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Research article

Water struggles and contested use: A capabilities assessment of household water security in marginalized communities

Michael Egge, Idowu Ajibade *

Department of Geography, Portland State University, USA

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ABSTRACT

In this study, we apply a capabilities approach to analyze a water consolidation project and water security outcomes following a severe drought in East Porterville, California. By combining hydro-social theory with the capabilities approach, we provide a holistic approach to household water security that is historically situated, considers residents' needs, and accounts for areas of life beyond hydration and domestic use. In addition, we offer a critical analysis of water system consolidation, a process of combining water systems physically and/or managerially as a solution to water insecurity in small towns. Drawing on interviews with residents, local experts, and government officials as well as archival research and participant observation, we find that the water consolidation project has mixed results for the East Porterville community, with beneficial, limiting, and contested effects on residents' social, cultural, and economic life. Although residents now have a consistent source of water in their homes, they find themselves limited in their ability to use water for drinking and cultural and economic purposes. Water negotiations and contestations also affected property values, independence, and livability. Through this empirical application of the capabilities approach, we demonstrate the need to expand the concept of water security and consolidation outcomes through needs-based perspectives. Furthermore, we show how the coupling of capabilities approach with a hydro-social framework provides descriptive, analytical, and explanatory tools for understanding and addressing household water security.

1. Introduction

In the last decade, water insecurity has been brought into sharp focus in policy and planning debates globally and in the United States. Recent water crises in East Porterville, California (London et al., 2018) Flint, Michigan (Pauli, 2019; Pulido, 2016), Newark, New Jersey (Iati, 2019; Yi, 2019) and Milwaukee, Wisconsin (Dirr, 2019), and Jackson, Mississippi (Nwanaji-Enwerem and Casey, 2022) have revealed unsettling trends in geographic, economic, and racial inequities prompting experts to propose a myriad of strategies to ensure water security for communities at risk. One proposed strategy is water system consolidation, a process of connecting two or more water systems managerially or physically as a solution to water insecurity in underserved communities (Balazs and Ray, 2014; Bostic and Chappelle, 2018; Feinstein et al., 2017; London et al., 2018; Nylen and Pannu, 2018; State Water Resources Control Board, 2018; Teodoro, 2019). While applauded by some scholars as a way to address racial and geographic disparities in water quality and access (Feinstein et al., 2017; London et al., 2018), others have raised concerns about the justice implications of such systems (Balazs and Ray, 2014; Nylen and Pannu, 2018; Ranganathan and Balazs, 2015). As water system consolidation gets implemented with increasing regularity, it is important to analyze their viability and the ways that it serves and fails the people it is purported to help. Indeed, such solutions may likely increase under increasing climate and socially-induced drought conditions.

In this paper, we define water security as the "capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability" (U.N. Water, 2013). To analyze the efficacy of water system consolidation in East Porterville we focus on the concept of water security for human development, a longstanding area of study. Traditional household water security metrics describe water quality, quantity, source, and affordability, but generally oversimplify what creates insecurity by ignoring social relations and power dynamics (Loftus, 2015; Wutich et al., 2017). Furthermore, these metrics are often based on water for drinking and sanitation,

* Corresponding author.Department of Geography Portland State University 1721 SW Broadway, Portland, OR, 97201, USA.
E-mail address: jajibade@pdx.edu (I. Ajibade).

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disregarding important socio-cultural uses (Jepson et al., 2017a, 2017b; Linton and Budds, 2014). Whereas, water security for human development emphasizes water as a necessity for human survival, wellbeing, and development, attending to the social barriers that prevent access to this vital resource (Jepson and Vandewalle, 2016). In the human development literature, water is often analyzed at the community and household scale along multiple axes of difference, including: race (Pulido, 2016)(Pulido, 2016), immigration status (Jepson and Vandewalle, 2016), nationality (Giglioli, 2012), gender (Harris et al., 2017; O'Reilly, 2006; Truelove, 2011), location (Ranganathan and Balazs, 2015), emotions (Sultana, 2011; Egge and Ajibade, 2021) income (Stoler et al., 2012) and other intersectional identities (e.g. Switzer and Teodoro, 2018).

There have been various attempts to improve the measures of water security, including the Household Water Insecurity Experiences (HWISE) Research Network, which seeks to develop a cross-culturally valid scale to analyze the degree of water (in)security and local problems by quantifying experiences across multiple components such as accessibility, adequacy, reliability and safety (Young et al., 2019). Other scholars have theorized that a capabilities approach can address these issues by broadening the scope of what it means to be 'water secure'. This approach pays attention to the multiple uses of water (e.g. cultural, spiritual) and its effects on other areas of life (Jepson et al., 2017a). This article adopts a capabilities approach to water security by analyzing the case study of East Porterville, California, a historically disadvantaged community that experienced a widespread loss of water supply to households during five years of prolonged drought from 2011 to 2015. We contribute to the ongoing debates about water security by demonstrating the efficacy of a capabilities approach and its complex interrelationship with water system consolidation projects and policies in the United States. Furthermore, we argue that the water system consolidation reflects, contests and (re)produces the marginalized status of East Porterville residents.

The paper is organized as follows. In the following sections, we elaborate on the meaning and theoretical foundation of the capabilities approach and specify how we apply it in our case study. Next, we describe our methods for data collection and analysis. We then describe the context of East Porterville, first focusing on the historic underpinnings of water insecurity, followed by the recent drought, and finally on the outcomes of water system consolidation. In the concluding section, we discuss the implications of our findings for understanding water security and water consolidation projects within historic and contemporary regimes of oppression and everyday struggles for survival.

2. Theoretical framework

The capabilities approach

At its core, the capabilities approach is a normative theory that is used to conceptualize and delineate injustices, as well as their effects on human well-being (Robeyns, 2016a). The approach centers around what individuals are able to be and do in society, adopting the terms capabilities and functionings for the evaluation of well-being (Sen, 1999). Functionings describe 'doings' or 'beings', such as doing the laundry or being educated; they are actions (doings) or states (beings) that people may value, while capabilities describe the ability to achieve a functioning (Sen, 1999, 2004, 2005). The capabilities approach largely derives from work by Amartya Sen (1980, 1999, 2004, 2005), Martha Nussbaum (2003, 2005, 2011), and Ingrid Robeyns (2005a, 2005b, 2006, 2016a, 2016b, 2017) to assess social arrangements that produce restrictions and openings to well-being, and propose paths toward social change (Robeyns, 2016a). It was developed as an alternative to other assessments of well-being that focus on either subjective or material measures.

Critical of the utilitarian approach for its sole focus on maximizing benefits and failure to account for unique differences among people and their individuality, Sen (1980) developed the capability approach to address these problems. Similarly, he criticizes quantifying primary goods as a measurement of justice for its focus on the presence or absence of material goods and not on a person's ability to use the goods to their own benefit (Robeyns, 2005a; Robeyns and Brighouse, 2010; Sen, 1980, 1999). He does not dismiss such measures of well-being as unusable but argues that they only make up one part of the picture, leaving out social, individual, and environmental factors that may limit equality and access. Theoretically, capabilities are the culmination of factors that create the optional engagement in a functioning (Sen, 1999, 2004, 2005). They offer an alternative approach to evaluate equitable social outcomes, the ability to achieve them, and the multiple factors that enable individual choices.

Conceptually, capabilities and functionings are value-neutral categories (Robeyns, 2017 pp. 41–45). In practice, specific capabilities and functionings can be good, bad, neutral, or conflict with other people's ability to achieve wellbeing. Moreover, their valuation is subject to the beholder (Nussbaum, 2003). As Nussbaum (2003 p. 45) cogently argues, verbal sexual harassment (a functioning) has a negative effect on the victim of the harassment but can be defended as a right to speech (a capability) by the perpetrator. Other capabilities may be considered universal goods (breathing) or bads (murder) by society at large (Stewart and Deneulin, 2002 p. 67). Outside of conflict with other persons' capabilities, an individual's own capabilities may be present, but in conflict with one another (Nussbaum, 2011). In this case, the means to each capability, such as time or income, is limited to the point that it can only be used for one capability. If each capability is necessary for their well-being, the individual is faced with a tragic choice between capabilities: choosing one would eliminate the option to choose the other (Nussbaum, 2011). Ultimately, the capabilities approach asks that positive capabilities are increased (Alkire, 2005) while negative functionings are weakened (Robeyns, 2017 p. 52) at the individual level (Nussbaum, 2000). This focus on individuality represents an important critique of classical economic approaches, particularly trickle-down economics, which focus on growth in average living standards (e.g. income) but obscure the continued disenfranchisement of marginalized populations by assuming an equal rise in living conditions across the entire population. In contrast, the capabilities approach adopts the Kantian principle of each person as an end, wherein each individual has value, requires care, and faces unique barriers (Nussbaum, 2000 pp. 55–59).

Capabilities are made up of multiple conversion factors which disable/enable access to a functioning. Conversion factors may be personal (e.g. physical dis/abilities), social (e.g. structural racism), environmental (e.g. proximity to surface water) or technological (e.g access to infrastructure (Crocker and Robeyns, 2009; Robeyns, 2005a). These factors are important because resources are often necessary to perform actions, but without the necessary social circumstances they are unusable (Robeyns, 2005a; Sen, 1980, 1999). Conversion factors vary greatly among individuals and social groups, making them an important element of analysis, but they must be contextualized within the capabilities they can support (Sen, 1982). From a methodological perspective, the end goal or the capability in question should be determined first. Then the means to an end, the status of goods and conversion factors, can be analyzed to understand if and how the capabilities will be accessible (Robeyns, 2017). For example, Zaidi and Burchardt (2005) analyzed the capability required to convert income into standards of living for people with disabilities, by investigating conversion factors like household composition, the means. Since the capability approach provides a flexible framework that can fit a variety of situations, cultures, and disciplines and account for various perspectives and values (Robeyns, 2017; Sen, 1992). We find it to be valuable in exploring household water access and functionings. However, we note that it does not fully account for the structural and socio-natural factors that shape the metabolic circulations and flow of water across urban spaces and

especially in unincorporated communities. To account for these factors, we draw on the hydro-social cycle as a complementary framework for understanding inequities in water security at the household scale.

The hydro-social cycle as a complementary theory

By drawing on the hydro-social cycle as a theoretical framework (Bakker, 2002, 2012; Linton and Budds, 2014; Swyngedouw, 1999, 2009), the capabilities approach can account for the socio-natural power structures that enable and limit water access, and push the boundaries of what it means to be 'water secure' (Jepson et al., 2017a). In his seminal paper, Swyngedouw (1999) argues that, although elites dramatically alter the waterscape by mobilizing their knowledge, expertise, and power in the name of social and natural reform, water is more than a medium to exert power. Rather, water itself embodies these processes as a hybrid of nature and society, wielding power itself. Prior to this work, it was well established that water was altered by humans and society, but it was still largely conceived of as an object separate from humans. Instead, Swyngedouw (1999) argues that water influences society, expresses history, reveals struggles, and represents power relations. These ideas would heavily influence the conceptualization of the hydro-social cycle, first defined by Bakker (2002). Within the hydro-social cycle, water is treated as a product of geophysical, technical, and social forces that acts with agency, recursively changing the structures that produce it (Bakker, 2002, 2012; Linton and Budds, 2014; Swyngedouw, 2009). Even as society exerts control over water, water itself changes, affecting its usability and portability, creating opportunity and conflicts among users (Barnes, 2012). Coupling this theory with the capabilities approach offers a new dimension in the household water security literature, by scaling up the analysis of local capabilities to understand how water is constantly redefined by social, natural, and technical interactions that result in the unequal access to water-related functionings (Jepson et al., 2017a).

Integrating a hydro-social theoretical framework with a capabilities analysis pushes water security issues beyond its physical dimensions to encompass the social and material relations that structure unequal water access. This combined framework attends to the differences within communities and households, where different uses and values of water abound, emphasizing the (in)ability of individuals to use water for a variety of functions (Jepson et al., 2017a; Mehta, 2014). This approach also extends beyond direct uses of water into ancillary effects, where water access is not only derivative of social status and power relations, but can actively affect these areas (Wutich et al., 2017). Improved water-related capabilities have the potential to positively affect a range of other capabilities such as those related to status and income (Gimelli et al., 2018a). Gimelli, Rogers, and Bos (2018b) apply the capabilities approach to assess water related freedoms in India. They consider how capabilities affect change within water politics and its rippling effects on political power more broadly. In doing so, they scale up from water sources and household access to the structures of marginalization that determine local capabilities. In many ways, this approach enables a deeper engagement with water security, speaking to the relational and hybrid nature of water, its social and cultural uses, and the political-economic structures that underpin inequality in access.

This article provides an empirical application of the capabilities approach rooted in the hydro-social cycle. We apply this framework to evaluate the outcomes of a water system consolidation project in drought-prone locations, looking beyond drinking water to understand how such projects can (or fail to) serve communities and how pre-existing social relations and unspoken norms can limit community capabilities and functionings. In doing so, we demonstrate the effectiveness and limitations of the approach for future water security studies. In the following section, we describe our research methods before turning to a description of our case study site, East Porterville, California.

3. Methodology and analysis

The following sections draw on interviews and participant observation in and around East Porterville, California from July to August 2018 and January to February 2020, as well as content analysis of archival and recent newspapers from publications between 1960 and 2018. These multiple qualitative methods provided an opportunity for triangulation (Bowen, 2009; Creswell and Miller, 2000) of both the historical context and the lived experiences of water users in the area. Semi-structured interviews took place with residents, local experts, and government officials to gain an understanding of the multiple perspectives and decision-making during the water crisis. We conducted 37 interviews: households (n = 21), local experts (n = 11) and government officials (n = 5). Participants were recruited through snowball sampling and word of mouth. Demographically, participants identified as Latinx = 24, White = 12, and one person described themselves as Texican. The government officials were white. Five of the local experts were white and six were Latinx. The majority of the household participants were Latinx and two household identified as white. Each interview lasted between 30 min to one and a half hours. We used a local translator for four Spanish language interviews in order to build rapport between participants and the research team. Participant observation took place over several days within a month at a local non-profit agency that was instrumental to providing water and services to residents during the drought, while also serving on the government taskforce described later. Archival sources (newspapers, photos, maps, local history books) were collected at the Porterville and Visalia Libraries and the Porterville Museum, providing historical context to the 2011–2018 water shortage. We conducted our interview a year after the water consolidation project was completed. The project was done in two phrases. The first phase kicked off in early 2016 connecting 300 homes. The second phase connected 450 additional households that still had access to water in their wells but who wish to avoid future water losses and water insecurity (California Department of Water Resources, 2018)

When applying a capabilities application, the researcher must determine the relevant capabilities and/or functionings for analysis (Robeyns, 2016a; Sen, 1993). One way to apply the capabilities approach is through the democratic selection of capabilities and functionings under analysis, based on the beliefs and desires of the population in question (Byskov, 2017). A democratic approach is useful for exploring individual perceptions of what makes up wellbeing (Biggeri et al., 2006), contextualizing the extent of agency (Verd and Andreu, 2011), and discovering points of contention (Frediani, 2007). In this article, we used multiple qualitative methods to probe respondents for local capabilities and functionings associated with water. Capabilities and functionings were then chosen for analytical focus through a general inductive approach, which consisted of multiple rounds of reading and coding the transcriptions for a representative list of the most relevant themes emerging from the data (Thomas, 2006). Therefore, they are meant to represent the most frequently cited capabilities and functionings in East Porterville, without prioritization placed by the researchers.

We draw on interviews, observation, and archival records to provide a rich descriptive analysis from multiple situated viewpoints to understand the positive, negative, and contested effects of the water project (Robeyns, 2005a, 2017 pp. 31–35). According to Unterhalter (2003), a descriptive approach probes deeper into questions of justice, especially in understudied areas, and can problematize popular accounts of justice initiatives by contextualizing capabilities in local histories and structures of oppression. Descriptive accounts can also adopt qualitative techniques to provide rich descriptions of the effectiveness of development interventions (Conradie, 2013). Throughout the rest of this article, we describe the shifting capabilities in East Porterville before, during, and after the drought, largely focusing on the post-consolidation present and future.

4. Local geography and context

In this section, we describe the hydro-social relations at play in the East Porterville case. We also highlight capabilities that existed prior to the drought, as well as the negotiations that took place as part of the water system consolidation.

4.1. Peri-urban life and political relationships

East Porterville is an unincorporated community that lies on the outskirts of the City of Porterville in Tulare County, California (see Fig. 1). Driving through the city into the community, there is no gap between the two distinctly designated areas. However, one can see and feel the quality of the road change when crossing the line from city to county jurisdiction. As an unincorporated community, East Porterville occupies a peri-urban space, a unique geographic position between the urban-rural divide, a transition zone of sorts (Anderson, 2007). Peri-urban areas are defined by their proximity to incorporated cities, but lack of city services. Often, they are made up of marginalized populations who are unable to live in, or have been excluded from, the city proper (Anderson, 2007) and, in the case of California, lack consistent water access (Ranganathan and Balazs, 2015). In the water project, the main governmental bodies are the City of Porterville, Tulare County, and the State of California. East Porterville lacks its own governing body and primarily relies on officials elected at the county level for development.

Residing outside of city jurisdiction does afford residents certain capabilities that do not exist in the city. As one resident told us, "We have more land, access to more land, so we have the ability to build things on our property … the reason why [my father] switched over to this house was because it gave him the ability to own livestock. We have the land for livestock, planting, and vegetation. He likes planting fruit gardens" (Household 10, August 16, 2018). Oftentimes, people move to the area for these benefits. They prefer the availability of land for horses, livestock, gardens, and open spaces, which provide clear economic benefits as a source of food, but also health and cultural benefits. Residents describe feeling "peace" in their gardens, and report sharing their harvest with the community free of charge. Furthermore, Latinx immigrants can also "plug into a community [with] people that speak their own language" (Local Expert 7 August 14, 2018) by moving to East Porterville. However, many residents may not live there if they had a choice.

Rental prices in East Porterville are markedly lower than in the city, drawing in many of the low-income farmworkers. Several of these field laborers are immigrants from Latin American countries, some of whom are undocumented, meaning that they lack legal documentation of immigration which could lead to deportation if found. The combination of rental prices and low police presence encourage this marginalized population to live in the area, where they can fly under the radar at low risk of exposure. On the other hand, as these immigrants avoid government contact, they become exposed to predatory landlords. Homes in the area depict exposed wires, poor structure, or "it's not even a house, it's just four walls with a plastic cover on the top" (Local Expert 4, August 7, 2018). There are also two gangs in the area that threaten personal security and well-being of community members. One interviewee told us "the gangs … [have] affected us, it would affect anyone. There are people who've been killed" (Household 6, August 11, 2017). He went on to say that if he had the money, he would move away from East Porterville.

Although the geographic location provides certain opportunities, the challenge with East Porterville is the economic, racial, and social marginalization of immigrants; this is prevalent across California (Ngai, 2014; Méndez et al., 2020). American immigration policy systematically controls and disenfranchises Latinx bodies, exploiting their labor and threatening them with deportation, pushing them to the fringes of society (Brendese, 2014; Márquez, 2012; Valdez, 2016; Vasquez, 2014). East Porterville itself is considered a low-income (Flegal et al., 2013) disadvantaged unincorporated community, with a Latinx population (78%) above both the regional average (48.9%) and adjacent Porterville (62.4%) (London et al., 2018). It is neglected by the county in part because investment in the area would quickly lead to annexation, costing the county government money/capital that could benefit the City of Porterville (Flegal et al., 2013). Latinx social groups are one of many immigrant groups historically marginalized in California and the American West more broadly, occupying low paying jobs, subject to poor working conditions, and systematically excluded from citizenship and thus legal rights (Ngai, 2014). This is tied into the historic practices that force Latinx families and other communities to live on the fringes of cities, near services, but separate and isolated (Flegal et al., 2013). Without city water infrastructure, disadvantaged communities in California struggle with water access and quality (London et al., 2018), affecting their water-related capabilities and life chances by systematically making life more difficult, while allowing easier control by the state and corporate actors.

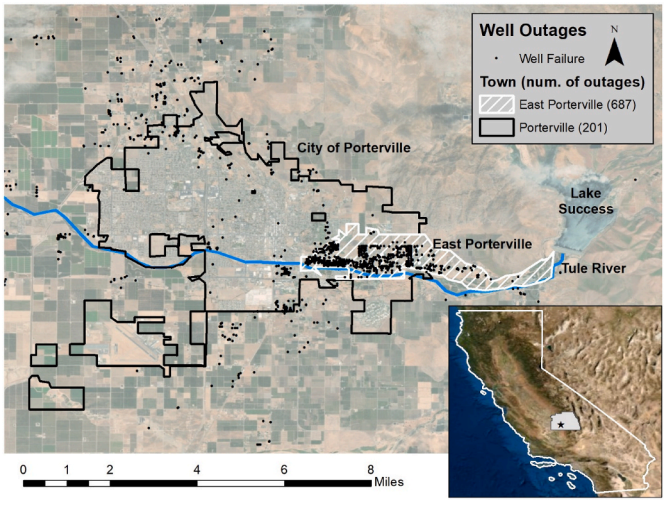

Fig. 1. Map of well outages due to water shortage or contamination in Porterville (201) and East Porterville (687). Data: Tulare County Office of Emergency Services, Esri, DigitalGlobe, USGS (Egge and Ajibade, 2021).

4.2. Pre-drought water security

Groundwater in East Porterville is fed by the Tule River. As the river flows, the groundwater is found near the surface. Homes in the area easily dig point wells to access this shallow reservoir, as little as 20 feet in depth in places. This puts homes at the mercy of the river: when the Tule runs dry, so do the homes. Drilling deeper is difficult: below the shallow water table lies bedrock, followed by a deeper and more abundant aquifer accessible to the wealthy, but too expensive for most anyone else. Historically, East Porterville has struggled with water supplies from these shallow wells due to periodic drought (Méndez-Barrientos et al., 2022; Hoagland, 1977; Pompeii, 2020). A centralized water system was never installed in the area because it was not incorporated into the City of Porterville. In the 1960s, the construction of the Success Dam upriver of East Porterville controlled the river, providing more consistent river flow and groundwater to the residents (Méndez-Barrientos et al., 2022; J. Young, 2002). In 1972, the City of Porterville proposed a vote to install a water system and annex East Porterville (Election Polls Set, 1972). As the vote approached, residents voiced concerns surrounding taxes and a loss of independence associated with annexation, while doubting the need for a water system now that the dam leveled out water supplies (Méndez-Barrientos et al., 2022). Residents of East Porterville voted down the measure, retaining the capability to exploit peri-urban functionings: independence and

self-sufficiency. However, it also set the stage for future water insecurity.

> Even before the most recent drought, one resident told us that they "were having problems with the well already, we'd had it for years and sometimes it gave us enough water and sometimes not so much. We wanted the opportunity to connect to the city, we thought the city would help us by giving us a water connection" (Household 5, August 9, 2018). Some residents often spent time in the summer with reduced or no water from their wells, relying on other temporary sources until the shallow water table returned later in the year. Since this problem was short lived and unevenly experienced across the community, it largely went unnoticed by those outside the community.

East Porterville residents were susceptible to both water contamination and water shortage. Water quality, however, was a less visible problem. Water quality testing is uncommon in the area, and most residents have not seen it as an issue: "When we had the well we would drink and everyone would say 'wow, this is good water'" (Household 7, August 11, 2017). Although this woman enjoyed drinking her water, she, like many others, was unlikely to have it tested because of the taste: "There's historical septic tanks in the area. There are bacteria in the water. There's nitrates in the water, so no, just because your well [water] tastes good, it may not necessarily be safe" (Local Expert 7, August 14, 2018). In this case, there is a gap between local and institutional knowledges surrounding water quality. The condition of the water is determined by embodied knowledge, taste, or by quantifiable measures such as chemical testing. Thus, water seen as useable by residents may not be fit by institutional standards, and vice versa.

4.3. Water crisis and consolidation

California experienced its worst drought on record between 2011 and 2015 (Swain, 2015). During this time, dry wells were widespread across California, "but nothing like the concentration in Tulare County, and then nothing in Tulare like the concentration in East Porterville" (Local Expert 1, June 16, 2018). However, reports of dry wells were slow to reach nonprofits and government institutions. First, periodic dry wells were common in East Porterville. Second, fear of the government persisted throughout the community due to immigration rhetoric, preventing early reports. Eventually, community members began reaching out to non-profits and city leaders. Soon after, an avalanche of reports came in, turning the shortage into a veritable water crisis. The crisis worsened as the drought continued, resulting in hundreds of well outages due to water shortage and contamination until state, non-profit, and individuals began to provide water supplies to the community.

In response to this crisis, the state of California opted for a water system consolidation between East Porterville and the City of Porterville. California has begun to promote water system consolidation as their main method to secure water for small communities facing water shortages and contamination (Allaire et al., 2018; London et al., 2018). Water system consolidation can take place by merging managerial and/or physical water systems (see Fig. 2). Managerially, a water company can take control of a separate entity's water system, perform maintenance, collect fees, and complete other duties. Physically, a water company can extend its water supply to another water system to provide them water, charge the second company a fee, and maintain managerial independence from the second company. These activities shape the metabolic flow and circulation of water, thus playing an important role in the hydro-social cycle. In our case study site, the City of Porterville both extended its water system to East Porterville homes and maintained managerial control over the new water infrastructure (London et al., 2018). Allaire et al. (2018) state that consolidation creates economies of scale, providing more resources to these otherwise small and underserviced areas. However, issues exist in early efforts to consolidate water systems (Balazs and Ray, 2014; Nylen and Pannu, 2018; Ranganathan and Balazs, 2015) and research still needs to be done to address these concerns.

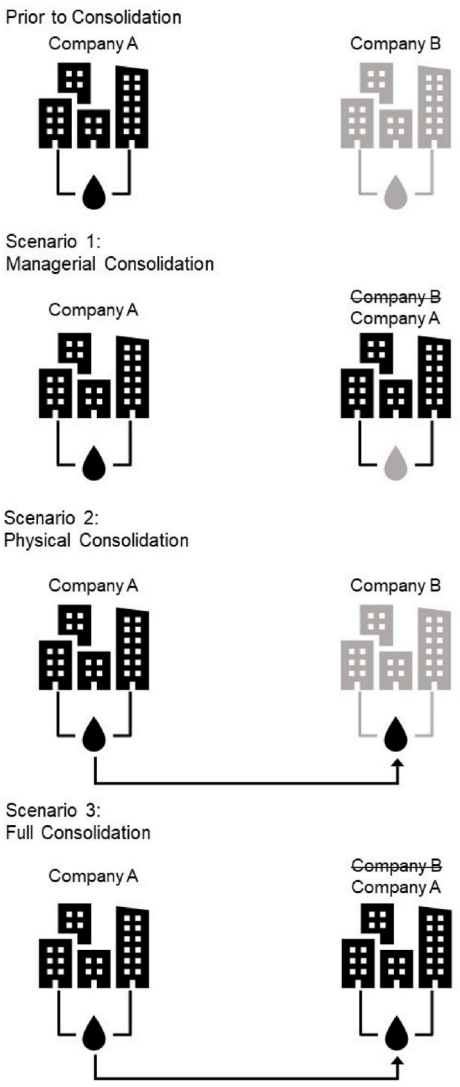

Fig. 2. Prior to consolidation, Companies A and B would provide water under different management and water systems. In Scenario 1, Company A takes over control from Company B, without combining water systems. In Scenario 2, Company B remains in place, but receives water from Company A. In Scenario 3, Company A provides a new water supply/system and gains managerial control over the entire system.

In the East Porterville case, the City of Porterville used state funding to extend water lines to the homes in the area, maintaining managerial control over the entire water system in the process (Department of Water Resources, 2018). The State of California controlled funding for the project and coordinated with the City of Porterville's local knowledge to develop the water project, alongside input from East Porterville residents and Tulare County officials. Residents were not forced to connect their homes, but did have to meet requirements to participate in the consolidation, a few of which are listed here.

1. Sign a consent to annexation form: the city will be able to annex homes at any point in the future. Annexation is not required under water system consolidation (State Water Resources Control Board, 2018), but was implemented here (Klein, 2016).
2. Remove the property's well: state funded well abandonment on properties less than five acres. If over five acres, wells could be maintained.

3. Pay a city water bill: pay a water utility for household usage, rather than the previous electric charges for running the well pump.

Outside of connecting homes to the city water supply, the state also installed fire hydrants in the area, dug new wells for the Porterville water system, and partially funded a new water tower for storage. Not all residents took advantage of the consolidation-about 345 of 1100 eligible homes did not sign up (Department of Water Resources, 2018). Some higher income residents drilled new or deepened wells during the drought, both insulating them from these effects and encouraging them not to participate, but most connected to the city water because, as one resident told us, "we didn't have any other option, we didn't have any water, we needed to have water one way or another" (Household 7, August 11, 2018).

In the following sections, we discuss the implications of the consolidation for capabilities in East Porterville relative to the time prior to the drought. These include physical, social, economic, and cultural capabilities. We elaborate on capabilities that have either been added, limited, or have become contested following the consolidation, and also discuss implications for the future.

5. Findings and discussion

Consolidation and Capabilities: Benefits, Limits, and Uncertainties.

The water system consolidation project's main goals were to provide water to the community of East Porterville. In this section we describe the effects of the consolidation on fire hydrants and drinking water (water consistency and water quality). Since participation in the water system consolidation was optional, the benefits of the project are unevenly dispersed throughout the community.

5.1. Social capabilities: water flow and social services

5.1.1. Fire protection

As an unincorporated community, East Porterville lacked basic city services including fire hydrants. It is worth noting that there is a high fire risk in East Porterville – it is in an arid part of the state frequently affected by drought and it lacks building code enforcement, leading to exposed wires and other hazards. Amidst the political negotiations surrounding the water project, the City of Porterville and representatives of the community began to push the state to install fire hydrants as a quality of life issue. At first, the state argued against the city's proposal because it was outside the purview of their objectives. The city insisted, offering to pay for the installation despite the city's lack of jurisdictional power and duty to the area. The state eventually agreed to fund the fire system, recognizing that local issues extended beyond drinking water.

The effects of this political process are twofold. First, all residents in the community have access to a new capability: the ability to use fire hydrants in the event of a fire. As a local lawyer and taskforce member told us, "even the people who didn't choose to connect still benefitted, because they have a backstop there now, they have a safety net, and they have fire protection that they didn't have before, because previously there was not a single fire hydrant anywhere in East Porterville. Now they're everywhere" (Local Expert 6, August 13, 2018). Beyond the immediacy of fire hydrants, the political negotiations surrounding this issue represent increased government concern and attention for a disadvantaged community. By caring for the community, the state recognized the residents' rights to be in the state and legitimized their claims on society, thus incrementally increasing the community's political power as a group and increasing their capability to draw on the state in the future.

5.1.2. Drinking water

Despite the increased water supply in homes, residents often feel unable to use it, reflecting their lack of trust in the government. On the one hand, residents now benefit from a more consistent source of water in their homes after years of worry: "I felt tranquility and peace knowing that I wasn't going to have that worry anymore – I didn't have to be worried about the water in the tank running out. To know that we had our own water for the services in the house, to bathe comfortably, to go to the bathroom [brought me peace]" (Household 5, August 9, 2018). This is clearly an added capability, as residents can use this water for its material benefits, as well as a sense of security after years of uncertainty. However, a gap exists between connected and unconnected households. Unconnected homes often improved their wells, avoiding any conflicts between capabilities before and after the consolidation, but they may face future water shortages depending on the well's reliability. Those that did not drill new wells may remain water insecure, either due to water contamination or the lack of consistent supply.

On the other hand, water quality remains contested to this day, limiting residents' capability to use the water. Residents of East Porterville often refuse to drink the water that they now receive from the city: "The water before, it was good and we can drink it. And we can do everything with that water. I can't drink … the city water … [An official] said you can drink, but you cannot drink. It's why we have to buy the [bottled] water now" (Household 11, August 21, 2018). This sentiment was repeated by numerous community members. However, city officials claim that the water is "regimentally tested" and lacks contaminants that appear in other water systems in the state. To him, "it's a personal preference thing" and that "it is not water quality" (Government Official 5, August 20, 2018). Similar struggles and dismissal of residents' water perception were reported in Flint, Michigan and Jackson, Mississippi (Pulido, 2016; Nwanaji-Enwerem and Casey, 2022), until media reports about poisoning surfaced in the media. In East Porterville, the question why the gap in perception and testing is an important one.

The state agents and residents measure quality differently. Residents lack the technical capability to scientifically test the water in their homes, relying instead on their senses, which has some credibility. Following the consolidation, the water tastes, smells, and looks different than it did before, which is read as low quality and undrinkable. In sharp contrast, the city frequently tests the water for concentrations of toxins. To disinfect the water, they add chlorine, among other treatment procedures. If water meets regulatory standards set by the Environmental Protection Agency (EPA) under the Clean Water Act[1] (Environmental Protection Agency, 1972), it is cleared for consumption. In the process, however, this changes the taste of the water, making it seem unsafe to residents. As a result, the capability to access drinking water is reduced by a lack of trust and differences in perceptions despite state claims of usability and safety.

5.2. Economic capabilities

The water system consolidation had rippling effects on the economic capabilities of residents and landlords. Property values significantly increased as a result of the consolidation but new water costs limited the uses of water.

5.2.1. Property value

At the household scale, the economic benefits of the water connection are unevenly distributed between landlord and tenant. When implementing the consolidation, the state planned to connect owner-occupied homes for free and charge rental homes a connection fee. The state claimed that the landlord would need to pay for improvements to their properties to provide tenants essential services. However,

[1] The EPA sets water quality standards that are designed to protect human health and aquatic life by limiting level of pollutants that can be present in surface waters such as rivers, lakes, and streams. The standards are both numeric and narrative standards enforced through permits and monitoring programs.

tenants of rental homes are often fearful of retribution from their landlords; they fear that the landlord would report them to immigration enforcement, evict them, or otherwise deprive them of their livelihood. As a result, residents often refused to report their landlords, allowing landlords to forgo both the water connection and fee. Understanding the conflict between tenants and landlords, the state agreed to connect any residential property in the area free of charge. As one local expert told us, the property value of homes increased significantly: "[the owner] didn't pay for the system … [They] got about $10,000 worth of services for free" (Local Expert 2, July 25, 2018). Renters and tenant-owners each benefited from water flowing through their homes, but only property owners experienced the bump in property value, allowing them to sell the land at higher rates in the future, an increase in economic capability. This issue also speaks to the historic marginalization of Latinx residents who distrust the government and are unable to fully benefit from government programs, in ways that are similar to the recovery efforts that reify the privilege of wealthy landowners (Collins, 2010; Simon, 2014; Méndez et al., 2020).

5.2.2. Water pricing

Peri-urban East Porterville water users are economically deprived by the new cost of water associated with the city's water system. Originally, the cost of water was associated with the electricity to run the well, but now it is based on a city pricing structure: "For a certain amount of money, they give you a [water] limit. If you surpass those gallons, then you're paying more" one resident told us. He compared the cost of his electricity bill, "fifteen dollars total", to his friend's water bill that reached $200 because "she started watering her plants again, she wanted to keep up her garden … but she also wasn't accustomed to paying for that utility" (Household 10, August 17, 2018). City pricing mechanisms designed to conserve water resources conflict with important peri-urban water uses including large gardens and livestock, uses atypical for cities. Today, the change in pricing affects residents twice. First, they pay more per month on water than before. Second, it affects their ability to raise animals, fruits, and vegetables, which would otherwise limit their need to buy food. What was once perceived as a reasonable quantity of water to use at home dramatically changed into a drain on financial resources, not only reducing direct water uses but also related economic capabilities, self-sufficiency, and livelihood options.

5.3. Cultural capabilities

Water is intimately tied to cultural capabilities in East Porterville, which were degraded during the drought and are reduced following consolidation. During the water crisis, residents lost livestock, pets, and gardens. These possessions are not simply regained following a water connection but must progressively be replaced by the continued use of water:

> "I had yellow flowers … all the way around the side, roses all along this fence that hung down, and I had two or three other plants that were here that died. It was beautiful here. It was lush. Now we still don't give them quite enough water because we're almost afraid to until we have a good rain … I'm afraid to buy new plants because I don't want to buy them and kill them" (Household 8, August 15, 2018).

Her garden was not important for the economic gains, but for the cultural and aesthetic benefits that are now lost. She managed to keep her horses through the drought, but others sold livestock that they now lack the capability to replace. These cultural capabilities are also affected by the city water regulations that pressure the residents to use water in different ways or abandon these uses entirely, thus reflecting how power (re)directs the hydro-social flow of water and its uses. Culturally, these capabilities help the area feel like home: "for many people that come from rural Mexico, it's just one piece of land for another" (Local Expert 6, August 8, 2013). Similar to rural Mexico, the community is reliant on each other rather than the government. They exchange the produce and animal products that they gain from these cultural water uses, building community and a sense of place. Without these cultural capabilities, residents have a limited ability to achieve the life they wish to lead.

5.4. Annexation and uncertain futures

Above, we have outlined the clear benefits, limitations, and conflicts between capabilities that have stemmed from consolidation, but consolidation also leads to uncertain futures. Eventually, East Porterville will be incorporated into the City of Porterville through annexation. Development in East Porterville will now occur under the city's watchful eye. New buildings will now adhere to city building code, which is stricter than county regulations. On the one hand, this will increase the safety of the buildings for those who move there. On the other hand, it will also drive up building and rental costs. Under future annexation, other regulations will take effect: "If you have farm animals that are not allowed by city zoning usually … once you are annexed, you'll no longer be able to replace those animals when they are sold or they die." (Local Expert 1, July 16, 2018). Although this is not an immediate issue, consolidation will have rippling effects into the future.

Under city jurisdiction, there will be greater police presence in the area, presenting a conflict for the Latinx residents' desire for safety and fear of police profiling. Some residents believe the police will offer protection from gang violence: "I think it's better to be more allied with the city, so they listen to us more and can protect us more" (Household 6, August 11, 2018). However, there is also a trend of police profiling in the area. One man described an incident with his grandson who was walking his broken bike down the street:

> "He walked three blocks from the house and somebody came and told my daughter, '[the cops] got [him] sitting on the edge of the sidewalk and they're talking to him.' … So my daughter gets in the car, goes out there asking, 'What's the problem?' … [They replied], 'Well we just wanted to find out if it's his bike or if he stole it.'" (Household 4, August 6, 2018).

Police gang enforcement in Latinx communities is associated with legitimated profiling, stricter surveillance, increased criminalization, and police misconduct, affecting entire communities and their ability to move freely in society (Durán, 2009; Solis et al., 2009). East Porterville residents disagree on whether police presence will benefit or harm the community. Residents might gain the freedom to move within their community without fear of gang violence or they will be restricted in new ways by the police.

If the goal is to increase the livability of East Porterville for the typically low-income, Latinx immigrants who move there, the city and state must take actionable steps to account for historic disenfranchisement and marginalization. Otherwise, East Porterville may become inaccessible to residents when it transitions into the City of Porterville, consequently negating the capabilities that were gained in the process. The water system consolidation represents a benefit for a historically disadvantaged community, but it does little to change residents' position in the social hierarchy without systemic change in other axes of inequalities.

6. Conclusion

As climate-related and socially-induced droughts persist around the world, disadvantaged communities will likely experience heightened water insecurity if innovative approaches are not taken to prevent loss of water. In this study, we apply a capabilities approach to evaluate the outcome of a water consolidation project in East Porterville, California. Our study revealed three important findings. First, water system consolidation proves to be effective at providing water at the minimally acceptable standards. In other words, consolidation resulted in sufficient

clean water for sanitation and household use. However, when a capabilities approach is adopted in analyzing effectiveness, the results are mixed. Negotiating water access within a consolidation regime forced East Porterville residents to sacrifice certain cultural, social, and economic capabilities that are deemed important by residents. Under current conditions, residents are restricted in their ability to garden, live independently, create a sense of home, or return to the lives they led before the drought. Furthermore, the water project failed to address root problems in East Porterville, including the persistent distrust of the government and the marginalization of the Latinx residents. As a result, residents extend their distrust of the government to a distrust of the water, often forgoing tap water for consumption, and turning to other sources.

We acknowledge that water system consolidation has several benefits and was instrumental to addressing the water crisis in East Porterville. The project represented a coalition of interests working together toward a solution that benefitted many people in the community. However, the consolidation is inadequate without considering the broader hydro-social dynamics that affect people's ability to use water for what they deem valuable to their households and overall wellbeing. We suggest the following steps be taken to improve future water projects and water-related capabilities: 1). Assess local functions of water for cultural, social, and economic uses. Then consider how water projects may limit or enhance the associated capabilities. Whether to rank and choose among capabilities is open to debate. We do not endeavor to rank the options in this case, but we urge that tragic choices for project recipients be avoided when possible; 2). Evaluate and re-evaluate outcomes of water projects by assessing local perceptions of water usability and working to enhance or reestablish capabilities following shifts in water regulation. A water project should not end when the last pipe is installed; and 3). Consider the effects of water projects on other areas of life that are seemingly disconnected to water. Engage in subjective, qualitative assessment within communities informed by their situated knowledges. Outside of any single water project, there must be greater systemic change to increase water-related capabilities for the most marginalized members of society. In East Porterville, this would include trust building among historically marginalized communities, immigration reform on a national scale, and social programs that serve economically disenfranchised individuals.

Finally, coupling the capabilities approach with a hydro-social framework provides descriptive, analytical, and explanatory tools for understanding and addressing household water security, thus advancing theoretical and empirical knowledge in this area of study. Traditional utilitarian approaches to household water security studies would likely view the East Porterville project a success for its provision of sufficient clean, affordable drinking water by institutional standards. However, the capabilities approach adopted in this study shows how many areas of life have been both negatively and positively affected by the water project, providing a more nuanced understanding of its outcomes. Our coupled hydro-social theory and capabilities approach offered a clearer picture of the root causes of the East Porterville water crisis, including the dynamic flows of water, power, and knowledge that often conflict with the goal of water security. Our recommendation to future scholars is to adopt this approach and/or develop their own nuanced applications of methods and theories that will advance knowledge on household water security and the processes involved. We also suggest doing a stocktake of water consolidation projects to tease out differences across case studies (for example, researchers may explore questions such as how frequent are different kinds of water annexation systems implemented? What kinds of decision making and participatory processes inform their design? and in what ways do different project design expand or constrain household capabilities?). Doing so will improve our collective understanding of water security at multiple scales, while pushing the boundaries of solutions and best practices to ensure water justice for all.

Credit author statement

Michael Egge (First Author): Conceptualization, writing, fieldwork, visualization, review, editing, project design, and management. **Idowu Ajibade (Second Author):** Conceptualization, writing, review, editing, project design, and management.

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Declaration of competing 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.

Data availability

The data that has been used is confidential.

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