

DECARBONIZING IRRIGATION, RECHARGING GROUNDWATER, AND PROTECTING SMALL FARMS

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Provide Additional Support for GSAs to Restrict New Groundwater Demand
- Compensate Farmers for Dry Wells
- Pay for Class Counsel on Behalf of Small Farms and Rural Residents in Adjudication
- Complete the Transition to Decarbonized, Efficient, Multi-Benefit On-Farm Irrigation Systems
- Invest in Small-Scale Water Delivery Infrastructure Modernization

A CLIMATE PLATFORM FOR CALIFORNIA AGRICULTURE

This is one in a series of CalCAN policy briefs that describe approaches to moving California agriculture boldly and quickly toward a carbon-neutral and climate-resilient future. Together, they make up *A Climate Platform for California Agriculture*.

Access the full report at: calclimateag.org/ca-agriculture-climate-platform

AUTHOR: Brian Shobe



INTRODUCTION

After decades of groundwater overdraft, local groundwater sustainability agencies (GSAs) are tasked with bringing groundwater basins into balance by 2042 as required by the Sustainable Groundwater Management Act (SGMA) of 2014. While achieving the goals of SGMA is essential, the law's implementation and 20-year timeline have had a number of unintended consequences on small farms that need to be addressed. The expansive planting of almonds, pistachios, and other orchard crops in recent decades—which require more water than most row crops and field crops they replace, harden water demand, and increase groundwater pumping—has exacerbated these challenges.

The swing from severe drought to severe flooding, or “precipitation whiplash,” we experienced in 2022–2023 is likely to become more common in the years ahead as a result of climate change.¹⁰⁶ Adapting to this trend will require continued improvements in on-farm irrigation efficiency on California's approximately nine million acres of irrigated cropland as well as increased groundwater recharge in wet years.

Water and energy use are closely linked, so achieving the state's climate and renewable energy goals requires decarbonizing irrigation energy use and maximizing irrigation efficiency. However, the barriers to accomplishing this extend well beyond a farm's borders.

FINDINGS

SGMA Has Had Unintended Impacts on Small Farms

Stopping groundwater overdraft and all its secondary impacts (subsidence, crumbling infrastructure, dry wells, worsening groundwater contamination, etc.) is essential for agricultural viability and resilience in California. This is why CalCAN supported SGMA and why we maintain that the law must succeed in achieving its goals and objectives. That said, the law's implementation has had a number of unintended impacts on small farms that need to be remedied.



Photo Credit: USDA-NRCS

¹⁰⁶ Swain, D.L. et.al. (2018). [Increasing precipitation volatility in twenty-first-century California](#). *Nature Climate Change*, 8. 427–433

First, large-scale growers on the west side of the San Joaquin Valley, facing restrictions on pumping groundwater, have scoured the east side of the valley and the Sacramento Valley looking for land to buy or lease that has more secure water. This increased land competition has raised the price of land and land rents, which has raised costs for the many small farms that lease land and has made it more difficult to access land to start or expand a small farm.¹⁰⁷

Second, in recent years and ahead of any groundwater restrictions that may come with SGMA implementation, there has been an influx of investment capital from billionaire investors, pension funds, hedge funds, insurance companies, and other investors for the establishment of new perennial orchards, causing a significant increase in irrigated acres and water demand. For example, in Yolo County between 2008 and 2021, 55,000 acres of perennial crops were planted, with 45 percent of this acreage planted on historically non-irrigated land.¹⁰⁸ These newly irrigated lands are often supported by new wells that are typically deeper than the residential and agricultural wells of their neighbors. The well drilling frenzy has driven up the cost of well drilling due to demand but also due to the need to go deeper as the water table falls. For example, the cost of a replacement well drilled to 260 feet with an 8-inch casing in Yolo County was \$44,277, according to a farmer we spoke with. Replacing wells is a cost that small farms are ill-equipped to bear.



Hanging drip irrigation lines in a vineyard make soil management easier.

Third, managers of local Groundwater Sustainability Agencies (GSAs) have raised funds from local farms both to operate the GSAs as well as to fund projects that would recharge groundwater or bring in new surface water. These fees are imposed on landowners who in turn pass them on to tenants where land is leased. Since many small farmers lease land, they become the ultimate funders of these projects.

Fourth, in some areas where groundwater is being seriously overdrafted, GSAs are imposing allocations on farmers, such that they will not have sufficient water to irrigate all of their land. Farmers in our network report that this is leading to more well-resourced farmers and investors attempting to buy up neighboring land, again bidding up the price of land but also displacing other farms.

Fifth, in other areas with significant groundwater overdraft, large farms in some GSAs are filing for adjudication in the courts to determine how the sustainable groundwater yield should be divided up. This forces every groundwater rights holder into court and subverts the community process that SGMA envisioned. Small farmers are not able to pay attorneys for long periods to be represented in such proceedings and stand to lose their ability to pump groundwater. There are likely to be many adjudication proceedings in the future.

¹⁰⁷ According to the [National Agricultural Statistics Service Land Values 2022 Summary](#), the average value per acre of irrigated cropland in California increased 27 percent between 2018 and 2022.

¹⁰⁸ Data from the Yolo Groundwater Sustainability Agency.



On-Farm Irrigation Efficiency Investments Yield Multiple Benefits

Investments in on-farm irrigation efficiency are good for climate change, community health, and farmers. The State Water Efficiency and Enhancement Program (SWEEP), administered by the California Department of Food and Agriculture (CDFA), has invested \$123 million in 1,130 projects to date. These investments in on-farm irrigation systems have resulted in many benefits beyond what the program's water efficiency-oriented title suggests. These other co-benefits merit additional consideration in policy and fiscal decisions as the legislature looks to maximize its return on investments.

From a climate perspective, SWEEP is estimated to have reduced CO₂ emissions by 93,000 metric tons per year through a combination of irrigation pump electrification, upgrades, and solar power installation. SWEEP projects that include drip irrigation are also likely to have significant reductions in N₂O emissions, a greenhouse gas that has 265 times more heat-trapping impact than CO₂. A global meta-analysis of N₂O emissions from drip irrigated cropping systems showed that drip irrigation reduces N₂O emissions by 32 percent and 46 percent compared to furrow and sprinkler irrigation systems, respectively.¹⁰⁹

From a community health perspective, SWEEP projects improve both water and air quality, which is especially important in regions such as the San Joaquin Valley that experience severe challenges with both. SWEEP projects have great potential to reduce nitrate leaching into groundwater by allowing more precise application of fertilizer through fertigation and greater control over the amount and uniformity of irrigation, both of which limit the volume of nitrates that percolate beneath the root zone.¹¹⁰ SWEEP projects also reduce local air pollution. Nearly 20 years ago, the California Air Resources Board estimated electrifying 5,700 diesel irrigation engines in the Central Valley would eliminate 11,600 tons of air polluting nitrogen oxide (NOx) emissions and 860 tons of particulate matter each year, equivalent to eliminating nearly half the yearly NOx and one-quarter of the yearly particulate matter created by all of California's power plants.¹¹¹ The vast majority of SWEEP projects have occurred in the San Joaquin Valley, which is home to both critically overdrafted groundwater basins¹¹² and the worst air quality in the country.¹¹³

Farmers we interviewed have observed a number of other agronomic co-benefits of SWEEP projects. By applying irrigation more precisely, farmers have observed less weed pressure, which in turn requires less labor, tillage, and herbicide. Farmers also report additional labor savings through the automation of their irrigation systems. And by reducing their overall water and energy use, farmers see significantly lower water and energy bills, all while maintaining or improving crop yields. Not surprisingly then, farmers have consistently demonstrated high interest in SWEEP, with applications persistently outpacing available funding, even as funding for the program reached a record \$50 million in fiscal year 2021–2022.



Photo Credit: USDA photo by Lance Cheung

¹⁰⁹ Kuang, W. et.al. (2021). [A global meta-analysis of nitrous oxide emission from drip-irrigated cropping system](#). *Global Change Biology*, 27(14). 3244–56.

¹¹⁰ Letey, J., & Vaughan, P. (2013). [Soil type, crop and irrigation technique affect nitrogen leaching to groundwater](#). *California Agriculture*, 67(4). 231–41.

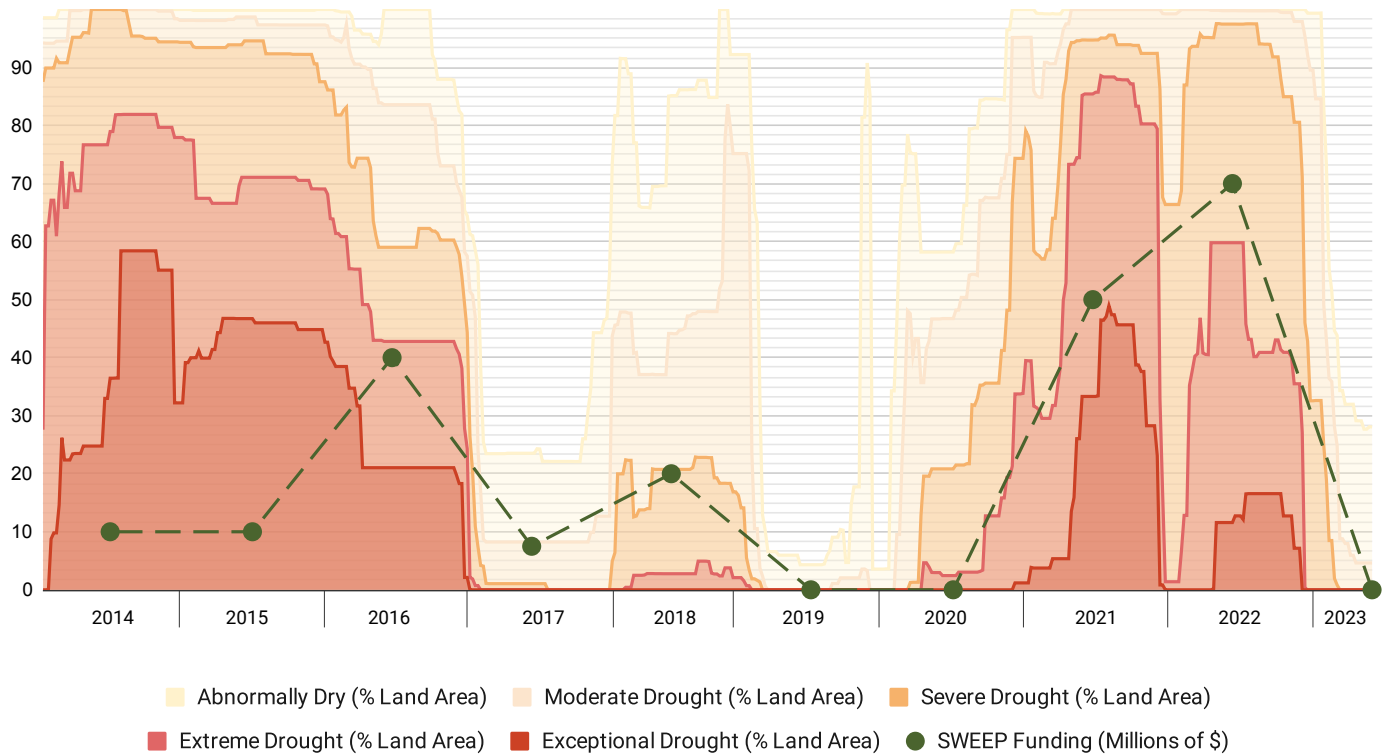
¹¹¹ California Air Resources Board. (2004). [New program to encourage electrically powered irrigation pumps](#).

¹¹² See a map of critically overdrafted groundwater basins: <https://water.ca.gov/programs/groundwater-management/bulletin-118/critically-overdrafted-basins>

¹¹³ American Lung Association. State of the Air. (2023). [Most polluted places to live](#).



Figure 3: SWEEP Funding vs. Percent of CA Land Area in Drought Conditions (2014 - 2023)



Despite SWEEP’s multiple benefits and consistent demand, funding for SWEEP has mirrored the state’s precipitation swings since its inception in 2014, with funding rising and falling in response to drought conditions. To fully decarbonize irrigation energy use in the state, the approximately 8,000 remaining diesel-powered irrigation pumps (eight percent of the irrigation pumps in the state)¹¹⁴ will need to be replaced with electric pumps—a goal SWEEP can help to achieve by 2045 while providing the co-benefits described above.

Maximizing Benefits of On-Farm Irrigation Efficiency Requires Upgraded Infrastructure

Maximizing the benefits of on-farm irrigation system upgrades requires having access to flexible, on-demand water delivery from irrigation districts. Due to outdated infrastructure that was designed to support flood irrigation, many irrigation districts have rigid water delivery schedules or, at best, pre-arranged demand schedules that require water delivery to be scheduled several days in advance with a fixed duration. This approach limits the on-farm efficiency gains of the type of precision irrigation systems that SWEEP funds and often leads to an overreliance on groundwater pumping. Recognizing this dilemma, the U.S. Department of Agriculture’s Natural Resources Conservation Service (NRCS) and the U.S. Bureau of Reclamation recently expanded their Water Smart Initiative, which pairs NRCS’s on-farm water efficiency investments with Bureau of Reclamation’s irrigation district-level infrastructure modernization investments.¹¹⁵

¹¹⁴ National Agricultural Statistics Service. Table 13: [Energy expense for all well pumps and other irrigation pumps by type of energy used: 2018.](#)

¹¹⁵ [U.S. Bureau of Reclamation’s Water Smart Initiative](#)



RECOMMENDATIONS

Provide Additional Support for GSAs to Restrict New Groundwater Demand

GSAs need additional authority and support to restrict new groundwater demand from 1) conversion of previously unirrigated lands to irrigated lands; 2) conversion to higher water use crops; and 3) new housing developments. Counties also need to impose greater control on the issuance of permits to drill new wells on previously unirrigated lands.

Compensate Farmers for Dry Wells

New groundwater demand on one parcel of land should not be allowed to imperil its neighbors and dry up shallower domestic and agricultural wells that already exist. In cases where shallower wells go dry as a result of nearby new groundwater demand or new wells on previously unirrigated lands, owners of the dry wells should be fully compensated for their losses.

Pay for Class Counsel on Behalf of Small Farms and Rural Residents in Adjudication

Small farms and rural residents should not have to pay attorneys to be represented in court in adjudication proceedings. They need class counsel to be appointed by the court, which could be paid by the other parties—as happened in the Antelope Valley groundwater cases—or could be paid by the state.¹¹⁶

Complete the Transition to Decarbonized, Efficient, Multi-Benefit On-Farm Irrigation Systems

The state should continue investments in SWEEP—even in wet, non-drought years—recognizing there are more benefits to SWEEP than drought resilience and water use efficiency. Investments in SWEEP can play a critical role in completing the electrification and decarbonization of California's irrigation systems by 2045, which will also help the state achieve other objectives related to air and water quality, especially in the San Joaquin Valley. The SWEEP program should continue to monitor the rapidly evolving field of on-farm, low-cost irrigation technology innovations and incentivize them.

Invest in Small-Scale Water Delivery Infrastructure Modernization

Learning from the federal Water Smart Initiative, the California Department of Water Resources (DWR) and CDFA should continue to explore opportunities to synergize their respective investments in irrigation district modernization (DWR) and on-farm irrigation systems (CDFA) to maximize their benefits for water conservation, energy use efficiency, and farmers. For example, projects funded through the Water Smart Initiative have paired investments in converting irrigation districts to pressurized, piped water delivery systems or automated, remotely controlled gate and turnout systems that make water delivery more available on-demand, with funding for on-farm irrigation efficiency upgrades and water-conserving soil health practices. Multiple farmers and irrigation experts we interviewed also advocated for investments in small-scale infrastructure to improve farmers' access to and ability to use surface water to reduce reliance on groundwater pumping and increase opportunities for groundwater recharge. This small-scale infrastructure includes pipes, pumps, and filters to connect farms to existing canals and on-farm ponds to store and use surface water with micro/drip irrigation systems.

¹¹⁶ The [adjudication of the Antelope Valley Groundwater Basin](#) is the largest, most complex groundwater pumping rights case ever in California and one of the largest in U.S. history.

