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Water Poverty in California's Rural Disadvantaged Communities

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Abstract

California, the eighth largest economy in the world, has nearly one million residents that lack daily access to clean drinking water, yet it recently became the first state in the US to declare water a human right through the passage of 2013 Assembly Bill 685. The majority of water quality violations take place in the rural San Joaquin Valley in unincorporated, low-income communities, which have difficulties accessing clean, drinking water due to issues including quality, affordability, and physical accessibility. The role of community integration in improving water poverty has been studied extensively in developing countries but its impact is infrequently studied in the developed world. This study uses a theory-exploring case study approach in five Fresno County communities to ask the question: How does community integration affect access to drinking water in the San Joaquin Valley? The study finds that local community participation, interaction with non-profits, and public resources can improve the quality of drinking water in rural, disadvantaged communities.

Introduction

A prominent saying of the Western United States is, “water flows uphill towards money” (Reisner 1986). In California, rivers now flow backwards and through mountain tunnels for hundreds of miles to reach their destination. Decades of volatile water disputes between urban, agricultural, and environmental interests have been at the forefront of California’s politics since before its statehood. Nonetheless, there are nearly one million Californians that lack daily access to clean drinking water (Francis and Firestone 2011). Furthermore, California, the eighth largest economy in the world, recently became the first state in the US to declare water a human right through the passage of 2013 Assembly Bill 685, yet the effects of this affirmation have not been fully realized for all residents (Thor 2013). The majority of Maximum Contamination Violations (MCLs), the measurement of sufficient water quality in California, take place in the San Joaquin Valley (SJV), the southern half of California’s Central Valley, in unincorporated, low-income communities of color. These communities are a part of ‘municipal underbounding’ where cities and counties avoid annexing such communities akin to gerrymandering (Aiken 1987, 1990; Balazs *et al.* 2011, Francis and Firestone 2011, Lichter 2007, Pannu 2012, Mukhija and Mason 2013, Rubin 2007). Failure to incorporate communities often leads to a lack of basic infrastructure and services, such as potable water and sewer systems.

In the developing world, scholars have created a holistic, universal tool, called the water poverty index (WPI), which measures water quality in an effort to press policymakers for cleaner water (Garriga & Perez-Foguet 2010, Molle and Molinga 2003, Sullivan and Meigh 2007). The United Nations General Assembly July 2010 resolution 64/292, recognizing the human right to water and sanitation, led to the creation of a WPI framework based on this declaration (Anderson 2010, Flores, Jimenez, and Perez-Foguet 2013, Francis and Firestone 2011, Thor 2013,

UNDESA 2010). While the topic of water poverty has been studied extensively in developing countries; such as Nicaragua, Bolivia, and Pakistan; there is a significant lack of literature and application to water-poor communities in developed countries (Korc and Ford 2013). In this paper, I apply a similar framework to communities in the SJV of California.

Scholars first applied the WPI in the United States in 2013 to ‘colonias,’ rural settlements along the US-Mexico border region, in Texas. Public outcry over the deplorable conditions in these colonias took place during the 1980’s and led to increased services and funding at the state and federal level (Carter and Ortolano 2004, Korc and Ford 2013, Ward 1999). Although unincorporated communities in the SJV share many of the same characteristics as colonias, their location outside of the border region excludes them from many of these resources (Rubin 2007). In California, water has been a controversial and highly discussed topic, but very little of the focus has been on access to clean drinking water (Hundley 2001, Resiner 1986, Serrano 2011, Walton 1992). That is not to say that the two are mutually exclusive, on the contrary, I argue that the historical narrative of water wars and lucrative water projects is directly linked to the current situation of water poverty in California (Carter 2009, Hundley 2001, Reisner 1986). Consequently this paper serves as one of the few WPIs applied to water-poor communities in wealthy countries and it also demonstrates what measures are taken towards implementation of clean water access where the human right to water exists.

For the purposes of this paper, I utilize a theory-exploring case study to look at five disadvantaged communities within western Fresno County, located in the SJV of California (George & Bennett 2005, Lijphart 1971). I adjust the definitions for the human right to water framework developed by water policy analysts Oscar Flores, Alejandro Jimenez, and Agusti Perez-Foguet (2013) to fit the case of California. The framework includes five normative criteria

for water (availability, quality, physical accessibility, affordability, and acceptability). The data include seventy-five surveys with residents of five communities. The water poverty indicators work as my dependent variable which I then tie to four explanatory factors: the levels of horizontal integration (relationships between members of the community), vertical integration of communities (relationships between the community and powerful outside actors), public funding, and access to information (Mukhija and Mason 2013, Ward 1999). I ask how does community integration affect access to clean water in disadvantaged communities in California?

I find that the most important variables influencing water poverty are the communities' level of interactions with powerful actors such as county officials and non-profits and their ability to access state funding. Thus, my study shows the relevancy of the WPI for policymakers in California who should seek to improve the lives of nearly one million residents without access to clean drinking water. In the following sections I provide the historical and economic background of the SJV. I then look at international theories on water policy and its possible applications to communities within the United States and within a human right to water framework, after which I describe my methods and present my findings and policy implications.

A Case Study of Water in California's San Joaquin Valley

Marc Reisner's *Cadillac Desert* recounts the events that altered the Central Valley of California from biologically diverse marshlands and deserts to one of the richest agricultural regions in the history of the world (1986). In 1929, California pulled ahead of Iowa as the leading farm state, but significant groundwater over-pumping led to water shortages by the middle of the 1930's. As Valley farmers sought new sources of water, they turned to Franklin D.

Roosevelt and his New Deal to fund a water system that would move snowmelt from the Sierra Nevada to the Central Valley.

The Central Valley Project (CVP) was the most elaborate and expensive public works project ever built, creating a 3,000-mile network of dams, canals, and reservoirs that transported water around the Valley for irrigation. The Westlands Water District was a completely arid region in Fresno and Kings County before long-term contracts for irrigation with the CVP turned it into the largest and most heavily subsidized water district in the nation (Hundley 2012). Irrigated water was provided at a highly subsidized rate and was given to farmers on the stipulation that the large farms would be broken up into smaller farmers with a 160-acre limit and that the farmer would reside on the farm, but it was never enforced. The corporate farms in Westlands would become some of the wealthiest in the nation while the towns within the area were amongst the poorest in the state, primarily made up of farmworkers while the owners of the farms lived in cities. This led to chronic underdevelopment of the region (Carter 2009). For example, a comparison of social patterns in two contrasting Central Valley towns found that Dinuba, which was surrounded by smaller farms, averaging 60 acres, had more income equality and higher standards of living and community life than the town of Arvin, which was surrounded by farms averaging 500 acres in size (Goldschmidt 1944). The political tide eventually shifted from agriculture towards the environment during the 1980s and 1990s, water prices for farms were increased virtually overnight and most companies left but the ones that remain today are the most productive and water-efficient in the country (Else and Harrar 1997).

As of 2014, the SJV remains one of the most agriculturally productive regions in the world, supplying a quarter of the nation's produce. It's one of the fastest growing regions in the state, doubling its population from 2 million to 3.8 million since 1980, and is expected to reach 6

million by 2020 (Serrano 2010). Yet, the SJV is one of the poorest regions in the US. A Congress Research Service Report found that although Appalachia receives more media coverage and federal funding, the per capita income is lower and the poverty rates were significantly higher in the SJV (Cowan 2005). A 2014 UC Davis Economic Analysis of the drought projected that 60 percent of all fallowed cropland and 70 percent of statewide crop revenue losses (\$567 million) would occur in the SJV (Howitt et al. 2014). Further depletion of the aquifer was expected as farmers heavily rely on groundwater during droughts (Howitt et al. 2014). Indeed 2014 saw reports of thousands of SJV wells going dry, only increasing the number of Californians that lack access to clean, drinking water (Marcum et al. 2014, Medina 2014).

Furthermore, intense agricultural practices have contaminated the aquifers with nitrates and pesticides, leading to the majority of California's water quality violations taking place in the SJV, where 95% of the domestic supply comes from groundwater (Carter 2009, Francis and Firestone 2011, Pannu 2012). Nitrate pollution causes blue baby syndrome in infants when the blood loses the ability to carry oxygen, resulting in a slow suffocation, and hormone disruption in adults (Balazs and Ray 2014, Pannu 2012). Predominantly Latino communities have higher nitrate levels in their water and communities with lower rates of homeownership have higher arsenic levels (Balazs and Ray 2014). A study of nitrate-impacted communities found that 43 percent of households were not aware that their tap water was contaminated, with Spanish speaking households being even less aware (Moore et al 2011). These residents must find alternative water sources, leading their expenditures to exceed the state affordability threshold of 2% of median household income (MHI), or sometimes by over three times the limit (CA Water Update 2013).

In 2013, California became the first state in the US to declare water a human right through the passage of Assembly Bill 685 (Thor 2013). Although increased costs were a concern, \$2.5 billion was budgeted towards water infrastructure in California during the 2012-2013 fiscal year, with a projected \$39 billion needed for public water systems over the next twenty years, according to the Environmental Protection Agency (Thor 2013). This figure does not take into account the costs associated with supplying water access to families that don't already have it. Therefore, California finds itself in a paradox within the water poverty context. Although it is the 8th largest economy in the world and the first state in the world's wealthiest nation to recognize that water is a human right, approximately one million Californians lack access to safe and affordable drinking water (Francis and Firestone 2011).

Literature Review

In this section, I outline water poverty measurement indicators used in developing countries and sustainable development theories based on community participation. I then look at water poverty issues in the United States by comparing Texas colonias to unincorporated communities in California. I also look at the factors that impact disparities in access to clean water such as selective annexation, lack of resources, and low community participation.

Water Poverty Indicators

Literature on drinking water interventions in developing countries often focuses on water as a human right and how inequalities in accessing resources are linked to increased conflict (Lecoutere et al. 2010, et al. 2013; Molle and Mollinga 2003). This has driven academics to find a way to universally measure water poverty, leading to the creation of the Water Poverty Index (WPI), a holistic tool developed to varying degrees by multiple scholars. (Lawrence et al. 2002,

Garriga and Perez-Foguet 2010, Molle and Molinga 2003, Sullivan et al. 2003, Sullivan and Meigh 2007). The WPI takes physical, social, economic, and environmental variables into account in order to understand the impact that water scarcity has on the human population (Sullivan 2002, Sullivan et al. 2003). The five key components of the WPI framework are: availability of water resource, access to water services, capacity to purchase and manage water, use of water, and environmental impact of water management (Korc and Ford 2013). However, it does not have a specific component related to water quality. Pollution in a water source can severely hinder access to water and cause adverse human health effects, thus making quality an important omission of the WPI. The WPI was created to measure water stress at the household and community level, aid policymakers in determining priority needs, allow local communities to express their needs in a tangible way, and to analyze whether water rights are sufficiently met where the legal right to water exists (Flores, Jimenez, Perez-Foguet 2013, Sullivan et al. 2003).

Scholars recently have expanded the WPI based on the human right to water framework and have applied it to rural areas of Nicaragua (Flores, Jimenez, and Perez-Foguet 2013). They draw from the United Nations General Assembly July 2010 resolution and develop five normative criteria for water (availability, physical accessibility, affordability, quality, and acceptability). Availability is defined as a water source that is of sufficient quantity and reliability. Physical accessibility is defined as the proximity to the clean water source. Affordability is based upon how much of the household's income is going towards meeting their water needs. Quality is defined as whether the water is contaminated or not. Acceptability looks at whether the water is an acceptable odor and color. They also propose three cross-cutting criteria, or what I consider to be potential explanatory variables (non-discrimination, participation, and accountability) which are represented in a non-discriminatory distribution of

services through public funding, community participation through horizontal and vertical integration, and accountability through transparent access to information (Flores, Jimenez, Perez-Foguet 2013)ⁱ.

Sustainable Development & Community Participation

Failed development strategies in developing countries led to a general shift away from top-down approaches to ones that are locally based and more democratic, taking the communities' needs and perceptions into account (Hill et al 2001). This bottom-up approach is seen in Community-based Natural Resource Management (CNRM), which attempts to incorporate local people's knowledge into tailored solutions that bring long-term results (Mathipa and le Roux 2009, Saldias et al. 2013, Smith 2008). CNRM was implemented in the Pakistani province of Punjab, where women and female children once spent 6 hours a day collecting water, but, as a result of the local communities' input, the women are more empowered, the communities have safe drinking water, and school enrollment increased as more girls could attend (Saldias et al. 2013). However, CNRM has been criticized because of its "idealization of the resource community as a homogenous and harmonious community" (Saldias et al. 2013). CNRM could lead to the exclusion of minority opinions within a local population (Saldias et al. 2013).

Community participation also is emphasized in the European Water Framework Directive (WFD) in Germany, which was the first directive of its kind that combined environmental policy goals with local participation (Kastens and Newig 2008). Northwest Germany presents an example for community participation in a water-poor area in a developed country. Lower Saxony was experiencing nitrate pollution in its groundwater because of the intensive livestock farming and agriculture in the region (Kastens and Newig 2008). Participatory governance was analyzed

at the federal, intermediary, and regional level with the regional level concluded to be the “most suitable scale for effective involvement” (Kastens and Newig 2008).

Sustainable development theory has further metamorphosed into an approach that focuses on the rights of individuals, emphasizing that human rights can lead developmental change (Gips 1988, Laban 2007). In regard to water theory, the Right’s Based Approach (RBA) can “enhance local level accountability” as projects often have suffered when the local population did not feel a sense of ownership or see it as meeting their long-term interests (Laban 2007). A study in rural Kenya shows that ethnic diversity in communities led to a negative impact on water well maintenance, seemingly pointing to a collective action failure (Miguel and Gugerty 2005). Therefore, the extent to which locals can each claim their rights and take ownership for the management of their resources is key to sustainable results (Laban 2007). RBA also emphasizes accountability of NGO and local governments in ensuring that underprivileged groups are recognized and can network with policy makers (Laban 2007).

Water Poverty in US Colonias

There is no universal drinking water service mandate in the US, but laws such as the Federal Water Pollution Control Act protect citizens from contaminated water (Thor 2013). The Safe Drinking Water Act was passed in 1974, authorizing the EPA to set standards for drinking water quality such as MCLs (*epa.gov* 2). Scholars note that anti-poverty programs in the US hardly focus on water issues and their effects on the poor (Korc and Ford 2013, Wescoat *et al.* 2008). While most literature has sought a way to measure water poverty in developing countries, Marcelo E. Korc and Paula B. Ford, in a study about colonias, demonstrated that WPI also could measure water-poor communities in wealthy countries (2013). Along the US-Mexico border, two thousand colonias exist in which federal programs have identified problems with access to water

and sanitation services (Korc and Ford 2013). Residents are primarily low-income and Latino and work within the agriculture industry (Ward 1999).

The Lower Rio Grande River Valley, home to the highest concentration of colonias in Texas, supplies about ninety-seven percent of the region's freshwater, which is then allocated into a fragmented water delivery system that reflects "the contested history of water development that favored irrigation over universal domestic production" (Jespon and Brown 2014). In order to obtain potable water, residents often had to go through alternative providers with higher than public rates. For example, purchasing from a tanker truck would cost \$22 per 1,000 gallons for a Texas colonia in 1988. Meanwhile, residents in the City of El Paso paid \$1.07 per 1,000 gallons of city water in 2000 (Olmstead 2003). By the 1980s about 20 to 25 percent of colonia residents lacked potable water, leading it to be called "Texas' Third World" (Mukhija and Mason 2013). Political pressures eventually led the Texas legislature to establish the Economic Distressed Areas Program in 1989 and the US Congress to pass the Cranston-Gonzalez National Affordable Housing Act of 1990, which set aside a Community Development Block Grant for colonias within 150 miles of US-Mexico border (Carter and Ortolano 2004, Korc and Ford 2013, Mukhija and Mason 2013). Despite these gains, not all colonias have obtained drinking water services.

In colonias, residents are often removed from policy makers because of their location at the border and the perception that they are illegal residents, although 85 percent of colonia residents in Texas were found to be US citizens or legal residents (Ward 1999). Geographer Peter Ward points out that community participation has become a "sine qua non of government development projects" but notes that community organization in colonias has not benefited from community and state collaboration to the same extent seen in developing countries. Ward measures community participation as horizontal integration, the level of engagement amongst

local community members trying to access resources, and vertical integration, the level of interaction between community members and powerful actors outside of the community. Horizontal integration takes a more community-based route that is popular with international development agencies, whereas vertical integration focuses on the interactions that local, nongovernmental, and governmental actors have with communities. Ward finds that communities with high vertical integration tended to have more services but notes that horizontal integration must happen first. Furthermore, local leadership within the community is an important aspect in horizontal integration but Ward finds that it is often outside organizations that began to mobilize on behalf of colonias (1999). Nevertheless, there are barriers in participation, such as lack of information flow and language barriers that can impede residents from becoming leaders.

Municipal Underbounding & Unincorporated Communities

The case of unincorporated communities in Texas and California points to a broader literature regarding ‘municipal underbounding,’ namely when cities avoid annexing low-income, primarily people of color, communities. Geographer Charles Aiken first used this term to describe how small towns in the South would avoid annexing poor African American enclaves in a type of racial gerrymandering (1987, 1990). Cities often avoid annexing these poor communities because of the resources that would be needed to improve their infrastructure, such as water and sewer systems. A study measuring the underbounding of colonias in the Rio Grande River Valley found that census blocks containing colonias, especially those with poor infrastructure, are less likely to be annexed than those that do not contain colonias (Durst 2014).

Many chronically underserved communities in the SJV formed during the 1930s as Dust Bowl migrants flooded the region and makeshift farmworker housing was formed, constituted as

rural slums due to the crowded conditions and poor sanitation (Stein 1973; Cole 1951). In the southern SJV, a Tulare County's 1971 General Plan identified fifteen "non-viable" communities with "little or no authentic future" stating that, "as a consequence of withholding major public facilities such as sewer and water systems, enter a process of long term, natural decline as residents depart for improved opportunities in nearby communities" (Pannu 2012). And forty years later, thirteen of the original fifteen "non-viable" communities remain in existence (Pannu 2012). The systematic exclusion of these underserved communities did not lead them to die off as expected, but only continue to exist for decades without proper water systems. SJV contains the largest relative concentration of small, unincorporated communities within California (Rubin 2007). These communities, numbering over 200, contain a total population of over 400,000 people or 1 in 4 residents of the SJV (Rubin 2007).

Therefore, given the literature presented, I ask the question how does community integration affect access to clean drinking water in California? Concentrating on the human right to water and WPI, I select five communities in Fresno County to apply this framework.

Research Design

In order to investigate how community resources affect access to clean drinking water in California's unincorporated communities, I use a human right to water framework (Flores, Jimenez, and Perez-Foguet 2013) containing five criteria (availability, quality, physical accessibility, affordability, and acceptability) that are meant to create an overarching measurement of water poverty. Acceptability looks at whether the water is an acceptable odor and color but this aspect is considered under the quality indicator. After talking with local non-profit leaders in the SJV, the infrastructure of community water systems was confirmed as an

additional criterion in access to clean drinking water. Therefore, the indicators in my framework are: availability, quality, physical accessibility, affordability, and infrastructure (See Table 1).

This index is applied to five communities in California using a theoretical exploration of case studies (George & Bennett 2005, Lijphart 1971). Both theory-confirming and theory-infirming case study methods are utilized (Lijphart 1971). The theory-confirming method allows literature on low-income unincorporated communities and their lack of services to be addressed. Meanwhile, theory-infirming is utilized to show that generalizations, such as that water poverty only happens in developing countries or that colonias only exist near the border, are not always correct (Lijphart 1971). I collect communities' data on indicators related to community resources from households and local NGOs, which I then compare to the WPI in order to see whether increased participation and community integration leads to improved access to clean water. To allow for a structured and focused comparison, a survey is employed that asks a set of standardized questions of individual members in each community (George & Bennett 2005). The WPI is adjusted to fit the specific case of California (i.e. adding the infrastructure indicator), even though this “reduces comparability or cumulatively with previous studies” (George & Bennett 2005). This method also includes variables that “provide some leverage for policymakers...to influence outcomes” (George & Bennett 2005).

Five communities in western Fresno County, California are analyzed, all of which are disadvantaged communities in agricultural areas that are primarily overwhelmingly Latino. A community is considered disadvantaged or severely disadvantaged if the median household income (MHI) is less than 80 percent or 60 percent of statewide MHI, respectively, according to California Health and Safety Code sections 116275 and 11676.20 (CA Water Plan 2014). The communities have similar characteristics to a colonia, whether they are designated or not, such as

substandard housing and lack of infrastructure. Three of the communities: Three Rocks, Cantua Creek, and Five Points are located in the Westlands Water District and receive their water supply from surface water purchased by the county from the Westlands. The two other communities, Lanare and Raisin City, are also located in western Fresno County but outside of the Westlands and rely on groundwater for their water supply. These communities were all selected based on the local knowledge of the non-profit California Rural Legal Assistance (CRLA), who named four of the communities as having problems with water poverty. Five Points was selected as the fifth community after surveying a resident of the community while in Lanare, CA; where he pointed out that they also had water problems. Seventy-five structured interviews were conducted with residents from the five communities in community spaces such as local markets or by canvassing the neighborhoods.

Given the literature presented, I hypothesize that public funding greatly improves access to clean drinking water in disadvantaged communities. All of the communities selected have been chronically underserved as a result of municipal underbonding and suffer from some barrier in access to clean drinking water. Furthermore community mobilization both horizontal and vertical integration have been advanced as the panacea to resource inequity by scholars and policymakers alike, yet empirical evidence proving its effectiveness is significantly lacking (CA Water Plan 2014, Francis and Firestone 2011, Saldias et al. 2013, Ward 1999). Therefore, I hypothesize that horizontal and vertical integration within a community will increase access to clean drinking water, with horizontal integration being more common.

The application of WPI in this study takes five criteria into account: availability, physical accessibility, affordability, quality, and infrastructure. Each criterion contains sub-components and definitions that are outlined in Table 1.

The first criterion for the human right to water is availability or the sufficient and continuous supply of water. The community residents' perception of whether they have a sufficient quantity of water per person per day makes up the first sub-component. The reliability of the water supply is taken into account based on a two-part index by Rietveld, Haarhoff, & Jagals: the number of hours per day of unplanned interruption and the number of days per month without unplanned water supply (2009). Households are surveyed for these indicators.

The second criterion is physical accessibility measured by the proximity to the water source and the ease of transportation. The mode of transportation and distance in miles are analyzed. This differs from WPI physical accessibility criteria in developing countries because Californians are less likely to walk to a water source. Instead, rural residents must often drive for at least 15 miles to get to the nearest grocery store to buy bottled water or other supplies, and the amount they can buy per store also can be limited. United Nations Resolution 64/292 states that the time to retrieve water should not exceed 30 minutes (2002). A second indicator takes into account the surveyors' perception of how easily it is to travel to get a sufficient amount of clean water.

The third criterion is affordability. The first indicator of affordability is the monthly tariff for the water service compared to the median household income or MHI. As defined by AB 2334: California Water Plan 2012, the cost of water should not exceed 2% of the MHI. For this indicator, the participant's monthly expenses for water are compared with to the MHI of each community to determine whether they meet the affordability standard set by California. The perception of whether the water service is affordable is obtained from the respondents. They are also asked what the average replacement cost for their water is on average every month. This replacement cost includes supplies like bottled water or water tanks that must be bought when

the water supply is unsafe. A household survey of water systems in Tulare County with recent nitrate violations found that the average replacement cost was \$28.91 per month (Christian-Smith et al. 2013).

The fourth criterion is water quality. This is measured based on the Maximum Contamination Level (MCL) violations of the water system and the residents' perception of their water supply quality. MCL violation information regarding specific community water systems can be obtained through the State Water Resources Control Board and Consumer Confidence Reports produced annually by the California Department of Public Health (CDPH) in Fresno County (*cdph.ca.gov*).

The fifth criterion of infrastructure is not in the original human right to water framework but is an issue greatly affecting water poverty in California (CA Water Plan 2013). The size and age of the water system can hinder access to clean water in disadvantaged communities because of an issue with economies of scales. The households' and community water systems' perceptions of their infrastructure are taken into account for this indicator.

Table 1: Human Right to Water Framework in California

Criteria	Indicator	Definition/Benchmarks	References	Source of Information
Availability	A1: sufficient quantity A2: Reliability/continuity	A2: Likert Scale A2: number of hours/day of unplanned interruption of the water supply to households, number of days/month without unplanned water supply	A1: Moriarty 2010; Schouten 2011; A2: Rietveld, Haarhoff, & Jagals 2009.	A1: households A2: households
Physical accessibility	PA1: proximity (mode of travel/distance) PA2: Ease of transportation (perception)	PA1: collection time should not exceed 30 minutes. PA2: Likert Scale	PA1: UNESCO 2002 PA2: No indicator agreed by consensus	PA1: households PA2: households
Affordability	AFF1: Monthly tariff (water tariff) AFF2: Affordability (perception) AFF3: Replacement cost	AFF1: 2% of median household income AFF2: Likert Scale AFF3: average of \$28.91 per month	AFF1: California Water Plan (AB 2334) 2012 AFF2: no indicator agreed by consensus AFF3: Christian-Smith, Balazs, Heberger & Longley 2013	AFF1: households, US Census Bureau AFF2: households AFF3: households
Quality	Q1: Quality Q2: Quality (perception)	Q1: Maximum Contamination Level (MCL) violations Q2: Likert Scale	Q1: California Safe Drinking Water Act Q2: no indicator agreed by consensus	Q1: State Water Resources Control Board, California Department of Public Health Q2: households
Infrastructure	I1: infrastructure (perception)	I1: Likert Scale	I1: California Water Plan Update 2013	I1: households

Four explanatory variables are connected to the overall status of the communities' water poverty: public funding, horizontal integration, vertical integration, and access to information as outlined in Table 2.

The first factor analyzes federal and state funding or grants to the local communities. Local non-profit leaders and community members were asked what funding or grants related to water that the communities had received. The second factor is horizontal integration, defined as the level of engagement amongst community members (Ward 1999). The participants were

asked whether they considered the community to be active relating to water issues. The presence of local leadership is also looked at and whether such leadership is effective based on the perception of local community members. See Appendix A for the survey given to community members. The third factor is vertical integration, defined as the level of interaction between community members and powerful actors outside of the community, such as government officials at the city, county, or state level; politicians; or nongovernmental leaders (Ward 1999). Vertical integration is examined to see whether the communities are represented in their respective water districts and in decision-making processes. Local water boards are analyzed to see whether there are members representing these disadvantaged communities. The frequency and effectiveness of interactions between communities and with NGOs such as regional coalitions is also examined. The fourth criterion is access to information, measured as whether the respondents' have information about community meetings occurring and whether information is available in their language. Respondents are also asked about how much they know about water law, specifically relating to the human right to water in California.

A benefit of a WPI is that a holistic, universal tool is created to measure various characteristics of water poverty, which can then be reapplied to similar communities and utilized by policymakers. The qualitative surveys and interviews provide first-hand information about the challenges by these disadvantaged communities regarding access to clean water.

Table 2: Explanatory Variables Influencing WPI

Criteria	Indicator	Definition/Benchmarks	References	Source of Information
Public funding	PF1: grants or aid for water	PF1: whether the community receives funding related to water infrastructure or drinking water	PF1: Cowan 2005, Jimenez & Perez-Foguet 2010, Rubin 2007, Mukhija & Mason 2013	PF1: NGOs, assorted
Horizontal Integration	H1: community participation H2: Local leadership	H1: whether community is believed to actively participate or not H2: presence & effectiveness	H1: Ward 1999, Perez-Foguet 2013,	H1: households H2: households
Vertical Integration	V1: representation in water districts & decision-making V2: linkages to NGOs, other communities	V1: the communities' opinions on whether they are active in decision-making and represented on water boards V2: active partnerships between communities and NGOs	V1: Flores, Jimenez, Perez-Foguet 2013 V2: Flores, Jimenez, Perez-Foguet 2013, Ward 1999	V1: households V2: NGOs
Access to information	AI1: information about meetings AI2: water law (knowledge) AI3: language AI4: knowledge of contamination	AI1: frequency that community hears about meetings before they occur AI2: regarding CA & US law and UN resolutions AI3: information is available in their language AI4: whether the household is aware that their tap water is contaminated or not.	AI1: Flores, Jimenez, Perez-Foguet 2013 AI2: Flores, Jimenez, Perez-Foguet 2013 AI3: Moore et al. 2011 AI4: Moore et al. 2011	AI1: households AI2: households AI3: households AI4: households

Results

All Communities

In total, five communities and 75 households were surveyed in western Fresno County.

The communities were: Three Rocks, Cantua Creek, Raisin City, Lanare, and Five Points.

Relevant demographic information about each community is in Table 3.

The average monthly water rate for all of the communities was \$112, with an average of \$34 spent on drinking water per month. The percentage of each community's MIH that was spent on water is summarized in Table 4. Three of the communities (Cantua Creek, Three Rocks,

Raisin City) exceeded the affordability standard of 2 percent by over four times, with Three Rocks residents spending 15.3 percent of their income on water. Residents traveled eight miles on average to retrieve water. Five criteria of water poverty were analyzed which included availability, physical accessibility, affordability, quality, and infrastructure. Of the five criteria, affordability and quality were the most pressing issues. Contamination is a major issue in these communities because many of them are in industrialized agricultural areas and have high levels of arsenic and nitrates in their groundwater and disinfectant byproducts in their surface water as a result, leading their water sources to exceed Maximum Contamination Levels (Francis and Firestone 2011, CSA 30, CSA 32). Infrastructure and physical accessibility were the second largest barriers to clean drinking water but varied depending on the community. For instance, Three Rocks and Cantua Creek traveled 18 and 14 miles on average to retrieve water so physical accessibility was an issue. Infrastructure was a common issue in most communities although often not the predominant problem. Availability was not as much of an issue as expected in Fresno County, given the current California drought and reports of wells going dry in Tulare County, which borders Fresno County. Only the community of Five Points reported minimal issues with continuity of their household water supply.

The communities with the highest WPI were Cantua Creek and Three Rocks where residents paid the highest amounts for both their water supply that was contaminated and for alternative drinking water supplies. These communities' rural location also made retrieving water more difficult than the other communities, as they had to travel 17 miles on average to get drinking water. Both of these communities showed high rates of community participation although many noted this was a recent phenomenon due to skyrocketing water rates.

The community with the lowest WPI was Lanare, where many residents received free water deliveries from the government because a non-profit had helped them apply for emergency drought funds. They paid the least amount for water compared to the other communities. They have had a long history of community participation both horizontally through community groups and vertically through their interactions with non-profits and lawmakers.

Table 3: Demographics of Communities Surveyed.

Community	Population	Distance from city (miles)	Distance from county seat (miles)	Percentage Latino	Number of surveys completed (Total=75)
Three Rocks	246	18	45	95.5%	17
Cantua Creek	466	22	41	98.9%	13
Raisin City	380	13	13	81.1%	15
Lanare	589	24	24	88.1%	17
Five Points	70	25	32	96.7%	13

Table 4: Affordability of Drinking Water

	Monthly water rate (avg)	Cost of drinking water	Total cost of water per month	MIH (2012)	Percentage of income for water
Three Rocks	\$168	\$53	\$221	\$17,353	15.3%
Cantua Creek	\$164	\$38	\$202	\$18,542	13.1%
Raisin City	\$88	\$26	\$114	\$14,902	9.2%
Lanare	\$47	\$23	\$70	\$45,690	1.8%
Five Points	N/A	\$28	\$28	\$33,254*	1.01%

*Note: MIH not available for Five Points, only for zip code 93624 which includes households outside of Five Points.

Three Rocks

The community of Three Rocks, CA with a population of 246, is located eighteen miles from the nearest city of Mendota in western Fresno County. I attended a community meeting in Three Rocks, with Cantua Creek residents present as well, about water rate increases and how county officials were looking for options such as consolidating the water systems of both communities. County officials explained that water is expensive because they purchase the water

from the Westlands Water District, where the cost of water has tripled in price from \$348 an acre foot to \$1,140 an acre foot due to the current drought. Three Rocks had a well in the past, but it was shut down because of arsenic in the groundwater so they now must rely on surface water. An employee with California Rural Legal Assistance told me that Westlands is not liable to treat the water since Westlands only has an agricultural contract with the US Bureau of Reclamation in lieu of municipal or industrial contracts. Thus, the water in Three Rocks is contaminated with disinfection byproducts such as Trihalomethanes (THMs) and Haloacetic Acids. According to the EPA, disinfection byproducts can lead to adverse long-term health effects such as an increased risk of cancer and central nervous system problems but are classified as low-level contaminants and thus the California Department of Public Health (CDPH) tells residents that the water is safe to drink and no special precautions need to be taken (2013; CSA 30).ⁱⁱ

Residents were most concerned with the affordability and physical availability of drinking water. Residents reported paying an average of \$168 per month for their water supply, which they could not drink. Water cost residents about 15.3 percent of their income, the highest percentage out of all the communities. County officials noted that the water was expensive because Three Rocks is a small, rural community. They were seeking options to link the water systems of Three Rocks and Cantua Creek together to make it more affordable for both communities and were applying for a state grant to fund the project. Residents spent a monthly average of \$50 for drinking water and had to travel about 17 miles to the nearest city to buy these supplies. 75 percent of residents agreed that their water infrastructure was bad.

About half of the residents surveyed (47%) said they attended community meetings. While they did not think there were local leaders in the community that advocated for clean water, they did think that the community was very active in water issues. A few residents noted

that the community did not have meetings previously, but recently held more because of increasing water rates. A majority of residents also stated that they did not feel represented by their local water board, Westlands, or in decision-making that affected their water supply. The Westlands Water District requires board members to be either a landowner in the District or a designated representative of a landowner. Each landowner is also “allowed one vote for each dollar’s worth of land to which he/she holds title” (*westlandswater.org*). As the majority of residents in Three Rocks and other disadvantaged communities are either tenants or don’t own large parcels of land, they are effectively excluded from these boards which limits attempts at vertical integration. The majority of residents (77%) knew that their water supply was unclean. They also knew about general water law and said that information about water-related community meetings was available in their own language, pointing to a consensus that they had access to information about water.

Overall, Three Rocks was one of the worst cases of water poverty given its isolated location, expensive water rates, and contaminated water supply. Nevertheless, this case shows promising signs of horizontal integration through community attendance of meetings and vertical integration with county officials and local non-profits (but not with water boards) that appeared to be leading to a public grant in the near future.

Cantua Creek

Cantua Creek is located three miles west of Three Rocks, CA with a population of 466. Residents pay an average of \$164 for their water bill each month and \$38 for their drinking water supplies each month. Infrastructure appeared to be less of an issue than in Three Rocks, with only 54 percent saying that their system was bad. Their water is also supplied from the California Aqueduct in the Westlands Water District and therefore they experienced the same increase in

water rates as in Three Rocks. A 2014 Consumer Confidence Report by the CDPH stated that their water was in violation of EPA standards for Haloacetic Acids and Total Trihalomethanes (CSA 32 2014). Although the report said that the water was safe, 85 percent of participants bought alternative drinking water. With a median household income of \$18,542, water costs about 13.1 percent of residents' income. 82 percent of residents affirmed that this was unaffordable for them and recently voted down an increase in their water rate under Proposition 218, leading to the county threatening to shut off their water supply in March of 2015 (Benjamin 2015).

Notably, 23 percent of the residents did not pay for alternative drinking water supplies and they also disagreed with the statement that their water was contaminated, which could point to a disparity in access to information. The Consumer Confidence Report was written only in English and all of the people that didn't buy alternative drinking water took the survey in Spanish. Nearly half of residents (46%) said that they attended community meetings and believed that the community was very active in water issues (77%). 62 percent of residents said that there were local leaders in the community pointing to signs of strong horizontal integration. Their location in the Westlands also made it extremely difficult to have a voice in their local water board. However, the non-profit CRLA was working towards getting emergency drought funding allocated to Cantua Creek and Three Rocks as of early 2015.

A confounding variable for both Three Rocks and Cantua Creek is the prolonged drought that California has been experiencing since 2013. Water rates in these communities have increased partly due to the drought, although they long have had issues with access to affordable and clean drinking water.

Cantua Creek faced many of the same problems as Three Rocks did given their close proximity and the fact that their water is also sourced from the Westlands Water District, although Cantua Creek faced greater affordability issues as their MHI was 60 percent lower than Three Rocks. Similar levels of horizontal integration were seen in Cantua Creek as in Three Rocks as the two often collaborated together for meetings in support of one another. Vertical integration was also similar in that they attended each other's meetings that were held by county officials and also each interacted with CRLA, although weren't able to interact with their water board.

Raisin City

Raisin City, with a population of 380, is located 13 miles outside of the city of Fresno. This community had the largest disparities in responses. For example, some participants said that their water was perfectly clean while others said they couldn't drink it. This points to a polarizing state of water quality even within this small community, which is supported by the fact that 73% of participants agreed that families without water services are primarily disadvantaged, the highest percentage out of all of the communities surveyed. Some residents were connected to a well with clean drinking water while others lived in trailers with no sewer system. 80 percent of participants said that their water supply was clean but many still spent money on alternative drinking supplies, averaging about \$26 per month. The average water rate was also high at \$88 per month, leading to 9.2 percent of residents' income going towards water. The majority of residents said that their water system infrastructure was good.

Overall the community was not very active concerning water issues. 54 percent said that there were no local leaders and half of total participants thought they were ineffective. The majority thought they were represented in decisions made that affected their water supply at the

county level and by their water boards. Raisin City has its own Water District that provides groundwater for primarily agricultural purposes (Ballantyne and Schmidt 2007). They also heard information about community meetings before they occurred. The responses concerning community participation had the most variation with residents evenly split between agreeing or disagreeing with statements, also pointing to contrasting viewpoints on the state of water in the community. These polarizing opinions on water in the community could be explained by the county not allowing Raisin City to grow and thus a small community developed over the past two decades in the northeast of the community – “without paved streets, clean water, sewer, or any other modern public health and sanitation services” (Bellows, Seaton, and Garibay 2013).

Therefore, it is difficult to fully conclude the status of water poverty for Raisin City. Some residents faced water quality and availability issues while others did not. The community did suffer from water rates exceeding the affordability standard by three times. Horizontal integration was low as of 2015. Nevertheless, the community has a history of vertical integration with the non-profit Rural Community Assistance Cooperation, which mobilized the community to petition Fresno County to install a city water system in 2002 when they had water contamination issues. Their collective efforts led to the installation of a new well (Center for Collaborative Planning 2002). It could be that the horizontal integration of the community decreased after the water situation improved and therefore was not apparent when the community was surveyed a decade later.

Lanare

The community of Lanare with a population of 589 was the largest community surveyed, located about 24 miles southwest of the city of Fresno. This community’s access to clean drinking water was the best by far with 70 percent of residents reporting that they received free

monthly deliveries of drinking water by the state government. Their household water supply was contaminated with arsenic as 62 percent of residents affirmed and they paid a monthly water rate of about \$47 (Grossi 2013). The average monthly cost of drinking water supplies was \$23 although less than half paid anything for alternative water, while some needed it as a supplement to the water deliveries. In order to retrieve water, residents traveled an average of four miles to the nearby town of Riverdale. 62 percent of residents agreed that their water system infrastructure was bad.

Lanare has a long history of community involvement in order to improve its living conditions (Bellows 2013). In 1969, residents received funding from the county and formed the Lanare Community Organization, whose efforts led to the installation of a community water system and running water in households for the first time (Bellows 2013). From 2000 to 2006, Lanare received a Community Development Block Grant to fund a treatment plant for arsenic contamination; but, once it started operating, the water rates soared and the plant sat unused (Brown 2012). A local group, Community United in Lanare, works closely with the non-profit California Rural Legal Assistance (Bellows 2013). In 2012, after the CDPH rejected the group's proposal to be connected to an arsenic treatment plant in Riverdale, the group sought media attention and testified in Sacramento to support a bill that would force the consolidation of the two communities' water systems (Bellows 2012). The bill was eventually dropped but the CDPH did give a \$500,000 grant to Lanare in order to fund a feasibility study.

Less than half of respondents said they attended community meetings, which many said were small in numbers, but a majority did believe that the community was active. 70 percent said that they knew about the human right to water. Furthermore, residents felt that they were not represented in their local water boards. Although, the Lanare Community Services District

was formed by local residents and is their local water board (Grossi 2013). This disparity could be due to, as some residents noted, the corruption and mismanagement that has negatively impacted the community. Lanare also had strong partnerships with multiple non-profits in the region including CRLA, Community Water Center, and Self-Help Enterprises. Community groups working with non-profits led to Lanare securing free water deliveries sourced from the state's emergency drought funds in early 2014.

A confounding variable is the emergency grant money used to supply these water deliveries to Lanare, which used to suffer from high water rates. It downplays the affordability issues that Lanare has struggled with in the past and the current situation could change if funding runs out. Furthermore, Lanare also has the largest population of the communities surveyed so perhaps the economies of scale made it less difficult for them to achieve access to clean drinking water because they had more people to mobilize in local community groups and advocate their water poverty to public officials.

Lanare's history of community participation horizontally and vertically led to its ability to decrease not only its water rate but also its ability to secure free water deliveries from the state, thus leading it to have the best water situation out of all of the communities.

Five Points

Five Points was both the smallest and most rural of all of the communities, with a population of 70 and located 25 miles from the nearest city. The community seemed to be split into two sections: a neighborhood behind the market and a row of houses along Mt. Whitney Avenue. The row of houses, which made up 31 percent of participants, housed farmworker who are employees of the pistachio farm nearby. One resident reported that their water was clean and regularly monitored by someone. It appeared their situation differed slightly from the other

neighboring homes, which had water availability and quality issues. In 2014, the CDPH issued three compliance orders on MCL violation for Nitrates and Total Trihalomethanes for three separate water systems within Five Points (*waterboards.ca.gov* 2015). The nitrate violation notice came with a drinking water warning in both English and Spanish about precautions that needed to be taken due to the contaminated water and that it should not be consumed (*waterboards.ca.gov* 2015).

None of the participants reported paying a water rate, most were renters and so they said it was included in their rent. Although their water supply also came from surface water from the Westlands Water District, it was not immediately clear whether this translated into an increase in their monthly rent fees. The average cost for drinking water supplies was \$28 per month and traveling to retrieve the water was easy because a sufficient market is located in town. Five Points had most significant continuity issues, with 31 percent reporting that the water supply in their house would sometimes stop. The majority of residents said that their water supply was clean although half reported that their water infrastructure was bad.

Seventy-five percent of participants did not attend community meetings about water and 67 percent said that there were no local leaders so Five Points, as a whole, was not horizontally integrated. 73 percent still felt represented in decisions made by the county and local water board, the Westlands, concerning their water supply, pointing to vertical integration. Although, there appeared to be no interaction with non-profits in the community. Overall, Five Points had the least evidence of both horizontal and vertical integration. Residents were confident that their water was clean although there was a recent history of several MCL violations but there were multiple water systems in the small community, which could have led to variations in responses.

Table 5: Summary of Water Poverty Indicators in All Communities

	Availability	Physical Accessibility	Affordability	Quality	Infrastructure	Total WPI Score
Three Rocks	0	1	1	1	1	4
Cantua Creek	0	1	1	1	1	4
Raisin City	0	0	1	1	0	2
Lanare	0	0	0	1	1	2
Five Points	1	0	0	1	1	3

Note: A value of 1 means the factor played a role in the community's water poverty. A value of 0 means the factor was not present.

Findings

For the purposes of this paper I have identified four explanatory factors that could influence the WPI in small, disadvantaged communities in California. These factors are public funding, horizontal integration, vertical integration, and access to information. While each variable was present to a certain degree in multiple communities, public funding and vertical integration played the most significant role in achieving access to clean drinking water.

Public Funding

Lanare was a clear example of the difference that public funding can make. Its residents paid the least amount for their water rate and for their alternative drinking water even though their water was still contaminated with arsenic. Residents stated that their water rate used to be high but had decreased recently. Lanare had also been receiving drinking water deliveries from the state from emergency drought funding, which while helpful, is a temporary solution. The problem with funding is oftentimes not whether it is available, as California sets aside funds specifically for disadvantaged communities, but how the communities can go about securing the funds. One non-profit employee said that while he was glad that more funds were being allocated due to the drought, he worried that this would only increase the bureaucracy needed to secure the

grants. Many communities aren't able to apply for these grants on their own and thus rely on non-profits to help them because the county isn't always willing to put the time and effort into applying for it. Fresno County specifically has been reluctant to apply for grant funds requested by Community United in Lanare (Bellows, Seaton, and Garibay 2013). Although, Raisin City was able to secure county funding in 2002 for a water system after a non-profit grant helped them with the initial process. The quality of their water greatly improved afterwards although they still had periodic MCL violations and households developed on the fringes of Raisin City were not connected to the water system and so public funding did not benefit all of the residents.

Horizontal Integration

As Peter Ward wrote about colonias, those with higher levels of vertical integration tended to have more services but horizontal integration must happen first. In regards to Fresno County, horizontal integration appeared to be helpful at improving the WPI where it was present but not necessarily instrumental in attaining access to clean drinking water. Lanare had a long history of horizontal integration and had a low WPI but Five Points had a low WPI as well, with little apparent community involvement. Raisin City had a history of community involvement that had allowed them to interact with non-profits and install a new water system, but evidence of horizontal integration was gone by the time the survey was conducted. Horizontal integration had also recently increased in Cantua Creek and Three Rocks, as outrage spread over the high water rates increased by the drought, but they were also aided by local non-profits. Therefore, while horizontal integration is certainly beneficial to communities looking to access clean drinking water, it doesn't appear to be the most significant factor.

Vertical Integration

Vertical integration includes the level of interaction between community members and outside local, nongovernmental, or governmental actors. In Fresno County, this factor was exemplified most in the interactions between communities and local non-profits. Three Rocks, Lanare, and Cantua Creek all were very involved with California Rural Legal Assistance and other non-profits like Self-Help Enterprises and Community Water Center to varying degrees. CRLA was instrumental in helping Lanare receive free water deliveries from the state and was working towards Cantua Creek and Three Rocks receiving these funds as well.

Given the data collected, it seemed extremely rare that a disadvantaged community would be able to apply for these funds on their own. County officials are reluctant to invest time and resources towards securing for these communities (Bellows, Seaton, and Garibay 2013). Although there was some level of interaction with county officials, as they organized the meeting I attended to notify Three Rocks of water rate increases. Many residents don't have internet access, don't speak English, or don't have the free time to find out that these funds are available and apply for them without outside help. The county is often reluctant to apply for these funds on behalf of the communities and thus, non-profits often fill that void.

Meanwhile, Five Points and Raisin City didn't have as much interaction with outside actors but their water quality was also not as dire as the others. Raisin City had a history of mobilizing in 2002 for the installation of a new water system, so they had de-mobilized since then as most residents had clean water even though some residents were not connected to the clean water system. About half of the Five Points households were farmworker housing and residents appeared to have clean water and be well-represented by the farm.

Furthermore, vertical integration with local water boards is very difficult for most of the communities as many residents are not landowners and thus not allowed to be a board member or be represented in the voting process. Therefore, vertical integration for these communities can make a dramatic improvement to their WPI but often only through non-profits and not through county officials or local water boards. Also, Cantua Creek and Three Rocks had vertical integration but a high WPI but their vertical integration was very recent and emergency drought relief funding was tentative in March of 2015.

Access to information

This variable appeared to be the least significant in the communities surveyed in Fresno County. Information about community meetings, in particular, was generally presented in both English and Spanish. The community meeting I attended in Three Rocks was conducted entirely in Spanish even though of the five county employees present, only one was able to speak Spanish. CRLA did note that there are some indigenous people like Mixtecos from Mexico that speak neither Spanish or English, so that can be a barrier in accessing information.

Contrastingly, 23 percent of participants in Cantua Creek, all surveyed in Spanish, did not appear to know that their water was contaminated and did not pay for alternative drinking water. This could be because their Consumer Confidence Report on their water quality produced annually by the CDPH in Fresno County is in English. The beginning reads in Spanish: “This form contains important information about the quality of your drinking water. Please read the form or communicate with someone that can translate the information” (CSA 32 2014). The form then goes onto explain that their water exceeds the MCL for Haloactic Acids and Total Trihalomethanes, which even most native English-speakers would have trouble understanding, yet still says that the water is safe. While Spanish-speakers felt that information about

community meetings was generally available to them in Spanish, official documents given by the CDPH are oftentimes only made available in English.

Table 6: Summary of Explanatory Variables in All Communities

	Public Funding	Horizontal Integration	Vertical Integration	Access to Information	Total
Three Rocks	0	1	1	1	3
Cantua Creek	0	1	1	1	3
Raisin City	1	0	1	0	2
Lanare	1	1	1	1	4
Five Points	0	0	0	1	1

Note: A value of 1 means the factor played a role in the community's water poverty. A value of 0 means the factor was not present.

Conclusion

In this paper I have analyzed how community resources can influence access to clean drinking water in Central California. While the topic of water poverty has been researched extensively in developing countries, the framework has rarely been applied to water-poor communities in developed countries and never before in California. California, an immensely wealthy state, which was also the first state to declare that water was a human right, has approximately one million residents that lack this right. This can partially be attributed to the history of water development in the region that favored powerful agricultural and municipal interests over universal access. Because of the intense agricultural practices in the San Joaquin Valley, the groundwater was not only left extremely polluted but the economy remained undiversified and underdeveloped. Small farmworker communities that first developed during the Dust Bowl were systematically neglected and withheld investment by city and county officials.

Utilizing a theory-exploring case study, I surveyed five underserved communities in western Fresno County that had issues with access to clean water. Using the Water Poverty Index developed abroad and applying it to the case of California, I analyzed availability, physical accessibility, affordability, quality, and infrastructure as indicators. I found the most influential factors on water poverty to be affordability and quality in disadvantaged communities within western Fresno County. I then looked at four factors that could influence this water poverty which were: public funding, horizontal integration, vertical integration, and access to information.

I found vertical integration and public funding to be not only the most important factors influencing water poverty in these communities but also intrinsically linked. Communities that had more interaction with local non-profits and to a lesser extent, public officials, were able to improve their water situation through state funds, as seen in the case of Lanare and Raisin City. Lanare, as a direct result of public funding, paid the least amount for their water rate and received free water deliveries from the state each month even though their water was still contaminated. On the other hand, communities with the highest WPI such as Cantua Creek and Three Rocks also had vertical integration, although its development was much more recent and public funding appeared to be tentative as a result. Nevertheless, vertical integration is not necessary in order to have a low WPI, as seen in Five Points. A lack of community integration does not mean that the water quality will be bad; rather that integration, especially vertical, can improve the political power of a disadvantaged community as they try to improve their water poverty.

This partially confirms the literature by Peter Ward that says that vertical integration leads to increased resources but conflicts with the literature that prioritizes horizontal integration

or a bottom up approach, as some communities like Three Rocks and Cantua Creek had strong relationships with non-profits without having a long history of community participation. Their recent inter-community collaboration, qualified as vertical integration, also appeared to be effective at gaining the attention of local media and county officials, although it was too early to draw conclusions (Benjamin 2015). Consequently, investment in community-based nongovernmental organizations in the SJV could lead to vast improvements for these disadvantaged communities. Although non-profits are one of the most effective factors in this case, non-profits in the region are smaller and less well-funded than other regions in the state (London and Sommer 2007). Contrastingly, vertical integration between communities and their local water boards were severely limited, as most could not participate on the board or in voting if they were not landowners or owned large prosperities. County officials also had a history of being reluctant to interact with these disadvantaged communities. Therefore further research should be conducted regarding this lack of representation for communities by their local water boards and local government officials. Access to information was seen as a barrier not at the community level, but at the state level where documents given by the California Department of Public Health were only given in English and stated that the water was safe even while in violation of MCLs.

This study has shown that any comprehensive understanding of water poverty must be understood at the community-based level. Future research and this specialized application should be no longer only be applied in developing countries but also in water-poor regions in developed countries. With the 2014 passage of California's Proposition 1, a \$7.5 billion Water Bond for water-related projects, and other public funding going towards water development and emergency drought relief, research can focus on whether the implementation of these funds is

more efficiently reaching those that need them most. The state of California should consider creating positions specifically to deal with the implementation of these grants in disadvantaged communities since the responsibility often falls on non-profits after county officials refuse to take on these roles. Increased investment should also be made in local non-profits already working on this issue, as they were seen to be the most effective actors in this study and already have experience in advocating for these communities. Furthermore, research on this topic will continue to have relevance in relation to climate change, as the current California drought is in its fourth year with no immediate end in sight, the water problems seen in this study will only continue to get worse.

There are several policy implications from this study that also call for increased attention. First, what does it mean for a partially governmental agency such as the Westlands Water District to receive large quantities of tax dollars in order to continually reap riches in one of the poorest areas of the US? These communities are not impoverished by chance but because of policies dating back nearly a century. Residents continue to be shut out of the decision-making process, limiting vertical integration, because their water board is allowed to exclude non-landowners, an antiquated policy more reminiscent of the Reconstruction-era South than the 21st century. The constitutionality of this policy should be questioned. Is it acceptable that one large landowner's vote counts more than one small landowner's vote?

Second, should the regulation of disinfectant byproducts be relooked at by the California Department of Public Health and the State Water Resources Control Board? The World Health Organization, EPA, and numerous scientific studies have the consensus that there are long-term health effects ranging from cancer to reproductive and nervous system problems. Is it acceptable to tell residents of these contaminated systems that their water is safe to drink and they need not

take any special precautions, especially when language or educational barriers might impede them from completely understanding the risks associated with their water supply?

Finally the WPI should, and is meant to be, utilized by policymakers. State officials should think holistically when it comes to water and use this framework to prioritize the needs of their constituents. In times of drought, as in any environmental crisis, often it is the poor that cause the least damage yet bear the brunt of the costs. California should be proud to be the first state in the US to declare water as a human right, but it must realize that vast strides still need to be made before this law can be completely achieved.

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Endnotes

ⁱ “Cross-cutting issue” is a terminology used by the United Nations, usually relating to Human Rights, to mean “non-negotiable norms or standards” that can be approached across all sectors (i.e. private sector, NGOs, civil society, etc.) (UNDG 2007)

ⁱⁱ As of July 1, 2014, the Drinking Water Program transferred from the CDPH to the State Water Resources Control Board. (*waterboards.ca.gov* 2 2015).

Appendix A: Questionnaire for Households

(Likert Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, 0 = N/A)

Availability:

1. Each person in my household has a sufficient amount of water on a daily basis (LK)
2. The water supply in my house is interrupted _____ hours per day on average (option of 0-24 hours)
3. The water supply in my house is interrupted _____ days per month on average (option of 0-31)

Physical accessibility

4. To retrieve water, I must travel _____ miles on average
5. To retrieve water, I _____ (drive a car, walk, take public transportation, carpool, ride a bike, get it delivered, other)
6. Traveling to retrieve water is relatively easy (LK)

Affordability

7. I pay about _____ for my water service every month
8. I consider paying for water on a monthly basis affordable (LK)
9. I spend about _____ on alternative water supplies every month (i.e. water bottles, water tanks, delivery services)

Quality

10. I consider the water supply in my household to be clean (LK)

Infrastructure

11. I consider my water system infrastructure to be good (LK)

Community Participation

12. The families without water services are primarily disadvantaged. (LK)
13. I attend community meetings (LK)
14. The community is very active in community meetings. (LK)
15. There are people in this community I would consider local leaders. (LK)
16. The local leaders in this community are effective. (LK)
17. Our community is represented in our local water boards. (LK)
18. Our community is represented in decisions made that affect our water supply (LK).
19. I know about water law in California and the human right to water (LK).
20. My water is contaminated (LK).
21. I hear information about community meetings before they occur (LK).
22. Information about community meetings is available in my language (LK).
