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ADVANCED REVIEW

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Exposing the myths of household water insecurity in the global north: A critical review

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Abstract

Safe and secure water is a cornerstone of modern life in the global North. This article critically examines a set of prevalent myths about household water in high-income countries, with a focus on Canada and the United States. Taking a relational approach, we argue that household water insecurity is a product of institutionalized structures and power, manifests unevenly through space and time, and is reproduced in places we tend to assume are the most water-secure in the world. We first briefly introduce "modern water" and the modern infrastructural ideal, a highly influential set of ideas that have shaped household water provision and infrastructure development over the past two centuries. Against this backdrop, we consolidate evidence to disrupt a set of narratives about water in high-income countries: the notion that water access is universal, clean, affordable, trustworthy, and uniformly or equitably governed. We identify five thematic areas of future research to delineate an agenda for advancing scholarship and action—including challenges of legal and regulatory regimes, the housing-water nexus, water affordability, and water quality and contamination. Data gaps underpin the experiences of household water insecurity. Taken together, our review of water security for households in high-income countries provides a conceptual map to direct critical research in this area for the coming years.

This article is categorized under:
- Human Water > Human Water

KEYWORDS

colonialism, household water insecurity, race, social inequality, water infrastructure

1 | INTRODUCTION

In March 2020, tap water was turned back on for some households in Detroit, Michigan. In response to civic pressure and emergency efforts to curb the spread of Covid-19—a public health strategy that hinges on frequent hand-washing—government officials announced plans to halt shutoffs and temporarily reconnect water services for Detroit residents who had been disconnected due to unpaid bills. Shutoffs are not uncommon tactics in Detroit. Since 2013, when the city filed for bankruptcy, an estimated 137,165 water accounts—including homes and businesses—have been disconnected, under the direction of a debt recollection plan and state-appointed emergency manager. Many households have been shut off more than once in the same year. In 2019, water service was disconnected for more than 23,000 accounts, three-fifths of which were still without service as of mid-January 2020 (Lakhani, 2020). Instead of running water, households turned to bottled sources and social networks to meet their water and hygiene needs. While the March shutoff moratorium was welcome news in Detroit, the implementation process has since been criticized as slow and inadequate—with examples of activists delivering bottled supply to waterless households (Noor, 2020). "It's a nightmare," said a Detroit resident without running water, "The virus is killing people all over the world and we can't flush the toilet or wash our hands regularly" (Lakhani, 2020).

Household water insecurity is defined as a lack of safe, reliable, sufficient, and affordable water for a thriving life (Jepson, Wutich, Colllins, Boateng, & Young, 2017). As the Detroit case makes clear, problems of water insecurity are not confined to the global South. A growing body of research has begun to track systemic disparities and drivers of water insecurity in high-income countries, including those with extensive network coverage and advanced technological capacities. For example, an estimated 1,121,120 people (±25,537 margin of error) in the United States lacked piped running water between 2013 and 2017 (Meehan et al., 2020). In many major U.S. cities, water rates are unaffordable for

low-income households, putting people at risk of water service shutoffs (Teodoro, 2018). In Canada, one in five First Nation communities are on a boil water advisory at any given time (Black & McBean, 2018).

Who gets to "thrive" and who suffers from household water insecurity in the global North? Why do such conditions arise and persist? What are the impacts and diverse consequences of household water insecurity? What are the gaps in knowledge and practice? In this article, we present the first major review of research about household water insecurity in high-income countries. Most scholarship on water poverty and insecurity has a geographic focus and theoretical origins in the global South, where notions of sufficient and secure domestic water are tied to indices of human development (Jepson et al., 2017; Mehta, 2014). Our goal in this article is to set an intellectual agenda for water insecurity research in the global North, drawing on a relational approach that places systemic processes that reproduce water inequalities at the center of inquiry and analysis (Jepson et al., 2017; Loftus, 2015).

We review the field with an initial focus on Canada and the United States, where much of the emerging scholarship is located and where activist struggles around water—such as in Flint and Standing Rock—have focused attention on the historical and contemporary relations that produce conditions of water insecurity. Our intention is not to equate Canada and the United States with all high-income nations or settings. Just as the global South cannot be mapped as a stable location or ontology (Roy, 2015), what we call the "global North" reflects much diversity and difference—not a singular history or experience. Rather, we use the experience of water insecurity in Canada and the United States as a starting point for a broader research agenda and as a tactic to provincialize theory within and across North–South lines (Lawhon, Nilsson, Silver, Ernstson, & Lwasa, 2018; Lawhon & Truelove, 2020; Ranganathan & Balazs, 2015). In this way, we seek to theorize water insecurity as a global condition that exists across development gradients, and we begin to explore its manifestation in high-income countries and the particular relations, drivers, or policies that might be relevant.

What do we mean by a relational approach to water insecurity? Our approach is grounded in efforts to excavate the social and spatial relations that *produce* poverty—including conditions of water insecurity (Deitz & Meehan, 2019; Jepson et al., 2017; Loftus, 2015; Sultana, 2012, 2018; Wutich, 2020). This approach insists that household water insecurity is a product of structural and institutionalized power; manifests unevenly through space and time; and is reproduced in places we tend to assume are the most affluent and water-secure in the world. In the sections that follow, our review challenges six common narratives (or "myths") about household water in Canada and the United States. We first turn to "modern water" and the modern infrastructural ideal: a highly influential set of ideas that have informed water governance and infrastructure development over the past two centuries.

2 | MODERN WATER

The notion that household water is universal and secure in high-income countries is a product of what Linton (2010) calls "modern water": a set of ideas, discourses, and practices associated with scientific and Western models of water management. When water is abstracted and modern, it is imagined as uniform. The modern water ideal has dominated how many societies conceptualize infrastructure networks and water services, with these essential services viewed as uniformly delivered to everyone with similar quality and cost, across cities, and regions (Graham & Marvin, 2001). Modern water also exemplifies political ideals of liberal models of governance and citizenship that underpin designs and universal prescriptions of infrastructure development (Furlong, 2014; Lawhon et al., 2018). Indeed, the ideas of liberal democracy emerged in tandem with the development of infrastructure networks (Agostoni, 2003), and democracy was, in many places, viscerally symbolized by the water and sewer grid (Banister & Widdifield, 2014).

Scholars have criticized modern water and its logic of universality. The abstraction of water as the substance H_2O, circulating in the hydrologic cycle, masks the socio-cultural and political relations to water forged through interactions among water users infused with power differences and cultural politics (Boelens, 2013; Linton, 2010; Linton & Budds, 2014). Stripped of its social meaning and contextual specificity, water in the modern form is rendered as a resource available for human consumption and use that can be known and managed or manipulated by humans (Linton, 2010; Strang, 2004). In following an anthropocentric assumption that "nature" exists solely for human use, the separation of water from its social context is considered at the root of contemporary water crises (Schmidt & Shrubsole, 2013).

Modern water continues to underpin the design and policy prescriptions of water and infrastructure across the global North and South (Furlong, 2014; Lawhon et al., 2018). We suggest, in the following sections, that modern water has also given rise to a set of collective beliefs—what we call myths—about "secure" household water in sites such as

Canada and the United States. While the following set of myths may not fully describe people's beliefs or realities, our collected evidence from the literature reveals they are deeply *hegemonic* in nature. In other words, water myths in the global North are rooted in the experiences of people in power—the most well-off and watered households in society. And these water myths rarely hold as universal experiences or empirical truths among Indigenous peoples, racialized groups, the poor, and other historically marginalized groups.

3 | EXPOSING SIX MYTHS OF HOUSEHOLD WATER INSECURITY

3.1 | Myth 1: Water access is universal

Many global development reports concerning goals of "water and sanitation for all" present a rosy view of water access in high-income countries. For example, the Joint Monitoring Program (JMP), which oversees global progress toward the Sustainable Development Goal targets, reports that 99% of the U.S. population has "safely managed" access to drinking water that is "free from contamination." Some high-income countries, such as England and Poland, report 100% universal water access (UN-WHO Joint Monitoring Programme, 2020).

Recent research suggests that household water access is far from universal in high-income countries. In the United States, for example, a total of 471,000 households (±5,600) or 1.1 million people lacked piped water access between 2013 and 2017, with the majority (73%) of households located in metropolitan areas and nearly half (47%) in the 50 largest urban areas (Meehan et al., 2020). Rural areas also face risks associated with water access: the JMP (2020) reports that roughly 10% of the U.S. population reliant on domestic wells have safely managed water, studies from across the country—including Virginia, Wisconsin, and California—show that households reliant on wells are prone to chronic shortage risks (Pauloo et al., 2020) and multi-faceted contamination concerns (Knobeloch, Gorski, Christenson, & Anderson, 2013; MacDonald Gibson & Pieper, 2017; Pieper, Krometis, Gallagher, Benham, & Edwards, 2015). Comparatively, the literature on insecure access is more limited in Europe, but similar access trends are found in Nordic countries (Gunnarsdottir, Persson, Andradottir, & Gardarsson, 2017), Lithuania and Estonia (Orru & Rothstein, 2015), and France (WWAP, 2019).

What creates gaps in universal water access in high-income countries? To date, research in Canada and the United States identifies at least four factors. First, the ability to access piped water is linked to the geography and scale of drinking water systems. Mismatched utility districts, municipal boundaries, and water service inclusion decisions can result in exclusion from the network (Pierce, Gonzalez, Roquemore, & Ferdman, 2019). Across North America and Europe, smaller systems tend to fail in providing universal water access more often than larger systems (McFarlane & Harris, 2018; Orru & Rothstein, 2015). In North Carolina, for example, the process of "underbounding" community water service districts is a legacy of racial segregationist policies that excluded African American communities from secure piped water and sewerage (Leker & MacDonald Gibson, 2018; MacDonald Gibson, DeFelice, Sebastian, & Leker, 2014).

Second, the literature indicates that insecure water access is produced by racialized wealth gaps that are expressed through the unequal geographies of housing—what Meehan et al (2020) call the housing-water nexus. Precarious housing is a significant driver. In the United States, residents of mobile homes and trailer parks have consistently worse water service in terms of connection, reliability, and quality (Deitz & Meehan, 2019; Pierce & Jimenez, 2015). Gaps in access can be the result of parks' spatial and administrative marginalization through zoning decisions, which leaves them served by small, self-managed water systems (Pierce, Gabbe, & Gonzalez, 2018). Owners and managers of mobile home parks also play a mediating role by neglecting infrastructure maintenance or bill payment (Pierce & Gonzalez, 2017). Water access is even more insecure for people living without stable or conventional housing—a population estimated at over 1 million people in Europe and the United States combined (Fazel, Geddes, & Kushel, 2014). Such groups include people experiencing a spectrum of homelessness (DeMyers, Warpinski, & Wutich, 2017; Hale, 2019; Speer, 2016) as well as migrant, Irish Traveler, and Roma communities living in informal settlements (Davis & Ryan, 2017; Filčák, Szilvasi, & Škobla, 2018; Hout & Staniewicz, 2012). Across these cases, water access disparities are produced at the fragmented juncture of housing policy, water management, and entrenched social inequality (Meehan et al., 2020).

Third, differential access is linked to the status of citizenship and belonging. Hydraulic citizenship, defined by Anand (2017, 18) as the ability of residents to be recognized by water agencies through legitimate water service. For example, in the South Texas region, limited access to (safe) water infrastructure has been traced to specific political

dynamics in the 1970s that denied residents living in disadvantaged Hispanic unincorporated communities (called *colonias*) the right to vote in elections for their own regional water governance institutions, a legacy of the Jim Crow era and agro-industrial interests (Jepson, 2012). Such early instances of network exclusion—both political and geographic—established a path of water insecurity in which communities and households found themselves in subsequent decades (Vandewalle & Jepson, 2015). In some areas, foreign-born U.S. residents continue to depend on water trucks, stores, and vending machines, despite recent local improvements in water and sanitation services (Jepson & Brown, 2014; Pierce, Gonzalez, et al., 2019). A recent study revealed the odds of being water insecure were 4.2 times more likely for "mixed status" households as compared to households with members who were all documented (Jepson & Vandewalle, 2016). Taken together, flows of water to and through households follow patterns that reflect political marginality, despite the promise of universal access and water security.

Fourth, disparities in water access reflect institutionalized structures of marginalization that are unevenly expressed through space and place. Indigenous communities have disproportionately higher levels of water insecurity as compared to non-Indigenous populations (Deitz & Meehan, 2019; Hanrahan, 2017; McGregor, 2014; Mitchell, 2019; Patrick, Grant, & Bharadwaj, 2019; Sarkar, Hanrahan, & Hudson, 2015; Walters, Spence, Kuikman, & Singh, 2012; Winnipeg, 2016). In Canada, the displacement and forced relocation of Indigenous peoples to reserves were accompanied by a lack of planning for infrastructure development or policy frameworks to ensure universal water and sanitation (Hanrahan, 2017; White, Murphy, & Spence, 2012). Today, provincial and territorial regulations that govern safe drinking water do not extend to First Nations reserves. In its place, a segregated system of governance—often involving unclear and fragmented responsibilities among the federal government and provincial/territorial governments with First Nations—perpetuates the divide between Indigenous and non-Indigenous peoples (Daigle, 2018; Hanrahan, 2017; Phare, 2009; Wilson, Harris, Joseph-Rear, Beaumont, & Satterfield, 2019). Gaps in water provision and access are not simply a case of "technical" issues or network failures, but the product of a system of racialized dispossession, colonialism, and property rights, often through and at the hands of the state (Curley, 2019).

3.2 | Myth 2: Water is clean

In high-income countries, there is a pervasive view that water is clean enough to drink straight from the tap. Such beliefs reflect nearly two centuries of engineering expertise, treatment technologies, public policies, and regulatory oversight to improve and protect water quality (Melosi, 2011). Evidence suggests that many people in high-income countries believe their tap water is generally clean (Ragusa & Crampton, 2016; Watson, 2006), even when it comes from recycled sources and reclaimed effluent (Garcia-Cuerva, Berglund, & Binder, 2016; Ishii, Boyer, Cornwell, & Via, 2015; Marks, Martin, & Zadoroznyj, 2008; Ormerod & Scott, 2013).

Despite high levels of public confidence in water quality, there are at least three emerging areas of concern with respect to "clean" water. First, aging water infrastructure increasingly fails to provide the kind of clean water people have come to expect (Allaire, Wu, & Lall, 2018; Grigg, 2019; Kenney et al., 2019). For example, the 1993 outbreak of *Cryptosporidium* in the Milwaukee, Wisconsin public water supply (the largest waterborne disease outbreak in U.S. history that sickened over 400,000 people and killed over 100) was caused by contamination of a 1962-era water purification plant that was unable to provide adequate disinfection (MacKenzie et al., 1994). Moreover, contaminants of emerging concern present novel challenges to clean drinking water. New classes of toxicants, including pharmaceuticals and endocrine-disrupting chemicals, are not federally monitored or regulated in the United States. Examples include atrazine (a pesticide), perchlorate (a component of rocket fuel and explosives), and per-and polyfluorinated substances (Domingo & Nadal, 2019).

Second, a growing body of research documents on how water contamination has less to do with identifiable technological failures and more to do with the social and institutional dynamics of marginalization. In these cases, communities may suffer from direct exposure to unclean drinking water (MacDonald Gibson et al., 2014; Stillo & MacDonald Gibson, 2017) or are forced into reliance on unsafe and hazardous sources, as a result of longstanding systems of institutionalized inequality (Balazs & Ray, 2014; DeMyers et al., 2017). For example, among First Nations communities in Canada, the widespread problem of tainted water is embedded in ongoing colonial practices of the state that most often do not take into account Indigenous knowledge, cultural identity, or governance practices (Baijius & Patrick, 2019; Mascarenhas, 2007; Patrick, 2011; Smith, Guest, Svrcek, & Farahbakhsh, 2006; Wilson, 2014).

The Flint, Michigan water crisis deserves special mention here. Starting in 2014, lead leached from pipes in the Flint drinking water systems, exposing an estimated 98,000 residents to elevated levels of lead, *Escherichia coli*, and

Legionella bacteria (Butler, Scammell, & Benson, 2016; Pauli, 2020). In brief, failure to treat the water properly, given the piping system and age of infrastructure, led to a variety of problems with water quality and public health (Pauli, 2020). As Pulido, Kohl, and Cotton (2016) argues, the decisions leading to contaminated drinking water were set in motion by austerity measures cast by an underfinanced and debt-leveraged municipal government, in which water provision to low-income and racialized communities of Flint was explicitly devalued and subordinated to the goals of fiscal solvency. In this way, the Flint water quality crisis is understood as an extension of a history of deindustrialization, racialized dispossession, and racial segregation between the city and its suburbs (Clark, 2018). Ranganathan (2016, p. 19) describes this process as racial liberalism's "illiberal legacies" with consequences that continue to shape how clean water is understood and provisioned.

A third area of concern has to do with differential understandings of clean water and risk. Water utilities, for instance, apply a techno-scientific approach to meeting regulatory standards and risk; risk is understood and regulated as a phenomenon that can be identified and measured empirically. In this view, water experts assess, measure, and calculate risk as a probability that can then be used to inform decision making for mitigating adverse impacts (Checker, 2007). In contrast, the understanding of risk by the general population is less related to probabilistic scenarios, which is devalued because it is not based on "objective" science. For example, First Nations in Canada and Indigenous peoples elsewhere continued use of untreated traditional water sources is often assessed as "unsafe" by Western colonial standards but more holistic assessments of risk or safety explain the role of relationships to water as a "living entity" and settler-colonial histories as they inform needs for spiritual and cultural well-being and broader distrust in water treatment (e.g., chlorination and its effects on physical health and the spirit of water itself (Eichelberger, 2016; Goldhar, Bell, & Wolf, 2013; Wilson et al., 2019). In some cases, water may be perceived as "unclean" but not necessarily unsafe per existing regulations, leading to mistrust in tap water (Parag & Roberts, 2009; Pierce, Gonzalez, et al., 2019). In this way, different notions of risk further exacerbate tensions between how regulatory science and communities begin to define clean and safe water.

3.3 | Myth 3: Water is affordable

The idea that water should be provided at affordable rates is enshrined in global policy principles and human rights discourse. Despite relatively good coverage of drinking water in the global North, new studies have revealed a growing reality that water and sewerage services are not affordable for many low-income households, and many are potentially at risk of delinquent accounts and shutoffs (Mack & Wrase, 2017; Teodoro, 2018, 2019). In a study of water-rate affordability across 25 major U.S. cities, household costs for piped water and sewerage (calculated as a percentage of disposable income for a lower-middle-class household) range between 26.9% of disposable income or approximately 13.6 hr of labor time at minimum wage in San Francisco to as low as 4.9% of disposable income or approximately 4.0 hr of labor time at minimum wage in Phoenix (Teodoro, 2018).

At least three major themes have emerged in the literature. First, water affordability is a contingent and contested social construct, not an objective measure (Mack & Wrase, 2017; Sawkins & Dickie, 2005; Teodoro, 2005, 2018, 2019). In high-income countries, we lack a full understanding of affordability challenges and experiences across populations. Debates over definitions, methods, and metrics, as well as the complexity of residential water service regimes, have made comprehensive assessments of household water affordability elusive. Conventional affordability metrics typically calculate the average cost of water as a percentage of the median household income in a given area and deem water to be "unaffordable" above a given threshold (Teodoro, 2019). This fixed threshold approach is useful for its intuitive appeal (Wutich et al., 2017), but has been criticized because it conflates utility-level metrics with household-level affordability, fails to account for household differences in water use and other expenditures (e.g., basic needs, cost of living), and masks potential affordability problems for the lowest-income households (Teodoro, 2019).

In its place, critics have proposed a more nuanced understanding of water affordability as (a) produced through a relationship between household income and expenditures and (b) situated within the capacity of a household to obtain sufficient water to meet basic needs and maintain well-being (García-Valiñas, Martínez-Espiñeira, & González-Gómez, 2010; Gleick, 1996; Goedemé & Vanhille, 2018; Korc & Ford, 2013; Molle & Mollinga, 2003; Sawkins & Dickie, 2005; Switzer & Teodoro, 2018; Teodoro, 2005, 2018, 2019). Scholars have proposed new metrics that measure affordability in more granular and comprehensive ways (Teodoro, 2018), but such metrics have not been widely adopted by regulators or decision-makers.

Second, anecdotal evidence suggests that affordability problems may be caused, in part, by differences in the kinds of water service ownership and operation models, such as investor-owned or investor-operated utilities. Drivers of water unaffordability include trends toward investor-owned water utilities, inequitable water pricing programs, deferred maintenance and infrastructure investments, and reduced rate-payer bases (Mack & Wrase, 2017; Mirosa, 2015; Reynaud, 2016). Inadequate water system regulation (and enforcement), especially small-scale providers, and investment structures that favor debt service over water service—such as the Detroit example—are also potential contributors. Across the United States, Teodoro (2019) finds there are no significant differences in system ownership that impact affordability, but he does find differences using a HM metric. Effects of these processes are especially acute in areas that bear the legacies of historical and systemic racism (Butts & Gasteyer, 2011; Pauli, 2019).

A third area of research evaluates household response and impacts of unaffordable water. Households experience a set of intersecting and cascading negative effects in response to high water tariffs and service shut-offs (Martins, Quintal, & Antunes, 2019). High water utility bills may lead to water rationing, illegal use, and expenditure tradeoffs to avoid loss of service and reconnections fees (Montag, 2019; Vanhille, Goedemé, Penne, Van Thielen, & Storms, 2018). Households often forgo essentials such as medicines and groceries to pay water bills and avoid shut-offs. People bathe and wash clothes less frequently, violating personal hygiene standards (DeMyers et al., 2017). These situations can lead to social stigma and reduced employment opportunities (Poremski, Whitley, & Latimer, 2014), which perpetuate a cycle of inability to pay for housing and water (Goodling, 2019; Montag, 2019). Delinquent water bills can lead to evictions or liens on properties that result in foreclosures, forced relocation, and/or homelessness (Amirhadji et al., 2013; Montag, 2019). Disconnected households buy higher-priced water from tankers, vendors, or stores (Christian-Smith, Balazs, Heberger, & Longley, 2013; Jepson & Brown, 2014). Finally, the inability to provide safe drinking water and/or maintain hygiene standards are grounded for losing child custody under child protection laws in 21 U.S. states (Amirhadji et al., 2013). Such conditions have been shown to lead to acute psychosocial distress such as feelings of shame, affronts to human dignity, degradation of self-efficacy, and fear of impending catastrophe (Amirhadji et al., 2013; DeMyers et al., 2017; Gaber, 2019).

3.4 | Myth 4: Water delivery is trustworthy

In line with notions of modern water, it is clear that expectations of trust are built into the very infrastructures of water provision in high-income countries. The invisibility of water networks in the North, often buried underground and out of sight, conveys a message that consumers need not be concerned with daily provision—we merely turn on the tap and "safe" water appears (Kaika, 2005). At the core of the modern infrastructural ideal is an implicit and expected trust in the engineers, technocrats, and public health officials who work to deliver drinking water regardless of the documented cases of contamination as discussed previously in Section 3.2 (Melosi, 2000, 2011).

Crises in water provision reveal the fragile and socially constructed nature of trust between households and water providers in the North—which, in many jurisdictions, implicates the state. A number of high-profile water crises have contributed to a loss of trust in public water providers and regulatory authorities. The water contamination crisis of Walkerton, Ontario was a shocking revelation to some Canadians that they could not always depend on pristine and ever-abundant tap water (a reality that was already apparent to some Indigenous and rural populations). Researchers offered that "the idea that something most Canadians take for granted—the system that delivers safe drinking water— could falter so completely seemed to resonate across the country" (Grey, 2001).

Trust in household water is fundamentally linked to social power, including relational dynamics of governance, accountability, and authority. In the case of the Flint water crisis, trust in state authorities was eroded by initial denial among officials that there was an issue with water safety, despite rising community concerns. In this instance, Flint authorities ignored community concerns and their experiences of drinking water, as attention to lead in the water was only considered at later stages, when external experts eventually became involved (Lambrinidou, 2018; Pauli, 2019). What Flint makes clear is how trust is related to how certain people are perceived and valued by decision-makers and authorities—in short, a function of *who* people are and the extent to which they are (de)humanized.

Similarly, a lack of trust in drinking water among Indigenous communities in Canada and the United States is bound to broader experiences of colonialism and marginality (Latchmore, Schuster-Wallace, Longboat, Dickson-Anderson, & Majury, 2018; Wilson et al., 2019; Yates, Harris, & Wilson, 2017). For instance, a lack of trust in water systems may be linked to regulatory injustices—the result of longstanding colonial relations—that have undermined Indigenous

governance systems and mechanisms of cooperation, limited their roles of authority, and diminished Indigenous sovereignty and well-being (Curley, 2019; Daigle, 2018). Thus, trust and distrust must always be contextualized in relation to these broader processes and dynamics, again highlighting linkages with race, class, coloniality, and other political-economic dynamics.

What are the impacts of such mistrust? In some cases, low levels of trust in municipal water providers and services can fuel higher reliance on bottled water (Anadu & Harding, 2000). For instance, Fragkou and McEvoy (2016) found that prior problems with tap water in the state of Georgia were important factors explaining the use of water filters and bottled water. Non-whites consumed bottled water at higher rates, particularly within Latino communities (Hobson et al., 2007). In the United States, nationally representative data from 2007 to 2016 showed that after the Flint water crisis, tap water avoidance increased, especially among Hispanic and non-Hispanic black populations, and households in lower socio-economic classes (Rosinger & Young, 2020). It is also evident that the bottled water industry has relied on—and in many cases has actively fostered—diminished trust in municipal delivery systems (Doria, 2006), using slick marketing campaigns to promote bottled water as "pure" and more healthful that tap water (Pacheco-Vega, 2019; Zenner, 2018).

More broadly, trust in household water is also linked to public views about science, expertise, and government regulation. Debates about water fluoridation and chlorination reveal that community concerns are as much about faith in scientific experts, regulatory agencies, and governance as they are about the technical matter at hand. Broad considerations regarding trust in government, faith in democracy, and how this is connected to household water provision has only begun to be explored in the literature (Harris, 2020).

3.5 | Myth 5: Water is uniformly governed

In contrast to the modern ideal of "uniform" water infrastructure, delivery, and service, emerging research in the North points to institutional fragmentation in the water sector, leading to regulatory and coverage gaps, sectoral failures, and institutional erasures that perpetuate inequality and household water insecurity. Fragmentation occurs when "responsibility for water governance is allocated amongst multiple actors and/or agencies with relatively little or no coordination and no clarity about how final decisions are made" (Bakker & Cook, 2011, p. 280). While water governance for domestic use operates differently across high-income countries, with varying levels of centralized or decentralized authority, decision-making, and regulatory power, the experience in the United States and Canada reveals fragmentation in the current political and physical organization of water, with the result of (dis)advantaging different social groups (Arsenault, Diver, McGregor, Witham, & Bourassa, 2018; Bakker & Cook, 2011; Bereskie, Delpla, Rodriguez, & Sadiq, 2018; Boyd, 2012; Hughes & Mullin, 2016; Kim, Keane, & Bernard, 2015; McGregor, 2014; Mullin, 2009; Pannu, 2012; Pierce & Gonzalez, 2017).

In Canada and the United States, fragmentation may occur in terms of (a) laws and regulations, (b) sectoral responsibilities, and (c) infrastructure provision. For example, laws differently govern groundwater and surface water, source water quality, drinking water quality, and between point and non-point source pollution. Both water and regulatory enforcement are further fragmented across these different water types and across jurisdictional hierarchies of international, federal, state, and local governments. Most residents in the United States (87%) receive water from a water system owned and operated by their city, investor-owned utility, or a mutual water company, for example (Dieter and Maupin, 2017). Water systems have differential capacities to comply with the variety of regulations., and there is no clear consensus around whether public or private system ownership yields fewer health-based water quality violations (Allaire et al., 2018; Beecher, 2013; Kirchhoff, Flagg, Zhuang, & Utemuratov, 2019; Konisky & Teodoro, 2016).

Many of these studies caveat system performance by size. Structural disadvantage has created situations where smaller systems are not well supported in terms of financial, managerial, or technical capacity, thus impairing their ability to deliver sufficient and safe water and undermining trust of their customers (McFarlane & Harris, 2018; Scott, Moldogaziev, & Greer, 2018; Switzer & Teodoro, 2017; Switzer, Teodoro, & Karasik, 2016). For people without access to centralized water provision (13% of the U.S. population), households self-supply from a domestic well or from an unregulated small system. This landscape of local water governance fragmentation may allow for local self-determination and autonomy; yet it may also (re)produce uneven power relations among users (Arsenault, Bourassa, Diver, McGregor, & Witham, 2019; Harris, 2004). As such, positions of power can be exploited precisely because of the ways that fragmentation privilege certain groups and makes invisible others.

Fragmentation in water governance provides opportunities for elites to take advantage of how water decisions are made. Urban and rural communities were mapped out water system services through restrictive racial covenants and redlining policies (Anderson, 2007; MacKillop & Boudreau, 2008; Pierce, Lai, & DeShazo, 2019). Cities and local water districts in California's Central Valley, governed by land-owning political elites, have for decades avoided extending water services to low-income and unincorporated communities (Pannu, 2012) and continue to fail to include them in newly formed groundwater agencies (Dobbin & Lubell, 2019). Local political elites continue to make development decisions to facilitate a certain kind of segregated, landscape and thus deprived other residents' access to resources and services otherwise available. Furthermore, the fragmentation of water supply systems renders invisible these unequal power relationships.

What are the consequences of fragmentation for households? While evidence is still emerging, research suggests that households develop a range of informal modalities to cope with formal service gaps and respond to governance failure (DeMyers et al., 2017; Ranganathan & Balazs, 2015; Stillo & MacDonald Gibson, 2017; Wutich et al., 2018). While informal mechanisms may reflect alternative value systems and moral economies of water (Wutich et al., 2018; Wutich & Beresford, 2019), they also represent points of potential exploitation. In unincorporated parts of California and in communities along with the U.S.-Mexico border, households rely on water vending machines and retail water stores, small decentralized water systems, tanker trucks, nonprofit water corporations, and other non-networked means of water supply (Jepson & Brown, 2014; Olmstead, 2004; Pacheco-Vega, 2019; Vandewalle & Jepson, 2015). In many instances, households with access to networked service may augment supplies with expensive "replacement" water, because the water provided by the system is suspected or known to be unsafe (Balazs, Morello-Frosch, Hubbard, & Ray, 2012; Morckel & Terzano, 2018; Pacheco-Vega, 2019; Stillo & MacDonald Gibson, 2017).

3.6 | Myth 6: Modern water is the best water

Over the 20th century, the rise of the hydrologic sciences has made water increasingly legible—through the quantification of stocks and flows of water—and amenable to control and management by state agencies (Linton, 2010). Infrastructure expansion and development enabled the hydraulic state, a set of public institutions and agencies that marshaled resources and consolidated power to construct the necessary infrastructure to manage water—and by extension, people, and territory (Akhter, 2015; Banister & Widdifield, 2014; Davis & Ryan, 2017; Dunlap, 1999; Harris & Alatout, 2010; Jackson & Head, 2020; Meehan, 2014; Swyngedouw, 2015; Worster, 1986). In colonized regions, in particular, the expansion of settler-colonial states was tied to the dispossession of Indigenous peoples through mechanisms that include policy and law, property and water rights, ideology, and discourse about identity, and the subversion of Indigenous knowledge and modes of water governance (Arsenault et al., 2018; Curley, 2019; Daigle, 2018; McGregor, 2014; Montoya, 2017; Todd, 2018; Yazzie & Baldy, 2018). Dam construction has led to dispossession and resettlement of people with important consequences for livelihoods, health, and cultural connections to territory (Lawson, 1994; Martin & Hoffman, 2008; McCully, 2001).

As the literature on Indigenous water governance makes clear, a focus on the ontological politics of water illustrates the implications of modern water as a hegemonic practice (McGregor, 2014; Wilson & Inkster, 2018; Yates et al., 2017). Ontological politics are the "conflicts that ensue as different worlds or ontologies strive to sustain their own existence as they interact and mingle with each other" (Blaser, 2009, p. 877). The consequences of such politics are best illustrated by the clash between colonial and Indigenous relationships to water. Indigenous relationships to water most often center on understandings of water as a living entity that has agency or "spirit" and exists in networks of reciprocal responsibilities between humans and non-humans (Chiblow (Ogamauh annag qwe), 2019; Craft, 2014; LaBoucane-Benson, Gibson, Benson, & Miller, 2012; McGregor, 2014; Wilson & Inkster, 2018; Zoanni, 2017).

Wilson et al. (2019) illustrate the implications of imposing western scientific assessments of water safety, based on a modernist "treatment ontology," onto Indigenous peoples such as the Tr'ondëk Hwëch'in peoples in Northern Canada. Elders consider the use of traditional drinking water sources (e.g., untreated mountain creeks) essential for cultural and spiritual wellbeing because, among other reasons, this use maintains reciprocal relationships to water as a living entity, however, western scientific assessments ignore these relational qualities by assuming that it is possible to break water down into merely H_2O. In this way, the settler-colonial imposition of modern water entails significant "ontological violence" because, in imagining water as a mere resource, it disregards the possibility of water as a living entity (Hunt, 2014; McGregor, 2014; Sundberg, 2014; Wilson & Inkster, 2018; Yates et al., 2017).

In reconceptualizing water beyond a strictly modernist paradigm, critical scholarship argues for approaches that decenter human agency and reposition water as fundamentally relational and political (Linton, 2010; Linton & Budds, 2014; Todd, 2018; Wilson & Inkster, 2018). The acknowledgment of multiple worldviews and ontologies of water is fundamental to making this shift (Yates et al., 2017). This ontological pluralism would necessitate "a fundamental rethinking of governance including the values, decision-making processes, and institutions that are involved in such a system" (Wilson & Inkster, 2018, p. 531).

Engaging multiple ontologies also requires decolonial processes that place Indigenous self-determination, legal orders, rights, and responsibilities at the center of governance practice (Todd, 2018). In the *Te Awa Tupua* (Whanganui River Claims Settlement) (Te Awa Tupua (Whanganui River Claims Settlement) Act, 2017) in Aotearoa (New Zealand) the Whanganui Māori iwi (kin group) won a 140-year legal battle to recognize their ancestral river as having personhood (legal standing) and thus legal rights equal to that of humans (Salmond, 2014). Similar legal rights have been extended to Lake Erie, an effort spearheaded by Toledo, Ohio (USA) activists, and citizen organizations. In this way, building on Indigenous understandings of water to restructure legal and institutional arrangements is one example of how to govern beyond modern water. Nonetheless, the intertwined history of modern water and settler-colonial states provide cause to question the ability of the state to "see" beyond modern water (Wilson, 2019). Indeed, scholarship on Indigenous water governance and politics also reveals the inherent tensions and contradictions of thinking about the state, and interconnections with modernist assumptions of water, as the dispenser of justice and best available mechanism to achieve or advance environmental justice (Pulido et al., 2016).

4 | FUTURE DIRECTIONS FOR RESEARCH AND ACTION

Citizen action and emerging research have begun to chip away at the persistent myths and universalizing discourses of modern water. If water insecurity implies the lack of water for a thriving life (Jepson et al., 2017), then the scholarship reviewed here draws attention to the hidden trends, devalued communities, and institutionalized failures that have produced insecure water conditions in Canada and the United States—a stepping stone for research in other high-income countries. Looking forward, we outline a set of five research priorities to shape future scholarship and practice. Taken together, these lines of inquiry should be paired with critical analytics, methodologies, and modes of knowledge coproduction that work toward more equitable water futures.

First, research should continue to clarify the legal, political, and socioeconomic dynamics that produce and maintain conditions of water insecurity. The household does not stop at the front door. In taking a relational approach, research should target the array of water supply organizations (WSOs)—from community-level providers to large municipal utilities—and identify how organizations and actors reproduce practices that may perpetuate water insecurities. For example, too little is known about the relationship between small water operators and household water insecurity, in part due to inconsistent or absent data, reporting, or monitoring requirements (McFarlane & Harris, 2018). Small operators supply water to many low-income communities, yet they lack capital to improve infrastructure, draw from a limited workforce, and charge higher-than average water rates for less reliable service.

Legal and property rights—so often the focus of water resources research—play a role in perpetuating household water insecurity (Jepson, 2012). For example, the legal mechanisms that are used to resolve water disputes—such as Indian water settlements in the Navajo country—are often the very same perpetrators of water injustice (Curley, 2019). Taking a cue from scholarship from/of the global South, the role of informality—as a modality or "idiom" of development (Roy, 2015)—is underexplored in the North. The presumption is that informal water development is an anomaly in the highly regulated landscapes of infrastructure in the global North. But what happens when, as Ranganathan (2016) has written about in the case of Flint, housing foreclosures force lower-income residents into informal and extractive arrangements with landlords or banks? At the same time, how might we conceptualize informality as a site of struggle, as in the case of California water activists who use so-called "illegal" or informal plumbing tactics to circumvent modernist water regulations (Meehan, 2012)? Greater attention to the legal geographies and contested spaces of water governance will offer grounded insights on how state–society interactions shape water insecurity, in ways that potentially transcend North–South binaries and open up new opportunities for analytical comparison and insight (Jepson, 2012; Perramond, 2020; Winkler & Flowers, 2017).

Second, a critical political-economic perspective is essential to understand how households are leveraged by WSOs in ways that influence or possibly exacerbate water insecurity. Financialization—the adoption of new tools of extracting rent in monopolistic systems like municipal water provision—is arguably one of the principal techniques for WSOs to

squeeze new kinds of revenue out of households and infrastructure systems (Loftus & March, 2016, 2019; Loftus, March, & Nash, 2016; Loftus, March, & Purcell, 2019). These shifts imply a new set of accumulation logics and relational dynamics, in which WSOs have insulated ownership from day-to-day management to mitigate investment risks (March & Purcell, 2014) and households have become a guaranteed revenue source for financialized utilities (Loftus et al., 2016; Loftus, March, & Purcell, 2019). The question remains: what are the impacts of financialized modes of accumulation on water affordability, access, and service delivery for citizens and communities? At the same time, a number of formerly private water systems are moving back under public control as part of re-municipalization agendas (McDonald, 2018). What are the implications of these shifts for household provision and water security? Who bears the burdens and who enjoys the benefits of a new political economy of water?

Third, water access and disconnection must be conceptualized as a gradient or continuum: from "unplumbed" households to those with reliable and secure networked service. Along this spectrum, problems of disconnection, interruption, and water-shutoffs are prominent in popular media, but only recently have been a focus of scholarly inquiry (Swain, McKinney, & Susskind, 2020). Residents of mobile homes, for example, have nearly 20% higher odds of suffering from unreliable water service (shutoffs) than the general population; similarly, odds of experiencing chronic water service interruption are three times higher among mobile home occupants than those living in single-family dwellings (Pierce & Jimenez, 2015). Precarious or intermittent water lead to adaptations that include various forms of informal water provision and water sharing that often go unreported or overlooked. Homelessness is the ultimate form of water disconnection, and further research is urgently needed to address the complex experiences of chronic disconnection and housing precarity (DeMyers et al., 2017; Meehan et al., 2020; Speer, 2016). The politics of disconnection also open new questions for hydrosocial relations and water security. How do so-called "off-grid" or informal systems—such as rainwater harvesting, micro-grids, or private well systems—enable households to secure water in ways that perhaps augment household resilience? (Leker & MacDonald Gibson, 2018; Meehan & Moore, 2014; Molden, Khanal, & Pradhan, 2018; Radonic, 2019; Stillo, Bruine de Bruin, Zimmer, & Gibson, 2019). How and why do people disconnect from the network? What trade-offs emerge in hybrid or mixed-infrastructure systems? What policies or governance regulations enable or prevent disconnection?

A fourth area of concern is the relationship between contamination, regulation, expertise, and trust. More research is needed to elicit the story of household water insecurity and contamination—whether by microorganisms, organophosphates, or heavy metals. Efforts should trace the socio-environmental pathways from source to tap, and pay particular attention to the political and economic relations produce conditions of pollution, community response, and impacts on human health and wellbeing. Only recently, researchers have begun to clarify how environmental regulatory regimes contribute to insecure water in terms of water quality (Jepson & Brown, 2014). Evidence suggests that inadequacy of existing "expert" approaches to regulation often compound contamination challenges. Mistrust is exacerbated, in part, because political and scientific authorities marginalize communities in governance and reporting processes. American Indian and First Nations communities' limited capital resources and technical expertise constrain their capacities to self-manage water quality to address perpetual water's degradation in ways that align with state-mandated standards (Baijius & Patrick, 2019; Norman, 2019; Perlinger et al., 2018). Further work should map the intersections of expertise, power, and water quality in ways that open new visions of how visible and invisible water contamination can be described, understood, and governed for public health and wellbeing.

Finally, water affordability is perhaps the most understudied dimension of household water insecurity, despite the leadership of activists and organizations across Canada and the United States. A research agenda would examine water affordability in relation to other essential needs (e.g., sanitation, energy, housing) and in relation to race, ethnicity, immigration status, and other structural disadvantages. Metrics that effectively evaluate and monitor water affordability are a critical area of research. In addition to improved techniques to measure affordability across space (Teodoro, 2018), natural experiments can use the existing range of water affordability programs to examine variables such as eligibility requirements, utility size, geographic location, and ownership (Mirosa, 2015; Pierce, Chow, & DeShazo, 2020). Metrics should also assess tradeoffs, opportunity costs, and non-economic dimensions of water affordability. More information about household coping strategies in response to unaffordable water are needed and could serve as a vital site of comparison and theory-building across North–South settings. For example, recent scholarship points to the negative physical and mental health effects of the tradeoffs people make when water is unaffordable (Rosinger, 2020), but additional studies are needed to understand the extent and scope of these impacts. Key questions remain: what are the best normative and critical ways to define and measure affordability? What policy tools exacerbate (or mitigate) costs for households and augment insecurity?

5 | CONCLUSION

For well over a century, the modernist legacies of engineering expertise, infrastructure coverage, advanced treatment technologies, public policies, and regulatory oversight have produced particular logics and landscapes of household water provision in high-income countries. Universal water access, quality, and affordability—or the ideal that everyone in society has access to the same quality and quantity of water—were predicated on uniform water delivery governed by trusted scientific and regulatory regimes. Or so was the promise.

Returning to our initial question: who gets to thrive and who suffers from household water insecurity in the global North? This article has consolidated evidence that brings modernist narratives into question. Myths are more than a collection of misleading statistics or gaps in understanding: as shared beliefs, myths create and sustain norms and perceptions of secure water, including whose water experiences are deemed hegemonic or universal, and whose experiences are made invisible. As we document here, people who do not have secure water rarely get the necessary attention or support. In the example of Detroit, the longstanding problem of water affordability and shutoffs did not gain international media attention until the Covid-19 pandemic struck. In Canada and the United States, household water insecurity is a product of structural and institutionalized power that favors elites at the expense of largely poor and racialized communities—a systemic and relational problem that demands more than simple technical responses. In busting these myths, we bring overdue attention to the fissures and silences in these dominant narratives.

More work remains. In moving forward, the five thematic areas of future research all pivot on challenges embedded in legal and regulatory regimes, the housing-water nexus, water affordability, and new and emerging contaminants. We need to fill data gaps and develop metrics that can more precisely document affordability, as it likely plays an outsized role in perpetuating water shutoffs and insecurity, especially in the United States. A range of research methods are needed take stock of water access, insecurity, and disconnection at the household scale (Wutich et al., 2017).

Our review demonstrates the ideal of modern water is central to development myths that may hide long-standing social and spatial inequities. We have consolidated a wide body of research that identifies trends in household water insecurity across high-income countries, starting with Canada and the United States. Uniform water systems have never been universal and accessible to all households, due to long histories of racial segregation cut through by experiences of poverty, housing precarity, and systematic exclusion. Fragmented and technocratic water governance further contributes to patterns of disconnection and distrust. Taken together, emerging scholarship on water security for households in high-income countries demonstrates that water may have never been modern.

CONFLICT OF INTEREST
The authors have declared no conflicts of interest for this article.

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Katie Meehan: Conceptualization; writing-original draft; writing-review and editing. **Wendy Jepson:** Conceptualization; funding acquisition; writing-original draft; writing-review and editing. **Leila Harris:** Conceptualization; funding acquisition; writing-original draft; writing-review and editing. **Amber Wutich:** Conceptualization; writing-original draft; writing-review and editing. **Melissa Beresford:** Writing-original draft; writing-review and editing. **Amanda Fencl:** Writing-original draft; writing-review and editing. **Jonathan London:** Writing-original draft; writing-review and editing. **Gregory Pierce:** Writing-original draft; writing-review and editing. **Lucero Radonic:** Writing-original draft; writing-review and editing. **Christian Wells:** Writing-original draft; writing-review and editing. **Nicole Wilson:** Writing-original draft; writing-review and editing. **Ellis Adams:** Writing-review and editing. **Rachel Arsenault:** Writing-review and editing. **Alexandra Brewis:** Writing-review and editing. **Victoria Harrington:** Writing-review and editing. **Yanna Lambrinidou:** Writing-review and editing. **Deborah McGregor:** Writing-review and editing.

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