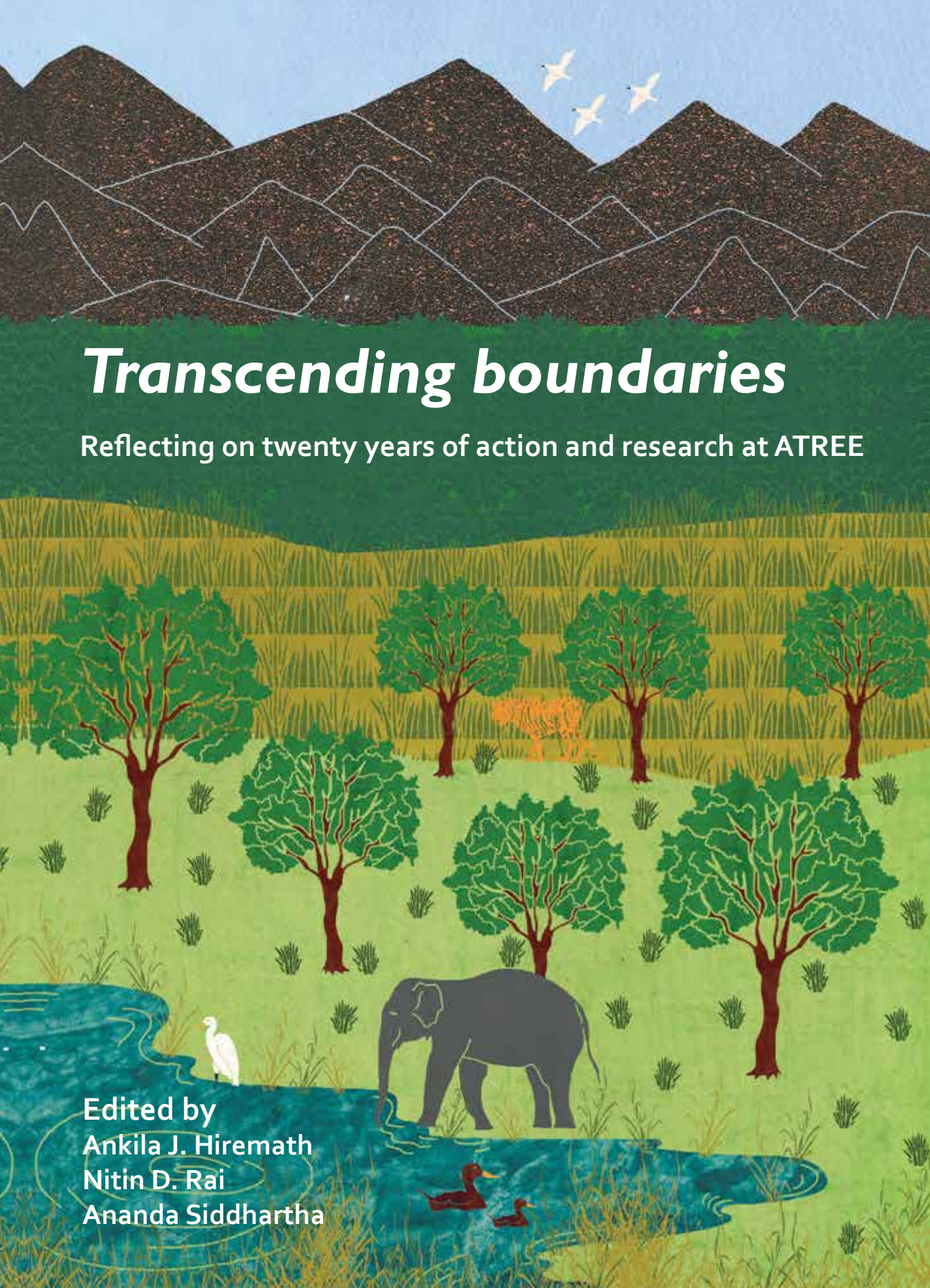

Transcending boundaries

Reflecting on twenty years of action and research at ATREE

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THE URBAN WATER PROBLEM

Urban regions in India are experiencing an unprecedented growth in population and income, and providing safe, adequate, and affordable domestic water continues to be a challenge. Although 90% of urban households in India have access to safe drinking water, households in 22 out of the 32 big cities in India face frequent water shortages[1].

Currently, the international 'ideal water system' that urban water agencies aspire to achieve is '24/7 water supply', i.e., water that is supplied through pressurised pipelines to households throughout the day. In the western world, 24/7 water supply is considered the gold standard in civil engineering design. Cities are tapping into water sources further and further away, building large reservoirs to store water. Water is transported via massive pipelines to centralised treatment facilities, where it is treated to potable quality, and then distributed through pressurised pipelines to households. Because the pipes are fully pressurised, sewage or groundwater does not seep into them, and the water utility is able to effectively control the quality of water delivered. Households are charged for the services provided based on their water meter readings. The utility is able to recover the cost of supply, and is able to maintain and expand infrastructure in the long run. In such systems, because households receive high-pressure, good-quality treated water in their taps round-the-clock, there is no need to store water in buckets or in underground sumps. In the USA, in 2010, for example, 86% of the total population received water from the public supply system, and only a small fraction of the population (14%) depended on their own domestic wells.

Under such a system, water supply to the household is not constrained in any way. Water agencies are able to supply as much water as households need at the prevailing water tariff structure. Households can use as much water as they want as long as they can pay for it. They do not need to resort to any other source of water. On the flip side, significant changes in the price of water can influence the way households use water. In other words, the water tariff (based on the meter reading) can regulate the water use behavior of people. The link between the price of water and its use at the household level is therefore straightforward.

In India, however, such a system has not worked. Faced with highly variable and uncertain rainfall, limited reservoir storage, an aging piped network infrastructure, poor cost recovery, and rapidly growing demand, no Indian city today has 24/7 water supply. Instead, piped supply is intermittent—available for only a few hours each day with variable pressure and quality. Consequently, cost recovery from the households is low, which in turn leads to a low level of reinvestment in domestic water infrastructure. This situation is strikingly different from that in other Asian countries where 24/7 water supply has been achieved in at least some major cities.

Many urban households in India that have in-house water connections also depend on private sources such as borewells, water vendors, etc., to supplement their piped water supplies. In reality, households effectively get water 24/7 in their taps by collecting water in a local storage structure, either at the household, or at the apartment-block level. The water is then pumped using motor pumps to overhead tanks, from where the water flows into the households' taps. If the water stored in the overhead tanks is of sufficient quantity, then the household can get high pressure water supply any time of the day without needing to store it in buckets or pots.

[1] Households access to safe drinking water. https://data.gov.in/catalog/households-access-safe-drinking-water. Accessed January 3, 2017.

Most cities in India do not have metering. Instead, water agencies charge a flat-rate tariff regardless of the quantity of water used. Most Indian water agencies recover barely a fraction of the cost of supply. As a result, the existing piped infrastructure is poorly maintained and leaky. In some cities, only half the water brought from reservoirs hundreds of kilometres away eventually reaches end users. Some scholars have termed this situation of poor cost recovery, an unreliable supply, and a crumbling infrastructure as a 'low-level equilibrium'.

Additionally, many households do not have access to in-house connections at all. The public water supply situation is even more precarious in the case of socio-economically weaker sections of the city and slum dwellers, who receive poor quality intermittent water supply delivered through public standpipes. These households tend to collect water from various formal and informal sources and store it in pots and buckets for their daily domestic use. Studies show that slum dwellers are left out of the public water supply system, either completely, or almost completely, and have to turn to expensive private sources such as water vendors. Even when they are given 'free water', they often have to pay some forms of bribes ('tips') to linemen, public water tanker drivers, and others to access public water.

DEBATES ON URBAN WATER SUPPLY

The main ongoing debate in the urban water sector is whether Indian cities should follow the Western model of 24/7 water supply, or evolve an alternative model more suited to local conditions. If the latter, what might such a model be?

Proponents of 24/7 supply point out the health benefit of high-quality water, along with the reduction of losses through pipeline leaks, and improved financial viability of the water utility in the long-term. They argue that many Indian cities, like Delhi and Mumbai, actually have enough water resources to supply every single citizen 100–150 litres per capita per day (LPCD), and the true problem is not resource scarcity but pipeline leakage. They believe that charging people the cost of water will ensure that households are responsible about water use. In fact, they argue that it can benefit the poor and the women, who are the worst hit by the need to store and collect water. Further, they contend that a basic lifeline amount can be supplied free of cost through targeted subsidies, so affordability should not be a concern.

A public drinking water tap next to a flowing open drain in a Coimbatore slum. (Photo: Durba Biswas)

Opponents of 24/7 supply argue that charging people the full cost of water, in a highly unequal society, will lead to the rich (who can afford to pay) capturing most of the water at the expense of the poor. They point out that figures of available water are grossly overestimated, because they only consider the populations of cities that currently have access to piped supply, not the unserved (often poorer) peri-urban populations. In an era where water resources are fully allocated, new reservoirs or water transfers to urban areas must deprive either farmers or ecosystems of water. If 24/7 water supply becomes a norm, water resources will be allocated to the wealthiest cities first, while smaller towns and villages trail behind, waiting for their share. Moreover, pipeline leakage-fixing projects have yet to yield tangible benefits, as they often lack transparency in the manner in which funds are allocated and used, and end up as a bottomless sink for tax-payer funds that benefits the utility-politician-contractor lobby. Finally, opponents argue that water pricing cannot actually control demand as effectively or equitably as a combination of rationing plus local storage, and the goal should be to rely on a mix of local and imported sources.

The problem is that, while some of these arguments stem from differences in normative concerns (efficiency versus equity versus sustainability), many of these differences stem from different beliefs about user and system behavior, which cannot actually be resolved in the absence of solid empirical evidence. Can water pricing effectively constrain water use so the city's total water use does not exceed the available water resources? On the face of it, this question may seem to be a simple economic one. A deeper investigation, though, reveals several layers of assumptions that must be uncovered in order to answer it: that households 'know' the price of water, that the person paying the bill is the same as (or can effectively control) the persons using the water, that price is a relevant, or even an important factor in constraining water use, and that the burden of procuring and/or paying for water is equitably distributed among all household members. ATREE's research in urban water has been aimed at unbundling some of these complexities.

LESSONS FROM ATREE'S WORK ON URBAN WATER SUPPLY AND USE

There are limits to imported water, but local alternatives exist

The central question of 'is there enough water for everyone' persists. Given the increasing urbanisation and growth of population, there is an increasing scarcity of river water. Not only is it expensive to import water to cities by transporting it over long distances, far from the cities themselves, but river water itself may be insufficient to meet all household-level demands.

Coimbatore, a city in Tamil Nadu, offers a glimpse into what an alternative to complete dependence on imported river water would look like. Coimbatore currently uses a unique 'dual source' water supply system—the water agency supplies locally procured groundwater along with imported river water. Water (of different qualities) from these two sources may be supplied through the same piped system on different days, through different piped networks, or it may be blended. Local groundwater is typically hard and saline, and is therefore considered to be of an inferior quality. Nevertheless, it is typically used for mopping, washing

A woman carrying water from a public drinking water tap in a Coimbatore slum. (Photo: Durba Biswas)

clothes, and for toilets. Imported river water is considered 'sweet', and of superior quality, and is generally used for cooking, drinking, and whenever possible, for bathing. Although the frequency of supply of river water varies widely across the city, the frequency of groundwater supply is fairly good. Interestingly, the city's water utility seems quite effective in compensating for the differences in river water supply in different parts of the city, by augmenting with groundwater. In spite of significant differences in supply of 'sweet' river water, the total water supply is remarkably equitable.

There are opportunities to reallocate water within cities

Secondary data across cities in India show vast differences in water use within cities. Generally, older (often wealthier) parts of the city have shallow water tables as groundwater is not used and piped water use is high, whereas newly added areas get very little piped water and rely significantly on groundwater. Ironically, because water supply pipelines tend to leak and recharge groundwater, the core areas of most cities also have plentiful groundwater supply. This creates severe inequities in water availability between the core and peripheries of the cities.

In theory, it should be possible to distribute the available water resources more evenly, and encourage the older areas to recycle, or use local groundwater. In practice, communities tend to exert political power, or simply bribe linemen to hold on to their allocations. However, transparency and awareness may create opportunities to reallocate water more equitably within cities. Such a policy of reallocation can be an alternative to the 24/7 water supply system.

Understanding households' response to pricing is extremely challenging in the absence of data

The question of whether households respond to price signals remains very difficult to answer. A significant number of the households (60%) in Coimbatore are not metered at all, and even those that are have defunct, or tampered meters. In cities like Chennai, the fraction of metered households is even lower.

Even if all households were fitted with well working water meters, when water is insufficient pricing is a difficult policy to use to influence consumer behavior. In Indian cities households use water of various qualities, from multiple sources, which can be either formal (in-house water taps), informal (water vendors), or even illegal (illegal water connections), some involving direct payments, and others involving indirect costs, and connections are shared between multiple households. In such a context, understanding how households respond specifically to pricing of piped water poses methodological challenges.

At present, there are no reliable data on actual water use by a household. Our analysis of the meter reading data suggests that they are suspect, given the large degree of tampering and poor maintenance. This at least points towards the need to quantify actual household water use, without which it is difficult to understand the behavior of the consumers. For example, initial results from an extensive household-level water monitoring exercise undertaken by ATREE in Coimbatore shows that at least 50% of the households among the monitored households received 110 LPCD, which included both local groundwater and imported river water. Thus there is a need to acknowledge, at a policy level, that groundwater is being used significantly, and that households use water of different qualities for different purposes.

Existing household coping-infrastructure may limit how much tariffs can be raised

One of the biggest gaps in the push towards a 24/7 water supply policy, is the understanding of how such a policy would be affected by the existing household infrastructure. A sizeable portion of households in cities in India already have sumps (to store piped water), and borewells (to supplement with ground water). For instance, in Chennai, 60%, and in Coimbatore, 28% of the households have access to private borewells.

When households have existing sumps where the piped water is collected, they may not realise the water quality benefits, as the water often gets re-contaminated in these household storage structures. A study in the 24/7 zones in the twin cities of Hubballi–Dharwad, in Karnataka, showed some empirical evidence for this.

A study in Chennai, on a linked groundwater and user-behaviour model, indicated that if the price of piped supply is hiked significantly, households that have already invested in borewells may use more groundwater, although they might not drill new borewells. So, raising water tariffs could have an unintended consequence on groundwater over-extraction, unless groundwater regulation is also brought under the purview of the water utility.

Storage, and not quantity delivered, limits water use by the poor

Surveys in Coimbatore show that slum households lack adequate water storage space within their homes. Inexpensive storage options such as drums and pots take up a lot of space in small slum dwellings. Alternative storage structures, such as sumps (sub-surface), or overhead tanks (on the roofs), are expensive. This implies that even in slums where the public supply of water is high

Where households lack sumps or overhead tanks, water must be stored in pots and drums. (Photo: Durba Biswas)

pressure and frequent, women have to make multiple trips to the standpipe to fetch water.

However, investing in enhanced local storage by the state can lead to a 24/7 water supply at the locality level, which can benefit the poorest households, as well as women, by removing uncertainty around water supply.

Women bear the burden of poor supply in multiple ways

Women living in slums spend up to 2 hours per day in collecting, storing, and redistributing the water for various uses such as cooking, mopping, washing clothes, etc. However, as the slums receive water at irregular, and often inconvenient, times of the day, women tend to wait for many hours for the supply, making the effective time spent on collecting water much longer than 2 hours a day. The irregularity of water supply timings also has other kinds of implications for the women. For example, given that the water supply timing is not fixed, women do not travel too far away from the home for work, because they have to rush back as soon as they hear the news that water supply has begun. This limits their employment opportunities. When household financial decisions are made jointly by both the husband and the wife, it allows women to pay bribes to tanker drivers and linemen. However, in cases where women have no say in financial decisions, women tend to put in more time and physical effort to find cheaper water sources.

In contrast, a 24/7 water delivery system designed to be subsidised, regulated and strongly monitored, could minimise or completely eliminate the burden of water collection on women from poor and minority backgrounds and benefit the poorest of households in the cities.

CONCLUSION

In a developed country context, 24/7 water supply system implies high pressure, treated river water supplied through pipelines to households. Based on ATREE's work, we argue that in the Indian context, the 24/7 system may not work as well as it is meant to, if it ignores Indian realities. The 24/7 system is limited by how much water can be imported from outside the cities, and once imported, how it can be distributed among households through a well-functioning piped-water system. Our study in Coimbatore, with its dual-source water-supply system, throws up some interesting insights. Primarily, the dual-source system can lead to an overall equitable access to water, where households use groundwater for the purpose of mopping, sanitation, and washing clothes, and surface water for the purpose of drinking, cooking, and bathing. This provides an alternative to the model of 24/7 supply of only imported river water. Secondly, 24/7 supply of river water can benefit poor households and women from slum households, as it removes water supply uncertainty, thereby removing the time spent in collecting water and investing in storage options. Finally, a 24/7 water supply system is a pricing strategy to influence households' water use behavior. ATREE's work in Coimbatore shows that a significant percentage of households are either not metered at all, or have incorrectly functioning meters. Therefore, before moving towards the 24/7 system, there is a need to have good estimates of households' water consumption patterns.

Further reading

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