THE CALIFORNIA HEALTHY SOILS PROGRAM:

A Progress Report









CalCAN
CALIFORNIA CLIMATE & AGRICULTURE NETWORK

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

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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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Diversity of crops at Full Belly Farm.

Photo credit: Full Belly Farm.

EXECUTIVE SUMMARY

California's Healthy Soils Program (HSP) has the potential to transform California agriculture by incentivizing farmers and ranchers to transition to agricultural management practices that have a multitude of benefits to farms and society. Healthy soils practices improve yields, pest and disease management, 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.[1] As the first program of its kind in the country, HSP also has the potential to inform and inspire other state soil health programs across the country.

Since 2017, HSP has provided over $42 million to 640 projects on farms and ranches, including 67 demonstration projects. Farmer demand for funding from the program has increased six-fold in just three years. This unprecedented investment and farmer interest in on-farm, soil health-based climate solutions merits both celebration and analysis, as rapidly scaling up these solutions is necessary to achieve many of the state's objectives, including the natural and working lands climate and biodiversity goals recently articulated in Governor Newsom's Executive Order.[2]

In this progress report, we provide a brief overview and history of HSP, discuss notable achievements and program elements worth replicating in other states, and identify opportunities for program improvements that the California Department of Food and Agriculture (CDFA) is well positioned to address.

Our findings and recommendations, summarized below, are based on analysis of the latest program data available from CDFA and years of engagement with HSP implementation, including interviews, surveys, and focus groups with farmers, technical assistance providers and scientific experts between 2017 and 2020. Our recommendations describe how the program can better support the state's diverse farmers, fill research gaps, and address pressing questions about how to scale up, normalize, and sustain implementation of healthy soils practices. Our report also underscores the need for a reliable funding source for HSP and the state's other climate smart agriculture programs to achieve California's climate goals.

Emma Torbert of Cloverleaf Farm talks about the hedgerow she installed as part of her HSP incentives grant.

Photo credit: Saxon Holt.

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

[2] Executive Order N-82-20, signed by Governor Gavin Newsom on October 7, 2020.

FINDINGS

1. **HSP successfully catalyzes immediate adoption of healthy soils practices across the diversity of California agriculture's cropping systems and geographies. More support is needed to achieve equity for farmers of color, women farmers, and small and mid-scale farmers.[3]**
2. **Conventional farms receive the vast majority of HSP grants. Incentivizing organic transition would help farms sustain multiple healthy soils practices in the long term.**
3. **Insecure land tenure is a barrier to participation in HSP.**
4. **HSP incentivizes a diverse range of practices, with compost application by far the most popular practice.**
5. **Technical assistance, breadth of eligible practices, demonstration projects, and a streamlined application have all been critical to the growth in farmer demand for the program.**
6. **Some program elements need refinement, such as soil testing, language accessibility, grant contract finalization, and payment rates.**
7. **Comprehensive program evaluation is needed to improve implementation and impact.**

RECOMMENDATIONS

We recommend CDFA take the following actions:

1. Prioritize HSP funding for small and mid-scale farms, farmers of color, and women farmers by awarding their applications first, as long as the applications meet a minimum score. To implement this, CDFA will need to wait to review applications until after the grant application deadline, instead of on a rolling, first-come-first-served basis.
2. Incorporate into HSP incentives grants an option for a one-time payment for conventional farmers who want to transition to certified organic production to pay for a consultant to help develop an organic system plan.
3. Allow farmers with one-year leases to participate in the program and apply for practices that are implemented annually without having to document landowner approval. Add guidelines to the program that allow CDFA or the farmer to terminate a grant agreement if the farmer loses control of the land. This is consistent with the recommendation from CDFA's 2020 Farmer Equity Report to update program guidelines to accommodate farmers who have short-term leases.[4]
4. Clarify the purposes of soil sampling and other data collection in the program. Develop an implementation strategy, including the provision of guidance for data collection and transparency and resources to achieve those purposes. CDFA's Science Advisory Panel should consider convening an ad hoc advisory group to accomplish this recommendation.
5. Translate all program materials into multiple languages to ensure equitable program access to all California farmers. To determine which languages should be prioritized, consult with technical assistance providers and other partners who have relationships with farmers in diverse language communities throughout the state.

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[3] We define small and mid-scale farms as farms and ranches with less than 500 acres.
[4] See page 10 of CDFA's 2020 Report to the California Legislature on the Farmer Equity Act.

6. Develop a program timeline and/or increase staff capacity to allow CDFA to process and finalize grant contracts with HSP recipients before fall plantings.

7. Continue to use NRCS EQIP rates as the foundation for the program and incorporate an opportunity for stakeholders to comment on existing payment rates and practice standards whenever CDFA solicits proposals for new practices. For payment rates that stakeholders flag as too low, CDFA could repeat the process it has used to update compost payment rates by collecting cost data from a subset of funded HSP projects to re-evaluate specific payment rates.

8. Conduct a comprehensive program evaluation in 2021, collaborating with skilled and qualified researchers and institutions in California, to assess the impact of HSP incentives and demonstration projects on attitudes and knowledge about healthy soils practices, barriers to practice adoption, and *long-term* implementation of healthy soils practices.

LOOKING FORWARD

Despite the economic recession caused by the coronavirus pandemic, we must not lose sight of the long-term climate goals championed by California. As the impacts of climate change continue to intensify across the state, the Healthy Soils Program—in concert with the state's other Climate Smart Agriculture programs—serves a critical role in helping farmers adapt to climate change, while removing carbon from the atmosphere and reducing potent greenhouse gas emissions. With another likely gap year in funding for these programs, CDFA and advocates must work together to identify new funding sources.

Silvopasture with sheep in the olive trees at PT Ranch – a HSP incentive grant recipient.

Photo credit: PT Ranch.

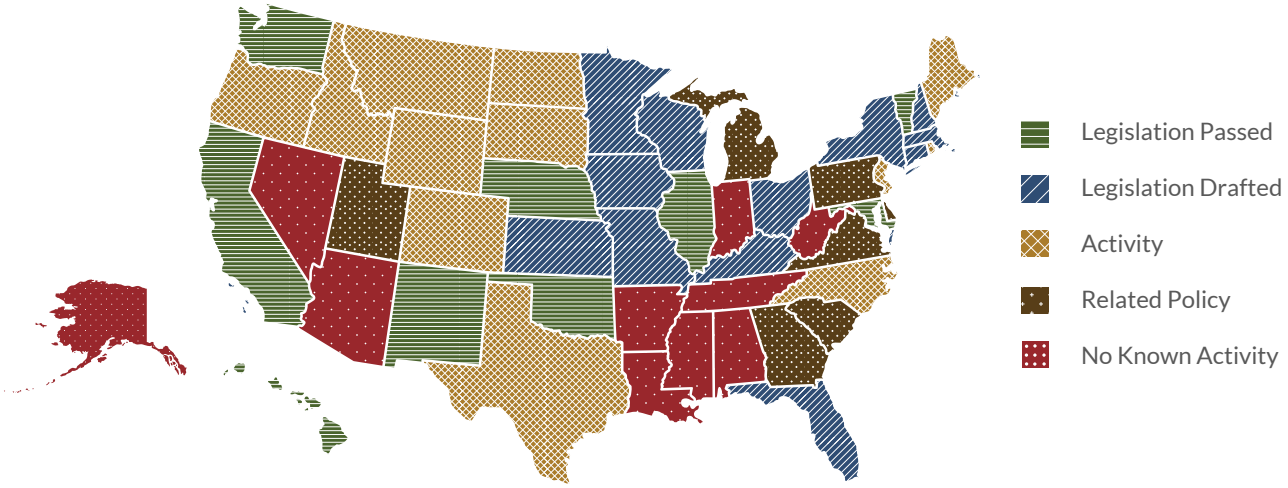
INTRODUCTION

Soil is the foundation of our agricultural productivity in California and around the world. 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 improve farmers' economic viability and resilience. Healthy soils 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.[5]

Recognizing the benefits of improved soils management for agriculture and society at large, the state of California established the Healthy Soils Program in 2016. Since its launch, the program has invested nearly $42 million in 640 projects on farms and ranches, including 67 demonstration projects. Farmers' interest in the program has grown significantly, as evidenced by the six-fold increase in farmer demand for funding since the program began. Despite the fact that the most recent application period opened just before the beginning of the coronavirus pandemic, California farmers submitted a record-breaking 614 applications between late February and early May 2020.

California's Healthy Soils Program has also sparked interest nationally. Responding to this interest, CalCAN launched the National Healthy Soils Policy Network in early 2018, a group of farmer-centered organizations that advocate for state healthy soils policies. Several Network members, and others around the country, are advancing a variety of policy proposals to incentivize healthy soils practices. A summary of the status and focus of healthy soils bills in the U.S. is available on a frequently updated webpage managed by Tufts University. Some of these states have borrowed language and various program design elements from California.

Healthy Soils State-Level Policy Activity (as of November 16, 2020)
Source: State Healthy Soil Policy Map



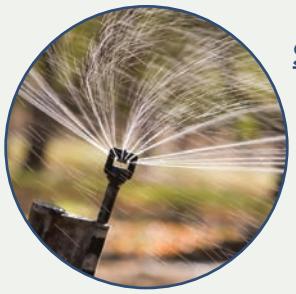
[5] For a review of primarily California-based peer-reviewed scientific literature on the many benefits of healthy soils practices, check out our publication: Climate Change Solutions in California Agriculture (2019).

In this report, we provide an overview of California's Healthy Soils Program, summarize its impacts to date, highlight the program's successful design elements, and explore areas of potential growth for the program. While we recognize the value of analyzing the strengths and weaknesses of California's broader policy context as it pertains to the adoption of healthy soils and other climate smart practices (e.g., regulations and funding for other agricultural research, programs, and services), such policy analysis is beyond the scope of this report. Rather, this report is intended for policymakers and advocates in California and across the country who are interested in this specific program. We aim to both inspire and inform those working to accelerate and scale up the use of healthy soils practices. CalCAN continues to work in coalition with other organizations to assess and influence the broader policy context.

Cover crops at Pinnacle Organic.

Photo creidt: CalCAN.

OTHER CLIMATE SMART AGRICULTURE PROGRAMS IN CALIFORNIA:



STATE WATER EFFICIENCY & ENHANCEMENT PROGRAM (SWEEP), launched in 2014, funds on-farm water and energy efficiency projects that reduce GHG emissions.

SUSTAINABLE AGRICULTURE LANDS CONSERVATION PROGRAM (SALCP), launched in 2014, funds conservation easements on agricultural lands at risk of development and local government planning and policy development for farmland conservation.

ALTERNATIVE MANURE MANAGEMENT PROGRAM (AMMP), launched in 2017, provides financial assistance to dairy and livestock producers to transition to dry manure handling and storage as well as pasture-based systems to reduce potent methane emissions. **Note:** CDFA also has a separate Dairy Digester Research & Development Program (DDRDP).

CLIMATE SMART AGRICULTURE TECHNICAL ASSISTANCE PROGRAM, launched in 2019, expands available technical assistance for farmers and ranchers in developing climate smart agriculture projects on their operations.

Photo credits: USDA NRCS.

BACKGROUND

HEALTHY SOILS PROGRAM HISTORY

The Healthy Soils Program (HSP) was established in California statute in 2016 after many years of legislative efforts to create a state program to invest in on-farm climate solutions. Those efforts began in 2010 when CalCAN, working with state Senator Lois Wolk (D- Davis), sponsored the first in a series of bills to leverage the state's cap-and-trade auction revenues—which would become the major source of funding for climate investments in the state—to fund sustainable agricultural solutions to climate change.[6] Those early legislative efforts catalyzed a discussion in the state legislature and with Governor Jerry Brown's administration about the multiple benefits of agriculture's unique climate solutions and carbon removal capacity. What followed was the creation of a suite of Climate Smart Agriculture programs, beginning in 2014. See the sidebar on page 5 for the list of other Climate Smart Agriculture programs CalCAN has advocated for in addition to HSP.

The Healthy Soils Program was established in statute in 2016. As specified in the California Food and Agriculture Code, 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.*"[7]

The program, administered by the California Department of Food and Agriculture (CDFA), was the first state-led effort of its kind to offer farmers financial incentives to adopt soil health practices to reduce greenhouse gases and increase carbon sinks.

Following the first years of implementation of the Climate Smart Agriculture programs, and in response to needs identified by farmers, CalCAN successfully sponsored a bill in 2018 (AB 2377, Irwin) to establish a technical assistance fund for the programs at CDFA. Under the new statute, at least five percent of the budgets from HSP, SWEEP and AMMP programs are set aside to fund outreach and technical assistance for farmers to develop and implement Climate Smart Agriculture projects. Technical assistance funds are prioritized for small and mid-scale farms and at least 25 percent of the funds must be used to assist "socially disadvantaged farmers and ranchers" (SDFRs).[8]

The bill also established a comprehensive definition of technical assistance in statute as "*outreach, education, project planning, project design, grant application assistance, project implementation, or project reporting assistance provided to a farmer or rancher to improve his or her successful participation in the program.*"[9]

HSP has evolved quickly in its first few years by adding new practices and streamlining the application process, among other technical changes. Until 2020, HSP's funding levels increased each round, as did farmer demand.

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[6] Those bills were: SB 1241 (Wolk) in 2010; SB 237 (Wolk) in 2011; and SB 367 (Wolk) in 2015. The Healthy Soils Program was finally established in statute in 2016 through budget trailer bill language (SB 859).

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

[8] "Socially disadvantaged farmers and ranchers" are defined in California Food and Agricultural Code Section 512 as: "a farmer or rancher who is a member of a socially disadvantaged group… whose members have been subjected to racial, ethnic, or gender prejudice because of their identity as members of a group without regard to their individual qualities."

[9] Food and Agricultural Code, Division 1, Part 1, Chapter 3, Article 8.5, Section 570 (a)(3).

HEALTHY SOILS PROGRAM OVERVIEW

Below we offer a brief overview of the program's primary components: funding sources, oversight, project types, eligible practices and GHG reduction methodology.

Funding:

The primary funding source for HSP is California's Greenhouse Gas Reduction Fund (GGRF), which consists of revenues from the auction of greenhouse gas emission allowances in the state's cap-and-trade program. As a market-based system, the price and volume of allowances sold fluctuates over time, which means the total available funding in the GGRF changes from year to year. Until 2020, typical quarterly auctions generated $600 to $800 million; however, in May 2020 the cap-and-trade auction performed very poorly, generating only $25 million. The August 2020 auction performed significantly better, raising approximately $474 million for GGRF. Such volatility in the market, in addition to changing legislative priorities for how the revenue is invested, creates challenges for program implementation and continuity. Inconsistent and unreliable funding sources threaten program viability and the state's ability to achieve its climate goals over the next ten years.

Based on the poor performance of recent auctions, we anticipate HSP will experience a gap year in funding in FY 2020-2021, the second gap year in its short history. Proposition 68 (2018), a $4 billion natural resources bond measure, provided $10 million in funding to HSP, but those funds are now expended. Given the tenuous history of program funding, we believe it is incumbent upon the state to identify a reliable source of funding moving forward. See Table 1 for a history of HSP funding levels.

Table 1. HSP's Funding To-Date

FY 2016-2017	FY 2017-2018	FY 2018-2019	FY 2019-2020	FY 2020-2021	**TOTAL**
$7.5 million	$0	$15 million	$28 million	$0	**$50.5 million**

Note: CDFA may use up to five percent of HSP's funding for administrative costs and must set aside an additional five percent of HSP funding for technical assistance

FARMER STORIES

Another Important Way of Assessing HSP's Impacts

Data can only reveal so much. Farmers' stories, like Jose's, about receiving and implementing these grants are critically important for understanding HSP's more nuanced impacts. You can check out more farmer HSP profiles on our website.

We also encourage you to check out CDFA's Climate News YouTube channel for videos of farmers who have received Climate Smart Agriculture programs grants.

Robles Farm

Jose Robles of Robles Farm farms almonds in Stanislaus County. In 2017, Jose received a Healthy Soils Program incentive grant to apply compost, plant cover crops and establish a hedgerow.

"The most immediate benefit we get is to our health. Now, we can pick nuts right from the trees without worrying about getting sick from pesticides"

- Jose Robles

Pictured: Jose and his granddaughter

[10] Food and Agricultural Code, Division1, Part 1, Chapter 3, Article 8.5, Sections 560-570.

Program Development and Oversight:

The law establishing the Healthy Soils Program requires CDFA to develop the program in consultation with the Environmental Farming Act Science Advisory Panel (EFA SAP), which was established by the Cannella Environmental Farming Act of 1995.[10] 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 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 and HSP advocates and stakeholders to share and discuss feedback on program implementation.

Incentives and Demonstration Projects:

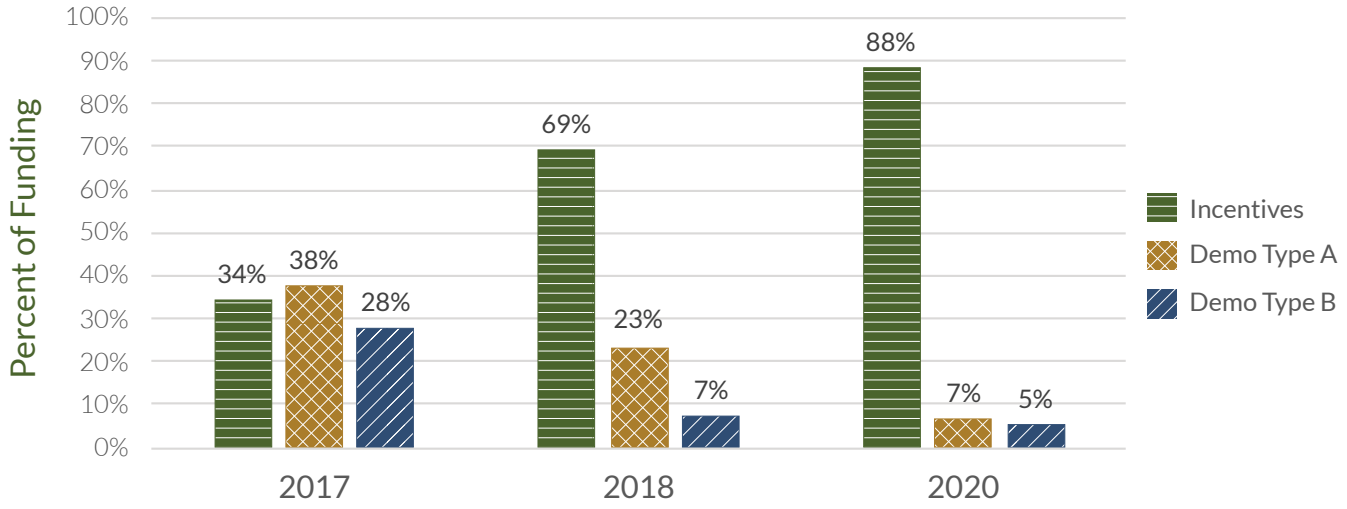
HSP funds two categories of projects. Incentives projects provide grants of up to $100,000 to farmers and tribes to implement one or more healthy soils practices. The total grant amount is determined by multiplying the payment rate for each practice by the total area on which the farmer plans to implement each practice.

The other project type, demonstration projects, funds collaborations of farmers and cooperating entities—such as a university, Resource Conservation District, tribe, or nonprofit—to establish on-farm demonstrations of healthy soils practices and conduct field days and other educational activities to promote farmer-to-farmer learning, well understood to be one of the most effective ways to scale up best practices. There are two types of demonstration projects: Type A projects are required to include replicated research plots and data collection on the soil health and greenhouse gas impacts of the project and are funded at up to $250,000 per project. Type B projects do not require replicated research plots or greenhouse gas measurements and are funded at up to $100,000. Both Type A and Type B projects must include robust outreach to growers.

All HSP projects are for a term of three years, which is intended to give farmers time to get past the learning curve of implementing a new practice with reduced risk and begin to see the agronomic benefits of the practices. For more information on HSP's grant guidelines, see CDFA's HSP website.

While the distribution of funding to incentives projects and both types of demonstration projects was nearly equal during the first year, CDFA has shifted the distribution of funding over time as farmer demand for incentives funding has grown. Figure 1 shows that the percent of funding allocated for incentives projects has increased substantially over the past three rounds.

Figure 1. Percent of Funding Allocated by Project Type (2017-2020)



Eligible Practices:

Healthy soils are defined in California's law 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.*"[11]

HSP's first application round in 2017 required farmers to apply for one of a narrow set of practices (reduced till, compost, mulch, or cover crops) in order to be eligible to apply for other soil health practices (e.g., hedgerows, riparian plantings) that have many co-benefits. This requirement limited participation in that first round, especially for farmers who had already adopted those required practices on their farms. HSP also initially offered fewer practices for ranchers. After the first round, the program removed this requirement and included new rangeland practices (e.g., prescribed grazing).

The program now includes more than 25 management practices (see sidebar) that are eligible for incentives grants. CDFA uses the conservation practice standards (CPS) established by the United States Department of Agriculture's Natural Resources Conservation Service (NRCS) for all HSP practices, with the exception of compost application and whole orchard recycling.[12] In order to be eligible to implement a particular practice on a field, the practice cannot have been previously implemented there for the past 12 months, as the goal of the program is to incentivize new or additional practice implementation.

Greenhouse Gas Reduction Estimates (COMET-Planner):

The greenhouse gas benefits of HSP practices are estimated using an HSP-specific version of COMET-Planner that has been developed by scientists at the California Air Resources Board (CARB), CDFA, USDA, and Colorado State University. 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

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

[12] When HSP was established, there was no corresponding NRCS Conservation Practice Standard (CPS) for compost application and whole orchard recycling. In late 2019, NRCS approved Interim CPS 808 for a "Soil Carbon Amendment," which includes compost application and whole orchard recycling.

ELIGIBLE HSP PRACTICES IN 2020

1. Alley Cropping
2. Compost Application (**note:** compost can be from a certified facility or produced on-farm)
3. Conservation Cover
4. Conservation Crop Rotation
5. Contour Buffer Strips
6. Cover Crop
7. Field Border
8. Filter Strip
9. Forage and Biomass Planting
10. Grassed Waterway
11. Hedgerow Planting
12. Herbaceous Wind Barrier
13. Mulching
14. Multi-Story Cropping
15. Nutrient Management (**note:** requires a 15% reduction in fertilizer application)
16. Prescribed Grazing
17. Range Planting
18. Residue and Tillage Management – No-Till
19. Residue and Tillage Management – Reduced Till
20. Riparian Forest Buffer
21. Riparian Herbaceous Cover
22. Silvopasture
23. Strip Cropping
24. Tree/Shrub Establishment
25. Vegetative Barriers
26. Windbreaker/Shelterbelt Establishment
27. Whole Orchard Recycling

improve accuracy. Every applicant must use COMET-Planner to estimate the GHG emission reductions of their projects. Using the tool, applicants select their county and enter the number of acres they plan to implement for each of their selected practices. COMET-Planner then produces an estimate of the net GHG impact, which includes carbon dioxide, nitrous oxide, and methane emissions. Only projects that achieve net GHG reduction benefits are considered for funding. For more information on COMET-Planner, see the COMET-Planner website.

REPORT METHODOLOGY

The development of this report was informed by our active engagement with Healthy Soils Program implementation as well as input from stakeholders. CalCAN staff conducted interviews and/or regional focus groups with farmers and technical assistance providers following each funding round of the program. In 2019, we surveyed 27 HSP technical assistance providers. In the spring of 2020, the authors spoke with nearly 30 technical assistance providers, experts, and other stakeholders familiar with the program. In addition, the report was reviewed by 21 experts (listed on the second page (ii) of the report).

We also compiled program data from CDFA, some of which was publicly available and the rest we obtained through a public records act request. When available, we used data from all three HSP funding rounds; however, we based some findings on data from 2017 and 2018 only, when 2020 data was not available. Finally, 2017 and 2018 data come from projects with signed grant contracts, whereas 2020 data came from an announcement of selected awards that are considered tentative until grant contracts are completed.

The following questions guided our research:

- What elements of the program are key to its growth and may be worth replicating in other states?
- What are the program's impacts to date (2017-2020)?
- What improvements to the design of the program would make it more equitable and effective in achieving its multiple objectives?
- How do we evaluate long-term program success?

Benito Valley Farms
Hollister, California

Linda Chu of Benito Valley Farms farms 700 acres of Asian vegetables in San Benito County. In 2018, Linda received a Healthy Soils Program incentive grant to apply compost and establish a hedgerow.

"Applying the compost has improved the health of my crops and the productivity of the soil. It's challenging to stay in business and this grant has helped us a lot."

-Linda Chu

Pictured: Linda and her husband Jeremy

FINDINGS

In this section, we describe the main findings from our analysis, revealing program successes and identifying opportunities for refinement.

Healthy Soils Program Numbers at a Glance (2017-2020)

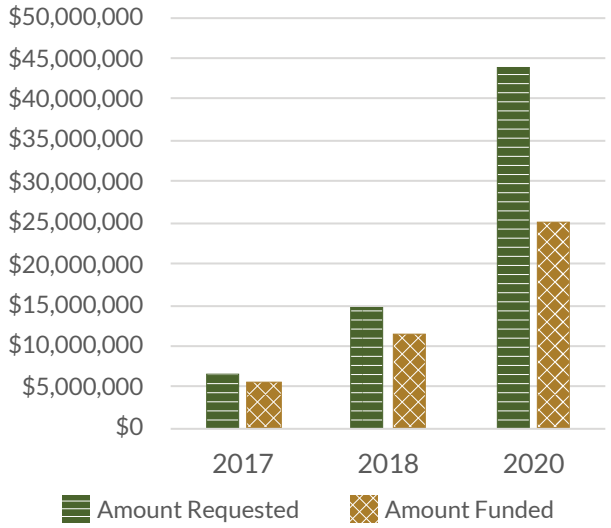
# of Grants	$ Awarded	Total Acres Implemented	Total Estimated GHG Reductions/Year[13]
640 total:	**$42 million total:**	**56,076**	**107,357** metric tons of CO_2 equivalents[14] Equivalent to 11.6 million gallons of gasoline consumed[15]
573 Incentives **27** Demo Type A **40** Demo Type B	**$32 million** Incentives **$6.4 million** Demo Type A **$3.6 million** Demo Type B		

Finding #1:

HSP successfully catalyzes immediate adoption of healthy soils practices across the diversity of California agriculture's cropping systems and geographies. More support is needed to achieve equity for farmers of color, women farmers, and small and mid-scale farmers.

California agriculture is known not only for its many microclimates and production of more than 400 crops but also for its diversity of farm sizes and farmers. Our analysis found that HSP is successfully catalyzing growing interest in and immediate adoption of healthy soils practices across California's diverse agricultural landscapes, but also emphasizes that it must better prioritize small and mid-scale farms, women farmers, and farmers of color to account for and address historical and ongoing inequities.

Figure 2. Total Amount Requested by farmers and Funded in Each Round (2017-2020)



[13] Estimated with the HSP version of COMET-Planner.

[14] The program's cost per metric ton of carbon equivalent reduced ($/MTCO2e) is approximately $309, which ranks #23 out of 44 among California's other Climate Investment programs. Source: California Climate Investments 2020 Semi-Annual Data Update.

[15] Calculated using the United States Environmental Protection Agency's Greenhouse Gas Equivalency Calculator.

Ward Burroughs of Burroughs Family Farms in his compost windrows.

Photo credit: CalCAN.

Farmer Demand

Overall farmer demand for the Healthy Soils Program continues to grow. During the most recent application period in 2020, over 600 farmers applied for incentives projects, requesting a total of $38 million, far exceeding the total available funding of $25.52 million. Farmer demand in terms of funding requested from the program in 2020 was more than three times higher than in 2018, and more than six times higher than the program's first round in 2017, as shown in Figure 2. The demonstration projects also remain popular, with 39 applications submitted this year, requesting a total of nearly $6 million.

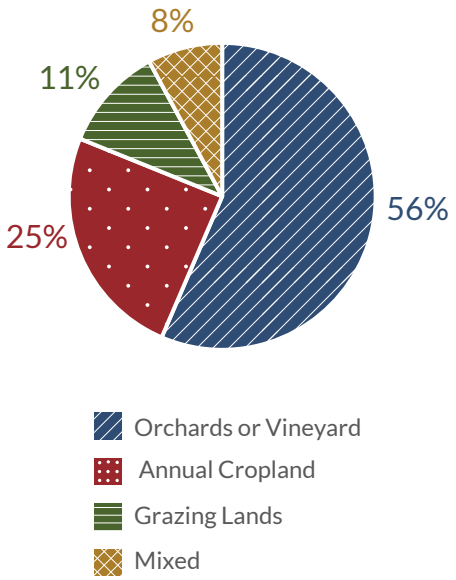
Land Use Type

While a diversity of farm types participates in the program, we found that significantly more projects occur on orchards or vineyards, with much fewer HSP projects on grazing lands and "mixed" farms, according to the land use classification used by COMET-Planner (Figure 3).[16]

For comparison, the National Agricultural Statistics Service's (NASS) 2017 Census of Agriculture found that 75 percent of California farms reported having cropland (which includes orchards, vineyards, and annual cropland in NASS's classification), 27 percent of farms reported having permanent pasture or rangeland, and four percent of farms reported having pastured woodland.[17]

The percentage of grants awarded to orchards or vineyards increased from 42 percent in 2017 and 2018 to 70 percent in 2020. Across all three rounds, projects on orchards and vineyards account for over 50 percent of all HSP awards. The increase in grants to orchards and vineyards may be due in part to the relative ease of implementing the program's most popular practices—compost application and cover cropping—in perennial orchard and vineyard systems. The inclusion of whole orchard recycling as an eligible practice in 2020 may also be a factor in the increase of awards to orchard systems, as 15 HSP incentives projects included the practice.

Figure 3. HSP Project Distribution by Land Use Type (2017-2020)



[16] When farmers apply for HSP grants, they must select their "agricultural system" in COMET-Planner before selecting their practices. The options given are: "Cropland," "Orchard or Vineyard", and "Grazing Land." HSP projects are thus categorized by those systems. Projects that select multiple systems are categorized as "Mixed."

[17] Source: 2017 USDA Census of Agriculture Table 7. Income from Farm-Related Sources: 2017 and 2012.

Farm Size

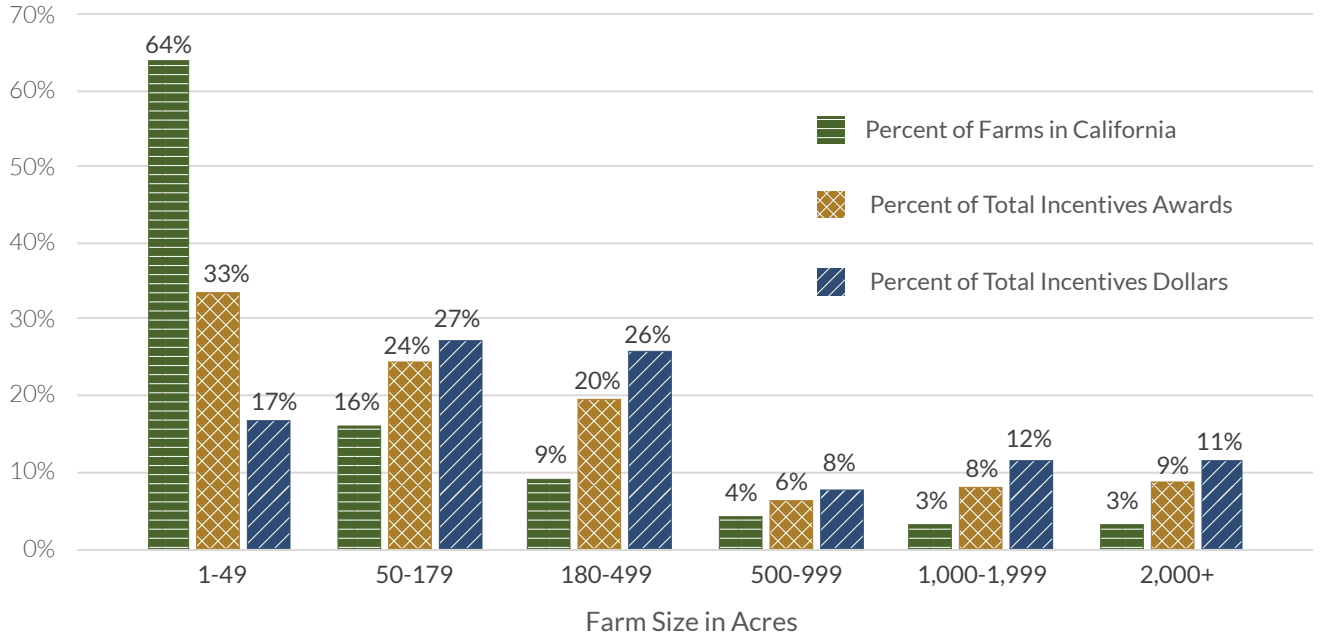
According to the 2017 Ag Census, 90 percent of California farms have less than 500 acres, meaning that the vast majority of farms in the state fall into what we consider the small and mid-scale farm category.[18] However, small farms are disappearing faster than any other farm size in the state: between 2012 and 2017 California lost more than 6,000 small farms (<100 acres), or more than 10 percent of small farms in the state.

We found that small and mid-scale farms of less than 500 acres received approximately 77 percent of HSP incentives grants and 70 percent of total HSP incentives funding from 2017-2018 (Figure 4).[19] Large farms of 500 acres or more received approximately 23 percent of awards and 30 percent of incentives funding. The median farm size of an HSP grant award was 80 acres.

Currently, HSP does not explicitly prioritize small or mid-scale farms in the award process. HSP's complementary technical assistance program does require technical assistance providers to prioritize assistance for small and mid-scale farms. To help stem the loss of small and mid-scale farms in the state and achieve equity, HSP must better prioritize funding for small and mid-scale farms, which have less resources on average than large farms to adopt these practices and provide important benefits for food system resilience and local and regional economies.

Compost at Full Belly Farm.
Photo credit: CalCAN.

Figure 4. Percent of Total HSP Incentives Awards and Dollars by Farm Size Compared to Percent of Farms in California by Farm Size (2017-2018)



[18] Source: 2017 USDA Census of Agriculture Table 1. Historical Highlights: 2017 and Earlier Census Years.
[19] We did not include farm size data for 2020 awarded projects as it is currently unavailable to the public.

Geographic Distribution

Since 2017, CDFA has awarded HSP grants to projects in 49 out of the state's 58 counties, with the greatest number of projects in the Central Valley and Central Coast, two of the most agriculturally productive regions in the state.

Table 2 shows the top 25 counties to receive awards. The top 10 agricultural producing counties in California received 29 percent of total grants.[20] Agriculturally rich Southern California counties like San Diego, Imperial and Riverside received fewer awards than those in the San Joaquin Valley. Table 2 also shows that Fresno and Merced counties received far more HSP awards than neighboring counties in the San Joaquin Valley like Tulare, Kern, Madera, and Kings. This disparity within the San Joaquin Valley may be due in part to the differences in the presence and capacity of technical assistance providers in the regions.

Farmer Demographics[21]

Farmers of color officially make up 19 percent of California's farm operators, but that percentage is likely an undercount, due to language and other barriers these farmers sometimes face in filling out the census. Women farmers currently make up 37 percent of California operators. The percentages of these farmers in the state is expected to increase, particularly as more white male farmers retire.

In 2017, the Farmer Equity Act (AB 1348 Aguiar-Curry) was signed into law, seeking to rectify the inequities faced by farmers of color in California, including unequal access to resources such as incentives and technical assistance. The Act requires CDFA to "ensure the inclusion of socially disadvantaged farmers and ranchers in the development, adoption, implementation, and enforcement of food and agriculture laws, regulations, and policies and programs."[22] Although the Act mentions gender, CDFA interprets the Farmer Equity Act's definition of "socially disadvantaged farmer or rancher" to mean farmers

[20] Source: California Agricultural Statistics Review 2018-2019.

[21] For the HSP data related to SDFR status and gender presented in this section, it is worth noting that many farms have multiple producers, but HSP only asks for the gender and SDFR status of the person filling out the application. As such, may not account for other SDFR and woman producers involved in the day-to-day management of farms receiving HSP grants.

[22] Food and Agricultural Code, Division 1, Part 1, Chapter 3, Article 6, Section 513 (a).

Table 2. Top 25 Counties by Number of Awards (2017-2020)

County	Number of Awards	Total Amount Awarded
Fresno	48	$ 3,084,260
Yolo	43	$ 4,133,654
Sutter	40	$ 2,857,304
Merced	36	$ 2,589,373
Butte	33	$ 1,970,912
Colusa	32	$ 2,811,005
Solano	28	$ 1,347,514
Sonoma	25	$ 1,317,115
San Luis Obispo	23	$ 1,293,219
Tulare	21	$ 1,512,685
San Diego	20	$ 804,308
Kern	15	$ 1,105,714
Glenn	14	$ 817,535
Imperial	13	$ 1,073,698
Riverside	13	$ 422,283
Santa Cruz	13	$ 278,732
Yuba	12	$ 1,202,578
Marin	12	$ 392,826
Monterey	11	$ 746,778
Santa Barbara	11	$ 705,218
Mendocino	11	$ 401,153
Madera	10	$ 993,811
Modoc	10	$ 787,517
Ventura	9	$ 657,447
Kings	9	$ 732,463

who are members of a group subjected to racial or ethnic discrimination, including: African Americans, Native Indians, Alaskan Natives, Hispanics, Asian Americans, and Native Hawaiians and Pacific Islanders. As such, women farmers who identify with one or more of those racial or ethnic groups are counted as SDFRs, but white women farmers are not.

CDFA now designates 25 percent of total funding to SDFRs in the Healthy Soils Program and related technical assistance program. That prioritization appears to be having a positive impact. We found that HSP funding to SDFRs increased from 21 percent in 2018 to 25 percent in 2020 (Figure 5). However, HSP lags behind another climate smart agriculture program—the State Water Efficiency and Enhancement Program (SWEEP)—in terms of funding for SDFRs. In 2018-2019, 42 percent of SWEEP funding went to SDFRs. The key difference is that HSP designates a set-aside (or floor) of 25 percent of funding for SDFRs and SWEEP prioritizes funding for SDFRs by requiring that qualified SDFRs are the first in line to receive funding.

Figure 6 shows that HSP awards to women farmers decreased from 28 percent in 2018 to 19 percent in 2020. Neither HSP nor its related technical assistance program prioritize or set aside funding for women farmers specifically.

Figure 5. Percent of Incentives Dollars by SDFR Status (2018 and 2020 Only)

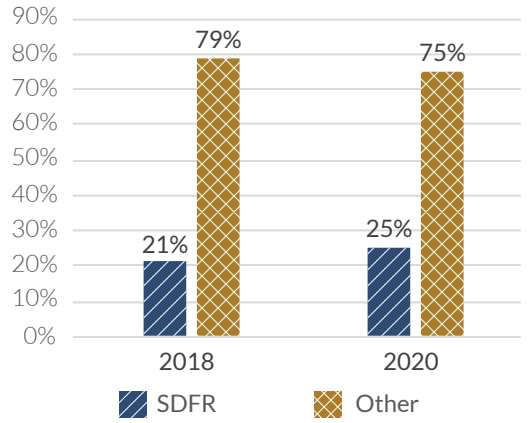
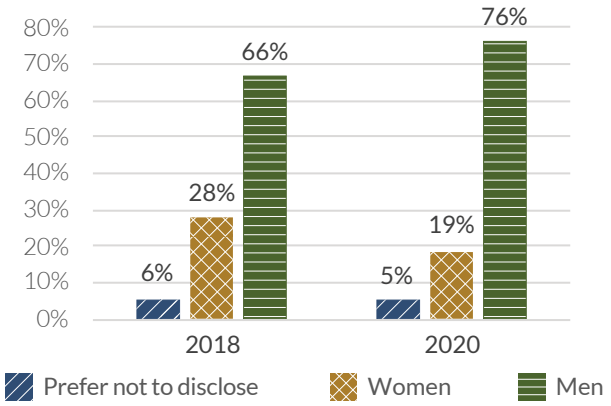


Figure 6. Percent of Incentives Projects by Gender (2018 and 2020 only)



Farmers of color in California have experienced over a century of injustices, including multiple periods and policies of explicit race-based exclusion, discrimination, and land theft. Women farmers have also experienced over a century of gender-based discrimination in agriculture. For these reasons, it is incumbent on CDFA to ensure that these farmers are first in line for HSP funding.

A few stakeholders we interviewed asked us if HSP collects information on whether grant recipients are beginning farmers.[23] The stakeholders noted that in their experience, beginning farmers are more likely to want to experiment with healthy soils practices, but often face barriers to adoption due to insecure land tenure and limited resources (e.g., access to capital, equipment, and technical assistance). CDFA has not historically collected this information on the HSP application, but could easily do so alongside the questions about gender and SDFR status.

[23] USDA's Beginning Farmer Rancher and Rancher Development Program defines a beginning farmer as: "A farmer, rancher, or operator or non-industrial private forestland who is in the first ten years of operation."

Demonstration Projects

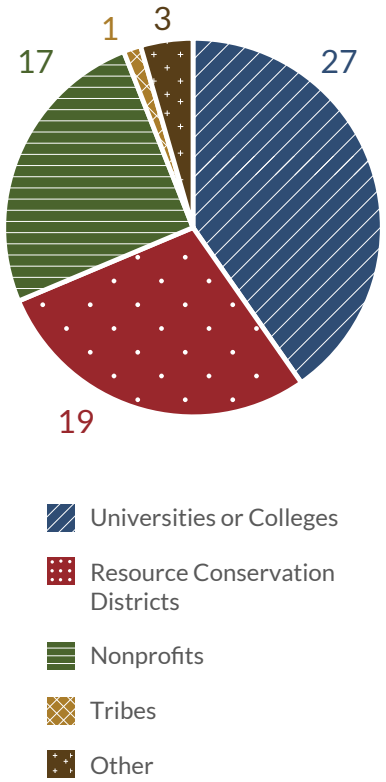
CDFA reports that demonstration projects attracted over 4,000 attendees, including nearly 2,000 farmers, in 2017-2019. All of the demonstration projects and their research are still ongoing, and in light of the pandemic, many are conducting outreach and education through webinars and other online platforms.

Table 3. HSP Demonstration Projects at a Glance

# of Grants	Total $ Awarded	Total Acres Implemented	Total Number of Attendees[24]	Total Number of *Farmer* Attendees[25]
67	$9,851,485	2,751	4,360	1,947

Although all demonstration projects must take place on farms, other organizations often apply for and manage the demonstration grant on behalf of the farmer and other cooperating entities. Figure 7 shows the distribution of demonstration grants by the type of recipient organizations.

Figure 7. Number of Demonstration Projects by Type of Recipient Organization (2017-2020)



4J Horse & Livestock Co.
Jamul, California

John Austel of 4J Horse & Livestock Co. runs cattle with his sons in San Diego County. In 2018 John worked with the Resource Conservation District of Greater San Diego County to receive a Healthy Soils Program demonstration grant for prescribed grazing.

"We are traditional ranchers using current science to help manage our operations. By growing grass, we are storing carbon and water, and helping prevent drought which matters for our bottom line."

- John Austel

[24] Demonstration project attendee data includes only data from 2017-2019.
[25] Demonstration project attendee data includes only data from 2017-2019.

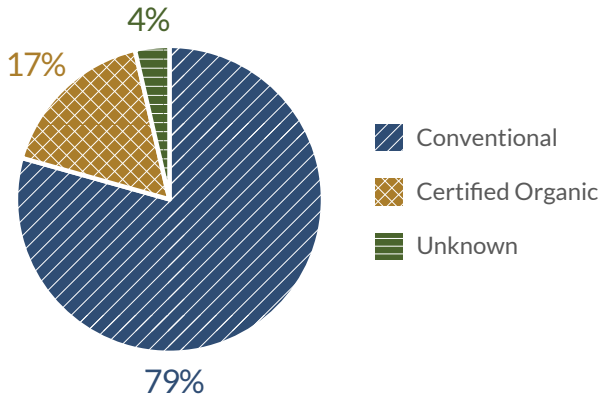
Finding #2:

Conventional farms receive the vast majority of HSP grants. Incentivizing organic transition would help farms sustain multiple healthy soils practices in the long term.

An analysis by California Certified Organic Farmers (CCOF) found that the vast majority (79 percent) of HSP incentives dollars went to conventional farms. Certified organic operations are receiving 17 percent of incentives dollars (Figure 8).

HSP's guidelines prevent farmers from applying for incentives for practices they are already implementing. This rule tends to affect organic operations—which in most cases are already implementing some combination of healthy soils practices—more than conventional operations. Despite this, with a diversity of eligible practices in the program, many organically certified operations we interviewed were able to apply to adopt one or more new practices or to expand the implementation of practices on new acreage they had acquired.

Figure 8. Percent of Incentives Dollars by Certified Organic Status (2017-2020)



Many stakeholders we interviewed noted that one way to increase the likelihood that farmers will continue using healthy soils practices after the end of their three-year HSP grant is by incentivizing them to transition their land to certified organic production over the course of their grant period. Federal law requires certified organic producers to maintain or improve soil organic matter, while also prohibiting them from using synthetic, fossil-fuel based fertilizers and pesticides—the lifecycle GHG, soil health, and public health impacts of which are largely overlooked in HSP. As it is, most organic farmers utilize a combination of healthy soils practices to maintain soil fertility and manage pests and diseases.

The three-year process of transitioning conventional acreage to certified organic—during which time producers must comply with organic standards but cannot receive the organic price premium—is a major barrier for producers, especially beginning farmers and non-English speaking farmers. Farmers often face a steep learning curve during transition, which includes developing an organic system plan, maintaining the detailed paperwork required for organic audits and inspections, and learning about organically approved materials and practices. Because of this, farmers going through transition often benefit from having access to consultants who specialize in organic production systems and certification. These consultants help farmers overcome the steep learning curve, while also ensuring they do not make costly mistakes that could delay or jeopardize their certification.

An incentive to help farmers offset the costs of organic transition, paired with existing incentives grants for healthy soils practice implementation, would meet the objectives of HSP to support the economic viability of California agriculture and contribute to healthy soils and net long-term on-farm GHG benefits. Scientific studies, including those conducted by UC Davis researchers, consistently find that organic farming builds soil organic matter[26] and has lower net GHG emissions.[27] Additionally, the organic price premium farmers receive once their operation is certified would help offset the costs of continuing to implement healthy soils practices.

[26] Greater carbon storage in organically managed plots has been found in numerous published studies including reports on UC Davis trials, USDA Agricultural Research Service studies in Salinas, a national soil survey, and an international meta-analysis of soil quality data. See Wolf, K., Herrera, I., Tomich, T.P., & Scow, K. (2017). Long-term agricultural experiments inform the development of climate-smart agricultural practices. *California Agriculture*, 71, 120-124; Brennan, E.B., & Acosta Martinez, V. (2017) Cover cropping frequency is the main driver of soil microbial changes during six years of organic vegetable production. *Soil Biology and Biochemistry*, 109, 188-204; Ghabbour, E.A., Davies, G., Misiewicz, T., Alami, R.A., Askounis, E.M., Cuozzo, N.P., … Shade, J. (2017) Chapter one - national comparison of the total and sequestered organic matter contents of conventional and organic farm soil. *Advances in Agronomy*, 146, 1-35; Sanders, J. & Hess, J. (Eds) (2019) Leistungen des ökologischen Landbaus für Umwelt und Gesellschaft . Braunschweig: Johann Heinrich von Thünen-Institut, 364 p, *Thünen* Report 65.

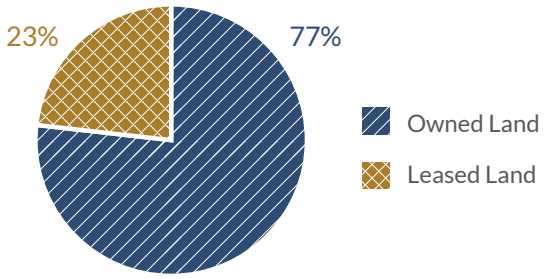
[27] De Gryze, S., Wolf, A., Kaffka, S. R., Mitchell, J., Rolston, D. E., Temple, …Six, J. (2010). Simulating greenhouse gas budgets of four California cropping systems under conventional and alternative management. *Ecological Applications*, 20(7), 1805-1819.

Finding #3:

Insecure land tenure is a barrier to participation in HSP.

HSP requires that "*applicants must lease, own or otherwise control the fields and APNs [Assessor Parcel Numbers] where project activities are proposed to occur for the entirety of the project duration,*" which is three years. For applicants who lease their land, HSP also requires them to "*document approval by the landowner.*" Several TA providers we interviewed indicated that these requirements proved difficult, if not impossible, to meet for many farmers in the state who operate on year-to-year leases—especially young, beginning, and socially disadvantaged farmers—and sometimes have complicated or simply limited relationships and communication with their landlords.

Figure 9. Percent of Incentives Grants by Land Tenure Status (2017-2020)



This barrier appears to be reflected in the program data. Figure 9 shows that HSP incentives projects on leased land made up only 23 percent of all projects. For context, 45 percent of all agricultural land is leased in California.[28]

With increasing land values and the land access challenges faced by young and beginning farmers and SDFRs[29], we expect the percentage of California farmers who lease land will continue to rise. CDFA must find ways for HSP to better support and accommodate farmers who lease land, especially SDFRs.

Finding #4:

HSP incentivizes a diverse range of practices, with compost application by far the most popular.

Figure 10 shows the percentage of incentives projects implementing each eligible practice.[30] Overall, soil management practices (compost, cover crop, mulch and tillage) were most frequently implemented. Compost application outpaced all other practices with about 72 percent of incentives projects implementing the practice. Cover cropping was the next most popular practice, included in 36 percent of projects. Hedgerow planting was the third most common practice at 16 percent, while other conservation plantings were much less commonly used. The most popular practices — compost, cover crops, mulching, and hedgerows—provide important benefits for erosion control and water infiltration and retention, in addition to their climate mitigation benefits. Hedgerows and some cover crops also provide habitat and food sources for pollinators and beneficial insects and birds.

One strength of HSP is that it allows farmers to implement multiple healthy soils practices on the same acreage, aligning with scientific literature that shows a synergistic relationship from implementing multiple practices in the same area.[31, 32, 33, 34, 35] Figures 11 and 12 show the percentage of projects implementing multiple practices on the same acreage. In the first two rounds (Figure 11), two-thirds of incentives projects implemented two or more practices. However, in the third round (Figure 12), less than 40 percent of incentives projects plan to implement two or more practices. This shift merits further exploration to understand its causes, as well as consideration of ways to incentivize multiple practices in the program.

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[28] Source: U.S. Farmland Ownership, Tenure and Transfer Table 1, pp. 16.

[29] See pp. 9-10 of 2020 Report to the California Legislature on the Farmer Equity Act.

[30] The percentages in Figure 10 should be read as the percentage of incentives projects that include each practice. Because projects can implement multiple practices, the percentages add up to more than 100 percent.

[31] De Gryze, S., et. al. 2009. Assessment of Greenhouse Gas Mitigation in California Agricultural Soils. California Energy Commission: Public Interest Energy Research Program.

[32] Suddick, E., et. al. 2010. The Potential for California Agricultural Crop Soils to Reduce Greenhouse Gas Emissions: A Holistic Evaluation. *Advances in Agronomy*, 107.

[33] De Gryze, S., et. al. 2011. Assessing the potential for greenhouse gas mitigation in intensively managed annual cropping systems at the regional scale. Agriculture, *Ecosystems and Environment*, 144, 150-158.

[34] Paustian, K., et. al. 2016. Climate-smart soils. Nature, 532, 49-57.

[35] 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.

Figure 10. Percentage of Incentives Projects Implementing Each Practice (2017-2020)

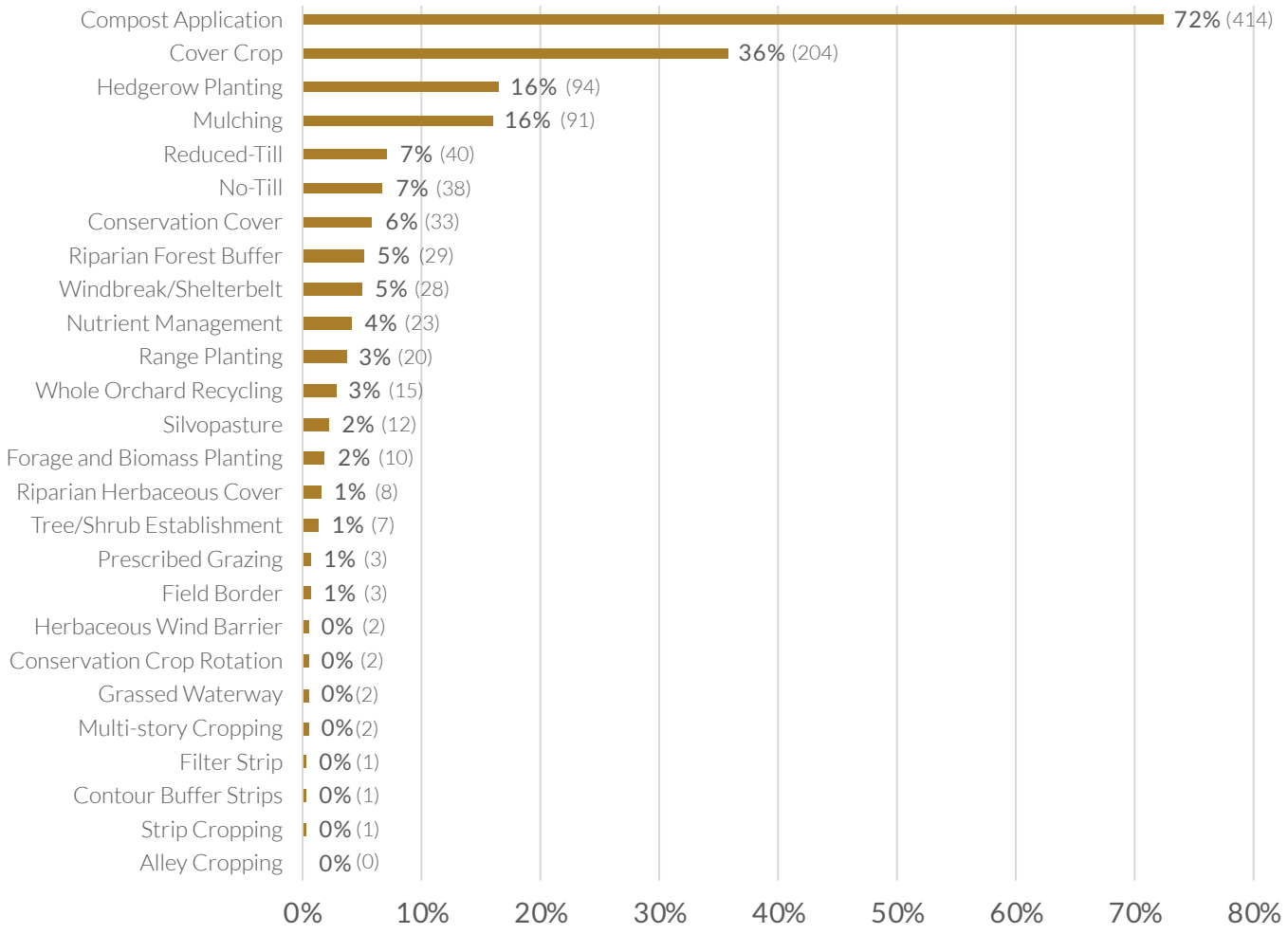


Figure 11. Incentives Projects Distribution by Number of Practices Implemented (2017-2018)

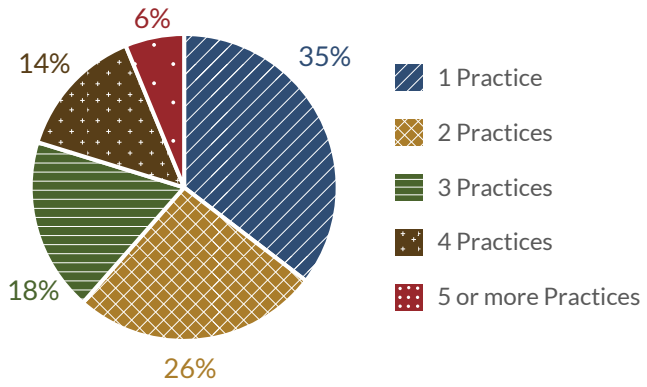
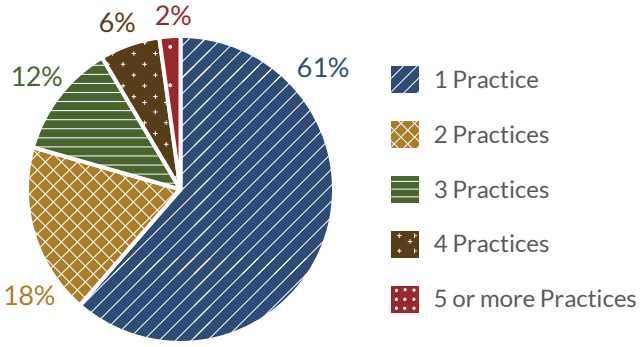


Figure 12. Incentives Distribution by Number of Practices Implemented (2020)

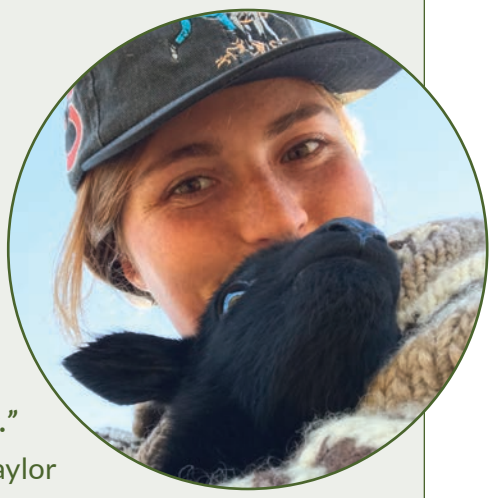


PT Ranch
Ione, California

Molly Taylor of PT ranch raises a variety of livestock with her family in Amador County. In 2020, Molly received a Healthy Soils Program incentive grant to apply compost, plant cover crops and practice no-till.

"This program is important because it helps California producers increase the resilience of their farms and ranches to extreme weather. The healthier your soil, the more water you have, the more soil organic matter you have, the better you are able to weather these extreme temperatures."

- Molly Taylor



Finding #5:

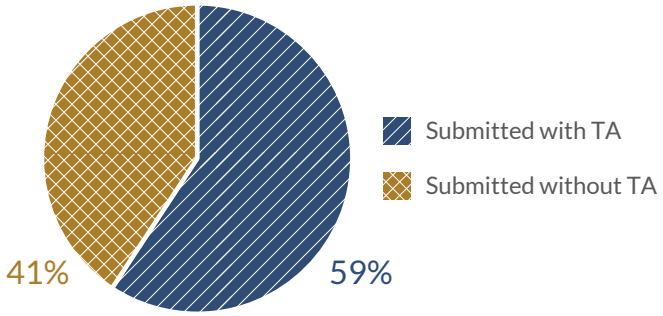
Technical assistance, breadth of eligible practices, demonstration projects, and a streamlined application have all been critical to the growth in farmer demand for the program.

Applications for incentives projects have grown from fewer than 100 applications in the first round to over 600 applications in the most recent round. Stakeholders we interviewed attribute this remarkable growth to a number of factors described below.

Technical assistance integral to successful farmer participation, especially for SDFRs

In our interviews, farmers often said learning about and applying to HSP required significant time and effort, and emphasized ongoing farmer outreach and technical assistance as necessary components of a successful program. Technical assistance (TA) was especially critical to farmers who faced language barriers to participating in HSP. TA providers often stated that many of the farmers they worked with would have been unlikely to hear about or successfully apply to the program without their outreach, assistance, and in some cases translation services.

Figure 13. Percent of Applications Submitted with TA (2018 and 2020 only)



Technical assistance providers who have expertise in soil conservation, relationships with farmers, and experience assisting farmers in navigating government programs have been key to helping farmers overcome barriers to participating in HSP. CDFA has funded technical assistance since the first round of HSP grants, starting with small grants to 13 TA providers in 2017. However, in response to farmer feedback that technical assistance needed to be expanded, both in terms of funding and scope, CalCAN successfully sponsored legislation (AB 2377, Irwin) to establish a comprehensive definition of TA, set aside a minimum of five percent of HSP funds for TA, and require that TA funding be prioritized for SDFRs and small- and mid-scale farmers.

Since AB 2377 took effect, 59 percent of applications have been submitted with help from technical assistance providers (Figure 13), illustrating the value of TA to farmer applicants.[36] Ahead of the 2020 round of HSP, three-year TA grants were awarded to 16 Resource Conservation Districts, 12 nonprofit organizations, and four UC Cooperative Extension staff. In the first six months of 2020, these 32 TA providers assisted a total of 1,125 farmers, of which 723 operate small or mid-scale farms, 166 are SDFRs, and 107 are non-English speakers.[37, 38] As noted above in Figure 5, projects funding SDFRs have increased slightly with increased investments in technical assistance.

Other states considering their own programs should plan to integrate comprehensive and ongoing technical assistance into their programs from the beginning.

Breadth of eligible practices maximizes farmer choice

Every farmer and farm is unique, and farmers prefer to have as many tools in the toolbox as possible. With so much diversity in production systems, natural resource concerns, and farmers themselves, it helps to give farmers many options to choose from in order to improve soil health.

As HSP developed over time, it became more flexible and diverse in its offerings of incentives for farmers, which has improved program participation. For example, as we discussed above, HSP's 2017 program guidelines required farmers to apply for a narrow set of practices in order to be eligible to apply for additional soil health practices. Farmers and technical assistance providers indicated that this constrained set of available practices limited participation in the first year of the program. After removing this requirement and expanding the eligible practices, 69 percent of TA providers we surveyed in 2019 indicated the expanded list of eligible practices was an improvement.

Demonstration projects drive word-of-mouth and facilitate farmer-to-farmer learning

Farmers learn best from fellow farmers and are most receptive to changes in their management practices when they see fellow farmers doing it successfully. Recognizing that, HSP embraced farmer-to-farmer learning early on by funding on-farm demonstration projects in addition to direct incentives projects. These demonstration projects may extend the impact of the program by inspiring some farmers who attend them to experiment with and implement healthy soils practices on their own without additional incentives, especially those practices which are known to have economic return on investment over time.

White Buffalo Land Trust
Summerland, California

Jesse Smith is the Director of Land Stewardship for White Buffalo Land Trust and manages their legacy avocado orchard. In 2018, they received a Healthy Soils Program demonstration grant to plant a hedgerow and apply mulch.

"We want the demonstration site to show that each and every farm and ranch operation has the opportunity to leverage this funding for soil building purposes. This grant provides a jumping off point to realize our vision of an integrated agricultural system."

- Jesse Smith

[36] CDFA data presented at the Oct. 17, 2019 meeting of the Environmental Farming Act Science Advisory Panel.
[37] Assistance was provided in English, Spanish, Chinese, Hmong, and Portuguese.
[38] CDFA data presented at the Oct. 15, 2020 meeting of the Environmental Farming Act Science Advisory Panel.

To date, CDFA reports that nearly 2,000 farmers have attended demonstration project field days or farm tours, which is approximately triple the number of farmers who have been able to receive incentive grants through the program, highlighting the way these projects may be able to stretch the impact of limited government resources.[39] This shows that other states considering ways to maximize the impact of their investments in soil health programs should consider demonstration projects.

Streamlined application makes farmer-friendly process

Based on feedback from stakeholders, CDFA significantly streamlined the application process for farmers in the most recent funding round (2020). CDFA reduced the number of questions and attachments required in the incentives grant application by eliminating most short-essay questions, eliminating the budget worksheet by incorporating payment rates into the COMET-Planner tool, and developing a new integrated mapping tool that allows applicants to submit several pieces of required information at once. Feedback from many farmers and TA providers indicated that these improvements made the application process much easier and more accessible. These improvements are worth noting for other states and advocates starting similar initiatives.

The one aspect of the application that has remained farmer-friendly throughout all the rounds is COMET-Planner. To estimate the GHG benefits of their projects, applicants use a California-specific iteration of the COMET-Planner tool. For other states seeking a farmer-friendly tool for estimating GHG reductions, COMET-Planner is a good place to start. Implementing a state-specific version may be unnecessary in other states, so this question should be evaluated on a case-by-case basis. In California, CDFA continues to work with partners to continually improve the modeling for the tool.

Field day at Bobcat Ranch.
Photo credit: Saxton Holt.

[39] Demonstration project attendee data includes only data from 2017 and 2018.

Finding #6:

Some program elements need refinement, such as soil testing, language accessibility, grant contract finalization, and payment rates.

In this section of our findings, we detail a few important areas of program design that could be strengthened according to stakeholders involved in this report, including soil testing and data collection, language accessibility, grant contract finalization, and payment rates for the eligible practices.

Soil testing and data collection need clear purpose and strategy

Currently, CDFA requires every HSP incentives project recipient to sample their soils and submit a laboratory report of their soil organic matter content for three consecutive years. CDFA's stated purpose for this requirement has shifted over time—from potentially being used to determine the continued eligibility of specific practices based on changes in soil organic carbon, to improving COMET-Planner and other climate models, and most recently to inform a statewide soil organic carbon map. However, stakeholders we talked to consistently expressed skepticism about how useful soil sampling results from the first few rounds of HSP will be for achieving any of those results.

Many stakeholders pointed out that incentives projects are not controlled experiments. HSP incentives projects are not required to control for or document other management or environmental variables (e.g., tillage or irrigation) that can have significant impacts on soil health metrics. Additionally, stakeholders noted there is potential for significant sampling inconsistency and reporting error, because farmers are responsible for conducting the soil sampling and submitting the data themselves. Moreover, stakeholders noted that research shows that changes in soil organic matter occur slowly and often variably over a field, which means the expectation of seeing statistically significant changes in soil organic matter after just three years may be unrealistic in many situations. One soil scientist noted that other more responsive metrics than soil organic matter could be used to measure changes in labile carbon pools in soils.[40] However, they noted that some of these metrics require more complex analysis in a lab and may not be practical.

Soil sampling in HSP incentives projects can potentially serve multiple purposes, including helping farmers better understand soil health metrics and changes; informing their nutrient management decisions; addressing specific research gaps; and advancing climate models. However, each of those purposes requires a different level of sophistication in sampling methodology, data standardization and transparency, and accompanying resources.

Demonstration projects are also required to conduct soil sampling and, for Type A projects, to set up three replicated research plots and measure field GHG emissions. With these requirements and mostly professional soil scientists and conservationists carrying out these measurements, demonstration project data are more likely to be useful for filling specific research gaps.

However, stakeholders we interviewed still expressed a desire to see a more targeted approach to demonstration project research and data collection. For example, CDFA could survey farmers, soil scientists, and climate modelers to understand their most pressing research questions and then target demonstration project funding

Farmer showing off healthy soil from cover-cropped acres.

Photo credit: USDA.

[40] Labile carbon pools in soils are made up of amino acids, simple carbohydrates, microbial biomass, and other simple organic compounds. Labile carbon pools are the most active fraction of soil organic carbon, with rapid turnover times, and they change substantially with disturbance and management. Labile carbon is a great indicator of soil quality because it is the main source of energy for soil microorganisms and is directly related to nutrient cycling and bioavailability for plants. Recalcitrant carbon pools, in contrast, take more time to decompose and are not readily available to microorganisms. More responsive measurements for labile carbon pools include soil respiration by incubation, microbial biomass carbon and nitrogen, and anaerobic incubations to look at the potential capacity of soil microorganisms to mineralize inorganic nitrogen from soil organic matter.

to address those needs. Farmers we interviewed expressed the view that demonstration projects should prioritize answering farmers' questions—including economic and operational questions—about healthy soils practices and their benefits.

Language accessibility barriers for non-English speakers

California farmers and the farm managers and farm-workers often carrying out management practices speak several languages, and many speak a language other than English as their primary language. TA providers we interviewed who work with limited- or non-English-speaking farmers consistently indicated that the lack of HSP materials (e.g., the request for grant applications, outreach materials and the application itself) in the farmers' primary languages was a major barrier to them participating in the program. CDFA's own 2020 Farmer Equity Report to the legislature recognized this as a barrier as well: "*Many struggle to find resources and information because the majority of the information available about farming practices, programs, marketing and regulations is in English…Developing materials in other languages is critical to helping non-English-speaking farming communities understand CDFA's programs, resources and policies.*"[41]

Slow grant contract finalization can delay time-sensitive fall plantings

For the past two HSP rounds, we have heard feedback from multiple farmers and TA providers that slow grant contract finalization with CDFA has impacted their projects, in some cases resulting in farmers missing their ideal planting date for practices like hedgerows and cover crops. Stakeholders also noted that native plants used in hedgerow and riparian forest buffer plantings often take more time to obtain than traditional transplants, making timely grant contract finalization even more important.

Payment rates do not account for regional cost variation

In our 2019 survey of HSP technical assistance providers, 63 percent of respondents indicated that HSP payment rates are too low. In response to this finding, we explored how payment rates are developed and applied to HSP's three most popular practices—compost, cover crops and hedgerows—by reviewing documents from CDFA and NRCS and conducting interviews with NRCS staff and a number of experts on those three practices.

Fat Uncle Farms
Wasco, California

Nathanael Siemens of Fat Uncle Farms dry-farms almonds, wheat, cotton and livestock in Kern County. In 2017, Nathanael received a Healthy Soils Program incentive grant to plant cover crops, mulch, practice no-till and apply compost.

"Thanks to the Healthy Soils Program, we have made new connections with other farmers and organizations. Most importantly, we have been able to try new practices that benefit our farm, the environment and overall climate."

- Nathanael Siemens

Pictured: Nathanael and his wife Bekki

[41] CDFA. 2020 Report to the California Legislature on the Farmer Equity Act.

CDFA typically doubles the payment rates used by NRCS for the Environmental Quality Incentives Program (EQIP). EQIP payment rates typically cover between 50 to 75 percent of the total cost listed in cost scenarios established by NRCS. Although NRCS engages both national and regional experts when developing their cost scenarios, the scenarios tend to be skewed towards national cost averages, not on what might be appropriate or sufficient in California.

While CDFA's choice to double EQIP payment rates was smart—especially given the low uptake of healthy soils practices in California EQIP—we found that HSP's payment rates still do not always account for California's regional and crop-specific cost variations.

The experts we interviewed indicated that in most situations the 2020 HSP payment rates are sufficient for hedgerows and compost application, but can be too low for cover crops. However, our interviews also revealed numerous variable costs associated with each of the practices that can cause farmers to incur higher costs than payment rates provide. For example, stakeholders repeatedly cited California's higher land, water and labor costs as compared to national averages.

Table 4 compares our California cover crop experts' cost estimates for implementing cover crops on conventionally managed walnuts and conventionally managed field corn to EQIP's cost scenario for implementing a cover crop on "irrigated or non-irrigated cropland, orchard or vineyard alleys."

Martin Flores of Boonville Barn Collective after an olive harvest – a HSP incentive grant recipient.

Photo credit: Gilbert Bages.

The comparison shows that implementing cover crops on a conventionally managed walnut orchard ranges from $120 to $160 per acre. The range is from $105 to $242 per acre on a conventionally managed corn field. The current HSP payment rate ($106/acre[42]) falls below the estimated cost range for cover crops in walnut orchards and on the very low end for cover crop costs in corn. Complicating matters even more, these two commodities have significantly different profit margins, which likely affects farmers' willingness to shoulder some portion of the costs of practice implementation. This example reveals the extent of variable costs associated with cover crop practices in California and emphasizes the need for regionally responsive payment rates that account for variability and higher California costs.

Stakeholders we interviewed also suggested more attention should be paid to practices with low implementation rates in HSP to better understand what barriers may exist. As an example, stakeholders pointed out that the HSP payment rate for prescribed grazing ($22/acre) is only intended to cover the costs of pasture and range monitoring and data collection. To actually implement a prescribed grazing plan, ranchers often need funding to build fences and install water systems. The limited payment rate may act a disincentive to use the practice.

[42] The HSP payment rate for cover crops was $146 per acre as recently as 2019, but fell to $106 per acre as a result of changes to NRCS's cost scenario for cover crops.

Table 4. Cost estimates to add legume, legume mix, or non-legume multiple species cover crops to irrigated or non-irrigated cropland, orchard or vineyard alleys (NRCS CPS 340)

Item/Activity	Cost per acre			Notes
	Walnuts on pressurized irrigation	Field corn on furrow irrigation with tillage	EQIP cost scenario	
Cover crop seed	$45 - $65[43, 44]	$30 - $67[45, 46]	$34.63[47]	
Ground preparation[48]	$15 - $30	$15 - $50	$4.97[49]	Assumes disk or chisel (1 pass).
Inoculant	N/A	$1.50[50]	N/A	
Seeding (1 pass)	$15 - $25	$15 - $50	$22.55[51]	Drill will take 1 pass. Broadcast may require a 2nd pass to cover seed.
Irrigation	$15 - $30[52]	$32 - $54[53]	N/A	
Termination:	$15 - $30[54]	$15 - $40[55]	$8.98[56]	
Termination: incorporation	$15 - $30	N/A	N/A	Assumes disk.
Total estimated cost	**$120 - $160**	**$105 - $242**	**$71.13[57]**	
EQIP Payment Rate	**$53.35[58]**			= 75% of EQIP Cost Scenario
HSP Payment Rate	**$106.70[59]**			= 2x EQIP Payment Rate

[43] An example mix might include the following (% of seed by weight): 30% Annual Ryegrass, 30% Oat (Cayuse), 15% Brown Mustard, 8% Daikon Radish, 15% Purple Vetch, 2% Phacelia.
[44] Seeding rates for this type of mix are typically 50 to 75 pounds per acre, planted in orchard middles.
[45] An example mix including the following (% of seed by weight): 20% Bell Beans, 8% Purple Vetch, 20% Fall Ryegrain, 30% Oat (Cayuse), 17% Spring Triticale, 5% tillage radish.
[46] Seeding rates for this type of mix are typically 75 to 100 pounds per acre.
[47] Estimate for warm or warm season annual grass and legume mix. Includes material and shipping costs.
[48] The number of passes for ground prep and termination will depend on field conditions, cover crop biomass in the spring and grower preference.
[49] Chemical application performed by ground equipment. Includes equipment, power unit and labor costs.
[50] Assumes one bag will treat approximately 20 acres of a green manure mix with legumes.
[51] No Till drill or grass drill for seeding. Includes equipment, power unit and labor costs.
[52] Assumes 2 acre-inches of water with sprinklers.
[53] Assumes 6-10 acre-inches on furrow.
[54] Assumes mow prior to incorporation.
[55] Assumes disk/mow.
[56] Using glyphosate.
[57] Source: USDA NRCS California Environmental Quality Incentives Program (EQIP) FY 2020, p. 168
[58] Source: USDA NRCS California Environmental Quality Incentives Program (EQIP) FY 2020, p. 11
[59] Source: CDFA HSP Incentive Program RGA 2020, p. 28 and 40

Finding #7:

Comprehensive program evaluation is needed to improve program implementation and impact.

While our findings reveal laudable progress in the state's commitment to climate smart agriculture, they also demonstrate research gaps and the need to evaluate this work more comprehensively. As the state looks to scale up agricultural solutions to climate change long-term, HSP and other Climate Smart Agriculture programs offer an opportunity to do deeper analysis of what works and what does not in state incentives programs.

In interviews, stakeholders raised a number of important questions that we were unable to address in this report and which merit exploration. These questions include the following:

- Do recipients continue healthy soil practices after their three-year HSP grant ends? At what scale and with what frequency? Why or why not? What barriers do they face in scaling up and sustaining practices? Do they have the equipment and other resources they need?
- How are knowledge and attitudes about healthy soils practices changing among incentives grant recipients and demonstration project attendees?
- How is awareness, interest, and participation in the program changing over time among different groups of farmers?
- What is the distribution of specific healthy soils practices by land-use type and crop? Why do some practices have such high uptake (e.g., compost application) and others such low uptake (e.g., prescribed grazing)? To what extent are farmers applying for compost application solely as a short-term fertilizer input substitute?
- Many stakeholders we interviewed asked questions about a number of instances in the 2020 HSP incentives round in which there appears to be one company or family (under slightly different names) receiving multiple grants for the same practices. While HSP currently allows this if the applicants use different tax identification numbers and will be implementing the practices on separate APNs, it struck some of the stakeholders we interviewed as potentially unfair. To what extent are these legitimately separate operations? And is there a way to prevent potential abuse of the program in the future?

California's incentivization of healthy soils practices has attracted interest from a wide group of state researchers, including a group of scientists at the Berkeley Food Institute, who recently surveyed and interviewed technical assistance providers working with farmers on these issues. We believe their research would help the comprehensive evaluation and hope to see their work advanced in collaboration with CDFA.

We recommend conducting an independent and comprehensive program evaluation soon, as it could result in program changes necessary to achieve the state's 2045 carbon neutrality goals by optimizing on-farm carbon sequestration. An evaluation's findings could also be timely in informing the Newsom administration's early actions in response to the Governor's recent Executive Order on natural and working lands climate solutions and biodiversity. Given that the first round of HSP grants will complete their three-year term in 2020, the year 2021 presents a perfect opportunity to conduct this evaluation on the first round of HSP projects. Further, with the impending likelihood of a gap year in funding due to the economic recession resulting from the coronavirus pandemic, 2021 will likely provide a break for program staff from the typical quick-turnaround grant cycles they have to manage. Finally, the pandemic offers an unusual opportunity to compare the impacts of the innovative, remote, and virtual outreach and educational tactics that demonstration projects have been forced by necessity to employ.

RECOMMENDATIONS

Prioritize funding for small and mid-scale farms, farmers of color, and women farmers

Program data and interviews with program stakeholders revealed that the program needs to take further action to prioritize disadvantaged farms and farmers, specifically small and mid-scale farms, farmers of color, and women farmers. These farms and farmers tend to have fewer resources and less access to financial capital and technical assistance, on average, which can present barriers to transitioning to HSP practices that state funding can help overcome.

CDFA does not have to look any further than its SWEEP program for a more effective approach. In 2018-2019, the SWEEP program awarded 50 percent of its grants and 42 percent of its total funding to SDFRs. The program achieved this by awarding funding to SDFR applications first, so long as those applications met a minimum scoring threshold. This approach can be adopted in HSP for SDFRs, women farmers, and small and mid-scale farms.

RECOMMENDATION:

Similar to the SWEEP program, prioritize HSP funding for small and mid-scale farms, farmers of color, and women farmers by awarding their applications first, so long as the applications meet a minimum scoring threshold. To implement this, CDFA will need to wait to review applications until after the grant application deadline, instead of on a rolling, first-come-first-serve basis.

Incorporate an incentive for organic transition into the program

A small investment to help conventional farmers get past the largest hurdle to becoming certified organic—the three-year transition and initial certification—is a wise way to ensure that more HSP recipients continue to utilize healthy soils practices well after their three-year HSP grant period ends. Organic farming has been well documented to increase soil organic matter and reduce GHG emissions, and has the added benefit of reducing the impacts of synthetic fertilizers on water quality and synthetic pesticides on farmworkers and pollinators.

RECOMMENDATION:

Incorporate into HSP incentives grants an option for a one-time payment for conventional farmers who want to transition to certified organic production to pay for a consultant to help develop an organic system plan.

Cover crops and farmer Phil Foster at Pinnacle Organic. Photo credit: CalCAN.

Remove barriers to farmers operating on leased land

Interviews with farmers and TA providers revealed that for many farmers who operate on year-to-year leases, there are two requirements that are difficult to meet: (1) that "*applicants must lease, own or otherwise control the fields and APNs where project activities are proposed to occur for the entirety of the project duration*" (i.e., three years), and (2) the requirement to "*document approval by the landowner.*" These barriers seemed to be reflected in the program data (see Figure 9 above). While the requirement for control of the land and approval from the landowner is reasonable for long-term conservation planting practices, which require long-term maintenance and may change the landscape permanently, it is not clear why landowner approval is necessary for annual practices (e.g., compost application, cover crops, reduced tillage) that are within the realm of standard agricultural practices.

RECOMMENDATION:

CDFA should act on the recommendation in its 2020 Farmer Equity Report to *"Review grant program guidelines to ensure that farmers who operate on leased land have equal access to apply for grant programs and encourage these farmers to participate in the programs."* More specifically, CDFA should allow farmers with one-year leases to participate in the program and apply for practices that are implemented annually without having to document landowner approval. Add guidelines to the program that allow CDFA or the farmer to terminate a grant agreement if the farmer loses control of the land.

A field day at Morris Grassfed.
Photo credit: CalCAN.

Clarify purposes of soil testing and improve data collection protocols

Soil sampling for the purpose of filling research gaps requires a rigorous methodology and targeted approach to test specific hypotheses in specific conditions; data collection on other management variables; and will benefit from having trained professionals (i.e., researchers or technical assistance providers) conducting standardized soil sampling and data collection. Soil sampling for the purpose of helping farmers understand changes in their soils over time is less rigorous, but does often benefit from technical assistance to help farmers interpret the sampling results. Soil sampling for the purpose of improving COMET-Planner or other climate models would likely also require the standardized collection of several data points including management practices (tillage, implement type, fertigation, etc.) and related inputs (amendments, fertilizer, etc.), biomass (cash crop, cover crop, etc.), yield, soil, and water (irrigation and precipitation) data. Finally, to develop a more accurate depiction of long-term carbon storage in soils, long-term studies (more than three years) are needed to validate as well as parameterize the models, suggesting that this purpose may not be met through HSP soil sampling.

In the process of clarifying the reasons for soil sampling and other data collection in HSP incentives and demonstration projects, the most important motivation should be to meet the needs of farmers, who are often more focused on the economic and operational questions surrounding practices than on their climate benefits.

RECOMMENDATION:

CDFA, in collaboration with stakeholders, should clarify the purposes of soil sampling and other data collection in the program. Develop an implementation strategy, including the provision of guidance for data collection and transparency and resources to achieve those purposes. CDFA's Science Advisory Panel should consider convening an ad hoc advisory group to accomplish this recommendation.

Make the program materials available in multiple languages

TA providers and the 2020 Farmer Equity Report both indicate that the lack of translated program materials is a persistent barrier to many of the state's farmers.

RECOMMENDATION:

Translate all program materials into multiple languages to ensure equitable program access to all California farmers. To determine which languages to prioritize, consult with technical assistance providers and other partners who have relationships with farmers in diverse language communities throughout the state.

Increase staffing or timeline to process and finalize grant contracts faster

Farmers need their contracts finalized by late summer in order to be able to implement time-sensitive, fall practices like cover cropping and conservation plantings.

RECOMMENDATION:

Develop a program timeline and/or increase staff capacity to allow CDFA to process and finalize grant contracts with HSP recipients before fall plantings.

Dawyne and Steven Cardoza of Cardoza Ranches – a HSP demonstration grant recipient.

Improve payment rates to reflect costs

The results of our research and interviews reveal tradeoffs between the current payment rate system and potential alternatives. By using EQIP's nationally-skewed cost scenarios and payment rates as the foundation for HSP, CDFA provides incentives that do not always account for the above-average and variable costs faced by California farmers, but saves CDFA significant time and administrative costs associated with developing California-specific payment rates. By using fixed payment rates, farmers are also spared from the administrative costs of having to submit detailed budgets and itemized receipts for their expenses.

To update payment rates for specific practices that stakeholders indicate are too low, CDFA could consider the same approach it took to updating its compost payment rates in 2018 after feedback from stakeholders indicating that the payment rate was too low. In that case, CDFA collected compost price data from 2017 HSP projects and then averaged it to determine its new payment rate. This simple but effective methodology, using actual data from funded HSP projects, resulted in increasing the compost payment rate from $35 per ton to $50 per ton. Collecting these data required additional administrative costs by CDFA and farmers but resulted in making the payment rate more reflective of actual costs.

RECOMMENDATION:

We recommend CDFA continue to use NRCS EQIP rates as the foundation for the program and incorporate an opportunity for stakeholders to comment on existing payment rates and practice standards whenever CDFA solicits proposals for new practices. For payment rates that stakeholders flag as too low, CDFA could repeat the process it used to update compost payment rates by collecting cost data from a subset of funded HSP projects to re-evaluate specific payment rates.

Solicit comprehensive program evaluation

Overall, our analysis demonstrated several instances of program improvement in just three years, which demonstrates CDFA's capacity to adapt and refine this program over time. Lessons learned through program evaluation can help strengthen program delivery in California and inform public and private soil health incentive programs that are starting throughout the country.

RECOMMENDATION:

Conduct a comprehensive program evaluation in 2021 in collaboration with skilled and qualified researchers and institutions in California to assess the impact of HSP incentives and demonstration projects on attitudes and knowledge about healthy soils practices, barriers to practice adoption, and *long-term* implementation of healthy soils practices.

Cover crops at Frey Vineyards.

Photo credit: CalCAN.

CONCLUSION

Over the past three years, HSP catalyzed healthy soils practices implementation across a broad swath of California's geographies, agricultural operations and farmer demographics. HSP's achievements reveal the value of incentives programs in facilitating implementation of healthy soils practices. However, HSP must continue to adapt to farmers' needs by prioritizing disadvantaged farmers, by translating program materials, by modifying its guidelines to accommodate the realities of insecure land tenure, and by responding to regional variation in costs. If designed deliberately, soil sampling and other data collection in the program can be used to educate farmers and fill research gaps.

HSP has incentivized practices on just over 50,000 acres, which is less than one percent of California's agricultural lands. To reach its 2030 and 2045 climate goals, California must rapidly scale up and ensure long-term adoption of climate smart agriculture practices. More robust program evaluation, starting in 2021, is necessary to inform how HSP's incentives and demonstration projects can be expanded and improved to achieve long-term success.

HSP's record-breaking demand during the COVID-19 pandemic demonstrates that farmers are enthusiastic about the opportunity to receive financial and technical assistance to implement practices that improve soil health. This underscores the importance of continued funding and administrative support for the program, despite the economic recession.

To scale-up *long-term* adoption of climate smart agriculture practices to help California reach its climate targets, the state will need to ensure reliable and consistent funding for this program and others. This will require innovative funding mechanisms to achieve our shared climate goals in a timely manner, as well as connecting HSP outcomes to other state objectives, such as improved water quality and quantity, biodiversity, organic waste management, and more.

CalCAN
CALIFORNIA CLIMATE & AGRICULTURE NETWORK

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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