Ways of storing and using water: Experiences of uneven water scarcity in a water-rich region

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Abstract
Communities in Darjeeling town have been experiencing and coping with water scarcity for decades. Developmental history points towards fragmented governance and inefficient infrastructural interventions, which have led to uneven access to water defined by physical and political aspects at the household level. The outcomes of inequalities are reflected in the coping behavior and the ways of storing and using water. This work draws from urban political ecology (UPE), and it contributes to UPE studies by examining the physical, political, and infrastructural aspects of households in the production of unequal water scarcity. It furthers the need to add altitude while carrying out urban studies in the mountains as a driving factor for water accessibility. This essay is based on fieldwork carried out from 2014 until 2019 in Darjeeling town, which included topic-guided interviews, transect walks, unstructured interviews, document analysis, and household questionnaires.

Keywords
Urban political ecology, domestic water scarcity, mountain towns, household water security, inequality, Darjeeling

1. Introduction

Water scarcity is produced by biophysical, institutional, and political-economic factors that affect populations unevenly (Daoud, 2010; Badiger, Gopalakrishnan & Patil, 2014; Mehta *et al*., 2011; P. B. Anand, 2001; Wolfe & Brooks, 2003). But these driving factors are often ignored when focusing primarily on coping and adaptation to water stress. Among other factors, unevenness of access to potable water is defined by the physical and socio-economic location of the household, landscapes, patterns of urbanization, distance to water sources, and storage capacities (Cohen, 2016 *in* Millington, 2018). Using an urban political ecology (UPE) framework, I place the household at the center of an analysis of unequal access to water in the town of Darjeeling, India. This section begins with a review of UPE studies that assess unequal access to water, water accessibility outside the urban water system, and research in urban India.

Studying uneven water access

Water has been an important focus in urban political ecology, engaging with the production of uneven access (Bartels, Bruns, & Alba, 2018), and its remains central to UPE (Domenech *et al.*, 2013; Mehta, 2011; Mukherjee, 2015; Narain & Singh, 2019; Ranganathan, 2015; Sultana, 2013). The term was coined 20 years ago, defining urban metabolism as dynamic, and formed and reformed by social nature (Castan Broto *et al.*, 2012; Heynen, 2014) and newer studies attempt to imagine the urban outside of 'narrowly construed capitalist relations' and with situatedness in the Global South (Heynen, 2014).

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UPE draws from Marxist thinking, enabling the study of power relations and uneven urban configurations (Ranganathan, 2015; Heynen, 2014; Harvey 2003). Subjectivity, urban space, and infrastructure interact to enable or disable access to infrastructure (Kooy & Bakker, 2008). Differences in access due to socioeconomic and socio-spatial differences have heightened during colonial times (Björkman & Harris, 2018). Political and financial planning of infrastructure affects the social well-being of subjects in communities (N. Anand, 2012; Birkenholtz, 2010; Kooy & Bakker, 2008; Millington, 2018; Sultana, 2013).

Histories of uneven service delivery intersect with infrastructure and technology. The politics of water rationing, or scarcity, has much to do with housing and land use both physically and politically (Cohen, 2016). Physical aspects such as topography and the nature of urbanization determine the availability of water, and socio-cultural and political-economic aspects such as the legality of land ownership affect accessibility (Millington, 2018; Samanta & Koner, 2016).

Beyond the formal network

Lack of basic entitlement culminates in the normalization of scarcity (Mehta *et al.*, 2011), with the failure of governments to provide water, pushing households to depend on a hybridized network of water provisioning systems that can be formal, informal or self-devised (Meehan, 2014). The majority of the urban population in the Global South are located outside the formal network. With the predominance of informality, hybrid and disaggregated systems are receiving attention (Lawhon *et al.*, 2018). This disaggregation moves away from networked to non-networked infrastructure.

Cities in the Global South develop coping mechanisms for scarcity by creating such systems, drawing on technical knowledge as well as their social understandings (Furlong, 2014). In the absence of formal networks, pseudo-municipal systems have evolved, under local community-based organizations or the cantonment of space, that replicate the municipality infrastructure and/or its functions (Shah, 2022).

The presence of a parallel network of pipes, pumps and water storage devices is an indicator of unequal state support (Bakker, 2008), along with the troubled relationships that the communities may have had with an existing formal network (Furlong, 2014). Upstream and downstream issues, which have been seen in the case of irrigation projects, are aggravated in mountainous terrain due to altitudinal variations.

Domestic water storage units and institutions further affect the reach of the state, creating different experiences in more informal networks (Meehan, 2014; Millington, 2018). Storage is an important aspect of water security, especially in the developing world (Apoorva *et al.*, 2018; Burt & Ray, 2014; Millington, 2018; Shrestha *et al.*, 2020), where water storage is pragmatic—it is used when needed (Furlong, 2014). Therefore, ways of storing and consuming water become imperative to understand how communities cope with water scarcity (Birkenholtz, 2010).

Kasper and Schramm (2023) examine water storage and its entanglement with the networked/post-networked city. They argue that storage, as a socio-material aspect of a household, highlights the inequalities faced by different communities (Kasper & Schramm, 2023). The perpetuation of this sociotechnical inequality in water access that enables differentiation needs to be understood within the context of historical and contemporary urban planning (Furlong, 2014).

It is necessary conceptually to move beyond examining the formal network, to capture the realities and the ecological connections between various water sources and sinks, understanding where most of the population acquires water. We need to shift our thinking from focusing on binaries—formal vs. informal or state vs. non-state or networked vs. non-networked—and bring them together to analyze access from a household perspective through the water bundles they create, the storages they have, and the ways of water usage. Frameworks to analyze socio-technical systems in the global North with an apolitical and a 'one-cap-fits-all' stance (Furlong, 2014) will not work. This study, instead, advances scholarly and theoretical discussions on the ways of accessing, storing and using water from an altitudinal highland in the Global South.

Focus of urban water studies in India

Water crises in the face of increasing urbanization will increasingly have adverse and unequal impacts in developing nations such as India, given the pace of urban growth (Biswas, 2006). Most studies critically investigating urban water access in India are based in the four metropolises – New Delhi, Kolkata, Mumbai, and Chennai – and a fifth one, Bengaluru. These studies have provided methodological innovations, and

historical and temporal understandings of urban ecology and water (Mukherjee, 2015; Mukherjee & Chakraborty, 2016). Water supply systems have been assessed vis-à-vis decentralization and private supplies (Allen, Davila, & Hofmann, 2006; Rajashekar, 2015), governance (Connors, 2005), the right to water (Mehta *et al.*, 2014), infrastructural breakdowns (Bjorkman, 2014), and evaluation of projects (Ranganathan, Kamath, & Baindur, 2009). Studies have focused on the creation of unequal access by gaps in planning, design, and policy (Srinivasan & Kulkarni 2014; Srinivasan, Thomas, *et al*., 2013; Vogt, 2021), physical and social locations of communities (Alankar, 2013), and institutions and entitlements (P. B. Anand, 2001; N. Anand, 2012). Nikhil Anand (2011; 2012) and Ranganathan (2014) have furthered the understanding of access to water via the concept of (hydraulic) citizenship.

By 2050, more than 50% of Indians will be living in urban areas, and the maximum growth is projected to occur in smaller towns and cities (Tamang & Jana, 2017). Case studies have moved beyond the metropolises (Narain *et al.*, 2013; Shaban & Sharma, 2007; Tanner *et al*., 2009). There are also multiple site-based studies on water access through water vending machines (also known as water ATMs) in Bhubaneshwar (Schmidt, 2020), storage and informal water sources in Hubli-Dharwad (Burt & Ray, 2014), water collection practices in Jaipur (Birkenholtz, 2010), religion and water access in Ahmedabad (Mawani, 2019), socio-institutional studies in Bailhongal (Badiger, Gopalakrishnan, & Patil, 2014), and household-level water estimation in Coimbatore (Apoorva, Biswas, & Srinivasan, 2018), among others.

Water scarcity in the Indian Himalayan Region has also been studied (Barua *et al.*, 2014; Kelkar *et al.*, 2008; Munsi *et al.*, 2006), with some research looking at water accessibility from an urban political ecology framework through peri-urbanization (Narain & Singh, 2019), environmental justice (Domenech, March, & Sauri, 2013), a demand-supply gap (Samanta & Koner, 2016) and a gendered framework (Joshi, 2014).

The water crisis in Darjeeling town, my primary study site, has also been studied extensively (Basumajumdar, 2016; Bhutia, 2014; Drew & Rai, 2016; Ghatani, 2015; Khawas, 2002; Lama & Rai, 2016). The urban political ecology framework implemented by Samanta and Koner (2016) in their study of water scarcity in Darjeeling town sheds light on informal and illegal private water markets, economic marginality, material inequality, and 'water paranoia.'

The article proposes and illustrates a bottom-up approach to an urban political ecological understanding of the manifestation of uneven water scarcity, focusing on the intertwining of the biophysical, administrative, and legal spatiality of households (Millington, 2018). This article develops the need for the second generation of UPE to understand the definition of water accessibility outside the capitalist relations of the state and the market (Heynen, 2014) by centering on households.

The article is structured as follows. I begin by locating the eternal water question of Darjeeling town. Darjeeling as a case sits in a cold, mountainous landscape. The methods follow. For the discussion, I begin by arguing that the interactions of the physical and political characteristics produce unequal water scarcity and impacts. I then explore the role of household-level water storage in further perpetuating inequality, and the use of dynamic storage as a coping mechanism.

2. Darjeeling's water question (*paaniko prashna*)

The mountains are the water sources of the world, feeding streams and rivers that eventually flow into the oceans and the seas. However, the communities in the mountains primarily depend on springs, which are groundwater sources. Springs, unlike groundwater that can be extracted but cannot be created, have self-emergent characteristics. Ecological connections due to the topography of the mountains between springs and the formal and informal supplies are evident from gravity-based water supply (Furlong & Kooy, 2017).

Darjeeling municipal town, my primary field site, geographically falls in the Eastern Himalayan region, which receives an annual rainfall ranging from 2,500mm[4] to 4,000mm, making it one of the most 'water-rich' regions of the country. Using this definition of 'water-rich', which looks solely at the amount of precipitation received, it is paradoxical that most hill towns and settlements face water scarcity for a greater part of the year.

The town was set up as a sanatorium for British soldiers during colonization (Bhattacharya, 2013). Patterns and remnants of colonization still exist. Being a colonial town, the segregation between the upper colonial and the lower native towns can be teased apart. Recent settlements emerge as additions to the lower

[4] Millimeters

neighborhoods (Brown, Ganguly-Scrase, & Scrase, 2016). There are also settlements built out of accumulated discarded soil from other parts of the town, such as *Man Pari Busty*.

Darjeeling and also Kalimpong are the two hill districts in West Bengal, which is otherwise comprised of plains (Figure 1). They have been embroiled in a separate statehood movement for around 100 years (Chettri, 2013), with agitations occurring in 1986, 2007 and 2017. Each time, protests have led to the formation of an autonomous territorial council, currently the Gorkha Territorial Administration, a semi-autonomous body that succeeded the Darjeeling Gorkha Hill Council.

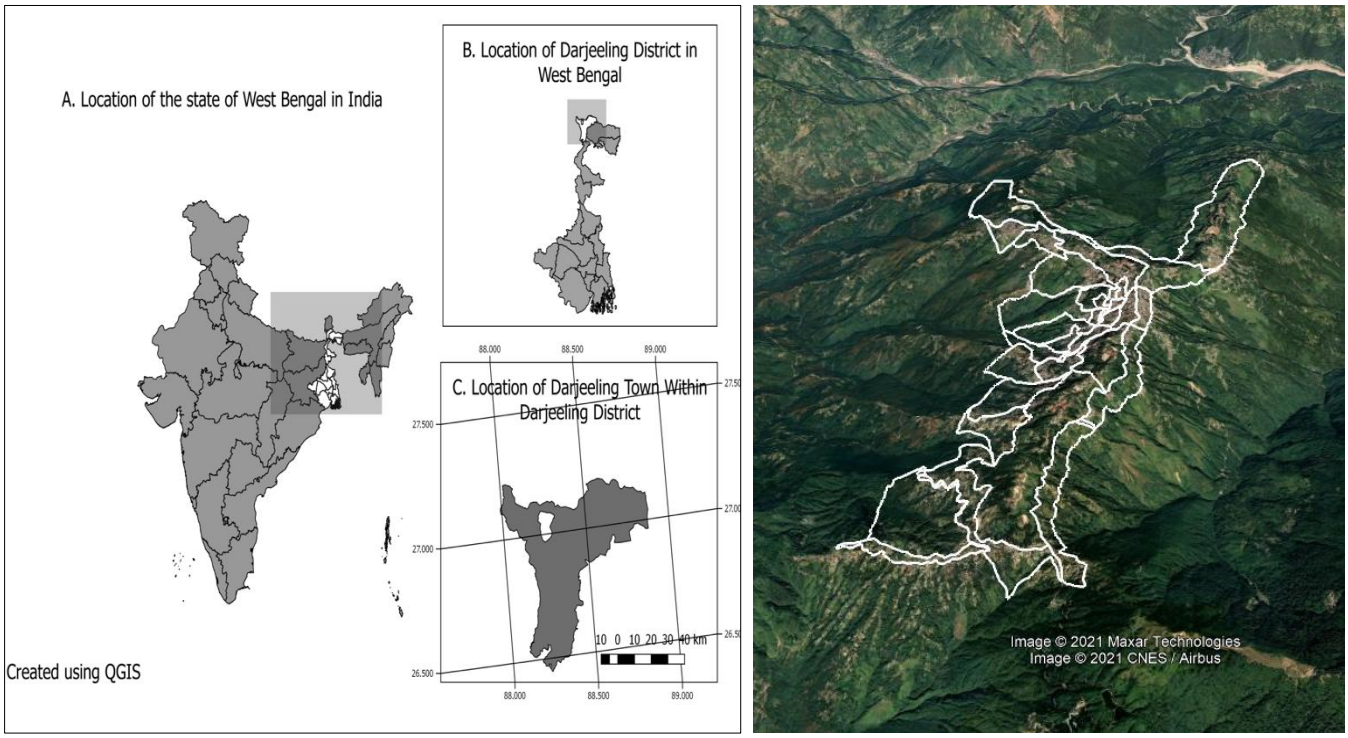

Figure 1: Darjeeling Town. Illustration by the author on QGIS and Google Earth

Darjeeling has 32 wards spread across 10.75 square kilometers. The permanent population stands at 120,000 (Census 2011) with a floating population of 20,000-30,000 people. It is one of the densest mountain towns in the Himalayan Region (Munsi *et al.*, 2006). It is physically restricted since it sits on a ridge surrounded by either tea plantations or forests. There are two large cantonments within the town that occupy a large area and contribute to the waterscape (Shah 2022).

Darjeeling has 88 slums and informal settlements in 24 wards. Slums in the hills are not contiguous and are scattered, which makes it difficult to define them according to the standard Indian definition (Khawas, 2003). Despite being notified slums, Darjeeling slums neither have water nor sanitation facilities. There is a definite overlap between the total BPL (Below Poverty Line) population and the slum population.

The Water Works Department of the Darjeeling Municipality is responsible for providing water to the residents of Darjeeling town (Shah & Badiger, 2018). The Municipality gets its water from the two water tanks – North and South Lakes – located in the Senchal Wildlife Sanctuary. These lakes are fed by springs and streams within the Sanctuary. The water is transported to Rockville and St. Paul's supply tanks[5] and then through private household connections (2,145 in number), commercial connections (144) and public hydrants (standpipes)

[5] As of today, a revamp of the system is being carried out by increased the supply sub-tanks under the AMRUT (Atal Mission for Rejuvenation and Urban Transformation) scheme (Municipal Affairs Department Government of West Bengal, 2017).

(400).[6] This makes up only 15% coverage of households under the municipality supply distribution. Water supply frequency is one to three times a week, depending on the season and the amount available in the supply reservoirs.

The municipality has neither been able to keep up with demand, nor provide better coverage of their supplies to the town. For the former, investments to the tune of several million have been made (Rasaily, 2014; Shah, 2023). However, only a handful of the projects are functional. The difficulties in implementation can also be attributed to the multiplicity and hybridity of institutions, creating fragmented governance (Shah & Badiger, 2018).

Low coverage and intermittent supply from the municipality push most of the households to seek water from other sources, namely springs and private water supplies. High costs and the proof of legality required to apply for municipal connections discourage communities from even applying for them.[7] The water bundles of the residents are made up of water from private municipal connections, public hydrants, private water suppliers, and natural springs. The dominant and prevalent water source are these different kinds of private water suppliers (Shah, 2023).

Darjeeling has been facing water scarcity since the 1990s. This was also the time when water tankers first made an appearance. Now, there are close to a hundred privately owned tankers that supply water to houses, businesses, and government buildings. Around 60% of the households depend on springs by visiting them or drawing water into their households. The households carry out the tasks themselves, hire labor, or pay a middleman. The plethora of arrangements highlights the efforts households need to make to secure the basic quantity of water they need.

Delivery of safe drinking water is one of the characteristics of good governance, which pushes a government towards further development (Sultana, 2013). However, in the case of Darjeeling, the unwillingness of the state fragmented governance have exacerbated water crises. Municipality water supply covers only 15% of the households (Shah & Badiger, 2018). The NSSO (National Sample Survey of India) 69th Round on *Drinking water, sanitation, hygiene and housing condition in India* states that 95% of the households in Darjeeling district are water water-sufficient (Ministry of Statistics & Programme Implementation, 2014; Shah, 2015). But with public tap/standpipes, unprotected wells, tube wells and borewells as the primary water sources, they fail to recognize springs as a primary source of water.

3. Methods

I undertook a qualitative and quantitative mixed methods approach (Wutich *et al.*, 2017) with fieldwork conducted between 2014 and 2019. I carried out topic-guided interviews, transect walks, unstructured interviews, document analysis, and household questionnaires in Darjeeling town. For topic-guided interviews, my interviewees included former and current employees of water institutions and organizations. I also interviewed tanker drivers, researchers, and practitioners. Undertaking transect walks was essential to understanding the layout of the town and capturing its socio-spatial aspects. During this process, I recorded the wards, water sources, and walking tracks. Unstructured interviews with the communities took place during the walks. For document analysis, I relied on water management and development schemes, state project reports and pamphlets, schemes commissioned by the national and regional government, newspaper reports, water connection forms and the Government of India Planning Commission Reports. Additionally, I studied the notifications, rules, Acts and frameworks issued by the Government. These documents were either available on government websites or the interviewees shared them from their personal records. Snowball sampling was used to gather primary data, and secondary data were gathered from official municipal reports, government documents, and the literature. I took daily field notes, which provided insights and directions for in-depth discussions on the field and subsequent analysis.

With preliminary analysis from the transect walks and topic-guided interviews, I began with a pilot household questionnaire adapted from the ASHWAS (A Survey of Household Water and Sanitation) project

[6] The numbers are as of 31/10/2011.

[7] The water connection fee is INR 17,000/35,000 depending on urgency [approximately US$203/US$419]. Plus, there are additional material and labor costs which brings the total to INR1-1.5lakh [US$1,197-US$1,795]. Three documents (1) *Khatian* (a record of rights) (2) Land registration documents and (3) Mutation documents from three different departments – Land Reforms, court and municipality respectively – are required just for an application (Shah 2015, 2023).

under *Arghyam*.[8] Variation in water supply noted from the preliminary analysis, followed by the pilot questionnaires, emphasized the spatial factors of center-periphery and altitude as the driving variables for the stratified random sample for implementing household questionnaires. The center-periphery is acknowledged in understanding inequality in cities (Cleaver & Elson, 1995), but altitude became an important variable for this town located in the mountains. I was able to carry out 149 questionnaires in 29 out of the 32 wards. I was supported by students from St. Robert's School, Darjeeling for the last few questionnaires. This analysis was carried out in Microsoft Excel and mapping was done in QGIS.

4. Uneven access to resources defined by physical and political aspects

All those who are driving into the town or taking the famous Toy Train of the Darjeeling Himalayan Railway enter from the south along the national highway on the western slope. On the ride, one will encounter bunches of PVC (*polyvinyl chloride*) pipes hanging across the roads, laid along the railway tracks, and jostling for support on poles with a few stray ones here and there (Figure 2). The closer one comes to the town center, these pipes disappear. One sees GI (galvanized iron) pipes, which are much fewer in number than PVC ones. The GI pipes are denser within the higher altitude of the town center and disappear as one moves down the slope towards the outer urban limits.

The explanation is that the municipality has historically used GI pipes, and the private water suppliers use PVC. Under the AMRUT (Atal Mission for Rejuvenation and Urban Transformation) scheme, newer connections or replacements are gradually being made with bright blue PVC pipes (Municipal Affairs Department Government of West Bengal, 2017).[9] The presence and density of the GI pipes act as an indicator of municipality coverage. The PVC pipes are used by private suppliers and households from the springs within the town. Their eye-catching presence highlights the predominance of 'alternative' water sources (Furlong, 2014). In Darjeeling, the alternative is fast becoming mainstream since a majority of the households reported private water suppliers as their primary water source.

The visual appearance of the pipes sheds light on the water supply during colonial times, where private taps were designated by the municipality for the colonizers and with public supplies for the natives. Transect walks and household questionnaires showed that many of the public taps today are in designated slums, denoting further segregation. Public taps are the only way in which these areas can get access to formal water supplies since the residents do not have sufficient documents or capital to even apply for a municipality connection (N. Anand, 2012). Proving one's legality via three supporting documents from the Land Reforms Department, the court, and the municipality is impossible for households in the slums (Shah & Badiger, 2018).

Water sources at a house or within a compound eases access. By comparison, water availability at public sources is inversely proportional to the number of people dependent on it. The low frequency of water supply and more users means that some households get access only after 16 days (Household Questionnaires, 2019).

The mountainous terrain makes altitude a significant variable that affects socio-spatial segregation (Molden *et al*., 2014). Darjeeling is surrounded by state and private land, including forests and tea plantations and has two cantonments (permanent military installations) located within its municipality boundary. With a 10.75 square kilometer area, there is little space for expansion; urbanization takes place vertically and there is encroachment on public lands and properties, while households extend in the lower ends of the town (Ganguly-Scrase and Scrase, 2015). Such expansions tend to be informal, rendering them ineligible for formal private water connections.

[8]See: https://admin.indiawaterportal.org/sites/default/files/iwp2/ASHWAS_Process_handbook__A_planning_and_execution_guide_for_participatory_surveys_of_household_water_and_sanitation_Arghyam_2011.pdf

[9] These changes are happening currently, and were not present during my fieldwork.

GI Pipes

PVC Pipes

Figure 2: GI and PVC pipes in Darjeeling town. (Images by the author, 2018)

Springs are the major sources of water for the communities, private water suppliers, and also for the municipality. The presence of springs is vital to a household's water security, especially for those who do not have any other supply to depend upon. The physical environment (topography, nature of urbanization and presence of springs) and political factors (legality of land ownership) have led to the creation of clusters for water access (Figure 3). Each of these clusters has a unique combination of sources that make up their water bundles.

The Southern cluster sits around Jalpahar (mountain of water) cantonment, the highest point in the municipality. Here, we find the highest concentration of PVC pipes, which draw water from springs that are owned, bought, or rented by the households, a supplier, or the cantonment. They are also dependent on municipality sources and tanker trucks. The springs are located in the forests, in the upper reaches.

Lebong, the other cantonment, is located in the northern cluster. It makes up the right arm of a Y-shaped ridge. The households here are dependent on tanker trucks throughout the year. They are located farthest from the sources of the tanker trucks, with high chances of them being 'kidnapped' by others on their way to the locality. Municipality supplies are low and in the form of public taps, which reduces water availability for the households. The tanker trucks are more expensive than the municipality supplies. Springs are mostly located below the residential areas, which increases their travel time on their way back. Private water tankers are a regular feature of their water bundle, although for those in the south, they are called upon only if all other sources fail.

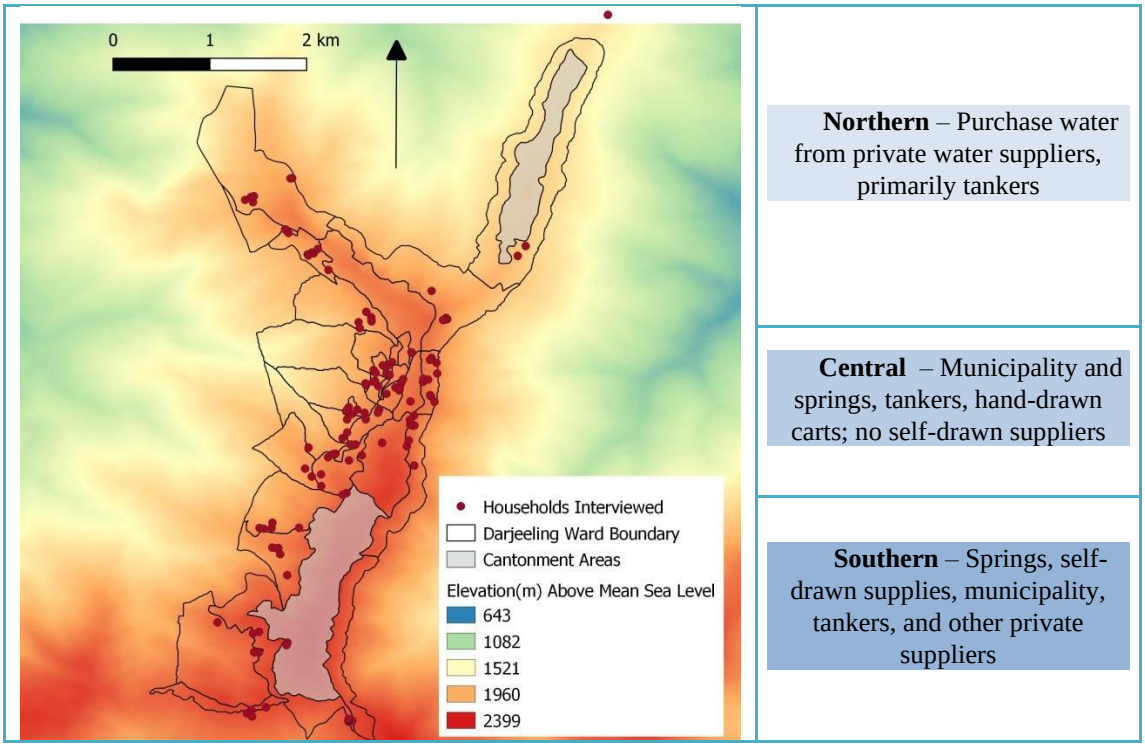

Figure 3: Clusters of water access in Darjeeling. (Image by the author, 2019)

As of 2011, the town cluster housed 65.73% of the municipal individual connections, the north housed around 23.45%, and the south around 10.82% (Darjeeling Municipality, n.d.). The town center has the highest concentration of municipality supplies, affirming the disjuncture between urban center and periphery. It is also located closer to the municipality offices, where grievances are lodged (Portnov, Adhikari, & Schwartz, 2007). The PVC supplies are non-existent here due to the lack of water sources to draw from, as there is hardly any forested area since it is a built-up commercial center. Hand-drawn carts supply water to shops and houses due to the compact nature with heavy traffic of people and cars.

The physical and socio-economic location of households affects the accessibility of water sources (Burt & Ray, 2014). Households create water bundles from the sources that are available, affordable, and preferred (Shah & Badiger 2018).

5. Ways of storing water

Due to the infrequent and intermittent water supply, water access is defined as much by the ways of storing water as by the network of pipes (Kasper & Schramm, 2023; Apoorva, Biswas, & Srinivasan, 2018). Storage infrastructures at the household level also determine their ability maintain access to water, creating differential experiences of water scarcity (Burt & Ray, 2014).

Household storage acts as an important variable in choosing private water suppliers where choices exist. Households acquire water from sources that match their storage or are flexible enough to meet their requirements, usually obtaining smaller quantities. The water tanker truck, the predominant private water supplier, has a 6,000-liter capacity. Due to limited household storage space, which rarely exceeds 1,500-2,000 liters in volume, small households cannot order water from such tankers. In areas where water tankers are the only available option, 3-4 houses come together to order a 6,000-liter tanker. Respondents also described instances when the tankers provide water to those in need or simply discharge it into drains when customers do not have enough storage.

Due to a lack of storage, especially for those in rented accommodation, residents have to visit public sources more than twice a day during severe water crises, increasing their opportunity costs. Socio-economically weaker households depend on public resources, leading to low water availability (P. B. Anand, 2004). The dependence and preference for public sources exist because they involve no monetary investments. "How much can you buy and use?" they say. In the case of Darjeeling, the public sources are either community springs or public taps. Such dependencies are also uncertain, especially in the case of municipality public taps, due to unreliable supply timings and duration, and the availability of labor to fetch water. Households depend on leakages from municipality pipelines too. Despite all the hardships and uncertainty, households are compelled to purchase water during times of stress.

Tenants also lack storage space for water, affecting the amount they can fetch at one time. This increases their visits to their sources, adding further burden. When deciding to rent a house, tenants need to weigh the tradeoff between those with water availability and the proximity to their workplaces or colleges. Those who cannot afford suitable accomodation have to spend time and effort collecting water. People living near springs make weekly day trips for washing, taking their lunches along, making it a picnic.

During the rainy months, all households collect rainwater using ingenious methods. The households expressed that they need more storage for rainwater harvesting for sustained use. During the winters, the supply from the municipality increases, but they lack storage to keep it. Households in the southern cluster have private water sources but no cisterns or containers at their homes. In the town center, where houses are just one-room kitchen sets, storage spills over onto walkways and stairways (Figure 4).

In sum, house size and ownership determine the storage capacity of individual households, pushing the marginalized further into more expensive setups for acquiring water, in terms of time and labor.

6. Dynamic storage defined by usage

Households use separate storages for different kinds of water—municipality, private suppliers, springs and rainwater, and have preferences for assigning water to particular purposes. They follow the First In First Out (FIFO) system, determined by the time and day they have collected the water, to circulate it in their vessels and insure none is empty. A better-off household located close to the water supply tank in the upper part of the town has a tank with a pump for emergency purposes and a washing space in the bathroom with a 50-liter tank. Another household has 100 liters of drinking water and 200 liters of water for washing clothes. Segregation is done so that rainwater can be collected in the 200-liter storage meant only for washing; it also has a tap attached for ease of use. One household stores water in 15-liter containers and an additional 2-3 jerry cans for drinking water. Drinking water is segregated and kept safely since they feel that rainwater stored over time is not good and any water stored over time makes them sick. Rainwater is also used in toilets.

Storage capacity is made up of buckets, pots, and jerry cans which range from 10-20 liters and drums of 80 liters. Most of this storage is within the household or on their veranda or staircases, wherever there is space. Bigger plastic storage units popularly called 'sintex', a company which manufactures them, are installed on the rooftops. Most households use water by dipping a cup or a mug into the storage unit. Some storage units have taps attached. Where tenants are renting, they usually have separate storage dedicated to them. This also works for dipping and drawing water, with no tap connection. Storage vessels, where accessible, are cleaned when they become mossy. The water used here is reused for plants and toilets. Some people don't wash them.

Lack of storage and hence water availability forces households to keep guests at bay, creating uncomfortable situations. There is a defined behavior when dealing with people from outside the community, where interviewees mentioned that they felt scared when guests or even their children who had been living down on the plains came home. Water consumption is much lower in Darjeeling than on the plains, where water is used lavishly. Even though households agreed upon the insufficiency of water, they also said they have to make do and manage with what they get.

Figure 4: Water storage units in walkways. (Image by the author, 2019)

The article has illustrated some of the multiple interactions that occur daily to acquire a basic quantity of water. There are geographical, altitudinal, and sociopolitical dimensions to water access. Focusing on the household level in terms of social and physical location, administrative and legal spatiality, and their everyday practices of water acquisition, storage, and usage,

Mountains in India are viewed as a bountiful resource, but this contrasts with the marginalization they face politically, environmentally, and economically. Strides in rapid urbanization make them ill-prepared with low-functioning public services. Patterns of urbanization differ from one mountain town to another, with houses being added to the lower parts of the town or over the few available public spaces. The article has shown that the creation of scarcity involves factors beyond the visible capitalist relationship between the state and the market, by focusing on the household. Focusing only on state-provided water access misses out on the majority who operate outside it. The addition of altitude as a necessary spatial variable to understand mountain landscapes also disturbs spatial theories of urbanization (Furlong & Kooy, 2017). The placement of the study site offers a Global South perspective on the water problems of an altitudinal highland, breaking up the notion of a homogenous 'urban' south (Bakker, 2003). The capacities of households in Darjeeling to negotiate effectively given their limited resources determine their levels of access to basic utilities like water. It is also true that markets for water have innovated to profit from the failures of the piped municipal water system to

reach all households. This suits the needs of private enterprises who match services to the socio-economic and physical characteristics of the household.

In this reading of water provision in Darjeeling, the household is a political space where its spatial location determines legality, determining the access to institutions and infrastructure to gain access to basic services. The prevalence of parallel networks is evidence of unequal state support. This inequality is exacerbated by household infrastructural characteristics, in the form of domestic water storage capacity. Households from socio-economically weaker backgrounds or those unable to establish the legality of their residence are neither able to apply for municipal private connections nor buy water from private water suppliers. Households in the upper parts of the town center have a historical advantage, which has continued to this day with the municipality providing good water coverage and frequency. The lower parts of the town center and those outside it have much less access to municipality supplies and make do with private water suppliers most of the time. The small size of most households prevents them from getting water from cheaper but larger volume suppliers, forcing them to purchase more expensive smaller volumes. They are further disadvantaged if there are no springs or public taps they can depend upon.

Tenants are usually the most disadvantaged, as they are at the mercy of the landlords for water, and are lucky if it is provided. In many cases, they must fend for themselves. They use a variety of water storage units. Drinking water is kept separate from the water meant for other uses and they believe that storing water for long periods makes it bad. Tenants and households with no individual connections need to spend more time at public sources to secure significantly smaller volumes of water. Families have to decide whether they should consume from a dirtier source which is closer, or a cleaner source that is farther away (Personal Communication, 2024).

7. Conclusion

Darjeeling town has been facing water scarcity for decades. Its developmental history highlights the multiplicity of institutions that create fragmented governance. However, few studies have looked at it from an urban political ecological perspective. I used this framework to understand the production of scarcity, placing the household as my site of inquiry. Unequal access to water is defined by the biophysical and political aspects of a household, which is further complicated by infrastructural interventions and household storage characteristics.

Studies of urban areas have considered a center-periphery division as the spectrum of the 'haves and the have-nots.' This two-dimensional spatial understanding is insufficient to understand water scarcity in mountainous landscapes. Additionally, springs, unique groundwater sources with emergent characteristics and unpredictability to weather and natural hazards, are the primary sources of water for the mountains. Hence, unpacking water scarcity needs to consider the biophysical uniqueness of the region.

Legality is seen as a barrier or a push towards informal water suppliers since the majority do not have the necessary documents to gain access to state supplies (Hofmann, 2014). In this sense, the location of the household becomes a political factor that defines the kind of access they have to water sources. Difficulties due to the geographical and economic factors mentioned above have made around 85% of the households of Darjeeling depend on informal water sources. Even the remaining 15% do not solely rely on formal sources, highlighting the inefficacy of the state supply system.

Household infrastructure furthers the inequality of access. Storage is an important aspect of water security in towns and cities in the Global South, as this case shows. Variations exist between different geographies, different levels of urbanization, and different socioeconomic groups. Due to the density of the town, not all households have the space for water storage. Small households have minimal to no storage and have to collect it repeatedly, reducing time for other activities. The smaller the volume of water supplied, the more expensive it gets.

In conclusion, water scarcity alleviation initiatives need to consider the social and spatial location of households to improve the access and availability of water to the households.

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