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Building a Global Agenda for Water Security with Insights from Social Infrastructures in Latin America

Construyendo una agenda global para la seguridad hídrica con conocimientos de las infraestructuras sociales en América Latina

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I've been working on water insecurity in Latin America for more than 20 years.[1] Those early days were rife with hope for universal water access. The United Nations Millennium Development Goals, and later the Sustainable Development Goals, held the promise of safe and sustainable water for all. Today we face a sobering reality in which climate change, infrastructure decay, and social upheavals seem to be reversing progress in water security (Stoler et al., 2022). And so, from Chile to Mexico, near-crises in water are besetting communities across Latin America.

Some might argue that water-rich Latin America is not the best place for theorizing water insecurity. And yet, like many geographers, I understand water insecurity to be born of the interplay between society and hydrology (Budds et al., 2014; Jepson et al., 2017; Sultana, 2011). My research is set in places where political and economic systems produce severe water insecurity for humans, even when water supplies overall are sufficient or even abundant. In Latin America,

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these very water-insecure places are often informal settlements, urban and peri-urban areas, and Indigenous communities (Britto et al., 2019; DeVincentis et al., 2021).

Highly water-insecure settings are challenging because time-tested water solutions have long failed. But they are also the best places to develop new ways of thinking about how to get people water. MAD water is one of our best ideas—modular, adaptive, decentralized water systems that integrate engineered and social infrastructure (Stoler et al., 2022; Thomson et al., 2024; Wutich et al., 2023). Many will be familiar with some of the engineered technologies used for MAD water. They can be as simple as harvesting rainwater or advanced as nanotechnology-enabled water treatment (Stoler et al., 2022). And more are being developed every day.

The problem is, in much of the world the social infrastructure isn't working well with engineered infrastructures. This is where new research—which takes social infrastructure as seriously as engineered infrastructure—can help show us the path forward. But to understand how social infrastructure works best, we need to work with communities that already use social infrastructure successfully in well-integrated MAD water systems. Latin America is full of them. Community members' ingenuity, insights, and successes are essential to improving MAD integrated engineered and social infrastructures.

Community-based, participatory, and engaged research methods developed by Latin American scholars such as Paulo Freire and Orlando Fals Borda, as well as rising Latin American methods innovators (e.g., Castro-Diaz et al., 2024; Pacheco-Vega & Parizeau, 2018; Roque et al., 2022), are particularly well-suited for exploring MAD solutions to complex hydrosocial water insecurities. And while I am an anthropologist, I have found my thinking about water often aligns best and is most enriched by my collaborations with geographers. I've particularly benefited from collaborations in the Water Insecurity (WISE) network, led by geographer Wendy Jepson (Harris et al., 2020; Jepson et al., 2017; Meehan et al., 2020; Shah et al., 2023; Stoler et al., 2022; Thomson et al., 2024; Wilson et al., 2023). The Household Water Insecurity Experiences (HWISE) Research Coordination Network was initially funded by the U.S. National Science Foundation (2018–2024) and WISE is now a permanent Community of Practice in the American Association of Geographers.[2]

WATER INSECURITY AFTER BOLIVIA'S WATER WAR

I started working in Bolivia just after Cochabamba's Water War in 2000. Protests broke out after control of all of Cochabamba's water was leased to a private consortium. After Cochabamba's protesters won their fight, the old water systems were reinstated. Globally this was celebrated as a victory of David vs. Goliath in the fight against privatization. However, those old water systems still excluded many informal settlements. My research began just after the Water War was won, as people struggled for water in its aftermath.

The work I did in Cochabamba's informal settlements helped me understand how social infrastructure—informal institutions,

cultural norms, and social networks—is a life-saver in water-insecure settings. Over a decade, my research explored the experiences of people in Cochabamba's water-scarce informal communities. My early work was conducted with Bolivian co-researchers Wilda Valencia, Richard Aguilar, and Wilfredo Valencia.

One of our first questions was: How bad was the water insecurity? This is very easy to study in metered water systems, like those we see in fully centralized water infrastructure. But beyond White, Bradley, and White's 1972 classic *Drawers of Water*, there wasn't much guidance about how to measure household water use in informal water systems.

Working with community members, we devised a diary-based method for measuring water use. We found many households fell below the World Health Organization's threshold for short-term survival in emergencies. Over a year's time, 11 percent of households fell below a "survival allocation" of one bucket (10 liters) of water daily; 35 percent fell below the short-term sustainable level of two buckets (20 liters) a day; 46 percent of households fell below Peter Gleick's "basic water requirement" of five buckets of water (50 liters). In sum, 92 percent of households in this Cochabamba informal settlement *did not* meet basic human water needs.

Having established that people were not getting enough water, my research turned to the MAD (modular, adaptive, decentralized) systems people were using to survive. Some of these were highly visible; others were covert. Water-sharing and informal water markets were two examples. For these MAD water systems, I found social infrastructure—informal institutions, cultural norms, and social networks—determined much of how engineered infrastructure worked at household levels.

WATER SHARING: HIDDEN, UNIVERSAL FORMS OF MAD WATER

As any anthropologist will tell you, one of the best ways to uncover social infrastructure is to ask people about reciprocity—food-sharing especially. Who we break bread with reveals a lot about our hidden social worlds. In Cochabamba, I asked about reciprocity–and got surprising answers. Ultimately, 66 percent of people reported hidden water-sharing arrangements.

My collaborators in Cochabamba helped me understand how water-sharing worked (Wutich, 2011). For example, a tight-knit circle of neighbors, many of whom often ran low on water, lent each other one or two 10-liter buckets of water. Sometimes, neighbors refused loan requests, saying they only had a few buckets of water left. Many preferred to ask family or close neighbors with 5,000+-liter storage tanks, but would approach distant neighbors in a pinch. If that didn't work, people tried to buy buckets of water from *tiendas* (corner stores).

Statistical analysis of the survey data from Cochabamba showed people's ability to share water depended a lot on how far people lived from water sources, how much water storage they had at home, how water-insecure they were, and how deeply embedded they were in local reciprocal relationships. At the time, the Cochabamba findings were a bit of a puzzle.

Was this case a one-off, or was there hidden water-sharing happening in water-insecure communities all around us?

To explore this globally, I worked with WISE collaborators. With geographers, I did some hard work conceptualizing water-sharing (Harris et al., 2020; Wutich et al., 2018). With partners in 19 low- and middle-income countries, we found water sharing in all 21 research sites we studied (Rosinger et al., 2020). And in some sites—in Colombia, Democratic Republic of the Congo, Pakistan, and India—water-sharing rates were over 80 percent.

Research in geography and allied fields confirmed that water-sharing really is a hidden but near-universal form of MAD water (e.g., Harris et al., 2020). And it can work with very inexpensive technologies, like buckets and hoses (Staddon & Brewis, 2024). Though, as the Cochabamba data showed, water-sharing works much better with large-scale home water storage infrastructure.

The trouble is, it doesn't seem to work very well all of the time. My work in Bolivia showed that it was one of the most distressing ways for people to get water (Wutich et al., 2018, 2022). People told me they felt afraid to ask for help. They felt humiliated when their neighbors rejected requests or charged them for water. This adds important nuance to broader findings in geography about the pervasiveness of water-related emotional distress (e.g., Sultana, 2011).

And in our WISE research in 20 global sites, we confirmed statistically the findings in Bolivia. Cross-culturally, people who *gave and received* water reported more distress and conflict (Wutich et al., 2022). So, if water sharing really is the last, best hope for people experiencing water crises globally, we need to figure out how to make it work better.

Now, let's turn for a moment to the other universal MAD water system I studied—where a surprisingly similar pattern emerges.

INFORMAL WATER MARKETS: MALIGNED BUT POTENTIALLY PROMISING FORMS OF MAD WATER

In Cochabamba, informal water markets were the main way that communities without centrally connected systems got water. Water vending trucks loaded up water in the north side of the city, and then drove down to the south side to sell the water in increments of 200 liters or 20 buckets. But the vendors did not like to waste gas driving out to the informal settlements, and they worried about damaging their trucks on rough unpaved roads. Typically, despite the huge demand for water, only one or two trucks came to far-flung informal settlements each day.

During the time I lived and conducted participant-observation in Cochabamba's informal settlements, I often saw neighbors running up and down the streets, chasing the giant water vending trucks and begging vendors to sell their families water. The vendors often refused. But even worse, there were days when no water vendors came to the community at all. Watching this as a participant-observer, I wondered what could possibly produce such market dynamics?

To answer that question, I had to talk to informal water vendors. These water vendors have been denounced, not just in

Cochabamba but in Bolivia more broadly, as profiteers and price gougers who prey on the desperation of the water-poor. The vendors were, unsurprisingly, disinclined to talk to interviewers. Working with Bolivian scholar Cinthia Carvajal (Wutich et al., 2016), we interviewed two sets of water vendors—a group of unionized workers, and vendors called *piratas* (pirates) who were largely unregulated.

We found that both piratas and unionized vendors were concerned about the cost of water. They all made efforts to ensure that pricing was affordable, even given their very high operation costs. And they were all also motivated to build interpersonal *casero* (loyal client) relationships, which created a more predictable supply-and-demand dynamic for everyone.

But only the unionized vendors coordinated among themselves to ensure there would be cost-of-living adjustments to water pricing, regular water quality checks, predictable schedules for deliveries, and accountability in vendor interactions with clients. And without the accountability mechanisms, there was no control on serious abuses like price gouging and denial of service, especially among the piratas.

So the good news was that even in informal and unregulated water markets, it was possible to design a system where water was reasonably affordable, accessible, of good quality, and distributed in a fair and just way. But the bad news was just 30 of the 300 water vendors operating at the time of our research were unionized. The rest—90 percent—were piratas, operating without much supervision or accountability.

A later World Bank report led by geographer Dustin Garrick built on our findings to make recommendations for global water markets (Garrick et al., 2019). The report argued that informal water markets would become a much larger part of global water systems in the future, and sought ways to limit predatory informal water markets. Recommendations included more oversight involvement from clients and more self-regulation by vendors. That doesn't seem to be happening yet in many informal water markets globally. But I am excited to be working with Garrick et al. (2023) on a network of water market observatories, marking a global effort to advance this work.

To recap, my work in Bolivia uncovered two key findings about social infrastructures for MAD water: (1) the existence of hidden life-saving networks of water sharing; and (2) informal water markets can perform in fair and just ways even without formal regulation. In both cases, people were redistributing privately held water in unregulated and uncoordinated ways that were crucial to survival in water-insecure communities. But in both cases, something was wrong. The social infrastructure was extensive, but people were experiencing the MAD water systems as burdensome, stressful, unpredictable, and humiliating.

GROWING MORAL ECONOMIES IN BOLIVIA AND BEYOND

I started to work with the idea that a moral economy—a classic concept developed by E. P. Thompson and James Scott—might help us understand what about MAD water

systems was working, what wasn't, and how they could work better (Wutich, 2011). I found the theoretical work difficult, and it was really slow going. Happily, with WISE colleague Melissa Beresford's leadership, we're now making real progress in understanding the role of moral economies in MAD water systems (Beresford et al., 2024).

Moral economies for water have three parts (Beresford et al., 2024):

1. Shared understandings of justice, especially a moral right to survival: This moral commitment has to be shared among those at various levels of power and influence in the society. There can't be one moral view among elites and a different moral view among less powerful people—that's a recipe for oppression.

2. Normative economic practices that uphold justice: Economic practices, like water-sharing or water-pricing, should be seen as just and fair among people at various levels of power and influence in a society.

3. Mechanisms of social pressure to keep normative economic practices in place: These can be anything from shaming and shunning to protesting and punishing. The social pressure mechanisms must be seen as legitimate across society. And people with less power must be able to assert legitimate pressure on people with more power.

These three pieces—right to survival, economic practices, and social pressure—are the basic recipe for moral economies in MAD water systems. Now let's revisit the Bolivian examples of water-sharing and water-vending to see how well they align with a true moral economy for water.

"Water Is Life" wasn't just a slogan in Bolivia's Water War; it was a way of life. A shared commitment to a moral right to survival was something people universally affirmed, and were willing to sacrifice to see enacted in Cochabamba's informal settlements. Unfortunately, though, this commitment wasn't fully shared by people at various levels of power and influence in society. Some pirata water vendors put profits over people. And informal settlements were repeatedly denied municipal water service. A right to survival isn't very powerful if it isn't universally affirmed across social inequalities.

Economic practices that upheld a right to survival, too, were clearly present in Cochabamba water-sharing. Cochabamba neighbors regularly lent each other buckets of water. The problem was, when water stress was really high, there were not clear norms about how to act. Some refused to help; others charged their neighbors for water; resentments emerged. This is why people felt stressed and humiliated to ask for water. In a true moral economy for water, denials are certainly allowed, but they should be predictable.

Social pressure mechanisms that hold people to their moral obligations were missing, and it showed. If a neighbor refused to share water, nothing happened. This is where social pressure mechanisms that work well for

social equals—like shaming and shunning—are important. And if pirata water vendors exploited clients, there was no recourse. This is where social pressure mechanisms that work well across social inequalities—like protesting and punishment—would have been crucial. As this example shows, more fully realized moral economies might make the MAD water systems we already have work better.

BUILDING FROM LATIN AMERICAN GEOGRAPHY TO GLOBAL WATER SECURITY

Building better moral economies for water could transform the MAD water systems that water-insecure communities have already built. Powerful work in geography and allied fields on informality, hybridity, polycentricity, gray zones, meshwork, and alternative and everyday water infrastructures will be essential to growing this field. Leveraging the full range of research on social infrastructures for water, in Latin America and beyond, can make these MAD water systems fairer and more just (Empinotti & Garjulli, 2024; Roque et al., 2023).

Recent work indicates that the state, and local governments, too, can play a vital role in funding and managing MAD water systems (e.g., Empinotti & Garjulli, 2024; Guerrero et al., 2015). And we don't know much about how moral economies can interface with the new technologies we anticipate will be common in MAD water systems—sensors and AI, for example (Stoler et al., 2022; Thomson et al., 2024). We'll need more research and practice to bring our burgeoning knowledge of moral economies for water to bear on the water challenges of our future.

Collaborative research between geographers and communities has uncovered hidden water solutions from Latin America and shown how they can work across cultures. Such work hints that the missing key to solving water insecurity may be hidden in the social infrastructure all around us. Using deep insights from community knowledge—made accessible through collaborative research—we can learn to leverage social infrastructure to distribute clean water in fair and just ways. This kind of work is part of what makes me optimistic about water futures in Latin America and globally.

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NOTES

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2 For more information about the Community of Practice in the American Association of Geographers, you can visit https://www.aag.org/groups/water-insecurity-wise-cp/

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