



TOOLS FOR TRANSFORMATION

Cultivating climate resilience
in 2030 and beyond



CalCAN
CALIFORNIA CLIMATE &
AGRICULTURE NETWORK

A CLIMATE PLATFORM FOR CALIFORNIA AGRICULTURE

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A Climate Platform for California Agriculture is CalCAN's contribution to the rich and complex dialogue and strategy about how California agriculture can move boldly and quickly toward a carbon-neutral and climate-resilient future. It consists of two parts:

Part 1. State of the State: Taking stock of a decade of climate progress in California agriculture

Part 2. Tools for Transformation: Cultivating climate resilience in 2030 and beyond

The full report is available on the CalCAN website: calclimateag.org/ca-agriculture-climate-platform

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The California Climate and Agriculture Network (CalCAN) is a statewide coalition of sustainable farmers and ranchers and allied organizations, agricultural professionals, scientists, and advocates that advances state and federal policy to realize the powerful climate solutions offered by sustainable and organic agriculture.

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EXECUTIVE SUMMARY



Climate change is creating widespread disruptions in our food and farming system.

Farmers and ranchers face unprecedented challenges with increasingly scarce water, extreme heat, flooding and wildfire events, and unpredictable weather and pest patterns. Even experienced farmers are struggling to stay in business, and new farmers face not only climate-related challenges but also a lack of access to affordable, secure land. Ongoing structural and discriminatory barriers exacerbate the challenges for farmers of color. Climate-related crop losses are on the rise, driving up food prices and contributing to an increase in the number of people who are food insecure and hungry. Farmworkers are on the front lines, exposed to unhealthy air and facing the reality of working on more dangerously hot days. They and their families and communities are among California's most economically vulnerable people and also often lack access to healthy food, safe drinking water, and homes that are affordable, air-conditioned, and energy efficient.

Because the stakes are high, re-envisioning how we grow food must be one of our highest and most urgent priorities.

The good news is that science continues to identify many solutions that can help farmers and ranchers both cope with these climate impacts and also reduce greenhouse gas emissions, sequester carbon, and improve the health of humans and ecosystems. There is a growing workforce of agricultural professionals to support farmers with implementing best practices, and farmers and ranchers are interested and willing to adopt new practices. By increasing resources to scale up current programs, we can unleash the huge untapped potential of California's farms and ranches, furthering the state's leadership in building a climate-resilient future.

This work requires a systems approach, multidisciplinary collaboration, ingenuity, an entrepreneurial spirit, and a commitment to addressing systemic inequities. It also requires financial investments in research, technical assistance, market development, and incentives for farmers and ranchers to lower the risk of the transition to climate-resilient practices and technologies. By making strategic investments in our food and farming system now, we will reap the rewards of an agriculture sector that is a net sink for greenhouse gases rather than a net source and avoid some of the worst impacts from a changing climate.



MOVING TOWARD CLIMATE-RESILIENT AGRICULTURE

We believe that California's farms and ranches must be better prepared to adapt to and recover from climate shocks. We also know that agriculture has a key role to play in reaching the state's climate and biodiversity goals.

However, true climate resilience goes beyond mitigating climate change and adapting to its impacts. It also means that farmers and ranchers are profitable and rural communities and their economies are thriving. Food is produced in balance with natural resource limits and with maximal biological diversity. The people who grow our food and their families have safe working conditions and adequate wages and affordable housing, and rural communities have clean air and water and healthy food. Productive agricultural land is permanently protected and there is abundant access to land for new farmers and racially and culturally diverse farmers. Resources for the agricultural communities most impacted by climate change are prioritized, and these communities themselves guide the policies they need.

California is moving toward climate-resilient agriculture. But we are not moving quickly enough. We must act with more urgency and equip our farmers, ranchers, and the farming economy with the necessary tools to achieve carbon neutrality in agriculture well before California's economy-wide target date of 2045 for net carbon neutrality.

In Part 1 of this report (*State of the State: Taking Stock of a Decade of Progress in California Agriculture*), we summarize the progress made in research, policy, and practice. We note that in the last decade, scientific research on climate-resilient agricultural management has advanced considerably. Since 2015, close to \$1 billion has been committed by the state to Climate Smart Agriculture programs, supporting farmers and ranchers with incentives and technical assistance.

In Part 2 of the Platform (*Tools for Transformation: Cultivating Climate Resilience In 2030 and Beyond*), we identify the most important actions needed to achieve the state's 2030 climate and biodiversity goals and set us on a path to climate resilience. These actions include incentives, regulations and regulatory efficiency, research, education, pilot projects, procurement policies, market development, and land use decisions. The effectiveness of these actions will depend on collaborations that bring together the best and brightest innovators and leaders from diverse backgrounds to guide the way.

The ideas presented here are intended to engage and inspire policymakers, agriculture stakeholders, and advocates in the food and farming, environmental, and climate justice fields to advance policies that yield faster and deeper change.



TOOLS FOR TRANSFORMATION

To develop over 50 policy recommendations in the Platform, we drew upon numerous reports and peer-reviewed studies. We also consulted over 60 issue area experts and assembled a team of 16 reviewers to inform and challenge us. Our recommendations will accelerate the pace of transition to climate resilience and net carbon neutrality in the agriculture sector. A snap shot of all the recommendations can be found in the [Platform Recommendations At-a-Glance](#).

The experts we interviewed and the recommendations we include repeatedly emphasize the following themes:

WHOLE-FARM SOLUTIONS	To remain economically viable in the face of climate change, farmers and ranchers will have to adapt to significant and recurring extreme weather events at the same time as they work to reduce greenhouse gas emissions. This will require stacking multiple synergistic practices and taking into account the economic, ecological, practical, and marketplace realities of agricultural businesses.
INVESTING IN PEOPLE AND KNOWLEDGE	In every solution chapter of this Platform, there are recommendations focused on workforce development, training, and cooperation among individuals and within networks.
MULTI-STAKEHOLDER COLLABORATION	Implementing many of the recommendations in the Platform will depend on bringing together different agencies and governmental jurisdictions, farmers, researchers, and community members. Such interdisciplinary collaboration will lead to the most innovative, impactful, and practical outcomes.
ADDRESSING SYSTEMIC INEQUITY	Racial, gender, and economic equity are essential to achieving climate resilience. Many of the Platform recommendations note the importance of designing policies and prioritizing limited public dollars to support small and medium-scale and socially disadvantaged farmers and ranchers. These farmers lack resources because they have faced systemic barriers in agriculture.

FINANCIAL INVESTMENTS TO UNLEASH INNOVATION IN AGRICULTURE

It is critical that California's farmers and ranchers have the information and financial support they need to be productive and profitable while also innovating and taking risks with new practices and technologies that reduce greenhouse gas emissions and make their operations more adaptable to a rapidly changing climate. Increasing investments from government, the private sector, and philanthropy is essential in the transition to a climate-resilient food and farming system. There are several potential sources of funding described in the section [*Funding the Transition: Investment Strategies for Agricultural Solutions to the Climate Crisis*](#).

The scale of these investments should be on the order of \$1 billion annually. To put this into perspective, this represents less than 0.5 percent of California's average annual state budget for a sector that generates approximately 2.5 percent of the state's GDP.

Our Proposed Investments for Climate-Resilient Agriculture



Invest \$1 billion / year

It is critical that the state accelerate its financial investment in climate-resilient agriculture. The scale of these state investments should be on the order of \$1 billion annually for a total of \$7 billion between now and 2030.

GETTING TO WORK

This *Climate Platform for California Agriculture* is CalCAN's contribution to the rich and complex dialogue and action underway in the state to move boldly and quickly toward a carbon-neutral and climate-resilient future.

The sooner we implement the agricultural climate solutions recommended in this Platform, the sooner we will see a return on investment and the more powerful their impact will be. We invite you to join us in this work of a generation.

ON-FARM TOOLS

[Enhancing Soil Health and Biodiversity for On-Farm Climate Resilience](#)

[Dairy Manure Management: Moving From Waste Problem to Climate Solution](#)

[Reducing Farmer Dependence on Fossil Fuel-Based Pesticides and Fertilizers](#)

[Harvesting the Sun: Advancing On-Farm Solar Deployment](#)

[Protecting Farmland Using Integrated Land Use Planning](#)

[Decarbonizing Irrigation, Recharging Groundwater, and Protecting Small Farms](#)

[Preventing and Mitigating Catastrophic Wildfires](#)

SYSTEM-WIDE STRATEGIES

[Funding the Transition: Investment Strategies for Agricultural Solutions to the Climate Crisis](#)

[Breaking Down the Silos: Coordinating Agriculture Climate Action Across Programs](#)

[Expanding Technical Assistance to Support On-Farm Climate Resilience](#)

[Advancing Farmworker Safety and Well-Being](#)

[Moving Beyond Consolidation: Building a Climate-Resilient Agricultural Economy](#)

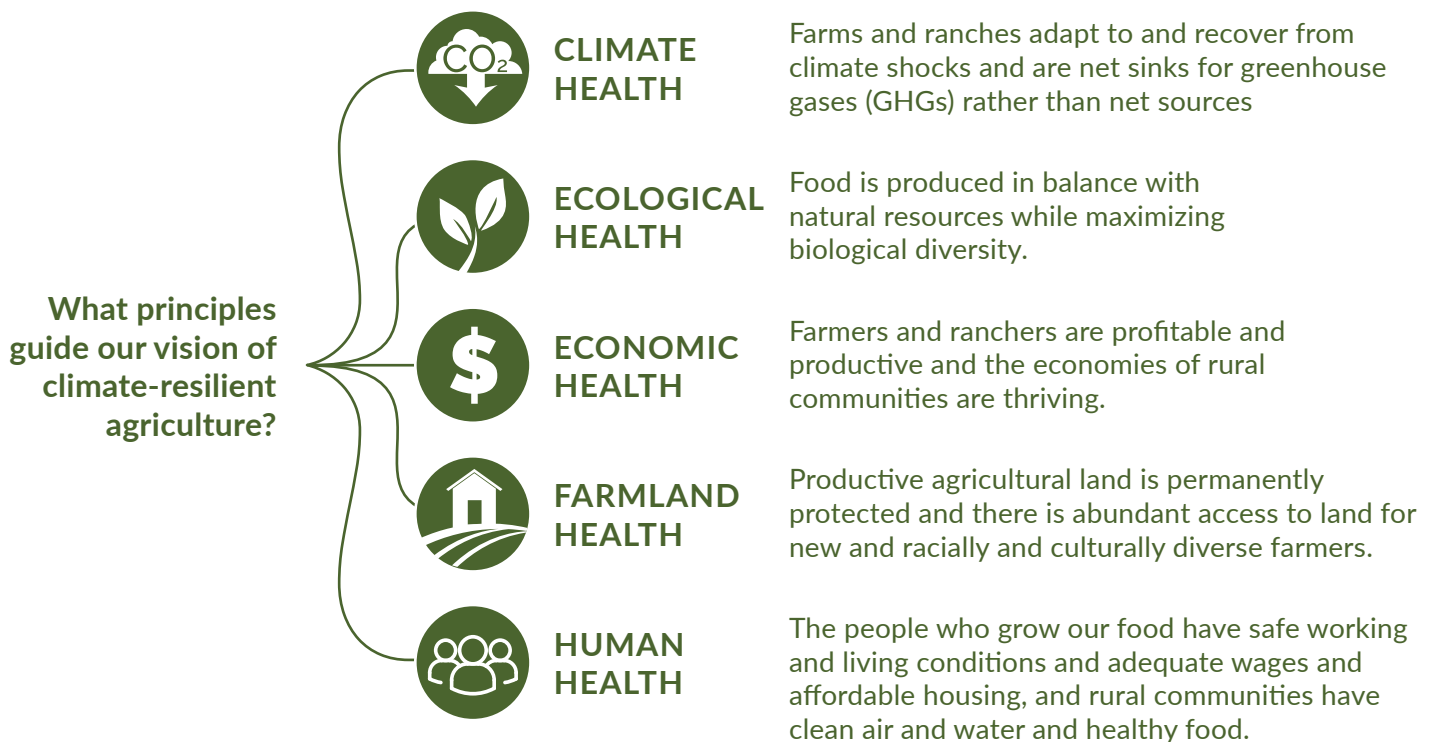


INTRODUCTION

Since 2009, the California Climate and Agriculture Network (CalCAN) has advanced public policies that catalyze the powerful climate solutions offered by sustainable and organic agriculture and move California agriculture toward a system that is increasingly resilient and just. We are farmer-centered advocates for science-based, practical agricultural climate solutions. Our work is grounded in the belief that making a transition to climate resilience in agriculture will ultimately lead to a healthier, more equitable, more humane, and more generative food and farming system and rural landscape.

This [Climate Platform for California Agriculture](#) is CalCAN's contribution to the rich and complex dialogue and action underway in the state to move boldly and quickly toward a carbon-neutral and climate-resilient future. The ideas presented here are intended to engage and inspire policymakers, agriculture stakeholders, and advocates in the food and farming, environmental, and climate justice fields to advance policies that yield faster and deeper change.

There are many readily available approaches, strategies, and tools to inform how the transition to agricultural climate resilience can happen, including those of indigenous peoples, farmworkers, and organic producers. We can weave together the experience, science, and knowledge systems of these food producers with emerging renewable and sustainable technologies to carry us into the future.



Local, state, and federal governments have a central role to play in catalyzing systemic change. They can put in place mandates and use a combination of incentives and regulation to enable agricultural businesses to succeed. They can fund research, education, and pilot projects. They can use their purchasing power to create new markets and their regulatory power to shape them. They can incentivize and influence land use decisions. They can convene the best and brightest innovators and leaders from diverse backgrounds to guide the way. For these reasons, the work of CalCAN and this report focus on solutions that can be unleashed in the public sector and with public funding.



MOVING FROM INCREMENTALISM TO TRANSFORMATION

California has begun to move down the path toward climate-resilient agriculture. In Part 1 of this report ([State of the State: Taking Stock of a Decade of Progress in California Agriculture](#)), we summarize the accomplishments of the last decade or so. Since 2017, the state has committed almost \$840 million in grants to farmers and ranchers for using climate smart practices (i.e., improving soil health, conserving water and energy, and managing manure to reduce methane) and to permanently protect agricultural lands from urban development. Research in this field has greatly accelerated in the past decade, lending confidence to models used to estimate the climate benefits of on-farm climate smart practices and equipping technical assistance providers to support producers with science-based information about best practices.

Yet this is not enough. We must act with more urgency and strive for carbon neutrality in agriculture well before California's economy-wide net carbon neutrality target date of 2045.¹ Farmers and ranchers can deliver climate solutions that are cost-effective and that have many co-benefits such as air and water quality improvements, improved health of farmworkers and rural communities, increased biodiversity, reduced dependence on fossil fuel-based chemicals, and more.

GOALS, SCOPE AND METHOD

In this *Tools for Transformation* report, we make 50 policy recommendations needed to achieve the state's 2030 climate and biodiversity goals and set us on a path to climate resilience. We focus on farm-based strategies that are scientifically valid and economically and technically feasible for producers to implement. We include approaches that deliver not only climate solutions but also multiple on-farm, environmental, and public health benefits.

Because we believe that one of the roles of government and public resources is to address historical injustice, we emphasize the need for policies that prioritize farmers of color who have lacked access to land, technical assistance, and financial incentives as the result of patterns of structural discrimination. We also advocate on behalf of small and medium-scale farmers and ranchers who lack the capacity and capital that large farming corporations have to make improvements and take the economic risks that can come with trying new farming practices.

To develop our recommendations, we referenced numerous policy reports, peer-reviewed research, and data sets. We also consulted over 60 issue area experts and assembled a team of 16 reviewers.



¹ California Air Resources Board. [2022 Scoping Plan Update](#).

ACKNOWLEDGING BROADER STRUCTURAL CONSTRAINTS AND CHALLENGES

We acknowledge there are two significant fundamental legal and economic constraints that are beyond the scope of this report and that complicate and impede our collective ability to achieve net carbon neutrality and climate resilience in agriculture: water rights and land ownership.

1 WATER RIGHTS AND REGULATIONS	California has begun to curb its unsustainable use of groundwater with the implementation of the Sustainable Groundwater Management Act. However, the process is rolling out very slowly over the course of two decades—far too slow to respond to the water scarcity crisis farmers face year after year that forces them to drill deeper wells, sacrifice crops, fallow land, and in some cases sell their farms. Furthermore, smaller and limited-resource farmers are at risk of being unable to influence the groundwater sustainability agencies and courts that make decisions about water allocation. Surface water management is just as challenging and complicated. Hundreds of water agencies and irrigation districts rely on 19th-century water rights determined during an entirely different era and climate and use 20th-century infrastructure to deliver water to tens of thousands of farms.
2 LAND OWNERSHIP	Consolidation of ownership of agricultural land is increasing, fueled by private speculators, both foreign and domestic, who have no relationship to the land and are motivated by profit, not climate resilience. Older farmers are aging out and few new farmers can afford to buy land or to secure long-term leases. Insecure land tenure disincentivizes the necessary investments in soil health and resilient infrastructure. Pressure to develop farmland is increasing, whether for urban uses or utility-scale solar.

Underlying both of these constraints is a historic pattern of systemic racial injustice that includes the genocide of indigenous peoples, the exploitation of various groups of immigrant laborers, and discriminatory laws that made it difficult or impossible for farmers of color to own farmland. The impact of these injustices continues to this day and has resulted in a vast consolidation of land and water resources that severely limits the ability of farmers of color, farmworkers, and the next generation of small family farmers to thrive and scale up agricultural climate solutions.

Our ability to address these constraints and the continued pattern of racial discrimination will determine how meaningfully and quickly we will be able to move toward a future that includes a truly equitable, healthy, and resilient food and farming system.



SCALING UP INVESTMENT IN AGRICULTURE'S CLIMATE SOLUTIONS

To ensure California’s farmers and ranchers continue to be productive and profitable in the face of climate change, it is critical that the state accelerate its financial investment in climate-resilient agriculture. The scale of these state investments should be on the order of \$1 billion annually for a total of \$7 billion between now and 2030, on par with those made in other sectors. There are many potential sources of public, private and philanthropic funding to deploy, as described in the section [Funding the Transition: Investment Strategies for Agricultural Solutions to the Climate Crisis](#).

By making strategic investments in our food and farming system now, we will reduce the costs of cleaning up disasters and paying for health care and food aid, and we will gain immeasurable environmental, economic, and social benefits that compound over time.



Invest in Climate-Resilient Agriculture

\$1 billion/year

It is critical that the state accelerate its financial investment in climate-resilient agriculture. The scale of these state investments should be on the order of \$1 billion annually for a total of \$7 billion between now and 2030.

Examples of Other Public Funding for Climate Solutions

Both California and the federal government are investing heavily in all sectors of our economy to manage a rapid and just transition away from fossil fuels and toward climate stability. Here are a few examples of the public funds available in other sectors.

		
Residential Energy Efficiency	Wildfire Resilience	Drought and Flood Resilience and Response
\$1.1 billion/year	\$3.7 billion/year	Approx. \$2 billion/year
California residents can receive rebates and other incentives for household energy efficiency measures such as appliance upgrades, lighting retrofits, electrification, and energy storage. The funding comes from a combination of ratepayer fees and the federal Inflation Reduction Act. ²	California’s budget for fire protection, resource management, and fire prevention was estimated to be \$3.7 billion for the 2021–22 fiscal year. ³ The money comes from the general fund and the Greenhouse Gas Reduction Fund.	In fiscal years 2021–22 and 2022–23, the state allocated \$8.7 billion through the year 2025 for dam safety, flood protection, water recycling, ecosystem restoration, drought resilience, and implementation of the Sustainable Groundwater Management Act. ⁴

² California Public Utilities Commission. (2023, June 29). [CPUC adopts milestone investment in energy efficiency to expand ghg reduction and equity inclusion efforts](#).

³ Legislative Analyst's Office. (2022). [The 2022–23 budget: Wildfire and forest resilience package](#).

⁴ Sencan, G. (2023, August 1). [New state budget maintains water and natural resources funding in an uncertain economy](#). Public Policy Institute of California.

PLATFORM RECOMMENDATIONS AT-A-GLANCE

ON-FARM TOOLS

Enhancing Soil Health and Biodiversity for On-Farm Climate Resilience

- Build on Successes and Lessons Learned in the Healthy Soils and SWEEP Programs
- Include an Agriculture Component in the 30x30 Biodiversity Initiative
- Catalyze the Widespread Deployment of Hedgerow and Agroforestry Installation

Dairy Manure Management: Moving From Waste Problem to Climate Solution

- Scale Up AMMP Funding
- Develop Guardrails for Incentivizing Feed Additives
- Catalyze Innovations in Regional-Scale Manure Composting Infrastructure

Reducing Farmer Dependence on Fossil Fuel-Based Pesticides and Fertilizers

- Expand the Pool of SPM Technical Assistance Providers
- Set a Higher Bar for Statewide Increase in Organic Transitions
- Fund Long-Term Research on Organic and Sustainable Pest Management Approaches
- Provide Funding and Multi-Stakeholder Processes to Implement the DPR Roadmap
- Tailor Pest and Fertilizer Regulations by Region, Farm Size, and Crop Diversity
- Increase Fertilizer Mill Fee to Fund R&D on Climate-Resilient Approaches to Soil Fertility

Harvesting the Sun: Advancing On-Farm Solar Deployment

- Promote a Least-Conflict Process for On-Farm Solar Siting
- Set Up a California Clearinghouse for On-Farm Renewable Energy Generation
- Ramp Up the State’s Role in Accelerating Agrivoltaics Deployment

Protecting Farmland Using Integrated Land Use Planning

- Invest in Integrated Farmland Conservation and Infill Housing Development
- Set Ambitious Goals for Agricultural Land Protection and Require Local Smart Growth Policies
- Establish Requirements for Local Action on Farmland Conservation
- Set Up State Financing for Land Purchases for Beginning Farmers and Ranchers
- Create “Just Cause” Tenancy Termination Protections and Give Farmers the Right of First Refusal

Decarbonizing Irrigation, Recharging Groundwater, and Protecting Small Farms

- 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

Preventing and Mitigating Catastrophic Wildfires

- Invest in Coordinators and Workforce to Unlock Private Sector and Community Efforts
- Support Data Analysis and Planning at the Site-Specific, Regional, and Statewide Levels
- Improve Regulatory Efficiency for Prescribed Fire and Grazing
- Increase Liability Insurance Options for Prescribed Burners and Prescribed Graziers
- Lengthen Grazing Leases and Cost-Share Infrastructure to Lower Cost of Prescribed Grazing



PLATFORM RECOMMENDATIONS AT-A-GLANCE

SYSTEM-WIDE STRATEGIES

Funding the Transition: Investment Strategies for Agricultural Solutions to the Climate Crisis



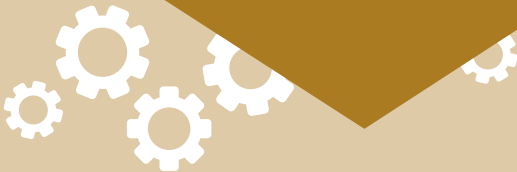
- Invest State and Federal Resources in Multi-Benefit Solutions
- Invest State and Federal Resources in Underserved Producers
- Target Bond Investments in Food and Agriculture Systems, Resilience, Equity
- Invest Special Funds, Fees in Scaling Up Agricultural Climate Solutions
- Develop Private–Public Partnerships, Focus on Supply Chain Resilience and Regional Innovation
- Invest Philanthropic Funding in Regional Innovation, Equity

Breaking Down the Silos: Coordinating Agriculture Climate Action Across Programs



- Prioritize Investments in Regional Leadership and Collaboration
- Build on Existing Interdisciplinary Programs to Catalyze Innovation
- Develop Cooperative Agreements with Local Providers, Incentivize Innovation
- Increase Regulatory Streamlining To Achieve Multi-Benefits

Expanding Technical Assistance to Support On-Farm Climate Resilience



- Expand Regional Hubs to Deliver State and Federal Resources
- Establish a California Center for Technical Development
- Improve State Grant Terms to Support TA Provider Professional Development

Advancing Farmworker Safety and Well-Being



- Increase Investment in Farmworker Workforce Development and Innovative Partnerships
- Develop New Farmworker Housing Units and Improve Existing Housing Stock
- Fund Unemployment, Food, and Health Access for Farmworkers
- Increase Farmworker Wages and Reform Federal Immigration Policy

Moving Beyond Consolidation: Building a Climate-Resilient Agricultural Economy



- Invest in Regional and Local Food Processing, Distribution, and Aggregation
- Support Climate-Resilient Market Development
- Develop Farm-to-Institution Procurement Policies and Programs
- Invest in Agricultural Cooperatives Planning and Development, Review Tax Issues
- Government Action Needed to Restore Competitive Agricultural Markets



ENHANCING SOIL HEALTH & BIODIVERSITY FOR ON-FARM CLIMATE RESILIENCE

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Build on Successes and Lessons Learned in the Healthy Soils and SWEEP Programs
- Include an Agriculture Component in the 30x30 Biodiversity Initiative
- Catalyze the Widespread Deployment of Hedgerow Installation

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INTRODUCTION

In 2022, California's severe multi-year drought conditions led to the fallowing of roughly 750,000 acres of agricultural land.⁵ And then early in 2023, historic flooding devastated some of the state's most productive agricultural land, impacting livelihoods, rural communities, and farmworker homes. While this weather whiplash can be a natural occurrence in the arid West, climate change is increasing the severity and accelerating the frequency of these events. These climate impacts are laying bare the vulnerabilities of a highly engineered and aging water system and a decades-long lack of attention to agricultural soil health and biodiversity.

The scientific understanding of soil biodiversity is evolving quickly, as is the understanding of the relationship between soil health, carbon sequestration, and flood and drought resilience. A report called *Soil Biodiversity in California Agriculture*,⁶ commissioned by the California Department of Food and Agriculture (CDFA) and released in July 2023, provides a thorough overview of the science of soil biodiversity as well as numerous recommendations for enhancing it. Several of the authors of that report also informed this solution chapter of the CalCAN Platform.

Practices for improving on-farm soil health and on-farm biodiversity—which are closely linked—offer potent, relatively inexpensive, and readily available strategies to help farmers and their neighboring communities cope with both droughts and floods while also mitigating climate change.



Photo Credit: Saxon Holt

Bell bean cover crop at River Garden Farms showing complex root structure that builds soil carbon.

⁵ Medellín-Azuara, J., et al. (2022). [Economic impacts of the 2020–22 drought on California agriculture](#). Public Policy Institute of California.

⁶ CDFA Belowground Biodiversity Advisory Committee. (2023). [Soil biodiversity in California agriculture: Framework and indicators for soil health assessment](#).

Soil organisms also play a large role in forming soil structure and enabling soil to act like a sponge and hold on to water. This makes more water available to crops during times of water scarcity and can improve water infiltration⁷ and groundwater recharge. When heavy rains and floods come, the water is better absorbed by soil rather than eroding valuable topsoil and exacerbating infrastructure damage.⁸ Diverse soil and plant communities can promote the formation of soil carbon,⁹ reduce nitrogen losses,¹⁰ and help suppress plant and soil pathogens.¹¹ And in good news for producers, soil health practices can increase profitability, as shown in a recent national study that found an average 42 percent increase in yields and a net farm income increase of \$65 per acre.¹²

Increasing on-farm biodiversity using conservation plantings such as hedgerows, riparian buffers, windbreaks, silvopasture, agroforestry, and other conservation plantings also has a role to play in climate resilience and mitigation. All four of the principles for healthy soils (see sidebar) are provided by hedgerows, which also store carbon in their woody tissues. A recent study by UC Davis researchers found that plantings of hedgerows on the edges of farm fields in California can increase soil carbon on farms at a depth of one meter. The researchers offer an indication of how impactful the practice can be, stating that “assuming adoption rates of 50 to 80 percent across California for hypothetical field edges of average-size farms, and an identical soil organic carbon (SOC) sequestration potential across soil types, hedgerows could sequester 10.8 to 17.3 MMT CO₂e or 7 to 12 percent of California’s annual greenhouse gas reduction goals.”¹³ These plantings can also help limit erosion and mudslides while providing habitat for wildlife, pollinators, and beneficial insects.

Our interviews helped us to understand how improved soil health and increased biodiversity can provide resilience to drought and floods while also curbing climate change. The interviews also helped us to identify policy tools to scale up farming practices that achieve these co-benefits.

Healthy Soils Principles¹⁴

Healthy soils can promote soil ecosystem functioning and provide multiple benefits including improved water availability in soils and improved water infiltration. The main principles of soil health management include:



⁷ Acevedo, S. E., et al. (2022). [How does building healthy soils impact sustainable use of water resources in irrigated agriculture?](#) *Elementa: Science of the Anthropocene*, 10(1).

⁸ This NRCS video portrays the soil health benefits for flood control on the organic walnut orchard of farmer Russ Lester: USDA NRCS (2014, June 11). [Cover crops and water infiltration of soil](#). AgNet West.

⁹ Wagg, C., et al. (2021). [Diversity and asynchrony in soil microbial communities stabilizes ecosystem functioning](#).

¹⁰ Bender, S. F., & van der Heijden, M. G. A. (2015). [Soil biota enhance agricultural sustainability by improving crop yield, nutrient uptake and reducing nitrogen leaching losses](#). *Journal of Applied Ecology*, 52(1).

¹¹ Schlatter, D., et al. (2017). [Disease suppressive soils: New insights from the soil microbiome](#). *Phytopathology*, 107(11).

¹² Soil Health Institute. (2023). [Nationwide study on 30 U.S. farms shows positive economic impact of soil health management systems](#).

¹³ Chiartas, J. L., et al. (2022). [Hedgerows on crop field edges increase soil carbon to a depth of 1 meter](#). *Sustainability*, 14(19).

¹⁴ USDA NRCS. [Principles to manage soil for health](#).



FINDINGS

Healthy Soils Increase Flood Protection and Groundwater Recharge

In our interviews with researchers working on agricultural solutions to the climate crisis, we discussed healthy soils as a climate resilience strategy. One researcher stated that “when it comes to floods, soils can really help.” Cover crops can have a significant impact on water infiltration and the capture of water in agricultural soils. After two years of research on the benefits of cover crops in vineyards, researchers found deep percolation of water, and they found less nitrate loading in surface water runoff.¹⁵ Improved water infiltration of soils can also contribute to improved groundwater recharge over time. Reduced tillage, plantings of perennial crops, cover crops, diversified crop rotations, as well as organic matter amendments like compost, biochar, and crop residues can improve soil structure and infiltration.^{16,17}



Photo Credit: USDA Photo by Lance Cheung

Salvador Prieto applying mulch to avocado and lemon orchards in Somis, CA.

Combining Soil Health and Deficit Irrigation Can Save Water, Improve Drought Tolerance

Our researcher interviewees cautioned that improving soil health as a drought mitigation strategy to achieve water savings is possible but complicated. In areas with sandy soils and low precipitation that start with low levels of soil organic matter (SOM), even a one percent increase in SOM can be challenging. Improved soil health can bolster the ability of soils to hold and retain water, but to reduce water use on irrigated acreage during times of drought, it is important to combine soil health practices with deficit irrigation strategies that delay irrigation without overly stressing crops. For example, in permanent crop systems such as orchards which cannot be fallowed during droughts, compost applications can increase soil water-holding capacity while also reducing evaporation, thereby limiting yield losses.¹⁸

Increasing On-farm Biodiversity Has Many Benefits but Insufficient State Action

Increasing biodiversity on farms using conservation plantings such as hedgerows and agroforestry can sequester carbon and deliver many co-benefits that create greater climate resilience. The researchers we interviewed noted that these strategies can also reduce the impacts of high wind and heavy rainfall that cause runoff and erosion on farms. Some farmers use conservation plantings to reduce erosion and mudslides following wildfires. Climate change is a factor in the decline of pollinator populations, so the habitats provided by hedgerows can help support them and protect yields in almonds and other crops dependent on pollinators. Climate change is also linked to changes in pest pressures, so conservation plantings can improve pest adaptation by increasing habitat for natural pest predators and decreasing reliance on agrochemical inputs.

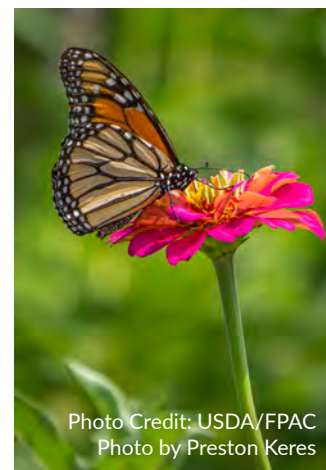


Photo Credit: USDA/FPAC
Photo by Preston Keres

¹⁵ Publication forthcoming. A recent overview of the role of soils in provisioning multiple environmental benefits, including flood tolerance can be found here: Keestra, S., et al. (2021). [The role of soils in regulation and provision of blue and green water](#). *Philosophical Transactions of the Royal Society B: Biological Sciences*, 376(1834).

¹⁶ Acevedo, S.E., et al. (2022). [How does building healthy soils impact sustainable use of water resources in irrigated agriculture?](#) *Elementa: Science of the Anthropocene*, 10(1).

¹⁷ De Graaff, M., et al. (2019). *Chapter one - Effects of agricultural intensification on soil biodiversity and implications for ecosystem functioning: A meta-analysis*.

¹⁸ Jahanzad, E., et al. (2020). [Orchard recycling improves climate change adaptation and mitigation potential of almond production systems](#). *PLoS ONE* 15(3).



CDFA launched two promising new biodiversity-focused programs that made their first approximately \$13 million in grants in 2022: (1) the Conservation Agriculture Planning Grants Program, providing grants for plans that will help farmers and ranchers identify actions for climate change mitigation and adaptation;¹⁹ and (2) the Pollinator Habitat Program²⁰ to establish pollinator habitat on agricultural land.

The state's primary biodiversity roadmap report, *Pathways to 30x30 California*, focuses on how to improve biodiversity and address the state's biodiversity crisis²¹ and notes the benefits of increasing biodiversity in agriculture, but does not include any biodiversity recommendations for croplands and rangelands. Several interviewees noted that this was a missed opportunity for the state to identify strategies to increase on-farm biodiversity to help meet our biodiversity goals.

Healthy Soils Program Is Popular but Limited in Impact

Since its inception, the state's Healthy Soils Program (HSP) has been oversubscribed, and we have heard from farmers in our network that it is a driver that can lead to new approaches to soil management with many benefits. However, several design changes are needed to increase its impact. The scientific literature makes clear that soil carbon sequestration—and more broadly, soil health—comes from stacking multiple soil health practices over several years (for example, combining cover crops, compost use, reduced tillage, and/or hedgerow installation). Changes in farming practices and irrigation methods that increase soil microbial populations and diversity need to be sustained for several years in order to see an impact. However, the grants are provided for only three years, and two-thirds of producers apply for funding for just one practice, the most popular of which is compost application.

The farmers whom we interviewed spoke about the importance of the HSP and State Water Efficiency and Enhancement Program (SWEEP), but also their limits given the three-year project timeline, limited unreliable annual budgets, and competition for funding. They told us that no one strategy or program is sufficient to support farmers in transitioning their operations to climate-resilient and smart operations and that a diversity of approaches is needed. They pointed to the importance of access to markets for their products, longer-term land security, and the need to support farmers for their ecosystem services over the long term. They also spoke about the importance of reaching those producers historically underserved by state and federal programs.

RECOMMENDATIONS

Build on Successes and Lessons Learned in the Healthy Soils and SWEEP Programs

There was a consistent refrain among interviewees that while HSP and SWEEP are popular and valued, it is time to consider the next stage of their evolution. Just as with other sectors of the economy (for example, energy or transportation), a transition toward climate resilience and mitigation requires longer-term, consistent, sizable investments. Producers typically operate with five-year business plans, and science tells us that reliable improvements in soil organic matter and carbon sequestration may take five to ten years, a time frame that should be supported with grants to give farmers time to see a return on investment. They should be encouraged to adopt multiple practices and supported to maintain them.

Include an Agriculture Component in the 30x30 Biodiversity Initiative

Pathways to 30x30 California mentions the value of on-farm biodiversity strategies—but it stops there. Ignoring the significant and wide-reaching potential of practices on farms and ranches to preserve aboveground and belowground biodiversity is a missed opportunity. CDFA, the California Natural Resources Agency (CNRA),

¹⁹ For more on the Conservation Agriculture Planning Grants Program, see <https://www.cdfa.ca.gov/oefi/planning/>

²⁰ For more on the Pollinator Habitat Program, see <https://www.cdfa.ca.gov/oefi/php/>.

²¹ [30x30 California](#), see page 31.



and the Department of Conservation (DOC) should convene stakeholders to evaluate the current status of on-farm biodiversity in California, consider barriers to adoption of greater aboveground biodiversity,²² set actionable, measurable targets for accelerating on-farm biodiversity, and identify the resources needed to achieve these targets. This process should build on the recommendations in CDFA's *Soil Biodiversity in California Agriculture*,²³ including these important actions:

- Integrate soil biodiversity assessment into CDFA's HSP and tackle barriers such as the scarcity of soil testing labs and the lack of a cost-effective soil test for farmers to use
- Run a pilot program within the HSP, selecting a subset of projects that relate soil biodiversity indicators with complementary measurements of soil health
- Build capacity in the public and private sector to provide services and training for soil biodiversity analysis and assessment
- Develop an Adaptive Management Framework that allows farmers and agricultural practitioners to dynamically respond to changing conditions and uncertainties in their farming systems

Catalyze the Widespread Deployment of Hedgerow and Agroforestry Installation

In September 2023, CalCAN and other agriculture and environmental advocates provided recommendations to the California Natural Resources Agency in response to its call for public comment on target setting as required by AB 1757. Based on available opportunities and feasible implementation rates, we recommended the following targets for conservation plantings: 290,000 acres of silvopasture by 2030 and 22,100 acres of riparian forest buffers, plus 380,000 acres of hedgerows and windbreaks by 2040.²⁴

CDFA's new Pollinator Habitat Program²⁵ provides resources to farmers interested in adding hedgerows, agroforestry, and other conservation plantings to their operations. This program could be expanded to develop a workforce capable of greatly scaling up conservation plantings on farms and ranches across the state. Providing skilled professionals to plant appropriate species and maintain them for the first few years as they get established would likely increase farmer willingness to participate and would increase the success of the plantings and protect the state's investments in this climate solution. This program could be connected to or modeled on the California Conservation Corps that provides workforce training for on-farm conservation and could partner with Resource Conservation Districts and Point Blue Conservation Science.



Sheep used to remove mature cover crops and add manure for soil fertility in a new orchard.

²² There is good research on these issues that can be reviewed with stakeholders, including a recent Central Coast study on agriculture's adoption of biodiversity strategies: Esquivel, K. E., et al. (2021) [The "sweet spot" in the middle: Why do mid-scale farms adopt diversification practices at higher rates?](#) *Front. Sustain. Food Syst.*, 5.

²³ CDFA Belowground Biodiversity Advisory Committee. (2023). [Soil biodiversity in California agriculture: Framework and indicators for soil health assessment.](#)

²⁴ See this [CalCAN blog](#) for more details on these targets and their rationale.

²⁵ CDFA. [Pollinator Habitat Program.](#)



DAIRY MANURE MANAGEMENT: MOVING FROM WASTE PROBLEM TO CLIMATE SOLUTION

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Scale Up AMMP Funding
- Develop Guardrails for Incentivizing Feed Additives
- Catalyze Innovations in Regional-Scale Manure Composting Infrastructure

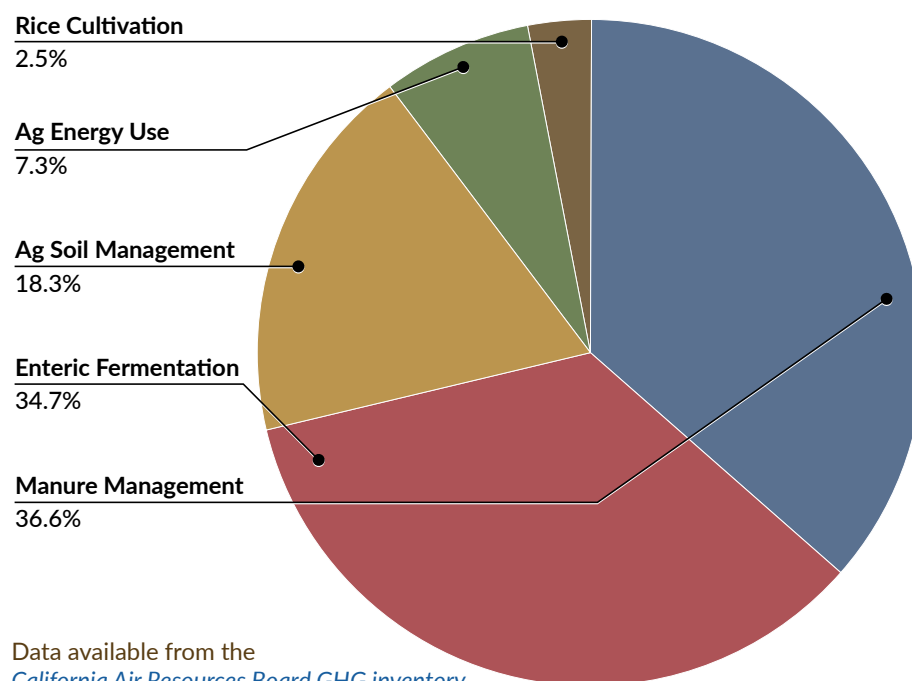
AUTHOR: Renata Brillinger



INTRODUCTION

California's dairy operations are responsible for approximately 45 percent of the state's methane emissions (other livestock operations contribute an additional 10 percent),²⁶ and 80 percent of the state's agricultural methane is emitted on dairies.²⁷ Approximately equal amounts of methane come from the anaerobic decomposition of liquid manure and from enteric fermentation (gaseous emissions from the cows themselves). In 2016, Governor Brown signed SB 1383 (Lara) which includes a statewide target for reducing methane from dairy and livestock operations to 40 percent below 2013 levels by 2030.

2020 CA Agriculture Emissions by Source (CARB GHG Inventory)



This law spurred state investments totaling more than \$290 million in two voluntary incentive programs to cut methane emissions generated from manure. The California Department of Food and Agriculture (CDFA) launched the Dairy Digester Research and Development Program (DDRDP) in 2015 and has granted more than \$200 million for

²⁶ California Air Resources Board. [GHG short-lived climate pollutant inventory](#).

²⁷ Legislative Analyst's Office. (2021). [Assessing California's climate policies—agriculture](#).

anaerobic dairy digester projects to capture methane from manure flushed from barns into lagoons and refine it for bio-energy or biofuel. Hundreds of millions more have been spent on biogas infrastructure to deliver and process the methane in refineries.

Then in 2017, CDFA started the Alternative Manure Management Program (AMMP) with grants to fund equipment that supports management of manure in a dry form, including separation of manure solids from liquids and production of valuable compost. In 2023, a U.S. Department of Agriculture (USDA) grant launched the Dairy PLUS Program at CDFA for projects that reduce both methane emissions and nutrient surplus associated with manure management.²⁸ Finally, CDFA is funding research into potential feed additives to reduce methane emissions from enteric fermentation,²⁹ and in the 2023 –24 fiscal year budget, \$20 million was allotted to incentivize the use of these products.



Photo Credit: Joseph Camozzi Dairy

To evaluate progress made toward achieving the SB 1383 targets, the California Air Resources Board released a report in March 2022 that projected that the industry will get about halfway to the 2030 target of a reduction of 9 MMTCO₂e, assuming no additional funding beyond FY 2020 –21.³⁰ They concluded that to achieve the target, the dairy and other livestock sectors need to reduce annual methane emissions by another 4.4 MMTCO₂e using new projects and programs.

CalCAN advocates for livestock methane reduction strategies that have multiple climate and other environmental benefits and work for small and medium-sized dairies³¹ that face mounting challenges to staying in business. With insights gained from interviews with dairy producers, industry experts, technical assistance providers, and advocates, we focus here on approaches that are practical, economical, and feasible for producers and that cycle manure waste into fertility products, decreasing groundwater nitrate contamination and air pollutants, and creating healthier conditions for farmworkers, communities, and livestock.

FINDINGS

Incentives Skew Toward Large Dairies and Are a Driver of Consolidation

About half of milk production in California occurs on dairies with 2,000 cows or fewer and half on dairies with larger numbers of cows.³² An economic analysis conducted by UC Davis predicts that over the next two decades, dairy herd sizes will increase and the number of farm businesses will decrease, especially dairies with fewer than 500 cows³³ (mainly pasture-based operations located on the North Coast). Most organic dairies in the Central Valley have gone out of business over the past decade as the price premium on organic milk has not kept pace with the higher cost of feed and land. Dairy producers tell us that they worry about their ability to stay in business, and they are watching the fabric of their communities change as more and more dairies close.

²⁸ CDFA's [Dairy PLUS Program](#) has \$85 million over five years.

²⁹ CDFA. (2022) [California livestock methane measurement, mitigation and thriving environments research program \(CLIM3ATE-RP\)](#).

³⁰ California Air Resources Board. (2022). [Analysis of progress toward achieving the 2030 dairy and livestock sector methane emissions target](#).

³¹ The average dairy herd size in California is approximately 1,200. Smaller herds of 500 or fewer are clustered on the North Coast and are mainly organic and grassfed. Medium-sized herds of 1,000 –2,500 and the 200+ largest herds with 2,500 to as many as 10,000 head are all located in the San Joaquin Valley. Source: Sumner, D. A. (2020). [California dairy: Resilience in a challenging environment](#).

³² Kaffka, S., et al. (2022). [Manure nutrient recovery, removal, and reuse on California dairies](#). California Biomass Collaborative.

³³ Sumner, D. A. (2020). [California dairy: Resilience in a challenging environment](#).



Funding Sources: Alternative Manure Management Versus Anaerobic Digester

Alternative Manure Management:

- CDFA's AMMP program: **\$88.4 million to date**



Garry Mahrt at Gillian's Dairy aerating manure in his compost pack barn, an eligible practice for AMMP funding.

Anaerobic Digesters:

- CDFA's DDRDP: **\$203.7 million to date**
- California's Cap-and-Trade Carbon Market: approximately **\$28.5 million in 2019**
- Low-Carbon Fuel Standard (LCFS) Credits
- USDA Environmental Quality Incentive Program (EQIP)
- USDA Rural Energy for America Program (REAP) grants and loans
- Electric Program Investment Charge, California Energy Commission
- Pipeline infrastructure for clusters of dairies with digesters: California Public Utilities Commission; Aliso Canyon natural gas leak legal settlement
- Other federal grants and loans, including Conservation Loan Program; Biorefinery, Renewable Chemical, and Biobased Product Manufacturing Assistance Program; Bioenergy Program for Advanced Biofuels; Biomass Research and Development Program; Biodiesel Fuel Education Program; and Carbon Utilization and Biogas Education Program

There are many sources of incentives for anaerobic digesters used by dairies with large herd sizes. In contrast, medium and small dairies have only California's AMMP grants to incentivize dry manure management techniques. Concerns About the Environmental Impact of Digesters Consolidating dairies also concentrates waste, related air quality impacts (from ammonia, particulate matter, and nitrous oxide), and nitrates that contaminate groundwater. Critics of the environmental impacts of large dairies see public subsidies for digesters driving the expansion of dairies, providing them with multiple revenue streams for producing more manure and more methane. Most of California's large conventional confinement dairies are in the San Joaquin Valley, concentrating environmental harms in poor rural and socially disadvantaged communities.

In particular, the method for calculating the carbon intensity of the Low Carbon Fuel Standard (LCFS) credit for biogas produced in anaerobic digesters is coming under scrutiny for its potential to exacerbate harm in environmentally burdened communities. Also, given the enormous amount of public funds invested in anaerobic digesters, it is also important to have a clear evaluation of the volume of methane that leaks from these systems and the amount of methane generated from the solids left after methane digestion (called digestate). One study reports that digestate accounts for more methane emissions per tonne than the original manure.³⁴ Another study noted the high degree of variability in research on methane emissions and found emissions 60 percent higher than those reported by CARB.³⁵

³⁴ Bakkaloglu, S., et al. (2022). [Methane emissions along biomethane and biogas supply chains are underestimated](#). *One Earth*, 5(6).

³⁵ Vecchi, N. T., et al. (2023). [Ammonia and methane emissions from dairy concentrated animal feeding operations in California, using mobile optical remote sensing](#). *Atmospheric Environment*, 293(15).



Dairy Producers Are Interested in Modernized Manure Management Systems

The AMMP program has been oversubscribed by two to three times the available funds since it began in 2017. It provides grants to install equipment that manages manure with dry scrape systems, solid separation, compost pack barns, or increased pasture time. These techniques reduce the amount of manure stored anaerobically and dramatically reduce methane emissions by as much as 90 percent.³⁶ However, AMMP has been plagued by inconsistent and highly variable state support, making it difficult for producers to plan for and prepare time-consuming grant applications and assess their chances of getting funded.

Alternative Manure Management Program Demand (\$ millions)



We consistently hear from small and medium-sized dairy producers that AMMP grants, besides reducing a potent greenhouse gas, also enable them to invest in capital improvements in their operations that they otherwise could not afford given their tenuous economics. Some producers use the composted manure solids for bedding, displacing the need to purchase bedding material and reducing greenhouse gases (GHGs) associated with bedding transport. Other farmers apply it to hay fields or orchards instead of fossil fuel-based fertilizer, which can save money and cut GHG emissions.

Interest and Concern About Enteric Fermentation Feed Additives

We heard a combination of interest and caution about feed additives such as seaweed to reduce enteric emissions of methane. While recognizing that there is potential, one interviewee told us that “feed is the most expensive line item on dairy ledgers, and adding to it is going to be a hard sell.” As one small dairy farmer pointed out, the economies of scale often set up disadvantages for small operations, possibly skewing incentives once again in favor of large concentrated dairies. An organic producer wondered about how it might affect their organic certification or consumer perceptions. Research is needed to address grower concerns about palatability and the effect on the taste of the milk, as well as on the net cost increase of feed additives. Finally, a thorough environmental life cycle assessment of using additives is needed. We have heard general concern that the policy is getting ahead of the science and that farmers need to have access to reliable science and be at the table in policy debates.

³⁶ Owen, J., & Silver, W. (2014). [Greenhouse gas emissions from dairy manure management: A review of field-based studies](#). *Global Change Biology*, 21(2).



Multiple Benefits of Turning Waste Into Resources

By design, CARB's approach to reducing methane emissions on livestock operations is very narrow. The GHG calculator used for AMMP projects does not account for improved soil health and the potential carbon sequestration and water use efficiency that can come from compost applications. It also does not include potential nitrous oxide reductions associated with avoiding the application of liquid manure to crops or pasture, nor the substitution of composted manure for synthetic forms of nitrogen on California croplands and pastures.

We heard about the importance of facilitating and incentivizing the composting of manure and other agricultural waste. A recent report of CDFA's Manure Recycling and Innovative Products Task Force³⁷ found that solar drying of separated solids is a key strategy for achieving whole-farm nutrient balance on dairies. However, nitrous oxide emissions may increase, so the impact on net GHG emissions should be evaluated.³⁸ Composting manure solids reduces methane emissions that could otherwise result from storing liquid or solid manure in anaerobic conditions. It can also reduce the leaching of nitrates into groundwater that can occur when dairies produce more manure or digestate than they can safely distribute on their land mass. Furthermore, compost applications can also improve soil health and thereby increase carbon sequestration and mitigate flooding and drought by improving the water-holding capacity of soils.

The State Water Resources Control Board recently clarified that dairies with Regional Water Quality Control permits that include manure management requirements can compost under their existing Regional Board permits and are not required to obtain a separate composting permit nor adhere to the feedstock import and compost export limitations of separate composting permits.³⁹ This clarification helped ensure compost remains a viable option for dairies to export their surplus manure to reduce nitrate leaching to groundwater and meet their existing permit requirements.



Manure solid separator funded by AMMP at Beretta Dairy in Sonoma County.

A 2022 study found that methane emissions from manure can be further reduced by 60 to 84 percent by adding biochar, and estimated that the SB 1383 target could be met with 132 fewer digesters than CARB projects are needed.⁴⁰ Compost augmented with biochar can improve soil nitrogen retention and plant productivity and therefore can improve air quality and water quality. The biochar could be produced through pyrolysis from the Central Valley's abundant amounts of almond shell and hull waste, removed trees, and other woody agricultural waste that would otherwise be burned in open piles.

Several interviewees for both this solution chapter and [Reducing Farmer Dependence on Fossil Fuel-Based Pesticides and Fertilizers](#) noted the opportunities available by taking a holistic approach to closing the agricultural waste cycle. One interviewee remarked that “creating some sort of innovation engine to deal with waste cycling that isn't necessarily commodity-specific is one role that governments can play to organize and fund solutions at a regional scale.”

³⁷ Manure Recycling and Innovative Products Task Force. (2022). [Final report to CDFA](#).

³⁸ U.S. EPA. [Practices to reduce methane emissions from livestock manure management](#).

³⁹ CDFA's [On-Farm Compost Regulatory Overview](#) states: “Dairy sites issued an individual permit or enrolled in a general order that includes requirements for manure management can accept agricultural material from offsite and can compost and give away or sell as much finished compost as desired.”

⁴⁰ Harrison, B. P., et al. (2022). [Dairy manure co-composting with wood biochar plays a critical role in meeting global methane goals](#). *Environ. Sci. Technol.*, 56(15).



RECOMMENDATIONS

Scale Up AMMP Funding

To meet dairy producer demand, we recommend an average annual investment of \$50 million for a total of \$350 million by 2030. Including dairies that already have AMMP projects installed, this would reach an estimated total of two-thirds of California's 1,100 dairies. Assuming a consistent level of reductions as those achieved to date, by 2030 methane emissions would be reduced by a total of 6.56 MMTCO₂e annually (73 percent of the SB 1383 methane reduction goal). We also recommend the creation of a new federal AMMP program to increase the reach of the program and to extend it to other dairy states across the country.

Develop Guardrails for Incentivizing Feed Additives

There is growing scientific and policymaker interest in feed additive products that may reduce methane emitted from enteric fermentation. Future policy, whether for carbon market protocol design, publicly funded grants, or regulations, should be informed by the following considerations:

- A complete life cycle assessment to evaluate the net greenhouse gas and environmental impact of growing, harvesting, and processing enteric fermentation feed additives
- An assessment of whether feed additives deliver co-benefits such as air and water quality improvements, reductions in ammonia and odor, and improved farmworker safety and well-being
- An evaluation of the economic feasibility and practical implications of purchasing and delivering the appropriate amounts of the feed additives to livestock, with particular concern for the operational challenges faced by small and medium-sized producers
- There should be no cost to small and medium-sized dairy operations, and they should accrue some of the market value of providing an ecosystem service
- No single product manufacturer should benefit from state funding and promotion of their products

Catalyze Innovations in Regional-Scale Manure Composting Infrastructure

Policies are needed to shift agricultural waste management in the dairy sector and other commodities from a narrow and siloed approach to a holistic, multi-beneficial approach. To the fullest extent possible, the use of manure and compost should be prioritized over synthetic nutrient sources, with a view to reducing synthetic fertilizer imports into the state. This can be done by building on the recommendations for compost strategies identified in the Manure Recycling and Innovative Products Task Force Final Report.⁴¹ A life cycle analysis is needed to evaluate the potential to replace synthetic fertilizers with compost or manure, taking into account the ecosystem benefits of on-farm compost use, including GHG emissions reductions, soil health improvements, water conservation, and water quality improvements. Investments are needed in pilot projects to establish cooperatives that manage agricultural waste in regional hubs, perhaps under the framework of the Resource Conservation Districts.



Manure solid separator funded by AMMP at Brindeiro & Danbom Dairy in Stanislaus County.

⁴¹ Manure Recycling and Innovative Product Task Force. (2022). [Final report to CDFA](#). See Section 5.2, Compost Strategies.



REDUCING FARMER DEPENDENCE ON FOSSIL FUEL-BASED PESTICIDES AND FERTILIZERS

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Expand the Pool of SPM Technical Assistance Providers
- Set a Higher Bar for Statewide Increase in Organic Transitions
- Fund Long-Term Research on Organic and Sustainable Pest Management Approaches
- Provide Funding and Multi-Stakeholder Processes to Implement the DPR Roadmap
- Tailor Pest and Fertilizer Regulations by Region, Farm Size, and Crop Diversity
- Increase Fertilizer Mill Fee to Fund R&D on Climate-Resilient Approaches to Soil Fertility

AUTHORS: Anna Larson,
Renata Brillinger



INTRODUCTION

Planning for and accelerating the transition away from fossil fuel-based pesticides and fertilizers must be a high priority in the transition to agricultural climate resilience. This transition needs to happen even as climate change leads to new pest, weed, and disease patterns and pressures, and it must be done while safeguarding our food supply and keeping family farmers in business.

Reducing fossil fuel-based agrochemical inputs (referred to in this report as fertilizers and pesticides) has a critical role to play in reducing greenhouse gas (GHG) emissions in the agriculture sector. Approximately 16 percent of California's agricultural GHG emissions come from fertilizers that metabolize to nitrous oxide, a GHG nearly 300 times more potent than carbon dioxide.⁴² It is also important to take into account the energy-intensiveness of producing fertilizers and pesticides from fossil fuels. It is estimated that pesticide manufacturing represents 6 to 16 percent of the energy required to produce crops.⁴³ The production of nitrogen fertilizer accounts for 1.2 percent of global energy demand.⁴⁴

Additionally, the over-application of fertilizers can have a negative impact on soil health⁴⁵ and can significantly reduce soil organic matter and inhibit soil carbon sequestration.⁴⁶ Pesticides also can harm beneficial soil microorganisms and have detrimental impacts on soil ecosystems,

16%

of California's agricultural
GHG emissions come
from fertilizers

6-16%

of the energy required to
produce crops comes from
pesticide manufacturing

1.2%

of global energy demand
comes from the production
of nitrogen fertilizer

⁴² Legislative Analyst's Office. (2021). [Assessing California's climate policies—agriculture.](#)

⁴³ Audsley, E., et al. (2009). [Estimation of the greenhouse gas emissions from agricultural pesticide manufacture and use.](#)

⁴⁴ Ahlgren, S., et al. (2008). [Ammonium nitrate fertiliser production based on biomass—environmental effects from a life cycle perspective.](#) *Bioresources Technology*, 99(17).

⁴⁵ Ozlu, E., & Kumar, S. (2018). [Response of soil organic carbon, pH, electrical conductivity, and water stable aggregates to long-term annual manure and inorganic fertilizer.](#) *Soil Science Society of America Journal*, 82(5). 1243–51.

⁴⁶ Khan, S. A., et al. (2007). [The myth of nitrogen fertilization for soil carbon sequestration.](#) *Journal of Environmental Quality*, 36(6). 1821–32.

which decreases the amount of carbon the soil can store.^{47,48} Conversely, it has been shown that organic farms have higher stable soil organic matter compared to conventional systems;⁴⁹ and practices such as compost, cover cropping, crop rotations, and increasing biodiversity to create habitat for natural pest predators can enhance soil carbon sequestration.

Not only do over-applying fertilizers and using toxic pesticides contribute to climate change, but there are also numerous well-documented environmental and human health hazards, including leaching of nitrates into groundwater, which contaminates drinking water.⁵⁰ These harms are often concentrated in agricultural regions that are home to low-income communities of color, resulting in exposure to some of the worst air and water quality in the country.

FINDINGS

Site-Specific Pest and Fertility Management Are Essential

A climate-resilient approach to farm management views farms as ecosystems and seeks to promote biodiversity, soil health, and plant health as part of one integrated system. These management approaches often include practices such as cover cropping, composting, creating habitat for birds and predatory beneficial insects, minimized disturbance to the soil, and integration of livestock into cropping systems. These practices can support a healthy farm ecosystem, increasing plant resilience and creating an environment less conducive to pests and weeds. The best management approaches depend on local farm factors such as crop type, soil composition, and climate, which vary widely across the state.

Risk Aversion, Cost, Product Availability, and Regulations Drive Fertilizer Use

Farmer decision-making regarding fertilizer use is influenced by a suite of factors that include perceived or real yield impacts, risk aversion, up-front costs, product availability, and regulatory requirements. Farmers sometimes use fertilizer applications as a safety net to ensure high productivity, resulting in over-application. A report by the Central Coast Water Board found that most farms reported their fertilizer use exceeded the application rate recommended by UC Cooperative Extension, many by two to three times.⁵¹ Furthermore, they found that most farmers do not account for the nitrogen already in irrigation water—which can be substantial—when determining how much fertilizer to use. However, farmers become more receptive to using alternatives when fertilizer prices spike, particularly the alternatives that can be reliably sourced and have fewer price fluctuations.

Food safety regulations can be a barrier to adopting alternative fertility management strategies such as compost and livestock integration and can discourage ways to increase biodiversity with hedgerows and other conservation plantings that create wildlife habitat. A study of growers in the Central Coast found that food safety regulations “frequently characterized biodiversity as a liability rather than an asset, particularly in the wake of more stringent food safety audits” and discouraged or prohibited farmers from using compost and hedgerows.⁵² Almond farmers have similarly reported food safety regulations severely limiting the window of time in winter and spring when they can bring in sheep to graze their orchard floors.

⁴⁷ Seghers, D., et al. (2003). [Effect of long-term herbicide applications on the bacterial community structure and function in an agricultural soil](#). *FEMS Microbiology Ecology*, 46(2). 139–46.

⁴⁸ Gunstone, T., et al. (2021). [Pesticides and soil invertebrates: A hazard assessment](#). *Front. Environ. Sci.*, 9.

⁴⁹ Paustian, K., et al., (2016). [Climate-smart soils](#). *Nature*, 532. 49–57

⁵⁰ For more on this subject: [Pesticides and Climate Change: A Vicious Cycle](#).

⁵¹ From a 2015 presentation to the Fertilizer Research and Education Program technical advisory committee by Chris Rose, Irrigated Lands Regulatory Program of the Central Coast Water Board.

⁵² Esquivel, K.E., et al. (2021). [The “sweet spot” in the middle: Why do mid-scale farms adopt diversification practices at higher rates?](#) *Front. Sustain. Food Syst.*, 5.



Regulatory efforts to reduce and track fertilizer over-application and pollution are needed, but they must be adapted to meet the needs of small-scale, diversified, organic, and/or socially disadvantaged farmers. The Irrigated Lands Regulatory Program (ILRP) is intended to prevent nitrate leaching from fertilizers into surface water and groundwater by educating producers and requiring them to produce nutrient management plans and reports. However, for farmers with diverse crop systems, the reporting can be unduly complex and time-consuming. Also, there is insufficient technical assistance available for diversified, small-scale, and organic farmers and for socially disadvantaged farmers who may have language and technology barriers. Finally, the regulations are not well-suited to organic farmers or others who use biological alternatives that cause much less nitrate leaching than conventional fertilizers.

In recent years, the Fertilizer Research and Education Program (FREP) at the California Department of Food and Agriculture (CDFA) has been funded with a fee on fertilizers, and it can play a valuable role in reducing farmer reliance on fertilizers. Encouragingly, in the last several years it has broadened its original narrow focus on funding research on nitrogen fertilizer use efficiency to also funding technical assistance and including soil health as one eligible funding area. With new expertise on the FREP technical advisory committee, more could be done to deliver needed resources for farmers ready to transition to alternative nutrient management systems.

Farmers Need Support to Reduce or Eliminate Agrochemical Use

Three important alternatives to fossil fuel-based fertilizers are compost, cover crops (plants such as clovers, legumes, and ryegrass that provide soil nutrients), and integrated crop and livestock systems. The [Enhancing Soil Health & Biodiversity for On-Farm Climate Resilience](#) section of this report summarizes the many co-benefits of these practices for farmers and the environment.

Transitioning to alternative sources of fertility involves risks for conventional producers who may have relied on fertilizers for the past six or seven decades. These barriers can include the need to make infrastructure investments; little access to information and advice on alternative approaches; and small profit margins that leave little room for experimentation and learning. Additionally, while organic forms of fertility tend to provide benefits such as less nitrate leaching and nitrous oxide emissions, they can be harder for farmers to manage because the nutrients are released slowly and sometimes at unpredictable rates, introducing risk of yield drops. Finding reliable supplies of cover crop seed can be challenging—one interviewee recalled a recent heat wave in Oregon that wiped out an entire variety of cover crop seed, leaving only one supplier who was unable to meet the demand. It can also be a challenge to meet the demand for high-quality and affordable compost, whether it is produced from manure or urban waste, that doesn't have to be transported long distances.

Farmers stressed that if regulations remove tools, there also needs to be support to transition to alternatives. Many of our interviewees pointed to the clear need for demonstration projects and technical assistance to support growers in changing their management approaches and mitigating the financial risk or potential short-term economic losses associated with transitioning. Examples include the Biologically Integrated Farming Systems Program⁵³ and the new Pollinator Habitat Program.⁵⁴

Organic agriculture is an effective and reliable strategy to eliminate agrochemical use while receiving a price premium, but many producers face barriers to transitioning. Farmers need technical assistance to learn new management approaches and navigate organic regulatory requirements, and some growers need financial assistance to help de-risk the three-year transition process.

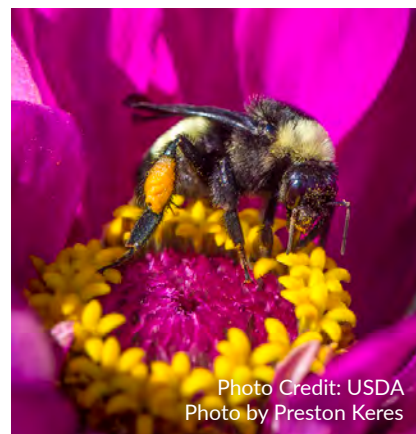


Photo Credit: USDA
Photo by Preston Keres

⁵³ Funded by a grant from CDFA, the [Biologically Integrated Farming Systems Program](#) is run by the University of California Agriculture and Natural Resources' Sustainable Agriculture Research and Education Program.

⁵⁴ CDFA's [Pollinator Habitat Program](#) awarded its first \$15 million in grants in 2022.





Organic agriculture is the only federally backed certification standard, and it does not allow growers to use synthetic pesticides or fertilizers on organic acreage. Rather, organic producers approach pest, disease, and weed management by looking at the farm as an agro-ecosystem. Many of the approaches used in organic and climate-resilient food production are techniques developed by indigenous farmers and farmers of color over long periods of time in relationship with land.⁵⁵ Likewise, most California farmworkers come from agrarian backgrounds and have extensive knowledge rooted in their relationship with land that can provide key insights into growing food without reliance on agrochemicals.

While organic agriculture encompasses a diverse set of approaches to farming, on average organic farms sequester more carbon and are associated with better soil health than conventional farms.^{56,57} California has outlined a goal in its 2022 Scoping Plan Update to certify 20 percent of California's acreage organic by 2045.

California's Sustainable Pest Management Roadmap Shows Promise

In January 2023, informed by two years of in-depth multi-stakeholder consultation and dialogue, the California Department of Pesticide Regulation (DPR), CDFA, and CalEPA released *Accelerating Sustainable Pest Management: A Roadmap for California*, which outlines many elements needed for a transition away from high-risk pesticides toward adoption of safer, more sustainable pest control practices.⁵⁸ The *Roadmap* sets a 2050 goal of eliminating the use of "priority pesticides"⁵⁹ by transitioning to sustainable pest management (SPM) practices. It calls on the state to, by 2025, develop a plan, funding mechanisms, and programs to prioritize pesticides for reduction and to transition away from the use of high-risk insecticides, fungicides, and herbicides.

Several interviewees noted that the DPR-led *Roadmap* is an important coalescing of key agriculture stakeholders around a common vision of sustainable pest management. This planning process brought together growers, commodity groups, agency staff, environmental justice advocates, and technical assistance providers to lay out an ambitious vision grounded in the need to transition from fossil fuel-based pesticides. Importantly, the *Roadmap* takes a systems-based view to sustainable pest management that considers community impacts, equity, broader environmental impacts such as soil health and climate impacts, and a broader consideration of economic benefits and impacts.⁶⁰ Resources will be needed to implement the *Roadmap* in order for DPR to continue coordinating state-level leadership.

⁵⁵ Carlisle, L. (2022). [Healing Grounds](#).

⁵⁶ Rodale Institute. [Farming systems trial](#).

⁵⁷ Merrigan, K., et al. (2022) [Grow organic: The climate, health, and economic case for expanding organic agriculture](#). NRDC.

⁵⁸ As defined in the [DPR Roadmap](#): "Sustainable Pest Management (SPM) is a holistic, whole-system approach applicable in agricultural and other managed ecosystems and urban and rural communities that builds on the concept of integrated pest management (IPM) to include the wider context of the three sustainability pillars: human health and social equity; and, environmental protections; economic vitality."

⁵⁹ The criteria for classifying pesticides as "Priority Pesticides" includes, but is not limited to, hazard and risk classifications, availability of effective alternative products or practices, and special consideration of pest management situations that potentially cause severe or widespread adverse impacts. The identification of these Priority Pesticides will be conducted by DPR under advisement of the multi-stakeholder Sustainable Pest Management Priorities Advisory Committee.

⁶⁰ California Department of Pesticide Regulation. [Accelerating sustainable pest management: A roadmap for California](#), p. 6.



RECOMMENDATIONS

Expand the Pool of SPM Technical Assistance Providers

Adopting new management approaches requires learning new farming techniques. One critical way to mitigate the risk for farmers in making the transition to climate resilience is to increase the availability of technical assistance providers trained in SPM and alternative nutrient management. A high priority when implementing the DPR *Roadmap* should be to establish a new Pest Control Advisor (PCA) credential for sustainable pest management and require all PCAs to receive baseline training in SPM.⁶¹ Since many PCAs derive their income in part from sales of agrochemical products, the state should consider subsidizing independent PCAs. Technical assistance providers with language and cultural literacy need to be recruited and trained to ensure that state resources are accessible to all farmers, particularly to farmers of color and underserved farmers. Resources are needed to provide technical assistance and access to land for farmworkers seeking to start farm operations, such as the services provided by the Agriculture and Land-Based Training Association.

Set a Higher Bar for Statewide Increase in Organic Transitions

Transitioning to organic production, a federally backed and enforced label, is the most clearly defined and verifiable strategy to farm without fossil fuel-based inputs. The state has set a goal of reaching 20 percent organic acreage by 2045, which is not sufficiently ambitious considering the high and increasing demand for organic products and the number of farmers seeking to transition to organic who face financial and knowledge barriers. This target also undervalues the effectiveness of organic as a strategy for sustainable pest management. With sufficient technical assistance (TA) and financial assistance from both state and federal programs⁶² to support farmers transitioning to organic, California can reach 40 percent 2045.⁶³

Fund Long-Term Research on Organic and Sustainable Pest Management Approaches

As was identified in the DPR *Roadmap*,⁶⁴ more research is needed into alternative pest management techniques and tools such as insect mating disruption and automated traps, but also climate-resilient approaches that manage the farm as an ecosystem. Over the past several decades, funding for biological control research has declined dramatically, and the state has very few researchers that focus on organic farming methods. To support research for alternatives, we recommend the following:

- Funding UC Cooperative Extension to hire five career track, permanent positions for organic specialists to serve across the state
- Increasing support for research and demonstration projects, such as the Alliance Grants Program⁶⁵ and Biologically Integrated Farming Systems (BIFS),⁶⁶ that support farmers' transition away from synthetic pesticides and fertilizers
- Funding participatory research that involves organic and diversified farmers, farmers of color, and indigenous and Tribal producers in positions of leadership

⁶¹ Ibid. p. 46-47

⁶² USDA launched a new [Organic Transition Initiative](#) in 2022 with \$300 million in funding.

⁶³ This target was included in recommendations made by CalCAN and a coalition of advocates to the California Natural Resources Agency in response to its call for public comment on target setting as required by AB 1757. See this [CalCAN blog](#) for more details.

⁶⁴ California Department of Pesticide Regulation. [Accelerating sustainable pest management: A roadmap for California](#). p. 27, 42.

⁶⁵ See more on the Alliance Grants Program [here](#).

⁶⁶ See more on the BIFS program [here](#).



Provide Funding and Multi-Stakeholder Processes to Implement the DPR Roadmap

To address the challenges discussed above regarding DPR's funding sources, we recommend that the state consider other funding sources to support the agency. One option is to increase the pesticide mill fee, which could include higher fees for more hazardous pesticides. The legislature funded a study released in 2022 that examined this possibility and recommended rate options.⁶⁷

We also recommend that DPR institutionalize the multi-stakeholder working group that guided the *Roadmap* process to guide its implementation.

Tailor Pest and Fertilizer Regulations by Region, Farm Size, and Crop Diversity

The Irrigated Lands Regulatory Program (ILRP) is a powerful tool for reducing nitrate leaching. To ensure that the program meets the needs of diversified, small-scale farmers using alternative fertility approaches, the State Water Resources Control Board should look to the Central Coast's regionally tailored approach. The Central Coast accounts for the use of non-legume cover crops during the winter, as they scavenge nitrogen and prevent it from leaching into groundwater.⁶⁸ Regional tailoring to local conditions and crops should be made in coordination with partner agencies like CDFA and UC Agriculture and Natural Resources (UCANR) and with grower consultation. In addition, more technical assistance is needed to support diversified, small-scale, organic, and socially disadvantaged farmers with ILRP compliance.

In May 2023, CDFA kicked off a two-year public process to evaluate food safety and water quality regulatory reporting requirements as part of an effort to improve administrative processes.⁶⁹ This process should prioritize addressing barriers to healthy soils practices like compost use, cover cropping, and hedgerows.

Increase Fertilizer Mill Fee to Fund R&D on Climate-Resilient Approaches to Soil Fertility

A refrain during our interviews was that, in order to achieve climate resilience, it will be critical for farmers to have effective, affordable, and available alternatives to fossil fuel-based fertilizers. UCANR should add more extension research positions to refine our scientific understanding of biological alternatives to fertilizers. FREP can contribute to this effort by expanding their resources for research and technical assistance on compost, cover crops, and other soil-building nutrient management strategies. An increase in the fertilizer mill fee (currently \$0.001 per dollar of fertilizer sales) could be dedicated to this purpose.



Photo Credit: Anna Buss

Farmer Al Courchesne, of Frog Hollow Farm stands next to his compost pile.

⁶⁷ Department of Pesticide Regulation. (2023). [Mill assessment study: Preliminary recommendations and implementation plan](#).

⁶⁸ Technical background available in a [video produced by Dr. Eric Brennan](#) from the USDA Agricultural Research Service explaining this model approved under Ag Order 4.0 for the Central Coast Regional Water Quality Control Board.

⁶⁹ CDFA. (2023, May 2). [CDFA announces new study to explore opportunities to streamline regulatory processes for agriculture](#) [Press release].



HARVESTING THE SUN: ADVANCING ON-FARM SOLAR DEPLOYMENT

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Promote a Least-Conflict Process for On-Farm Solar Siting
- Set Up a California Clearinghouse for On-Farm Renewable Energy Generation
- Ramp Up the State's Role in Accelerating Agrivoltaics Deployment

AUTHOR: Renata Brillinger



INTRODUCTION

Here we examine opportunities for scaling up on-farm distributed solar energy projects (either traditional solar panels or agrivoltaics co-located with crop and livestock production). We also take stock of the development pressures created by utility-scale solar and explore guardrails needed to limit negative impacts on food production and farm profitability.

Farmers and ranchers who install solar arrays can save money by offsetting their energy costs while also contributing to a clean energy future. Many in California do, producing more renewable energy than their counterparts in any other state in the country. The U.S. Department of Agriculture (USDA) Census of Agriculture shows that the number of Californian farms with solar installations almost tripled between the 2012 and 2017 census. In 2017, almost 14,000 farms in California made up 15 percent of the country's on-farm solar projects.⁷⁰ While the results of the 2022 census are not yet available, it seems likely that this upward trend has continued and, given the investments the Biden Administration is making in renewable energy, could accelerate dramatically in the coming years.

While there are many advantages to small-scale distributed solar on agricultural land, it should be noted that utility-scale solar deployment, if not sited carefully, can present a threat to the conservation of farmland needed to produce food. Farmland and rangeland is attractive to solar developers because it tends to be flat, with good exposure to sun, and relatively cheap to develop. A recent study by the U.S. Department of Energy⁷¹ found that achieving a carbon-free energy supply by 2050 will require the deployment of solar on 10 million acres of land across the country. A report by the Public Policy Institute of California⁷² found the following:

83%

**of new solar generation built by 2040
would likely be sited on agricultural acreage**

⁷⁰ USDA National Agricultural Statistics Service. [2017 Census of agriculture.](#)

⁷¹ Office of Energy Efficiency & Renewable Energy. [Solar futures study.](#) U.S. Department of Energy.

⁷² Public Policy Institute of California. (2022). [Solar energy and groundwater in the San Joaquin Valley.](#)

As of 2019, there were about 20 gigawatts (GW) of installed solar capacity (including utility-scale and distributed generation) throughout the state, with about 3 GW of that located in the San Joaquin Valley—in both cases, roughly half of this capacity was installed in the last five years. Capacity is expected to increase rapidly in the coming decades, and eventually exceed 70 GW if California reaches its 2045 renewable energy goals (California Energy Commission 2021), with potential for 100 GW or more, depending on the extent of electrification in the rest of the economy.

Concerned about how this would impact farmland and food production, the American Farmland Trust (AFT) produced an analysis estimating that 83 percent of new solar generation built by 2040 would likely be sited on agricultural acreage.⁷³ They sum up the concern as follows: “This growth will create opportunities, but it also threatens farmland. America needs both—renewable energy and productive, resilient farms and ranches.”

Projected build-out of solar energy resources to achieve SB 100 goals

Senate Bill 100 (De León, 2018) sets a 2045 goal of powering all retail and state agency electricity sold in California with renewable and zero-carbon resources.

We interviewed thought leaders about on-farm solar development, seeking their input on how to achieve an appropriate balance between the three goals that AFT identifies in its “Smart Solar”⁷⁴ framework: (1) accelerating solar energy development, (2) strengthening farm viability, and (3) safeguarding land well-suited for farming and ranching. We offer recommendations for accelerating farm-scale distributed solar and agrivoltaics projects as well as guardrails for utility-scale projects.

FINDINGS

Solar Development Pressure Could Accelerate the Loss of Valuable Farmland

As noted in the section [Protecting Farmland Using Integrated Land Use Planning](#), for many years California has been losing farmland to various types of development at a rate of approximately 50,000 acres per year. With the average age of farmers continuing to rise, those looking to retire may be tempted to sell to solar developers who can outbid other farmers trying to rent or buy land.

This is of particular concern for young farmers, as Holly Rippon-Butler, land campaign director for the National Young Farmers Coalition, pointed out in a recent media story:⁷⁵ “Land access is the No. 1 challenge [beginning farmers] are facing, and this challenge is even greater for farmers of color. Are we really understanding what we trade off when we put solar panels on farmland?” Others point out that losing farmland has an impact on rural economies and jobs. Farmworkers are already vulnerable when land is taken out of production due to flooding, wildfires, or fallowing caused by drought or restrictions on groundwater use due to Sustainable Groundwater Management Act (SGMA) regulation. Displacement due to utility-scale solar development creates a permanent loss of farmworker jobs.

Appropriate Siting of Large Solar Is the Key

AFT has developed guiding principles to help shape solar development and protect our most productive agricultural land.⁷⁶ They state that solar siting should be prioritized on buildings, contaminated land, and on land not suited for agriculture. Irrigation canals present an interesting opportunity, and recent research on solar installations over irrigation canals found that they reduce evaporation, enhance photovoltaic performance due to the cooler microclimate next to the canal, and mitigate aquatic weed growth, all of which helps to

⁷² Public Policy Institute of California. (2022). [Solar energy and groundwater in the San Joaquin Valley](#).

⁷³ American Farmland Trust. [Farms under threat 2040](#).

⁷⁴ American Farmland Trust. [Smart solar on farmland and rangeland](#).

⁷⁵ Marshall-Chalmers, A. (2023, April 12). [The rush for solar farms could make it harder for young farmers to access land](#). *Civil Eats*.



offset the additional cost of the cable-support structures required to span the canals.⁷⁷ The Turlock Irrigation District expects to complete California's first such project in 2024.

A second principle AFT puts forward is that policies and practices should protect soil health if solar is developed on farmland or rangeland, especially during construction and decommissioning, to enable the land to be farmed again after the typical 30-year lifespan of solar installations. Third, they aim to expand development of agrivoltaic projects—or the generation of solar energy and farm products on the same piece of land throughout the lifetime of the project. Finally, they state that farmers and underserved communities should benefit from solar energy development and that it is important that the siting and design of solar projects be determined based on “inclusive stakeholder engagement to ensure projects strengthen farm viability and reflect farmer interests, including underserved producers that face barriers to accessing land and other resources.”



Farm-Scale Solar Development Can Benefit Farmers and the Environment

Farms and ranches have many opportunities to install solar to meet their energy demands. Agricultural operations have many cost-effective solar siting opportunities, including houses, barns, equipment or packing sheds, on pumps for stock water and irrigation (both of which can be funded by California's SWEEP program), ground-mounted arrays that provide shade or can be located in under-utilized areas, and in some cases over ponds or compost windrows. Farmers can benefit from the Net Energy Metering Aggregation program⁷⁸ which makes it easier and cheaper to connect renewable energy projects to the grid and enables one solar installation to serve the aggregated load of multiple meters.



As electric cars, trucks, and tractors, like this one at Pie Ranch in Pescadero, become more available and affordable, farmers may find it profitable to convert to electric fleets and power employee vehicles.

One solar consultant we interviewed envisions integrating electric farm vehicles and charging stations into on-farm solar infrastructure. As electric cars, trucks, and tractors become more available and affordable and diesel fuel gets more expensive, it may prove profitable for farmers to convert to electric fleets and provide power for employee vehicles. Power purchase agreements negotiated with solar installers can remove some barriers for farmers to financing and accessing rebates. As battery storage (and eventually microgrid technology) becomes more affordable, farms and ranches are good candidates for these technologies to buffer them against power outages that can endanger livestock health and lead to food spoilage.

⁷⁶ American Farmland Trust. [Smart solar.](#)

⁷⁷ McKuin, B., et al. (2021). [Energy and water co-benefits from covering canals with solar panels.](#) *Nature Sustainability*, 4, 609–617.

⁷⁸ California's incumbent utilities offer net energy metering aggregation following passage of a 2014 bill that CalCAN sponsored ([SB 594](#), [Wolk](#)). More information from PG&E can be found [here](#).



Interest in Agrivoltaics Is Growing

There is a groundswell of interest and research in agrivoltaics technology that generates solar energy in a way that is compatible with crop or livestock production.⁷⁹ One approach is to graze animals beneath solar arrays where they control weeds and grasses, thereby eliminating the need to mow. Another approach is to mount specially designed solar panels over crops that allow the red wavelengths of the light spectrum that plants need to grow to penetrate through while filtering out the blue wavelengths that are most effective for generating energy.⁸⁰

The shade provided by solar panels can be beneficial for the people who grow our food, for cool season crops such as brassicas and lettuces, and potentially even for heat-tolerant species as climate change leads to more extreme heat days. The shade also reduces the amount of water that evaporates from soils and plants, and in turn plant evapotranspiration cools the panels and improves their efficiency.⁸¹ One researcher told us that water use efficiency is an important criterion for evaluating the impact of agrivoltaics on crop yield, particularly in water-scarce areas of the state. Frost protection may also be a benefit in some crops and seasons. More research is needed to better understand the optimal conditions for scaling up this technology, as well as pilot projects in partnership with farmers willing to experiment with it.

RECOMMENDATIONS

Promote a Least-Conflict Process for On-Farm Solar Siting

In 2016, then-Governor Jerry Brown's Office of Planning and Research (OPR) took part in a project called Solar and the San Joaquin Valley Identification of Least-Conflict Lands Project.⁸² The diverse stakeholders involved set out, in a relatively short six-month time frame, to come to mutual agreement on mapping lands that could be suitable for solar development.⁸³ The assumption was that the process would result in less litigation for projects on sites identified collectively and that it would provide more surety for developers and guide decisions about building new transmission infrastructure. While the experts we interviewed who were involved in the process agree that it successfully mapped optimal sites for solar, questions remain about how well it is informing actual project development.

OPR, the California Department of Food and Agriculture (CDFA), and the California Energy Commission (CEC) should build on the least-conflict approach in the San Joaquin Valley in several ways:

1. Evaluate the impact of the process on solar development projects in the San Joaquin Valley since completion of the project.
2. Develop a best practices guidebook for replicating the least-conflict process in counties, irrigation districts, and community choice aggregation entities. To set the table for a least-conflict approach, CDFA should develop guidelines for siting utility-scale solar projects to avoid negative impacts on agricultural land. Models to look to are those created by the Pennsylvania Department of Agriculture.⁸⁴
3. Create incentives to encourage solar on the agreed-upon sites (e.g., regulatory efficiency, permit consolidation, first in line for grants and loans, etc.).

⁷⁹ In June 2023, [S.1778](#) was introduced in Congress to advance research and demonstration of agrivoltaics.

⁸⁰ Camporese, M., & Najm, M. A. (2022). [Not all light spectra were created equal: Can we harvest light for optimum food-energy co-generation?](#) *Earth's Future*, 10(12).

⁸¹ USDA Climate Hubs. [Agrivoltaics: Coming soon to a farm near you?](#)

⁸² UC Berkeley Center for Law, Energy and the Environment. (2016). [A Path Forward: Identifying least-conflict solar PV development in California's San Joaquin Valley.](#)

⁸³ A process modeled on the California experience is underway in [a region of Washington state](#) to answer this question: "Where can utility-scale solar be developed in the Columbia Plateau region while also ensuring that important natural habitat, productive farmlands and ranchlands, and tribal rights and cultural resources are protected?"

⁸⁴ Pennsylvania Department of Agriculture. [Farmland considerations for siting grid-scale solar panels.](#)



Set Up a California Clearinghouse for On-Farm Renewable Energy Generation

We recommend that the California Energy Commission launch an agriculture-focused resource center to serve farmers and solar developers. One model is the AgriSolar Clearinghouse created by the National Center for Appropriate Technology.⁸⁵ Another is the Bay Area Regional Energy Network (BayREN), a network of nine counties formed to promote water and energy efficiency and funded by utility ratepayer funds through the California Public Utilities Commission.⁸⁶ The clearinghouse could offer a range of services such as the following:

- Farmer-focused educational materials and outreach events
- Listings of qualified consultants and advisors that offer free or discounted technical assistance to help farmers navigate their options for on-farm solar
- Directory of solar consultants and technical assistance providers vetted based on certain standards
- Solar project financing resources such as grants, rebates, on-bill financing, and cost-share programs at the state and federal level
- Easily accessible mapping tools that show the available capacity on existing grid infrastructure near their customers

Investor-owned utilities, municipal utility districts, community choice aggregators, and irrigation districts could also take the initiative to set up services like these to accelerate on-farm renewable energy deployment.

Ramp Up the State’s Role in Accelerating Agrivoltaics Deployment

There are several actions that various California agencies can take to accelerate the use of agrivoltaics.

CALIFORNIA ENERGY COMMISSION	Invest in more research on agrivoltaics and distributed solar generation on agricultural land, including better quantification of greenhouse gas (GHG) reductions and other co-benefits such as decreased evapotranspiration. The New York Power Authority ⁸⁷ produced a technical report that is one example of a statewide effort like this.
CALIFORNIA PUBLIC UTILITIES COMMISSION	Promulgate rulemaking to provide regulatory clarity and consistency for agrivoltaics permitting and development and set a target for agrivoltaic deployment.
DEPARTMENT OF CONSERVATION	Develop guidelines pertaining to the development of agrivoltaics projects on land under Williamson Act ⁸⁸ protection.

⁸⁵ See here for more on the AgriSolar Clearinghouse: <https://www.agrisolarclearinghouse.org/>

⁸⁶ See here for information on BayREN: <https://www.bayren.org/>

⁸⁷ New York Power Authority. (2023). [Agrivoltaic leading practices technical report.](#)

⁸⁸ The [Williamson Act Program](#) enables local governments to enter into contracts with private landowners for the purpose of protecting their agricultural use.



In addition, the legislature could look to models in other states and at the federal level for approaches to accelerating agrivoltaics and on-farm solar research and development while protecting working lands. Some examples include the following:

- U.S. Senate: Introduced in June 2023, the Agrivoltaics Research and Demonstration Act of 2023 (S. 1778, Heinrich and Braun) develops a regulatory definition of agrivoltaics and funds a study to identify gaps in agrivoltaics research and examine the risks and benefits, economic scalability, and best options for agricultural land for such systems. It also sets up a network of demonstration sites across the country to focus on increasing farm productivity, profitability, resilience, biodiversity, and economic opportunities in rural communities.
- Colorado (SB 23-092): Sets up a task force and funds agrivoltaics demonstration or research projects.
- Maine (LD 1227): Establishes a pilot to test and study best practices for "dual-use projects" combining solar development on agricultural lands.
- Massachusetts: Developed an Agriculture Solar Tariff to encourage on-farm solar development.

In 2023, the California legislature considered a bill (SB 688, Padilla⁸⁹) that would require the State Energy Resources Conservation and Development Commission to fund research and development in agrivoltaic systems and to work with CDFA to develop funding guidelines and criteria. The bill, which CalCAN supports, will be held over to 2024.



Photo Credit: Agrisolar Clearinghouse

⁸⁹ SB 688 text [here](#).

PROTECTING FARMLAND USING INTEGRATED LAND USE PLANNING

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Invest in Integrated Farmland Conservation and Infill Housing Development
- Set Ambitious Goals for Agricultural Land Protection and Require Local Smart Growth Policies
- Establish Requirements for Local Action on Farmland Conservation
- Set Up State Financing for Land Purchases for Beginning Farmers and Ranchers
- Create “Just Cause” Tenancy Termination Protections and Give Farmers the Right of First Refusal

AUTHOR: Sandra Nakagawa



INTRODUCTION

California is steadily losing some of its most productive agricultural land to development at an average rate of 40,000 acres per year. In the past 40 years, the Department of Conservation reports the loss of 1.6 million acres, about the size of Ventura County.⁹⁰ Their last farmland conversion report for the years 2016 to 2018 found that two-thirds of developed agricultural land during that time period was lost to housing, commercial, or industrial uses (most of it in Southern California) and a bit less than one-third was converted to solar facilities.

As summarized below, there are several pressures that are likely to exacerbate this trend in farmland conversion. Given the higher greenhouse gas (GHG) emissions associated with developed land (e.g., residential or commercial uses) relative to land used for agriculture,⁹¹ the land use policy choices the state of California and local governments make in the coming years will have implications for the state's climate goals. These choices will also impact access to agricultural land for current and future generations of farmers as well as flood and wildfire resilience due to the buffering effect farms and ranches play.

Many decades of unregulated groundwater pumping have led to an unsustainable expansion of irrigated cropland and critically overdrafted groundwater basins. In response, in 2014 the state passed the Sustainable Groundwater Management Act (SGMA)⁹² which is expected to lead to fallowing as much as 900,000 acres out of California's 9.5 million acres of irrigated cropland in the coming years as an effort is made to achieve groundwater sustainability.⁹³ Some of this land would likely have gone out of production in any event when it ran out of water, some of it may be converted to less intensive agricultural uses (e.g., rangeland and dry-farmed grains), some may be restored to wetlands and other wildlife habitat, and some could be developed into housing or large-scale solar. This underscores the critical importance of conserving the viable farmland that we do have left.

Another factor driving agricultural land loss is the demographics of today's producers. The average farmer in California is 59 years old, and as more farmers retire in the coming years, thousands of acres of agricultural land will change hands. Farmers who own their land often

⁹⁰ Department of Conservation. [2016-2018 Farmland conversion report](#).

⁹¹ A study looking at Yolo County (Jackson, L., et al., (2012). [Adaptation strategies for agricultural sustainability in Yolo County, California](#)) found that an acre of developed land emits 70 times as much greenhouse gas emissions as the same amount of irrigated crop land does.

⁹² [Sustainable Groundwater Management Act](#) background.

⁹³ Public Policy Institute of California. (2023). [Policy brief: The future of agriculture in the San Joaquin Valley](#).

need to sell it as part of their financial strategy for retirement. Even when there are other farmers interested in purchasing agricultural land, they may find it challenging to compete with more lucrative buyers such as solar developers, logistics warehouses such as those proliferating in the Inland Empire,⁹⁴ or hedge funds, pensions, and other wealthy investors who may not keep the land in agriculture if given more profitable options.⁹⁵

In terms of increased values for farming and ranching land, agricultural land prices in the state rose 10 percent between 2021 and 2022.⁹⁶ Nearly all new farmers—and particularly new farmers of color—are priced out of purchasing land for their operation and instead lease land without any certainty about whether they will be able to continue on the same land from one year to the next. In the absence of secure access to land through ownership or a multi-year lease, many farmers are unable to invest in sustainable, climate-resilient practices that can take multiple years to yield benefits. In recognition of the stark disparities in land access, California recently formed an Agricultural Land Equity Task Force at the Strategic Growth Council (SGC) which will develop recommendations on how to equitably increase access to agricultural land for food production and traditional Tribal agricultural uses by 2026.



Historically, farmers of color in California have not had equitable access to land and other resources necessary to conduct farming in the state, and that legacy of prejudice persists. Female farmers represent less than a quarter of all farmers in the state, and only 2 percent of California farmers are women of color On average, socially disadvantaged farmers and ranchers in California receive less in federal payments than their White counterparts and also earn less.

— Strategic Growth Council⁹⁷

Finally, as California grapples with its shortage of affordable housing, it remains to be seen whether housing developments will sprawl onto valuable agricultural land or be sited within existing communities guided by transit-oriented development planning principles. California's high-speed rail project will drive the development of communities built around train stops. Whether train stations are located in existing cities or in between, there will be opportunities to design sustainable, dense, and compact development rather than following the low-density sprawl patterns that characterize much of California.

The experts we interviewed emphasized the need to develop comprehensive policies and innovative approaches to balance development needs with the conservation of farmland and rangeland in order to optimize climate resilience in both urban and rural communities.

⁹⁴ Ho, J. (2023, April 19). [In California's Inland Empire, the warehousing industry's growth comes with consequences](#). *Marketplace*.

⁹⁵ Greene, C. (2021, December 26). [Farmland in demand](#). *LA Times*.

⁹⁶ USDA National Agricultural Statistics Service. [Land values 2022 summary](#).

⁹⁷ Included as an attachment in a Strategic Growth Council [meeting packet](#) on October 22, 2022.



FINDINGS

Housing Crisis Drives Displacement and Sprawl

At the same time that agricultural land is under threat, the state faces a severe affordable housing crisis. Over half of California's households are considered "cost burdened," which is defined as paying more than 30 percent of household income on housing costs. In search of more affordable housing options, Californians—and especially low-income Californians of color—are increasingly priced out of coastal urban areas and many are forced to become "super commuters," enduring long drives between inland and rural areas with more affordable housing and job-rich coastal cities that have failed to adequately expand the housing supply. In its 2022 Statewide Housing Plan, the Department of Housing and Community Development (HCD) projects that the state needs to build 2.5 million new housing units, one million of which are affordable to low-income households, by the end of the current eight-year housing needs allocation period that ends in 2032.⁹⁸

However, while it is clear that the state needs to build much more housing if it wants to see more affordable rents and home prices, our interviewees noted that not all housing development is equally beneficial from a climate change mitigation or resilience perspective. Large, low-density single-family home developments tend to be more energy- and water-intensive to build and operate than dense, multifamily residential developments in mixed-use neighborhoods. Additionally, because California has seen decades of sprawl development, many areas of the state have a high level of car dependence and the associated greenhouse gas (GHG) emissions.



Some Progress Made on Transit-Oriented and In-Fill Housing Policy

California has made some notable efforts to promote more affordable, sustainable, dense housing developments near jobs and public transit through policies and funding. In particular, state housing and sustainable planning efforts include requiring cities and counties to allow accessory dwelling units (also known as "in-law units" or "casitas"), the creation of the Infill Infrastructure Grant (IIG) program, the Transformative Climate Communities (TCC) program, and the Affordable Housing and Sustainable Communities (AHSC) Program. The legislature similarly enacted policies to make it easier to build affordable housing near transit and in areas with low vehicle-miles traveled.

One of the main pillars of the state's housing policy is the Regional Housing Need Allocation (RHNA) process, which happens in eight-year cycles. Several reforms to the RHNA process have revised the method the state uses to determine the number of housing units that regions must accommodate through their local planning process. To support the increased RHNA numbers and other new requirements, significant planning funds were provided to cities and counties through the Regional Early Action Planning (REAP) and Local Early Action Planning (LEAP) programs before the current sixth cycle of the RHNA process. These funds were intended to help local governments plan for housing and comply with new laws that incentivize housing development, further fair housing, and promote climate smart development.

However, "greenfield" housing developments on undeveloped land (and often agricultural land) continue to be common. In addition to being GHG-intensive, these developments are often on the wildland-urban interface and face significant and growing fire and flooding risks.

⁹⁸ California Department of Housing and Community Development. (2022). [A home for every Californian: 2022 statewide housing plan](#).



Efforts to Reduce GHG Emissions From Transportation and Urban Sprawl Are Falling Short

In 2008, the state enacted SB 375 to establish Sustainable Communities Strategies (SCS), regional government plans intended to reduce land use–related GHG emissions through transit, housing, and farmland conservation strategies. However, SCSs have not had the desired impact, and vehicle miles driven in the state are increasing despite the adoption of these strategies. Ongoing sprawl development further exacerbates the problem because suburban homes tend to have larger household carbon footprints than urban homes.⁹⁹ The California Air Resources Board reported in a 2022 update on the impact of SCSs that the state is not on track to reduce transportation-related GHG emissions, and that while new growth has generally been more compact, development in the San Joaquin Valley has become less compact.¹⁰⁰

California has taken some steps to protect agricultural land that is at risk of development. In 2015, it launched the Sustainable Agricultural Lands Conservation (SALC) Program, administered by the Department of Conservation (DOC), which is explicitly intended to prevent increases in GHG emissions that come with urban and suburban sprawl. The program has protected 199,000 acres of agricultural land by funding permanent conservation easements as well as supporting planning and capacity building at land trusts and other conservation organizations. However, the experts we interviewed all agreed that SALC alone is not sufficient to reverse agricultural land loss and create the types of sustainable communities that are needed to lower GHG emissions from housing and transportation.



Decentralized Local Land Use Decisions Present Challenges

One major hurdle to achieving the dual goals of protecting prime agricultural land while promoting dense, infill housing is the fact that local cities and counties decide on land use plans and approval of housing developments. California has 539 cities and counties that each have different processes for housing permitting and approvals. Moreover, these local governments often face pressures from not-in-my-backyard (“NIMBY”) constituencies that oppose infill developments and any increases to housing density in existing neighborhoods, including through accessory dwelling units or allowing duplexes on single-family zoned parcels.

Even when local governments are willing to “upzone” and allow more dense housing developments in urbanized transit-rich, job-rich areas, building infill housing tends to be more complicated and less lucrative than greenfield or brownfield development. The COVID-19 pandemic also enabled more remote work opportunities for white collar professions, and there are reports of increased housing costs in a number of “zoom towns,” which are typically located in more suburban and rural areas. Our interviewees noted the need for research on what effect zoom towns have had on agricultural land prices.

⁹⁹ Jones, C., & Kammen, D. M. (2014). [Spatial distribution of U.S. household carbon footprints reveals suburbanization undermines greenhouse gas benefits of urban population density](#). *Environ. Sci. Technol.*, 48(2). 895–902.

¹⁰⁰ California Air Resources Board. (2022). [Draft 2022 progress report: California’s sustainable communities and climate protection act](#).



RECOMMENDATIONS

Invest in Integrated Farmland Conservation and Infill Housing Development

While land use decisions are made at the local level, they are shaped by state priorities and the incentives provided in laws and regulations. Funding and political commitment are needed to develop a statewide land use planning framework that comprehensively brings together climate, housing, equity, and natural resource goals including agriculture. We heard that REAP funding for local governments was especially effective because it required community engagement in the process. There are examples in other states to look to as models for this type of framework (e.g., Oregon's statewide land use planning goals¹⁰¹ and Washington state's Growth Management Act approach that establishes goals, deadlines, and guidelines but protects local decision-making authority¹⁰²).

One possibility the state should explore is greater integration of agricultural land protection with funding and technical assistance for infill development planning. Both the SALC Program and the AHSC Program can fund planning, but neither program currently requires or incentivizes integrated housing and agricultural planning. The SALC Program continues to be oversubscribed, and at the very least needs reliable and sufficient funding, particularly for planning and capacity building in areas of the state where farmland loss is the greatest and program participation lags.

Set Ambitious Goals for Agricultural Land Protection and Require Local Smart Growth Policies

California's 2022 Scoping Plan sets a goal of conserving only 5,500 acres of annual cropland through conservation easements, and it does not include rangeland conservation goals at all. This is far less than the estimated 40,000 acres of cropland and rangeland land lost each year, and as such, the state should set more ambitious goals for agricultural land conservation going forward. We recommend at least doubling the annual cropland protection goal to 11,000 acres/year and adding goals of 14,000 acres/year for perennial agriculture and 35,000 acres/year for rangeland.¹⁰³ It should also strengthen its Sustainable Communities Strategy by requiring agricultural land protection policies and tying state funding to local compliance with regional SCSs.

Establish Requirements for Local Action on Farmland Conservation

As a complement to voluntary incentive programs like SALC and other sources of funding for agricultural easements, the state should consider ways to require local governments to adopt agricultural mitigation ordinances when approving developments that take agricultural land out of production. One possible method for doing this would be to identify and codify requirements that arguably already exist under the California Environmental Quality Act (CEQA) and in legal precedent. Several local jurisdictions have adopted farmland mitigation programs, including the cities of Davis, Stockton, and Brentwood and Yolo and San Joaquin counties.¹⁰⁴ To be most effective, agricultural land mitigation policies should require a high ratio of agricultural land to be conserved relative to the amount being developed. All California cities and counties are required to have a general plan that serves as a blueprint for the jurisdiction, and the state should further require an agricultural element as part of their general plan. Also, all California counties are required to have Local Agency Formation Commissions (LAFCOs) that oversee regional land use planning, and the state should ensure that they have sufficient resources and training to implement agricultural land conservation.

¹⁰¹ Oregon's Department of Land Conservation and Development. [Oregon's statewide land use planning goals](#).

¹⁰² [Washington's Growth Management Act](#). MRSC.org.

¹⁰³ These targets were included in recommendations made by CalCAN and a coalition of advocates to the California Natural Resources Agency in response to its call for public comment on target setting as required by AB 1757. See this [CalCAN blog](#) for more details.

¹⁰⁴ Meserve, O. (2011). [Overview of legal restraints on agricultural land mitigation programs](#).



Set Up State Financing for Land Purchases for Beginning Farmers and Ranchers

California's Housing Finance Agency (CalHFA) operates programs to assist first-time homeowners with purchasing a house or condominium, but no similar program exists for those looking to purchase agricultural land. The state should consider setting up a similar lending program, and it should also work to implement the recommendations of the Agricultural Land Equity Task Force when those are complete. Additionally, the state should consider how public lands owned by the state and local governments could better support secure land tenure for farmers and ranchers. According to the Climate Smart Land Management Strategy, 0.4 percent of California's agricultural land is owned by the state and an additional 0.4 percent is owned by local agencies. In 2019, Governor Newsom issued an Executive Order¹⁰⁵ requiring the state to inventory unused land in order to find suitable sites for affordable housing. The state should take similar action with agricultural land or undeveloped land it owns and connect new, beginning farmers and socially disadvantaged farmers and ranchers with opportunities to farm. Additionally, decision-makers may want to consider how the SALC Program can better incentivize the "buy-protect-sell" or "buy-protect-lease" model to better connect beginning farmers and farmers of color with land for agricultural production.

Create "Just Cause" Tenancy Termination Protections and Give Farmers the Right of First Refusal

Many climate-resilient farming and ranching practices require deployment for several years before benefits can be realized. Additionally, some practices that involve putting in permanent or semipermanent fixtures like hedgerows are prohibited in lease terms. This presents a barrier to producers who operate on one-year leases that may or may not be renewed each year. That uncertainty prevents farmers from accessing certain incentive programs like the Healthy Soils Program, which requires climate-resilient practices such as composting and cover cropping for at least three years on the same fields. To address this, the state should consider requiring a "just cause" basis for terminating agricultural leases. Additionally, some California cities and counties have "tenant opportunity to purchase" policies that allow renters the first right of refusal to buy the home or apartment complex they're renting when it is going to be sold. A similar policy could be adopted to allow farmers and ranchers the opportunity to purchase the land they farm when it is sold.



¹⁰⁵ Executive Order [N-06-19](#).

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

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.

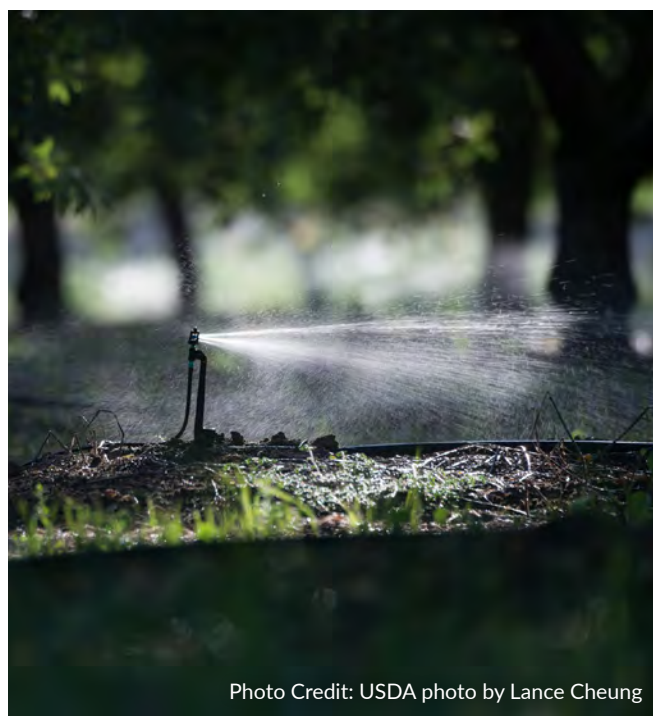


Photo Credit: USDA photo by Lance Cheung

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.

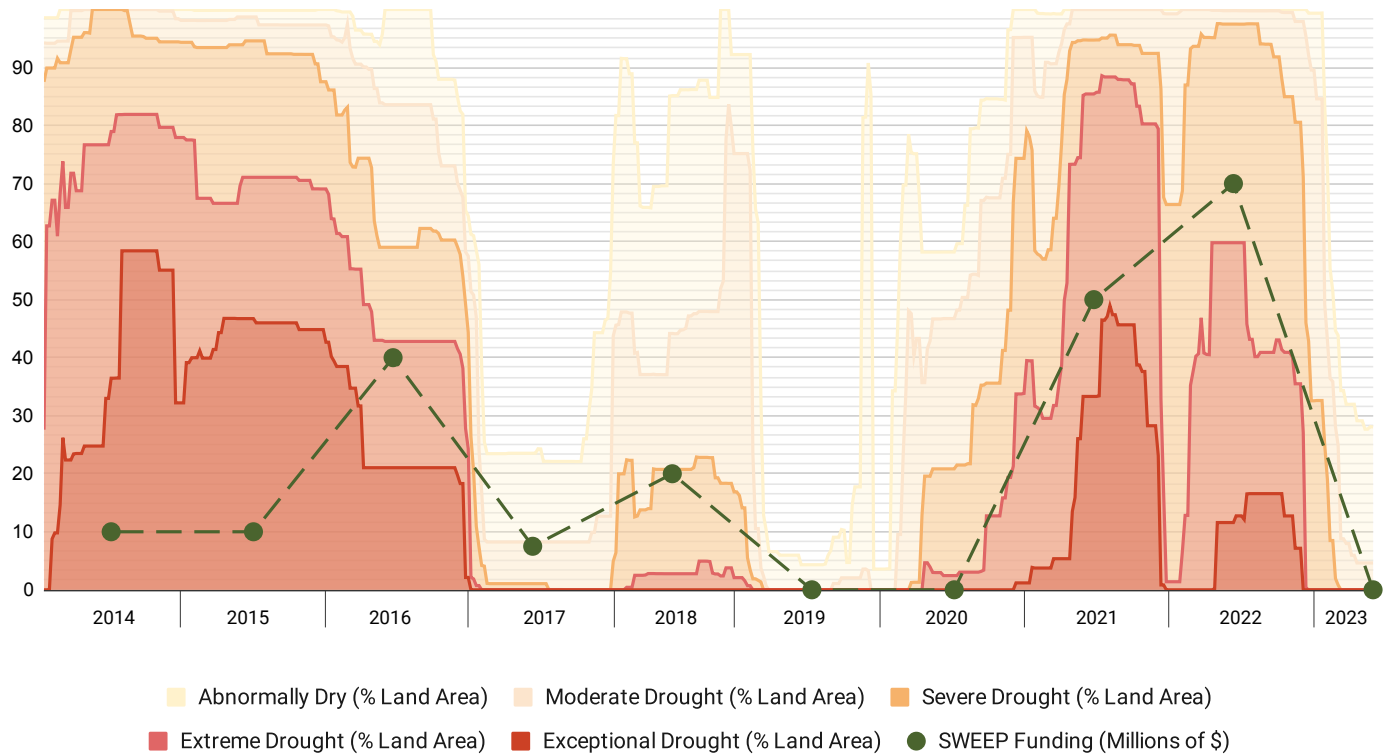
¹¹¹ California Air Resources Board. (2004). [New program to encourage electrically powered irrigation pumps](#).

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.



PREVENTING AND MITIGATING CATASTROPHIC WILDFIRES

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Invest in Coordinators and Workforce to Unlock Private Sector and Community Efforts
- Support Data Analysis and Planning at the Site-Specific, Regional, and Statewide Levels
- Improve Regulatory Efficiency for Prescribed Fire and Grazing
- Increase Liability Insurance Options for Prescribed Burners and Prescribed Graziers
- Lengthen Grazing Leases and Cost-Share Infrastructure to Lower Cost of Prescribed Grazing

AUTHOR: Brian Shobe



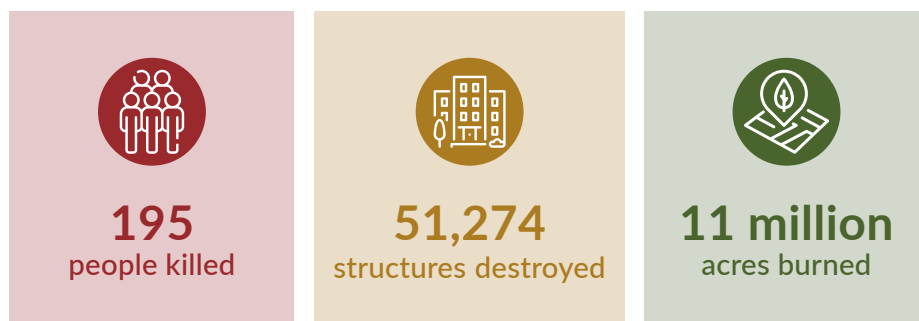
INTRODUCTION

Between 2017 and 2022, catastrophic wildfires in California have killed 195 people, destroyed 51,274 structures, burned over 11 million acres, and cost billions of dollars.^{117,118} These same wildfires have also become an increasingly significant source of GHG emissions in the state, fueling a vicious cycle in which catastrophic wildfires accelerate climate change which in turn contributes to more severe wildfire conditions (e.g., drought, extreme heat, etc.).¹¹⁹ In 2020, wildfires were the second largest source of GHG emissions in the state.¹²⁰

Farmers and ranchers have been on the front lines of these impacts in terms of evacuations, smoke, and lost property, livestock, crops, income, and insurance. For example, one industry analyst estimated the 2020 wildfires alone cost the California winegrape industry \$3.7 billion in lost property, inventory, grapes, and the wine those grapes would have produced.¹²¹

Farmers and ranchers, who manage approximately 25 million acres of private land (one-quarter of the state's land mass) and millions of acres of public lands through grazing leases are well-positioned to scale up many of the solutions now recognized as critically important, including prescribed fire and prescribed grazing. They are motivated, have intimate knowledge of the land, and in some cases already have the equipment needed to help the state scale up fuel treatments.

2017 - 2022 Wildfires



¹¹⁷ [CalFire incidents archive.](#)

¹¹⁸ California Council on Science and Technology. (2020). [The costs of wildfire in California.](#)

¹¹⁹ California Air Resources Board. [Wildfires and climate change.](#)

¹²⁰ Jerrett, M., et al. (2022). [Up in smoke: California's greenhouse gas reductions could be wiped out by 2020 wildfires.](#) *Environmental Pollution*, 310.

¹²¹ Nelson, D. (2021, April 12). [Exploring smoke taint on the fly.](#) UC Davis College of Agricultural and Environmental Sciences.

FINDINGS

Catastrophic Wildfires Catalyzed Overdue Cultural Shifts

When asked what the most impactful development in wildfire mitigation has been in the past decade, almost every expert we interviewed responded by talking about cultural shifts. They pointed to the growing awareness of fire as an integral force in many of California's ecosystems and of indigenous Californians' extensive use of cultural burning for food and fiber production (e.g., to promote grassland grains, manage acorn pests, and stimulate new shoot growth for basketry materials). The experts also highlighted the growing recognition of the benefits of grazing animals for managing invasive weeds and fine fuels (e.g., grasses and weeds that ignite easily and spread fire quickly) and ladder fuels (e.g., shrubs and small, low-hanging tree limbs that carry fire from the ground level into brush and tree canopies). They saw these shifts as an exciting opportunity to build new partnerships to support ecological management practices that cultural fire practitioners, some on-the-ground conservation groups, and California farmers and ranchers have long advocated for.

As two interviewees noted, for much of the 20th century, public agencies and conservation groups had been converting lands previously managed with fire and/or grazing into open spaces or wilderness areas with little to no vegetation management. The subsequent lack of management on these lands allowed the encroachment of shrubs and accumulation of thatch in grasslands, the dense overgrowth of forests, and the prolific invasion of weeds like brooms and thistles—all conditions fueling our catastrophic wildfire problem now. The silver lining of recent catastrophic fires, according to one expert, is that many public agencies and the broader public have woken up to this problem and are now working to return beneficial fire and grazing to the lands they manage.



Farmers and Ranchers Provide Valuable Firefighting and Wildfire Prevention Services

Firefighters often tell us they see farms and ranches—and grazed lands in particular—as wildfire buffers and areas where they can safely mount their defense against a wildfire, but this is rarely acknowledged in public discussions on wildfire prevention and firefighting. An ongoing study led by UC Davis underscores the critical role farmers and ranchers play in aiding wildfire response personnel.¹²² Seventy-one percent of the study's 519 farmer and rancher respondents contributed to emergency response efforts. This included providing local knowledge to firefighters about local fire behavior or access routes, supplying water for firefighting, creating fire breaks, assisting neighbors in defending homes, and aiding in evacuating people and others' livestock.

In discussions about controlled burns, it is a positive, albeit long overdue development, that indigenous peoples of California are now regularly recognized for their long history of cultural burning. Two of the experts we interviewed noted that what is often overlooked in these discussions is that California ranchers also historically used controlled burns in California, in part inspired by what they observed about indigenous

¹²² Jimenez, N. P., et al. (2023), [The wildfires and agriculture study](#). Manuscript in preparation.

management. Ranchers even used to form range improvement associations—what would today be called prescribed burn associations—to support each other in larger-scale prescribed burns. But this practice largely stopped in the second half of the 20th century due to increasing regulations.¹²³ This shared cultural history between California Tribes and ranchers of using fire to restore ecosystems for food and fiber production, including better forage for both domesticated and wild ungulates (hooved herbivorous mammals such as sheep, goats, cattle, deer, elk, and bison), offers an opportunity to build a powerful political alliance to enact the policies needed to scale up good fire.

Firefighters have long described grazing as an effective tool for slowing or stopping the spread of wildfires and providing the fuel conditions firefighters need to safely and effectively fight fires. Recent field trials examining the impact of grazing on wildfire behavior backs up firefighters' observations, finding that grazing effectively reduces flame length and spread in many conditions.¹²⁴ Cattle grazing alone removed an estimated 11.6 billion pounds of non-woody plant materials (i.e., wildfire fuels) in California in 2017, and at no cost to the state.¹²⁵ If that grazing were to be removed, tens of millions of acres would need to be treated with other means. For that reason, a couple of the experts we interviewed noted they would like to see the cultural shifts described above go a step further by more explicitly valuing ranchers for the ecosystem and wildfire prevention services they and their animals provide. One expert, noting that targeted sheep and goat grazing operations are now regularly paid for their fuel abatement services, suggested it may be time to reevaluate the prices that cattle ranchers pay to public land managers as tenants to graze.



Progress of a wildfire stopped at the boundary of Brisa Ranch in Pescadero, CA.

Scaling Solutions Requires People and Planning

To get to the scale of vegetation management needed in the state, we will need a lot more people engaged in the work. While one-time grants for discrete vegetation management projects are helpful, funding to develop the capacity of *people* and *communities* is what the experts we interviewed said would result in long-term, sustainable fuels reduction work and healthy fire ecosystems.

¹²³ Biswell, H., (1999). [Prescribed burning in California wildlands vegetation management](#). University of California Press.

¹²⁴ Foss and Shapero, in process

¹²⁵ Ratcliff, F., et al. (2022). [Cattle grazing reduces fuel and leads to more manageable fire behavior](#). *California Agriculture*, 76(2).



To tap into state and federal funding for vegetation management and associated equipment and infrastructure, private landowners are often required to have site-specific forest management or grazing management plans developed by a registered professional forester or certified rangeland manager. The up-front cost of developing these technical plans is often a significant barrier but they are important to ensure state and federal agencies and taxpayers that their investments will result in science-based ecological management.

Of course, preventing catastrophic wildfires will require more than just a patchwork of private landowners doing their part. Local and regional governments such as cities, counties, special districts, and joint powers authorities need to map, plan, prioritize, permit, and do the necessary public outreach to implement strategic landscape-level fuels management initiatives where they will have the greatest impact on reducing wildfire risk in a region. At the state level, agencies that regulate or fund wildfire risk reduction activities must continue to coordinate to ensure their actions are complementary to each other.

Regulatory Inefficiency Is a Drag on Prescribed Burns and Grazing

The California Environmental Quality Act (CEQA) applies to every state-funded fuels treatment project, meaning that every prescribed fire and prescribed grazing project that receives state funding must evaluate, disclose, address, and mitigate when feasible any anticipated environmental impacts of the project. Completing the CEQA process, which often includes hiring a consultant, conducting biological site evaluations, and producing a ream of documentation, often delays prescribed fire and grazing projects by 6 to 12 months and costs between \$60,000–80,000 per project, according to the experts we interviewed. One interviewee noted that ranchers have consistently declined to host prescribed burn trainings on their properties because they do not want to be involved in the CEQA process. For these reasons, the experts we interviewed cited CEQA costs and requirements as a major barrier to scaling up state-funded prescribed fire and grazing projects.



Photo Credit: Lenya Quinn-Davidson

Jeffery Stackhouse, Humboldt County UCCE advisor, participates in a controlled burn on a ranch in Humboldt County.

Some of these experts noted that the California Vegetation Treatment Program (CalVTP),¹²⁶ a Programmatic Environmental Impact Report (PEIR), offers some hope of progress in improving the CEQA process for qualifying projects. However, they also noted that there are still gaps in the PEIR and limited examples or guidance to learn from, especially for prescribed grazing projects. For example, the CalVTP PEIR only applies to prescribed grazing on slopes less than 50 percent, so one grazing project had to pay for an environmental consultant to develop a document specifically to address slopes greater than 50 percent, adding significant costs and delays to the process.

¹²⁶ [California Vegetation Treatment Program](#)

Farmers and Ranches Need Affordable Liability and Commercial/Residential Fire Insurance

Liability insurance for both prescribed burns and prescribed grazing businesses came up as a challenge in our interviews. For prescribed burns, the challenge is that there are currently no commercially available liability insurance options. One positive development is the \$20 million prescribed fire liability claims fund pilot created by SB 926 (Dodd) and launched in June 2023.¹²⁷ However, this pilot program is currently limited to coverage of \$2 million for a maximum of 200 projects at a time and is set to expire in 2028. As such, there is still a long-term need for commercially available insurance for burn bosses¹²⁸ or their businesses.

Some prescribed sheep and goat grazing businesses face a different challenge, which is that their liability insurance rates have dramatically increased because their insurer has decided to classify them as “landscaping” businesses instead of as agricultural livestock management businesses. These business owners say they have only found one insurer in California willing to cover them, so they have been forced to accept the higher rates despite the apparent misclassification.

Lastly, many farmers and ranchers in our network have had their residential and/or commercial fire insurance policies dropped, which puts them in severe financial risk and can result in them being denied a mortgage or loan. The state’s FAIR plan (Fair Access to Insurance Requirements)¹²⁹ has worked as a last resort for some of these farmers and ranchers, but others have been unable to participate due to a \$20 million cap on commercial property coverage.

Infrastructure and Longer-Term Grazing Leases Can Lower the Cost of Prescribed Grazing

The availability and condition of infrastructure such as perimeter fencing, corrals, and livestock watering systems are often significant factors in determining what type of animal can be used for grazing, at what scale, and at what cost. Generally speaking, maintained perimeter fencing, functioning corrals, and livestock watering systems lower the cost of grazing by any type of livestock. This infrastructure also makes it easier to utilize cattle, which can graze larger areas at a lower cost than sheep and goats. Where such infrastructure has been removed, deteriorated, or destroyed due to wildfires, temporary mobile fencing and mobile watering systems must be used, which result in higher labor costs and present other challenges for livestock managers such as animals escaping and trucking in water.

In interviews with grazing experts, the lack of permanent infrastructure, cost-sharing funding available for permanent infrastructure investments, and long-term contracts/leases in California, especially on public lands, came up repeatedly as significant barriers to reintroducing prescribed grazing and sustaining that grazing long term.

Moreover, on lands where grazing and controlled burning were removed, shrub encroachment and the accumulation of brush over multiple decades mean that returning those practices to those lands sometimes requires more up-front work to clear brush.

¹²⁷ [CalFire Prescribed Fire program](#)

¹²⁸ Burn bosses are individuals who are certified to plan, organize, and execute prescribed fires. California has a [state certification program](#) for prescribed fire burn bosses.

¹²⁹ The [FAIR Plan](#) is available to California residents and businesses in urban and rural areas who cannot obtain insurance through a regular insurance company.



RECOMMENDATIONS

Invest in Coordinators and Workforce to Unlock Private Sector and Community Efforts

Fuels management, especially for fine fuels, is an annual requirement, which means it requires sustained community effort. We recommend the state prioritize more funding for 1) coordinators for groups like prescribed burn associations and fire safe councils, whose work mobilizes broader communities to engage in short- and long-term fuel reduction on mostly private lands and 2) trainings and workforce development for burn bosses, mastication/thinning crews, and herders, which are in short supply, limiting the ability of private sector businesses to meet growing demand. Multiple interviewees highlighted the work of the Watershed Research and Training Center as a model for building the capacity of local organizations.¹³⁰

Support Data Analysis and Planning at the Site-Specific, Regional, and Statewide Levels

For site-specific planning, the state should consider providing additional cost-sharing assistance through programs like the California Department of Food and Agriculture's (CDFA) recently established Conservation Planning Grant Program.¹³¹

For regional planning, the state should continue to invest in the Regional Forest and Fire Capacity Program¹³² to help more communities conduct vegetation data analysis and develop and implement Regional Wildfire Mitigation Plans as Santa Barbara County has done.¹³³ Santa Barbara County's regional planning efforts resulted in the largest prescribed grazing project in the county to date.¹³⁴

For statewide planning, the State Wildfire and Forest Resilience Task Force has been an effective forum for multi-agency strategic planning and coordination, which has made significant progress in advancing policies, partnerships, and investments to scale up forest thinning, fuel breaks, and prescribed fire on state and federal lands.¹³⁵ However, the value and role of grazing—the state's largest and most scalable fuel management technique—has been mostly overlooked by the Task Force. For example, the Task Force's "Wildfire and Forest Resilience Action Plan" does not identify any goals or actions specific to prescribed grazing.¹³⁶ The next update to that action plan, due January 1, 2026, should rectify that oversight.

Improve Regulatory Efficiency for Prescribed Fire and Grazing

The state should continue efforts to help applicants to state-funded wildfire prevention grants comply with CEQA requirements through training, guidance, improvements to CalVTP, and examples of streamlined and successful CEQA processes. With some additional effort on behalf of CalFIRE, documents addressing gaps in CalVTP's PEIR (e.g., grazing on slopes greater than 50 percent) could be turned into a standard project requirement and folded into CalVTP, which would prevent another project from having to repeat the same process in the future.

¹³⁰ [Watershed Research and Training Center](#)

¹³¹ [Conservation Planning Grant Program](#)

¹³² [Regional Forest and Fire Capacity Program](#)

¹³³ Learn more about the Santa Barbara Regional Wildfire Mitigation Program at <https://rwmpsantabarbara.org/>.

¹³⁴ For more information on regional wildfire mitigation approaches, see Moritz, M. A., et al. (2022) [Beyond a focus on fuel reduction in the WUI: The need for regional wildfire mitigation to address multiple risks](#). *Front. For. Glob. Change*, 5.

¹³⁵ [State Wildfire and Forest Resilience Task Force](#)

¹³⁶ State Wildfire and Forest Resilience Task Force (2021). [California wildfire and forest resilience action plan](#).



Increase Liability Insurance Options for Prescribed Burners and Prescribed Graziers

Building on the success of the prescribed fire claims fund and the data that will emerge from its implementation, the insurance commissioner and legislature should explore options to encourage insurers in California to offer commercial prescribed fire insurance. The insurance commissioner's office should also explore options to correct the misclassification of prescribed grazing businesses as landscaping businesses and encourage more than one insurance provider in the state to offer liability insurance to those businesses.

Lengthen Grazing Leases and Cost-Share Infrastructure to Lower Cost of Prescribed Grazing

In order for livestock managers to agree to invest their own capital in rebuilding permanent infrastructure, they often require cost-sharing support and a long-term grazing contract or lease of at least five years or more. To facilitate these conditions, the state should offer cost-sharing assistance for permanent grazing infrastructure (e.g., via the Wildfire Prevention Grants Program), and state land management agencies (e.g., California Department of Fish and Wildlife, California State Parks, etc.) should offer longer grazing leases or contracts.



FUNDING THE TRANSITION: INVESTMENT STRATEGIES FOR AGRICULTURAL SOLUTIONS TO THE CLIMATE CRISIS

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Invest State and Federal Resources in Multi-Benefit Solutions
- Invest State and Federal Resources in Underserved Producers
- Target Bond Investments in Food and Agriculture Systems, Resilience, Equity
- Invest Special Funds, Fees in Scaling Up Agricultural Climate Solutions
- Develop Private–Public Partnerships, Focus on Supply Chain Resilience and Regional Innovation
- Invest Philanthropic Funding in Regional Innovation, Equity

AUTHOR: Jeanne Merrill



INTRODUCTION

Investing in natural and working lands climate solutions is like retirement savings: it takes time and ongoing investment to reap the rewards of improved carbon stocks, reduced emissions, and greater resilience of our lands. California's leadership on climate change policy and investment is clear but it also suffers from the boom and bust cycles of the state tax revenue system and disproportionate political focus on urban industrial climate fixes over the long-term climate solutions of natural and working land conservation and restoration.

Beginning in 2014, California launched a suite of Climate Smart Agriculture programs.¹³⁷ In the initial years of the programs, funding came from the state's cap-and-trade auction revenue, which is deposited in the Greenhouse Gas Reduction Fund (GGRF). The amount of funding available to Climate Smart Agriculture programs depended, in part, on the highs and lows of the carbon price during the quarterly cap-and-trade auctions. New funding briefly became available to some of the programs, in 2018, when the SWEEP and the Healthy Soils programs both received Proposition 68 bond funding. In more recent years, as fewer of the GGRF dollars were available for annual appropriation, bond funds were spent, and as the General Fund increased, the vast majority of program funding shifted away from special funds to the General Fund, with some exceptions.¹³⁸

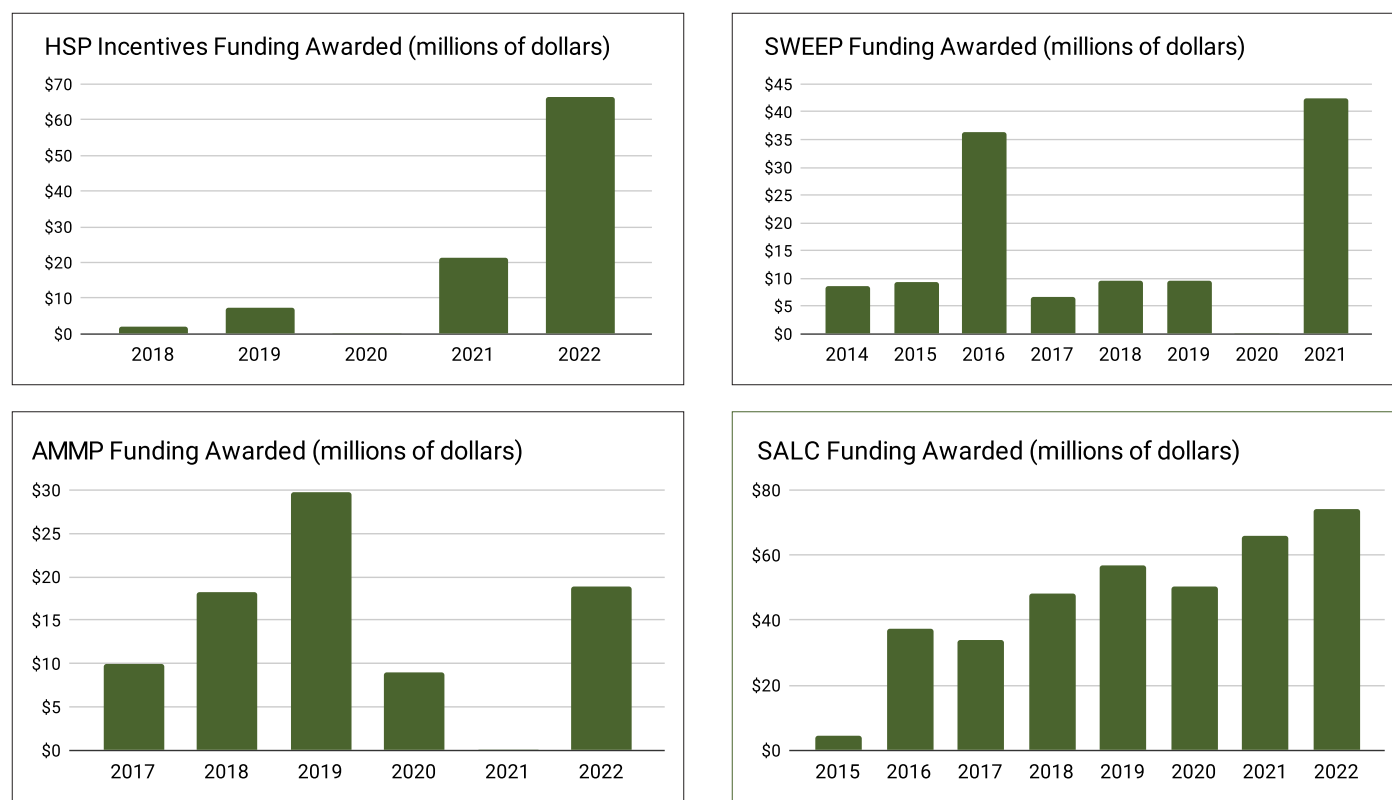


Photo Credit: USDA Photo by Lance Cheung

¹³⁷ For more details on the CSA programs, see Part 1 of the Platform: [State of the State: Taking Stock of a Decade of Progress in California Agriculture](#).

¹³⁸ For more on GGRF, see the Legislative Analyst Office 2023 report: [Cap-and-Trade Spending Overview](#); SALCP receives a portion of the Strategic Growth Council's continuous GGRF appropriation.

Variation in Funding Levels for Climate Smart Agriculture Programs



Beginning in 2021, the state of California, under Governor Newsom’s leadership and the leadership of the legislature, pledged \$54 billion in climate change–related investments, including natural and working lands climate strategies.¹³⁹ However, as the state careens from a record surplus to state budget deficit projections, those investments are at risk of cuts. This can hurt the ability of the state to achieve the long-term benefits of its climate strategies, especially those offered by our natural and working lands.¹⁴⁰ The state will need a diverse funding strategy to support climate investments, including in natural and working lands strategies.

We reached out to others working on natural and working lands policy and budget strategies to better understand how we might achieve more stable and diverse funding needed to make a difference on the ground. We also offer our cautions on the carbon market. Our findings and recommendations are below.

FINDINGS

Gains in Understanding of Nature-Based Climate Solutions

There was agreement among those we interviewed that progress has been made in California in elevating natural and working lands climate solutions among state policymakers and stakeholders. This progress, they argued, resulted in greater state investment in recent years in natural and working lands climate strategies. Interviewees highlighted Governor Newsom’s executive order in 2020 on advancing natural and working lands climate solutions¹⁴¹ and the Natural and Working Lands Climate Smart Strategy¹⁴² which was followed by significant state investments in those solutions in 2021–22 and again in 2022–23. They noted the inclusion of natural and working lands in the 2022 Scoping Plan Update, which is considered imperfect but an important start. They also highlighted the federal investments in agricultural climate solutions in the Inflation Reduction Act of 2022.

¹⁴¹ Executive Order N-82-20.

¹⁴² California Natural Resources Agency. [Expanding nature-based solutions.](#)



Interviewees also noted that urban-focused, technological, and industrial solutions (e.g., industrial carbon capture, etc.) still dominate the climate policy discussions and investments in the state. They also highlighted a strong need to continue to improve the understanding and importance of natural and working lands in achieving the state's climate goals, including resilience.

Carbon Offsets Have Hampered Natural and Working Lands Climate Efforts

There was also agreement among the interviewees that the focus on carbon offsets from natural and working lands over the past 10 years or more has hurt efforts to advance climate solutions, including efforts to seek state funding for natural and working lands climate projects outside of market mechanisms. Those policymakers and stakeholders are skeptical of the carbon market and concerned about allowing large polluters to avoid some of their own GHG emissions reductions through the offsets from forests and farms. They suggested that offsets have fueled a reluctance among some to advance natural and working lands climate solutions. Some of our interviewees supported moving away from offsets and focusing on natural and working land projects that are not intended as offsets and focusing those projects on incorporating improved resilience along with emissions reductions and carbon sequestration.

Carbon Markets Fail to Support Ag Climate Transformation

In 2012, the state of California launched its cap-and-trade program, a market-based program intended to reduce GHG emissions from the largest climate polluters in the state. The program allows unregulated entities like farms to sell offset credits to the polluters in exchange for using approved practices that reduce GHG emissions. The complex protocols that determine eligibility can take years to develop, and they must ensure the practices are additional, verifiable, and permanent. There are only two agriculture offset project types available, both aimed at reducing methane emissions. One is for rice management practices¹⁴³ (which took seven years to develop) but after eight years, no producers have yet participated. The other is for dairy digesters¹⁴⁴ which is one of many sources of financial support available that makes the projects affordable to farmers (see [Dairy Manure Management: Moving from Waste Problem to Climate Solution](#) section for more).

In addition to the dearth of agriculture project types available, most farmers other than the very largest do not participate because they lack the resources to deal with these additional constraints:

- **High transaction costs** for project development and verification.
- **Low carbon prices** do not come close to compensating farmers for the true costs of their new practices which are only affordable when supported by other sources of public and private funds, as in the case of dairy digesters.
- Carbon markets are blunt tools best suited to monocrops and single practices. **They cannot adequately incentivize multi-benefit projects** that address other environmental, justice, and public health concerns, like enhanced biodiversity, improved air, and water quality, and more.

¹⁴³ California Air Resources Board. [Rice cultivation projects](#).

¹⁴⁴ California Air Resources Board. [Livestock projects](#).



Need Funding for Climate Resilience as Well as Climate Mitigation

We heard from interviewees that the 2022 Scoping Plan Update's focus on carbon sequestration failed to consider how forests, farms, and other natural and working lands are critical for the state's resilience to greater weather extremes. One interviewee stated that we need to restore ecosystem functions in our forests and other natural and working lands. Another said that "sequestering carbon is not the only value," but the state, in the climate change policy space, is not doing enough to value the other components of natural and working lands. Our forests and watersheds are "going to get hammered by climate change" unless we act now, said another interviewee. All agreed that we need more of a focus on improved climate resilience for the state's natural and working lands, advancing mitigation efforts alongside adaptation and resilience.

New Funding Sources Needed

Our interviewees noted that it will be important to spend state investments wisely and strategically, and some noted concerns about state agency staffing levels hampering implementation as well as concerns that the lack of coherent regional plans for climate action on natural and working lands may also be a barrier to effective implementation. They suggested that we need to look at a diversity of funding sources in the future. Ideas included federal investments available in California, new fees, and a climate resources bond. They noted that no one source of funding would likely be adequate, nor can fees and a bond fully replace General Fund investment.

Philanthropic Funding Can Leverage Regional Opportunities

One example of the power of leveraging these resources was the combined efforts of four charitable organizations who collaborated in 2019 to fill a gap in funding needed to support a cohort of farmers of color in the Fresno area with their Climate Smart Agriculture grants projects. The funds totaling \$100,000 were spent to hire staff to provide additional technical assistance as well as compost spreading equipment for a cohort of 16 farmers who received Healthy Soils Program grants and 23 who got SWEEP grants for on-farm water conservation. These low-resource farmers, primarily Hmong, Latino, and African-American, were supported by staff with the UC Small Farms Program in Fresno. The equipment is still being shared with a large community of farmers in the region, and the Small Farm Program found ongoing funding to support and expand their staff capacity.

Regional Investments Needed

We heard from many interviewees about a strong need to invest in regional natural and working lands project implementation and related resources (e.g., technical assistance providers and other local partners). Ultimately, implementation happens at the local level, and having adequate resources and strategic plans to support that implementation is critical. They raised concerns that the state has not done enough to support good regional climate plans that include natural and working land solutions and that many plans lack the resources for implementation.

RECOMMENDATIONS

Invest State and Federal Resources in Multi-Benefit Solutions

As state and federal policymakers look to further support agricultural solutions to the climate crisis, it will be important to focus on those efforts that improve overall climate resilience and provide multiple benefits. The 2023 and 2028 farm bills must ramp up resources across the country to improve farmer resilience to greater weather extremes, increase food chain supply resilience, and expand regional and local food markets. At the state level, as California grapples with whiplashing state budgets, the state must maintain its commitment to climate change solutions by allocating a minimum of \$150 million annually in General Funds to the Climate Smart Agriculture programs to provide a baseline for the programs and maintain momentum.



Invest State and Federal Resources in Underserved Producers

It is also critical to provide resources for underserved producers, especially farmers of color, who experience discrimination in ways that historically and ongoingly obstruct participation in state and federal agriculture programs.¹⁴⁵ By focusing resources on those underserved producers, the state can reach a growing segment of California's agricultural economy and remove barriers to participation. Furthermore, the state's investment in climate-focused technical assistance and research will benefit all in agriculture by bringing the latest science forward in ways that further greater resilience for all.

Many climate-resilient farming techniques are practices that were developed by indigenous producers and farmers of color over many years in close relationship with land. Yet Tribal producers and farmers of color have been systematically dispossessed and excluded from land access and ownership. Policy that seeks to support a transition to climate-resilient management must also support these producers. Climate and agriculture incentive programs should include a minimum 40 percent set-aside for socially disadvantaged farmers and ranchers, including a 10 percent prioritization for Tribes.

Target Bond Investments in Food and Agriculture Systems, Resilience, Equity

For several years, the legislature has been debating bills to propose a climate change and natural resources bond for voter consideration on a ballot. These efforts stalled in 2021 and 2022 due to state budget surpluses that hit new heights and created little political appetite to advance bond measures. However, in this new environment of budget scarcity and great climate urgency, support for a climate bond is increasing among legislative leaders and the Governor. One bond measure proposal¹⁴⁶ by Assemblymember Lori Wilson (AB 408), supported by CalCAN and a diverse coalition, proposes \$3.7 billion for infrastructure to build a climate-resilient and equitable food and agricultural system. This would include funding for climate smart, organic, and sustainable agriculture incentives; regional food infrastructure; healthy food access; and farmworker housing.



Michael Yang at UC Cooperative Extension in Fresno consults with Xiong Pao Her on his SWEEP grant project.

Invest Special Funds, Fees in Scaling Up Agricultural Climate Solutions

Several climate smart agriculture incentives programs received funding from the GGRF early in their implementation. However, over the years, GGRF has been increasingly allocated to sectors other than agriculture. One exception is the GGRF funding that is awarded to the Sustainable Agricultural Lands Conservation Program (SALC), which receives two percent of the fund annually and is a powerful tool for preventing the loss of agricultural land to urban development. For other climate and agriculture programs, given the many competing climate priorities for those funds, other sources of funding need to be found.

¹⁴⁵ See more federal discrimination issues here: Bustillo, X. (2023, February 19). In 2022, [Black farmers were persistently left behind from the USDA's loan system](#). NPR. And see National Sustainable Agriculture Coalition. (2017, December 18). [Racial equity in the farm bill: Barriers for farmers of color](#). For more on California efforts to address racial discrimination in ag programs, see Nittle, N. (2019, May 6). [Farmers of color may soon get more support in California](#). *Civil Eats*.

¹⁴⁶ For more information on AB 408, see the [Food and Farm Resilience Coalition](#) website.



Agricultural fertilizers and pesticides are both assessed mill fees at their point of sale. Legislation signed into law in 2012 (AB 2174, Alejo) allows for the fertilizer mill fee to support efforts to reduce GHG emissions in agriculture.¹⁴⁷ An increase in the fertilizer mill fee (currently \$0.001 per dollar of fertilizer sales) could support research, technical assistance, and incentives to transition away from fossil fuel-based fertilizers. The legislature funded a study released in 2022 that examined the possibility of increasing the pesticide mill fee and recommended rate options, providing guidance for implementing this potential revenue source. For more details, see the section on [Reducing Farmer Dependence on Fossil Fuel-Based Pesticides and Fertilizers](#).

Develop Private–Public Partnerships, Focus on Supply Chain Resilience and Regional Innovation

Private investment is likely also needed to support farmers in becoming climate resilient. While we have outlined our concerns about carbon offset markets (see sidebar) there are other opportunities in the private sector to provide resources for farmers without the negative trade-offs associated with offset credits. For example, the Organic Valley insetting program as described in the sidebar could be a model for others in the industry that want to reduce the carbon footprint of their supply chains, especially as more companies are required to report on their Scope 3 GHG emissions.¹⁴⁸ These private investments in agricultural supply chains can complement federal and state investments by providing needed capital for new equipment and other materials not covered through state and federal programs.

Organic Valley Climate Insetting Program

One alternative to carbon offset credits is being explored by Organic Valley, the dairy and livestock farmer cooperative based in La Farge, WI with farmer members across the country including in California. The cooperative aims to become carbon neutral by 2050. They have set out to be the first major dairy brand to reduce on-farm emissions without using carbon offsets, and instead are designing a carbon insetting program¹⁴⁹ which will reward its producer members directly for GHG emission reduction projects on their farms. Organic Valley is working with a third-party certification company to develop systems to track the emission reductions from pre-approved project types.

Organic Valley is currently piloting the program with the support of state and federal grants. Farmers in the pilot will receive a payment based on their emissions reductions. Organic Valley will offer some of its buyers the opportunity to participate in the insetting program by helping to pay for the costs of the on-farm projects and in return be able to demonstrate reduced GHG emissions as part of the buyers' Scope 3 emissions reporting.¹⁵⁰

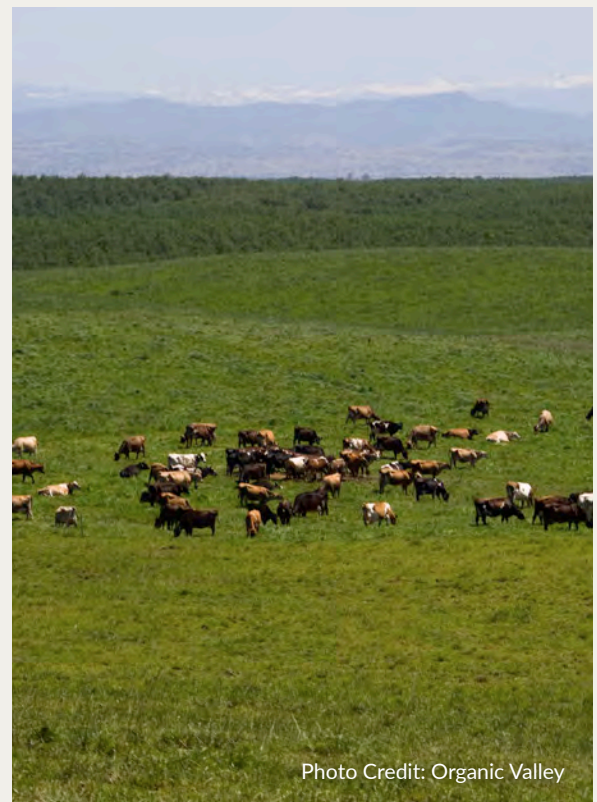


Photo Credit: Organic Valley

¹⁴⁷ [AB 2174](#).

¹⁴⁸ U.S. EPA [Scope 3 inventory guidance](#).

¹⁴⁹ Read more about Organic Valley's insetting program here: <https://www.organicvalley.coop/blog/reducing-farm-emissions-without-carbon-offsets/>

¹⁵⁰ For more on Scope 3 emissions reporting, see US EPA's summary and guidance documents: <https://www.epa.gov/climateleadership/scope-3-inventory-guidance>



Invest Philanthropic Funding in Regional Innovation, Equity

Private philanthropy can play an ongoing and important role in supporting innovation in climate resilience at the local and regional levels. There will always be necessary constraints on government spending but private funding can step in where the government cannot. It can support the coordination of resources, new projects, and pilots—all of which can inform potential new state or federal funding areas in the future. Private funding should look to reach underserved producers and advance equity in the transformation to climate-resilient agriculture. This will require partnering in new ways: with Tribes, farmworker organizations, underserved producers, and the technical service providers they work with.



Photo Credit: USDA photo by Lance Cheung



BREAKING DOWN THE SILOS: COORDINATING AGRICULTURE CLIMATE ACTION ACROSS PROGRAMS

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Prioritize Investments in Regional Leadership and Collaboration
- Build on Existing Interdisciplinary Programs to Catalyze Innovation
- Develop Cooperative Agreements with Local Providers, Incentivize Innovation
- Increase Regulatory Streamlining To Achieve Multi-Benefits

AUTHOR: Jeanne Merrill



INTRODUCTION

Breaking down silos across government programs is not a new concept but one that will be critical to achieving improved climate resilience. In the early years of California's Climate Smart Agriculture (CSA) programs the focus was exclusively on climate change mitigation—how to reduce GHG emissions and increase carbon sequestration. Now there is greater understanding among experts in the field that to remain viable farmers and ranchers will have to adapt to significant and recurring extreme weather events at the same time as they reduce emissions.¹⁵¹ To achieve this, the state needs to support improved climate resilience in holistic ways and often across program areas.

The elimination of programmatic silos can also ease the burden of program administration for state agencies and make the programs more accessible, especially for underserved producers. Over the years, CalCAN has worked with partners on CSA program implementation issues and we have written extensively about the need to improve coordination across state programs and with federal partners as well as increase regional capacity to support improved implementation.¹⁵² Today, those needs feel even more urgent as the state looks to scale up this work and address growing climate impacts.



Assemblymember Jim Wood at a soil health farm tour in Sebastopol, CA.

¹⁵¹ Lengnick, L. (2018). [Introduction to climate resilience in agriculture](#). SARE.

¹⁵² For program specific reviews see <https://calclimateag.org/publications/>.

FINDINGS

Partnership Across State and Federal Agencies, Stakeholders Needed

We heard in our interviews that there is interest among state and federal agencies to coordinate and share information to support agency efforts to scale up climate-resilient agriculture. They recognized that state and federal partners have different strengths. Most notably, USDA's Natural Resources Conservation Service (NRCS) has the “boots on the ground” capacity that state agencies like the California Department of Food and Agriculture (CDFA) do not have. One interviewee described NRCS as having a focus on “building long-term relationships” with producers and the state's efforts as often being “one-and-done.” However, CDFA and other state agencies have been quicker to respond to the climate crisis than federal partners.

The interest in improved coordination is most evident with the recent Memorandum of Agreement (MOA) signed between CDFA, CA NRCS, UCANR (UC Agriculture and Natural Resources), and CARCD (California Association of Resource Conservation Districts). The parties to the MOA meet weekly to review technical assistance (TA) delivery issues and opportunities, looking for ways that they can streamline and support each other's efforts. The MOA represents an important acknowledgment of the need to break down silos and work across state, federal, and local agencies and stakeholders to achieve climate resilience in agriculture. We heard that translating the MOA to additional regional coordination will be key to its success.

State and Federal Partners Agree to Collaborate on Conservation Technical Assistance

In November 2022, CDFA, working with partners UCANR, CARCD, and California's NRCS, developed an MOA to strengthen the delivery of conservation technical assistance to the state's farmers and ranchers.¹⁵³ The MOA states, “The Parties recognize by working together, they can pool resources and have more impact on addressing natural resource issues such as water quality, drought resiliency, healthy forests, healthy soils, and the existential threat of climate change.” The MOA outlines six key focus areas of work for the partners:

- Equity in the Delivery of Technical Assistance
- Conservation Innovation and Practice Adoption
- Coordination
- Technical Capacity
- Maintain Consistent Locally Led Technical Assistance
- Collective Impact and Communication

There are examples of this kind of coordination happening at the regional level now, such as the North Coast Soil Hub,¹⁵⁴ which is a partnership of the region's Resource Conservation Districts, NRCS field offices, Cooperative Extension, the Santa Rosa Junior College, Carbon Cycle Institute, and farmers and other agriculture professionals in the area. For more on how this work is expanding, see the section [Expanding Technical Assistance to Support On-Farm Climate Resilience](#).

¹⁵³ USDA NRCS. [Memorandum of agreement between CDFA, CARCD, UC ANR and USDA/NRCS](#).

¹⁵⁴ For more on the North Coast Soil Hub, see here <https://soilhub.org/>.





Compost made from dairy manure and almond prunings.

New Partnerships and Expanded Demand With Block Grants

Across several programs,¹⁵⁵ CDFA is attempting to improve program delivery, expand its capacity to efficiently distribute high volumes of funds, and strengthen local partnerships by shifting from individual producers applying directly to CDFA for program funding to a block grant approach where CDFA funds regional partners who then deliver grants directly to producers.

This new approach has already expanded the number of farmer-serving organizations engaged in the programs and revealed untapped demand for the programs. For example, the recent SWEEP block solicitation received applications from 34 organizations requesting a total of \$157 million. This demand is nearly four times larger than the available funding (\$40 million) and nearly two times larger than the previous record demand (\$83 million) in 2021. Many of the 34 organizations that applied are irrigation districts and producer associations that are well-positioned to support their farmer members and expand the reach of the SWEEP program.

As with any new approach, there have been a few growing pains that need to be tended to. We heard from some of the interviewees familiar with the new California Underserved and Small Producer (CUSP) Program block grant that there was some confusion on the ground. For example, we heard that farmers in one region had applied to one local administrator of a CUSP grant, and when they did not hear back in a timely way, the farmers applied to a different local administrator, not realizing that it was the same CDFA program. We also heard the concern from several interviewees that the block grant approach did not adequately compensate partner organizations for the resources needed to adequately administer the grant programs or take into account regional needs. One interviewee noted that CDFA had improved the compensation for block grant recipients under the Pollinator Habitat Program, making it possible for some to apply.

Limited Capacity Hampers Response to New Climate Funding

The increase in state and federal funding for climate and agriculture projects is a great opportunity but it has also presented challenges for state and local partners that lack staff capacity. We heard that often the new grant funds come with short turnaround times to apply, requiring agency and partner organizations to drop their regular work and focus on quickly developing projects for new requests for proposals. This can hurt ongoing projects and result in new projects that would benefit from more input and development. One technical assistance interviewee commented, “The past three years we have seen huge funding streams but institutions are not equipped to take on that funding We have to drop everything and can’t do regular work to apply for the programs. We don’t have the leadership structures to make these investments.”

¹⁵⁵ Examples of CDFA programs that are incorporating block grants include the [California Underserved and Small Producer Program](#), HSP and SWEEP (both of which began block grants in 2023), and the [Pollinator Habitat Program](#).





Demonstration of water infiltration with different soil types.

Regional Efforts Need Greater Support, Flexibility to Innovate

We heard from some of the interviewees that they were interested in seeing climate-related funding focus on investing in local and regional efforts to work with farmers. “To get agriculture to the table,” one interviewee discussed the need to have funding at the local level to develop partnerships. Another interviewee said, “We need programs with more flexibility for farmers to experiment. Right now programs are too rigid and hard to manage. Free people up to experiment and find what works for you. Get rid of silos and cross purposes.” Some interviewees find the prescribed nature of state programs too limiting and difficult to adjust to local realities.

Regulatory Reform Still Needed

We continue to hear about the need to avoid conflicting state regulatory efforts to remove barriers to climate-resilient agriculture. Some progress has been made. For example, the Central Coast Water Resources Control Board (WRCB), in its latest revision of its Ag Order, now incentivizes healthy soil practices including cover crops and compost applications.¹⁵⁶ Progress has also been made on groundwater recharge efforts in agriculture with the work of DWR’s Flood-MAR (flood-managed aquifer recharge).¹⁵⁷ On the composting front, CDFA has partnered with U.S. EPA and others to streamline resources and information sharing about on-farm compost regulatory issues.¹⁵⁸ But more is needed if we are to truly overcome barriers to on-farm practices that conserve natural resources and move away from fossil fuel-based inputs. The Central Coast WRCB is the exception and not the rule when it comes to the Irrigated Regulatory Lands Program, which continues to try to fit organic producers into a regulatory scheme not set up for those who do not use synthetic fertilizers.

¹⁵⁶ California Water Boards. (2021, April 16). [Central Coast Regional Water Board adopts general waste discharge requirements for discharges from irrigated lands](#) [Press release].

¹⁵⁷ California Department of Water Resources. [Flood-managed aquifer recharge \(Flood-MAR\)](#).

¹⁵⁸ CDFA. [California's healthy soils initiative: On-farm compost resources](#).



RECOMMENDATIONS

Prioritize Investments in Regional Leadership and Collaboration

The new MOA on technical assistance is a great start. But to achieve its goals, the work of the MOA cannot stop at the headquarters level but must reach staff working regionally. It will be important to provide training and opportunities for coordination at the regional level so that all agency staff and TA providers are aware of the diversity of the state and federal programs that can support farmers and partners. Some of this work has already begun as we highlighted in our North Coast example above. Creating those local “pods” of partners across CDFA, NRCS, RCDs, and UC Cooperative Extension (UCCE) along with nonprofit partners requires intentional relationship building. State leaders can support this work by hosting regional meetings, webinars, and trainings to further regional coordination and by investing in regional staff resources.

Additionally, we heard there is a need to have local leadership and capacity building to support the influx of climate program funds. State and federal leaders in UCCE, CARCD, and NRCS, in partnership with CDFA, should consider how they can improve the capacity for local offices to be prepared for these new program areas.

Build on Existing Interdisciplinary Programs to Catalyze Innovation

Throughout this section and in many others, we heard from interviewees about the need for greater coordination and interdisciplinary collaboration at the regional and state level. Whether tackling regulatory streamlining, regional waste management, land use planning related to solar siting or at the urban/rural interface, there was a call for breaking down silos and moving from single practice incentives to integrated innovation. We identified a need for a Center for Climate and Agriculture Innovation to be a catalyst and convenor to connect the many existing programs and leaders in the public and private sectors to realize the full potential of climate-resilient agriculture. The Sustainable Agriculture Research and Education Program (SAREP) is a statewide program that, with additional investments, could serve as the foundation for a center like this.

Develop Cooperative Agreements With Local Providers, Incentivize Innovation

We support CDFA’s efforts to move toward block grants to administer program funding at the regional level, but it will be important to adequately compensate regional administrators. CDFA should consider cooperative agreement models such as that used by NRCS as well as in other sectors to see what works and what does not work. Such cooperative agreements should not take a one-size-fits-all approach but should consider the regional needs and capacity of the local partners. Such agreements can also support regional innovation and the leadership of local partners as they support farmers in their area with implementing program goals, overcoming barriers to adoption, and fostering innovation. For example, building in flexibility with the use of funds by regional partners could result in purchasing compost application and cover crop equipment to be shared by farmers. This approach is currently being explored through CDFA’s Healthy Soils Program block grant pilot, and we recommend CDFA consider how to expand this approach to other programs.

Increase Regulatory Streamlining to Achieve Multi-Benefits

The state should continue to look for opportunities to streamline regulatory programs and avoid conflicting efforts. For example, the CDFA on-farm compost efforts should continue beyond information sharing to reducing regulatory barriers to on-farm compost use (see the section [Dairy Manure Management: Moving from Waste Problem to Climate Solution](#)). At the top of the list for consideration should be the state’s Irrigated Lands Regulatory Program and supporting regional water boards in developing incentives for healthy soil practices, as the Central Coast Board has done. Regulatory streamlining must provide multiple benefits to farmers, the environment, and public health, and this triple bottom line can bring multiple stakeholders together if resources are provided to develop innovative solutions.



EXPANDING TECHNICAL ASSISTANCE TO SUPPORT ON-FARM CLIMATE RESILIENCE

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Expand Regional Hubs to Deliver State and Federal Resources
- Establish a California Center for Technical Development
- Improve State Grant Terms to Support TA Provider Professional Development

AUTHOR: Jeanne Merrill,
Renata Brillinger



INTRODUCTION

Agricultural producer access to professional technical assistance (TA) is crucial to the success of the transition to climate-resilient agriculture. Technical assistance providers include Resource Conservation Districts (RCDs), University of California Cooperative Extension (UCCE), and nonprofits with access to the latest science to inform a farmer's decision-making about their management choices. They provide farmers with a range of services that can include on-farm conservation planning, market development/business planning, on-farm conservation project development, grant application assistance, and project implementation.

TA is most effective when provided in the context of a long-term relationship between the conservation planner and the producer. TA providers not only anticipate potential problems for current practices and help troubleshoot failing practices from past years, they also help identify opportunities for climate smart management and financial support for adoption of new practices. Adaptive management allows farmers and agricultural practitioners to dynamically respond to changing conditions and uncertainties in their farming systems, an approach that is becoming increasingly important as climate impacts increase. A recent study by UC Agriculture and Natural Resources (UCANR) reported on the success of their Climate Smart Agriculture Team that has provided in-depth technical assistance to more than 1,300 farmers and ranchers in 24 counties.¹⁵⁹ The report emphasizes the importance of providing tailored outreach, education, and technical assistance to small-scale, non-English-speaking, and otherwise underserved farmers and ranchers.

In addition to the coordination and information sharing among technical assistance providers, as highlighted in the recent memorandum of agreement (MOA) signed by the California Department of Food and Agriculture (CDFA) and several other



Photo Credit: USDA-NRCS



¹⁵⁹ California Ag Today. [Farmers save money, water by adopting climate-smart agriculture practices.](#)

partners¹⁶⁰ (see the solution chapter [Breaking Down the Silos: Coordinating Agriculture Climate Action Across Programs](#)), more attention is needed to the professional development and career pathways for TA providers in agriculture. The complexities of managing agricultural lands in the face of greater weather extremes, new pest pressures, and constrained water resources require that technical assistance providers receive relevant training and professional development to address these new realities. Such efforts can develop career pathways for 21st-century agricultural technical assistance and assist with staff retention and development and are central to a viable and sustainable agricultural industry in the state.

To better understand these issues, we interviewed leaders in the field of agricultural technical assistance. Below we offer our findings and recommendations.

FINDINGS

Technical Assistance Hubs and Networks Can Amplify Impact

Climate-resilient practices vary depending on regional context and specific farm conditions, and we heard how important it is to tailor TA provision and deliver services at the local level. Also, to be successful with outreach and project design and implementation, TA providers need trusted relationships with the farmers and ranchers they serve, particularly those who have been systematically disenfranchised. Strong local partnerships and collaborations are needed to expand the reach to producers who may not have participated in government grant programs.

One example of a strong TA network is the North Coast Soil Hub,¹⁶¹ which is a partnership of the region's Resource Conservation Districts, field offices of the Natural Resources Conservation Service (NRCS), UCCE, the Santa Rosa Junior College, Carbon Cycle Institute, and farmers and other agriculture professionals in the area. Together they provide farmer-to-farmer workshops, long-term experimental demonstrations, technical services, and educational resources to improve soil health and accelerate on-farm climate solutions.

Another model is the network of partner biologists at Point Blue Conservation Science¹⁶² who work closely with district NRCS offices to do conservation planning and support producers with federal grant applications. Having adequate, dedicated, and permanent TA funding and sufficient staff that can serve the needs of their local agriculture communities is essential. Finally, SAREP was recently awarded \$2 million to strengthen the California Farm Demonstration Network by building a "hub-and-spoke" network in three regions (Sacramento Valley, North Coast, and Central Coast), a pilot Hmong/Mien Demonstration Hub, and a statewide Organic Demonstration Hub.¹⁶³

Grant Structures Can Limit Professional Development for TA Providers

In our interviews with TA providers, we heard concerns that the lack of career pathways and professional development is impacting staff retention. One former RCD director noted that the types of jobs that the RCDs offer are in high demand, but that for some RCDs, the lack of resources for professional development and related career pathways creates long-term staff retention issues and high turnover. We were told that when grant terms are only one to three years or offer limited indirect cost reimbursements, it is harder to invest in long-term career development for staff. We heard that compared to state grants, federal grants often offer better indirect rates and reimbursement policies overall, making investments in staff development easier. For example, one interviewee noted that it can take up to two years of work to complete a state grant and bill for the work done. This creates not only cash flow constraints but also limits funding for staff professional development and training.

¹⁶⁰ USDA NRCS. [Memorandum of agreement between CDFA, CARCD, UCANR and USDA/NRCS](#).

¹⁶¹ For more on the North Coast Soil Hub, see <https://soilhub.org/>.

¹⁶² For more on the partner biologist program at Point Blue, see <https://www.pointblue.org/our-work/working-landscapes/>.

¹⁶³ Read more about the [SAREP grant](#) for the California Farm Demonstration Network.



Expertise in Climate Smart Measurement, Monitoring, Reporting, and Verification Needed

Interviewees noted that new U.S. Department of Agriculture (USDA) funding for climate smart agriculture creates opportunities for staff development but also brings with it the need for new staff expertise. Specifically, TA providers need to develop or enhance their capacity to do measurement, monitoring, reporting, and verification (MMRV) of GHG emissions reductions associated with their climate change and agriculture projects. Some interviewees noted that moving toward MMRV systems creates opportunities for staff development, but noted a lack of resources to do that kind of professional development. Some noted that more automated systems that allow for standard reporting are also needed.

Innovative Approaches in California and Washington Offer Models

We heard from several of our interviewees about professional development efforts in California and elsewhere that offer models to scale up career pathway opportunities in resilient agriculture. Among them is the work of the Carbon Cycle Institute (CCI), which offers a variety of professional development training options for RCDs and others working on carbon farm plans in agriculture.¹⁶⁴ With funding from USDA and others, CCI is able to provide a three-week online training for TA providers on carbon farm planning and implementation, reaching 40 to 50 TA providers annually. The Center For Regenerative Agriculture And Resilient Systems at Chico State University¹⁶⁵ has launched a comprehensive TA provider training program that provides many pathways for professional development and technical service certification. Training is carried out in coordination with NRCS specialists.

The Center for Technical Development (CTD) in Washington state is one out-of-state model to look to for inspiration. Developed by Washington's Conservation Commission in partnership with NRCS, UCCE, local conservation districts, and others, the CTD offers ongoing professional development for TA providers working with farmers on conservation management. It provides ongoing and consistent professional development. This kind of well-resourced and comprehensive professional training can center efforts to scale up climate resilience efforts across the state's working lands.

Washington State's Center for Technical Development

One potential model for California to consider for climate smart agriculture professional development can be found in Washington state. The Center for Technical Development (CTD) was established “for the purpose of ensuring that all Washington State Conservation Districts have equal access to the proper professional development opportunities to advance technical expertise and the support to consistently plan and implement diverse conservation programs unique to the clientele, available resources, and geographical influences of their region.”¹⁶⁶

In 2022–23, CTD reported that 150 people attended nine trainings that were offered by a collaboration of six partner organizations. Topics included conservation planning, soil health, soil testing, riparian considerations, on-farm solar, and contract and procurement training. They also offer online networking forums, bringing TA professionals together to ask questions, discuss resources, and build professional relationships; and they have a certification program intended to complement and improve integration with NRCS certifications and reduce barriers to entry.



Photo Credit: WSCC Center for Technical Development

¹⁶⁴ For more on the CCI Carbon Farm Planning training, see <https://www.carboncycle.org/education-training/>.

¹⁶⁵ Read more about the [Chico State TAP](#).

¹⁶⁶ Read more about the [Center for Technical Development](#) in Washington.



RECOMMENDATIONS

Expand Regional Hubs to Deliver State and Federal Resources

Regional hubs are likely to be most successful with expanding the reach of California's TA provision and scaling up practices. They should be structured to involve a variety of partners and professionals. The California Association of RCDs, in collaboration with the Carbon Cycle Institute, is in the process of replicating the successful North Coast Soil Hub, launching six new Regional Carbon Farming Hubs across California. These can form the building blocks of an impactful network of organizations and agencies that can connect funding opportunities and expertise to farmers and ranchers interested and willing to implement new practices that mitigate climate change and shore up the resilience of their operations. They also provide a framework for documenting needs and opportunities at the regional scale and act as a conduit between local agricultural communities and state and federal resource agencies.

Establish a California Center for Technical Development

We support the creation of a California Center for Technical Development, similar to the center found in Washington state. Such an effort can coordinate professional development training and mentorships across provider types (e.g., NRCS, UCCE, RCDs, nonprofit, PCAs, etc.) and improve staff retention by developing career pathways. Given the racial demographics and language diversity of California's farmers and the fact that the percentage of non-white farmers and farmers with limited English proficiency is likely to grow, recruitment of TA providers with cultural and language literacy that matches the state's demographics should be a high priority.

A California Center for Technical Development can also address new technical assistance needs, including MRV expertise. Having a lead entity focused on agricultural technical assistance can relieve the burden of professional development across individual TA providers and provide a more cohesive and effective delivery of professional development in this space. The state can look to the Washington state model for lessons learned. With an initial investment of \$5 million, California can support the professional and career development of the state's agricultural technical assistance providers and meet the challenge of developing a resilient workforce.

Improve State Grant Terms to Support TA Provider Professional Development

Waiting two years to be paid on a state grant or finding that a state grant will not cover basic administrative costs hampers TA providers and limits investments in staff. To address this, the state must improve grant terms and can look to USDA grants as one model for providing better terms for its TA providers. Another option is to develop agreements across provider types (e.g., RCDs) and the state to provide uniform and fair compensation (e.g., indirect rates, reimbursement time frames, etc.). The Governor's Office should prioritize and lead this effort so that there are improved grant terms for TA providers across state agencies and departments. Improved state grant terms can provide the stability and necessary funding to support the professional development of TA providers.



Photo Credit: USDA-NRCS



ADVANCING FARMWORKER SAFETY AND WELL-BEING

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Increase Investment in Farmworker Workforce Development and Innovative Partnerships
- Develop New Farmworker Housing Units and Improve Existing Housing Stock
- Fund Unemployment, Food, and Health Access for Farmworkers
- Increase Farmworker Wages and Reform Federal Immigration Policy

AUTHOR: Jeanne Merrill



INTRODUCTION

California is a diverse and large agricultural state with a Mediterranean climate, which allows for the production of specialty crops that are dependent upon seasonal hand labor. As a result, California is home to the largest farmworker population of any state in the country. It is estimated that there are between 400,000 to 800,000 farmworkers in the state, many of whom are undocumented and living in poverty.¹⁶⁷

A climate-resilient agricultural economy in California will require a secure and resilient agricultural workforce. But much work is needed to achieve this. In recent years, farm labor shortages following anti-immigration federal policies combined with significant health impacts on workers from the COVID-19 pandemic have highlighted the vulnerabilities of the state's farm workforce.¹⁶⁸



Photo Credit: USDA Photo by Lance Cheung

Climate change further exacerbates farmworker vulnerabilities. As essential frontline workers, farmworkers are at great risk of experiencing the health effects of greater weather extremes, including heat and wildfire smoke.¹⁶⁹ Recent research found that respiratory-related hospitalizations attributed to wildfire smoke were 10 times higher than those attributed to non-smoke, bad-air days in Southern California.¹⁷⁰ Farmworkers also face a greater risk of heat-related death, a 20- to 35-fold increase compared to other workers.¹⁷¹

¹⁶⁷ Martin, P. L., et al. (2017). [How many workers are employed in California agriculture?](#) *California Agriculture*, 71(1).

¹⁶⁸ Bhattarai, A., & Gurley, L. K. (2020, December 15). [Trump, covid slowed down immigration. Now employers can't find workers.](#) *The Washington Post*.

¹⁶⁹ Gross, L. (2021, September 21). [Fires fuel new risks to California farmworkers.](#) *Inside Climate News*.

¹⁷⁰ Aguilera, R., et al. (2021). [Wildfire smoke impacts respiratory health more than fine particles from other sources: Observational evidence from Southern California.](#) *Nature Communications*, 12.

¹⁷¹ Jackson, L., & Rosenberg, H. (2010). [Preventing heat-related illness among agricultural workers.](#) *Journal of Agromedicine*, 15(3).

Farmworkers face these safety challenges not only in the fields but also at home. A 2018 study found that 67 percent of farmworker households experienced severe overcrowding in the Salinas and Pajaro Valley Region.¹⁷² The same study found that 5,300 permanent and affordable farmworker housing units are needed in the region. Furthermore, inadequate HVAC systems in existing farmworker homes mean that many farmworkers are vulnerable to extreme heat when they come home from the fields.

We spoke with farmworker advocates on how to advance farmworker safety and well-being to achieve a more resilient and secure farm labor workforce. Below we offer our findings and recommendations.

FINDINGS

Farmworker Workforce Development Tied to Need for Improved Wages to Adapt to New Climate Realities

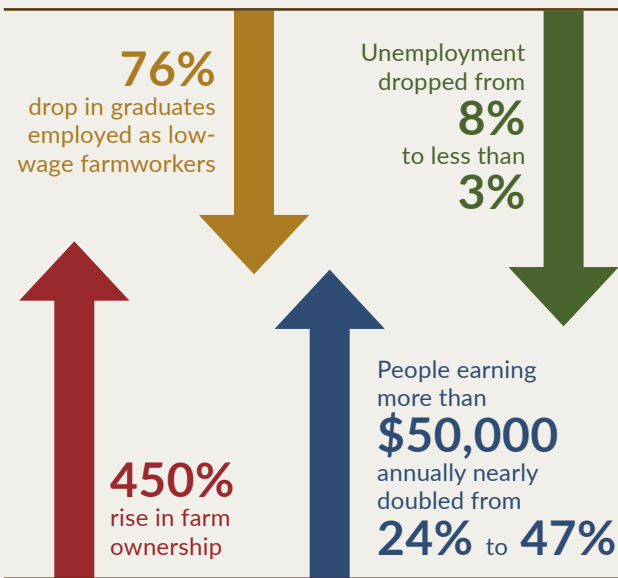
We heard from interviewees that farmworkers are already experiencing the impacts of a changing climate and related job losses. California’s recent drought resulted in land fallowing in 2022, especially in the Central Valley, impacting farmworker jobs. Excessive heat events have also impacted the health and well-being of farmworkers and their families. Recent floods have devastated farmworker homes in the Central Valley and on the Central Coast.

There is interest among farmworker advocacy organizations to develop workforce training options that support farmworkers in building farm management skills that support climate resilience (e.g., irrigation management, sustainable pest management, and pest monitoring), protect farmworkers from climate harms, and result in improved pay.

We heard from our interviewees that traditional workforce development through community colleges is inadequate for farmworkers. Many farmworkers lack the immigration status and education level that would allow them to participate in community college courses. Taking time away from work and losing associated wages also limits the ability of farmworkers to receive additional training. We heard that alternative models—often run by nonprofits that offer bilingual training (including multiple indigenous languages) and can compensate for the loss of wages—are more likely to be successful.

An example of a farmworker training resource is the Agriculture and Land-Based Training Association (ALBA)¹⁷³ in Salinas, CA. ALBA has incubated over 220 organic farm businesses, 85 percent of which are Latino-owned. Such programs require funding and partnerships to support farmworkers in receiving training that will improve their farm management skills and result in higher pay. Such partnerships will require working with farmers to identify needs and pay structures that compensate workers fairly.

ALBA’s 20-year impact report found the following changes reported by graduates of their incubator program:



¹⁷² California Institute for Rural Studies. (2018). [Farmworker housing study and action plan for Salinas Valley and Pajaro Valley](#).

¹⁷³ For more about ALBA, visit www.albafarmers.org



Safe, Affordable Homes Needed

Overcrowded housing with improper ventilation contributes to the high risks of airborne illnesses, including COVID-19 infections, among farmworkers and their families in California.¹⁷⁴ Furthermore, improper HVAC systems in existing farmworker homes put families at risk of heat events when proper cooling is not available. We heard about the importance of moving away from dormitory-style housing for single men that has been developed in some areas for workers with temporary H2A work permits and instead developing multi-unit, family housing for farmworkers and their households. AB 1654 (R. Rivas),¹⁷⁵ signed into law in 2022, requires the California Department of Housing and Community Development (HCD) to commission a study by the end of 2023 on the outstanding needs for farmworker housing.¹⁷⁶ The study should inform but not delay additional investments in farmworker housing and related investments in efficient HVAC systems.

The Food and Farm Resilience Coalition, working with Assemblymember Robert Rivas, was the lead advocate for the successful inclusion of \$200 million in the state budget for the Joe Serna Jr. Farmworker Housing Grant Program at HCD over two years (2021–22 and 2022–23). However, no additional funds were included in the state's 2023–24 budget.

Farmworker Families Need Access to Culturally Appropriate Health Care, Nutritious Food

The COVID-19 pandemic also highlighted the inadequate health care system for farmworkers and their families. We heard from interviewees about the initial difficulties of providing vaccine information and access to farmworkers. Adequate access to community clinics and hospitals is essential for farmworkers and their families. The closing of Madera Community Hospital in March 2023 has been especially hard on the farmworker families that the community hospital once served. Moreover, many farmworker families rely on food banks. We heard from advocates that to bring dignity and access to culturally appropriate, healthy food, the state should remove policy barriers to undocumented workers accessing the state's food assistance program.



Photo Credit: USDA Photo by Lance Cheung

¹⁷⁴ California Institute for Rural Studies. (2020). [Increased risks and fewer jobs: Evidence of California farmworker vulnerability during the COVID-19 pandemic.](#)

¹⁷⁵ AB 1654 text is available [here](#).

¹⁷⁶ California Institute for Rural Studies. (2020). [Increased risks and fewer jobs: Evidence of California farmworker vulnerability during the COVID-19 pandemic.](#)



Disaster Pay Needed

The COVID-19 pandemic had significant impacts on farmworkers who continued working and living in crowded conditions. A study done in Monterey County found that farmworkers in the county were three times more likely to contract the virus than non-farmworkers.¹⁷⁷ The vast majority of farmworkers who are undocumented are not eligible for unemployment pay when they are unable to work because of illness or extreme weather events like floods or wildfires. We heard from interviewees that disaster pay is critical for farmworker families, many of whom are food insecure and live on the edge of extreme poverty. A legislative proposal would create an unemployment fund for farmworkers, which our interviewees said was a critical step toward achieving a more resilient agricultural workforce in the state.¹⁷⁸

RECOMMENDATIONS

Develop New Farmworker Housing Units and Improve Existing Housing Stock

To make it possible for farmworkers and their families to thrive and participate in the agricultural economy, adequate housing that protects from heat events is essential.¹⁷⁹ Recent state investments in the Joe Serna Jr. Farmworker Housing Grant Program¹⁸⁰ and the farmworker component of the Low-Income Home Weatherization Program¹⁸¹ are great starts to this effort. But more is needed. We recommend the state establish a target of 2,500 new farmworker housing units annually from now until 2030, which would require an investment of roughly \$200 million per year. These efforts should be part of the state's larger efforts to support affordable, in-fill housing that is connected to transit and services. Given the state's recent multi-billion dollar housing budgets, this is a small piece of the state's overall efforts to address urgent affordable housing needs. We also recommend \$25 million annually for the Farmworker Component of the Low-Income Home Weatherization Program to support ongoing energy efficiency and HVAC improvement of existing farmworker housing.



Zero net energy affordable housing project for farmworker families in Woodland, CA.

¹⁷⁷ Ibid.

¹⁷⁸ Foy, N. (2023, February 16). [Floods, fires, droughts show California needs bigger safety net for farmworkers, advocates say.](#) CalMatters.

¹⁷⁹ Quandt, S. A., et al. (2013). [Heat index in migrant farmworker housing: Implications for rest and recovery from work-related heat stress.](#) *Am J. Public Health*, 103(8). e24–e26.



Increase Investment in Farmworker Workforce Development and Innovative Partnerships

As climate change brings more challenges to farmers, there is a growing need for farm managers and workers with the skills and expertise to manage farm operations in resilient ways, addressing water, soils, and biodiversity needs. To address these issues, farmworker workforce development is an ongoing need. Building upon the High Roads Partnership effort underway in the state, the state can seek out a diversity of partners to reach farmworkers. This effort cannot rely on a traditional model of community colleges that may constrain the participation of immigrants and non-native speakers with limited traditional education backgrounds. Nonprofits and community development corporations may be best suited to develop models that lead to training and career pathways for farmworkers to build climate-resilient farm management skills or to transition to farm ownership or into other agricultural careers such as technical assistance.

Fund Unemployment, Food, and Health Access for Farmworkers

All California workers, regardless of immigration status, should have access to unemployment when illness or disaster strikes and they are unable to work. We support efforts to establish unemployment funds for those undocumented workers. We also support efforts to allow undocumented farmworkers access to the state's food assistance program, CalFresh. The expansion of Medi-Cal benefits to undocumented workers has been a significant improvement for farmworkers and their families, but regional disparities continue and must be addressed. Such investments in unemployment and food assistance for farmworkers and their families can alleviate poverty, uplift families and their children, and avoid the long-term costs of communities impacted by extreme income disparities.

Increase Farmworker Wages and Reform Federal Immigration Policy

Ultimately, we need an agricultural system where farmers receive a fair price for their products and farmworkers receive a fair wage for their work. Fixes to the labor shortages that rely on bringing in guest workers without their families only perpetuate the disparities and harms that farmworkers experience. True immigration reform should give a path to legalized citizenship. As members of the National Sustainable Agriculture Coalition, we support their principles for immigration reform.¹⁸² We must bring together the needs of farmers and farmworkers to achieve an economy that is based on dignity, climate resilience, and justice for all.



¹⁸⁰ [Joe Serna, Jr. Farmworker Housing Grant Program](#)

¹⁸¹ [Farmworker Component of the Low Income Home Weatherization Program](#)

¹⁸² NSAC [Principles on Immigration Reform](#), adopted April 2013.



MOVING BEYOND CONSOLIDATION: BUILDING A CLIMATE-RESILIENT AGRICULTURAL ECONOMY

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Invest in Regional and Local Food Processing, Distribution, and Aggregation
- Support Climate-Resilient Market Development
- Develop Farm-to-Institution Procurement Policies and Programs
- Invest in Agricultural Cooperatives Planning and Development, Review Tax Issues
- Government Action Needed to Restore Competitive Agricultural Markets

AUTHOR: Jeanne Merrill



INTRODUCTION

Industry consolidation and the rise of anti-competitive markets in agriculture, where a very few multinational companies dominate the market landscape, is not new in agriculture. But increasingly, more industry leaders are highlighting the threats of these trends to the climate resilience of agriculture.

Consolidation in agriculture has skyrocketed in recent years. According to the National Sustainable Agriculture Coalition:

Just four corporations are responsible for 65 percent of sales in the global agrochemicals market, 50 percent of the seed market, and 45 percent of farm equipment sales. In the United States, just four companies represent 73 percent of beef processing, 67 percent of pork processing, 54 percent of chicken processing, and 45 percent of the retail grocery market.¹⁸³

Anti-competitive markets can hurt the ability of farmers to get a fair price for their products and are an important factor in the decline of family-scale farms in the country.¹⁸⁴ California has experienced a steady decline in farms and ranches over the years, especially small and mid-scale producers. From 2007 to 2017, the number of agricultural operations under 179 acres declined by nearly 10,000 operations or 15 percent; those “in the middle,” ranging from 180 acres to 499 acres, declined during this period by 650 operations or 9 percent. At the same time, the number of farms and ranches of 1,000 acres or more in the state remained the same.¹⁸⁵

To address these issues, since the 1990s, small and mid-sized farmers along with agricultural and food system leaders have created regional and local food markets to increase opportunities to sell farm products directly to consumers, diversify market opportunities for producers, and receive better prices. As a result, there is a strong but still relatively small regional



Photo Credit: USDA

¹⁸³ See the NSAC series [The Time is Ripe for Competition and Antitrust Reform in Agriculture](#) on the rise of anti-competitive markets in agriculture.

¹⁸⁴ InProgress. (2019). [A fair deal for farmers.](#)

¹⁸⁵ Data taken from the [California Ag Census](#) statistics from the USDA NASS.



Guido Frosini from True Grass Farms in Sonoma, CA.

food system in California made up of farmers' markets, community supported agriculture farms, and farm-to-institution procurement initiatives. The Economic Research Service of the U.S. Department of Agriculture (USDA) reports that by 2020, direct-to-consumer farms' sales reached \$10.7 billion nationally, up 35 percent from 2019.¹⁸⁶ This bifurcation of agricultural markets has allowed some farmers to continue despite the rise of anti-competitive markets in the sector.

Nonetheless, the dominance of consolidated agricultural markets and related rigid supply chains remain and have shown new vulnerabilities in recent years. In March 2020, in response to the COVID-19 pandemic shutdowns, institutional and restaurant markets closed and export markets faltered.¹⁸⁷ Practically overnight, many California farmers were

forced to leave crops to rot in the fields without markets to sell them, with some producers losing 50 percent of their markets.¹⁸⁸ However, the pandemic also highlighted the resilience of regional and local food markets. Those producers who had direct consumer markets (e.g., community supported agriculture, farmers markets, online sales, etc.) were able to still sell their products, and many experienced increased consumer demand as consumers looked for alternatives to traditional grocery stores.

In response to the supply chain challenges of the pandemic, USDA announced in June 2022 a framework for supporting more resilient food supply chains with nearly \$3 billion in investment from the American Rescue Plan.¹⁸⁹ Under its framework, USDA outlined investments in production, processing, supply chain aggregation/distribution, and markets. The framework offers an important roadmap to climate-resilient markets. This effort follows President Biden's 2021 Executive Order on Promoting Competition in the American Economy. Significantly, the order highlights the impacts of anti-competitive markets on farmers:

Consolidation in the agricultural industry is making it too hard for small family farms to survive. Farmers are squeezed between concentrated market power in the agricultural input industries—seed, fertilizer, feed, and equipment suppliers—and concentrated market power in the channels for selling agricultural products. As a result, farmers' share of the value of their agricultural products has decreased, and poultry farmers, hog farmers, cattle ranchers, and other agricultural workers struggle to retain autonomy and to make sustainable returns.¹⁹⁰

¹⁸⁶ USDA Agricultural Research Service. (2022). [Direct-to-consumer farm sales reach \\$10.7 billion in 2020](#).

¹⁸⁷ Ibid.

¹⁸⁸ Ross, K. (2020, April 3). [#FarmersFeedtheNeed – a coordinated effort to provide food to needy Californians](#). CDFA.

¹⁸⁹ Data taken from the [California Ag Census](#) statistics from the USDA NASS.

¹⁹⁰ The White House. (2021, July 9). [Executive Order on promoting competition in the American economy](#).



Following the executive order, USDA, tasked with advancing the administration's efforts to address industry competition issues in agriculture, has issued reports detailing the detrimental market environment farmers and ranchers are facing.¹⁹¹ The agency has also issued draft rules under the Packers and Stockyards Act, but they have so far failed to issue final rules and begin enforcement, delaying economic relief for the country's farmers and ranchers. A recent report card by agency watchdogs gave USDA a "C" for its work on market competition issues.¹⁹²

Here we dive into market consolidation issues and share our interview findings. We interviewed California agricultural industry leaders whose work is focused on developing regional and local agricultural markets and farmer associations as well as improving farmer access to land and capital in California. Overwhelmingly, we heard strong support for assisting the transition to climate-resilient agriculture but we also heard about marketplace challenges to scaling this effort. Below we offer policy recommendations.

FINDINGS

The Food System Is Broken

We heard that even for those producers who have transitioned to climate-resilient agriculture, including organic and sustainable farming methods, accessing markets, receiving a fair price, and continuing to be economically viable are challenges, especially for independent, small, mid-scale, and underserved producers. One financial consultant to underserved producers said: "We have a bifurcated system that's tilted toward export markets. We need more localized, regional food systems that are more diversified. We need to develop regional marketing efforts. Create food hubs, for example. We have a broken system. Farmers are usually price takers in the wholesale market. Loyalty is low and there's a real pressure to keep prices down."

The Future Is Resilient Agriculture, but Data, Markets, and Infrastructure Needed

All of our interviewees want to scale up climate-resilient agriculture and develop related markets. Some interviewees are focused on developing the data for buyers so they can identify those producers who are meeting their climate-related standards. For other interviewees, the focus is on growing local and regional markets for organic and pasture-raised products; however, the "consolidation of processing" presented challenges. To adequately grow the market, they argue that investment is needed in regional markets, related infrastructure (processing, food hubs, distribution), and market development.

Cooperatives Give Farmers Power in the Marketplace

We interviewed technical assistance providers working with producers, many of whom are underserved, to develop cooperatives to improve farm economic viability. The benefits of cooperatives to farmers, they argue, are many, including accessing markets, bringing down the costs of inputs and other equipment, and learning best practices from fellow producers. One interviewee stated that "co-ops are resilient business models; they are more resilient to market failures." One interviewee stated that co-ops can offer services, including bilingual services to its members and grant application assistance. Co-ops, they stated, give farmer members power in the marketplace that they otherwise lack as individual producers. Staff with the California Center for Cooperative Development have worked in recent years to support new agricultural cooperatives in the state, some of which are interested in advancing climate-resilient agriculture.

We also heard that there are challenges with cooperatives. Both technical assistance providers and academics working on these issues pointed out that the cooperative tax law should be reviewed to level the playing field with corporate law and improve the chances of cooperatives to thrive.

¹⁹¹ See two reports from USDA: [Agricultural Competition: A Plan in Support of Fair and Competitive Markets](#) and [More and Better Choices for Farmers: Promoting Fair Competition and Innovation in Seeds and Other Agricultural Inputs](#).

¹⁹² Open Markets and Farm Action. [A 2023 review of the Biden Administration's commitment to food system competition](#).





Photo Credit: USDA

RECOMMENDATIONS

Invest in Regional and Local Food Processing, Distribution, and Aggregation

The regionalization of food systems requires access to food processing, distribution, and aggregation infrastructure to support farmers in bringing their products to local and regional markets. As USDA outlined in its resilient food supply chain and systems initiative, investment in this kind of infrastructure can improve the resilience of food supply chains and make possible farmer access to new markets. Moreover, connecting those new markets with climate-resilient agricultural products can provide additional incentives for producers to make the transition. Given the needs for regional market infrastructure, the state should also advance these efforts through investment. By connecting these investments with lifting up climate-resilient agriculture, a strong case can be made to include these investments in any forthcoming climate bond measure.

Support Climate-Resilient Market Development

Connecting infrastructure development with new local and regional market development—which seeks to increase community access to healthy, culturally appropriate foods—is a crucial part of the resilient food supply chain effort. Investing in community-based market development, focused on key principles of resilience, health, and sustainability, will support strategic regional market investments and development. USDA’s new Organic Transition Initiative has a strong focus on organic market development that California could look to as a model in an effort to improve markets for climate-resilient agricultural products.¹⁹³

Develop Farm-to-Institution Procurement Policies and Programs

Since 2020, California has invested nearly \$850 million in Farm-to-School procurement projects, school kitchen equipment, and workforce development to support the procurement of locally sourced foods for school meals.¹⁹⁴ This kind of commitment to market development supports farmers in accessing new markets that otherwise were largely only accessible to corporate food buyers. Other state institutions can follow suit through the development of procurement policies and programs that prioritize local and regionally produced food, with a focus on procuring sustainable and organically produced food that advances the state’s climate goals. We recommend a target of 20 percent for the state’s procurement of organic food by 2045.¹⁹⁵

¹⁹³ USDA Agricultural Marketing Service. (2022, October 24) [USDA announces regional networks for new Transition to Organic Partnership Program](#) [Press release].

¹⁹⁴ Marshall, Chalmers, A. (2022, August 15). [Farm to school efforts just got a big influx of cash. Will it help more schools get on board?](#) *Civil Eats*.

¹⁹⁵ This target was included in recommendations made by CalCAN and a coalition of advocates to the California Natural Resources Agency in response to its call for public comment on target setting as required by AB 1757. See this [CalCAN blog](#) for more details.



Invest in Agricultural Cooperatives Planning and Development, Review Tax Issues

Farmers can gain access to markets and strengthen their position in the marketplace through the development of agricultural cooperatives. Cooperatives give farmers greater bargaining power in the marketplace, allowing them to go from “customers to markets,” as one interviewee described the benefits of co-ops. And in times of market disruptions, like the COVID-19 pandemic or during extreme weather, cooperatives can help buffer their farmer members through access to pooled resources. State investment in cooperative planning and development could bring together otherwise underserved producers to more effectively position themselves in the marketplace. We also support a review of state cooperative tax law to better understand how current policies may limit the effectiveness of cooperatives as an alternative model for producers.

Government Action Needed to Restore Competitive Agricultural Markets

As we heard in our interviews, the agricultural economic system is broken. To fix it, we must address market consolidation and the rise of anti-competitive markets, where a few corporate players—in seeds and other inputs to processing, distribution, and procurement—dominate. This requires federal and state governments to use anti-trust powers to break up oligopolistic markets and restore competition. For some commodities, like dairy, it may mean a return to supply management to restore fair pricing to producers. In 2019, the Center for American Progress released *A Fair Deal for Farmers*, a report which outlined how governments can restore competitive agricultural markets. California’s Attorney General can also bring to bear the state’s anti-competitive laws to address consolidation and anti-competitive markets in the agriculture sector.¹⁹⁶ Ultimately, we need the Biden Administration to issue final rules governing market competition issues in agriculture. We likely also need engagement by the Federal Trade Commission (FTC) in agriculture-adjacent markets, like food retailers. We must go beyond draft rules and executive orders toward enforcement if we are to end the squeeze on small family farmers.

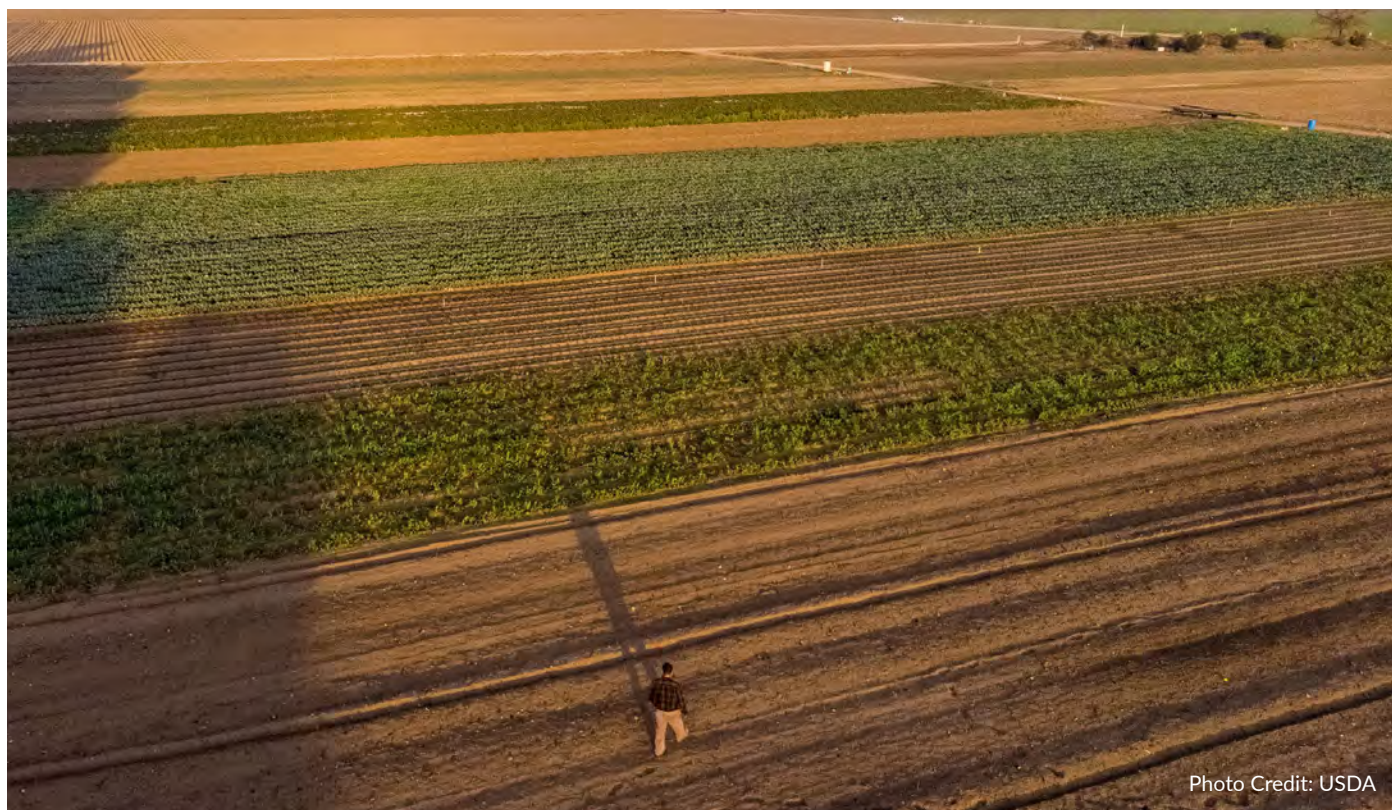


Photo Credit: USDA

¹⁹⁶ One example of the California Attorney General’s efforts to address anti-competitive markets is the state’s lawsuit against Amazon as reported in Politico, September 14, 2022. [California sues Amazon over third-party contracting.](#)





OUR MISSION:

CalCAN is a statewide coalition that advances state and federal policy to catalyze the powerful climate solutions offered by sustainable and organic agriculture. We use policy to move California agriculture towards a system that is increasingly resilient and just.

OUR VISION:

We envision a California agriculture system that is resilient, is a sink for greenhouse gases rather than a source, and that supports wildlife habitat and biological diversity.

Sustainable and organic farming and ranching practices rooted in ecological principles are widespread, readily accessible to all farmers, and supported by a robust network of technical advisors and researchers.

The people who grow our food have safe working conditions and agricultural communities have clean air and water, access to healthy food, and thriving rural economies.

To ensure our food security, abundant productive agricultural land is permanently protected, and new farmers have access to the land, capital, and technical resources they need to be successful.

Photo Credit: USDA