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CHAPTER 11

# Water Justice in California's Central Valley

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## BACKDROP: TOOLEVILLE AND ITS DISCONTENTS

The unincorporated community of Tooleville, California, is located at the eastern edge of Tulare County's valley floor, at the foot of the rolling Sierra Nevada foothills that are dotted with orange groves and small residential enclaves. Tooleville is a farmworker community; the roughly seventy households living here are predominantly Latino, with a median annual household income of $16,000 (about a third of the median income for California). Residents pride themselves on the beauty of their natural surroundings and their high rates of homeownership. Ms. Jimenez[1] remembers the day her father purchased a home in Tooleville—"I was so proud that we owned a house." She still lives there and is passionate about staying in her community, despite the challenges Tooleville faces.

Like most small communities in the San Joaquin Valley, Tooleville residents rely on groundwater for drinking. But since 1997, Tooleville's two wells have exceeded the Safe Drinking Water Act (SDWA) maximum contaminant level (MCL) for nitrate at least seven times. Nitrate is an acute contaminant, and, at these levels, infants are at risk of methemoglobinemia ("blue baby syndrome"), and women are at risk of adverse reproductive effects (Fan and Steinberg 1996). In some years, the drinking water has violated SDWA standards for total coliform. To deal with bacteriological contamination, residents could boil the water, but this would concentrate the nitrate.

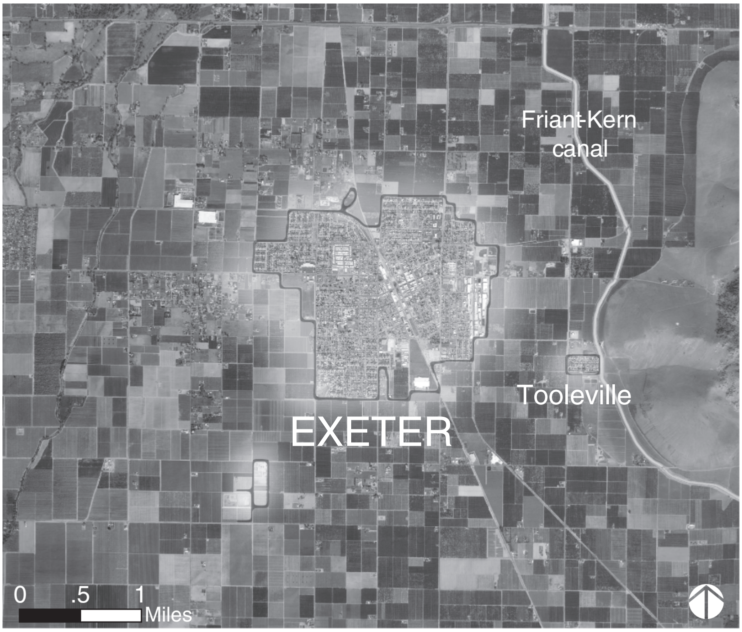

FIGURE 11.1. Aerial map of the city of Exeter and Tooleville, California. They are less than two miles apart. The Friant-Kern Canal passes to the east of Tooleville.

Tooleville residents are frustrated that historical planning processes have limited the financial and infrastructure resources available to Tooleville. Until 2012 Tulare County's General Plan of 1973 listed Tooleville as one of fifteen communities from which public resources, including water infrastructure, should be withheld. Solutions have been hard to come by. Attempts to drill new wells have had poor results—the groundwater all around the community is high in nitrates. This has left Tooleville with a persistent compliance and exposure burden, prolonging risks from exposure as well as household coping costs. Even coping mechanisms such as purchasing bottled water are only partially protective. Most residents have drunk the contaminated well water at some point, and still use it for cooking.

Regional solutions have also been hard to achieve. For several years, residents and county officials hoped that Tooleville could physically consolidate with the nearby city of Exeter, which is less than two miles away, and has more wells and cleaner water (figure 11.1). But the city has been more interested in expanding its spheres of influence in other directions. Tooleville residents believe this to be intentional and discriminatory because theirs is a low-income neighborhood. In the 2000s, Exeter cited prevailing wages as a barrier to consolidation, from which it was later exempted. In 2009, the California Department of Public Health stepped in, and has been pressuring Exeter to connect to Tooleville. In the meantime, residents continue to rely on contaminated wells, and pay twice for water—once for their utility bill, and again for bottled water they can drink.

The story of Tooleville shows that, while small size does make a system physically vulnerable, a range of political actors and social-historical factors also impact exposure and coping capacity. Tooleville's story underscores the complexity of isolating "the cause" of drinking water pollution. Finally, the composite burden we describe—of exposure and coping costs—creates place-specific environmental injustices, even in a state such as California, where safe water is regularly taken for granted as a right fulfilled for all.

## INTRODUCTION

On January 1, 2013, California Assembly Bill 685, known as the Human Right to Water Bill, became effective. The new law intends to promote universal access to safe, clean, and affordable water throughout California. But what does such a bill mean in California, the richest state in the richest country in the world, where almost everyone has piped and potable water delivered to the home?

Poor drinking water quality is usually thought of as a "developing country" problem. In the main, this perception is correct. But hundreds of small communities in California and across the United States rely on unsafe drinking water sources that their modest means cannot mitigate. Research and grass-roots efforts have consistently drawn attention to high levels of contaminants in California's San Joaquin Valley (Dubrovsky et al. 2010; Harter et al. 2012); to inadequate services and infrastructure in U.S.–Mexico border *colonias* (Olmstead 2004) and rural communities in the South (Wilson et al. 2008; Heaney et al. 2011); and to bacteriological and chemical contamination in unregulated drinking water sources in the Navajo Nation (Murphy et al. 2009). Our own earlier research, conducted between 2006 and 2011, established that race/ethnicity and socioeconomic class were correlated with exposure to nitrate and arsenic contamination and with noncompliance with federal standards in community water systems (Balazs et al. 2011, 2012).

In this chapter we describe the Drinking Water Disparities Framework to explain environmental injustice in the context of drinking water in California's Central Valley.[2] The framework builds on the social epidemiology and environmental justice literatures, and is made concrete through five years of field data from California's rural San Joaquin Valley.[3] We focus on nitrate and arsenic contamination to show how race and class are correlated with contaminated drinking water in the valley. We then trace the mechanisms through which natural, built, and sociopolitical factors work through state, county, community, and household actors to constrain access to safe water supplies and to financial resources for communities.

A rich understanding of how disparities in access to safe drinking water are produced and maintained is essential for framing environmental justice concerns and developing effective public health interventions. Until recently, environmental justice research has focused predominantly on the disproportionate burdens of toxic sitings (e.g. Bullard 2005) and environmental exposures (e.g. Morello-Frosch et al. 2001; Morello-Frosch and Lopez 2006), and has been relatively silent on the topic of water.[4] It is often forgotten that the birth of the environmental justice movement in Warren County, North Carolina, included the concern that PCB-laced soil would leak into the drinking water supplies in a predominantly African American community (Cole and Foster 2001). This chapter provides a framework within which to understand environmental justice in the context of drinking water. In doing so, this chapter reflects the call by environmental justice scholars (Pulido 1996; Pulido et al. 1996) for more historically informed work on the causes and consequences of environmental injustice. We draw on a definition of environmental justice that includes both distributional and procedural elements, but more broadly defines water (in)justice as a composite burden shaped by a comprehensive set of actors, processes, and mechanisms.

Our Drinking Water Disparities Framework (Balazs and Ray 2014) shows that community constraints and regulatory failures produce social disparities in exposure to drinking water contaminants. Water system and household coping capacities lead, at best, to partial protection against exposure. This composite burden explains the origins and persistence of social disparities in exposure to drinking water contaminants.

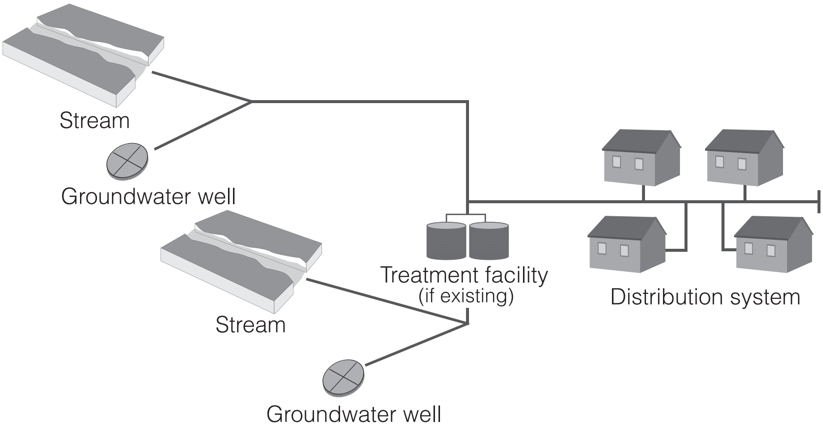

FIGURE 11.2. Schematic of a community water system. Water from a groundwater well or stream may be treated or untreated before entering into the distribution system. Source: Balazs et al. (2011).

## NITRATES, ARSENIC AND DRINKING WATER DISPARITIES IN CALIFORNIA'S CENTRAL VALLEY

We begin with the significant findings of our past research on drinking water quality in California's Central Valley. Our research explored the extent and nature of correlations between race, class, and drinking water quality, especially with respect to nitrate and arsenic contamination. For years local residents had sought to draw attention to water contamination in their communities, but had been told by local politicians that the issues were "community-specific" (personal communication). Our research sought to determine whether there was a disproportionate burden of exposure across the valley, not just in particular communities. We focused on community water systems (CWSs), which are public water systems that serve water year-round to at least 25 people or have more than 15 service connections (U.S. Environmental Protection Agency 2010). A simple schematic of a CWS is shown in figure 11.2.

Our first study (Balazs et al. 2011) asked whether CWSs predominantly serving people of color and lower-income areas were more likely to have higher levels of nitrate contamination. With its intensive irrigated agriculture, this valley has some of the highest nitrate levels in the country (Dubrovsky et al. 2010). Nearly 95 percent of the valley's residents rely on groundwater for drinking (California Department of Public Health 2008a). The valley also has some of the highest rates of poverty and minority populations—particularly Latinos—in the state (U.S. Census Bureau 2007). These communities are economically disadvantaged, making it harder for them to mitigate either the nitrates or the health consequences of nitrate contamination. With the continued use of nitrogen-based fertilizers (Dubrovsky et al. 2010), exposure may become increasingly widespread.

Our study statistically analyzed the relation between CWS demographics (percentage of the population that is Latino, and percentage of home ownership in the population) and average nitrate levels between 1999 and 2001. We classified nitrate levels for each CWS as *high* if the system-wide average exceeded the MCL of 45 mg $NO_3$/L; *low* if the average was less than half the MCL (<22.5 mg $NO_3$/L); and *medium* if it was 22.5–44.9 mg $NO_3$/L). Figure 11.3 shows our descriptive results. CWSs are stratified into quartiles based on percentage of Latinos living in the community. Quartiles with higher Latino percentages had a greater proportion of systems with high nitrate concentration (Latino quartiles 3 and 4 in figure 11.3). The two quartiles with the lowest rates of homeownership (a proxy for less wealth) had the largest proportions of systems in the medium and high nitrate categories (15 percent and 22 percent, respectively). In sum, we found a positive association between race and nitrate levels. A more robust statistical model then controlled for confounding variables that could mediate the relationship of interest. The model confirmed the descriptive findings. We found that CWSs that served higher fractions of Latinos and lower fractions of homeowners had higher average nitrate levels. This effect was strongest in small CWSs, indicating not only a social disparity in exposure but also a greater impact in the small communities that often have the fewest resources to cope with contamination.

Our second study (Balazs et al. 2012) explored whether CWSs that served predominantly low-income populations or people of color were more likely to have higher average levels of arsenic and a greater challenge in complying with drinking water standards. Arsenic in drinking water is linked to skin, lung, bladder, and kidney cancers (Tseng et al. 1968, 2000; Smith et al. 1992; Fereccio et al. 2000), and the most common exposure pathway is consumption of contaminated groundwater (Prüss-Ustün et al. 2011). In the valley, arsenic can reach elevated concentrations due to agricultural activities (National Research Council 2001).

In 2002, amid considerable debate, the U.S. Environmental Protection Agency (EPA) issued its revised arsenic rule reducing the allowable arsenic concentration in drinking water from 50 μg/L to 10 μg/L. It was understood from the start that systems with low economies of scale

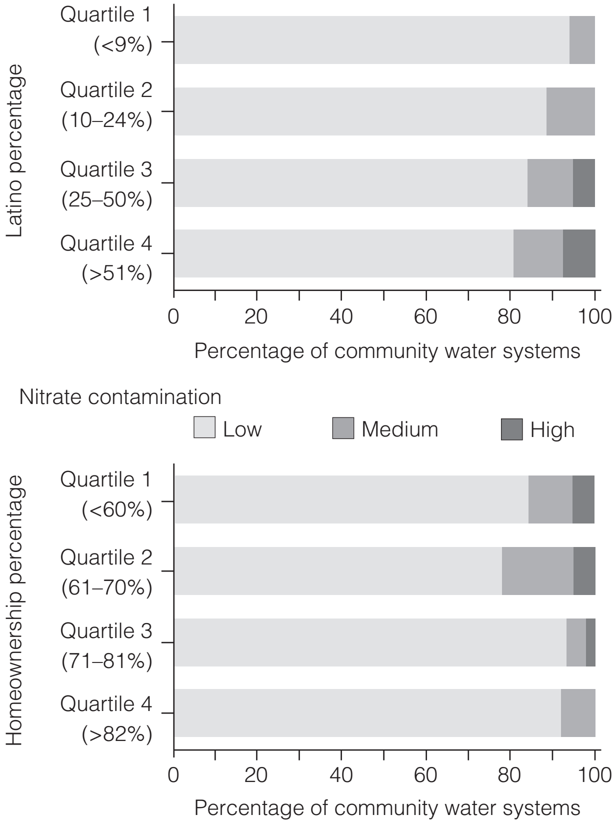

FIGURE 11.3. Percentage of community water systems with low, medium, and high levels of nitrate contamination plotted against Latino percentage and homeownership percentage in the service population. Source: Balazs et al. (2011).

would find it difficult to comply with the new rule (Stone et al. 2007; Pilley et al. 2009). But little attention was given to other inequities that could arise in exposure to arsenic or ability to comply. For this reason, we argued that a joint focus on compliance challenges and exposure to contaminants is most helpful for understanding the health, environmental justice, and policy implications of drinking water policies such as the revised arsenic rule. Our study thus employed a “joint-burden analysis” to analyze the environmental justice implications of both compliance capacity *and* exposure related to arsenic contamination. Our study period was 2005–2007, as water systems had been given until 2006 to comply with the revised rule.

We found that communities with lower rates of homeownership and greater proportions of people of color had higher odds of MCL violation. We also found a negative association between homeownership rates and arsenic concentrations in drinking water, with a stronger effect in smaller CWSs (those with fewer than 200 connections). These results indicate that communities with fewer economic resources faced a dual burden—they were not only exposed to higher arsenic levels, but were also served by systems more likely to receive an MCL violation.

What are we to make of these nitrate and arsenic findings? The association of race/ethnicity and socioeconomic status with nitrate levels could be due to several factors. Race/ethnicity could be related to the historical proximity of farm labor communities to agriculture, as well as the (in)ability of residents to participate in the governance of their CWS on account of language, citizenship status, or lack of political clout (Michelson 2000). That water quality varied by Latino percentage or homeownership matters not only on account of distributional inequities but also because elevated nitrate levels could pose a greater hazard to lower-income sub-populations that have less access to health care. Our findings also suggest a "canary in the coal mine" scenario: nitrate levels are impacting systems throughout the valley (Harter et al. 2012), not just in the small, lower-income areas that we studied. Eventually, many more towns and cities could face the mitigation and treatment costs associated with spreading nitrate contamination (Moore et al. 2011).

Arsenic in groundwater generally occurs naturally, so we should not expect a positive association between arsenic levels in CWSs and low socioeconomic status. Our results can best be understood in the broader context of the mediating role of system-level capacity. Smaller water systems often lack the economies of scale and resource base to ensure the technical, managerial, and financial (TMF) capacity to reduce contaminant levels (Committee on Small Water Systems 1997; Shanaghan and Bielanski 2003). The socioeconomic status of residents directly influences TMF capacity, because it affects the ability of a water system to leverage resources, both internal (e.g. rate increases) and external (e.g. loans; Committee on Small Water Systems 1997). Thus, in our arsenic study, CWSs with customers of lower socioeconomic status may have been less able to ensure compliance with the revised arsenic standard by 2007. Our joint-burden analysis highlights the need to consider not only exposure and current states of compliance but also the future mitigation potential of impacted water systems and the households they serve.

## UNDERSTANDING WHY DRINKING WATER DISPARITIES EXIST AND PERSIST

Our work on nitrate and arsenic contamination led us to ask: Why do drinking water disparities exist, and how do they persist, despite the passage of the Safe Drinking Water Act of 1974? Designing solutions for contamination and contamination-related disparities requires a thorough historical-structural analysis (Pulido 1996; Pulido et al. 1996) of the mechanisms through which environmental injustices are produced.

Disparities in water infrastructure and "basic amenities" (Wilson et al. 2008; Wilson 2009; Vanderslice 2011) can drive adverse health effects. Historical and structural conditions shape lack of access to safe drinking water; these conditions include selective enforcement of regulations (Cory and Rahman 2009), noncompliance with federal standards (Guerrero-Preston et al. 2008; Rahman et al. 2010), inequities in access to funding (Imperial 1999), and (the absence of) a community's political power in accessing a safe water supply (Francis and Firestone 2011). Researchers have shown that the cost of service extension can drive inadequate service provision (Olmstead 2004); that municipalities provide or deny access by determining which areas to annex or exclude from their city boundaries (Wilson et al. 2008; Marsh et al. 2010); and that *de facto* segregation allows such determinations to continue (Troesken 2002).

Our Drinking Water Disparities Framework builds on this research to explain why drinking water disparities exist and persist, but draws primarily on the social epidemiology literature for its theoretical framing. Social epidemiological research uncovers how race, class, and social factors (Sexton et al. 1993; Gee and Payne-Sturges 2004) interact over multiple levels of decision-making (household, community, and region; Krieger 2001) to impact exposure to contamination (deFur et al. 2007).

Five years of primary data collection with residents, state and county drinking water regulators, water board members in unincorporated communities, participants at environmental justice meetings, and community-based organizations, in particular the Community Water Center, in the southern San Joaquin Valley provide the empirical grounding for our framework.[5] This richly nuanced dataset reveals not only the role of multi-level actors in shaping disparities but also the lived experiences of households and communities who struggle for safe water. Data on drinking water quality and Safe Drinking Water Act (SDWA) violations

(California Department of Public Health 2008a, 2008b) in CWSs across the valley complement the qualitative field data.

Our framework traces how the historical marginalization of poor communities, coupled with poor source water quality, determines the condition of their physical infrastructure and results in exposure. We thus emphasize the role of historical and structural factors, and trace the mechanisms through which these lead to exposure disparities. These structural factors are not deterministic; rather, communities and individuals exercise agency within the structures that constrain them. The extent of this agency also impacts exposure. Ultimately, our framework outlines a "composite burden" composed of exposure to contaminants plus the inability of socially vulnerable communities to mitigate contamination. We argue that this composite burden leads to persistent exposures and social disparities in exposure to poor drinking water.

## THE DRINKING WATER DISPARITIES FRAMEWORK

We present the Drinking Water Disparities Framework in figure 11.4. The figure depicts the factors within the three environments (natural, built, and sociopolitical) that drive drinking water disparities across race and class. The framework shows that these factors, when mediated through the actions (or inactions) of state, county, community, and household actors, jointly impact exposure and coping capabilities. Viewed comprehensively, these multiple possible pathways, or mechanisms, at multiple levels, can result in persistent exposures to water contamination that vary by the race and class of different communities.

Three "environments" contain the factors that drive the disparities. The *natural environment* includes ecological factors such as soil types, hydrology, and climate; these cannot be altered except over a long timeframe. The *built environment* represents human-modified spaces in which "people live, work and recreate" (Roof and Oleru 2008), such as agricultural land, buildings, and water infrastructure. The *sociopolitical environment* refers to institutional and group characteristics (e.g. community or household), including historical and present-day planning policies, governance practices, and community demographics. Each environment contains factors that act across all three scales—conventionally called *levels* in the social epidemiology literature—the regional (including state and county), the community, and the household. Arrows connecting the three environments show the factors' mutual interactions. For example, citrus farming is a part of the built environment, but affects the natural environment via water quality, and farming itself is influenced by natural characteristics such as climate and soil type. The lines separating the levels indicate that specific drivers of water access can occur at, and influence, multiple levels within an environment. For example, degraded community-level water infrastructure can (but need not) interact with household infrastructure.

Factors in all three environments and across all three levels act through, and across, actors within four distinct levels relevant to the valley: the state, the county, the community, and the household.[6] The state and county levels correspond to political and geographic boundaries. State and county regulators function within their respective levels. The community is defined by the physical service area of a CWS, defined earlier. A community can be an incorporated city with its own tax base, or it can be unincorporated. Municipal employees, community organizers and community groups, water board members, and non-governmental organizations are contained within the community level. The household level is where drinking water is usually accessed, though exposure ultimately occurs at the individual level. Ordinary residents are contained within the household level.

Our Drinking Water Disparities Framework highlights the role of multi-level coping mechanisms in influencing exposure by adding *coping* to the classic exposure–disease paradigm (bottom of figure 11.4). In general, exposure to drinking water contaminants in excess of SDWA standards necessitates mitigation, and the water system is required to implement a solution. However, when a water system is incapable of doing so, or while it waits to solve the contamination problem, households must individually respond. We show that exposure and coping are mutually constitutive; the degree of exposure dictates the need for coping, and the degree to which coping mechanisms are successful directly influences exposure. This is indicated in figure 11.4 with bidirectional arrows. To the extent that the coping of one actor (e.g. a community water board) is not successful, it necessitates coping by another (e.g. the household)—this is indicated by the lines within Coping Mechanisms. Coping leads to additional costs, and these added costs also constrain future coping capacity. Jointly, these feedback cycles and the resulting exposure and coping costs define what we have called a composite drinking water burden. In the next two sections we flesh out this framework with specific examples from rural communities in the San Joaquin Valley, showing how exposure occurs and how small CWSs (try to) cope.

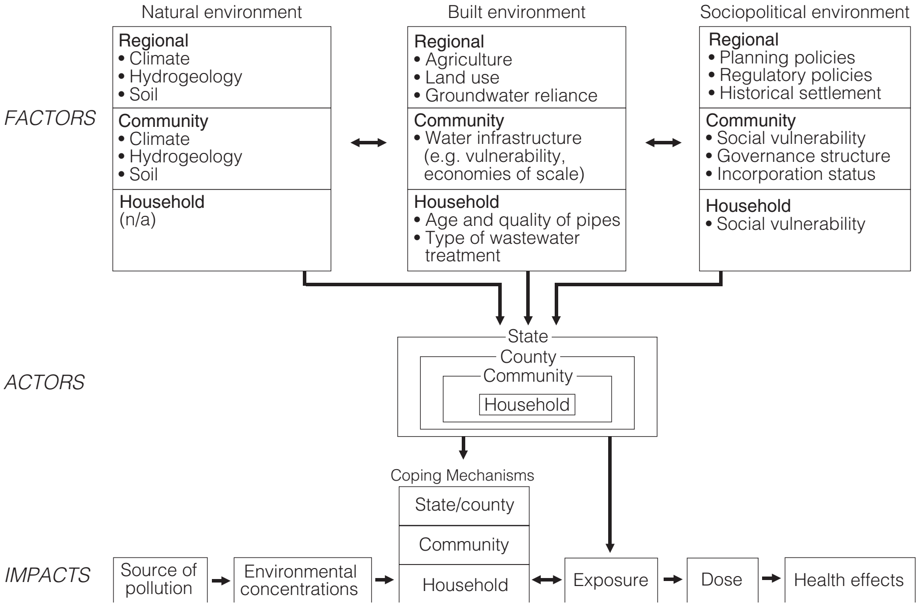

FIGURE 11.4. The Drinking Water Disparities Framework: a multi-level, multi-actor perspective. Source: Balazs and Ray (2014).

## THE FRAMEWORK APPLIED: MULTI-LEVEL FACTORS AND ACTORS IMPACT EXPOSURE

To begin, the natural and built environments, such as hydrogeology and land-use practices, shape source water quality, which in turn partially defines baseline contaminant levels. For example, the climate and soil of Tulare County's eastern foothills create favorable growing conditions for citrus trees that use high amounts of nitrate fertilizer. Since the water table in this region is shallow (figure 11.5), nitrates can leach into it rapidly and travel quickly into well water (Nash 2006). As a result, communities such as Tooleville, located on the eastern side of Tulare County, have some of the highest nitrate levels in the valley (Dubrovsky et al. 1998). On the western side of the valley, in communities such as Alpaugh, the Corcoran clay layer plays a converse role. This impermeable layer requires that CWSs relying on groundwater drill deeper wells (Galloway and Riley 2006), but at these deeper levels wells are likely to draw naturally arsenic-laden water (Welch et al. 2000; Gao et al. 2007).

Built and sociopolitical factors interact with natural factors to further determine exposure levels at the community and household levels.

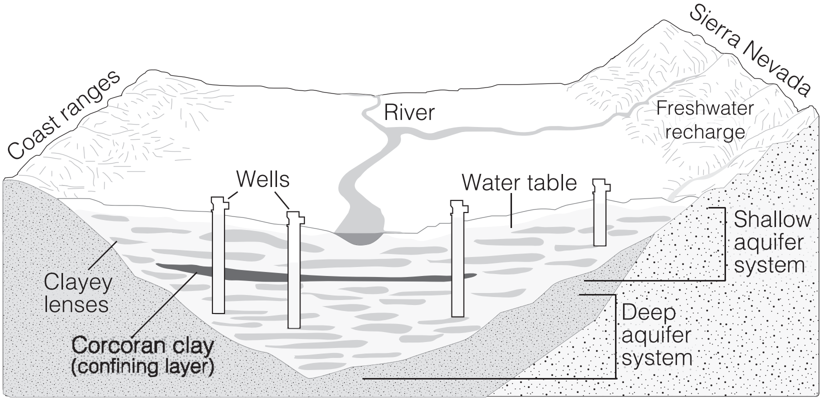

FIGURE 11.5. Cross-section of the valley, with Corcoran Clay layer on the left (west) and the shallower aquifers on the right (east). Adapted from Galloway and Riley (2006).

For example, the allocation of water rights and the development of water resources in the valley have played direct roles in determining drinking water quality. Government financing of large-scale water projects historically enabled the storage and conveyance of vast quantities of Sierra Nevada snowmelt and California Delta waters to farmlands. In this process, farmers received nearly unlimited surface water rights for agriculture (Reisner 1986), but 95 percent of the valley's residents were left to rely on groundwater for drinking (California Department of Public Health 2008a). This might not have mattered, were it not for the baseline natural conditions (e.g. arsenic in the soil) and agriculture's contamination of groundwater due to chemical runoff from pesticides and fertilizers (Dubrovsky et al. 1998; Viers et al. 2012). In 2007, 75 percent of all of California's nitrate violations occurred in the San Joaquin Valley (California Department of Public Health 2008a).

Policies at multiple levels interact to deprive communities of adequate drinking water resources. For example, the 1973 General Plan of the Tulare County Planning Department reads, "Public commitments to communities with little or no authentic future should be carefully examined beforeal action is initiated. These non-viable communities would, 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." Among the fifteen communities listed as "non-viable" are Alpaugh, Plainview, Seville, and Tooleville. Many of these communities were once labor camps, or are currently unincorporated, without their own tax base or municipal representation to draw on for infrastructure improvements. Thus this *de jure* discrimination results in the *de facto* discrimination of redlining, where the "non-viable" label is used to justify withholding of resources and to allow the perpetuation of poor infrastructure. A leader from one of the allegedly non-viable communities notes: "One of the questions a lot of people ask me is, if the water's so bad . . . why don't you move? And I'm thinking, why would you want me to move? That's my house. That's my town. I was born and raised there. . . . Do you think by moving it's going to get solved?"

As with county-level plans, selective annexation at the city level has allowed water problems to persist. The city of Exeter is less than two miles from Tooleville and has used its municipal decision-making authority to (in effect) prolong exposure in Tooleville. Exeter repeatedly cited prevailing wages as a barrier to extending pipelines to Tooleville even though two Senate bills (Senate Bill X29 and Senate Bill 110) explicitly exempted the city from paying prevailing wages. Exeter's 2020 expansion plan includes areas of undeveloped agricultural parcels and ranchette houses toward the east. The growth areas extend in some cases to at least the same distance as Tooleville, but they do not extend toward Tooleville. Residents experience this as a case of "municipal underbounding" (Marsh et al. 2010): "If we were rich, we'd raise their tax base. But we're poor, so they're not interested in us."

On balance, despite the best intentions, county drinking water regulators have been unable to ameliorate the valley's ongoing contamination problems. The SDWA promotes a system-by-system focus and provides few incentives for regulators to support regional solutions. As one county regulator noted, Tooleville residents "pay taxes in our county, they pay taxes in our stores, their children go to our school. . . . It irritates me that [Exeter] won't help those people." However, he continued, "I don't have an opinion, I'm a regulator." Clearly, this regulator can see the need for intercommunity solutions, but the solution is outside of his regulatory mandate. Residents in unincorporated places also see this problem: "Do you know how long we've been knocking on the county's door? . . . We've been doing this since my dad was a farmworker."

State and county regulatory failures add to the exposure burden produced by historically poor infrastructure and limited municipal support. In interviews, regulators agreed that because they are limited by funding and staff time, they are forced to prioritize which drinking water regulations to enforce. Violations of Tier 1 contaminants (those that can cause acute or immediate health impacts, such as total coliform or nitrate) are explicitly prioritized over a system's failure to comply with the SDWA's monitoring requirements. But prioritizing violations over monitoring leads to unforeseen exposure risks. In 2007, Fresno County returned primacy for water systems with fewer than 200 connections to state-level regulators; state officials found that many of the CWSs had failed to monitor for several years, but had not been given notice of monitoring violations by county regulators. Without water quality monitoring data county regulators had been unable to issue MCL violations, and with no notices of MCL violations residents had lacked information on whether they were being exposed to harmful levels of contaminants.

## THE FRAMEWORK APPLIED: MULTI-LEVEL FACTORS AND ACTORS IMPACT COPING AND MITIGATION

If coping and mitigation strategies at the community or household level could adequately address drinking water contamination, then vulnerability to exposure could be minimized (see figure 11.4). However, our fieldwork showed that inadequate infrastructure, poor TMF capacity at the community level, failures of the regulatory system to provide information on alternatives, and inadequate funding at the state level all undermine the success of coping mechanisms.

The joint role of poor infrastructure and poor TMF in undermining mitigation is best understood through the examples of the unincorporated communities of Alpaugh and Lanare. Alpaugh, in Tulare County, had exceeded the old arsenic standard of 50 µg /L since the early 2000s (California Department of Public Health 2008a) and had experienced water outages when its backup wells broke down. In 2005, the water board obtained $4.2 million to rehabilitate its system, but it did not include plans to upgrade to the 2006 revised arsenic rule of 10 µg As/L. As one newspaper article noted, "officials were just focusing on getting water flowing. Once that was accomplished . . . they would worry about the arsenic issue" (Boyles 2005). Similarly, in the unincorporated community of Lanare, in Fresno County, the MCL for arsenic had been exceeded by 2005. In July 2006, after securing a Community Block Grant, residents celebrated the installation of a new treatment plant (Nolen 2007). Six months later the plant was closed down. A grand jury investigation found that "because of mismanagement, unacceptable arsenic levels, and the absence of any other water source, the district is in crisis" (Fresno County Grand Jury 2008).

The cases of Alpaugh and Lanare could partly be explained by poor TMF capacity, a particular problem in small water systems. One regulator explained that in small communities local residents and volunteers run the water boards: "They live there, they're residents. They don't really understand our regulatory requirements." But regulators also noted that low TMF stems from a community's low resource base. Small, low-asset communities are unable to hire full-time operators who know the ins and outs of drinking water requirements and planning.

State funding mechanisms for new water sources or treatment could offer system-level solutions, but as currently designed, they often do not promote timely solutions. Congress revised the 1996 SDWA amendments to include capacity-development programs for small systems (Shanaghan and Bielanski 2003), but, in California, TMF capacity is required before water systems can get state revolving funds (California Department of Public Health 2009). Similarly, the American Recovery and Reinvestment Act of 2009 set aside $160 million for drinking water infrastructure; it earmarked stimulus money for "high priority" projects that were "shovel ready" (California Environmental Protection Agency 2010). In both cases, the funding criteria (TMF capacity and shovel-readiness) define eligibility on the core weaknesses of resource-poor communities. Communities that lack resources lack TMF; without TMF, funding is harder to attain; and without funding, TMF cannot be developed. The funding conditions through which exposure could be mitigated are thus conditions through which disparities in exposures are prolonged.

When system-level coping fails, households assume the burden of mitigation. But a combination of disenfranchised residents, inadequate water system responses, and regulatory failures is yet another pathway toward vulnerability. Interviewees reported that local water boards sometimes discriminate against residents on the basis of language, race/ethnicity, socioeconomic status, or homeownership. In 2010, residents from the community of East Orosi testified to the United Nations Special Rapporteur on the Human Right to Water and Sanitation that, due to their Spanish accents in English, they were regularly turned away by water board administrators when seeking clarification on their water quality reports (United Nations General Assembly 2011).

Regulatory failures further undermine household-level coping mechanisms. The SDWA focuses on a contaminant-by-contaminant mode of regulation, but has no stipulations on how residents should address multiple contaminants (e.g. nitrate and total coliform). In 2007, 5 percent of the valley's 677 active CWSs received an MCL violation for both nitrate and total coliform (California Department of Public Health 2008a). A violation of the total coliform MCL triggers a boil-water order. But boiling water can increase concentrations of nitrate. Neither does the SDWA explicitly address how to cope with long-term exposures. A resident from the community of Cutler explained that for years she has received Consumer Confidence Reports indicating that dibromochloropropane levels in the water exceeded the MCL. These reports note that residents should not worry because health impacts are not based on immediate exposure but on lifetime exposure. She had lived in her community for nearly 30 years—so, she asked, should she worry or not?

In these situations, water systems simply leave residents to cope with contaminated drinking water as best they can, and SDWA regulations ultimately fail the (low-income) household. Individual coping mechanisms to reduce exposure may not be effective. Households may purchase bottled water, but individuals may not consistently drink it. Households may install water filters, but may incorrectly assume that the filter treats for the contaminant of interest (Moore et al. 2011). Yet, significant costs are incurred for these only partially protective measures. In many low-income valley communities, households pay 4 to 10 percent of their monthly income for water (Moore et al. 2011), including the utility bill and vended water, well above the EPA's affordability criterion of 2.5 percent of median household income (U.S. Environmental Protection Agency 2003). Certainly when a successful system-level mitigation strategy is developed, these costs are passed along to the household. But under those circumstances there is a higher probability of achieving water quality of adequate standards.

## CONCLUDING THOUGHTS

The Drinking Water Disparities Framework traces the development of a composite drinking water burden that comprises the exposure and coping costs that many water systems and households face. The framework reveals that there is no direct causal path between race and class and disproportionate burdens; rather, race and class are imbricated in almost all the factors and actors that have historically combined, and still combine, to produce this composite burden.

The framework shows that decisions of multiple actors at every level, made intentionally or by default, prolong exposure and impede households' coping capabilities. It reveals how, alongside a baseline of contaminated source water, a series of policies have constrained access to physical and financial resources. These decisions, in conjunction with regulatory failures, a lack of community resources to mitigate contamination, and political disenfranchisement of local residents, help explain the origins of environmental injustice in the context of drinking water. These same forces also influence coping capacities, which may lead only to partial protection, which in turn exacerbates the impacts of drinking water contamination. This composite-burden analysis shows that there is no single cause or intentional action that defines environmental injustice and drinking water; rather, a comprehensive set of actors, processes, and mechanisms jointly shape it. It reminds public health practitioners and policymakers to look beyond exposure and proximate causes and include historical and structural factors in the analysis of exposure disparities. This highlights the need for a multi-pronged intervention agenda to reduce and mitigate the drinking water disparities. While this chapter focuses on the Central Valley, we believe it would be enhanced with lessons from other rural regions across the state, and with further engagement with urban settings.

From a policy perspective, the framework identifies multiple potential intervention points (Susser and Susser 1996). Numerous policies have attempted to address drinking water contamination and small-water-system challenges, including monies from the American Recovery and Reinvestment Act and the Safe Drinking Water State Revolving Fund. But unless future incarnations of these policies take seriously the disparity-producing mechanisms highlighted in this chapter, these policies are unlikely to improve drinking water conditions in the most disadvantaged communities. While new efforts to support small communities are already underway (e.g. California's Emergency Funding and Small Water System Program Plan), a concerted focus on improving TMF capacity in disadvantaged communities is critical. Funding mechanisms should not always use TMF capacity as a requirement, but should find ways to support it, or enhance other sustainable solutions. "Planning-ready" rather than "shovel-ready" funding would help small or disadvantaged systems develop their engineering and financial plans for contaminant mitigation and infrastructure needs.

Similarly, the promotion of water system consolidation—be it physical connection of a small system to a larger one or sharing of management capacities—must acknowledge the underlying political and social barriers noted here. Water policy experts often say that smaller systems block consolidation efforts for fear of losing local autonomy. But our work argues that a deeper and long-standing set of social, economic, and political processes also creates barriers. Consolidation may be more successful if it is not left to isolated cities and communities but facilitated by a regional drinking water development program. This may require abdication of some municipal authority, something many cities are loath to surrender.

Finally, future amendments to the SDWA are needed on three fronts. First, the ability of water systems to comply with monitoring and reporting violations should be given priority. Secondly, drinking water regulations should clearly address the co-occurrence of contaminants and how to adequately inform residents about long-term protective measures. And thirdly, regional or cross-system solutions will be necessary. The prevalent methods of system-by-system monitoring and contaminant-by-contaminant remediation cannot alleviate the composite burden of drinking water vulnerability in low-income communities.

## POSTSCRIPT: TOWARD A WATER JUSTICE FUTURE FOR CALIFORNIA

At the time of writing this chapter, great momentum was building towards addressing the drinking water concerns we outline above. In 2012, Governor Brown created the Governor's Drinking Water Stakeholder Group, bringing together environmental justice advocates, water regulators, and agriculture and water industry experts to work on developing solutions to operation and maintenance challenges in disadvantaged communities. That same year, the California Department of Water Resources funded seven integrated regional water management (IRWM) pilot projects to address the challenges faced by disadvantaged communities and ensure more active involvement in regional planning. At the beginning of 2013, California's thriving water justice movement achieved the passage of AB 685, the first Human Right to Water bill in the country. Later that year, Governor Brown released his draft California Water Action Plan. Among the top ten priorities were the need to "invest in integrated water management and increase regional self-reliance" (priority 2), "provide safe drinking water and secure wastewater to all water systems" (priority 7), and "improve operational and regulatory efficiency" (priority 9).

When we began our research in 2005, acknowledgement and integration of these core drinking water needs was nearly nonexistent. Local community members were told that their issues were "local to their community." Agricultural interests maintained that the main source of nitrate was leaching septic tanks, not nitrate fertilizers. There was little acknowledgement of funding barriers for small systems to achieve compliance. Regional solutions were acknowledged but rarely supported by regulators or local IRWM groups.

Since then, strong environmental justice leadership and local communities have caused the ground to shift. Supported by Senate Bill X2-1 (Perata, 2008), researchers documented the primary role of agriculture in creating nitrate contamination in the valley (Harter et al. 2012). Early results from the IRWM pilot projects have highlighted that regional solutions hold much promise, given adequate funding and technical support and a willingness of traditional power-holders in IRWM planning to involve traditionally marginalized groups (Balazs and Lubell 2014). And research on cumulative impacts is developing tools to consider the multiple components of water contamination,[7] including multiple contaminants and system-level characteristics. These shifts hold much promise for ensuring that all Californians obtain access to clean and affordable water.

And yet, much work remains. Regional solutions must continue to be developed in order that systems with low economies of scale gain the efficiencies necessary to obtain clean water at affordable prices. The political participation of traditionally marginalized communities must continue to be supported so that the voices and needs of less traditionally powerful voices are adequately incorporated into water policy and shape local planning efforts. In essence, the pathways and mechanisms outlined in our Drinking Water Disparities Framework must be continually revisited, so that Californians can work toward a future that meets both the distributional and procedural goals of water justice.

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## NOTES

1. Pseudonym used in accordance with the Protection of Human Subjects protocol of the University of California, Berkeley.

2. The topic of water justice in California spans an array of issues, including traditional water uses, recreational water use, rural versus urban issues etc. (see e.g. the 2014 documentary, *Thirsty for Justice*).

3. Water-justice and drinking-water struggles are also present in urban settings, but this chapter draws on data from rural cases.

4. There is a growing international environmental justice focus on water; see e.g. Debbane and Keil (2004).

5. All interviews and focus groups were conducted in person, in English and Spanish, by Carolina Balazs.

6. National and within-state regions could potentially be included as additional levels, but for this chapter these are not central.

7. See e.g. the California Environmental Protection Agency's CalEnviroScreen.

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