Society & Natural Resources
An International Journal

ISSN: 0894-1920 (Print) 1521-0723 (Online) Journal homepage: https://www.tandfonline.com/loi/usnr20

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To cite this article: Linda Estelí Méndez-Barrientos, Alyssa DeVincentis, Jessica Rudnick, Ruth Dahlquist-Willard, Bridget Lowry & Kennedy Gould (2020): Farmer Participation and Institutional Capture in Common-Pool Resource Governance Reforms. The Case of Groundwater Management in California, Society & Natural Resources, DOI: 10.1080/08941920.2020.1756548

To link to this article: https://doi.org/10.1080/08941920.2020.1756548

Published online: 29 Jun 2020.

SOCIETY & NATURAL RESOURCES
https://doi.org/10.1080/08941920.2020.1756548

Farmer Participation and Institutional Capture in Common-Pool Resource Governance Reforms. The Case of Groundwater Management in California

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ABSTRACT

Farmers are often critically important to the success of common-pool resource governance reforms. Nevertheless, their participation in these off-farm reform processes has received limited research attention. This paper investigates farmer participation in state-mandated common-pool resource governance. Using groundwater governance in California as a case study, we show that existing social networks, in combination with asymmetries in resource access within the farming community, and a collective identity framed against central government intervention, explain participation and representation in groundwater governance processes. An important governance paradox has emerged, in which groundwater-dependent users are unequally represented in the very groundwater management agencies that have been developed to protect them. This case sheds light on documented shortcomings of common-pool resource governance reforms and aims to inform the design of future reform processes.

ARTICLE HISTORY
Received 30 June 2019
Accepted 26 March 2020

KEYWORDS
Climate adaptation; farmer; groundwater; governance; institutional change; participation; water policy

Introduction

As the need for sustainable natural resource management continues to grow worldwide, agriculture often plays a pivotal role in environmental governance reforms (OECD 2008). Agricultural stakeholders, such as farmers, are often required to participate in the design and implementation of such reforms (De Loe, Murray, and Simpson 2015; Hardy and Koontz 2010; Primdahl, Kristensen, and Busck 2013). Adoption of on-farm conservation measures designed to reduce environmental impacts from agricultural practices are a common and well-researched reform example (Baumgart-Getz, Prokopy, and Floress 2012; Knowler and Bradshaw 2007; Prokopy et al. 2008, 2019). The participation of farmers in *off-farm* environmental governance processes has received less

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attention, and importantly, it is likely that the behavioral motivations to participate in these reform processes are quite different.

Of particular concern in this paper is the participation of farmers in top-down, state mandated reforms to create local common-pool resource (CPR) structures (i.e. management entities and institutions). The development of CPR governance structures has become a dominant environmental governance approach worldwide (Lemos and Agrawal 2006; Schlager 2007). Despite the important role farmers play in the success of CPR governance structures in agricultural landscapes, with few exceptions (De Loë, Murray, and Simpson 2015; Ferreyra, Loë, and Kreutzwiser 2008; Hardy and Koontz 2010; Primdahl, Kristensen, and Busck 2013), their perspectives have often been overlooked (Koontz 2003).

Farmers are being challenged to comply with and participate in CPR governance, on top of the day-to-day demands of their farm businesses, and an increasingly unpredictable climate. They are also dominant users of CPRs, such as water, which is a defining input for all crop and livestock operations. Their participation or nonparticipation in local water governance processes is key to understanding the feasibility and implications of proposed solutions that aim at reducing undesirable environmental impacts, increasing resilience to climate change, and improving water management (Castilla-Rho et al. 2017). Understanding farmer perspectives and behavior is thus important for the success of environmental governance processes.

This paper investigates what motivates California farmers to participate in a state-mandated groundwater governance reform, the Sustainable Groundwater Management Act (SGMA). Using secondary and qualitative interview data from 27 farmers across the state, we find that existing social networks (Bolding 2004; Wester 2008) in combination with asymmetries in resource access within the farming community (c.f. Agrawal and Gibson 1999; Ribot and Peluso 2009), and a collective identity (c.f. Abers 2007) framed against governmental intervention (De Loë, Murray, and Simpson 2015; Ferreyra, Loë, and Kreutzwiser 2008; Hardy and Koontz 2010, Niles, Lubell, and Haden 2013; Stock et al. 2014; Taylor and Van Grieken 2015) explain participation and representation in groundwater governance processes. Interestingly, experience with short and long-term environmental changes is not a consistent driver of farmer participation in groundwater governance reform processes. This case study shares farmers' first-hand experiences with the California groundwater reform and reflects on the failed promise to create equitable CPR governance structures.

In the next section we discuss theoretical tools for analysis followed by a description of the policy context in California. Our methods approach is then presented, followed by a discussion of results. In conclusions, we address the potential implications of asymmetrical participation in environmental governance processes.

Untangling Participation in Environmental Governance Processes

The main focus of this paper is to understand farmer participation in environmental governance processes. We use foundations from environmental behavior, political ecology and common-pool resource governance theory to inform our understanding of farmer participation in SGMA processes.

Research in environmental behavior has hypothesized that catastrophic climate events have the greatest likelihood of altering beliefs, risk perceptions, behavior and policy preferences toward climate change (Gifford 2011; Sanderson and Curtis 2016; Weber and Stern 2011). Relevant to our work are a number of empirical studies that have looked at the impact of drought on modifying farmers' behavior (Carlton et al. 2016; Findlater et al. 2018; Lane et al. 2018; Niles, Lubell, and Haden 2013; Schattman et al. 2016; Van Duinen et al. 2015). However, results have varied dramatically. Interestingly, Carlton et al. (2016) found that while farmers in the Midwest had a heightened risk perception toward the 2012 drought, this event had little impact on their attitudes toward climate adaptation actions. In California, Niles, Lubell, and Haden (2013) found that farmers' greatest concern around climate change was an increase in government regulation, rather than water security and drought. This indicates that perceived resource scarcity (Casciaro and Piskorski 2005; Hillman, Withers, and Collins 2009) related to climate change, may be one among many potential drivers of farmer participation in environmental governance.

We use the overarching framework presented by Hoogesteger and Wester (2015) to study groundwater governance. They based their framework on the theory of access presented by Ribot and Peluso (2009), which focused on access rather than rights. Access is defined as "the ability to benefit from things—including material objects, persons, institutions, and symbols" (Ribot and Peluso 2009, 153). Particularly for groundwater, a focus on access seems imperative since ability to use this resource is more convoluted than merely defining groundwater rights. Groundwater access is primarily a question of private hydraulic property (i.e., wells), access to electricity or diesel to facilitate extraction (i.e., power pumps), and land ownership (Hoogesteger and Wester 2015). Hoogesteger and Wester (2015) emphasized three core concepts in their framework that are relevant to the case study: hydrosocial networks, political economy, and discourses that define groundwater access.

Hydrosocial networks (Bolding 2004; Wester 2008) are configurations of resource-users, water resources, technology, and other material and productive resources that make water extraction, use and distribution possible (Mollinga 2003). These networks are thus constituted both by social actors and the natural, physical, and technological environment that organize the groundwater socio-ecological system (SES) (Ostrom 2009).

The political economy of groundwater enables access to land ownership, technology and other inputs, as well as the institutions which define productive relationships that organize rural communities (c.f. Clement 2010). Transnational markets of commodity chains, and agrarian and water policies are notable. Together they define who, where, for what purpose and at what cost, groundwater is extracted and used (Kumar, Scott, and Singh 2013; Levidow 2013; Scott 2011).

Discourses define groundwater access by influencing what is considered fair and acceptable resource use, legitimizing groundwater access (c.f. Clement 2010). Political and ideological convictions, as well as cultural norms, inform decision-makers at various scales, which in turn design policies and rules for groundwater governance (Ostrom 1990; Molle 2008).

Given the heterogeneity of farmers, who in practice are a community with distinct farm characteristics and access to technology, land, water, and other resources, and social and political views (Agrawal and Gibson 1999; Rudnick et al. 2016), their experience with CPR governance may be diverse. As such, farmers' motivations to participate may be driven by their various roles and capacities as community members or producers and landowners (Primdahl, Kristensen, and Busck 2013; Ribot and Peluso 2009). Thus, farmers may be "commitment-driven," when maintaining and increasing social status in their communities is important, or "capacity-driven," when they can overcome the transaction costs (Libecap 1994; Ostrom, Gardner, and Walker 1994; Williamson 1987) associated with participating in collective management (Primdahl, Kristensen, and Busck 2013).

Leveraging existing social networks to develop new CPR governance agencies can enable coordination and trust (Huxman and Vangen 2005), but farmers may belong to various (hydro)social networks that may not overlap. Their commitment may thus be related to various communities. This is important because those who are able to participate decide themselves with whom they want to collaborate and what they want to accomplish (Henry, Lubell, and McCoy 2011), challenging inclusion and adequate representation in governance processes (Leach 2006; Holley 2010; O'Toole and Meier 2004). This may result in the formation of unbalanced decision-making bodies that do not adequately represent the perspective of underrepresented groups from different sectors (e.g. environmental, municipal, rural residential) (Bryson, Crosby, and Stone 2006), as well as within the farming community itself (Kemerink et al. 2013).

Participation in CPR governance has associated transaction costs that come out of defining, negotiating, and coordinating collective management among various groups of resource-users (Libecap 1994; Ostrom, Gardner, and Walker 1994; Williamson 1987). The capacity to overcome these costs, such as time to go to meetings, access to meeting venues and information, staff and other resources, defines access to participation (Holley 2010; Ribot and Peluso 2009). Thus, only those who can bear these costs (Raab, Mannak, and Cambré 2015; Lubell et al. 2017) may be able to engage in CPR governance.

Finally, political and ideological convictions, as well as, cultural norms may also shape participation in environmental governance (Ostrom 1990). In regards to farmers, discourses on utilitarianism and libertarianism have been used to frame their collective identity (Hoogesteger and Wester 2015). For example, multiple studies have revealed that aversion to losing resource control through top-down regulations or legal mandates can drive farmer participation in local resource management (Ferreyra, Loë, and Kreutzwiser 2008; Hardy and Koontz 2010; Stock et al. 2014). In the face of inevitable government intervention, farmers may paradoxically seek to participate in CPR governance as a means to reassert their control over natural resources when they cannot get what they want without cooperating (Méndez-Barrientos et al. 2018).

California as a Case Study

California farmers face different climate-related challenges depending on their location in the state. However, most were affected by the recent 2011–2016 drought (Swain 2015). The drought began due to a combination of temperature and precipitation anomalies that reduced snowpack, spring runoff, and inevitably soil moisture on agricultural fields (Luo et al. 2017). This change in water availability resulted in reduced surface water supplies which led to a variety of drought adaptations, including increased groundwater pumping.

During these record breaking drought years, California's reliance on groundwater increased from approximately 40–60% (DWR 2013). An evaluation of California's groundwater basins found that 127 of the state's 515 basins—accounting for 96% of the state's total groundwater use - were at risk of overdraft (DWR 2017). Overdraft-associated impacts such as increased extraction costs, land subsidence, sea-water intrusion and water quality degradation, among others (DWR 2017), created widespread alarm that culminated in the legislative passing of the Sustainable Groundwater Management Act (SGMA) of 2014.

Until that point, groundwater pumping was largely unregulated and unmanaged, despite the existence of mechanisms for local management. Only 14% of water agencies had developed voluntary groundwater management plans before SGMA (MacLeod and Méndez-Barrientos 2019). Similarly, only 4% of groundwater basins had been adjudicated before SGMA (Wat. Code §10720.8.).

The Sustainable Groundwater Management Act (SGMA)

SGMA is a top-down, state-mandated governance effort that requires local public agencies overlaying groundwater basins to formally organize through groundwater sustainability agencies (GSAs) and create groundwater sustainability plans (GSPs). The goal is to prevent future undesirable environmental impacts associated with groundwater overdraft (Sustainable Groundwater Management Act 2014).

SGMA provided substantial flexibility for groundwater-users to form GSAs and did not grant any single existing agency jurisdiction or mandate a particular governance approach. It allowed any local public agency with water supply, water management, or land use responsibilities to be eligible to become a GSA (Wat. Code, § 10721, (j)), or form a collective GSA with other local agencies, bounded within the same groundwater basin(s) (Wat. Code §10723 (a)).

Disadvantaged communities (i.e. state-designated communities that are most impacted by economic, health, and environmental burdens (California Public Utilities Commission (CPUC) 2015), independent farmers, and private pumpers not represented by any local public agency (called hereby "independent groundwater users"), could be formally included in the decision-making bodies of GSAs. However, GSA formation processes challenged the capacity of these groups to participate, requiring frequent attendance at meetings, enough technical knowledge to navigate legal and hydrological jargon, and the social influence and authority to adequately participate in decision-making (Méndez-Barrientos, Bostic, and Lubell 2019). These unspoken requirements of participation created marked representation differences between local public agencies and independent groundwater users (Dobbin and Lubell 2019). For example, Méndez-Barrientos, Bostic, and Lubell (2019) found that only 12% of GSAs included independent groundwater users as formal representatives on management boards.

Farmer Participation in SGMA

Recent research has shown that while many farmers have felt underrepresented in the GSA development process (Niles and Hammond-Wagner 2018, 2019), some have effectively pursued various strategies to ensure their interests are represented. One such strategy has been securing support from regional farmer organizations such as the Farm Bureau, which have more resources and staff that could participate in GSA meetings. In addition, some water and irrigation districts have advocated for the expansion of their jurisdictions by annexing land owned by independent groundwater users to facilitate representation from these groups (Conrad et al. 2018). However, variance among levels of organization around land and water management and knowledge on water policy processes may challenge adequate participation of the wide diversity of farmers and farming systems that exist across California (Rudnick et al. 2016).

Methods

Data Collection

We conducted 27 semi-structured interviews with farmers in four different groundwater basins (12 different sub-basins) across the state between 2016 and 2018. Farmers who had a connection to the boundary organizations, University of California Cooperative Extension, the Farm Bureau and the USDA Natural Resources Conservation Service (NRCS), were contacted. The farmers interviewed were, in theory, *more* likely to be participating in SGMA processes because of their relationships with these boundary organizations, which typically diffuse information and connect various stakeholders to policy processes (Carr and Wilkinson 2005; Cash 2001; Klerkx, Aarts and Leeuwis 2010). These social network characteristics aside, interviewed farmers differed in geography and the characteristics of their farming businesses (i.e. farm size, crop type, water rights and membership to water service organizations) (Table 1). We did not select farmers based on their knowledge and involvement in SGMA. Instead, we selected farmers based on their location to ensure geographical representation throughout the state, ensuring we could capture diverse experiences related to precipitation distribution (e.g. North versus South Central Valley), groundwater basin overdraft, and their access to water infrastructure (e.g. access to Central Valley project and irrigation/water district service).

Our semi-structured interviews were predominantly guided by two lines of questioning. First, we sought to determine knowledge of SGMA and awareness of the environmental impacts of groundwater overdraft. If the interviewees indicated positive knowledge of SGMA, then interviews sought to understand level of involvement in local GSA(s) and explore barriers to participation in the process. Interviews were subsequently transcribed, hand-coded, and analyzed to understand what facilitated or prevented participation in groundwater governance. Member checking, which refers to the process of returning transcribed interviews to study participants for verification and correction (Birt et al. 2016), was not done with interviewees. Instead, authors hosted a focus group discussion in the San Joaquin Valley (September 17, 2019) and attended several GSA, SGMA farmer public meetings, and farm field days from 2016 to 2018.

Table 1. Agricultural operation characteristics.

		Farmer characteristics				Crop Type			Water Access			
	Organic operation	Female farmers	Farmer age >50 years	Farming experience >30 years	Mean farm size (acres)	Annual	Perennial	Mixed/multiple	Groundwater only	Riparian surface water	Water district water	Both groundwater & surface water
SGMA participant ($n = 15$)	3 (20%)	2 (12%)	12 (80%)	8 (53%)	4,586	2 (12%)	10 (75%)	3 (20%)	5 (33%)	2 (12%)	8 (53%)	7 (47%)
Non-participant ($n = 12$)	5 (42%)	1 (8%)	10 (83%)	9 (75%)	2,206	2 (16%)	5 (42%)	5 (42%)	4 (33%)	2 (16%)	6 (50%)	7 (58%)
Total sample ($n = 27$)	8 (30%)	3 (11%)	22 (81%)	17 (63%)	3,344	4 (15%)	15 (56%)	8 (30%)	9 (33%)	4 (15%)	14 (52%)	14 (52%)

Agricultural operation characteristics of farmers participating in SGMA ("SGMA participants"), not participating in SGMA ("Non-participants") and all farmers interviewed ("Total sample"). In each cell, count of farmers reported; parentheses show percentage of farmers in that category out of total (participants/ non-participants/ total sample) in row.

In parallel, we collected publicly available secondary data to characterize farmer experience with environmental change, including annual precipitation, change in groundwater elevations during drought, and groundwater basins conditions (Table 2). Using historical precipitation data from the California Irrigation Management Information System (CIMIS) database, we calculated precipitation changes for each farmer. The nearest CIMIS station to each farm was identified and for each station, the average annual precipitation was calculated for all available years. The calculated difference between the 20 or 30 year historical average (depending on data availability) and the 2011–2015 drought average was used to estimate experienced precipitation reduction. Using the Department of Water Resources (DWR, 2014) SGMA Data Viewer website, we calculated groundwater elevation changes for each farmer. The closest monitoring well to each farm was identified and for each well, water surface elevation (WSE) data, pre and post-drought was gathered (late 2011 and late 2016-early 2017 depending on the well reading available). The calculated difference between pre and post-drought WSE was used to estimate each farmers' experience of groundwater level reduction. Additionally, we included the groundwater sub-basins and their given prioritization by the DWR where the interviewees' farms were located.

Data Analysis

Semi-structured interviews were motivated by the literature on participation drivers in environmental governance processes previously discussed. As such, we used a theory-driven approach to develop a coding framework to analyze interviews.

Our analysis relied on two rounds of qualitative coding. First, we coded farmer and farm characteristics, and knowledge and participation in SGMA processes for all farmers. We built a database of descriptive variables for each interviewee, including the farm locations, water sources, farming experience, crop type, knowledge and participation in SGMA, and awareness of environmental impacts of groundwater overdraft. At this stage, we also integrated the secondary environmental change data, including annual precipitation and groundwater elevation changes, and the groundwater basin and its prioritization where the farmer was located.

Our second round of interview coding focused on identifying the drivers of SGMA participation. We prioritized the farmers that *were* knowledgeable of SGMA in order to understand *why* they were or were not participating, and what factors motivated their engagement. Interview excerpts on participation were extracted and organized by key themes, revealing the underlying behavioral drivers and motivations of participation that we discuss in depth in the following section.

Limitations

This research has several limitations that should be noted. First, although interviewed farmers reflected crop type and mirrored demographic trends seen in the state's agricultural census, the farm size, farm and farmer diversity, and location of farmers primarily located in high priority basins, does not sufficiently represent the diversity of California agriculture and farmers' roles under SGMA. In addition, nearly all interviewed farmers

Table 2. Environmental change perceptions and experiences.

	SGMA basin status			Awareness of overdraft-associated impacts						Surface and groundwater reductions	
	In high priority basins	In medium priority basins	Experienced previous CA droughts (Yes/No)	Reduced surface water allocations	Lost aquifer storage	Reduction in groundwater quality	Seawater instrusion	Land subsidence	Lowering groundwater levels	Mean reduction in precipitation during drought relative to historic average[a]	Mean reduction in groundwater level (WSE) during drought[b] (ft)
SGMA participants ($n = 15$)	12 (80%)	3 (20%)	13 (87%)	3 (20%)	0	4 (27%)	1 (7%)	3 (20%)	9 (60%)	23%	30.7
Non-participants ($n = 12$)	12 (100%)	0	10 83%)	6 (50%)	1 (8%)	2 (17%)	1 (8%)	1 (8%)	7 (58%)	29%	43.1
Total sample ($n = 27$)	24 (89%)	3 (11%)	23 (85%)	9 (33%)	1 (4%)	14 (52%)	2 (7%)	4 (15%)	16 (60%)	26%	36.6

This table summarizes the data collected on environmental changes related to water access and groundwater sustainability, across all interviewees, and between SGMA participants and Non-participants.

[a]Reduction in precipitation calculated by finding average local precipitation during drought years (2011–2016) for each farmer (from nearest CIMIS station) and comparing to 20 or 30 year historic average precipitation levels at their local station.

[b]Reduction in groundwater level calculated by finding closest monitoring well to each farmers' location and evaluating Water Surface Elevation (WSE) (measured in feet) before drought (2010–2011) and end of drought (late 2016), and calculating difference in groundwater level. Greater numbers indicate a greater depression in groundwater levels (Monitoring well level data available from SGMA Data Viewer).

were fairly well-connected to traditional information networks, as those same networks facilitated the research team's introductions to interviewees. Lastly, though we interviewed four farmers with less than 100 acres (and an additional four with less than 500 acres), we also interviewed a few farmers with very large operations (+10,000 acres), and thus the mean farm size of our sample is much larger than the mean farm size across California. Despite these limitations, we believe our findings contribute an important and nuanced discussion on the diversity of agriculture that will be affected by the recent passage of SGMA and ongoing GSP development process.

Results and Discussion

Our interview analysis yielded four key findings that we discuss in depth in this section. First, leveraging existing, surface water, social networks (Bolding 2004; Wester 2008) to develop groundwater management agencies facilitated participation from farmers who were embedded in those networks, but limited participation from independent groundwater users. Second, access to political, social, economic, natural, and human resources (Ribot and Peluso 2009) facilitated the participation of some types of farmers- namely large, industrial, surface-water rights holders. Third, all interviewed SGMA participants shared a collective identity (Abers 2007) framed as an aversion to state control which motivated their participation in local policy discussions that they may have otherwise ignored. Finally, nearly all interviewed farmers recognized how both short and long-term environmental changes had altered their water access, though this did not stand out as a factor that motivated SGMA participation (Table 2).

Environmental Change Experiences of Interviewed Farmers

We interviewed 27 farmers across California (Figure 1). Just over half of our interviews ($n = 15$) were with farmers who were participating in SGMA (henceforth "SGMA participants") to some degree, either by attending local meetings for their GSAs ($n = 9$) or serving as a GSA Board Member ($n = 6$). The remaining 12 interviews were with farmers who were not participating in SGMA (referred to as "Non-participants"). Only two farmers had not heard of SGMA at all.

Nearly all farmers interviewed (23 out of 27) had previously experienced a drought in California. The 2011–2016 drought led to reductions in average annual precipitation for all farmers interviewed, with an average decrease of 26% from "normal" (long-run historic averages) precipitation. As noted previously, reduced surface water availability spurred a dramatic increase in groundwater extraction, noticeably lowering aquifer levels over the course of a few years; on average, interviewees experienced a decrease of 36.6 feet in Water Surface Elevation (WSE) (Table 2). We found no notable differences between SGMA participants and non-participants, and their experienced precipitation reductions or groundwater level changes, suggesting that these short-term physical changes were not a driver of participation.

To gauge experiences with longer term groundwater changes, we asked farmers about their experiences related to groundwater overdraft environmental impacts. We found mixed responses (Table 2). Only one farmer mentioned loss of aquifer storage, two

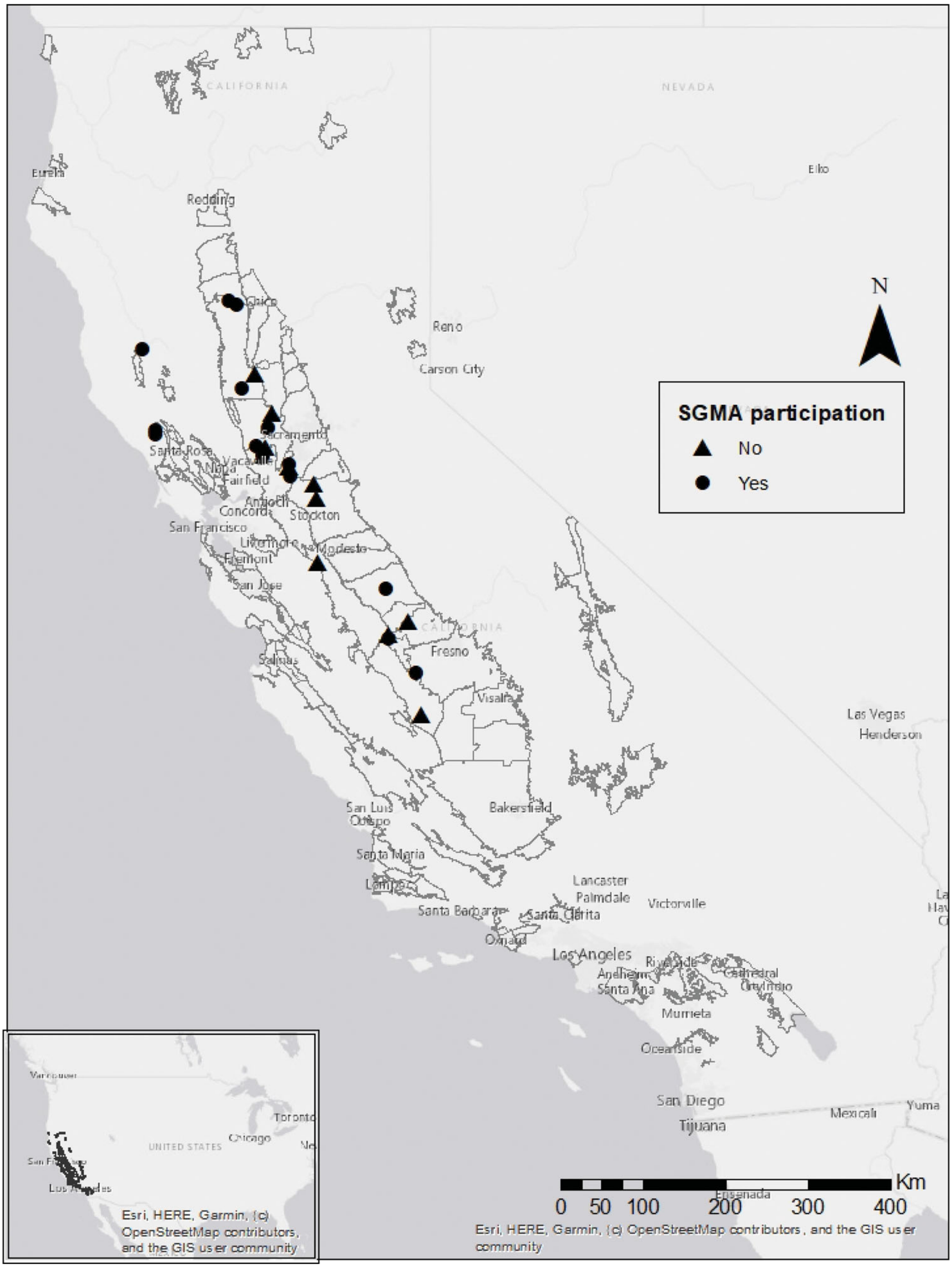

Figure 1. Distribution of interviewees across groundwater basins in California. Map shows the distribution of interviewed farmers and their farm locations within the limits of priority groundwater basins across California. Groundwater basins boundaries are shown in gray polygons; farmers participating in SGMA ("SGMA participants") are represented as dots and farmers not participating in SGMA ("Non-participants") are represented as triangles.

farmers mentioned sea-water intrusion (a phenomenon exclusive to coastal areas), four mentioned land subsidence, six mentioned reductions in groundwater quality, and nine mentioned reduced surface water allocations. The most frequently mentioned environmental impact was lowering of groundwater levels, with 60% ($n = 16$) of interviewees expressing great related concern. Ten farmers reported that they experienced a combination of various environmental impacts related to groundwater overdraft. Notably, the recognition of these undesirable impacts was similar for SGMA participants and non-participants. Moreover, exactly half of the farmers who were in high priority basins participated in SGMA (12 out of 24), though all of the farmers in medium priority basins participated (3 out of 3). Consequently, there were no significant differences between SGMA participants and non-participants, and their long-term experience with physical, hydrological, and/or environmental changes.

Leveraging Existing Social Networks to Assert Local Control

Our interview data shows a clear distinction between the political access enjoyed by some farmers, based on their membership to existing social networks around water management (i.e. irrigation and water districts), compared to the restricted access granted to independent groundwater users. SGMA's statutes (Wat. Code, § 10721, (j) and Wat. Code §10723 (a)) effectively granted authority to existing public agencies by stipulating that only public agencies could become a GSA, or form a GSA with other public agencies overlaying a groundwater basin. This automatically limited participation to a subset of stakeholders: independent groundwater users, such as disadvantaged communities, farmers and private pumpers unaffiliated to any local public agency.

Among the farming community, this created a governance paradox. Farmers who were affiliated with public agencies due to their surface water rights were granted authority to have formal representation or form a GSA; meanwhile, farmers who were entirely groundwater-dependent users and had not historically organized in public agencies due to the private hydraulic nature of groundwater (i.e., through wells), were denied that access. In essence, groundwater users who exclusively depended on this resource were at a disadvantage to participate and gain representation in SGMA, a groundwater reform that was meant to protect them.

This disadvantaged situation for independent groundwater users meant that they had two options to participate in SGMA: either organize to collectively form a new public agency and formally become a GSA, or be incorporated into an existing GSA decision-making board. The high transaction costs of pursuing both initiatives at the same time meant that few groups were successful in achieving either strategy. For example, of the 260 GSAs that were formed with SGMA, 47 (18%) were exclusive single GSAs constituted by farmer-led public agencies such as irrigation and reclamation districts. None (of the 260 GSAs) were constituted by recently formed public agencies of unorganized independent groundwater users. Furthermore, only 31 of the 260 GSAs (12%) had independent groundwater users as voting representatives in GSAs management boards (Méndez-Barrientos, Bostic, and Lubell 2019). These limitations disproportionately impacted the representation of small farmers and disadvantaged communities, suggesting that SGMA, whether intentionally or not, enabled the participation of public agencies within existing hydrosocial networks (Bolding 2004; Wester 2008), while keeping independent groundwater users outside of decision-making boards, largely unrepresented.

Our interviews illustrated the lengths to which independent groundwater users went to ensure some level of participation in SGMA. For example, one group of farmers in the North Coast hydrologic region revived a water district that was no longer functioning to be able to have formal representation in one GSA where leaders opposed inclusion of nonpublic agency representatives (pers. comm. CF11). Similarly, a group of groundwater users in the Sacramento Valley formed a group to advocate and negotiate for a voting seat within the new GSA's management board, but were unable to formalize their legal status as a public agency within the time frame of the GSA formation process (pers. comm. CF12).

Additionally, our interview data with SGMA participants exposed the significant representation demand disparities, both in time and money, between public agency representatives and independent groundwater users. Bi-weekly and sometimes weekly meetings for each GSA were challenging for farmers, especially for those who did not have staff or other representatives that could attend on their behalf. In contrast, representatives and staff from public agencies and organized farm groups (e.g. county and city officials, water and irrigation districts representatives and Farm Bureau staff) were paid to be there (c.f. De Loë, Murray, and Simpson 2015; c.f. Holley 2010); SGMA became part of their job and paid responsibilities. In addition, farmers whose farms were located in basins with multiple GSAs, or who had extensive land that stretched across multiple groundwater basins, had to attend SGMA meetings for more than one GSA, which was more costly and time-consuming (pers. comm. CF8, CF11,CF12, CF20, CF22). SGMA processes thus presented asymmetrical transaction costs (Libecap 1994) for various stakeholders.

Furthermore, multi-sector and multi-actor heterogeneity increased deliberation time and raised questions on adequate representation. Conflicting priorities (e.g. utilities interested in long-term resource access versus farmers focused on flexibility and short-term use) increased deliberation time to an already demanding process (c.f. Ayres, Edwards, and Libecap 2017). Rudnick et al. (2016), who calculated agricultural diversity by farm size and farm income in California, demonstrated the various representation needs of the agricultural sector. One agricultural stakeholder raised this precise conflict: "Say you want to allow an ag[ricultural] seat or a residential seat [on a GSA board of directors], how do you pick that person? … [If] there's no special district of agriculturalists, do you let the Farm Bureau pick [?], but then that may be politically more conservative than The Community Alliance of Family Farmers … " (pers. comm. RCD1).

The Political Economy of Groundwater That Enables Access to Environmental Governance

To further understand the political, economic and organizational disadvantage of groundwater users compared to surface water irrigators, it is worth noting that the state of California emerged through the most elaborate hydraulic [surface water] system in the world's history. Since the 1887 Wright Act and with support from the federal Bureau of Reclamation and the State, corporate irrigation enterprises and [white] farmers organized in irrigation districts and built expansive irrigation works for surface water delivery (Worster 1982). Since then, surface water irrigators have organized around districts not only to distribute water for canal irrigation and manage water rights, but more importantly, to mediate their political interests at higher government levels (c.f. Mollinga 2003).

In contrast, independent groundwater users, who have historically not organized in districts, have not directly benefited from state nor federal government funding. As it was mentioned before, farmers who exclusively rely on groundwater have instead invested in private hydraulic property (i.e., wells) with little interaction among themselves or with public agencies regarding water supply. These contrasting histories have resulted in the expansion of irrigation districts and other types of surface water districts serving California's large industrial farmers, juxtaposed with fragmented operations of unorganized groundwater users. The exception of course, are farmers who have access to both surface and groundwater.

One farmer described how regions with public agencies had a much easier time encouraging farmer participation than areas with no formally-organized farming groups: "The last [meeting] I went to for a San Joaquin GSA, there were 450 [farmers] … . Now, when I go to the East side GSA [with no organized districts], there [were] only 3 people. Because we don't have a vote, a lot of people don't show up. We're not part of an irrigation system or a city so they call us the white area" (pers. comm. CF7). Lack of clarity on how unorganized, independent groundwater users would be represented, or if they would have any voting representation at all, appears to have further discouraged participation from these farmers.

For some small-scale immigrant farmers, language, culture and land ownership barriers may have further hindered access to existing social networks of public agencies that facilitated participation in SGMA processes. Immigrant and refugee farmers such as Latino, Hmong and other Southeast Asian farmers in the Central Valley are mostly tenants, operating with short-term land leases. Since land ownership is key to having access to loans, these farmers also have limited access to financial resources to drill new wells when groundwater levels drop. As such, they are particularly vulnerable to changes in groundwater levels (Dahlquist-Willard et al. 2016; c.f. Shah et al. 2007). To cope with limited access to SGMA processes, the Asian Business Institute and Resource Center (ABIRC) and the University of California Cooperative Extension has been working with some GSAs to engage small-scale disadvantaged farmers in GSA decision-making processes. However, with so many GSAs throughout the Central Valley, it has been difficult for nonprofit groups or extension personnel to facilitate the inclusion of various independent groundwater user groups in groundwater governance agencies and processes.

It is noteworthy that the average farm size of SGMA participants (4,586 acres) was substantially larger (by 52%) than that of non-participants (2,206 acres) in our sample (Table 1). This result is even more striking when compared to the average California farm size (fluctuates between 300 and 400 acres, depending on year) (CDFA 2016) given that the average size of our full sample (3,344 acres) is significantly greater. Farm size can serve as a proxy to access to capital and labor, and therefore ability to overcome the transaction costs of SGMA participation and representation in GSAs throughout the state.

Access to capital was especially important in SGMA processes because formal representation had a "price-tag" per voting seat in some GSAs. This meant that in order to gain official representation at a board of directors, public agencies and sometimes independent groundwater users, had to contribute financially to ensure voting rights in GSAs boards (Méndez-Barrientos, Bostic and Lubell 2019). These high upfront costs further challenged inclusion of independent groundwater users in many GSAs, who in the absence of their own organized hydrosocial networks (Bolding 2004; Wester 2008), faced more barriers to secure financial contributions. In contrast, irrigation and water districts could rely on their collective membership and their operational budgets to appropriate funds to formally participate in GSAs. Participating in SGMA thus became prohibitive for stakeholders with less resources (c.f. Lubell et al. 2002).

Defining a "Common Enemy": Aversion to State Control

Our interviews revealed a consistent discourse among farmers: tension between central and local control over groundwater management. This was unanimously underscored in interviews with SGMA participants as an important participation driver, alluding to a strong collective identity on this issue (c.f. Abers 2007).

The resistance toward state intervention appeared twofold. First, there was a shared perception that blanket regulations implemented in a top-down fashion fail to recognize important local differences. As a result, farmers were motivated to be involved in the formation of GSAs out of self-preservation. As one farmer puts it, "Such a uniform regulation state-wide wouldn't necessarily work, so we were against SGMA. But, I saw the inevitability of the law being passed. [Therefore] I strongly advocated that [our] agricultural community should form … some kind of organization that should be qualified to be GSA eligible" (pers. comm. CF11). Second, multiple farmers emphasized that agriculture is continually facing more regulatory pressures, and SGMA may just be the newest in a sequence of environmental regulations. For example, another farmer shared, "… it's another way to take farming out. It's been a lot … Fish, water supply, water quality. And those were all surface. If you [had] groundwater, you were kind of safe, and you could be a farmer and be safe. And now you're not. So at what point do they [the state] feel like they just don't want farming anymore?" (pers. comm. CF21).

With these two fears in mind, some farmers participated in SGMA to avoid further state intervention and maintain local control. This finding is consistent with research that suggests aversion to government intervention is an explicit motivator for farmers to participate in local governance processes (Hardy and Koontz 2010; Stock et al. 2014; Taylor and Van Grieken 2015). In addition, this motivation may have important implications for the design of collective-action rules. Aversion to state-control could deter the creation of more ambitious rules (c.f. Ostrom 1990) and encourage attempts to make local collaboration appear "successful" as a way to keep government out.

Conclusions

We set out to understand what motivated farmers to participate in environmental governance processes using the implementation of SGMA, a groundwater reform currently underway in California, as a case study. Drawing from secondary and qualitative interview data from 27 farmers across the state, we find that socio-institutional rather than environmental change variables, explain participation and representation in groundwater governance processes.

Contrary to the literature on environmental behavior (Sanderson and Curtis 2016; Weber and Stern 2011), we do not find that environmental experiences are a consistent driver of farmer participation in groundwater governance processes; both short and long term experience with environmental changes appeared to have no influence. This concurs with observed farmer behavior in the latest drought which showed that amidst surface water scarcity, those who could afford it increased and expanded their use of groundwater. Nevertheless, it would be interesting to explore if environmental change is more likely to explain participation on groundwater governance amongst farmers with less resources. They may be less concerned with government intervention (c.f. Niles, Lubell, and Haden 2013) and more motivated to regulate groundwater given that they are more vulnerable to changes in groundwater levels (Dahlquist-Willard et al. 2016; Shah et al. 2007).

Using the framework presented by Hoogesteger and Wester (2015) to organize analysis of results, we found that existing social networks around water management largely explain participation in groundwater governance processes in California. Farmers who were participating in SGMA were more likely to have associations to local public agencies as members or representatives of those agencies themselves. This is not coincidental since SGMA built the implementation of its institutional reform around existing public agencies, who successfully adapted their spatial, social, institutional and material reach from surface to groundwater governance. This remarkable institutional capture illustrates the durability and strength of surface water public agencies in California (c.f. Bolding 2004).

This case study also supported previous findings that have shown that access to resources (Ribot and Peluso 2009), which in turn enables farmers to overcome transaction costs (Libecap 1994; Ostrom 1990), is key to participation in policy processes. We found that farmers with larger land acreages, with greater financial and human capital, and even English language skills, might have more agency to participate in SGMA processes and are likely better represented in GSAs throughout the state.

This has potential negative implications for the farmers who qualify as independent groundwater users (i.e. are not members of irrigation or water districts, which as public agencies are eligible to participate in SGMA). These independent pumpers are likely to have relatively less social and political capital that surface water users have historically developed (Worster 1982), cannot afford to contribute financially as individuals to formally participate in GSA decision-making boards, and cannot afford the time required to attend multiple, recurrent GSA meetings (Ayres, Edwards, and Libecap 2017; Dahlquist-Willard et al. 2016; c.f. Holley 2010; c.f. Shah et al. 2007). As a result, whether intentionally or not, SGMA has facilitated the participation of well-organized and well-resourced farmers, excluding less-organized and resourced farmers. If GSAs do not make a concerted effort to support participation from independent groundwater users, the institutional process will likely limit governance discussions to the interests of represented groups, which among the farming sector appears to exclude small farmers.

In addition, our findings concord with existing literature on farmer participation in collaborative environmental governance (De Loë, Murray, and Simpson 2015; Ferreyra, Loë, and Kreutzwiser 2008; Hardy and Koontz 2010, Niles, Lubell, and Haden 2013; Stock et al. 2014; Taylor and Van Grieken 2015), which have found that aversion to state control and government intervention is an instrumental participation driver for farmers. This has important implications for policy implementation. First, state aversion may encourage attempts to make local collaboration "appear" successful in order to avoid state intervention. With this priority in mind, stakeholders may focus on meeting deadlines and minimum requirements, excluding diverse voices that may vocalize dissent, delay processes or try to negotiate decisions. In turn, this may end up diverting needed state attention in areas that otherwise mask high conflict, and unequal participation and representation in decision-making boards. This defensiveness against government can thus render in the preservation of the *status-quo*. Opposition to sate-led institutional change could deter the creation of more ambitious operational and collective-action rules (c.f. Ostrom 1990).

The California case study clearly illustrates that the strength of existing [surface water] hydrosocial networks (Bolding 2004; Wester 2008) in combination with resource disparity within communities (c.f. Agrawal and Gibson 1999; Ribot and Peluso 2009) that cannot afford the high transaction costs of participation (Libecap 1994; Ostrom 1990), and the preservation of the status-quo that results from a collective identity (c.f. Abers 2007) against governmental intervention (De Loë, Murray, and Simpson 2015; Ferreyra, Loë, and Kreutzwiser 2008; Hardy and Koontz 2010, Niles, Lubell, and Haden 2013; Stock et al. 2014; Taylor and Van Grieken 2015) can lead to unequal representation from groundwater-dependent users in the very agencies that have supposedly been developed to protect them. Without adequate representation in groundwater governance processes, the fate of small-scale and historically disadvantaged farmers remains uncertain as new environmental reforms are implemented. Unfortunately, this reality is prevalent (Shah et al. 2007) and continues to challenge assumptions of the widely used collaborative governance approach for common-pool resource (CPR) management (c.f. Agrawal 2005; Bryson, Crosby, and Stone 2006; O'Toole and Meier 2004). We offer these insights on farmer participation in groundwater management processes to shed light on potential shortcomings of CPR governance reforms and improve the design of future environmental governance processes that seek farmer participation.

Acknowledgments

The authors would like to thank the interviewed farmers who granted their time and openness to talk with us. We would also like to thank professors Mark Lubell, Samuel Sandoval, and Graham Fogg for discussions that enriched the manuscript. Finally, we would like to thank Carole Hom for her support with this project and Sean Maxson for leading one interview that was used in this manuscript.

Funding

We would like to thank the National Science Foundation (NSF) for its financial support through the Climate Change, Water and Society (CCWAS) IGERT at the University of California Davis.

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