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ALSO IN THIS ISSUE

A Progress Report on California's Sustainable Groundwater Management Act

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Regions of California will face significant reductions in water use in the coming years. This article provides an update on the progress made thus far towards implementing the Sustainable Groundwater Management Act (SGMA). We discuss the composition of newly formed groundwater agencies and their proposed management actions. These actions may have substantial implications for the economic costs of SGMA.

The California Aquaduct bifurcates as it travels into Southern California.

CA Department of Water Resources

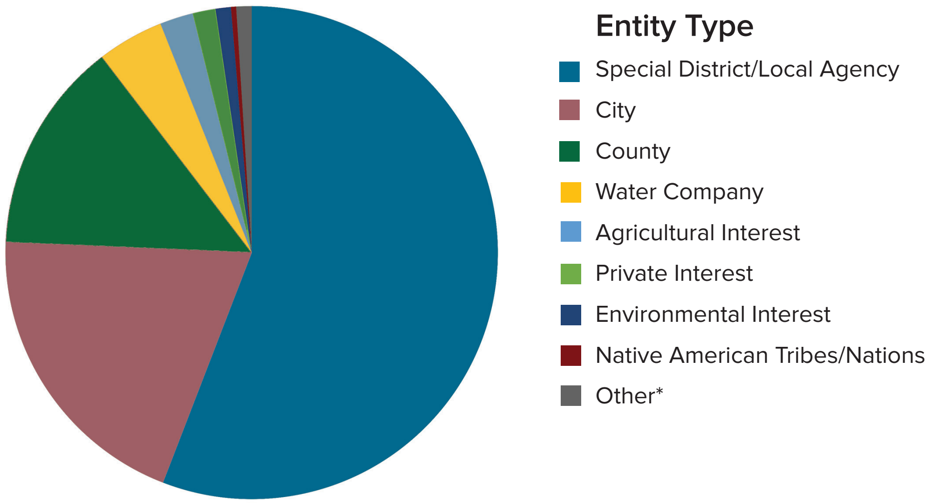
Groundwater accounts for 38 percent of California's water use on average but faces persistent drawdown from pumping in excess of replenishment. The Sustainable Groundwater Management Act of 2014 (SGMA) requires local agencies to develop plans ensuring the future sustainability of their underlying aquifers. Before SGMA, groundwater was free to extract (aside from pumping costs) for overlying landowners in almost the entire state.

The California agricultural industry depends heavily on access to this water, especially during droughts, when access to groundwater can serve as insurance against surface water shortages. The challenge facing agencies implementing SGMA is how to bring groundwater extraction back to sustainable levels while minimizing costs to current users. The stakes are high—the Public Policy Institute of California projects that poorly designed groundwater management could cut crop revenues in the San Joaquin Valley, a major region for the entire country's food production, by 17 percent.

The magnitude of SGMA's economic impact will depend heavily on the management actions taken by Groundwater Sustainability Agencies (GSAs). Under SGMA, GSAs are formed by pre-existing local agencies and charged with developing and implementing groundwater sustainability policies. Like any other government agencies, GSAs operate within a pre-existing political climate and are beholden to the interests of those they represent. It is fair to expect that the management actions taken by GSAs will be influenced by the composition of their local area's agriculture, the number and types of coordinating agencies, and other political and economic factors.

The Department of Water Resources (DWR) splits California's aquifers into 515 "subbasins," which were prioritized according to existing overdraft issues and projected water demand factors. The law requires groundwater basins designated as high- or medium-priority to have formed GSAs by June 2017, adopt a Groundwater Sustainability Plan (GSP) by January 2022 (2020 for basins in critical overdraft), and achieve groundwater sustainability by 2042. Lower-priority basins have later deadlines. Apart from these

Figure 1. GSA Seats Held by Entity Type for all High– and Medium–Priority Subbasins



Note: *Other includes federal agencies, universities, at-large seats, etc.

Source: Authors' compilation from DWR SGMA Portal and GSA websites

requirements, the law itself provides little guidance, leaving substantial flexibility for achieving compliance.

The full impact of SGMA will take decades to realize, but these earlier deadlines provide insight into how California's GSAs are forming and what kind of management actions they are considering. GSA and GSP submissions reveal a diversity of approaches being undertaken throughout the state.

The Boards of Groundwater Sustainability Agencies

GSAs, the chief entities responsible for developing GSPs and making progress toward sustainability, are formed by pre-existing local agencies with water or land-use responsibilities. Any such agency overlying a groundwater basin was eligible to form a GSA, and many elected to partner (via joint powers agreements or memoranda of understanding) and form multi-agency GSAs. GSAs pursuing the partnership route formed boards, with substantial leeway to design board representation as they pleased. Some GSAs granted board seats to non-agency partners, like water companies, private well stakeholders, or environmental organizations.

Data on the makeup of medium- and high-priority GSA boards are accessible from the SGMA Portal, maintained by the DWR, and from the GSAs' own websites. GSAs entered into the portal are linked to a single subbasin, but some GSAs overlie multiple subbasins and therefore have multiple entries. Collapsing these GSAs into single entities leaves 224 distinct agencies, 155 of which are single-agency GSAs, the remainder being multi-agency collaborations. Multi-agency GSAs contain an average of 6.51 board seats.

Figure 1 shows the breakdown of who holds GSA board seats (treating single-agency GSAs as a single "board seat" belonging to the forming agency). Board representation patterns are similar between high- and medium-priority basins. The majority of GSA board seats are held by special districts and local water agencies. Special districts, including reclamation, water, and irrigation districts, are local government entities created under state law to administer specific public services. An irrigation district, for instance, maintains irrigation canals and distributes surface water. Since groundwater and surface water systems interact, and these agencies have established relationships with agricultural groundwater users, it is no surprise that these agencies are most frequently taking up the GSA mantle.

Cities and counties are the next most common GSA participants. Both cities and counties control community water systems in different parts of the state, and therefore have a natural interest in the future of groundwater availability. Counties have an extra role under SGMA implementation as the backstop GSA for any basin areas left unmanaged by the formation of other GSAs.

Only public agencies with water or land-use responsibilities are eligible to form GSAs themselves, but the law allows collaborative GSAs to involve other people or organizations on their boards. These seats make up a small percentage of GSA board representation. In the most common arrangement, board formation documents specify a set of organizations (such as farm bureaus for agricultural seats or conservation NGOs for environmental seats) that can make nominations. The remainder of GSA board members then select a colleague from those nominations.

Only three GSAs, all of which are multi-agency partnerships, include formal representation for Native American tribes. Access to groundwater for federal reservations is guaranteed by federal law, and tribal land is exempted from requirements to form GSAs under SGMA. Still, underground aquifers flow between reservation land and non-reservation property, leaving a clear role for Native American participation in SGMA governance.

As an illustrative example of how GSA boards look throughout the state, consider the Kings subbasin of the San Joaquin Valley, host to eight separate GSAs. Of these, three are controlled by a single entity: James Irrigation District, Consolidated Irrigation District, and Tulare County. The remaining

GSAs have boards ranging from five to seven seats. The McMullin Area GSA, a Joint Powers Authority, has a five-seat board with two seats for the Raisin City Water District, one for the Mid-Valley Water District, one for the County of Fresno, and a final seat for a "white area" (land unserved by irrigation districts) stakeholder, appointed by the County of Fresno. This division of power, with water districts playing a dominant role, is typical.

Though nothing beats full and formal representation, GSAs are statutorily required to consider their decisions' impacts on all stakeholders. Many GSAs are forming advisory committees to formally seek input from various stakeholders. And, of course, special districts, cities, and counties are themselves local governments, with representatives voted into office in part by the broad set of stakeholders affected by SGMA.

Nonetheless, final decision-making authority rests in the hands of GSA boards, which are skewed towards existing agricultural interests. Many water-focused special district officials in California are elected by landowners only, reflecting their historically limited role as agricultural water suppliers. Whether and to what extent this impacts GSAs' choice of management actions is an ongoing topic of our research.

Collaboration on Groundwater Sustainability Plans

The first major deliverable for newly-formed GSAs is a Groundwater Sustainability Plan (GSP), which describes the current state of groundwater overextraction, projects future water budgets, and details management actions to bring extraction back to sustainable levels. Only GSAs in critically overdrafted basins were required to submit GSPs by January 2020; remaining high- and medium-priority basins have a January 2022 deadline. Not all high- and medium-priority basins will submit GSPs because some basins have pre-existing groundwater management plans, pre-existing adjudications of water rights, or proof of long-term extraction with a sustainable yield.

SGMA requires GSAs within the same basin to collaborate and ensure compatibility of their GSPs, but many GSAs took this further by collaborating on a single GSP, reflecting the complexity of preparing the multi-hundred-page documents. The 92 unique GSAs participating in California's high- and medium-priority GSPs grouped to form 43 GSPs. Of these, 29 were produced by a single GSA, and 14 were inter-GSA collaborations.

Demand Management Proposals in GSPs

Management actions in GSPs can be roughly split into two categories: supply augmentation and demand management. Supply augmentation seeks to resolve overextraction by making more groundwater available, often by direct recharge using wastewater or provision of new surface water sources to displace groundwater use. Supply augmentation schemes have an obvious role to play in SGMA compliance, but there is simply not enough unaccounted for surface water for supply augmentation to bear the full brunt of bringing basins back to sustainable levels.

Demand management seeks to achieve sustainability by limiting extraction. There are a variety of policymaking tools that constitute demand management. For example, fees on extractions change the decision calculus for groundwater extractors by imposing a price on groundwater use, and efficiency incentives can provoke users to invest in infrastructure improvements.

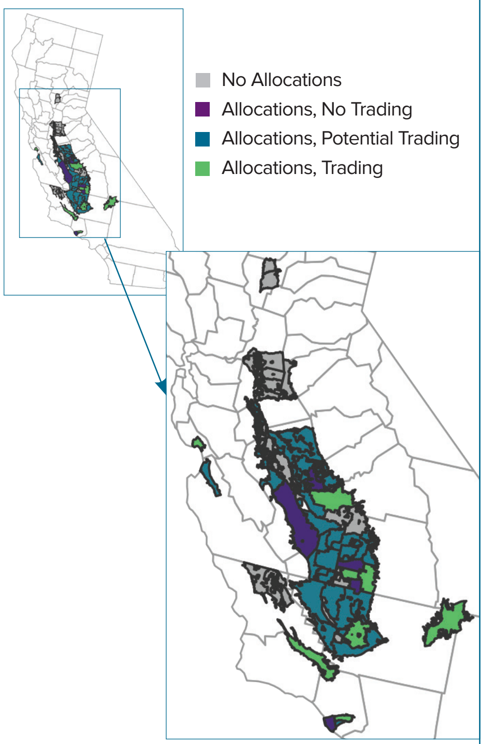
A pair of market-based policies favored by water economists are water allocations and trading, which can guide cost-effective solutions in environments where regulators lack key information. Under these systems, extractors with low-value products (e.g., alfalfa) can benefit by selling water allocations to users with higher-value products (e.g., almonds), maximizing the total value of water use while compensating the extractors that give up water. Investments in more efficient irrigation are naturally incentivized under allocation and trading since farmers can benefit from selling (or no longer needing to purchase) any water saved. In theory, the voluntary adjustments made under an allocation and trading scheme minimize the losses associated with reaching sustainability.

Contrast this with outright pumping restrictions, broadly scorned by water economists, which completely prevent users of groundwater from pumping under some specified set of circumstances. These policies risk preventing extractors from accessing water even when it is critically important, such as when a long-lived orchard is threatened by drought. Under pumping restrictions without the possibility of trading, orchards with decades of productive life left in them can wither, while much lower-value groundwater uses continue in the same neighborhood.

Supply augmentation is ubiquitous in GSP project proposals, but demand management is far more variable, as previously reported by the Public Policy Institute of California for GSPs in the San Joaquin Valley. In the following analysis, demand management refers to groundwater allocations, fees or taxes, restrictions on pumping, efficiency incentives, and land fallowing programs. It does not include merely monitoring extraction, supply augmentation, or improving efficiency of agency-owned infrastructure.

The demand management section of many GSPs are speculative, outlining potential actions rather than a

Figure 2. Allocation and Trading Programs in GSAs with GSPs



Source: Author's compilation from DWR SGMA Portal

well-defined set of programs the GSAs will definitely pursue. This makes it difficult, even with GSPs in hand, to say exactly how many GSAs will undertake any given demand-management action. For instance, only 24 GSPs (roughly half) include definite demand-management actions, but 41 GSPs (almost all!) include at least the possibility of demand management.

Demand management takes on different forms across GSPs. Figure 2 shows which GSAs are at least considering an allocation scheme and, among those GSAs, the status of trading allocations. Of the 27 GSPs considering an allocation scheme (14 are definite), 19 GSPs are also considering creating a market for trading that allocation. Allocation without trading does provide some needed certainty to groundwater extractors, but it stops short of maximizing the groundwater's value since lower-value extractors cannot make deals with higher-value users. In subbasins without trading, farmers with high-value, thirsty crops may face shortages.

Pumping restrictions, which prevent groundwater users from accessing additional water under specific circumstances no matter what the marginal value of that water might be, are less common. Only 21 GSPs consider them, and many are limited to drought conditions. Some GSPs list pumping restrictions as a backstop option—considered only when all other management actions have failed to achieve sustainability.

Fees and taxes are another common demand-management measure, with 40 GSPs considering some kind of fee. However, not all fees manage demand equally. While a tax on irrigated acreage can raise necessary revenues for a GSA, it does not alter an irrigator's pumping decisions in quite the same way as a direct tax on pumping. A farmer facing a tax on irrigated acreage can make some adjustments, like reducing the size of their farm or replacing some portion of it with crops that do not require irrigation. These are major adjustments, and will only be undertaken with particularly low-value or high-cost crops that cannot bear the tax. Taxes on pumping, on the other hand, directly incentivize all farmers to make marginal improvements to the efficiency of their irrigation systems. In aggregate, these smaller changes can help regions adapt to lower groundwater availability with fewer farm closures. Many GSPs are vague about how exactly their taxes or fees might be structured, but 24 consider fees for groundwater extraction specifically.

Conclusion

Substantial portions of California's land, including as much as 10–20% of the Central Valley's irrigated acreage, could be fallowed due to SGMA. The management choices selected by GSAs will ultimately determine how much land comes out of production, with economic implications for the entire regional economy. Well-designed management actions can temper these transitions, just as poorly conceived actions can aggravate and multiply losses.

Research on the political economy of SGMA and how existing interests and institutions are influencing management choices is an area of continuing research. Preliminary data collection shows the dominant role of existing, water-focused special districts in GSA boards, the ubiquity of supply augmentation, and the developing landscape of demand management.

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For additional information, the authors recommend:

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