Connecting the Dots between Climate Change, Household Water Insecurity, and Migration

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CRediT Author Statement

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Abstract

Climate change is now considered a primary global driver of migration, with water insecurity theorized to be a key determinant. Most studies have focused on large-scale climate migration events triggered by extreme weather events such as droughts, storms, or floods. But there are few studies of how climate change shapes the everyday household-level experience of water insecurity and subsequent migration decision-making, beyond the contexts of disasters and agricultural livelihoods—an invisible 'slow drip' of migration. This review proposes a complementary, alternative framework for linking climate change, household-level water insecurity, and environmental migration by positioning household water insecurity as a critical pathway for shaping migration decision-making in the context of socio-environmental change. We present evidence that household water insecurity is a push factor that motivates household members to migrate due to water-related disruptions to physical and mental health, livelihoods beyond agriculture, and social relationships. We close with implications for anti-poverty and development initiatives, and for water interventions to mitigate forced climate migration.

Key words water insecurity, WASH, migration, climate change

Introduction

Climate change is a critical global push factor of migration flows, along with political conflict and economic inequality, and is expected to be an increasingly important driver [1]. Major migration events are increasingly triggered by extreme weather events [2,3] such as the Coastal El Niño 2017 in Peru [4], the drought and conflict-induced mass migration of 1.5 million Syrians [5], or by political circumstances like the Rohingya migration crisis from Myanmar [6]. While such events draw significant media and scholarly attention, they fail to account for much climate-related migration beyond disasters. Most migration theories view migration as a decision in anticipation of improvements to one's life. Though various theories operationalize migration differently, the context that traditionally leads to out-migration is accordingly explained by factors like low prospects for education, employment, and healthy living.

Everyday experiences of household water insecurity—defined as the inability to 'access and benefit from affordable, adequate, reliable and safe water' [7]—can complicate and potentially ruin people's lives all over the world. This underappreciated phenomenon strikes at the very core of human wellbeing. More importantly, given its various social and political components, household water insecurity can occur in the absence of regional water scarcity, thereby inducing less-visible migration pressure that can be spatially asynchronous from regions experiencing droughts or other water quantity limitations. Water insecurity may thus be an important push factor that instigates a 'slow drip' of migration that may be misattributed to generalized economic or other drivers. New Economics of Labor Migration (NELM) theory positioned migration decisions as micro-scale decision making at the household level [8], offering a compatible level of analysis for analyzing the pathways through which household water insecurity experiences may shape migration.

Research communities have devoted significant time to unpacking the relationships between climate change and global water scarcity [9], and between global environmental change and migration [10]. Reliable water infrastructure has been considered an important non-economic pull factor for migration to mega-delta cities in Asia and Africa [11]. But such studies tend to be disconnected from the household scale, failing then to link these processes together to understand how household water insecurity may serve as a more proximate, key push factor

for migration in the context of governance and climate change challenges [3] as conceptualized in **Figure 1**. For example, a large household study of water-stressed sites in 23 low- and middle-income countries found that one-fifth of respondents had considered moving in the four weeks prior to survey due to water problems [12]. But we know little about which dimensions of water insecurity, and under what conditions, people ultimately decide to go.

In this paper, we review this basic potential model of household water insecurity as a 'slow drip' driver of migration decisions, a pathway that is distinctly different from the disruption of agricultural livelihoods due to climate variability.
We focus on aspects of the household water insecurity experience that are theorized to be
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experience that are theorized to be proximate determinants of migration, organizing the evidence around three migration-decision elements relevant to households in the contexts of water insecurity: (1) physical health and hygiene, (2) psychosocial health, and (3) non-agricultural livelihood and social disruption, while also recognizing that water and poverty can interact to inhibit migration. We close by discussing the implications of this model for sustainable health and development.

[FIGURE 1 ABOUT HERE]

Household Water Insecurity as a Determinant of Migration

Health and Hygiene

Inadequate water, sanitation, and hygiene (WASH) contributes to the global burden of disease through a variety of pathways [13] that increasingly includes non-communicable diseases [14]. The volume of water used by a household has been associated with health [15] and depends greatly on accessibility as determined primarily by distance, time, source type, reliability and potentially cost [16]. Health concerns may be high when water collected falls below five liters per person per day, distance exceeds 1 km or collection time exceeds 30 minutes [16]. However, there is a dearth of empirical evidence describing the relationship between availability of adequate water and migration in the literature. Instead, it appears that this relationship is assumed. Water quantity shortages have consistently been associated with migration, e.g. in Ethiopia [17], Syria [5], Brazil [18], and South Sudan [19]. In most cases, the water shortages interacted with political instability or existing internal conflict to yield large scale migration.

In addition to droughts, water shortages can be induced by pollution, unmaintained or insufficient infrastructure and other natural disasters, as seen in Pakistan [20], Brazil [21] and the Dominican Republic [22]. Communities in Coastal Bangladesh have faced increasing salinization of water (which increases hypertension risk, pre-eclampsia, and other health concerns) and low adaptive capacity which results in increased migration propensity caused in part by water insecurity [23], as well as the effects of salinity on crop production [24]. Sea level rise-induced salinization of groundwater may increase migration propensity in coastal communities where agriculture (and subsequent food security) is threatened [25], as well as among households who cannot afford alternative water supplies. In the Republic of Marshall Islands, 60% (168/268) of households surveyed said they left their home island community to find water during a natural disaster and 1% said they left their community to look for water at other times [26]. Residents affected by water pollution near an industrial area in Karnataka, India, had higher health expenditures for adults and children, and were more likely to migrate, with longer duration and at greater distances [27]. Even in high-income nations, water pollution or poisoning events—even if not climate-induced—can activate desire to migrate, as seen after the detection of high lead levels in the water of Flint, Michigan [28]. Concerns related to water, health, and hygiene may therefore be a proximate determinant of migration.

Psychosocial Health

Living with water insecurity is associated with heightened levels of anxiety and depression, and even—in extreme droughts—elevated risk of suicide [29,30]. The experience of living with inadequate access to safe, reliable water does not only provoke anxiety [31], but may also lead to social shame, frustrate abilities to meet important gendered social and productive roles, disrupt relationships, and expose distressing inequalities and injustices. For example, ethnographic work in informal urban settlements in Bolivia has established that both exclusion from community water schemes and having to deal with dismissive water vendors are both anger-inducing and deeply humiliating. The negative effects are most pronounced for women, because of their key domestic roles in negotiating access to and using water to maintain the household [32]. Women have also reported feeling embarrassed for being unable to welcome visitors with safe water and often have to make trade-offs in order to provide household water needs [33,34]. Recent studies have also shown water insecurity is associated with higher prevalence of women's reports of domestic violence [34-36]. The role of perceived water inequalities (as violations of informal institutions) can possibly be sufficiently emotional to create not just domestic but also community schisms. The very particular emotional dimensions of water insecurity suggest it could be an especially sensitive trigger for decisions to migrate, and that its relative importance as a factor in decision-making likely varies by gender.

Non-Agricultural Livelihood and Social Disruption

The time required for water collection in settings without functioning domestic piped supplies is substantial, often with pronounced seasonal variation depending on the availability of surface water or wells. When water from particular sources are in high demand, queueing for a turn at the pump or well-head may also be time-consuming. Water collection commonly disrupts livelihoods with implications for education and work opportunities, particularly for women and girls [37]. As time spent fetching water increases, girls can be pulled out of school to serve the family in this "more important" capacity [38-40]. In other instances, adult women assume more responsibility (and time) for water collection to keep young girls in school, but this puts further pressure on those same women who have less time for other non-water-related household responsibilities [41].

More importantly, climate change and water insecurity present obstacles to participating in urban and peri-urban climate change and water insecurity present obstacles to participating in urban and peri-urban labor markets, but these issues receive less attention than the challenges of farmers facing rainfall variability and extreme weather events. The demise of small farms, in part a result of climate change and water insecurity, typically results in the migration of family members to larger urban areas in search of alternative employment [42]. But urban migrants' time spent collecting household water—or limited available quantities—can reduce participation in income-generating activities for both men and women, albeit in different ways. Household water insecurity may disrupt the ability of the urban poor to pursue or maintain higher-order employment opportunities that require strict work schedules or regular laundering of professional attire or uniforms. It also limits the scope of employment opportunities by hampering water-related livelihoods such as hairdressing or food preparation [43]. Household water insecurity exacerbates the effects of gendered household roles that already limit female participation in labor markets around the world. Beyond observing and reporting this phenomenon, there is little research that explicitly analyzes the negative effect of household water insecurity on household income generation.

The time and energy required for water collection can lead to substantial opportunity costs in terms of domestic tasks and social engagements, whether in the home or the community. These in turn may place strain on social relationships, both with spouses and neighbors, and erode social capital. In rural highland Ethiopia, women reported missing sleep

on account of water collection, and abuse at the hands of their husbands for not completing tasks they had sacrificed on account of water collection. They also spoke of the shame they experienced at not being able to meet normative standards of hospitality and propriety by offering water to guests and keeping themselves and their children clean [36]. Depression and shame, therefore, may result from livelihood and social disruption when water insecurity occurs at the household level and can lead to, but also result from, migration [44]. The feedbacks of migration and remittances on household water insecurity in the origin community are yet another consideration for future research, but are beyond the scope of this review.

Trapped Populations

It is important to acknowledge that household water insecurity and concomitant poverty may also serve as a barrier to migration, effectively trapping people, or creating "displacement in place" [45], as seen in Flint [28]. Migration may be seen as a form of resilience, whereas the most vulnerable households are more likely to become trapped populations, perhaps as a result of some failed adaptation strategy [46,47]. Disasters may increase a community's labor needs or eliminate material or financial resources that enable migration [48,49]. Researchers have considered the interaction between climate change and poverty on migration in a laboratory setting, though with uncertain applications in the real world [50]. For example, in Kenya, migration was driven by the intersection of environmental change, ineffective governance, poverty, lack of adaptive capabilities, and individual desires [51]. Water's effects on migration are often gendered, with greater restrictions on women's movements, as seen in Bolivia, where water insecurity often led to men migrating and leaving women behind [52]. Water insecurity's interactions with climate change, governance failures, and poverty to trap populations in place remain understudied and are promising topics for future interdisciplinary migration research.

Conclusion

Oversimplifying water's role in migration as solely linked to agricultural production may mean that development opportunities to alleviate migration pressures are missed. Experiences of household water insecurity have the potential to ruin people's lives. Here we have reviewed evidence on how water insecurity can motivate household migration to mitigate disruptions to their health, livelihoods, and social relationships. Although few studies have examined the pathways between household water insecurity and migration propensity in the broad sense described here, the science of water insecurity suggests that they are likely diverse and numerous. Other prevalent experiences of household water insecurity that may increase migration propensity include injury avoidance [53], minimizing social exclusion [54], and high financial costs of water [55].

Some scholars have suggested that governments and aid agencies should focus on development policies that stabilize agricultural and livestock production (while also improving water supply systems) to reduce the impact of climate- and water-related drivers of migration, such as loss of income or income variability [56]. By analogy, improvements to water supply systems that simultaneously improve health and hygiene, while also reducing the social and psychosocial burdens of water insecurity, unlock a variety of opportunities to maximize one's well-being without leaving. How can we apply these key household-level climate-water-migration linkages, once specified and defined?

Recent high-profile integrated WASH interventions have underperformed on a narrow set of child health metrics [57], but most certainly mitigated many social manifestations of household water insecurity. It follows that measures of water insecurity and migration propensity might be considered as a monitoring and evaluation criteria of WASH interventions to more fully recognize the community- and household-level value of these interventions. New metrics of household water insecurity [58,59] offer unprecedented resolution for understanding fine-scale variation in water insecurity experiences in low- and middle-income settings, and allow

researchers to ask new questions about the complex interactions between people, the environment, and migration decision-making. Geospatial tools allow the assessment of climate-water-migration linkages at even finer scales that can assist evaluation of multiple Sustainable Development Goal Targets [60]. Increasingly, governments and agencies have better access to data, but are hampered by lack of integration of sectors toward common development goals. The framework we highlighted will bridge climate change, household water insecurity, and migration, and help spur precisely that integration.

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Declaration of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Figure Caption

Figure 1. Conceptual model of the pathway between governance, climate change, household water insecurity, and migration, as an alternative pathway to the most studied pathways between climate change and migration. The light arrows represent the most commonly studied links between water security and migration.

References and recommended reading

Papers of particular interest, published within the period of review, have been highlighted as:

• of special interest

•• of outstanding interest

• Cattaneo et al. 2019: This paper explores key features of the relationship between climate change and migration, distinguishing between fast-onset and slow-onset climatic events and examining the variation in migratory responses to climate events.

• Hunter et al. 2015: This paper is reviews the interdisciplinary theoretical history and drivers of environmental migration, broadly speaking.

• Miletto et al. 2017: This UNESCO report examines many of the relationships between water and migration through the multidisciplinary lens of gender and youth labor economics.

• Nagabhatla et al. 2020: This UNU-INWEH report summarizes many of the diverse connections between water and migration with case studies from around the world.

• Sobczak-Szelc & Fekih 2020: This paper analyzes the mechanisms by which Tunisian households adapt to disruptions to agricultural livelihoods and broader environmental change through migration.

•• Jepson et al. 2017: This paper provides a seminal conceptualization of household-level water insecurity and its constituent dimensions.

•• Rakib et al. 2019: This paper is one of the first studies to explore links between socio-environmental factors, drinking water quality, public health impacts and migration risk at the household level.

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