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Path Dependence, Evolution of a Mandate and the Road to Statewide Sustainable Groundwater Management

Evan M. Dennis^a , William Blomquist^b , Anita Milman^c , and Tara Moran^d

^aCenter for the Analysis of Social-Ecological Landscapes (CASEL), Indiana University Bloomington, Bloomington, IN, USA; ^bDepartment of Political Science, Indiana University Purdue University Indianapolis (IUPUI), Indianapolis, IN, USA; ^cDepartment of Environmental Conservation, University of Massachusetts-Amherst, Amherst, MA, USA; ^dWater in the West, Woods Institute for the Environment, Stanford University, Stanford, CA, USA

ABSTRACT

SGMA is a landmark transition in California water policy. For local governments engaged in managing at-risk groundwater basins, SGMA brought a transformation of responsibility and authority. These changes reflect a continuation of California water policy, rather than a disjuncture. This policy analysis describes the changing role of state government in groundwater management in California, explaining that role, including the passage of SGMA, through the lens of path-dependent policy evolution. We identify three phases in state groundwater policy: initially the State enabled, subsequently the State incentivized, and with SGMA the State mandated local action. Later phases built upon previous ones and added to existing state policies rather than replacing them, resembling an evolution within the constraints established by earlier decisions. The changing role of the State in California groundwater management demonstrates how initial decisions can push policy along a trajectory, within which there remain opportunities for adjustment and change.

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Introduction and Overview

California's Sustainable Groundwater Management Act (SGMA) substantially transformed the roles, responsibilities, and powers of the local entities tasked with implementing groundwater management in California and the state agencies overseeing them. While SGMA is a landmark in California water policy, it built upon previous policy developments. It was an outcome and continuation of, rather than a discontinuity or a departure from, prior policy direction. In this policy analysis, we examine the state of California's historical role in groundwater management in order to both depict and explain the design and adoption of SGMA. SGMA is the most recent manifestation of the changing role of the State¹ in groundwater management and a century of policy evolution characterized by path dependencies.

CONTACT Evan M. Dennis  emdennis@indiana.edu  Center for the Analysis of Social-Ecological Landscapes (CASEL), Indiana University Bloomington, Bloomington, IN 47405, USA.

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SGMA was not the State's first attempt to motivate local governments and water users to manage groundwater (Langridge 2012; Leahy 2015; Quinn 2020). State groundwater policy passed through three periods: (1) a long initial era of enabling and supporting locally-initiated groundwater management from roughly 1900 through the 1980s, (2) a period of offering incentives for local action from 1990 to 2014, and (3) a period of mandating local action in more than 100 basins from 2014 on. Along the way, a mixed record of local innovation and inaction, combined with worsening groundwater conditions in much of the state (DWR 2014), prompted changes in the State's role.

While these periods are separated by policy shifts, major continuities exist across them which, as we detail below, reflect path dependencies that constrained potential alternative trajectories and made it costly to move away from established arrangements, narrowing the range of feasible policy options. Continuities developed from the State's early choice to treat groundwater and surface water separately as a matter of law and regulation and its preference for local action combined with State provision of technical and financial support. Evolutionary change toward a more active State role has taken place within the contours of these continuities.

To begin our analysis, in the next section, we introduce path dependence as a way of understanding evolutionary policy change. The three subsequent sections cover each of the phases of State groundwater policy, respectively. A concluding section relates policy development during each phase to the concept of path dependence, showing how earlier events and choices helped to create the conditions leading up to SGMA.

Policy Evolution and Path Dependence

Central to our analysis are the concepts of policy evolution and path dependence. Policy evolution refers to change that is adaptive and emergent rather than abruptly transformative. Evolutionary policy change is often incremental (Lindblom 1959), though it is not necessarily a continual process of small steps. Policy evolution may exhibit a punctuated-equilibrium process with periods of relative stability separated occasionally by substantial policy shifts (True, Jones, and Baumgartner 2007). Incrementalism in policy evolution is explained by bounded rationality (Simon 1982; Gigerenzer and Goldstein 1996), as well as the challenges of obtaining political support for transformative change (Gregory 1989).

Path dependence refers to the observation that decisions and actions in ongoing processes of human social behavior are guided and bounded by earlier events and choices (Pierson and Skocpol 2002; Mahoney and Schensul 2006). In a path-dependent process, earlier decisions or events—even if random or exogenously triggered— affect feasible pathways, and consequently, the sequence of events matters enormously (Bennett and Elman 2006; Pierson 2000). Previous actions have lasting effects; they open new pathways, close other options, and constrain choices by creating high costs to or irremovable barriers to moving off established pathways (Bennett and Elman 2006). Increasing returns to previously made investments and institutional inertia caused by the relatively lower transaction costs of utilizing existing arrangements create positive feedbacks that

maintain trajectories (Pierson 2000). Reversing course or even major changes of direction tend to be costly, difficult, and rare. The result is directionality in policy evolution.

California Groundwater Policy Phase 1: State Enabling of Local Groundwater Management (c. 1900–1990)

As is characteristic of path-dependent processes, early choices or events often have large and lasting effects. Two developments more than a century ago shaped the trajectory of groundwater management in California. First, in 1879 the California Constitution recognized the home rule authority of cities and counties. Since then, the autonomy and authority of local government has become a central feature of California's political culture (Krane, Rigos, and Hill 2000). Second, early in its history, California water law treated groundwater and surface water as separate resources, making an exception only for the underground flow of a surface stream (Sax 2003; Leahy 2015; Owen et al. 2019).² In 1914, California made surface water subject to State regulation and a permit process, while leaving groundwater withdrawals exempt from State-level oversight. Once California had abjured State control, groundwater was left to be managed locally, if at all.³ While other western states eventually brought groundwater under some degree of State control (Emel 1987; Ashley and Smith 1999; Nelson and Perrone 2016), the combination of California's commitment to local control with its decision to adopt State regulation of surface water impeded the State from reversing course with regard to groundwater. While regulating groundwater was foreshadowed at several points during this phase, a lack of political will, concerns over issues of water rights law and local autonomy ultimately hindered its success (Leahy 2015).

California's institutionalization of home rule and its decision not to include groundwater in State regulation laid the framework underpinning the first phase of groundwater management in California, and continues to present day. More so than in other states, it has become something of a mantra in California that "groundwater is best managed locally."⁴ Thus the State's initial role in groundwater policy was to enable local action by providing groundwater information, enacting laws that established and empowered local water management, and sustaining court processes that facilitated the local resolution of groundwater disputes.

State Investments in Information Provision

Initial actions by the State to enable and support groundwater management included the funding and development of information about surface and groundwater resources. Throughout the period, the State produced and published studies such as Bulletin No. 4, *Water Resources of California* (1923), a series of "basin investigation" reports about local resources, and Bulletin 118, which contains information on all groundwater basins in the state and continues to be updated today. By providing the personnel and funding for these studies, the State equipped local residents with initial understandings of watershed and basin boundaries, precipitation, estimated inflow and outflow, soil types and composition, and other details about aquifer properties. While

the intent in developing and disseminating information during Phase 1 was to develop state-level understandings and to support local level management, it also had the effect of setting expectations of State provision of technical support for local groundwater management.

Enabling Legislation and the Creation of Local Water Governments

In addition to the provision of information, during Phase 1, the State created an extensive menu of options for the organization of local water resource development and management. Prior to the 1900s, legislation authorized the establishment of reclamation districts (1866) and irrigation districts (1887). Many more district types were authorized in the decades that followed.⁵ By the 1950s, the legislature had passed 32 statutes authorizing creation of varying forms of water districts (Henley 1957, 667). These acts provided a framework for the creation of locally-run public water authorities, usually through a process of gathering petitions followed by an election to gain the approval of voters within the proposed district. Most did not have particular responsibility for groundwater, though some Special Act Districts (e.g., Orange County Water District and Santa Clara Valley Water District) were created to address groundwater specific issues like seawater intrusion and subsidence, respectively. Other districts were created to support conjunctive use of surface and groundwater.

Courts, Referees, and Watermasters

California's judicial system also had a role in enabling local groundwater management in California. Beginning in the 1940s, trial courts (named superior courts in California) became forums for remedying disagreements about pumping among multiple well owners within a groundwater basin. Adjudication processes were locally driven: state courts provided the forum, but local water users used the courts and their procedures as institutional resources to undertake discovery about parties, pumping, and basin conditions. They then negotiated stipulated judgments and submitted them to the judge for approval. If approved, the judgment negotiated by the parties acquired the authorization of the State, and thus became enforceable by any party against the others. Furthermore, in these adjudicated basins the court retains continuing jurisdiction over the case, and local users can and did return to court periodically to modify the management arrangements governed by the judgment.⁶ At present, local groundwater management arrangements have been fashioned through these processes in 26 basins (Littleworth and Garner 2019, 76).

Path Dependencies and Phase 1: Enabling Local Management

In summary, during Phase 1, early decisions set California on a path toward the local management of groundwater, with self-reinforcing actions that were difficult or costly to reverse (see Figure 1). California's commitment to local control combined with its decision to adopt State regulation of surface water impeded the State from reversing

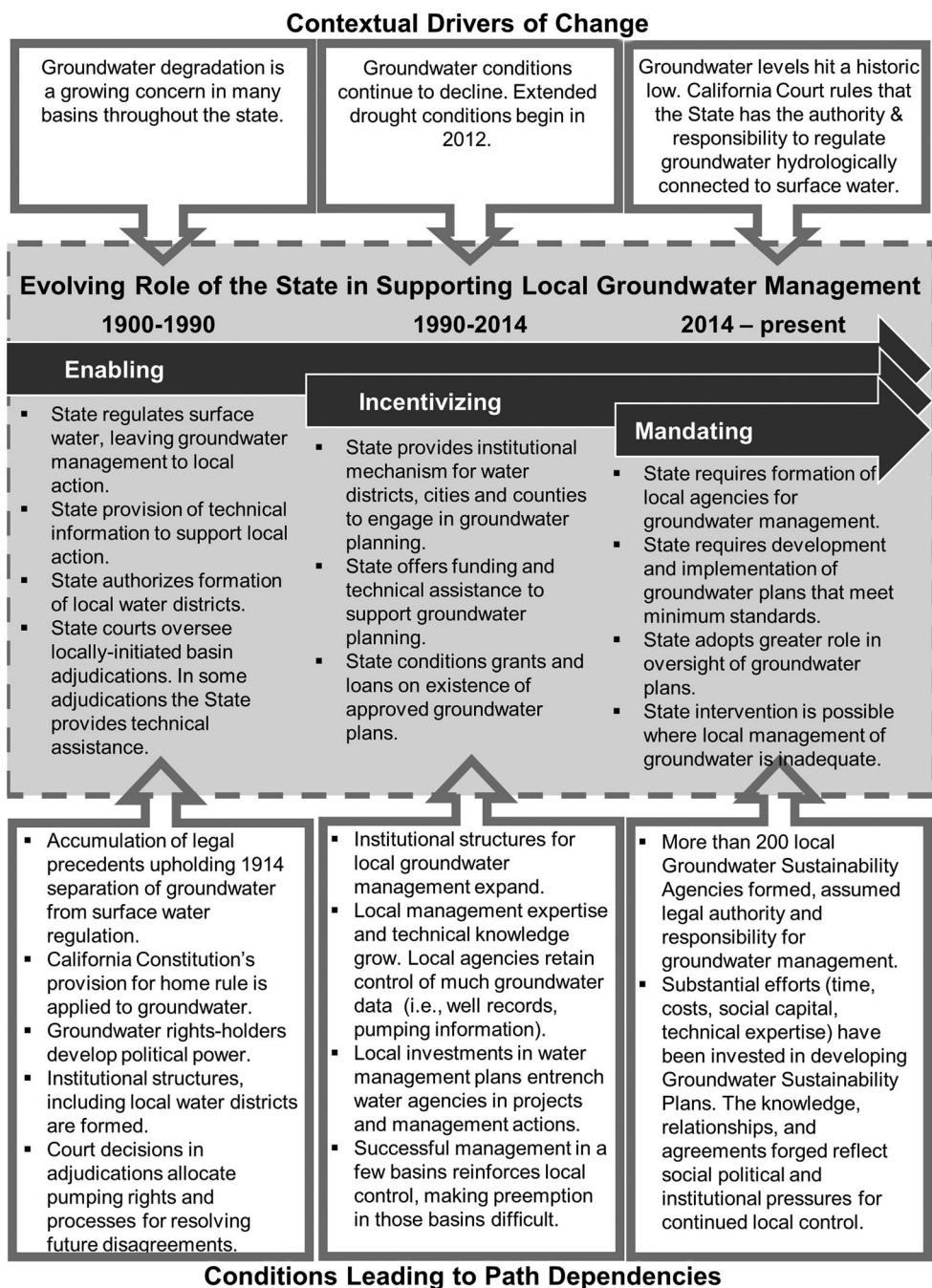


Figure 1. The evolving role of the State in groundwater management: drivers and path dependencies.

course with regard to groundwater. Additionally, The State provision of technical information helped to support local action to the extent that local-level actors chose to take advantage of it (Ostrom 1990). Substantial institutional structure was built as well. As

units of local government, water districts became established parts of California's political landscape; 11 of California's 14 Special Act District-managed basins were established; and many basin adjudications (17 of 26) occurred during this period. Consequently, when State groundwater policy changed at the beginning of Phase 2, the State's role continued along the path of encouraging local-level groundwater management.

California Groundwater Policy Phase 2: State Incentivizing of Local Groundwater Management (c. 1990–2014)

At the conclusion of Phase 1, the status of groundwater management across the state was mixed. In some locations, local entities produced sophisticated and effective groundwater management (Garner 2016) – enough success to reinforce California's reliance on local management. In other areas, however, the formation of water districts and adjudications had not controlled groundwater depletion, and in many basins no attempts at local management had arisen. By 1990 most basins in California, even ones with significantly deteriorating conditions, saw little or no management activity. Between 1990 and 2014, the pace and orientation of State policymaking shifted significantly, marking a second phase of California groundwater policy. Legislation, administrative actions, and judicial activity maintained the policies and institutions created during the enabling period, while seeking to incentivize more local entities to undertake groundwater planning and management.

Authorizing Additional Local Groundwater Entities and Incentivizing Planning

In 1991, in the 4th year of a drought, California's Legislature encouraged additional local-level groundwater management outside of the mechanisms of water districts, Special Act Districts, and basin adjudications. A new statute, Assembly Bill (AB) 255 (California Water Code Chapter 903), targeted 11 critically overdrafted groundwater basins and authorized existing local public water entities (e.g., irrigation districts) to design groundwater management plans within their service areas (Weber 1994). The following year, AB 3030 expanded the scope of AB 255 to (1) allow cities and counties to participate in groundwater planning, (2) encompass all groundwater basins, and (3) authorize local water districts or cities or counties producing plans to impose fees or assessments to generate the revenue needed to adopt and implement the plans.⁷

To support these local efforts, the California Department of Water Resources provided technical assistance, including a template for plans and a common reporting framework. The result was a substantial increase in the number of local governments engaged in groundwater management, with the total number of basins with plans growing from 28 to 71 between 1990 and 2002 (DWR 2013).

The Turn toward Incentives

During the 2000s, the State enhanced its effort to stimulate local groundwater management by providing funds (through AB 303, Proposition 13, Proposition 50, and

Proposition 84) that could be used for local groundwater studies, monitoring, or management projects, including integrated water resources management. In 2002 the legislature enacted SB 1938. This act aimed to address variation in the quality of AB 3030 plans and the fact that once developed, many AB 3030 plans were not being implemented. This act required local agencies to prepare a groundwater plan with management objectives and to monitor groundwater conditions in order to access State financing. Passage of SB 1938 and funding from Proposition 50 resulted in 90 additional basins undertaking groundwater planning between 2002 and 2014.⁸

Path Dependencies and Phase 2: Incentivizing Local Management

During Phase 2, groundwater management in California continued along the State-enabled local management trajectory initiated during Phase I, while also evolving. The changes were additions to ongoing practices, rather than discontinuities. The State continued to enable water districts and to provide monitoring support and technical information⁹, while also expanding programs to incentivize cities and counties to engage in groundwater management. It also continued to provide resources to support local-level management, yet began making receipt of those resources contingent upon specific actions. Even with the enactment of new laws and programs, the role of the State during Phase 2 thus remained largely along its established trajectory.

In response to State incentives there was a substantial growth of local activity including additional local agency formation and local groundwater planning processes. These were layered onto existing arrangements created during Phase 1, and each possessed jurisdictional authority that would be difficult to revoke. Further, the groundwater management successes and partial successes (such as development but not implementation AB 3030 plans), and the local-level investment in them, reinforced the overall policy commitment to local management and the likelihood of resistance to any attempt to roll back local-level control.

Nevertheless, while past and current decisions propelled California along the path of State-supported local groundwater management, other events intervened, changing the momentum. Specifically, during July 2014, the Superior Court in Sacramento County ruled that the “public trust” doctrine applied to groundwater.¹⁰ This ruling meant that the State Water Resources Control Board – the agency that regulates surface water – now possessed the legal authority and the obligation to regulate groundwater that was hydrologically connected to surface water flows.

California Groundwater Policy Phase 3: Mandating Local Groundwater Management through SGMA (2014–present)

Despite some localized action, by the end of Phase 2 the status quo of groundwater management was not merely unsatisfactory to state policymakers; it had become intolerable, even to stakeholder groups within California’s extensive community of local water managers and professionals (Quinn 2020). In a report to the Governor’s Drought Task Force, the Department of Water Resources summarized the extent and severity of the problem: too many groundwater basins in the state lacked any management plans, too

many of the plans that did exist weren't working effectively, significant monitoring gaps remained, and groundwater levels had reached all-time historical lows in most areas of the state (DWR 2014). Furthermore, ten additional basins had become critically over-drafted since 1980 (DWR 1980; DWR 2016). In 2014, in the midst of another severe and sustained drought, a cohort of legislators, staff, and stakeholders began assembling the pieces of the Sustainable Groundwater Management Act. With pressure from the Governor, the public trust court ruling, and the public, three complementary bills, AB 1739, SB 1168, and SB 1319 came together to form a new section of the California Water Code, collectively known as SGMA.¹¹

The Sustainable Groundwater Management Act

SGMA mandates that more than 100 groundwater basins¹² across the state be managed sustainably – defined as the avoidance of six “undesirable results”: chronic lowering of groundwater levels, reduction of groundwater in storage, degradation of groundwater quality, subsidence of overlying land, depletion of interconnected surface water, and intrusion of seawater (the last being applicable in coastal basins but generally not elsewhere). Groundwater sustainability management is to be achieved through the creation of local entities named Groundwater Sustainability Agencies (GSAs) that are tasked with developing and implementing Groundwater Sustainability Plans (GSPs). Any local government with land or water management responsibilities can apply to be recognized as a GSA, although GSAs cannot overlap the same territory. If parts of a medium or high priority basin are unclaimed by any GSA, SGMA treats the county government as the default GSA for that area.¹³

The law makes several powers and policy tools available to GSAs, but it also places significant requirements and deadlines upon them. Groundwater Sustainability Plans must be submitted to, reviewed by, and approved by the State, and the requirements for plan contents, updates, monitoring, and reporting are extensive. In basins where local agencies fail to meet the law's deadlines and requirements, the State Water Resources Control Board can take over the implementation of the law for that area, and recover its costs for doing so from the local agencies and water users.

Even while strengthening of its oversight role and creating the possibility of State intervention, the State's approach of enabling local action continues. To support GSAs in developing and implementing Groundwater Sustainability Plans, the State has run technical workshops to educate local agencies on stakeholder engagement and planning processes, provided technical information, administered planning grants, and signified a willingness to provide legal support to local agencies if necessary. It also provided facilitation services to agencies developing GSAs.

Path Dependencies and Phase 3: Mandating Local Groundwater Management

The changing role of the State in Phase 3 to a mandating entity with an expanded set of authorities and responsibilities illustrates the process of policy evolution occurring within previously established constraints. The State's response to ongoing degradation was constrained by a century of previous decisions that effectively closed off certain

avenues for dealing with deteriorating conditions and created feedbacks in terms of expediency and costs motivating the use of already established structures. Early choices, including the legal separation of ground and surface waters and home-rule, initiated a chain of policies and practices that created reinforcing conditions for California to follow the path of local groundwater management (see [Figure 1](#)). The evolution to a State role of mandating reflects evolution within this path.

The legal separation of ground and surface waters in California, along with over a century of State regulation of surface water, meant that SGMA targeted groundwater management. SGMA explicitly does not change California water rights or the laws that govern them. Entrenchment of water rights through the accumulation of court rulings and legal precedents over the course of the past century meant that any modification of those rights would require extensive legal processes. Further, had SGMA affected water rights, the political power of water rights holders would likely have prevented its passage.

Nonetheless, SGMA altered how ground and surface waters are addressed. While surface water laws remain unaffected, local agencies implementing groundwater management must, by necessity, carefully examine the relationship between ground and surface waters within their jurisdictions. The definition of groundwater sustainability under SGMA includes avoiding significant and unreasonable depletion of interconnected surface water. Furthermore, in many locations, addressing groundwater depletion will require recharge and/or conjunctive use. Thus GSAs will likely develop mechanisms for managing surface and ground waters jointly – albeit via incentive or voluntary mechanisms, rather through regulation.

Similarly, the path established by California's preference for local control is reflected in the State's approach to planning, and its continued investment during Phase 3 in enabling local capacity through technical assistance and information provisioning. Under SGMA, local entities retain the option to manage groundwater basins, operating under the law's new designation as Groundwater Sustainability Agencies. The hundreds of water districts created and allowed during Phase I of groundwater management in California, along with the cities and counties who assumed responsibilities for groundwater, remain an integral part of SGMA. The law also recognized the authority of the Special Act Districts that manage groundwater basins by designating them as default Groundwater Sustainability Agencies or offering them the first option to become a GSA.¹⁴ In all other areas covered by SGMA, local governments can become GSAs so long as they apply for that designation and do not overlap with another GSA. A continuation of the path dependence established by the previously granted authorities given to counties is also clear – where no local agencies exercise the option to form GSAs, (so-called 'unmanaged areas'), counties are presumed to be the GSA. Likewise, those areas within the state covered by court adjudications in Phase 1 and 2 were exempted from SGMA's requirements to form GSAs and adopt GSPs.¹⁵

While many local agencies had not responded sufficiently to past calls for groundwater management, decades of investments in them had built up localized expertise and knowledge, as well as a vast number of local-level supporters. Reversing course to remove control from these entities would have been infeasible. Furthermore, replacement of these localized structures for managing, monitoring and enforcement with

State-led structures would be costly. Instead, as in Phase 2, during Phase 3 the State expanded the financial and technical resources it provided to support local groundwater management including assistance directed at GSA formation, GSP development, scientific studies, and public outreach.

While the State continues along a path of local groundwater management, the evolution that has occurred under Phase 3 clearly expands the role of the State in oversight and enforcement, including the authority to intervene where local groundwater management does not emerge or is insufficient. Local groundwater management follows a framework for planning that has its roots in the requirements initially laid out in 1991 with AB 255, even though SGMA's requirements for plans are more extensive and include a State review and approval process.

Conclusions

The evolving role of the State in California groundwater management illustrates path-dependent policy evolution - how initial decisions, reinforced by feedback, can push subsequent policy change along a trajectory. Within each phase of its groundwater policy, the State of California worked within constraints and inertias to achieve broader policy impacts. State policy evolved from enabling, to incentivizing, to mandating local-level action on groundwater. In response to insufficient action on degrading groundwater conditions, the State fashioned a larger role for itself.

The resulting pattern of policy evolution is not unique to California or to groundwater. The federal Clean Water Act and Clean Air Act show similar histories. The combination of action and inaction by smaller units of government, when not nested within a higher-order monitoring and enforcement arrangement, ultimately led to centralized mandates and enforcement, while assigning significant responsibilities and authorities to states (Stevens 1971; McThenia 1973, more generally, see Zimmerman 2016). Implementing minimum-standard preemptions created new challenges for the federal government, and if history is a guide, California will soon be tested in similar ways as it grows into its new mandating role under SGMA. This will include adequately financing and allocating human resources to monitor the local application of GSAs' rules, the local enforcement of penalties against errant water pumpers, and supporting GSAs against pumper lawsuits and legal challenges to their delegated authorities.

As the role of the State evolves, the new demands on it will be met by solutions shaped by the feedbacks and constraints of the past. The current phase of State groundwater policy in California is still new, but the seeds of the future of groundwater governance are beginning to germinate. GSAs have formed, and as of January 2020, GSPs for the critically overdrafted basins have been submitted to the State for evaluation. As GSAs and the State navigate SGMA's implementation, including addressing the many requirements of SGMA for which there are no precedents, the role of the State will continue to evolve, even amidst ongoing path dependencies.

Notes

1. Throughout this article, "State" refers to the state government.
2. But see Kuenzi (2019), who points out that California courts did not make the groundwater-surface water distinction quite so sharp from the outset. What matters more

for path dependencies is that water users and public officials interpreted the courts' early decisions that way, established a separate State-run system for regulating surface water, and thus reinforced and hardened the distinction in ways that shaped subsequent actions.

3. For example, in the absence of State management of groundwater, the home-rule authority of counties has been understood to encompass groundwater. By 2014, 30 of California's 58 counties had groundwater ordinances, most of them prohibiting water exports (Water Education Foundation 2015).
4. This phrase was included also in Governor Brown's statement when he signed SGMA into law.
5. See [Supplemental Note 1](#) for additional details about legislation creating local water governments.
6. In addition to the role of state courts, the State supported some of the early adjudications through additional measures, including through the Department of Water Resources or the State Water Resources Control Board serving as a fact-finding referee during the pre-trial stage and through a court-appointed "watermaster" supporting post-judgment monitoring and reporting.
7. No local agencies exercised their revenue raising authority under the Act, perhaps because state law also required a majority vote in a local election in favor of raising revenue (DWR 2003).
8. See [Supplemental Note 2](#) for additional details about State incentives for local groundwater management.
9. See [Supplemental Note 3](#) for additional details about State monitoring programs developed during the Phase 2 time period.
10. *Environmental Law Foundation et al. v. State Water Resources Control Board* (2014). In 2018, the trial court decision was affirmed by the Third District Court of Appeals.
11. Participants in that legislative process have published firsthand accounts documenting policymakers' motivations and frustrations, and how the legislative package came together. See Leahy (2015) and Quinn (2020).
12. High and medium priority groundwater basins are subject to SGMA. See [Supplemental Note 4](#) for an explanation of the prioritization of basins.
13. A county may decline to serve as the GSA, leaving the area for another agency to manage as a GSA, or for the State to intervene.
14. In three locations, groundwater users organized Special Act Districts immediately prior to SGMA taking effect. While those entities are eligible to serve as GSAs, they were not grandfathered into the law.
15. In 2015, follow-up legislation (SB 226 and AB 1390) reformed the groundwater adjudication process to align it with SGMA (Brown 2017; Leahy 2015). This change does not affect previous adjudications.

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ORCID

Evan M. Dennis  <http://orcid.org/0000-0002-5666-0484>

William Blomquist  <http://orcid.org/0000-0001-5071-1159>

Anita Milman  <http://orcid.org/0000-0002-5712-9388>

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