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Water International, 2021; 46(6):900-918

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This is an Accepted Manuscript of an article published by Taylor & Francis in **Water International**, on 17 Aug 2021 available online:

<http://dx.doi.org/10.1080/02508060.2021.1963031>

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**8 March 2023**

<http://hdl.handle.net/2440/132549>

## **Water insecurity and patchwork adaptability in Bangalore's low-income neighbourhoods**

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## **Water insecurity and patchwork adaptability in Bangalore's low-income neighbourhoods**

This paper explores the 'patchwork adaptability' of low-income residents living in southeastern Bangalore to demonstrate the socially embedded ways that city dwellers patch ~~gaps in~~ their water supply gaps. Drawing upon site visits and semi-structured interviews in three neighbourhood enclaves, the discussion highlights how residents ~~make do in cope with~~ difficult and water insecure contexts despite the municipality's resource governance failures. While we encourage appreciation of the remarkable resilience that low-income populations in Bangalore exhibit, the evidence lays bare the need for more government support to help low-income residents navigate water insecurity in ways that require less time-intensive labour and social networking.

**Keywords:** Water insecurity, patchwork adaptability, low-income residents, informal economy, Bangalore/Bengaluru, India

### **Introduction**

In South Asian cities such as Bangalore,<sup>1</sup> the everyday experience of water insecurity varies significantly. Who receives sufficient water, and how one receives it, depends on factors ranging from geographical location, socio-economic status, caste affiliation, social networking and the degree of infrastructural support provided by a given municipality (Walters, 2013, 2016). As a result, it is difficult to generalise the nature of water insecurity for city dwellers – a state characterised by the three overlapping dimensions of inadequate water supply, insufficient access to water distribution systems, and seasonal water scarcity (Wutich & Ragsdale, 2008, p. 2117). To illustrate the variety of ways that people suffer water insecurity, including how they labour to secure water, this text examines the experiences of low-income residents in the southeastern corner of Bangalore. This demographic demonstrates what we consider to be *patchwork adaptability* because they work to 'patch' their resource supplies through

measures that can vary day-to-day in the pursuit of water access and storage. Patchwork adaptability also allows us to invoke, and pay attention to, the variety of time-intensive stop-gap measures that residents undertake to meet their daily resource needs via efforts that require extensive amounts of organisation, coordination, and manual labour. These water management efforts include the ‘patchwork system’ of informal activities and social networks upon which the urban poor rely (Peloso & Morinville, 2014, p. 121). For this reason, and as explained later, we fold social networks and ‘social embeddedness’ into our understandings of how people work to patch their water resource supplies.

The exploration of ~~low-income~~ patchwork adaptability contributes to research on ~~low-income~~ household water insecurity (Brewis et al., 2019; Jepson, 2014; Jepson et al., 2016, 2017; Linton & Budds, 2014; Wutich & Ragsdale, 2008). It also builds upon a wealth of existing scholarship about the persistent experience of ~~low-income~~ water insecurity ~~among the low-income households~~ ~~that is~~ found across a range of Indian cities (Burt & Ray, 2014; Goldman & Narayan, 2019; Kumar et al., 2018; McKenzie & Ray, 2009; Mehta & Karpouzoglou, 2015; Mehta et al., 2013; Nunan & Satterthwaite, 2001; Randhawa & Marshall, 2014; Ranganathan, 2009, 2014, 2015; Sultana, 2011; Truelove, 2011; Venkatachalam, 2015; Walters, 2013, 2016). Based on numerous site visits within Bangalore, explored later in this text, we demonstrate how ~~a~~ ~~the households in the~~ ~~sampling of~~ low-income neighbourhood enclaves are responding to water insecurity in ~~response to~~ ~~light of~~ the city’s resource-~~related~~ shortcomings. These ~~water~~ resource ‘governance failures’ (Bakker et al., 2008) are not specific to Bangalore and are, in fact, mirrored in other major cities across India.

What we add to the literature is an exploration of the adaptive yet patchwork means through which low-income and peri-urban residents reach beyond municipal

services to acquire the water resources they need to survive. Like a multi-patterned quilt fashioned from different materials, the notion of patchwork adaptability flags the mix-and-match ways that low-income residents work to secure water. These efforts include acts of water sharing – which is a ‘coping strategy’ that some adopt due to resource and economic constraints (Brewis et al., 2019) – as well as strategies to share knowledge about how, [when](#), and where, to access water. Such combined measures demonstrate the resilience of low-income residents to water insecurity, and they also illuminate the ~~often invisible~~[often-invisible](#) work of citizen-led efforts to make do where, and when, municipal resources are lacking. Another contribution of our study, via the case study snapshots we offer, is the empirical description of how ‘patchy’ – meaning, inconsistent and variable – water access strategies within a city like Bangalore can be. The neighbourhood-by-neighbourhood water supply patchiness that we empirically demonstrate is another aspect of our patchwork adaptability lens.

#### *[Low-income water insecurity in Bangalore's Low-income neighbourhood](#)*

As with other major cities in India, Bangalore’s water challenges are exacerbated by a combination of urban sprawl, population growth, and the loss of lakes and wetlands (Ranganathan, 2015). The changing water balance has accompanied Bangalore’s transition from the ‘Garden City’ of India to the nation’s equivalent to California’s ‘Silicon Valley’. In the process of becoming one of the nation’s biggest economic hubs, the market-driven demand for new buildings, malls, and parking lots have gobbled up much of the greenery for which Bangalore used to be famous (Ranganathan, 2009; Walters, 2013, 2016). By one estimate, the city lost 79% of its water bodies over the last four decades alone (Goldman & Narayan, 2019, p. 104). To date, a large gap in water availability has been patched by the resources piped into the city from the Cauvery River, located some 100 kilometres away (Ranganathan, 2015; Walters, 2016). [Looking](#)

~~forward, however,~~ The future of the city's water balance, ~~however,~~ remains in peril ~~because~~ as Bangalore's water demand is set to increase from around 1,900 to 3,800 million litres a day (MLD) within two decades (Ghosh, 2018).

The gaps in the water supply are alarming given that Bangalore's water supplies, both public and private, struggle to meet the current demand – and given that the distribution of Cauvery river water is limited in circulation across the city. Even more alarming is the evidence that, relative to their well-to-do compatriots, low-income residents struggle to secure the minimum resources they need. While 'elite' neighbourhoods can and do struggle for water, they are able to address this challenge through a smaller range of solutions than their low-income counterparts. The differentiated 'adaptive social practices' available to the well-to-do primarily involve supplementing the municipal water supply with new borewell and tubewell connections, and through tanker water deliveries that individual households store in dedicated tanks or sumps (Birkenholtz, 2010; see also Mehta & Karpouzoglou, 2015).

Whereas the well-to-do have been able to settle in the core areas of the city where Cauvery water is piped into homes, the poorest residents have predominantly found shelter in the city periphery where piped water is less common (Mehta et al, 2013). As a result, the urban poor ~~have to~~ purchase water in smaller increments than their wealthier neighbours ~~as they~~ while patching their water supplies via informal measures. As with many other parts of urban South Asia, such low-income populations end up spending more on water per litre and a disproportionately higher percentage of their income (Björkman, 2015; O'Leary, 2016; Walters, 2016, p. 182). Bangalore's low-income populations, which in 2015 constituted 25 to 35 percent of the total population (Roy et al., 2018), also receive a low per capita supply of water – estimated at around ~~40- to~~ 45 litres per person per day (Praj, n.d.). These precious water supplies do not

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come easily; in most cases, they are compiled from ~~a number of numerous~~ sources and suppliers ranging from groundwater and borewell pumps, public and private tanker services, and ~~purchased 20-litre bulk~~ bottles of filtered water.

The present discussion serves to describe the lived experience of household water insecurity in low-income neighbourhoods. As mentioned, we also aim to illuminate the remarkable level of adaptability that ~~people-residents in the target demographic~~ display in the face of water shortages. This adaptability is not divorced from the social relations that ~~they-people~~ share with those in their proximity. Indeed, we work from the premise that social embeddedness, which includes social cooperation and conflict, has been crucial to the patchwork adaptability of the lower-income populations who undertake daily tactics and strategies to mitigate water stress.

Social embeddedness is important when examining patchwork adaptability to water insecurity because social networks play a critical role in navigating uncertainties. This is true even in contexts where market forces have stepped in to address water supply challenges. Observations about the social nature of markets extend back to the insights of Polanyi (2001), who looked at the role of reciprocity, redistribution and networks of exchange in pre-capitalist societies. Subsequent scholars built upon this work in contemporary capitalist economies (Granovetter, 1985) because ‘culture matters’ (Bögenhold, 2013, p. 295), even in the realm of economics. Bögenhold (2013) criticizes neoclassical and institutional economic approaches that overlook social embeddedness in economic transactions – which is a pushback against notions that markets are populated by rational ‘*homo oeconomicus*’ actors (pp. 296). Proponents of social embeddedness, such as Cleaver (2002, p. 14) also argue that our understandings of social institutions need to recognize their fluidity and openness to change, as opposed to seeing them as solid or fixed. This is especially true when it comes to ‘local resource

management arrangements’ as they constitute a complex blend of social institutions that are ‘formal and informal, traditional and modern’ (Cleaver, 2002, p. 17).

For the above reasons, a fluid or dynamic social embeddedness framework helps to decipher multiple facets of water procurement among low-income urban households, including in our case study of Bangalore. As we argue, most processes of water procurement are socially embedded, and they are also influenced by the specific social characteristics of each neighbourhood studied. Following a patchwork adaptability framework, we bring these nuanced socially embedded elements to the foreground in the water procurement process of low-income households. We do so while paying attention to the additional influence of economic factors that include water pricing in market and municipal transactions.

The data that follows draws from fieldwork spanning from January to August 2018. During an eight-month period, field interviews were conducted by a core team of **three** researchers with an initial set of questionnaires and literature reviews done by three additional investigators. While the questionnaires of some 30 households were helpful in identifying the amount of money and time that residents put into allocating resources, they were not successful in painting a nuanced picture of how water scarcities were negotiated in everyday practice. It was also clear from the attempts at using questionnaires that respondents were hesitant to address queries drawn from a set list itemised on an official looking piece of paper. Compounding their hesitations were the nature of the census-like questions about household income, water expenses, and water procurement methods; it became evident from some of the implausible replies (including under-estimations for informal water use despite researcher observations to the contrary) that residents were wary of how and where that data would be used. Since

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we lacked confidence that the questionnaire responses were fully representational, we do not draw upon that quantitative data for this discussion.

To acquire a better understanding of the complexities of water management practices in everyday life, we followed up the [transect walk in the neighbourhood](#), surveys with door knocking and semi-structured interview requests in five sample neighbourhoods in southeast Bangalore. These neighbourhoods – which can be considered ‘unplanned’ settlements (but not ‘slums’ as they were not illegal) – were chosen at the inception of the study due to the southeast region’s burgeoning settlements in a part of the city that was not on the municipality’s piped water grid. As such, the majority of their water supply was ‘informal’ as it was ‘largely unregulated by a state entity’ (Burt & Ray, 2014, 106).<sup>2</sup> Of these five sample neighbourhoods, three were selected for follow-up visits due to the extensive nature of water insecurity that residents experienced combined with evidence of ~~collaboration~~[collaboration](#) among residents. The neighbourhoods selected were also chosen due to the research teams’ ability to identify a core set of interlocutors in each neighbourhood that were eager to share their perspectives and experiences. Additionally, these three neighbourhoods demonstrated extensive *yet differentiated* efforts to ‘patch’ water supply gaps by sharing knowledge about how, where, and when to obtain resources.

<Insert Figure 1 around here.>

Figure 1. A map of the study area in the peri-urban corner of southeastern Bangalore. Map image modified from Google Maps (left) and a Wikimedia Commons file (right). ([https://commons.wikimedia.org/wiki/File:Bangalore,\\_India\\_\(5461524320\).jpg](https://commons.wikimedia.org/wiki/File:Bangalore,_India_(5461524320).jpg))

The respondents constituted a mix of residential owners and tenants. Their accommodations ranged from one-room homes to those with two and, in rare cases,

three rooms. Most of the tenant-occupied households lacked water storage facilities other than one or two 200-litre canisters, which in Bangalore typically presented as a large blue cylinder made of plastic. The primary canister was often kept in the kitchen (which in some cases doubled as a shower room) with a second canister kept outside for those fortunate enough to have a backup.

The ~~vast~~ majority of the households studied earned between INR 10,000 to 20,000 per month, which was about \$134 to \$268 USD at the time of the interviews. The lowest income households were seasonal or permanent migrants from rural areas of Karnataka, Tamil Nadu, Telangana and Andhra Pradesh. Wages were meticulously saved in the seasonal migrant households because many of them had debts to pay back home, or they aspired to purchase land or property in a rural area so they could abandon the noise and hectic pace of city life. The low-income migrants we ~~encountered~~ came across in our fieldwork, in other words, were juggling many economic obligations and aspirations while managing budget constraints. The navigation of residents' uncertainties around accessing water, and the high costs they face when procuring it, comes into sharp focus in our patchwork adaptability framework.

These and other logistical details were predominantly shared to us by women as the fieldwork took place in the daytime and early evenings, which are times when men are typically away at work. Everyday across the nation, a significant population of low-income women stay near their residences to procure tanker water supplies and ~~to~~ wait for their turns with to collect water ~~collection at~~ from the nearby wells and borewells (Kumar et al., 2018; O'Leary 2016; Truelove, 2011). In practice, this means, ~~that~~ there is a noticeably gendered aspect to ~~low income~~ urban water procurement among the low-income households. These ~~gendered dynamics are part of the~~ social aspects

influencing the efforts to patch gaps in the water supply, as the discussion that follows highlights.

### ***Patchwork adaptability in Sector Sixty***

To demonstrate low-income resource use and patchwork adaptability, we begin with the case of a neighbourhood enclave within Bangalore that we will call Sector Sixty.

Hosting roughly thirty households, it is situated on a cul-de-sac off a tertiary road that manages to be as bustling as any of the city's main thoroughfares. This enclave's primary water supply comes in the form of borewell water that is turned on manually twice a day – once in the morning and once in the evening – to allow for a modicum of recharge that refreshes the water supply. Given the quantitative dearth available from the borewell, the municipality also supplies one tanker's worth of water, carrying 5,000 litres, once a week. This water is not delivered by the municipality itself as they purchase from private suppliers who do the job. How much of this water each household gets depends on a complex and heated on-site negotiation between the number of residents who show up to collect the water at the time of delivery, the scolding and pleas of neighbours clamouring for a fair share, and the direction of the tanker driver and perhaps even a municipal 'lineman' – if one is present to oversee the delivery. As this additional supply of water is still insufficient for household needs, residents have a variety of other means that they use to access water. One of these is to pool together resources to purchase additional tanker water deliveries from private suppliers. Another is to purchase buckets of water from one of the two wealthier households that have managed to build underground concrete-lined sumps to store several thousands of litres of water. And an additional option is to purchase water from a nearby landlord who has a private borewell and charges a fixed rate per bucket. A final option – and the most popular for accessing drinking water – is to purchase

'bubble cans' consisting of 20 litres of purified water that, depending on the brand purchased, costs as low as INR 25 and as high as INR 60 (USD \$.35-.82).

In short, for the residents of Sector Sixty, there are approximately six main ways of accessing water to meet each household's weekly needs. These options are not necessarily driven by choice and are not selected in a specific order of most-to-least efficient from the households' perspective. Rather, households have to navigate between these varied options to secure water based on their needs ~~relative to the municipal supply~~, their relationships with water providers and with their neighbours, and the availability of cash in hand. While residents are usually able to obtain sufficient resources, what bears underscoring is the sheer volume of time, and of social connections (Anand, 2011), that is required of residents to locate, coordinate, and access water from these six main water supply options. To get a household's fair share of the tanker water delivery, for instance, family members must be home at the time of the tanker's arrival – and the precise delivery time is often unknown until the last minute due to the unpredictable nature of the city's heavy traffic. For the children and women expected to be home when the tanker arrives to fill buckets, there are distinct social and economic losses. Children lose opportunities to study or practice crafts and sports while women forgo wage labour to be nearby when a tanker might arrive. And although the timings of the municipality-supplied borewell water are regular, this too requires children and women to be present early in the mornings and early in the evenings to carry buckets of water – and this process involves queuing and waiting for an unpredictable amount of time.

Notably, even the privately supplied borewell water poses complications. As the borewell water mark can drop down past 1,000 feet within the city of Bangalore (Goldman & Narayan, 2019, p. 104), this water is extracted at a maximum depth.

Despite signs that the borewell water contains mud residue, evidenced by a red tint, several householders in Sector Sixty shared that they often boil and consume the top layer of their sedimented borewell water. These householders reasoned that since the water comes ‘straight from the ground’ it is clean and fit for drinking. When such comments were shared in a focus group of five women in July of 2018, a teenage girl objected to her seniors, stating that the borewell water was ‘not good’ and that it was ‘tough to drink’. This opinion echoed the research that many of Bangalore’s borewell waters can be unfit for consumption, and that some of the city’s most contaminated sources are from groundwater supplies (Sekhar & Kumar, 2009). The lament about the poor quality of borewell water prompted some slight nods from the older women present as well as a side comment that at least the borewell water was cheaper than the 20-litre bubble cans of water. This latter comment was met by one of the younger women with a lowered gaze to the ground, as she clearly did not want to further contradict an elder in public. In instances like these, the affective nature of resource management became apparent. The emotional tenor of the conversation recalled the insights of Farhana Sultana (2011), who in her work on ‘emotional geographies’ points out how a complex set of factors, including honour and pride, impact the consumption of potentially unsafe water supplies across a range of locales. This leads her to reflect on how the ‘joys and relief of having safe potable water’ co-exists with ‘the pain, fear, despair, conflicts and overall suffering for and from water’ permeating everyday water-society relations (2011, 171).

<Insert Figure 2 around here.>

Figure 2: Tanker water collection at Sector Sixty. The demographics captured on camera include nine women, two men, and two male teenagers. Photo by Georgina Drew (2018).

The women of Sector Sixty estimated that they spent between three and four hours per week on water provision. This number, however, appeared to focus on the time spent in hands-on water management and did not take into account the amount of time that women spent for activities such as waiting at home for a tanker truck to arrive. When they were asked if the men also sometimes chip in to help ~~with the chore~~, they agreed that this happens if the men are home when water is being supplied. But the underlining statement was unequivocal: ‘it is always women who manage water’. Such statements illustrate how the experiences of low-income women in Bangalore reproduce the time-intensive (gendered) labour that is involved in procuring water in rural and semi-urban settings (Drew & Rai, 2016). The observation that low-income women experience extensive resource provision burdens echoes the insights from feminist scholarship while debunking the neo-classical understanding of efficient choice (Bakker, 2013). Our observations also overlap with scholarship highlighting how gendered divisions of labour can persist in urban settings, impacting women’s earning potential along with their spatial and economic mobility (O’Leary, 2016; Ray, 2007; Truelove, 2011).

In addition to gendered insights, our data indicates that the strength of social networks impacts the agility of households to access scarce water. Enclaves such as Sector Sixty, for instance, were populated by families who hailed from similar rural areas since news of housing availability and job opportunities often travel word-of-mouth through places of natal origin. This, combined with the ease of use of regional

dialects and languages not native to Bangalore, lent a sense of community because neighbours felt bound by the obligations and expectations of tightknit rural lifeways despite living in a bustling urban centre. The extended real and fictive kin networks within enclaves ~~and neighbourhoods~~ proved helpful when water was scarce, and when water coordination or water sharing was needed. In other neighbourhoods, where social networks were not as tight and social divisions were high, water became a stronger point of contention – making supply coordination and water sharing more difficult, and oftentimes less equitable.

#### ***Social divisions and resource inequities in Water Tower Panchayat***

We observed particularly tense social relationships around water access in a neighbourhood enclave of 300 homes running uphill along a street that begins with a broken water tower. This enclave, which we will call Water Tower Panchayat, as it is run by a local village council (known as a panchayat), is surrounded by several newly built high-rise apartments. Unlike Sector Sixty, residents hail from a range of locations across southern India and they do not commonly share the same rural networks. Since money is tight for many households, most male householders work full-time and several of the low-income women that we interviewed work as cleaners and maids in the nearby high-rise apartments – a vital source of supplementary income. Yet, the presence of such high-rises is also a source of concern for long-term water access because the apartment residents also rely upon borewell water for a significant portion of their water supply. As more high-rise buildings go up, this will put a strain on already stretched groundwater resources.

<Insert Figure 3 around here.>

Figure 3: A street view of Water Tower Panchayat. Photo by Georgina Drew (2018).

The women of Water Tower Panchayat shared stories about water access that demonstrated a wide range of experiences. Some of the households at the bottom of the hill had ease of access to the borewell that lay opposite the town's inept water tower. When the lineman opened the borewell at 4am in the morning – after undoing the padlock and firing up the pump – these families could dash back and forth with several bucket loads to stockpile their daily requirements. Some of these lower-lying households even had a dedicated or a shared sump, which they filled with purchased tanker water to offset the borewell supply. The women in these households expressed few difficulties despite a grumbling or two about the need to rise in the early morning hour to collect borewell water. Other women conveyed stories of hardship and frustration. Most of these women lived uphill from the borewell and were forced to walk back and forth morning and evening up a significant incline with four, five, or six rounds of water collection. One woman, who lived at the very top of the hill next to the wall that marks the enclave's border, looked weary as she spoke about her water access woes. She conveyed the hardship of working all day to secure water, prepare the children for school, cook the day's meals, work as a cleaner at a nearby location, and do the daily laundry and household chores. Pointing to an old bicycle as we spoke, she shared that it provides some relief when her husband is able to rise early to help with the morning water run. When this happens, he ties four or five buckets to the bicycle to transport the water back uphill. This assistance significantly eases her burden as she can only carry two buckets uphill at a time. Speaking to us as she hung clothes to dry in front of her house, she observed that, even with this help, she still ~~has to make~~s between three and four trips to the borewell each day.



Beyond the access challenges, residents expressed concerns with the borewell quality. The borewell water, we were told, sometimes smelled or looked suspect. One woman complained that they cannot drink this water because it is ‘not healthy’ and they get ‘throat pain’ when they try to consume it. So, like the households of Sector Sixty, anyone who can afford to purchase drinking water in 20-liter quantities makes this investment several times a week. The result is that the wealthier households were able to alternate between borewell water, sump water, and drinking-can water to meet their needs. The lower income households were forced to rely upon the dubious borewell water and drinking-can water – if and when it could be afforded. ~~The lowest income households might occasionally use borewell water for all their needs when money is tight.~~

Opportunities to secure better water access in Water Tower Panchayat have apparently been missed. According to one householder – who lamented that social relations in the enclave were just ‘so-so’ and that fights in the water queues were common – it would have taken only four to five thousand Indian rupees per household to get everyone in the area their own borewell connection. Sadly, people did not ‘come together’ to make this happen. Shaking her head, this interlocutor-woman observed that there was ‘no unity’ and that such improvements ‘have to be worked out together’ to be successful. As we surmised from her comments, some households were likely too poor to afford the individual household connection. What is more, some of the better off households also held what she termed ‘political power’, enabling them to persuade – and to pay – the lineman to occasionally fill their sumps with borewell supplies as an alternative to the more expensive tanker water. Such iniquitous acts fuelled the underlying tensions between the water-haves and the water-have-nots.

The economic stressors of life in Water Tower Panchayat were another factor impacting inequitable water access. For, ~~beyond-regardless of~~ the economic standing of each individual household, everyone we spoke with shared stories of heavy labour and industriousness. ~~The extensive daily tasks and chores listed off by all interlocutors underscored how hard even the better-off households have to work to make ends meet, and to enjoy even a modicum of comfort.~~ Commenting on the overall situation, one woman lamented that ‘everyone is so busy’ and that ‘women already work very hard’. As a result, it was difficult to generate social cooperation to improve resource access because, ‘People think it is better to take care of their own business.’

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In contrast to Sector Sixty, the relatively low levels of social cohesion that such comments illustrated meant that the lowest-income residents expressed significant amounts of emotional distress when speaking of their difficulties in navigating water scarcity. Emotional distress is exacerbated when the urban poor are forced to negotiate ‘the socio-economic systems that create barriers to water access re/produce water insecurity’ (Wutich & Ragsdale, 2008, p. 2123). The stress that women demonstrated also underscored the toll that water inequities had on residents. So, while social embeddedness can influence neighbour-hood ~~level~~ water management efforts, it does not necessarily lead to the fair distribution of water in everyday practice. This is one reason that we do not conceptually focus on the ‘community pooling’ of water in our analysis. Community pooling is a practice wherein ‘vulnerable communities self-organize’ by gathering money or organising labour in order to safeguard and allocate new water resources (Brewis et al. 2019, 208). While there is a degree of self-organizing in play when it comes to some of Sector Sixty’s resource management decisions, there are also instances when people are left on their own to ‘patch’ their water supplies when equitable water sharing and water pooling measures fail.

### ***Tanker supplier dependence in Meadow Enclave***

Just a few kilometres away from Sector Sixty lies a neighbourhood enclave with an entirely different water supply schema, and it speaks to the dependence that some residents have on tanker water to meet their resource needs. On three separate visits to this location, which we will call Meadow Enclave, we interviewed some of the lowest income families that we encountered during our research. In the housing block that was the focus of our investigations, all families lived in a single room dwelling. These families were rural migrants, as well – though they came from different villages and spoke either Tamil or Telegu as their first language. Similar to Water Tower Panchayat, most of the men in this housing block worked as auto rikshaw or rideshare drivers. A few of the women worked outside the home, though some found part-time employment washing dishes in local eating establishments or working as cleaners in wealthier homes.

In Meadow Enclave, water is sourced primarily from tankers. The resident-devised system requires each household to purchase tanker water for the entire housing row twice a month. This was reasonable despite the small earnings of the average household since their housing row consisted of only six one-room units – and these units were fortunate enough to have access to their own dedicated sump. This water is then carefully transferred into the home by the bucketload to fill a single 200-litre blue plastic container that serves as each household's indoor water supply. This water is used for washing and cleaning purposes only as residents doubted its quality for drinking and stated that 'children fall sick if they drink that water.' Similar to all the other low-income households we studied, all cooking and drinking water is sourced from 20-litre plastic cans that each home has delivered two to three times a week.

<Insert Figure 4 around here.>

Figure 4: A 20-litre can (bottom left) used for cooking and drinking in a kitchen in Meadow Enclave. Photo by Georgina Drew (2018).

Bangalore is notoriously dependent on tanker water. Day and night, tanker trucks ply the roads to meet the city's water demands, and to fill gaps in the municipal and groundwater supplies (Ranganathan, 2016). Due to the default reliance on tanker water deliveries, the residents of Meadow Enclave were resigned with their water supply arrangements. While they would prefer to receive municipal supplies, living in an informal section of the city far from the municipal water grid kept this dream out of arm's reach. The main problem with tanker water, they explained, is that it is drawn from groundwater aquifers spread across the city – and the quality of resources in these aquifers can vary significantly. Once extracted, the groundwater is stored offsite in dubious conditions such as in large tanks that have not been cleaned or in tankers that have previously ferried greywater and sewage. ~~Another water quality issue is t~~The potential presence of rust in tanker water is another water quality issue. One study done in Bangalore showed that three out of eight randomly selected tankers were shown to be internally rusted due to the lack of a ~~protective n-ethoxylated polythiimine (EPI)~~ coating. This coating is crucial as it ~~which~~ prevents hazardous chemical reactions that can occur between the tanker's metal composition and the salts and metals dissolved in the water ~~that it carries~~ (Reddy, 2019).

Despite the drawbacks of tanker water, a main benefit is that, as a market commodity, the supply can be rather reliable. Reflecting on this, a husband and wife living in Meadow Enclave expressed outright satisfaction with the system. One reason for this is that they use the same tanker supplier each time so that a relationship is built and maintained. This relationship includes a certain degree of trust so that the

occasional payment for delivery can be deferred if money is short. As scholars point out, the trust for tanker water also extends to an expectation that suppliers will not unduly inflate the rates for their service (Ranganathan, 2014). As for the option for payment flexibility, this aspect of the service can be a lifeline for families that live off modest incomes, especially since many of the households relocated to Bangalore ~~primarily~~ as a means of paying debts acquired in their natal villages ~~(-where the options for cash income are significantly less)~~. This creates a circular migration chain (Tumbe, 2018) for several of the householders with whom we spoke. In this chain, families go into debt back home due to crop failures, medical expenses, dowry payments, and even land purchases. They then dedicate themselves to several years of residence in Bangalore so that they can pay off their loans. As soon as these are cleared, they return home because ~~—~~ as one of the women asserted ~~—~~ village life is preferred to city life due to the stronger social networks and relative safety it provides. But as drought or disease or a daughter's marriage inevitably arises once back in the village, the cycle of debt payments begins anew. This circular migration chain is another reason that the water tanker arrangements met little opposition; the tenants of Meadow Enclave have little investment in finding long-term water supply solutions given their short-term residency intentions.

Relative to Sector Sixty and Water Tower Panchayat, the residents of Meadow Enclave exhibited the highest levels of satisfaction with their water system. It bears noting, however, that this was also the enclave with the smallest number of residents, all of whom were among the poorest households we encountered during our fieldwork. This means that ~~the respective everyone households~~ had ~~similarly low levels of~~ low purchasing power, and that no one resident could secure their water at the expense of another resident (as in Water Tower Panchayat). It also merits emphasising that their

water security was contingent on keeping strong relationships with the water tanker suppliers upon which they were highly dependent – more so than in any other enclave. If these relationships were to go into disrepair, such as through a lapse in payment or through unfaithfulness to their primary water tanker suppliers, then retribution via the threat of a halted supply was the primary risk (Ranganathan, 2014). In such a scenario, residents would have virtually no access to alternate sources of water. To mitigate the risk of losing their tanker water supply, residents kept a keen watch on whose turn it was to organise, and to pay for, the rotational management of tanker water. Failure to ~~fulfil~~fulfil this obligation was a major risk to the social cohesion of the six-unit enclave. This risk extended beyond the needs of water provision alone as we witnessed households taking care of their neighbours’ children after school so that parents could avail of off-site jobs. This indicates that social embeddedness in Meadow Enclave was significant to residents’ ability to not just ‘patch’ their water supply, but also to secure the opportunities needed to acquire the financial resources that brought them to Bangalore in the first place. Managing and maintaining strong social relationships, therefore, was important to their water access strategy as well as to the achievement of their economic goals – especially since the municipality offers little support.

***Patchwork adaptability: A response to governance failure***

Our fieldwork demonstrates that low-income households display a remarkable level of adaptability as they enact different strategies for ‘chasing water’ in the face of resource stress (Peloso & Morinville, 2014). This work highlights how, and why, patchwork adaptability operates within the burgeoning settlements of south eastern Bangalore. The efforts we observed are ‘patchwork’ because they involve strategies to piece together diverse types of water from a variety of sources whose availability, and quality, can vary in every repeat transaction. The diversity of the strategies employed is primarily

determined by the pre-existing infrastructural arrangements of each enclave and, secondarily, by the ability of each household to supplement their supplies beyond what any particular enclave's water municipal infrastructures provide. For the latter, the success of the lowest income households relied on word-of-mouth information – which, in turn, required the maintenance of social networks.

The capacity of these residents to adapt, in other words, is not divorced from the social relationships that they share with those in their proximity. This demonstrates the high degree of social networking that is required to secure information about how, where, and when to access water. The reliance on social networks is a core feature of the social embeddedness ([Hess, 2004](#)) of low-income water supply chains – and, therefore, of the economics of low-income water management since economic action is socially situated and embedded (Bögenhold, 2013; Granovetter, 1985). That said, to receive information about how, where, and when to access water comes with an expectation of reciprocity (as Mauss [2000] would remind us based on his work on systems of exchange and ‘gift giving’). Yet, such social obligations can be a major source of stress and concern in everyday life; Research on the relationship between social embeddedness and stress suggests that maintaining social networks can have ~~a~~ ~~an~~ ~~energetic and~~ ~~emotional~~ ~~high~~ cost when it comes to the experiences of underprivileged segments of society (Hyun-soo Kim, 2016, 236). The expectations for reciprocity means that the benefits of leveraging social networks may offer ‘a double-edged sword’ of sorts (Hyun-soo Kim, 2016, 244).

In light of the burdens placed on low-income residents to ‘patch’ the gaps in their water supplies, we assert that the case of water management in peri-urban Bangalore points to the importance of exploring the social responses that arise in response to a resource ‘governance failure’ (Bakker et al., 2008). In Bangalore, as

elsewhere, governance failure is characterised by the inadequate supply of municipal waters to burgeoning settlements combined with a lack of regulation of ~~the~~ informal water markets (see also Bakker, 2010). Not only are the informal markets insufficiently monitored by a regulatory agency, but the quality and quantity of water provided by private vendors is not systematically accounted for (Venkatalchalam, 2015). The lack of regulation also means that the urban poor lying outside of the municipal water supplier's reach pay significantly more than those on the city's water network (Raj, 2013); some estimates, for instance, say that low-income residents pay up to ~~twenty-~~ ~~two~~22 times more than residents on the piped water grid (Meera, 2014). The ~~end~~-result is that when it comes to ensuring adequate water supplies, the low-income populations pay with ~~both~~ their *time and money* in order to make up for the city's governance failures ~~when it comes to ensuring adequate and affordable water supplies.~~

**Commented [AJ2]:** Shall we make it residents or households consistently??

To date, the city's seemingly 'pro-poor' attempts at connecting low-income areas to the formal water supply network have been lacklustre. These attempts included a user-pays model that led residents to receiving water bills that are beyond what they could afford (Walters, 2013, 2016). Moreover, the default financial model tends to favour those with the capacity to pay upfront – which are invariably the better off neighbourhoods ~~—and it is biased against poor neighbourhoods as a result.~~ A study by Ranganathan ~~et al., Kamath and Baidur~~ (2009) found that such efforts, including the Greater Bangalore Water and Sanitation Project (GSBWASP), resulted in severe coping costs, especially for the low-income population ~~poor~~ in the peripheral regions.<sup>3</sup> The authors argue that the project's financial model was disconnected from the existing urbanisation patterns by treating the periphery as a 'homogenous expanse of willing customers' while not factoring in the 'difficult-to-connect slums, villages and tenuously legal sub-divisions' (Ranganathan et al., 2009, p. 54). They also contend that the

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project's highly centralised decision making has resulted in low political buy-in to the upfront contribution system. This once again demonstrates that urban water utilities have not factored ~~into the design of major policy frameworks in the importance of~~ ~~the limited~~ economic ~~capacities of~~ ~~aspects of~~ low-income ~~water supply~~ residents in ~~major policy frameworks.~~

It is the added costs of formal water supplies, combined with the perceived benefits of some aspects of the informal water supply (as seen in Meadow Enclave, for instance), that further helps to explain why the reality of water provision in low-income and developing regions can evidence a mix of overlapping water supply strategies (Bakker, 2003). In some ways, the patchwork efforts we observed ~~also created~~ ~~created~~ a semblance of 'reliability and convenience' (Burt & Ray, 2014, 118) ~~even when the~~ ~~strategies adopted to patch supply gaps were acknowledged as temporally and~~ ~~emotionally taxing. for low income households, even despite the fact that some of these~~ ~~efforts could be temporally and emotionally taxing.~~

### ***Conclusions***

The need to meet current and future water demands constitutes a 'crisis' for burgeoning cities like Bangalore (Goldman & Narayan, 2016). As municipalities attempt to ~~meet~~ ~~bridge various~~ supply-side and demand-side factors (McKenzie & Ray, 2009), the everyday struggles of low-income populations living in peri-urban zones are easily overlooked (Ranganathan et al., 2009; Venkatchalam, 2015; Walters, 2013, 2016). In low-income and well-to-do neighbourhoods alike, ~~tanker water and 20-litre~~ 'bubble can' ~~drinking water and tanker water~~ suppliers have stepped in to fill gaps in the formalized water supply while turning a sizeable profit (Ranganathan, 2014). As a result, the availability of good quality water in Bangalore is unevenly distributed and 'splintered' across the socio-economic inequities of the urban landscape (Graham & Marvin, 2001),

representing governance failures that can result in what Jessop (2019) might term the ‘anarchy’ of the water market. The focus of this discussion has been to illuminate how low-income residents adapt to living in such chaotic and insecure water contexts.

As highlighted in our snapshots of three southeastern neighbourhood enclaves within peri-urban Bangalore, the city’s low-income populations have devised relatively effective water access measures that are adaptive but also inherently patchwork. Their just-in-time measures to patch the gaps in their drinking and household water supplies involve extensive efforts to coordinate water supply measures with other low-income neighbours. While social embeddedness – evidenced by the sharing of information and resources – enables an effective point of adaptation and resilience to water stress (Cleaver, 2002, p. 26), it also comes at a cost to residents. This cost is especially high for women and children ~~in particular because, as~~ they are the main demographic tasked with being home when a borewell opens, a tanker arrives, or a bubble can vendor passes by (Kumar et al., 2018; O’Leary, 2016; Truelove, 2011). When resources are tight, it is ~~also~~ the women ~~and children~~ that are forced to fight over the allocation of borewell and tanker water, and to engage in the stressful emotional labour of repairing social relationships in the aftermath of water-related struggles.

To help address these gendered burdens and inequitable resource management strategies, we contend that the addition of more dependable *yet affordable* municipal water supplies would go a long way to improving the extent of duress that householders experience ~~as an increase in reliable water access~~. Additionally, access to better information and streamlined knowledge sharing about how and when water will arrive could significantly help to reduce residents’ stress levels when it comes to resource provision (Kumar et al., 2018, p. 150). That said, even with government assistance via the provision of more municipal water supplies, it is likely that a mix of formal and

informal water access measures will continue to be found in Bangalore's low-income areas ~~in the near future~~for some time to come. As this discussion showed, some of the informal measures that residents have come to rely upon are seen as cost-effective and advantageous even though they can be time consuming and emotionally draining. This does not mean that patchwork water access adaptations will continue indefinitely; rather, it helps to explain why, even with centralized support, there is likely to be some 'slack' in the transition to formalization (Burt & Ray, 2014, 118). In the interim, as residents wait for forward-facing solutions and state interventions, this study points to the continued viability of socially networked and embedded water supply measures – and it invites their appreciation via research programs that can further ~~elabourate~~elaborate upon the adaptive yet patchy responses evidenced in Bangalore, and in cities where similar strategies are also required.

### **Acknowledgements**

The authors are grateful to the people that participated in this research, without whom it would not have been possible. We would like to also acknowledge Maneesha Sudheer, Professor Sunanda Muralidharan and Jay Mishra for supporting the research, and for helping to arrange Georgina Drew's Research Visa through the School of Business at Amrita Vishwa Vidyapeetham University, Kochi. The authors are also thankful to the anonymous referees for their comments, which strengthened the article.

### **Disclosure Statement**

No potential conflict of interest was reported by the authors.

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## Funding

Funding Details: Georgina Drew would like to acknowledge the generous funding of the Australian Research Council (DE160101178), which made this research possible.

## References

- Anand, N. (2011). Pressure: The politeness of water supply in Mumbai'. *Cultural Anthropology*, 26(4), 542-564.
- Bakker, K. (2003). Archipelagos and networks: Urbanization and water privatization in the South. *The Geographical Journal* 169(4), 123-43.
- Bakker, K. (2010). Privatizing water: Governance failure and the world's urban water crisis. New Delhi: Orient BlackSwan.
- Bakker, K. (2013). Neoliberal versus postneoliberal water: Geographies of privatization and resistance. *Annals of the Association of American Geographers*, 103(2), 253-260.
- Bakker, K., Kooy, M., Shofiani, N. E., & Martijn, E. J. (2008). Governance failure: Rethinking the institutional dimensions of urban water supply to poor households. *World Development*, 36(10), 1891-1915.
- Birkenholtz, T. (2010). 'Full-cost recovery': producing differentiated water collection practices and responses to centralized water networks in Jaipur, India. *Environment and Planning A* 42(9): 2238-2253.
- Björkman, L. (2015). *Pipe politics, contested waters: Embedded infrastructures of millennial Mumbai*. Durham: Duke University Press.
- Bögenhold, D. (2013). Social network analysis and the sociology of economics: Filling a blind spot with the idea of social embeddedness. *American Journal of Economics and Sociology*, 72(2): 293-318.
- Brewis, A., Rosinger, A., Wutich, A., Adams, E., Dronk, L., Pearson, A., Workman, C., & Young, S. (2019). Water sharing, reciprocity, and need: A comparative study of interhousehold water transfers in Sub-Saharan Africa. *Economic Anthropology*, 6: 208-221.

Burt, Z., & Ray, I. (2014). Storage and non-payment: Persistent Informalities within the formal water supply of Hubli-Dharwad, India. *Water Alternatives*, 7(1): 106-120.

Cleaver, F. (2002). Reinventing institutions: Bricolage and the social embeddedness of natural resource management. *The European Journal of Development Research*, 14(2), 11-30.

Drew, G., & Rai, R. J. (2016). 'Water Management in Post-Colonial Darjeeling The Promise and Limits of Centralised Resource Provision.' *Asian Studies Review*, 40(3), 321-339.

Ghosh, S. (2018, July 20). Groundwater stress in Bengaluru like 'overdrawn credit card'. *Mongabay*. Retrieved from <https://india.mongabay.com/2018/07/groundwater-stress-in-bengaluru-like-overdrawn-credit-card/>

Goldman, M., & Narayan, D. (2019). Water crisis through an analytic of urban transformation: an analysis of Bangalore's hydrosocial regimes. *Water International*, 44(2), 95-114.

Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American journal of sociology*, 91(3), 481-510.

[Hess, M. \(2004\). 'Spatial' relationships? Towards a reconceptualization of embeddedness. \*Progress in human geography\*, 28\(2\), 165-186.](#)

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Hyun-soo Kim, H. (2016). Exploring the downside of social embeddedness: Evidence from a cross-national study. *Social Science Quarterly*, 97(2), 232-251.

Jepson, W. (2014). Measuring 'no-win' waterscapes: Experience-based scales and classification approaches to assess household water security in colonias on the US-Mexico border. *Geoforum*, 51, 107-120.

Jepson, W., & Vandewalle, E. (2016). Household water insecurity in the global north: a study of rural and periurban settlements on the Texas-Mexico Border. *The Professional Geographer*, 68(1), 66-81.

Jepson, W., Budds, J., Eichelberger, L., Harris, L., Norman, E., O'Reilly, K., ... & Stoler, J. (2017). Advancing human capabilities for water security: A relational approach. *Water Security*, 1, 46-52.

Jessop, B. (2019). The rise of governance and the risks of failure: The case of economic development. *International Social Science Journal*, 68, 43-57.

- Kumar, R., Post, A.E., & Ray, I. (2018). Flows, leaks and blockages in informational interventions: A field experimental study of Bangalore's water sector. *World Development*, 106, 149-160.
- Mauss, M. ([1950] 1990). *The gift: The form and reason for exchange in archaic societies*. New York and London: WW Norton.
- McKenzie, D., and Ray, I. (2009). Urban water supply in India: Status, reform options and possible lessons. *Water Policy*, 11, 442-460.
- Meera, K. (2014, November 11). 'Should Bengalureans be grateful for BWSSB's water rates?' *Citizen Matters*. Retrieved from <http://bengaluru.citizenmatters.in/should-bengalureans-be-grateful-for-bwssb-s-water-rates-6907>
- Mehrotra, R. (2019, March 13). No water from a tap, but water from a tanker. *Bangalore Mirror*. Retrieved from <https://bangaloremirror.indiatimes.com/bangalore/others/no-water-from-a-tap-but-water-from-a-tanker/articleshow/68382855.cms>
- Mehta, L., and Karpouzoglou, T. (2015). Limits of policy and planning in peri-urban waterscapes: the case of Ghaziabad, Delhi, India. *Habitat International*, 48, 159-168.
- Mehta, V. K., Goswami, R., Kemp-Benedict, E., Muddu, S., & Malghan, D. (2013). Social ecology of domestic water use in Bangalore. *Economic and Political Weekly*, 40-50.
- Nunan, F., & Satterthwaite, D. (2001). The influence of governance on the provision of urban environmental infrastructure and services for low-income groups. *International Planning Studies*, 6(4), 409-426.
- O'Leary, H. (2016). Between stagnancy and affluence: reinterpreting water poverty and domestic flows in Delhi, India. *Society & Natural Resources*, 29(6), 639-653.
- Peloso, M., & Morinville, C. (2014). 'Chasing for water': Everyday practices of water access in peri-urban Ashaiman, Ghana. *Water Alternatives*, 7(1), 121-139
- Polanyi, K. (2001). orig. 1944. *The great transformation: The political and economic origins of our time*, 2nd ed., New York: Beacon.
- Raj, K. (2013). *Where all the water has gone? An analysis of unreliable water supply in Bangalore city*. Institute for Social and Economic Change. <http://www.isec.ac.in/WP%20307%20-%20Krishna%20Raj.pdf>

- Randhawa, P. & Marshall, F. (2014). Policy transformations and translations: Lessons for sustainable water management in peri-urban Delhi, India. *Environment and Planning C: Government and Policy* 32(1), 93-107.
- Ranganathan, M., Kamath, L., & Baindur, V. (2009). Piped water supply to greater Bangalore: Putting the cart before the Horse? *Economic and Political Weekly*, 44(33): 53-62.
- Ranganathan, M. (2014). 'Mafias' in the waterscape: Urban informality and everyday public authority in Bangalore. *Water Alternatives*, 7(1): 89-105.
- Ranganathan, M. (2015). 'Storm drains as assemblages: The political ecology of flood risk in post-colonial Bangalore'. *Antipode* 47(5): 1300-1320.
- Ray, I. (2007). Women, water and development. *Annual Review of Environment and Resources*, 32, 421-449.
- Reddy, R. V. (1999). Quenching the thirst: the cost of water in fragile environments. *Development and Change*, 30(1), 89-124.
- Roy, D., Palavalli, B., Menon, N., King, R., Pfeffer, K., Lees, M., & Sloom, P. M. (2018). Survey-based socio-economic data from slums in Bangalore, India. *Scientific data*, 5, 170200.
- Sekhar, M., & Kumar, M. M. (2009). *Geo-hydrological studies along the metro rail alignment in Bangalore*. Technical report, Department of Civil Engineering, Indian Institute of Science, Bangalore, India, 2009, available online at: <http://bmrc.co.in/pdf/news/IISc-Report.pdf>.
- Sekhar, M., Tomer, S. K., Thiyaku, S., Giriraj, P., Murthy, S., & Mehta, V. K. (2017). Groundwater Level Dynamics in Bengaluru City, India. *Sustainability*, 10(1), 26.
- Sultana, F. (2011). Suffering for water, suffering from water: Emotional geographies of resource access, control and conflict. *Geoforum* 42(2), 163-172.
- Truelove, Y. (2011). (Re-) Conceptualizing water inequality in Delhi, India through a feminist political ecology framework. *Geoforum*, 42(2), 143-152.
- Tumbe, C. (2018). *India moving: A history of migration*. New Delhi: Penguin Random House.
- Venkatachalam, L. (2015). Informal water markets and willingness to pay for water: A case study of the urban poor in Chennai city, India. *International Journal of Water Resources Development*, 31(1), 134-145.

Walters, V. (2013) *Water, democracy, and neoliberalism in India: The power to reform*. London and New York: Routledge.

Walters V. (2016). Urban Neoliberalism and the Right to Water and Sanitation for Bangalore's Poor. In Venkateswar S., Bandyopadhyay S. (Eds.), *Globalisation and the challenges of development in contemporary India* (pp. 171-185). Singapore: Springer.

Wutich, A., & Ragsdale, K. (2008). Water insecurity and emotional distress: Coping with supply, access, and seasonal variability of water in a Bolivian squatter settlement. *Social Science & Medicine* 67(12), 2116-2125.

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<sup>1</sup> Bengaluru is the proper name for the city but in this article we use 'Bangalore' in keeping with the terminology most often used among English speakers.

<sup>2</sup> In contrast to an informal supply, a formal water supply 'usually means piped delivery' that is 'at least partly treated' and is regulated by a utility (Burt & Ray, 2014, 106).

<sup>3</sup> To access Cauvery water, owners had to pay per square metre of each property in addition to the water connection, ranging from \$1340 to \$2680 USD (Mehrotra, 2019). Even then, they were not guaranteed a regular supply.