

CALIFORNIA'S HEALTHY SOILS PROGRAM DEMONSTRATION PROJECTS: A Progress Report



CalCAN
CALIFORNIA CLIMATE &
AGRICULTURE NETWORK

NOVEMBER 2022

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Acknowledgements

We thank the California Department of Food and Agriculture (CDFA) for their assistance in providing information for the report.

This report is available on the CalCAN website: calclimateag.org/publications.

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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



As California's farmers and ranchers continue to experience worsening impacts of climate change, there is an urgent need to deliver on California's goal of scaling up healthy soils practices to increase climate resilience, sequester carbon, and provide a suite of co-benefits, as outlined in California's Natural and Working Lands Climate Smart Strategy and Pathways to 30x30.¹

As the state experiences record-high revenues, the time is now to invest in programs that deliver on California's climate goals. California's Healthy Soils Program (HSP) Demonstration Projects work to catalyze the wider adoption of healthy soils practices through demonstration, outreach, and research.

Healthy soils practices can help sequester carbon and mitigate the impacts of climate change. These practices can improve pest and disease management, crop yields, water infiltration and retention, and resilience to extreme weather. These practices also enhance public health, improve water and air quality, increase pollinator and wildlife habitat, and provide significant potential to mitigate climate change. As the first program of its kind in the country, HSP Demonstration Projects also have the potential to inform and inspire other state soil health programs across the country.²

Since 2017, the HSP has funded 78 demonstration projects to bring together farmers, technical assistance providers, and researchers to showcase healthy soils practices and engage in on-farm research and outreach. In 2020, we reviewed the HSP Incentives Program and shared a report on program successes and opportunities for improvement.³ Now, in 2022, the first round of three-year HSP Demonstration Projects is complete. In this report, we provide a brief overview and history of these projects, discuss program successes, and highlight ways to increase program effectiveness and better meet program objectives.

Our findings, summarized below, are based on an analysis of program data from 2017–2021 from the California Department of Food and Agriculture (CDFA) as well as interviews and surveys conducted with farmers, technical assistance providers, and researchers from December 2021 through February 2022. Our recommendations describe how the program can better support the widespread implementation of healthy soils practices.



¹ California Natural Resources Agency. (2022). [Natural and Working Lands Climate Smart Strategy](#), p. 34; California Natural Resources Agency. (2022). [Pathways to 30 x 30](#), p. 21.

² For a review of primarily California-based, peer-reviewed scientific literature on the many benefits of healthy soils practices, see our publication [Climate Change Solutions in California Agriculture](#) (2019).

³ CalCAN. (2020). [The California Healthy Soils Program: A Progress Report](#).



FINDINGS

1. **Program design must be participant-centered.** Program participants emphasized the importance of transparent, accountable processes for incorporating stakeholder feedback.
2. **Program rules need additional flexibility and clarity.** Respondents shared that in order to successfully implement healthy soils practices, farmers must be able to make management decisions that reflect local conditions and factors outside of their control.
3. **Current reporting requirements create administrative burden.** Many program participants experienced high compliance costs and stress associated with program requirements.
4. **Program research has generated meaningful soil science insights.** Participants noted important research insights, such as understanding the yield and soil carbon impacts of adopting specific healthy soils practices.
5. **Demonstration projects foster new connections and learning.** Growers, researchers, and technical assistance providers consistently shared that building relationships and connecting with new stakeholders was a highlight of the program.
6. **Demonstration projects would benefit from a broader research agenda and longer research timelines.** A longer research period would allow projects to better measure changes in soil carbon, as well as economic and ecosystem service benefits.
7. **Outreach requirements should reflect local conditions and prioritize quality.** Participants felt that it was important to engage key agricultural stakeholders in addition to farmers, and that outreach requirements should reflect region and crop type.
8. **Demonstration projects support meaningful outreach, but follow-up is needed to understand healthy soils practice adoption.** Program participants shared that the program supports important outreach, and project recipients are interested in understanding how demonstration projects impact practice adoption.

RECOMMENDATIONS

We recommend CDFA take the following actions:

1. Develop processes to regularly solicit, discuss, and incorporate stakeholder feedback into the HSP demonstration application, program guidance, and reporting requirements.
2. Support on-the-ground innovation and experimentation through program flexibility.
3. Reduce reporting requirements and focus on whether grantees achieved their project goals.
4. Refocus research on questions central to farmer adoption of healthy soils practices, such as benefits to farmers and economic analysis.
5. If the program continues to fund greenhouse gas (GHG) emission research, provide additional funding and clear data collection guidelines for field measurements of GHG emissions.
6. Extend program length for Type A projects to 5 to 10 years to accurately measure costs and benefits and/or soil carbon changes.



7. Allow participants to propose outreach plans that reflect their crop and region and include the full spectrum of farm decision-makers.
8. Encourage Type A projects led by university researchers to partner with an organization who will focus on the outreach and education component.
9. Work with partner organizations to conduct outreach in underrepresented regions.
10. After implementing the recommendations described above, conduct a program evaluation to understand program effectiveness and identify opportunities for improvement.





INTRODUCTION

Healthy soils are critical to productive, climate smart, and resilient agriculture. The health of our soils is improved through farm management practices that increase soil organic matter, water infiltration and retention, plant health, and crop yields—all of which also improve farmers' economic viability and resilience. Healthy soils, and relatedly, improving woody biomass on farms by planting trees and shrubs, can also reduce greenhouse gas emissions and increase carbon sinks, reduce the need for chemical inputs, increase drought and flood tolerance, and improve the quality of the air we breathe and the water we drink.⁴

While healthy soils farm management practices provide significant benefits, the upfront costs of implementation and need for new technical knowledge can be barriers for farmers and ranchers.

Recognizing these benefits and barriers, the state of California established the Healthy Soils Program in 2016 as part of a suite of Climate Smart Agriculture programs. The program funds primarily technical and financial assistance to farmers and ranchers to implement healthy soils practices on their operations.⁵ CDFA also included a demonstration projects component to fulfill the need for outreach and education on these farm practices.

The demonstration projects bring together farmers, technical assistance providers, and researchers to showcase healthy soils practices and engage in on-farm research and farmer outreach and education to increase adoption of healthy soils practices on California's farms and ranches. To date, the state has funded 78 Healthy Soils Demonstration Projects since 2016.

In 2020, we released a report on the state's Healthy Soils Program, which was unique in the country when it was established. That report focused primarily on Healthy Soils Program Incentives grants, which provide direct, acreage-based payments to farmers for implementing healthy soils practices. In that report, we were not able to analyze the demonstration projects and identify to what extent they are achieving their goal of making the agronomic and economic case for healthy soils practices to farmers and ranchers. Making the case to farmers that these practices benefit their operations is critical for the long-term success of climate smart agriculture.

In this report, we provide an overview of California's HSP Demonstration Projects, summarize their impacts to date, highlight the program's successes, and identify opportunities for improvement to better catalyze adoption of healthy soils practices. This report is intended for policymakers and advocates in California and beyond who are interested in the HSP Demonstration Projects.

⁴ Paustian, K., et al. 2016. Climate-smart soils. *Nature*, 532, 49–57.; Bowles, T., et al. 2014. Soil enzyme activities, microbial communities, and carbon and nitrogen availability in organic agroecosystems across an intensively managed agricultural landscape. *Soil Biology and Chemistry*, 68, 252–262.; Quemada, M., et al. 2013. Meta-analysis of strategies to control nitrate leaching in irrigated agricultural systems and their effects on crop yield. *Agriculture, Ecosystems and Environment*, 174, 1–10.; Smukler, S.M., et al. 2010. Biodiversity and multiple ecosystem functions in an organic farmscape. *Agriculture, Ecosystems and Environment*, 139, 80–97.

⁵ The program also includes practices that support soil health, such as prescribed grazing and tree and shrub planting.





BACKGROUND

PROGRAM HISTORY AND GOALS

The Healthy Soils Program, which includes both the Incentives Program and Demonstration Projects, was established in a California statute in 2016. The statute directed the CDFA, in consultation with the Environmental Farming Act Science Advisory Panel (EFA SAP), to create and oversee the Healthy Soils Program. The statute outlines the mission of the program and directs CDFA to determine program priorities within certain parameters.

As specified in the statute, the mission of HSP is to *“optimize climate benefits while supporting the economic viability of California agriculture by providing incentives, including, but not limited to, loans, grants, research, and technical assistance, and educational materials and outreach, to farmers whose management practices contribute to healthy soils and result in net long-term on-farm greenhouse gas benefits.”*⁶

The statute includes permission to fund on-farm demonstration projects as part of the program and stipulates that CDFA, in consultation with the EFA SAP, must establish a technical advisory committee to review demonstration project applications for “scientific validity and the proposed project’s potential to achieve greenhouse gas benefits.”⁷

Since establishing the program, CDFA has funded a total of 78 demonstration projects. Of those 78 projects, 47 are active, 5 were canceled, and 26 have been closed out (12 of which met program requirements at the time of closing out and 14 of which did not).^{8,9}

EFA SAP OVERVIEW

The 2016 statute establishing the Healthy Soils Program requires CDFA to develop the program in consultation with the Environmental Farming Act Science Advisory Panel (EFA SAP). The nine panel members are appointed by the Secretaries of CDFA, the California Environmental Protection Agency, and the Natural Resources Agency. Members, who serve three-year terms, are required to have relevant expertise, ranging from production agriculture and organic farming to environmental and climate science. The EFA SAP meets quarterly to advise CDFA on HSP and other issues. Among their other responsibilities, the EFA SAP reviews and approves eligible healthy soils practices and changes to the program’s rules and guidelines. The EFA SAP’s quarterly meetings also serve as an important public forum for CDFA staff, HSP advocates, and stakeholders to share and discuss feedback on program implementation.

⁶ [Food and Agricultural Code, Division 1, Part 1, Chapter 3, Article 8.5, Section 569 \(a\)\(1\).](#)

⁷ [Food and Agricultural Code, Division 1, Part 1, Chapter 3, Article 8.5, Section 569 \(a\)\(4\).](#)

⁸ California Department of Food and Agriculture (2021). [Demonstration Projects 2017-2020 Project Level Summary.](#)

⁹ Current as of September 2022.



PROGRAM FUNDING

Program funding amounts for HSP have steadily increased each year, with exceptions of a gap in funding in fiscal year (FY) 2018–2019 and again in fiscal year 2020–2021. In the two most recent budget cycles, the state has had a significant budget surplus and allocated sizable funds to the program. The percentage of HSP funding that has gone to demonstration projects has decreased considerably. Please refer to Table 1 for a breakdown of program funding each year.

Table 1. HSP Demonstration Project Funding in Millions of Dollars, FY 2016–2021.

Year	Demonstration Project Funding	Total Program Funding	Sources
FY 2016–2017	\$3.6	\$7.5	GGRF ¹⁰
FY 2017–2018	\$3.5	\$15	Prop 68 ¹¹ (67%), GGRF (33%)
FY 2018–2019	\$0	\$0	—
FY 2019–2020	\$3	\$28	GGRF
FY 2020–2021	\$0	\$0	—
FY 2021–2022	\$1.1	\$75	GF ¹² (67%), GGRF (33%)
FY 2022–2023	to be announced	\$85	GF

DEMONSTRATION PROJECTS OVERVIEW

This report focuses on the demonstration component of the Healthy Soils Program. For information on the Incentives Program, please refer to [CalCAN's Healthy Soils Program Progress Report](#).

The demonstration project component funds farmers and partners for a three-year term to establish on-farm demonstrations of healthy soils practices and conduct field days and other educational activities to promote farmer-to-farmer learning. Demonstration projects must have at least one partner organization who serves as the principal investigator for the project, and projects may have additional partners as cooperating entities if they choose. Partner and cooperating entities can be university researchers, Resource Conservation Districts (RCDs), University of California Agriculture and Natural Resources (UCANR) staff, Tribes, and non-profits.

The 2021 Request for Grant Applications states *“The purpose of the HSP [Demonstration Projects] is to improve soil health, sequester carbon, and reduce atmospheric GHGs by [...] funding on-farm demonstration projects that collect data and/or showcase conservation management practices that mitigate GHG emissions and increase soil health and creating a platform promoting widespread adoption of conservation management practices throughout the state.”*¹³

¹⁰ California Climate Investments. [Greenhouse Gas Reduction Fund](#).

¹¹ [Parks and Water Bond Act of 2018 \(Proposition 63\)](#).

¹² California General Fund.

¹³ California Department of Food and Agriculture. (2021). [2021 Healthy Soils Program Demonstration Projects Request for Grant Applications](#).



All demonstration projects have two primary components: demonstration of healthy soils practices and outreach. Some projects have one additional component: research on the carbon sequestration effects of healthy soils practices. Projects must be estimated to result in net reductions in greenhouse gas emissions, as determined by an HSP-specific version of COMET-Planner, to be considered for funding.¹⁴

PROGRAM REQUIREMENTS

All demonstration projects are subject to the following requirements:

- Submit three years of cropping history and management practice history in the application.
- Establish one or more healthy soils practices for demonstration and implement them according to specific protocols outlined in the Request for Grant Applications and Grant Award Procedures Manual.
- Connect with at least 120 unique farmers at the demonstration project site throughout the course of the three-year project.
- Collect soil organic matter data.

There are two project types, described in Table 2, with slightly different requirements.

Table 2. Program Requirements.

Requirement	Type A	Type B
Establish one or more healthy soils practice	✓	✓
Outreach to 120 unique farmers and ranchers	✓	✓
Collect soil organic matter data	✓	✓
Up to \$100,000 in funding		✓
Up to \$250,000 in funding	✓	
Provide crop yield data	✓	
Take GHG measurements from replicated research plots	✓	
Optional: Conduct additional analyses (economic, soil health, co-benefits, and ecosystem services)	✓	✓

¹⁴ For the HSP practices that have been developed by NRCS, COMET-Planner calculates the estimated GHG benefit using a model called DAYCENT. For the HSP practices that have been developed by CDFA and CARB (compost application and whole orchard recycling), COMET-Planner calculates the estimated GHG benefit using the DeNitrification- DeComposition (DNDC) model developed at the University of New Hampshire. Model estimation of GHG benefits for each practice is calibrated for each county based on factors including climate, soil type, crop type, and irrigation to improve accuracy. For more information on COMET-Planner, see the [COMET-Planner website](#).



ELIGIBLE PRACTICES

The California Food and Agriculture code defines healthy soils as “soils that enhance their continuing capacity to function as a biological system, increase soil organic matter, improve soil structure and water- and nutrient-holding capacity, and result in net long-term greenhouse gas benefits.”¹⁵

Type A demonstration projects are focused on providing scientific data that will help quantify the GHG reduction benefits of less-studied practices. Type B demonstration projects can use any of the healthy soils practices available in the larger program for purposes of outreach and education for farmers. Healthy soils practices for Type A and Type B projects are summarized in Tables 3 and 4.

Table 3. Practices Eligible for Type A Demonstrations.

Type A Eligible Practices	
Cropland, Orchard and/or Vineyard	Grazing Land
Anaerobic digestate application	One-time compost application with higher rates for grazed grasslands
Microbial inoculation with compost tea	
Mycorrhizal application	
Nutrient management—replacing synthetic N fertilizer with soil amendments	
Nutrient management—use of nitrification inhibitors	
Nutrient management—use of slow-release fertilizers	
Vermicompost application	
Biochar application	
Food waste hydrolysate application	



Table 4. Practices Eligible for Type B Demonstrations.

Type B Eligible Practices		
Cropland	Orchard or Vineyard	Grazing Land
Alley cropping	Compost application (from certified facility or on-farm)	Compost application (from certified facility or on-farm)
Compost application (from certified facility or on-farm)	Conservation cover	Hedgerow planting
Conservation cover	Conservation crop rotation	Prescribed grazing
Conservation crop rotation	Filter strip	Range planting
Contour buffer strips	Hedgerow planting	Riparian forest buffer
Cover crop	Mulching (from natural materials or wood chips)	Silvopasture

¹⁵ [Food and Agricultural Code, Division 1, Part 1, Chapter 3, Article 8.5, Section 569 \(e\)\(2\).](#)



Table 4. Practices Eligible for Type B Demonstrations. (continued)

Cropland	Orchard or Vineyard	Grazing Land
Field border	Nutrient management (15% reduction in fertilizer application)	Tree/shrub establishment
Filter strip	Residue and tillage management—no-till	Windbreak/shelterbelt establishment
Forage and biomass planting	Residue and tillage management—reduced-till	
Grassed waterway	Whole orchard recycling	
Hedgerow planting	Windbreak/shelterbelt establishment	
Herbaceous wind barrier		
Mulching (from natural materials or wood chips)		
Multistory cropping		
Nutrient management		
Residue and tillage management— no-till		
Residue and tillage management— reduced-till		
Riparian forest buffer		
Riparian herbaceous cover		
Strip cropping		
Tree/shrub establishment		
Vegetative barriers	<div>REPORTING AND VERIFICATION REQUIREMENTS</div>	
Windbreak/shelterbelt establishment		

REPORTING AND VERIFICATION REQUIREMENTS

Grantees are required to submit data on soil organic matter content at four points over the course of the three-year demonstration project, and grantees must submit semiannual progress reports. Reports include project data, outreach activities and impact, and project plans for the intervening time between reports.

Type A projects must report 1) soil organic matter data, 2) GHG fluxes/annual emissions, and 3) crop yield or economic analysis; projects may choose to report 4) co-benefits and ecosystem services. Type B projects must report 1) soil organic matter data and may choose to report 2) co-benefits and ecosystem services.¹⁶

CDFA environmental scientists conduct field evaluations or remote evaluations through phone, video conferencing, or emails to verify that projects are in compliance and that practices have been implemented. Grantees must also provide verification documents that vary depending on the practice and may include geotagged photographs, receipts, logs, and plant species names.¹⁷

¹⁶ [Healthy Soils Program Demonstration Projects 2021 Request for Grant Applications](#), p. 29.

¹⁷ [Healthy Soils Program Demonstration Projects 2021 Request for Grant Applications](#), p. 30, 37–45.



METHODOLOGY

We gathered feedback on the demonstration projects from farmers, technical assistance providers, principal investigators, and other partner organizations through 13 interviews. We also conducted a survey that received 34 responses. In total, we received feedback from at least 34 of the 66 total demonstration projects that were either active or completed as of March 2022.¹⁸ Additionally, we reviewed program data from 2017–2021 and final project reports from completed projects.

The final report was reviewed by six expert reviewers.

FINDINGS: PROGRAM NUMBERS





Based on our review of 2017–2021 program data, we found the following:

Finding #1:

Demand for Healthy Soils Demonstration Projects funding is decreasing.

Program demand has fluctuated during the years funded between 2017 and 2021, while total HSP Demonstration Project funding awards have decreased over time, as summarized in Table 5. Demand for demonstration project funding was highest in 2017 and 2020, with applicants submitting a combined total of 77 applications in those two years. Program demand was lowest in the most recent grant round in 2021, with only 12 project proposals submitted.¹⁹

Table 5. HSP Demonstration Project Submissions, Awards, and Funding.

Year	Projects Submitted 	Projects Awarded 	Percent Funded 	Total Funding 
2017	38	28	73.7%	\$3,573,501
2018	30	23	76.7%	\$3,460,953
2019 ²⁰	0	0	—	\$0
2020	39	20	51.3%	\$2,963,341
2021	12	7	58.3%	\$1,118,477

¹⁸ This number does not include the seven FY 2021–2022 awardees, who had not been announced at the time of project interviews and surveys.

¹⁹ California Department of Food and Agriculture (2021). [Demonstration Projects 2017-Summary By the Numbers](#).

²⁰ The Healthy Soils Program did not receive any funding for 2019.



Finding #2:

Program has modest funding, but significant program reach.

Between 2017 and 2021, 78 three-year projects have been awarded \$11.1 million to demonstrate healthy soils practices.²¹ The 26 closed-out projects have reached an estimated total of 2,577 farmers and ranchers.²²

Steven Cardoza of Cardoza Ranches grows organic raisin grapes in Fresno. He worked with the University of California Cooperative Extension Small Farms Program to receive a demonstration project award in 2020 to implement several practices to improve soil organic matter and minimize tillage.

"Managing weeds is the hardest part about an organic system. The grant gives us the chance to test out how to do it without tilling or herbicides while optimizing soil health. I think this could change the way we grow organic grapes. I'm excited to have people come so they can see, feel and smell the healthy soil we are building"

- Steven Cardoza, Cardoza Ranches



pictured: Steven Cardoza

Finding #3:

Healthy Soils Demonstration Projects reach 28 counties, but projects are missing in some key agricultural regions.

The distribution of demonstration projects by region roughly matches the regional distribution of farms and farmland across the state, with some significant exceptions. There have not been any projects in the Southern Desert Region, and there has been limited reach in the southern portion of the San Joaquin Valley— both significant agricultural regions.²³

Moreover, some agricultural areas have had many demonstration projects, whereas others have had only a few projects. The breakdown is as follows: Sacramento Valley (25 projects), Central Coast (18 projects), San Joaquin Valley (16 projects), San Francisco Bay Area (10 projects), South Coast (8 projects), North Mountains (3 projects), North Coast (2 projects), and zero projects in the Southern Desert Region (please see Figure 1 for a county map of projects and Table 6 for a breakdown of project numbers by county).²⁴

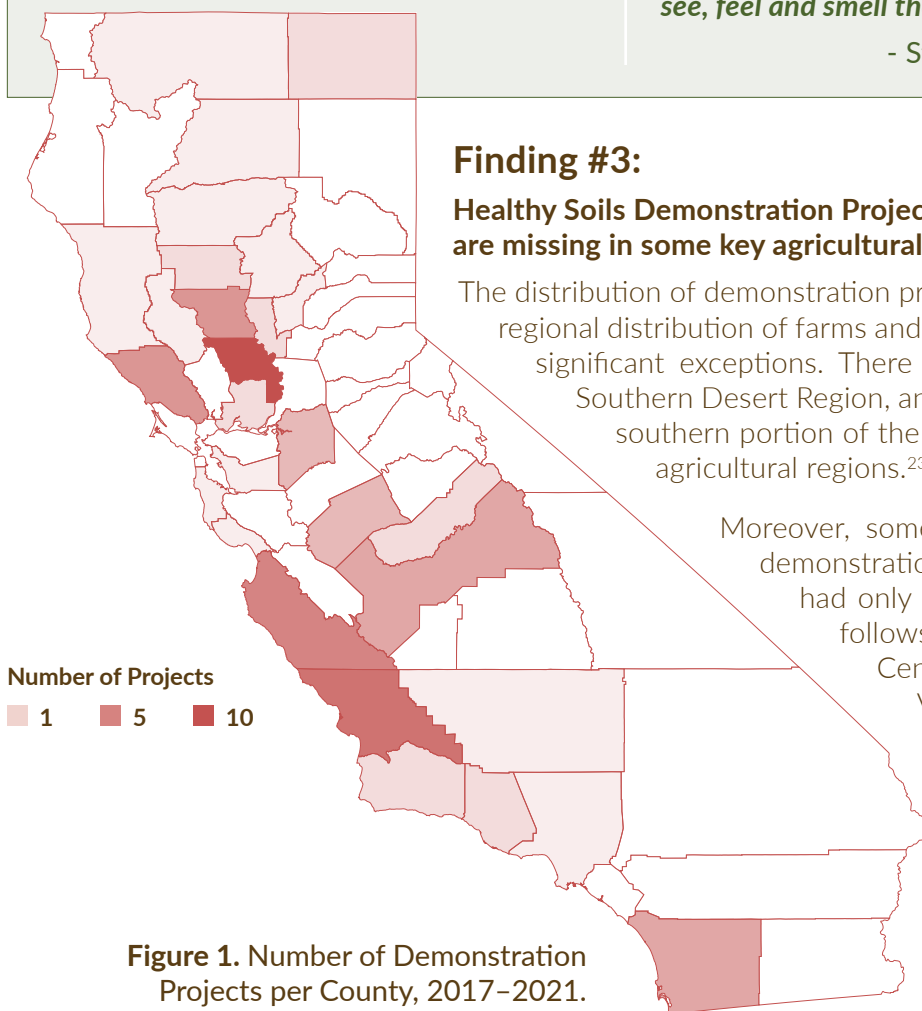


Figure 1. Number of Demonstration Projects per County, 2017–2021.

²¹ This total includes five projects that were funded but then canceled before project completion. These projects are excluded from the analysis.

²² California Department of Food and Agriculture (2021). [Demonstration Projects 2017-Summary By the Numbers](#).

²³ In this report, we use [UCANR regional county breakdowns](#), except that we further break down the Eastern Desert and Mountains Region by breaking out the Southern Desert Region, as these two areas have distinct agricultural systems.

Eastern Desert and Mountains: Alpine, Mono, Inyo, San Bernardino, Imperial west of San Jacinto Mountains and Santa Rosa Mountains

Southern Desert Region: Riverside, Imperial County east of San Jacinto Mountains and Santa Rosa Mountains

²⁴ There are also no projects in the Sierra Foothills region and Eastern Desert and Mountains region, but these areas are not highlighted in the report as they have less agricultural land.



Kern County, which has the most agricultural acres operated in the state (approximately 2.3 million acres),²⁵ has had only one Healthy Soils Demonstration Project, while Fresno County, the second largest agricultural county by acres (approximately 1.6 million acres),²⁶ has had five demonstration projects. Yolo County, which has about 460,000 agriculture acres²⁷ in operation, has hosted the most demonstration projects, with a total of 11 projects. Please refer to Table 6 for a detailed breakdown.

Table 6. Demonstration Projects by County, 2017–2021.

County	Projects Per County	County	Projects Per County
Sacramento Valley		San Francisco Bay Area	
Yolo	11	Sonoma	6
Colusa	6	Solano	2
Sutter	2	Alameda	1
Glenn	2	San Mateo	1
Tehama	1	Region Total	10
Yuba	1	South Coast	
Shasta	1	San Diego	5
Butte	1	Ventura	2
Region Total	25	Los Angeles	1
Central Coast		Region Total	8
San Luis Obispo	8	North Mountains	
Monterey	7	Modoc	2
Santa Cruz	1	Siskiyou	1
Santa Barbara	2	Region Total	3
Region Total	18	North Coast	
San Joaquin Valley		Lake	1
Fresno	5	Mendocino	1
Merced	4	Region Total	2
San Joaquin	4		
Madera	2		
Kern	1		
Region Total	16		

²⁵ USDA Census of Agriculture, *County Summary Highlights: 2017*.

²⁶ Ibid.

²⁷ Ibid.

Photo credit: USDA

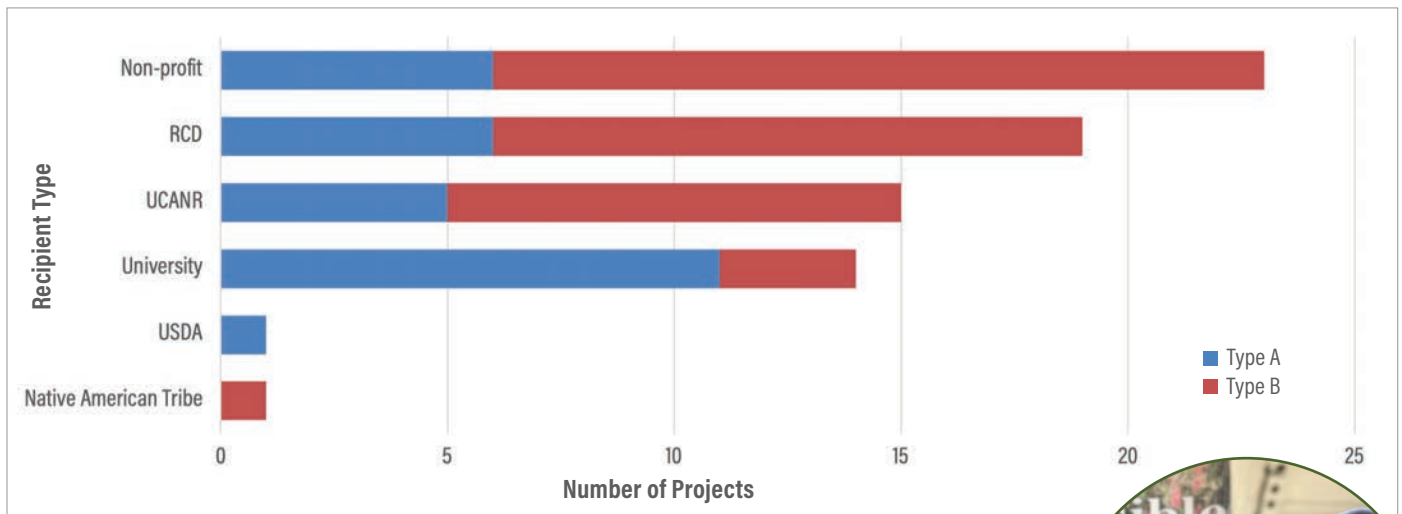


Finding #4:

University staff lead the majority of research projects; Resource Conservation Districts and non-profits lead the majority of outreach/education projects.

Demonstration projects must be awarded to one primary implementing organization, which can work with partner organizations to assist with implementation of the project. Research projects (Type A) were primarily implemented by university researchers as the lead organization. University researchers, including University of California Agriculture and Natural Resources staff, were the principal investigators for 55 percent of research projects, as shown in Figure 2. Outreach projects (Type B) were split between non-profits (39 percent) and RCDs (30 percent) as lead organizations.

Figure 2. Number of Demonstration Projects by Recipient Organization Type, 2017-2021.



Javier Zamora of JSM Organics grows organic fruit and vegetables in Monterey County. He collaborated with California Marine Sanctuary Foundation, USDA's Natural Resource Conservation Service, and the Resource Conservation District of Monterey County on his demonstration project. The project focuses on how compost and mycorrhizal fungi application impacts greenhouse gas emissions, soil organic matter (SOM), and yield.

"You can learn so much when you pay attention to details, and work with people in the industry and learn from them, and see how talented they are. Seeing that the things I do are beneficial to others makes me feel good."

- Javier Zamora, JSM Organics



Finding #5:

Program reaches diverse farm types.

Diverse types of farm operations have participated in Healthy Soils Demonstration Projects (see Figure 3). Annual cropland has been the most common site for Healthy Soils Demonstration Projects, representing about 38 percent of total projects. Pasture²⁸ (19 percent), orchards (16 percent), and vineyards (15 percent) were the next most common, while rangeland (7 percent) hosted relatively fewer projects.

Finding #6:

Compost and cover crops are the most popular practices.

The most popular practice in the demonstration projects was compost application, with 55 percent of projects including compost as either the sole practice or one of the practices demonstrated (see Figure 4). Cover crops were the next most popular, with 37 percent of projects demonstrating that practice. The next three most commonly implemented practices were mulching (12 percent), hedgerows (11 percent), and no-till (11 percent). These four practices are also the top four practices that farmers have received Healthy Soils Incentives grants to implement.²⁹ The vast majority of demonstration projects use one or two healthy soils practices. Almost half of projects (47 percent) demonstrated one practice, while 38 percent demonstrated two practices, 7 percent demonstrated three practices, and 8 percent demonstrated four practices.

Figure 3. Number of Demonstration Project Types by Land Use Type, 2017–2021.

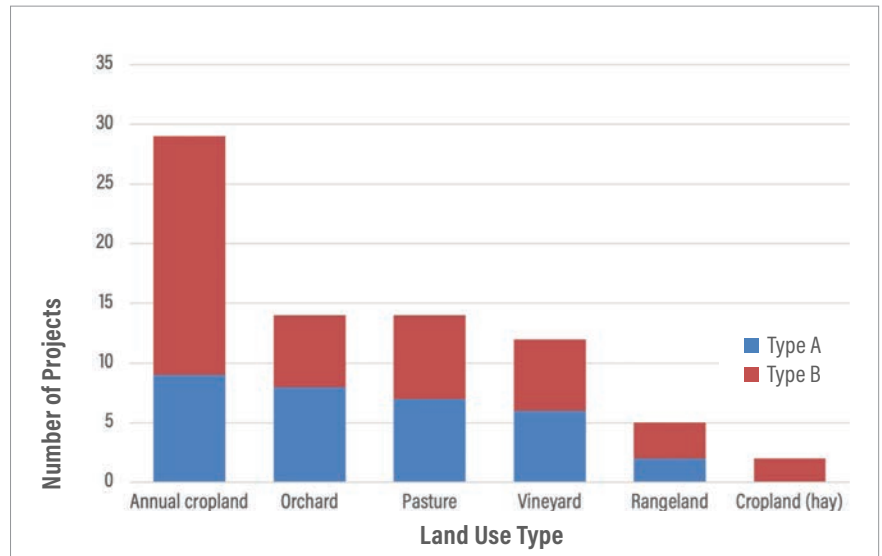
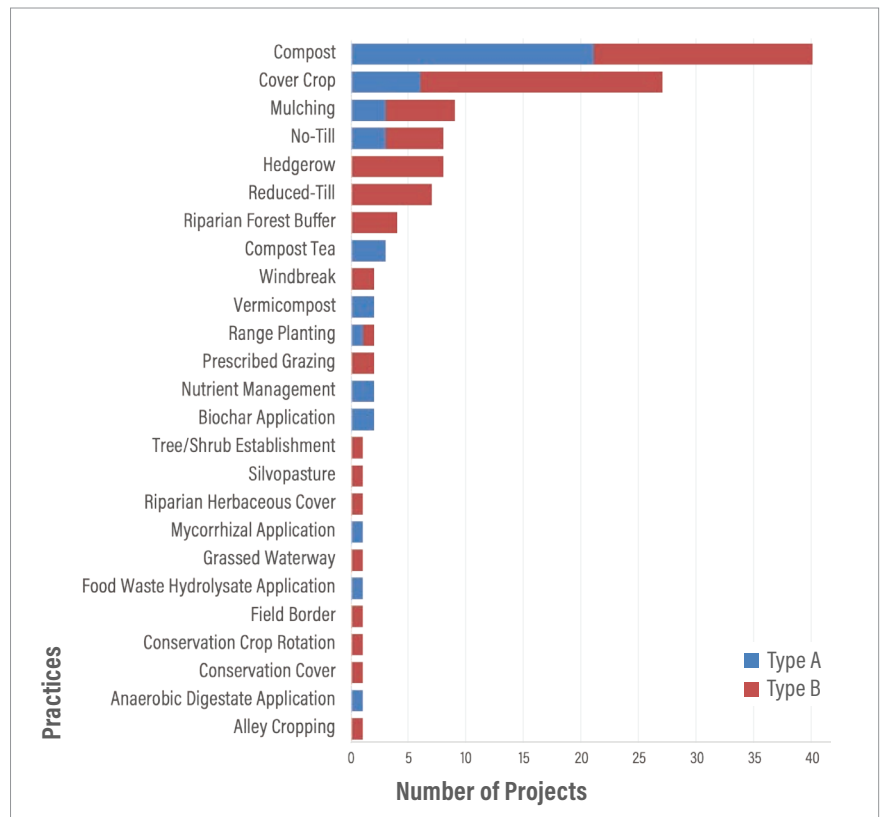


Figure 4. Number of Demonstration Projects Implementing each Practice, 2017–2021.



Demonstration projects may implement more than one practice, so graph totals exceed the total number of projects.

²⁸ CDFA uses the term “grazing land” to refer to “land used primarily for production of forage plants maintained or manipulated primarily through grazing management.” In this report, we refer to this land as “pasture” to clarify its distinction from rangeland.

²⁹ CalCAN. (2020). [The California Healthy Soils Program: A Progress Report](#).





FINDINGS: PROGRAM IMPLEMENTATION

Based on our interviews and survey of project participants, we found the following:

Finding #1:

Program design must be participant-centered.

In our interviews and survey responses, one overarching theme was concern regarding the lack of transparent, accountable processes for incorporating stakeholder feedback. This concern extended to inflexible program rules and burdensome project verification requirements. Participants felt that they were not given flexibility from CDFA to make on-the-ground decisions needed to achieve project goals. This rigidity impacted their ability to work with CDFA and project partners to successfully implement their demonstration projects. Many of the program challenges detailed below can be addressed through soliciting and incorporating user feedback into the process.

Finding #2:

Program rules need additional flexibility and clarity.

Many HSP Demonstration Project participants highlighted that commercial farms are dependent on factors outside of their control, such as market conditions, weather, and labor availability. Additionally, farmers are managing planting and harvest schedules, fertilization types and frequencies, and irrigation strategies. In order to successfully implement healthy soils practices, farmers must be able to make management decisions that reflect these external factors and local conditions. However, across the board, interviewees and survey respondents noted the rigidity and inflexibility of the program with respect to project implementation, verification, and reporting. In our survey of program participants, 41 percent of respondents disagreed or strongly disagreed that the program guidelines were clear and reasonable, while 32 percent were neutral and 26 percent agreed.³⁰ One grantee shared, “The focus should be on helping farmers adapt practices to their own farming operations in a way that would work for them, rather than rigidly conforming to a set of requirements that may not always match conditions on their farms.”

Many program participants experienced challenges with making project changes, particularly around practice implementation and data collection. One grantee shared, “Things always change on farms. It has been quite difficult to make those changes and make them in a way that is acceptable by CDFA. It hasn’t been consistent between projects—it seems to depend on who the manager is, what exactly their requirements are, and what you can and can’t do, and how many hoops you need to jump through.”



³⁰ No survey respondents selected strongly agree or non-applicable.





Finding #2a:

Demonstration Project application process has improved and could continue to be streamlined.

We found that participants had mixed experiences with the application process, perhaps reflecting that CDFA made improvements over the course of the program. In our survey of program participants, about 48 percent of respondents agreed that the program application was clear and easy to use, while 33 percent were neutral and 12 percent disagreed. No respondents strongly agreed, and 6 percent of respondents chose non-applicable. Several respondents noted the application was very labor intensive and that parts of the application were redundant.

Finding #3:

Reporting requirements create administrative burden and stress.

Additionally, the majority of program participants we interviewed and surveyed had experienced administrative burdens, including compliance costs and stress associated with program implementation, reporting, and verification requirements. In a survey question about whether program guidelines and expectations were “clear and reasonable,” 17 out of 24 written responses identified implementation challenges. All interviewees involved in the application and reporting processes highlighted administrative challenges around program implementation and reporting. One participant shared, “I would not recommend a demonstration project to others. The administrative burdens of constantly having to go back and forth with CDFA staff about minute changes and adjustments concerning an already underfunded project makes carrying out the project untenable.”

The program requires a significant amount of grantee time and resources for grant administration compared to other funding sources. One grantee reported having to budget 30 percent of total staff time to HSP Demonstration Project grant administration while budgeting just 5 percent for all other grants. Another participant shared, “The amount of bureaucracy and difficulties in dealing with budgets is unmatched by any other organization I’ve been funded by, even other California agencies.”

The program requirements also created stress for grantees. Several participants shared with us in interviews and survey responses that they did not feel trusted and respected to do their jobs as researchers and educators. One participant shared, “The orientation of the program feels punitive, with a focus on penalties if expectations are not met. This is inappropriate and counter-productive for a program that is supposed to be encouraging farmers to adopt new practices that involve taking risks and adapting practices to work for their own operations.” Another grantee shared that their least favorite aspect of their HSP Demonstration Project was “working with HSP staff and being under threat of revoking funds to support this project, and not feeling supported in our effort, but scrutinized.” These negative interactions significantly affected program participants, some of whom said that, due to these experiences, they did not seek additional funding or recommend the program to peers.



Finding #4:

Program research has generated meaningful soil science insights.

Despite these challenges, participants we interviewed felt that the HSP Demonstration Projects had contributed some meaningful research insights. About 47 percent of survey respondents agreed or strongly agreed that the research component of their projects provided meaningful insights to promote the adoption of healthy soils practices while 18 percent were neutral and 21 percent disagreed.³¹ One researcher expressed that the program has been valuable for understanding the yield and soil carbon impacts of adopting specific conservation agriculture practices in a conventional system in California. Another researcher shared that they were able to study a previously unstudied integration of livestock in vineyards. One researcher explained, “It is pretty rigid, but we have been able to be creative and set up our projects in a way that it is new data that adds to the advancement.”

Finding #5:

Demonstration projects foster new connections and learning.

The Healthy Soils Demonstration Projects have created opportunities for farmers, ranchers, RCD staff, non-profit staff, UCANR staff, and university researchers to learn together and from each other. Program participants consistently said that building relationships and connecting with new stakeholders was a highlight of the program. Some grantees also reported gaining an increased understanding of the barriers to farmer adoption of soil health practices and strategies to address these barriers. One grantee shared, “The farmers we are working with are amazing. We learned a lot about the challenges and nuances of implementing healthy soil practices.” Growers reported increasing their content knowledge and also highlighted the beneficial partnerships that arose from the project. One grower explained that the best aspects were “learning how Mother Nature works and how we can make it better and the community gathering and interaction and knowledge.” Another grower learned a lot more about “soils, forage, grazing, and connecting with more people from the non-ranching community who are wanting to help.”



Finding #6:

Demonstration projects would benefit from a broader research agenda and longer research timelines.

Most demonstration projects have not included economic analyses, according to our review of final reports and projects summaries. The HSP requires Type A projects to share crop yield data, and either project type may choose to include additional economic, co-benefits, and/or ecosystem service research. Out of the 18 completed projects that had submitted final reports at our time of review,³² five submitted economic data beyond the required crop yield data for Type A projects, and five looked at co-benefits.³³ Of the five that submitted additional data, some considered only revenue and input costs, while others included factors such as labor hours, fuel use and costs, and tractor operator costs. Of the 55 projects that are active or had not submitted reports at the time of our review, only five mentioned calculating cost savings or conducting economic analysis in their project summary. Three project summaries mentioned looking at co-benefits, and 10 mentioned considering ecosystem impacts.

³² As of March 2022.

³³ While 18 projects have submitted final reports, CDFA has categorized 11 projects as closed out. We have reviewed the 18 final project reports, which were the only final reports available as of November 2021.





Tower to monitor evapotranspiration

Finding #6a:

Carbon sequestration is not a primary driver of adoption.

While studying carbon sequestration dynamics is important for understanding the potential of California agriculture to sequester carbon and meet the state's greenhouse gas reduction goals, it may not be the most salient factor for growers. According to some program participants, growers first seek to know how adoption of healthy soils practices will impact the economics of their operation. The carbon sequestration potential of healthy soils practices may be a less compelling driver of adoption for growers. As one farmer explained, "Most growers won't do something until they can see it and see that their neighbor is doing well and making money." One researcher shared, "I think there will be interesting information that closes relevant knowledge gaps to the field of science, but in terms of really increasing adoption, what we need is more long-term trials that look at the ROI [return on investment] of these projects." These findings suggest that economic analysis of benefits and costs may be important for driving adoption of healthy soils practices.

Finding #6b:

Longer program timelines and additional funding are needed.

Researchers we interviewed raised concerns that a three-year study period is inadequate for capturing changes in soil dynamics and is insufficient for economic and ecosystem service analysis. These researchers cautioned that the three-year time period would capture the upfront costs of installing new healthy soils practices but not the ecosystem service benefits and associated financial returns, which often take five to ten years to accrue.³⁴

However, the participants we spoke with shared that the project funding levels are not sufficient to support this research and all its required activities. One researcher shared, "If changes in soil carbon are going to be measured, then more resources and time are necessary. Soil carbon doesn't change in 2.5 years." Another researcher explained, "In order to generate meaningful scientific information from our project, we had to seek additional grant funding. HSP Demo A projects do not provide enough support to produce meaningful data. Greenhouse gas measurements are informative when they happen very frequently (i.e., twice a week) and soil carbon pools change on five- to ten-year time horizons."

For these reasons, researchers cited concerns that the demonstration projects' soil organic matter and greenhouse gas data likely will not be usable in modeling efforts like COMET-Planner.

³⁴ CalCAN. (2018). [The Economic Case for Hedgerows](#); "My fear about these projects is that there will be a lot of data generated and very few that will show an increase in SOC [soil organic carbon] because the timeline is too short [...]. Five to six years would be helpful." – Researcher



Finding #6c:

Demonstration project outreach should be sequenced with research.

Grantees told us that in order to meet the outreach requirements, they often needed to hold their first field day before there were any visible changes in the field and before they had generated any data. Due to the long-term nature of the research questions, researchers we interviewed were concerned that they were unable to share research findings during the first two years of the program and could sometimes share emerging trends only by the third year. This mismatch between the timing of the research and the outreach requirements is a missed opportunity to effectively demonstrate the practices and their benefits.

Finding #7:

Outreach requirements should reflect local conditions and prioritize quality.

The majority of program participants felt that the outreach requirement of reaching 120 unique growers was unrealistic and not an effective metric for increasing adoption of healthy soils practices. Only 32 percent of survey respondents agreed or strongly agreed that their project was able to meet the outreach requirement of reaching 120 unique farmers, while 12 percent were neutral and 50 percent disagreed or strongly disagreed. Of the 26 projects that are closing out, 11 did not meet the 120-farmer outreach requirement.

There were several key concerns surrounding the 120-farmer outreach requirement. In some regions, this outreach number is not achievable due to either the low density of relevant growers or the high number of HSP projects happening in a given area. One grantee shared, “This is extremely difficult in small counties. Field days for annual crops generally draw in between 10–20 attendees, with some of them being growers and others, including industry or PCAs [Pest Control Advisors]. [...] Even with all reasonable efforts to reach out to every farmer in the county, including underserved groups, this is a very hard-to-meet requirement.”



Photo credit: Pixabay

Finding #7a:

Number of farmers reached is not an effective measure of practice adoption.

Program participants were skeptical that the number of farmers reached was a good proxy for uptake of healthy soils practices, pointing out that quality of outreach matters more than quantity. Another grantee stated, “We did not even come close despite a great track record. It was an unreasonable expectation. Particularly during COVID and with multiple demonstration projects targeting similar farmer groups, this is difficult to achieve. The focus should be on the quality of outreach rather than a set number.” One farmer observed that smaller workshops, whether they were online or in-person, were more dynamic and interactive and that farmers were more confident in asking questions. Some grantees expressed concerns that they would need to hold additional events beyond the original scope of work to meet the farmer outreach requirement.





Finding #7b:

Narrow definition of “farmer” overlooks key farm decision-makers.

Many program participants were frustrated by the narrow definition of “farmer” for the outreach requirement. Participants shared that they felt CDFA excluded key farm decision-makers from being counted in outreach totals. Pest Control Advisors (PCAs), Certified Crop Advisors (CCAs), farmworkers, and farm/land managers all make farm management decisions but are not all explicitly allowed to count toward the outreach requirement. One grantee shared, “CDFA staff has been unable to define a ‘unique farmer’ for us, which has led to having certain attendees rejected that are central decision-makers on farms—such as CCAs.” Another grantee said, “Our events are heavily attended by land managers (4:1) who are critical to reopening conserved lands to grazing, but unfortunately, these participants do not count toward our quota whatsoever.”

Russell Chamberlin of Chamberlin Ranch is a cattle rancher in Santa Barbara County. He worked with the Community Environmental Council to receive a demonstration project award in 2017 to look at the feasibility of compost application on grazed rangeland to increase soil health and mitigate greenhouse gas emissions.

“We were able to come together with environmental groups and find this common project. We’ve built an incredible relationship with one another. It’s been a huge bridge builder for us and the community and my family. That’s one of the most important things.”

- Russell Chamberlin,
Chamberlin Ranch



Pictured: Russell Chamberlin. Photo credit: Andrew Hill

Finding #8:

Demonstration projects support meaningful outreach, but follow-up is needed to understand practice adoption.

Despite these challenges, some interviewees felt like they had created meaningful outreach events, particularly smaller events that allowed for better conversation and for farmers to get their personal questions answered. Many farmers, principal investigators (PIs), and technical assistance providers (TAPs) said they anecdotally knew of farmers adopting practices in part due to their outreach efforts.

About 47 percent of survey respondents agreed or strongly agreed that farmers adopted healthy soils practices as a result of their demonstration projects, while 35 percent were neutral and 12 percent disagreed.³⁵ As one participant noted, “This is very hard to gauge without directly following up with the farmers and ranchers who received the information about this healthy soils project. The structure of the program seems to focus on merely showcasing healthy soils practices. Currently, there is no structure in place to document the impact these projects have on the rate of healthy soil practice adoption.” While there has not been systematic follow-up, several farmers anecdotally knew other farmers in their region who experimented with healthy soils practices partially as a result of their demonstration efforts.

³⁵ Six percent chose not applicable.





POLICY RECOMMENDATIONS

1. Develop processes to regularly solicit, discuss, and incorporate stakeholder feedback into the HSP demonstration application, program guidance, and reporting requirements.

We recommend that CDFA build in processes that regularly solicit and discuss stakeholder feedback as well as transparent and accountable processes to incorporate feedback. This process should go beyond written public comment periods and the existing Environmental Farming Act Science Advisory Panel meeting process.

RECOMMENDATION:

Hold stakeholder feedback sessions prior to drafting Request for Grant Applications.

RECOMMENDATION:

Provide more details in responses to public comments when stakeholder recommendations cannot be implemented. If CDFA is considering incorporating a recommendation, follow up to share the outcome of the decision-making process.

2. Support on-the-ground innovation and experimentation through program flexibility.

Commercial farming is dependent on a variety of factors outside of farmer and partner control. In order to successfully adopt healthy soils practices, farmers must be able to innovate on the ground. CDFA should prioritize flexibility and adaptability in program implementation and allow for project changes in the event of unforeseeable factors without requiring a multistep process for requesting project and budget changes.

RECOMMENDATION:

Address redundancies in the paperwork for project and budget changes and reduce the total number of forms required.

RECOMMENDATION:

Consider allowing grantees to reallocate up to 10 percent of funds in the project or make small changes (that will not impact GHG reduction estimates) by filling out a streamlined form or receiving email or verbal approval.





3. Reduce reporting requirements and focus on whether grantees achieved their project goals.

The science is clear that healthy soils practices can sequester carbon and generate significant co-benefits. To maximize these potential benefits, the HSP should focus on helping farmers to adopt practices in ways that works well for them, rather than expecting farmers to comply with a rigid set of rules often incompatible with the dynamic nature of farming.

RECOMMENDATION:

Focus requirements on verifying and reporting whether projects achieved their stated goals.

RECOMMENDATION:

For Type B projects, allow technical assistance provider partners to serve as third-party verifiers to ensure practice implementation.

RECOMMENDATION:

Reduce reporting to one mid-project report and one final report to ease the administrative burden on grantees and allow more project time to go toward achieving program goals.

4. Refocus research on questions central to farmer adoption of healthy soils practices, such as benefits to farmers and economic analysis.

The goal of the HSP Demonstration Projects is to scale up adoption of healthy soils practices. Farmers are not motivated to adopt healthy soils practices primarily by carbon sequestration benefits.³⁶ To encourage adoption, the program should focus on incentivizing and funding research that addresses key barriers. This should include analyzing economic and ecosystem services and researching operational challenges and supply chain and regulatory barriers (e.g., food safety concerns).

RECOMMENDATION:

Work with the EFA SAP to solicit public feedback on how to modify the Request for Grant Applications to encourage research projects that address key barriers to adoption, and consider increasing the funding cap for Type A projects.

³⁶ Liz Carlisle (2016). Factors influencing farmer adoption of soil health practices in the United States: A narrative review. *Agroecology and Sustainable Food Systems*, 40:6, 583–613, DOI: [10.1080/21683565.2016.1156596](https://doi.org/10.1080/21683565.2016.1156596).



5. If the program continues to fund greenhouse gas (GHG) emission research, provide additional funding and clear data collection guidelines for field measurements of GHG emissions.

CDFA has not yet publicly shared any summary of greenhouse gas data from the program or indicated how the data will inform COMET-Planner and other modeling efforts. To ensure high-quality data, CDFA should provide criteria for how data should be collected to ensure it is consistent and usable across projects.

RECOMMENDATION:

Fund a team of researchers to analyze the data already collected by HSP to determine its utility and make recommendations for improving data collection going forward.



6. Extend program length for Type A projects to 5 to 10 years to accurately measure costs and benefits and/or soil carbon changes.

Implementing soil health practices entails upfront costs, but benefits can take several years to accrue. It is key that study time periods are long enough to fully capture the benefits and costs of adoption. There is a need for longer-term studies to fill this knowledge gap.

RECOMMENDATION:

Work with the legislature and Department of Finance to increase the program timeline to 5 or 10 years.

7. Allow projects to propose outreach plans that reflect their crop and region and include the full spectrum of farm decision-makers.

Farmer and rancher density and interest in Healthy Soils Demonstration Projects varies greatly depending on the region and crop type. Rather than the current requirement to reach 120 unique farmers and ranchers, applicants should be able to propose an outreach plan that makes sense for their context. This requirement could be similar to the Specialty Crop Block Grant Program, which allows applicants to describe their expected outreach outcomes and asks grant reviewers to score the applicants' expected outreach outcomes for impact and feasibility. Additionally, Pest Control Advisors, Certified Crop Advisors, ranchland managers, farm managers, and farmworkers are all key decision-makers on farms and ranches, but they are not allowed to count toward the demonstration project outreach requirement. These groups can all play a key role in farm decision-making, and they should be part of the demonstration projects' outreach efforts.

RECOMMENDATION:

Allow applicants to submit an outreach plan that details their outreach goals in lieu of the requirement to reach 120 farmers and ranchers.

RECOMMENDATION:

Value the role of all farm decision-makers and farm influencers, not just farmers and ranchers, when considering project scoring and success.

RECOMMENDATION:

Encourage regional field days to promote greater collaboration, efficiency, and cross-pollination across projects. As these collaborative projects have synergistic effects, allow all collaborators to get full credit for hosting.



Photo credit: Zen-Chung, Pexels





8. Encourage Type A projects led by university researchers to partner with an organization who will focus on the outreach and education component.

A non-profit, Resource Conservation District (RCD), or Extension partner who specializes in outreach and education could help disseminate information on practice implementation and research findings.

RECOMMENDATION:

Encourage Type A projects to collaborate with non-profits, RCDs, or Extension partners who specialize in outreach to help share information on practice implementation and research findings.

RECOMMENDATION:

Consider allocating a portion of the HSP funds towards a statewide organization that supports program grantees with technical assistance, outreach, and evaluation. CDFA could use a similar model to the Regional Forest and Fire Capacity Program (RFFC) and Multibenefit Land Repurposing Program at the Department of Conservation that provide grants to statewide organizations that support program grantees.

9. Work with partner organizations to conduct outreach in underrepresented regions.

As discussed in Section V, several regions are underrepresented in demonstration project reach. CDFA could work with partners to encourage project development in regions of the state that have few or no demonstration projects, such as the Southern San Joaquin Valley and Southern Desert Region.

RECOMMENDATION:

Leverage CDFA partnership with UCANR [Climate Smart Community Education Specialists](#) in underrepresented regions to identify interested farmers and agricultural industry partners and foster the development of demonstration projects.³⁷ This could be modeled similarly to the Department of Conservation (DOC) partnership with UCANR, which created two positions to increase geographical equity in underrepresented regions for the Sustainable Agricultural Lands Conservation Program.

10. After implementing the recommendations described above, conduct a program evaluation to understand program effectiveness and identify opportunities for improvement.

We recommend prioritizing action now to improve the program and suggest conducting an evaluation in several years to assess how the changes are working. There is an opportunity to understand rates of adoption of healthy soils practices among demonstration project outreach attendees and the rate of growers who continue to utilize practices after the project period. There is a need to understand how effective the program has been at scaling adoption, what barriers need to be addressed, and what strategies work well to encourage long-term practice adoption.

RECOMMENDATION:

Prioritize key program improvements and follow up with a program evaluation in several years.

³⁷ [UCANR/CDFA Climate Smart Agriculture Specialists.](#)



CONCLUSION

Over the past four years, the Healthy Soils Program Demonstration Projects have connected thousands of farmers, ranchers, researchers, technical assistance providers, farm educators, and other key stakeholders to facilitate the adoption of healthy soils practices in California agriculture. To realize the full potential of the program and support farmers in adopting practices, the program should reduce administrative burden and allow innovation and flexibility on the ground. We are optimistic that these changes are possible and the state can realize the benefits of healthy soils practices on a diversity of farms and ranches throughout California.



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.