was ready for use in construction. No further action was necessary. River sand granules were also rounded in shape due to the continuous erosion of rocks by flowing water over thousands of years. On the other hand, due to the mechanized crushing process, m-sand granules have angular and jagged edges, which offer better bonding with cement. M-sand also has better consistency in quality and gradation because of the controlled production process. However, it leaves considerable room for human error. There can be variations in granule size, texture and angularity depending on which quarry the batch came from and what

quality-control procedures they employ. Due to this, it undergoes extensive washing and screening processes to remove impurities during the production process, which increases costs and on-site testing requirements. Furthermore, the greater angularity and jaggedness of m-sand granules, because of the way rock is cut by sharp metal, also requires a higher water–cement ratio for the workability of wet concrete. Water-reducing admixtures can be used to compensate for this, but they add further to construction costs. Thus, if not tested regularly, variations in size, grade, texture and granularity can cause serious problems to the structural integrity of infrastructures.

Joshy mentions that two sieve tests are performed for each new batch of sand that arrives on construction sites. One is performed at the site itself while another is done at an external testing laboratory. Only when both tests give satisfactory results is the batch approved for use in construction. Otherwise, it is rejected and sent back to the quarry or supplier from where it was procured. Importantly, Joshy also reveals that rejected sand batches are usually sold to smaller contractors like himself, indicating the workings of a 'secondary circuit of value' (Gidwani, 2015: 576) in the sand economy. Most small independent building contractors don't have the resources to conduct expensive quality-control checks. Only large construction companies and real estate developers follow detailed testing procedures. Smaller contractors are forced to use poorer-quality sand which will cause their infrastructures to develop structural issues over the long term.

Similar experiences were recounted by Sharad, Binu, Jeslin and eight other independent building contractors I interviewed, most of whom belong to lower- and middle-caste groups. They said that the 'quarry lobby', composed of upper-caste Western Ghat quarry owners, preferred not to engage with smaller contractors like themselves. They would rather sell directly to large real estate developers and construction companies because it suited their monopoly. They controlled m-sand prices by calling for indefinite production strikes if they felt their monopoly was being threatened. These strikes, which have been occurring more frequently in recent years, bring Kochi's construction industry to a standstill because sand production completely stops, triggering a city-wide sand shortage (*Kerala Kaumudi*, 2023). Attempts at bypassing strikes by importing sand from the neighboring states of Tamil Nadu and Karnataka, often result in violent confrontations with the quarry lobby (*The Times of India*, 2023). In this context, most small independent building contractors procure sand from mid-level sand vendors and intermediary suppliers, which is of inferior quality. This means that while Kochi's 'world-class' infrastructures, like airports, shopping malls, hotels and luxury condominiums, will remain structurally stable over a longer time, smaller 'ordinary' infrastructures, like independent family-owned houses, community-oriented infrastructures, and non-profit schools and hospitals will deteriorate faster.

These vignettes show how the livelihoods of small and mid-level actors in Kochi's construction economy, like independent building contractors and small-time builders, many of whom belong to subaltern caste groups, depend on the political-economic power of the quarry lobby which is controlled by upper-caste Syrian Christian plantation landowners in the Western Ghats. This is how plantation urbanism operates. It shows how the production of urban space in Kochi is dictated by the same plantation logics that accompany sand granules from the Western Ghats to Kochi city.

The workings of plantation urbanism were made clearer when I met quarry owner Shashi at his seventeenth-floor penthouse apartment in a luxury condominium overlooking India's largest shopping mall in Kochi. Shashi belongs to the upper-caste Nair[9] community and his quarry, which was also once a rubber plantation, was in Pathanamthitta district,

9 While the Syrian Christian community mainly benefitted from the 1940s settlement schemes in the Western Ghats, some upper-caste Nair communities also acquired plantation land especially in the south Kerala districts of Pathanamthitta and Thiruvananthapuram.

more than 100 miles south of Kochi. While he spends weekdays at the quarry site overseeing blasting, crushing and sanding operations, his weekends are mostly spent in Kochi. When I asked him why this was the case, he responded with a wry grin:

> Look, I don't enjoy life at the quarry much. It's a rural area. There's not much to do there. Here, I can visit the mall regularly. I own two shops in the mall, one of which is a fine-dining restaurant run by my son. I'm also planning to build a 5-stor hotel near the airport which will have musical fountains like Dubai and vertical gardens like Singapore (Shashi, quarry owner, interviewed February 2023).

Shashi reveals something important. Quarry owners like himself are reinvesting their profits from sand production in the Western Ghats, most of which is unaccounted for 'black money' (*Matrubhumi*, 2022), into Kochi's elite infrastructure projects. For example, Shashi owns two shops in India's largest shopping mall, one of which is a fine-dining restaurant operated by his son. He owns multiple apartments in luxury condominiums across the city, on which he earns a steady rental income. He is now planning to invest money in a real estate company to build a 5-star hotel near the international airport for which he will borrow architectural ideas from Dubai and Singapore. This means that profits earned from sand extraction in the Western Ghats do not remain restricted to those rural regions. Instead, quarry owners are actively reinvesting surplus profits in Kochi's high-end infrastructure projects to diversify their business interests and continue the accumulation of capital by acquiring valuable rent-giving real-estate assets in Kochi (*OnManorama*, 2019). This again shows how the production of urban space in Kochi is mediated by plantation logics.

This fact was further reinforced by Sebastian, the 70-year-old Syrian Christian proprietor of a real estate and hotel company, whom I met at an upmarket coffee shop in Kochi. When I asked him how he sourced the sand for his real estate projects, he said,

> 'Our family owns extensive plantation land in the Western Ghats. In fact, we started our first luxury hotel property there and then branched out into Kochi. Now we have converted some of that plantation into a stone quarry and sand production unit. My brother runs the quarry. We source sand for all our real estate and hotel projects from there. It keeps our construction costs in check (Sebastian, real estate developer, interviewed January 2023).

Sebastian's response reveals how deeply entangled the rural quarry–urban construction nexus in Kerala is today. Sebastian owns a real estate company in Kochi which has its origins in the Western Ghats plantation economy. He had built his first luxury hotel project on his ancestral plantation land and was able to expand his real estate and hotel operations to Kochi by reinvesting profits from that project into the city. Now he has converted part of the plantation to a stone quarry which his brother manages. He sources sand for all his Kochi-based real estate projects from there.

Similar experiences of reinvesting profits from Western Ghat stone quarries into Kochi's high-end real estate sector were narrated by 12 other quarry owners I interviewed. Some owned luxury condominium apartments and sprawling villas in Kochi. Others had invested money in Kochi's booming education and medical sectors by building expensive higher-education colleges and private hospitals. Some had put money into building malls, hotels and restaurants in Kochi, catering to its growing tourism industry. Still others preferred building a second home near Kochi's international airport because it enabled them to undertake regular international trips to the Arabian Gulf, which has deep ties with Kerala. Some quarry owners had invested money in luxury retirement and senior care facilities, another growing economy in Kochi. Some had diversified their businesses by starting new Kochi-based real estate and construction

verticals under the same quarry name. Others had bought equity in already existing real estate and construction companies as 'silent partners' to hide their illicitly gained wealth from illegal sand extraction. This means that Kochi's booming construction economy is being supported by investments from stone quarries in rural areas of the Western Ghats with direct links to nineteenth-century colonial plantations. This is plantation urbanism.

These vignettes illustrate the workings of plantation urbanism in Kochi where colonial plantation logics of extraction and exploitation do not remain confined to rural sites of sand extraction in the Western Ghats but extend to the city through the extended commodity chain of sand, thus actively shaping the uneven production of urban space in Kochi. I have shown how the materiality of sand extracted from the Western Ghats is changing urban construction practices such that large elite infrastructures will have better structural stability and longer lifespans compared to smaller houses and ordinary infrastructures. I have also shown how quarry owners are reinvesting their surplus capital in Kochi's elite infrastructures furthering socioeconomic polarization and wealth concentration in large cities. While colonial plantations can be credited with catalyzing a 'desakota' style spatially distributed model of urban and regional development in Kerala in the mid-nineteenth century (Sreekumar, 1990; Casinader, 1992), Kochi's plantation urbanism today is creating new patterns of uneven urban development predicated on the extraction of surplus value from alpine ecologies and lower-caste labor in the Western Ghats and its investment into Kochi's high-end urban infrastructures. In this way, Kochi's contemporary pattern of plantation urbanism is challenging and reversing decades of gains made by Kerala's much lauded economic justice and social development-oriented model of development in the state's fight against poverty and inequality.

Conclusion

In this article, I have examined the widespread extraction of m-sand from rural Western Ghat mountains for urban infrastructure projects in Kochi city in Kerala, south India to theorize the complexity of rural–urban entanglements in rapidly urbanizing regions of the global South. I have shown how the blasting, crushing and sanding of ancient mountain rocks into m-sand granules is causing extensive environmental damage in the Western Ghats, which have been implicated in triggering recurring landslides in Kerala. Critical scholarship has theorized the production of these distant extractive frontiers as the effects of the needs of green energy transitions and planetary urbanization. In my study, I have used a 'follow the thing' methodology to offer a postcolonial decentering of this explanation because it fails to fully capture the complex and multidimensional dynamics of urban transformation in Kochi and Kerala. Instead, I have argued that the case of sand extraction and its associated environmental destruction in Kerala should be analyzed through the lens of 'plantation urbanism', because it more accurately situates socio-spatial transformations in the region within the geographies and histories of plantations in the region.

My findings have revealed how the workings of plantation urbanism impact the production of sand extraction sites in the Western Ghats and urban infrastructures in Kochi. Faced with dwindling profits from colonial-era plantations in the post-1990s liberalization and free-market era, upper-caste plantation owners used their historically accrued caste and class power to convert plantations to stone quarries and sand production centers. Sand produced from these rural sites is being transported to urban construction sites in Kochi city to build elite infrastructures. The profits made from sand production are also being reinvested into many of these infrastructure projects. Furthermore, the extractive logics and social relations of rural quarry sites, first established and practiced in colonial-era plantation economies, are being recreated and reworked in Kochi's real estate and construction economies much to the detriment of lower-caste communities who occupy lower-value positions in the sand economy. The growing concentration of wealth and power in Kochi's elite infrastructures, through

plantation urbanism, is transforming Kerala's state-driven social and economic justice-oriented distributed spatial economy leading to uneven urban and regional development.

In addition to deepening our understanding about rural–urban entanglements and uneven development in India, my work has furthered debates in global urban studies. My central contribution to these debates is that meta-level theories like planetary urbanization are not only ahistorical and aspatial, thus limiting our understanding of urban transformations in the global South, they also foreclose other ways of understanding them. Different parts of the global South have distinct geographies and histories and it is important to situate our analyses within these specific contexts to continue the work of producing 'mid-level theories' (Ghertner, 2014) that can better explain the 'restlessly shifting socio-ecological terrains of the global urban' (Ortega, 2020: 669), so that we can continue the work of decentering global urban theory from its Euro-American moorings (Roy, 2009).

My findings have also revealed how new extractive frontiers in the global South created by the needs of the emerging green economy and planetary urbanization are not only not 'new' but are also not peripheral 'frontiers'. Much of the global South has already experienced several cycles of dispossession, extraction and exploitation during centuries of colonialism that were central to the development of contemporary capitalism and the modern world. It is important to remember that the roots of planetary degradation in the Anthropocene can be traced back to these historical processes (Barua, 2024a). By situating our examination of global environmental change within these colonial histories, we can move towards a 'decolonial ecology' (Ferdinand and Davis, 2022).

Lastly, my research has helped move theoretical debates beyond the 'regional closets' (Jegathesan, 2021) of plantation theory. While the recent focus on plantation legacies by critical scholars has revealed the complicit role of settler colonialism and racial capitalism in creating our current ecological crisis, it still dominated largely by a transatlantic lens. By foregrounding how plantation legacies operate in the sand extraction and construction economies of Kerala, I have emphasized the urgent need to study how plantation legacies are 'refracted through the architectures of the postcolonial present' (McKinson, 2020: 2) in other regions of the global South, like Jamaica (*ibid.*), Singapore (Strange, 2024) and Ecuador (Fenton, 2021), that were also integrated into the colonial world system under similar, yet different, circumstances. By not analyzing what these similarities and differences are, we risk losing the chance to build more robust theoretical frameworks through comparative cross-cultural analysis across world regional divides.

Siddharth Menon, Department of Geography and Environment, The London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, sidmen.academic@gmail.com

References

Abourahme, N. (2015) Assembling and spilling-over: towards an 'ethnography of cement' in a Palestinian Refugee Camp. *International Journal of Urban and Regional Research* 39.2, 200–17.

Andreucci, D., G. García López, I.M. Radhuber, M. Conde, D.M. Voskoboynik, J.D. Farrugia and C. Zografos (2023) The coloniality of green extractivism: unearthing decarbonisation by dispossession through the case of nickel. *Political Geography* 107, 102997.

Angelo, H., and D. Wachsmuth (2015) Urbanizing urban political ecology: a critique of methodological cityism. *International Journal of Urban and Regional Research* 39.1, 16–27.

Arboleda, M. (2016) Spaces of extraction, metropolitan explosions: planetary urbanization and the commodity boom in Latin America. *International Journal of Urban and Regional Research* 40.1, 96–112.

Balasubramanian, A. (2023) A forgotten famine of '43? Travancore's muffled 'cry of distress'. *Modern Asian Studies* 57.5, 1495–529.

Barua, M. (2024a) *Plantation worlds*. Duke University Press, Durham, NC.

Barua, M. (2024b) The metropolis and metabolic life. *International Journal of Urban and Regional Research, Spotlight On: Animals and the City* [WWW document]. URL https://www.ijurr.org/spotlight-on/animals-and-the-city/the-metropolis-and-metabolic-life/ (accessed 12 May 2025).

Barua, M., R.I. Martín and M. Achtnich (2023) Introduction: Plantationocene. *Society for Cultural Anthropology*, 24 January [WWW document]. URL https://culanth.org/fieldsights/introduction-plantationocene (accessed 12 May 2025).

Bathla, N. (2024) Inhabiting more-than-human ecologies of extended urbanization: unruly leopards amidst urban–wild enmeshment in the Northern Aravalli region. *Geoforum* 156, 104123.

Besky, S. (2013) *The Darjeeling distinction: labor and justice on fair-trade tea plantations in India*. University of California Press, Berkeley, CA.

Bhoopathy, V. and S.S. Subramanian (2022) The way forward to sustain environmental quality through sustainable sand mining and the use of manufactured sand as an alternative to natural sand. *Environmental Science and Pollution Research* 29.21, 30793–801.
Brenner, N. (2019) *New urban spaces: urban theory and the scale question*. Oxford University Press, Oxford.
Bruna, N. (2023) *The rise of green extractivism*. Routledge, Abingdon.
Casinader, R.A. (1992) Desakota in Kerala: space and political economy in Southwest India. PhD dissertation, Department of Geography, The University of British Columbia.
Chandramohan, P. (2016) *Developmental modernity in Kerala: Narayana Guru, S.N.D.P Yogam and social reform*. Tulika Books, Chennai.
Chandramouli, D.C. (2011) *Censes of India*. Office of the Registrar General and Census Commissioner, New Delhi.
Choplin, A. (2023) *Concrete city: material flows and urbanization in West Africa*. Wiley, New York, NY.
Connolly, C. (2019) Urban political ecology beyond methodological cityism. *International Journal of Urban and Regional Research* 43.1, 63–75.
Cook, I. (2004) Follow the thing: papaya. *Antipode* 36.4, 642–64.
Cronon, W. (1992) *Nature's metropolis: Chicago and the Great West*. W.W. Norton and Company, New York, NY.
Cushman & Wakefield and CREDAI (2023) *10 emerging markets. Engines for future growth of commercial real estate* [WWW document]. URL https://www.regnews.in/top-10-emerging-cities-for-real-estate-markets-cushman-wakefield-and-credai-joint-report (accessed 12 May 2025).
Dawson, K. (2021) Geologising urban political ecology (UPE): the urbanisation of sand in Accra, Ghana. *Antipode* 53.4, 995–1017.
Fenton, R.P., III (2021) Cacao capitalism and extended urbanization: on the contradictory origins of bounded urbanism in nineteenth-century coastal Ecuador. *International Journal of Urban and Regional Research* 45.1, 5–20.
Ferdinand, M. and A. Davis (2022) *Decolonial ecology: thinking from the Caribbean world*. Translated by A.P. Smith. Polity Press, Cambridge.
Gadgil, M. (2011) *Report of the Western Ghats Ecology Expert Panel, Part I*. The Ministry of Environment and Forests, Government of India, New Delhi.
Ghertner, D.A. (2014) India's urban revolution: geographies of displacement beyond gentrification. *Environment and Planning A: Economy and Space* 46.7, 1554–71.
Ghosh, S. and A. Meer (2021) Extended urbanisation and the agrarian question: convergences, divergences and openings. *Urban Studies* 58.6, 1097–119.
Gidwani, V. (2015) The work of waste: inside India's infra-economy. *Transactions of the Institute of British Geographers* 40.4, 575–95.
Gidwani, V. and J. Wainwright (2014) On capital, not-capital, and development: after Kalyan Sanyal. *Economic and Political Weekly* 49.34, 40–47.
Gillen, J., T. Bunnell, and J. Rigg (2022) Geographies of ruralization. *Dialogues in Human Geography* 12.2, 186–203.
Gopikuttan, G. (1990) House construction boom in Kerala: impact on economy and society. *Economic and Political Weekly* 25.37, 2083–8.
Gururani, S. (2020) Cities in a world of villages: agrarian urbanism and the making of India's urbanizing frontiers. *Urban Geography* 41.7, 971–89.
Gustafson, S., N. Heynon, J.L. Rice, T. Gragson, J. Marshall Shepherd and C. Strother (2014) Megapolitan political ecology and urban metabolism in southern Appalachia. *The Professional Geographer* 66.4, 664–75.
Harvey, D. (1996) *Justice, nature and the geography of difference*. Blackwell, Oxford.
He, S., and Y. Zhang (2022) Reconceptualising the rural through planetary thinking: a field experiment of sustainable approaches to rural revitalisation in China. *Journal of Rural Studies* 96, 42–52.
Hecht, G. (2018) Interscalar vehicles for an African Anthropocene: on waste, temporality, and violence. *Cultural Anthropology* 33.1, 109–41.
Hutton, J. (2019) *Reciprocal landscapes: stories of material movements*. Routledge, Abingdon.
Jamieson, W. (2021) For granular geography. *Dialogues in Human Geography* 11.2, 275–93.
Jazeel, T. (2018) Urban theory with an outside. *Environment and Planning D: Society and Space* 36.3, 405–19.
Jegathesan, M. (2021) Black feminist plots before the plantationocene and anthropology's 'regional closets'. *Feminist Anthropology* 2.1, 78–93.
Jeyaranjan, J. (2019) Sand and the politics of plunder in Tamil Nadu, India. In B. Harriss-White and L. Michelutti (eds.), *The Wild East: criminal political economies in South Asis*, UCL Press, London.
John, H. (2016) Pathanamthitta is Ayyappan's abode, but Kerala's stone quarry country is hell for villagers. *The News Minute*, 12 January [WWW document]. URL https://www.thenewsminute.com/kerala/pathanamthitta-ayyappans-abode-keralas-stone-quarry-country-hell-villagers-37610 (accessed 12 May 2025).
Keil, R. (2020) The spatialized political ecology of the city: situated peripheries and the capitalocenic limits of urban affairs. *Journal of Urban Affairs* 42.8, 1125–40.
Kerala Kaumudi (2023) Quarry strike brings construction sector to a standstill. *Keralakaumudi Daily*, 17 April [WWW document]. URL https://keralakaumudi.com/en/news/news.php?id=1049421&u=quarry-strike-brings-construction-sector-to-a-standstill-1049421 (accessed 12 May 2025).
Kirsch, S. (2013) Cultural geography I: materialist turns. *Progress in Human Geography* 37.3, 433–41.
Koothanady, A.G. (2020) A thousand platforms for crying trees, and toiling bodies, and more. *Nome* [WWW document]. URL https://nomegallery.com/chapter/a-thousand-platforms-for-crying-trees-and-toiling-bodies-and-more-by-antony-george-koothanady/ (accessed 12 May 2025).
Krause, M. (2013) The ruralization of the world. *Public Culture* 25.2 70, 233–48.
Krishna, A. (2014) Plantations and regional development: case of cardamom plantations in Kattappana, Kerala, India. NRPPD Discussion Paper 32 [WWW document]. URL https://cds.edu/wp-content/uploads/2021/02/NRPPD32.pdf (accessed 12 May 2025).
Kumar, C.V. (2023) Construction sector struggles as quarry products prices rise in Kerala. *Mathrubhumi*, 6 May [WWW document]. URL https://english.mathrubhumi.com/news/kerala/construction-sector-struggles-as-quarry-products-prices-rise-in-kerala-1.8535453 (accessed 12 May 2025).
Lamb, V. and Z. Fung (2022) Expanding transboundary environmental governance: a mobile political ecology of sand and shifting resource-based livelihoods in Southeast Asia. *Environmental Policy and Governance* 32.4, 281–91.
Lamb, V., M. Marschke and J. Rigg (2019) Trading sand, undermining lives: omitted livelihoods in the global trade in sand. *Annals of the American Association of Geographers* 109.5, 1511–28.
Lefebvre, H. ([1970] 2003) *The urban revolution*. University of Minnesota Press, Minneapolis, MN.
Li, T.M. and P. Semedi (2021) *Plantation life: corporate occupation in Indonesia's oil palm zone*. Duke University Press, Durham, NC.
Matrubhumi (2022) Rs 200 crore tax evasion detected in I-T raids on quarry operators in Kerala. *Mathrubhumi*, 10 January [WWW document]. URL https://english.mathrubhumi.com/news/kerala/rs-200-crore-tax-evasion-detected-in-i-t-raids-on-quarry-operators-in-kerala-1.6347527 (accessed 12 May 2025).
McKinnon, I., P.T. Hurley, C.C. Myles, M. Maccaroni and T. Finan (2019) Uneven urban metabolisms: toward an integrative (ex)urban political ecology of sustainability in and around the city. *Urban Geography* 40.3, 352–77.
McKinson, K.D. (2020) A house pon the hill: refractions of black death and desire through the Jamaican plantation great house. *Antipode Online*, 4 January

[WWW Document]. URL https://antipodeonline.org/wp-content/uploads/2023/12/9_McKinson.pdf (accessed 12 May 2025).
McKittrick, K. (2013) Plantation futures. *Small Axe: A Caribbean Journal of Criticism* 17.3, 1–15.
McWilliams, C. (2000) *Factories in the field: the story of migratory farm labor in California*. University of California Press, Oakland, CA.
Menon, S. (2023) Class, caste, gender, and the materiality of cement houses in India. *Antipode* 55.2, 574–98.
Menon, S. (2025a) Incompleteness. In E. Elinoff and K. Rubaii (eds.), *The social properties of concrete*, Punctum Press, Santa Barbara, CA.
Menon, S. (2025b) Reinforcing infrastructures: capital, nature, and the translocal relationalities of urbanizing India. PhD dissertation, Department of Geography, University of Wisconsin-Madison.
Mercer, C. (2024) *Suburban frontier: middle-class construction in Dar es Salaam*. University of California Press, Oakland, CA.
Miller, M.A. (2022) A transboundary political ecology of volcanic sand mining. *Annals of the American Association of Geographers* 112.1, 78–96.
Mishra, P. (2020) Urbanisation through brick kilns: the interrelationship between appropriation of nature and labour regimes. *Urbanisation* 5.1, 17–36.
Moore, S.S., M. Allewaert, P.F. Gómez and G. Mitman (2019) Plantation legacies. *Edge Effects* [WWW document]. URL https://edgeeffects.net/plantation-legacies-plantationocene/ (accessed 12 May 2025)
Morrison, K. D. (2002) Pepper in the hills: upland–lowland exchange and the intensification of the spice trade. In K.D. Morrison and L.L. Junker (eds.), *Forager-traders in South and Southeast Asia*, Cambridge University Press, Cambridge.
Nair, N.V. and J.S. Moolakkattu (2017) The Western Ghats imbroglio in Kerala. *Economic and Political Weekly* 52.34, 56–65.
Nambooodiripad, E.M.S. (2010) *History, society and land relations: selected essays*. Leftword, New Delhi.
OnManorama (2019) In Kerala, an illegal quarry is an object of desire everyone is vying for. *OnManorama*, 3 September [WWW document]. URL https://www.onmanorama.com/news/kerala/2019/09/03/illegal-quarry-kerala-wayanad-bribes-mining.html (accessed 12 May 2025).
Ortega, A.A.C. (2020) Desakota 2.0: worlding hybrid spaces in the global urban, *Urban Geography* 41.5, 668–81.
Paredes, A., S. Chao and A.L. Araya (2024) Intervention symposium. 'Plantation methodologies: questioning scale, space, and subjecthood'. *Antipode Online*, 4 January [WWW document]. URL https://antipodeonline.org/2024/01/04/plantation-methodologies/ (accessed 12 May 2025).
Peter, B. and V. Narendran (2017) *Labor migration to Kerala: construction*. Centre for Migration and Inclusive Development, Thiruvanatapuram.
Poe, J., and J. Bellamy (2020) Plantation urbanism: legacy, property and policing in Louisville, Kentucky. *Radical Housing Journal* 2.2, 143–64.
Raj, J. (2022) *Plantation crisis: ruptures of Dalit life in the Indian tea belt*. UCL Press, London.
Rammohan, K.T. (2008) Caste and landlessness in Kerala: signals from Chengara. *Economic and Political Weekly* 43.37, 14–16.
Rehman, N., A. Parikh, Z. Lamb, S. Syal, D.A. Ghertner, S. Menon, N. Anwar, H. Nabi, W. Butt, M. Ranganathan, K. Srinivasan, H. Bhat, A. Powis and N. Anand (2023) South Asian urban climates: towards pluralistic narratives and expanded lexicons. *International Journal of Urban and Regional Research* 47.4, 667–87.
Roy, A. (2009) The 21st-century metropolis: new geographies of theory. *Regional Studies* 43.6, 819–30.
Roy, A. (2016) What is urban about critical urban theory? *Urban Geography* 37.6, 810–23.
Sajeev, T.V. and C. Alex (2017) *Mapping of granite quarries in Kerala, India: a critical mapping initiative*. Kerala Forest Research Institute, Thrissur, Kerala, India.
Sajitha, A. (2023) Natural rubber sector in India. *Economic and Political Weekly* 58.5.
Sakthidharan, A.V. (2019) *Antigod's own country: a short history of Brahminical colonisation of Kerala*. Navayana, New Delhi.
Sanyal, K. (2007) *Rethinking capitalist development: primitive accumulation, governmentality and post-colonial capitalism*. Routledge, London.
Saradamoni, K. (1980) *Emergence of a slave caste: Pulayas of Kerala*. People's Publishing House, New Delhi.
Schmid, C., and M. Topalovic (2023) *Extended urbanisation: tracing planetary struggles*. Birkhäuser, Basel.
Shaji, K.A. (2022) Stone quarries aggravate landslides every monsoon, but Kerala is yet to address the issue. *The South First*, 9 August [WWW document]. URL https://www.thesouthfirst.com/kerala/stone-quarries-aggravate-landslides-every-monsoon-but-kerala-is-yet-to-address-the-issue/ (accessed 12 May 2025).
Sheppard, E., H. Leitner and A. Maringanti (2013) Provincializing global urbanism: a manifesto. *Urban Geography* 34.7, 893–900.
Strange, E.S. (2024) Singapore: plantation city? *Antipode Online*, 4 January [WWW document]. URL https://antipodeonline.org/2024/01/04/plantation-methodologies/ (accessed 12 May 2025).
Sreekumar, T.T. (1990) Neither rural nor urban: spatial formation and development process. *Economic and Political Weekly* 25.35/36, 1981–90.
Srivastava, P. (2023) Why Yogi govt thinks artificial sand is the future of construction. *India Today*, 5 June [WWW document]. URL https://www.indiatoday.in/india-today-insight/story/why-yogi-govt-thinks-artificial-sand-is-the-future-of-construction-2384214-2023-06-05 (accessed 12 May2025).
Suchitra, M. (2015) Lost in plantation. *Down to Earth*, 15 February [WWW document]. URL https://www.downtoearth.org.in/coverage/lost-in-plantation-48443 (accessed 12 May 2025).
Suresh, L. and M. Suchitra (2021) Suicidal resistance: nderstanding the opposition against the Western Ghats conservation in Karunapuram, Idukki, Kerala. *CDS Monograph Series* [WWW document]. URL https://docslib.org/doc/3646451/suicidal-resistance-understanding-the-opposition-against-the-western-ghats-conservation-in-karunapuram-idukki-kerala (accessed 25 May 2025).
Swyngedouw, E. (1996) The city as a hybrid: on nature, society and cyborg urbanization. *Capitalism Nature Socialism* 7.2, 65–80.
Tappin, S. (2002) The early use of reinforced concrete in India. *Construction History* 18, 79–98.
Tharian George, K. and M.R. Sethuraj (1996) Dynamics of world natural rubber economy: its relevance to India. *Economic and Political Weekly* 31.22, 1355–8.
The Times of India (2023) Indefinite quarry strike to hit construction sector in Kerala. *The Times of India*, 18 April [WWW document]. URL https://timesofindia.indiatimes.com/city/kozhikode/indefinite-quarry-strike-to-hit-construction-sector-in-kerala/articleshow/99570178.cms (accessed 12 May2025).
Thomas, J. (2022) Quarry owners comprise three-fourths of CPM donors. *OnManorama*, 2 December [WWW document]. URL https://www.onmanorama.com/news/kerala/2022/12/02/one-third-of-donations-from-kerala-to-cpm-fund-by-quarry-owners.html (accessed 12 May 2025).
Thomas, S. (2021) Kerala government data validates reality of reverse migration in Idukki. *The Times of India*, 8 March [WWW document]. URL https://timesofindia.indiatimes.com/city/kochi/kerala-government-data-validates-reality-of-reverse-migration-in-idukki/articleshow/81387038.cms (accessed 12 May 2025).
Tsing, A.L. (2012) On nonscalability. *Common Knowledge* 18.3, 505–24.
Tully, J. (2011) *The devil's milk: a social history of rubber*. Monthly Review Press.
Tzaninis, Y., T. Mandler, M. Kaika and R. Keil (2020) Moving urban political ecology beyond the

'urbanization of nature'. *Progress in Human Geography* 45.2, 229–52.
UNEP (2019) Sand and sustainability: finding new solutions for environmental governance of global sand resources. *GRID-Geneva, United Nations Environment Programme, Geneva, Switzerland*.
Viju, B. (2019) *Flood and fury*. Ebury Press.
Walker, R. (2015) Building a better theory of the urban: a response to 'towards a new epistemology of the urban?' *City*, 19.2/3, 183–91.
Wang, C.-M., D. Maye and M. Woods (2023) Planetary rural geographies. *Dialogues in Human Geography*, 20438206231191731.
Williams, R. (1973) *The country and the city*. Oxford University Press, Oxford.
Wright, A. (2021) *Between dreams and ghosts: Indian migration and middle eastern oil*. Stanford University Press, Stanford, CA.