

California Climate and Agriculture Network

Blueprint for a California Program on Climate and Agriculture

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EXECUTIVE SUMMARY

Scientists predict that in the years and decades to come, as temperatures continue to rise, we will experience more weather extremes—more frequent droughts, heat waves, wildfires, and floods—that will strain California’s agriculture, the leading producer of the country’s fruits, nuts, vegetables, and dairy products. Climate change will have implications for our agricultural economy and our food security.

Greenhouse gas emissions must be reduced and a transition to a clean energy economy must be made in order to avoid the worst impacts of climate change. California agriculture can make significant contributions to meet this challenge in unique and profound ways, including renewable energy production, water and energy-use efficiency, carbon sequestration in soils and woody biomass, and management practices that reduce methane and nitrous oxide emissions. Many of these climate-friendly farming systems offer additional benefits to our environment, health and economy.

With the Global Warming Solutions Act (Assembly Bill 32), the most comprehensive climate change law in the country, California is pioneering innovative programs to reduce greenhouse gas emissions and support a clean energy economy, while adapting to the inevitable changes to our climate. However, too little attention has been paid to the state’s agriculture and its unique opportunities to provide climate benefits.

Instead, California agriculture faces declining public investment in agricultural research, education, technical assistance, and financial incentives. These cutbacks limit the ability of agricultural professionals to deal with complex new issues like climate change, increasing the agricultural sector’s vulnerability to the impacts of climate change.

The California Climate and Agriculture Network (CalCAN) developed this Blueprint, with input from agriculture and climate change experts, to offer recommendations for the design of a state-funded California Program on Agriculture and Climate (CPAC). The Blueprint is intended to:

- Provide an overview of the ways agriculture can play a constructive role in achieving the state’s Assembly Bill 32 (AB 32) goals and meeting the state’s related policy objectives found in Senate Bill 535 (SB 535) and AB 1532
- Inform the implementation of a California-wide agricultural program to catalyze farm and ranch practices that mitigate climate change in diverse regions, crops, livestock, and scales and provide co-benefits to our economy, environment and public health
- Highlight “shovel-ready” climate solutions already being practiced by some of California’s most innovative farmers and ranchers

Opportunities for Investment in Agricultural Solutions

AB 32 includes the cap-and-trade program that is intended to achieve roughly 20 percent of the state’s greenhouse gas emission reduction goals. Overseen by the California Air Resources Board (CARB), the cap-and-trade program places a cap on the greenhouse gas emissions of the largest emitters in the state. The program may provide incentives or investments to achieve greenhouse gas emission reductions and carbon sequestration from agriculture through the carbon market or auction proceeds investment.

Cap-and-trade auction proceeds are a crucial component of meeting the objectives of AB 32. Investment of the funds into activities that achieve greenhouse gas emissions reductions can make the difference in achieving emission reduction goals by a target date of 2020 and beyond.

The Blueprint articulates the vision and design of a California Program on Agriculture and Climate (CPAC) that would guide allocations of cap-and-trade investments in agricultural activities, achieve additional environmental, health and economic benefits, and constructively engage California's agriculture industry in contributing to the state's climate goals.

Methodology for Developing the Blueprint

CalCAN conducted 41 interviews with a diverse range of researchers, farmers, ranchers, other agricultural and conservation professionals, and government agency representatives. Their input formed the foundation of recommendations for a state climate change and agriculture program. Following the interviews, CalCAN convened a roundtable discussion with experts to review and refine the first draft of the Blueprint recommendations. After completion of the final draft report, CalCAN staff and advisors met with leaders from relevant state and federal agencies and departments to discuss the draft recommendations. Expert stakeholders, listed in the acknowledgments, reviewed the final Blueprint report.

Objectives: California Program on Agriculture and Climate (CPAC)

The goal of CPAC is to achieve meaningful reductions in greenhouse gas emissions and increased carbon sequestration in soils and woody plants, while supporting multiple co-benefits to farmers, the environment, the economy, and public health.

CPAC will provide value to farmers and ranchers as they voluntarily opt to participate in education projects, technical assistance and financial incentives, all aimed at easing the path to new farm and ranch management activities that reduce greenhouse gas emissions and increase carbon sequestration. The benefits to participating producers will include reduced costs and related savings, more resilient systems and recognition, if desired, for their efforts.



photo credit: USDA NRCS

An important element of CPAC will be support for climate activities that provide multiple co-benefits. Most climate-friendly farm and ranch practices provide environmental and health co-benefits, including healthier soils, cleaner water, cleaner air, and wildlife and pollinator habitat.

Recommendations: CPAC Program Design

To achieve these goals and objectives, the CPAC program should balance and integrate three essential elements through a competitive grants process:

- **Research** to identify and evaluate gaps in agricultural climate mitigation strategies and their co-benefits

- **Education and Technical Assistance** to encourage and enable farmers to manage their operations in ways that reduce greenhouse gas emissions and provide multiple co-benefits
- **Financial Incentives** to implement high priority climate-friendly practices in the operations of farmers and ranchers

The expert stakeholders we consulted overwhelmingly supported a competitive grants program structure. The following specific recommendations on CPAC design characteristics are included in the Blueprint (please see the full report for all of the program design recommendations):

Administering Department: The Governor may consider two possible locations for the program: the Department of Conservation (DOC) within the Natural Resources Agency, or the California Department of Food and Agriculture (CDFA). These departments offer different approaches and strengths. Many of the experts interviewed for this report stressed the importance of having a field presence for CPAC, staffed with experts capable of outreach and program support for farmers and ranchers at the local level. To overcome the lack of direct grower outreach and programming capacity, the administering agency will have to rely on existing field offices, like the Resource Conservation Districts, for CPAC implementation, outreach and grower support. Whether the lead agency is DOC or CDFA, both departments as well as the California Air Resources Board (CARB) should be involved in implementation of the program, in consultation with an external advisory committee as described below.

Advisory Committee and Independent Review Panels: Stakeholder experts recommend that an advisory committee guide the development and implementation of the program. The Secretary of Natural Resources, the Secretary of CDFA and the Chair of CARB may select members of the advisory committee, based on nominations from the public. Independent review panels should be formed to make recommendations on proposal selection.

Funding Areas: As recommended, CPAC consists of the following two program areas:

1. **Research Program:** To fill gaps in our understanding of opportunities in California agriculture to reduce greenhouse gas emissions and sequester carbon, while supporting agricultural resilience and adaptation to the impacts of climate change.

Overwhelmingly, experts consulted for the Blueprint recommended prioritizing basic and applied research funding for projects that improve the ability of growers and technical service providers to develop on-the-ground projects that reduce greenhouse gas emissions.

We recommend that eligible projects be required to include the following:

- Consideration of how proposed changes in farm management affect greenhouse gas emissions and/or carbon sequestration
- Evaluation of the costs, benefits and practical considerations for producers associated with the mitigation practices to be studied
- Outreach and communication activities to disseminate research findings to agriculture and environment communities via webinars, in-person workshops, shared databases, trade and farm journals, etc.

Additional selection criteria may be considered, as described in the full report, with priority given to projects that meet multiple criteria.

2. Farmer and Rancher Program: To provide education and technical assistance that encourage and enable farmers and ranchers to reduce greenhouse gas emissions and sequester carbon, while supporting agricultural resilience and adaptation to the impacts of climate change. A financial incentives component can aid and support individual farmers who sign a contract to voluntarily implement recommended practices.

The Farmer and Rancher Program can provide competitive grants for education and technical assistance projects that reduce greenhouse gas emissions, sequester carbon, and support multiple economic, environmental and health co-benefits. A related crucial objective of the program is to demonstrate the advantages of participating in the funded projects.

We recommend that eligible projects be required to include the following:

- Reduced greenhouse gas emissions and increased carbon sequestration, with priority given to projects that demonstrate climate adaptation benefits
- Co-benefits from the project, including environmental, economic and public health benefits
- Cost-effectiveness of management practices employed
- Farmer or rancher interest in the targeted practices and effective dissemination of project results to grower associations and other farm groups

Incentives: The Farmer and Rancher Program may include the option of financial incentives to aid and support individual producers who sign a contract to implement recommended practices as part of a technical assistance project. Financial incentive contracts may be offered to farmers who agree to implement and maintain the practices for three to ten years. The lead agency could determine, with input from the advisory committee, to renew some contracts where additional support could help meet program objectives.

Measuring Program Performance: It is critical that performance metrics be selected and tracked with the first CPAC grant cycle. The lead agency will establish program performance measurements with guidance from the advisory committee and will build them into the overall program. The lead agency should also look to the privacy practices used by the USDA Natural Resources Conservation Service (NRCS) to ensure farmer confidentiality. The full report includes an overview of available methods for evaluating the effects of agricultural practices on greenhouse gas emissions and carbon sequestration.

Collaboration with the NRCS and the California Association of Resource Conservation Districts (CARCD): To build mutual capacity to carry out these projects, we strongly encourage the lead agency to consider a formal agreement with California NRCS, whose staff has extensive technical knowledge, a foundation of conservation practice standards, and good models for farmer contracts and compliance mechanisms. These kinds of agreements and collaborations between NRCS and state agencies are not uncommon and could improve efficiencies and further innovation. The lead agency may also consider a memorandum of understanding with the California Association of Resource Conservation Districts to assist with program outreach and project results dissemination. Such an MOU would ensure that the program objectives and opportunities are delivered effectively to producers throughout the state.

INTRODUCTION

Scientists predict that in the years and decades to come, as temperatures continue to rise, we will experience more weather extremes—more frequent droughts, heat waves, wildfires, and floods—that will strain California’s agriculture.

Farmers and ranchers are among the first to experience the effects of a changing climate, including erratic spring weather that affects planting or tree bloom, declines in snow melt that constrain water availability, and heat waves that stress workers, crops and livestock.¹

Climate change impacts on California agriculture can have profound implications for the state and the country. The state’s farmers and ranchers produce more than half the country’s fruits, nuts, vegetables, and much of its dairy products. We cannot afford to ignore the implications of climate change for our agricultural economy and food security.

In order to avoid the worst impacts of climate change, greenhouse gas emissions must be reduced and a transition to a clean energy economy must be made. Agriculture can make significant contributions to meet this challenge in unique and profound ways.

Farmers and ranchers can improve energy and water-use efficiency measures and generate distributed renewable energy (solar, wind, bioenergy) to help achieve the state’s renewable energy goals.

Farms and ranches can sequester carbon dioxide—our most ubiquitous greenhouse gas—through land management practices that increase the ability of soils, trees and shrubs to absorb and store carbon. Growers can also adopt management practices that reduce methane and nitrous oxide emissions, two potent greenhouse gases.

Many of the agricultural practices with the greatest promise for reducing greenhouse gas emissions and sequestering carbon also offer other important environmental, health and economic co-benefits. For example, improving soil management through cover cropping, irrigation efficiencies and conservation tillage can reduce greenhouse gas emissions, sequester carbon, promote water retention in soils, restore air and water quality, and reduce input costs for growers.² Importantly, many of these practices can help increase farm and ranch resilience to the impacts of climate change. For more on the agricultural practices with the greatest potential for addressing climate change and providing multiple co-benefits, see Appendix A.

The state of California is pioneering efforts to address climate change and avoid its worst impacts. In 2006 California passed the most comprehensive climate change legislation in the country, the Global Warming Solutions Act (Assembly Bill 32, AB 32), requiring the state to reduce greenhouse gas emissions to 1990 levels by 2020. In 2012 the state furthered its efforts to address climate change by passing legislation that stipulates that investment of a portion of cap-and-trade auction proceeds must benefit low-income communities that are disproportionately impacted by pollution (Senate Bill 535). Other legislation describes critical strategies for achieving greenhouse gas emission reductions, including sustainable agriculture (AB 1532).

How the state moves forward on climate change policy in the next few years will have implications for our food and farming systems and the rural and urban communities on which they depend.

¹ Office of Environmental Health Hazard Assessment (OEHHA). CalEPA. August 2013. Indicators of Climate Change in California. Available at <http://oehha.ca.gov/multimedia/epic/2013EnvIndicatorReport.html>

² De Gryze, Steven, Rosa Catala, Richard E. Howitt, and Johan Six. 2008. Assessment of Greenhouse Gas Mitigation in California Agricultural Soils. California Energy Commission, PIER Energy Related Environmental Research. CEC-500-2008-039.

However, the state lacks any kind of meaningful, coordinated effort to promote agricultural solutions to climate change and to support a robust and sustainable California agricultural sector. Instead, California agriculture faces declining public investment in agricultural research, education, technical assistance, and financial incentives. The situation makes it difficult for agricultural professionals to deal with complex new issues like climate change. This, in turn, increases the sector's vulnerability to the impacts of climate change.

To address the gap in climate change policy when it comes to agriculture and to support the long-term viability of California agriculture, the state will need to develop a California Program on Agriculture and Climate, a competitive grants program that furthers the state's climate change objectives while supporting a robust agricultural economy, healthy communities and vibrant ecosystems.

Climate Change Impacts on California Agriculture

Because it is dependent on weather and the availability of natural resources, agriculture is uniquely vulnerable to the effects of climate change, including:

Constrained water resources: As temperatures continue to warm, precipitation will increasingly fall in the form of rain rather than snow in the Sierra Nevada. Some researchers suggest that snowmelt runoff may occur up to two months earlier than current averages. Earlier snowmelts combined with heavy rain events in the winter and spring can increase flood risks and also limit available water supplies later in the season. The state's current severe drought is a profound reminder of the vulnerability of California agriculture to constrained water resources.



photo credit: USDA NRCS

Impacts on fruit and trees: Adequate winter chilling hours. Chill hours in California have decreased since the 1950s and predictions are that by the end of the century 50 to 90 percent of current chill hours will be lost in parts of the Central Valley, impacting production.

Extreme weather events: Climate change has the potential to increase the number and intensity of extreme weather events in the state, resulting in profound impacts on agricultural production. Flooding in the Delta and the Central Valley is likely to increase from the combination of increased winter and spring rainfall and the rapid snow melt caused by warmer temperatures in the Sierra Nevada. The magnitude and persistence of droughts are also expected to increase. More intense and frequent heat waves may also strain agricultural workers, livestock, and water supplies.

Rising weed, pest and disease pressures: Warmer temperatures will likely lead to the northern migration of invasive species

and in some cases may eliminate the cold temperatures needed to keep pests in check.

For a list of references, see Ready... or Not? An Assessment of California Agriculture's Readiness for Climate Change. <http://calclimateag.org/our-work/ready-or-not/>.

Purpose of the Blueprint

The California Climate and Agriculture Network (CalCAN) developed this Blueprint with the input of agriculture and climate change experts and the guidance of an advisory committee. The Blueprint outlines recommendations for the design of a California Program on Agriculture and Climate (CPAC). The Blueprint is intended to:

- Provide an overview of the ways agriculture can play a constructive role in helping achieve the state's Assembly Bill 32 (AB 32) goals and meet the objectives of the state's related policy objectives found in Senate Bill 535 (SB 535) and AB 1532
- Inform the implementation of a California-wide agricultural program to catalyze farm and ranch practices in diverse regions, crops, livestock, and scales that mitigate climate change and provide co-benefits to our economy, environment and public health
- Highlight "shovel-ready" climate solutions already being practiced by some of California's most innovative farmers and ranchers

The program does not include a focus on farmland conservation, which is a critical component of avoiding significant greenhouse gas emissions related to transportation and development.³ The state is in the process of developing a new agricultural land conservation program, as part of the larger Sustainable Communities Strategies program, which is funded by cap-and-trade auction proceeds. This important new program brings together for the first time agricultural land protection and smart-growth strategies to reduce the state's greenhouse gas emissions.⁴

Blueprint Overview

Section I reviews current state climate change policy with a focus on cap-and-trade auction proceeds investment. Section II reviews the methodology used to develop the Blueprint recommendations with input from expert stakeholders. Section III outlines recommendations for design of the CPAC. Section IV concludes with how to move such a program forward in the state. Throughout the report we include case studies showcasing current agriculture and climate projects in California. Additional background material may be found in the appendices.



photo credit: USDA photo by Bob Nichols (available at <http://www.flickr.com/photos/usdagov>)

³ For more on the greenhouse gas emissions reductions of farmland conservation, see: <http://calclimateag.org/triple-harvest/>

⁴ For more on this program, see: http://www.sgc.ca.gov/s_salcprogram.php

I. CALIFORNIA CLIMATE CHANGE POLICY

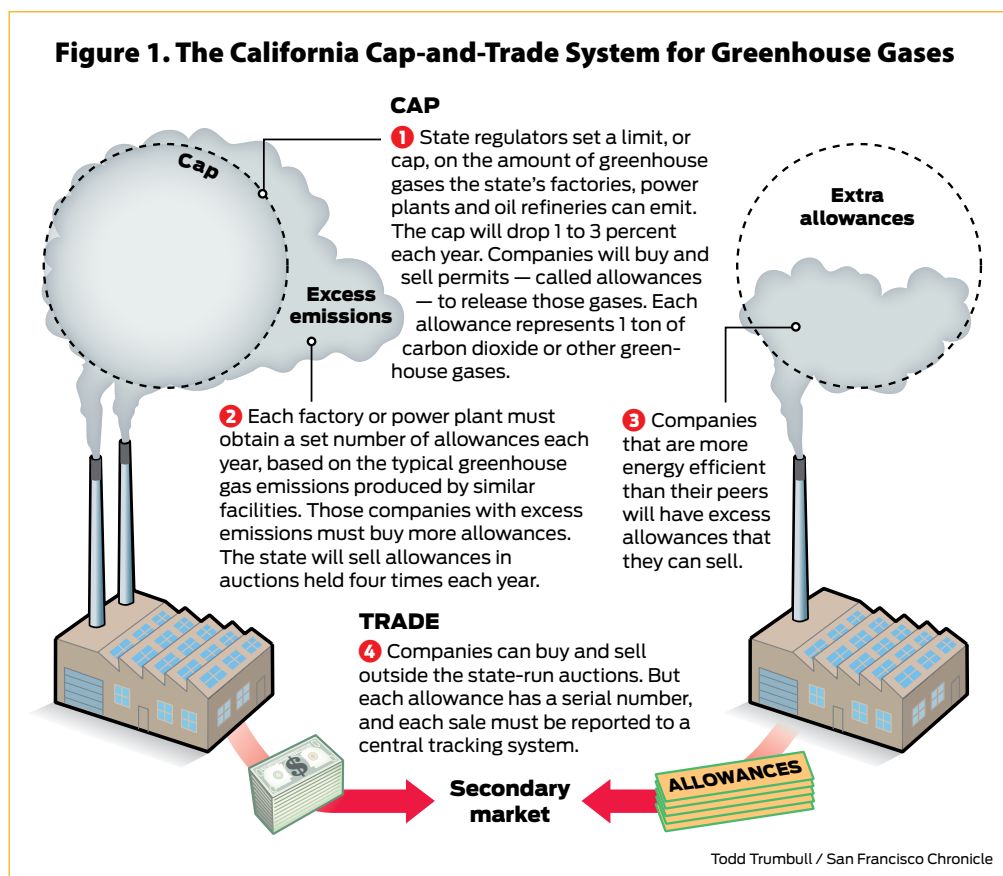
Since the beginning of implementation of the state's climate change law, greenhouse gas emissions are slowly declining,⁵ but if the state is to realize its 2020 and 2050⁶ emission reduction targets, agriculture must be engaged proactively in the state's climate change efforts.

Below we provide a brief review of the California cap-and-trade program as it relates to agriculture and discuss the opportunities it offers to engage the state's agricultural sector in achieving greenhouse gas emissions reductions.

Cap-and-Trade Program

As part of Assembly Bill 32 (AB 32), the cap-and-trade program is intended to achieve approximately 20 percent of the state's greenhouse gas emissions reduction goals.

Overseen by the California Air Resources Board (CARB), the cap-and-trade program places a cap on the greenhouse gas emissions of the largest emitters in the state (see Figure 1). Regulated entities include utilities and large industrial emitters. In 2015, fuel providers will also be under the cap. Each regulated entity must hold allowances (permits to emit greenhouse gases) and the number of allowances they hold will decline over time as the cap on allowed emissions decreases.



Agriculture is not directly regulated under the cap-and-trade program, but the program may provide incentives or investments to achieve greenhouse gas emissions reductions and carbon sequestration from agriculture through the carbon market or auction proceeds investment.

Carbon market offsets, a part of the cap-and-trade program, offer one avenue for California agriculture to engage directly in the incentives of the cap-and-trade program, but we recommend that it be a limited one (see Appendix B). The focus of our discussion here is the investment side of the cap-and-trade program.

5 Overall, emissions data finds greenhouse gases decreased nearly 3 percent from 2000 to 2010. Despite a population increase, per person emissions decreased from 13.9 to 12.2 tons of carbon dioxide equivalent. While the state's Gross Domestic Product increased from \$1.4 trillion in 2000 to \$1.7 trillion in 2010, the greenhouse gas intensity of the state's economy decreased. See CARB's inventory on greenhouse gas emissions: <http://www.arb.ca.gov/cc/inventory/inventory.htm>

6 Through executive order, California adopted an 80 percent emissions reduction target by 2050. See Executive Order S-3-05 <http://gov.ca.gov/news.php?id=1861>

Auction Proceeds Investment

Regulated entities receive their allowances through a combination of free allowances from the state and allowances purchased at auction. Over time, the percent of allowances sold at auction will increase and those received for free by the state will decline, thus generating additional auction proceeds for investment in Assembly Bill 32 (AB 32) activities. In the first year of the program, \$1 billion was generated through state auctions for allowances held by the utilities and the industrial sector.

The California Public Utilities Commission oversees the allowance auction for the public utilities and the distribution of the auction proceeds back to ratepayers. CARB oversees the auction for the industrial sector. The Governor and State Legislature, as part of the budget process, determine how industrial sector auction proceeds are to be invested. It is the industrial sector auction proceeds that are the focus of our discussion on potential investments in agriculture.

Signed into law in 2012, AB 1532 (Speaker Pérez) requires the Governor's administration to develop cap-and-trade auction proceeds investment plans every three years, with input from the public. The plans will guide future investments, and annual expenditure plans will be incorporated into the state's budget. Among other categories for eligible investment of auction proceeds, AB 1532

Declining Public Resources in Agriculture

Little has been done by the state to capitalize on the multiple benefits of engaging California's farmers and ranchers in climate activities. Instead, in recent years public resources for agricultural research, education, technical assistance, and financial incentives have declined, cutting off farmers and ranchers from the most recent scientific and technical expertise needed to address a variety of conservation issues, including climate change. For example:

- The Public Interest Energy Research (PIER) program of the California Energy Commission, once an important source of state funding for climate change mitigation and adaptation research in agriculture, no longer funds new climate change and agriculture research. In 2009, the PIER program provided nearly \$1.3 million in funding for agriculture-related climate change research.¹ With the loss of the original public goods charge and the development of the energy-focused research of the Electric Program Investment Charge (EPIC) overseen by the Public Utilities Commission, PIER ended funding for agriculture climate change research by 2012.
- The once robust University of California Cooperative Extension system is down today to fewer than 300 farm advisors and specialists, compared to a little over 500 staff in 1990.² The Resource Conservation Districts, which provide technical support for growers who want to address natural resource conservation issues, have not recovered from state budget cuts that eliminated their core state funding.
- Congressional budget cuts of \$6 billion to national agricultural conservation programs in the 2014 Farm Bill³ will likely limit federal funding and delivery of California's primary agricultural conservation programs, which in recent years have provided \$150 to \$200 million annually in conservation funding.

For more on the state of public agricultural resources, see the 2011 CalCAN report, *Ready or Not: An Assessment of California Agriculture's Readiness for Climate Change* available at <http://calclimateag.org/our-work/ready-or-not/>

1 See: <http://www.energy.ca.gov/2010publications/CEC-500-2010-018/CEC-500-2010-018-CMF.PDF> and <http://www.energy.ca.gov/2013publications/CEC-500-2013-013/CEC-500-2013-013-CMF.pdf>

2 Email communication with UC Cooperative Extension. October 2014.

3 See: <http://sustainableagriculture.net/blog/2014-farm-bill-working-lands/>

included sustainable agriculture activities. Also signed into law in 2012 was Senate Bill 535 (Senator De León), which requires that the state invest a minimum of 25 percent of cap-and-trade auction proceeds to benefit socially disadvantaged communities, including several Central Valley agricultural communities.⁷

In May 2013, the Governor’s administration released the first auction proceeds investment plan and included several areas of investment in agriculture to achieve climate benefits:

- Farmland conservation
 - Water and energy-use efficiency in agriculture
 - Renewable energy/bioenergy production development
 - Agricultural practices and fertilizing materials that reduce greenhouse gas emissions, improve water quality and provide other co-benefits
 - Compost production
- The cap-and-trade auction proceeds are a crucial component of meeting the objectives of AB 32. Investment of the funds into activities that achieve greenhouse gas emissions reductions can make the difference in achieving emission reduction targets for 2020 and beyond. Investments can also make the benefits of these activities—in the form of jobs, cleaner air and water—tangible to urban and rural communities alike.

The Blueprint articulates the vision and design of a California Program on Agriculture and Climate that would guide allocations of cap-and-trade investments in agricultural activities, constructively engage California’s agriculture industry in contributing to the state’s climate goals, and achieve additional environmental, health and economic benefits.



photo credit: USDA NRCS

7 See: <http://oehha.ca.gov/ej/ces2.html>

II. METHODOLOGY FOR DEVELOPING THE BLUEPRINT

California offers tremendous expertise for the delivery of effective programs aimed at supporting natural resource conservation on working agricultural lands. Tapping into that expertise, CalCAN employed a consultative process to develop the Blueprint, drawing heavily from input by numerous expert stakeholders.

Advisory Committee Formation

CalCAN assembled a five-member core advisory committee to guide the project. Members were selected for their knowledge of climate and agriculture issues and their experience with agricultural conservation practices and program delivery. They are:

- John Brodie, Program Coordinator, San Joaquin Resource Conservation District
- Terry Huff, District Conservationist, California Natural Resources Conservation Service (retired)
- Daniel Mountjoy, Director of Restoration on Private Lands, Sustainable Conservation; former Assistant State Conservationist, Natural Resources Conservation Service
- Kellyx Nelson, Executive Director, San Mateo Resource Conservation District
- Judith Redmond, Co-Owner, Full Belly Farm; Board Member, Community Alliance with Family Farmers

The advisors played a key role in the development of the project from its inception. They provided early input on the project scope and stakeholder interview questions. They were interviewed, participated in a roundtable discussion and reviewed several drafts of the Blueprint recommendations.

Expert Stakeholder Interviews

CalCAN conducted 41 interviews with a diverse range of researchers, farmers, ranchers, other agricultural and conservation professionals, and government agency representatives. Their input formed the foundation of the recommendations made in the Blueprint.

Interviewees were asked questions appropriate to their areas of expertise. A complete summary of the interview questions is included in Appendix C. The interviews covered many topics, ranging from current gaps in agricultural research, to insights on how to design the program, including reporting requirements, the role of outside experts, measuring program performance, and whether and how to fund various activities.



photo credit: USDA NRCS

Roundtable Discussion and Final Review

Following the interviews, CalCAN convened a roundtable discussion with 15 experts, including advisory committee members and a subset of the interviewees, to review and refine the first draft of the Blueprint recommendations. Following completion of the final draft report, CalCAN staff and several advisors met with leaders from relevant state and federal agencies and departments⁸ to discuss the draft recommendations. Expert stakeholders, listed in the acknowledgements, reviewed the final Blueprint report.

Walnuts to Watts (Solano County)

Dixon Ridge Farms is an organic walnut farm and processor in Yolo and Solano Counties. Owner Russ Lester became an innovator in on-farm renewable energy when, with a grant from the California Energy Commission in 2007, he installed a 50-kilowatt biomass powered generator that converts his major waste product—walnut shells—into heat and gas to dry their walnuts and electricity to power processing equipment and large freezers. In addition to reduced GHG emission, the bioenergy facility provides significant savings in electricity and propane costs. In 2012, Dixon Ridge doubled the size of their system and increased their capacity again in 2014. Combined with their solar arrays, they now generate enough energy to power all of their walnut processing facility, hulling, drying, shop, office, house and one of their farm wells.



Mounds of walnut shells waiting to be converted to bioenergy



Russ Lester in the walnut orchard at Dixon Ridge Farms.
photo credit: CalCAN

⁸ We reviewed an early draft of this report with the California Air Resources Board, California Department of Food and Agriculture, Natural Resources Agency, Department of Conservation, UC Cooperative Extension, USDA Natural Resources Conservation Service, and the Governor's Office.

III. STATE PROGRAM DESIGN RECOMMENDATIONS

Based on the stakeholder input we received, we summarize here the recommendations for the CPAC, a state competitive grants program aimed at achieving climate benefits in agriculture. The program recommendations are based on the following guiding principles:

- Optimize greenhouse gas emissions reductions while assuring the viability of California agriculture
- Ensure environmental, health and economic co-benefits
- Make science-based decisions
- Build on existing capacity
- Serve a diversity of regions, crops and scales
- Ensure program transparency
- Use a competitive selection process
- Include performance accountability mechanisms

A. Program Objective

The goal of CPAC is to achieve meaningful reductions in greenhouse gas emissions and increased carbon sequestration in soils and woody plants, while supporting multiple co-benefits to farmers, the environment, the economy, and public health. CPAC will spur a wide range of activities to support climate change mitigation in agriculture.

CPAC will provide value to farmers and ranchers as they voluntarily opt to participate in education projects, technical assistance and financial incentives, all aimed at easing the path to new management activities that reduce greenhouse gas emissions and increase carbon sequestration. The benefits to participating producers will include reduced costs (e.g., reduced energy and input expenses) and related savings, more resilient systems that provide buffers in weather extremes, and recognition (if desired) for their efforts.

The Climate Benefits of Rotational Grazing (San Mateo County)

Markegard Family Grass-Fed uses intensive grazing techniques on land in San Mateo and Sonoma Counties where they raise beef and dairy cattle. By allowing livestock access to relatively small pasture areas for short durations, ranchers seek a balance between providing adequate animal nutrition and leaving adequate recovery time for the grasses. Research indicates that this practice may enhance soil carbon sequestration.^e The Markegards used an Environmental Quality Incentives Program (EQIP) cost share grant from the USDA NRCS to install more than \$30,000 worth of electric fencing to manage their cattle grazing.



Doniga Markegard opens an ungrazed field to their Belted Galloway cattle. photo credit: CalCAN

An important element of CPAC will be support for climate activities that provide multiple co-benefits. Most climate-friendly farm and ranch practices provide environmental and health co-benefits such as healthier soils, cleaner water, cleaner air, and wildlife and pollinator habitat. This is especially important in rural communities of the Central Valley, many of which face disproportionate levels of pollution. Programs such as CPAC that support the long-term productivity and sustainability of California agriculture will help strengthen our food security and the viability of our rural communities.

To achieve these objectives, we recommend that the program balance and integrate three essential elements:

- **Research** to identify and evaluate gaps in agricultural climate mitigation strategies and their co-benefits
- **Education and Technical Assistance** to encourage and enable farmers to manage their operations in ways that reduce greenhouse gas emissions and provide multiple co-benefits
- **Financial Incentives** to implement high priority climate-friendly practices on the operations of farmers and ranchers

Greenhouse Gas Reduction Strategies in Agriculture

Based on our interviews with climate and agriculture researchers and the Natural Resources Conservation Service (NRCS) list of agricultural practices¹ that reduce greenhouse gas emissions and/or sequester carbon, below is a list of agricultural practices that offer climate benefits and other co-benefits. A more comprehensive summary of best practices is included in Appendix A.

- Irrigation water management plans that reduce greenhouse gas emissions, increase carbon sequestration and improve water efficiency
- Nutrient management plans (including the application of manure) that reduce nitrous oxide and methane emissions and improve water quality
- Use of alternatives to synthetic fertilizer inputs—such as cover crops, crop rotations, intercropping, and compost applications to reduce greenhouse gas emissions and improve soil quality
- Managed pasture or rangeland systems for carbon sequestration and enhanced wildlife habitat
- Innovative small-scale bioenergy projects that utilize agricultural by-products to maintain healthy soils while producing renewable energy
- Integration of perennial plants for rangeland, pasture, forage, riparian restoration, hedgerows, windbreaks, silvopasture, and other purposes that sequester carbon and provide multiple co-benefits
- Vegetative cover in cropping systems with cover crops, crop rotations, or residue management/conservation tillage for carbon sequestration and water and soil benefits

¹ Available at <http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/air/quality/?cid=stelprdb1044982>

B. Program Structure

The expert stakeholders we consulted overwhelmingly supported a competitive grants program structure. We recommend that a lead program administration agency be identified to receive the investment funds and administer the grants program for research, education, technical assistance, and financial incentives, explained in detail in Section C below.

The agency should administer the grants and contracts, provide oversight to ensure accountability, and fulfill reporting requirements to the state. Other agencies may be identified to provide expertise and advice. In addition, we strongly suggest that a CPAC Advisory Committee and independent proposal review panels be established to make recommendations on program implementation.

Administering Department

The lead administering agency will provide crucial oversight and expertise to guide the development and implementation of CPAC. We recommend that the Governor consider two possible locations for the program: the Department of Conservation (DOC) within the Natural Resources Agency or the California Department of Food and Agriculture (CDFA). These departments offer different approaches and strengths.

A critical component of successful CPAC implementation is the ability to extend the program beyond state offices in Sacramento and reach a diversity of growers and regions. Many of the experts interviewed for this report emphasized the importance of a CPAC field presence staffed by experts capable of outreach and program support for farmers and ranchers at the local level. Unlike USDA's NRCS, which delivers national farm bill conservation programs to California growers through its district/county offices (see Section D for more on this), neither DOC nor CDFA have a similar field office structure. To overcome the lack of direct grower outreach and programming capacity, the administering agency will have to rely on existing field offices for CPAC implementation, outreach and grower support.

Pioneering water conservation (San Joaquin Valley)

Red Rock Ranch, near Fresno in the water-scarce Westlands District, produces 4,000 acres of fruit and vegetable crops. Owner John Diener is a leader in water conservation. He employs water-saving practices that lower water use, decrease the energy needed for pumping water, reduce GHG emissions and save time and money. Some examples include:

- An integrated irrigation management program, including soil moisture monitoring
- Highly efficient drip irrigation in almond orchards and vineyards
- State-of-the-art center pivot sprinklers with precise computer-controlled irrigation scheduling that minimize losses to evaporation, using 65 percent less energy and 10-15 percent less water
- Low-till and cover cropping methods that improve water penetration into the soil, reduce irrigation demand, reduce tractor fuel use and increase soil carbon levels

For several years, John has been refining a technique called Integrated On-Farm Drainage Management (IFDM). The system recycles drainage water through a series of fields growing crops that are increasingly salt-tolerant, eventually harvesting the salt. Some of the most salt-tolerant crops are canola and mustard seed that are profitable when used as biofuels. He has reduced his irrigation water use by 20% using IFDM.

John's partnership with the UC Cooperative Extension Westside Field Station (<http://casi.ucanr.edu/>) and other researchers makes him highly effective in honing his innovations and sharing his knowledge with other growers.



The majority of those interviewed recommended DOC as a strong candidate for the CPAC administering agency, based in part on DOC's current work on agricultural conservation through its Division of Land Resources, and its role as the state partner with the Resource Conservation Districts (RCDs).

The 98 RCDs in the state collaborate with state and federal agencies to directly serve farmers and ranchers on a diversity of natural resource management concerns (e.g., nitrogen management, water-use efficiency, rangeland management, etc.). DOC engages with the RCDs on a variety of issues. The Department provides technical assistance to the RCDs as well as funding for watershed coordinators and programs that support watershed conservation measures with landowners. Importantly, many in the agricultural community perceive DOC's programs in agricultural conservation as non-regulatory. This is a key consideration, as many people in the agricultural community are wary of state programs, which are often regulatory in focus. Therefore, DOC participation may increase grower interest in CPAC.

CDFA is another department that could administer the CPAC. For many of the agricultural trade commodity groups, CDFA is the department with which they are most familiar. Under the FY 2014-15 budget, CDFA received cap-and-trade funding to administer programs aimed at reducing greenhouse gas emissions in agriculture related to water and energy-use efficiency, dairy digesters, and biofuels standards development. CDFA, like DOC, would need to enhance its capacity by partnering with local and regional field offices (e.g., RCDs, NRCS) that have expertise in delivering agricultural conservation programs.

The lead agency will need to develop their staff capacity and work closely with several state and local entities in the implementation of CPAC. The lead agency will also need to develop a program that is built on trust with the agricultural community and credibility with climate experts in order to achieve a program that delivers greenhouse gas emissions reductions and related co-benefits.

Whether the lead agency is DOC or CDFA, both departments as well as CARB should be involved in the implementation of the program, in consultation with an external advisory committee as described below.

Advisory Committee and Independent Review Panels

Stakeholder experts recommended that an advisory committee guide the development and implementation of the program. An advisory committee provides the opportunity for many stakeholders to bring their views to the table and interact with each other as they shape specific recommendations for the implementing agency to consider and adopt. Stakeholder involvement and open communication pathways would help state government solve problems as they arise, avoid unintended consequences, and win public support for an important program.

The Secretary of CDFA, the Secretary for Natural Resources and the Chair of CARB can select members of the advisory committee, based on nominations from the public. Members should have expertise in agriculture, climate change and environmental fields and should include academics in related fields as well as experienced agricultural and conservation professionals from California and throughout the country. They may include producers, non-profit representatives, agronomists, RCDs in addition to representatives from CDFA and CARB.

We recommend that advisory committee responsibilities include:

- Develop and review eligibility criteria, requests for proposals (RFPs) and related program design elements
- Review funding recommendations of the Independent Proposal Review (IPR) panels
- Make final recommendations for proposal funding
- Regularly review overall program effectiveness and make recommendations for ongoing program improvements

IPR panels can be formed (including advisory committee members among others) for recommendations on selection of proposals for funding. The purpose of the IPR is to draw upon needed expertise on specific topics. For example, if a request for proposals includes a call for projects on rangeland management strategies to increase carbon sequestration, the review panels should include rangeland ecologists with expertise on the topic. Review panel recommendations would be forwarded to the advisory committee for final recommendations.

Several of the stakeholders recommended modeling CPAC after two USDA competitive grant programs, both with program administrators in the state:

- For 25 years, the Sustainable Agriculture Research and Education program (SARE) has administered grants for research and education, with strong farmer involvement, collaboration between agencies and researchers, and an emphasis on dissemination of project results.
- The Conservation Innovation Grants (CIG) program is administered by the NRCS to provide funding to stimulate the development and adoption of innovative and new conservation approaches in agriculture.

Climate and Agriculture Research (UC Davis)

A UC Davis research project used data from several long-term field experiments to calibrate the DAYCENT computer model for seven major California crops (alfalfa, cotton, maize, rice, sunflower, tomato, and wheat) and evaluate the effect of several alternative crop management systems on soil carbon (C) levels and GHG emissions.

Study findings:

1. Management practices that increase C input (e.g. cover crops and/or manure/ compost addition) can significantly increase soil C.
2. Organic practices have the greatest potential for total soil GHG emission reduction, followed by winter cover cropping and then conservation tillage.
3. Long-range model predictions suggest that climate change will decrease California crop yields for rice, tomato, cotton, corn, and winter wheat.

More information can be found at:

<http://ucanr.org/sites/ct/files/44381.pdf> and
<http://www.energy.ca.gov/2009publications/CEC-500-2009-041/CEC-500-2009-041-F.PDF>



Field day at UC Davis showcasing climate and agriculture research
photo credit: CalCAN

C. CPAC Funding Areas and Design

We recommend that CPAC consist of the following two program areas:

- **The Research Program** to fill gaps in our understanding of opportunities in California agriculture to reduce greenhouse gas emissions and sequester carbon, while supporting agricultural resilience and adaptation to the impacts of climate change.
- **The Farmer and Rancher Program** to provide education and technical assistance that encourages and enables farmers and ranchers to reduce greenhouse gas emissions and sequester carbon, while supporting agricultural resilience and adaptation to the impacts of climate change. A financial incentives component can aid and support individual farmers who sign a contract to voluntarily implement recommended practices.

CPAC should be designed as an integrated and evolving program that produces the necessary research to answer critical questions about how producers can best reduce their carbon footprint. CPAC should support local and regional projects that accomplish near-term changes in land management by providing technical and financial assistance to producers.

Research Program Design

Overwhelmingly, experts consulted for the Blueprint recommended prioritizing both basic and applied research funding for projects that improve the ability of growers and technical service providers to develop on-the-ground projects that reduce greenhouse gas emissions.

The researchers interviewed unanimously recommended funding multi-year projects at levels ranging from \$100,000 to \$750,000 for research projects of up to four years in length.⁹ Eligible organizations may include universities, colleges, non-governmental organizations, Resource Conservation Districts, other local conservation entities, and private organizations with demonstrated expertise. With input from the advisory committee, the lead agency should consider capping overhead and capital expenses. Renewal funding could receive special consideration if the research has demonstrated promising results and is linked to implementation projects.

We recommend that eligible projects be required to include the following in their proposals:

- Consideration of how proposed changes in farm management affect greenhouse gas emissions and/or carbon sequestration
- Evaluation of the costs, benefits and practical considerations for producers associated with the mitigation practices to be studied
- Outreach and communication activities to disseminate research findings to agriculture and environment communities via webinars, in-person workshops, shared databases, trade and farmer journals, etc.

⁹ An additional potential source of funding for agriculture-related climate change research, beyond cap-and-trade auction proceeds, may be the State's new Climate Change Research Agenda. The legislature approved \$5 million in FY 2014-15 for climate change research, including research focused on agriculture-related questions. However, it is not clear where additional funding for the research agenda will come from. With the loss in 2012 of PIER funding the state lacks on-going support for critical climate change-related research. Could future public goods charges re-new funding for state climate change research?

Additional selection criteria may include the following, with priority given to projects that meet multiple criteria:

- An integrated farming systems approach is used, including consideration of nutrient and carbon cycles and analysis of how changes in management affect the carbon footprint of the whole farm, other ecosystem processes, and resilience to climate change
- Involvement of multiple partners or multidisciplinary teams of researchers and outreach specialists
- Farmers and/or ranchers are included in planning, research design, demonstrations, and/or outreach
- On-farm research components, potentially including funding to compensate farmer participants for their time and expenses

Overwhelmingly, the experts we consulted stressed the importance of translating the program's research findings to the diverse grower community, addressing all aspects of the state's agriculture. To that end, we recommend that the lead agency and the advisory committee consider a subcategory of research funding that combines research and outreach across multiple regions/counties to explore mitigation strategies under diverse conditions. Given the expanse of California and the diversity of regional soils and weather conditions, it would be of great benefit to the state to bring in multiple regions and stakeholders.

We recommend that researchers who receive CPAC funding be required to report on their progress annually and to participate in a biennial symposium on research findings. Reporting requirements should be reasonable and should increase the collective understanding of opportunities and challenges related to the research subject. The lead agency can maintain a publicly accessible record of grants and interim and final reports. Finally, we recommend that researchers be expected to publish their findings in peer-reviewed journals.

The importance of information sharing by researchers—amongst themselves as well as with producers and the public—should not be underestimated. Too often, valuable research findings do not get widely communicated to farmers, ranchers, and agriculture or conservation organizations. As an urgent new conservation goal of reducing greenhouse gas emissions and increasing carbon sequestration is brought into the mix, rapid sharing of new knowledge must be required and supported.

Biodiversity at Preston Vineyards (Sonoma County)

Preston Vineyards has become much more than a vineyard. They have diversified their crops to include a variety of fruits, nuts and vegetables, wheat, olives, lamb, pigs and pastured eggs. Raising animals provides an on-farm source of manure for soil amendment as well as non-chemical pest control and a method for clearing weeds and vegetation from fields without using diesel engines. Significant native forest has been left intact, providing carbon sequestration as well as wildlife habitat. Plantings of pollinator-friendly perennial hedgerows sequester additional carbon and provide habitat.

This diverse system has tremendous resilience to weather variability and other climate impacts. When some crops have bad years, others can fare well and maintain profitability for the business. The farm is experimenting with some climate adaptation solutions such as inter-planting fruit trees in hot spots in the vineyard to protect the vines from sunburn.



Lou Preston with grapevines, olive trees, hedgerow plants and native oak trees in the background.
photo credit: CalCAN

Farmer and Rancher Program Design

We recommend that the Farmer and Rancher Program provide competitive grants for education and technical assistance projects with farmers and ranchers to reduce greenhouse gas emissions and sequester carbon, while supporting multiple economic, environmental and health co-benefits.¹⁰

Experience with national conservation incentive programs demonstrates that it often takes strong model projects to set the stage and gain the interest and motivation of producers before they are willing to implement and successfully manage new farm practices or systems.

We recommend that CPAC fund projects that conduct outreach, education, demonstrations, community engagement, and technical assistance on planning and implementing farm practices. The option of providing financial incentives for participating farmers and ranchers (described further below) should be made available but not required.

A related crucial objective of the program is to demonstrate a range of benefits to the farmers and ranchers who participate in the funded projects. Since the climate message alone may not be the most salient for many farmers and ranchers, the related agronomic, financial, conservation, and other production benefits of climate-related activities may be more compelling, and those advantages should be communicated.¹¹

We recommend that both short-term pilot projects and multi-year implementation projects up to four years be eligible for funding. Select projects may be chosen by the advisory committee for funding to monitor ongoing climate benefits and provide valuable data for future projects. An attempt should be made to achieve geographic balance of projects around the state.

A range of eligible organizations and collaboration among multiple partners should be encouraged. Eligible applicants may include universities, UC Cooperative Extension, colleges, non-governmental organizations, RCDs and other local conservation entities, and private organizations. UC Cooperative Extension and RCDs are uniquely qualified to play a lead role in these projects because they have technical staff throughout the state and the ability to scale up efficiently.

The capacity of independent Technical Service Providers (TSPs) and private consultants such as Certified Crop Advisors may be increased to provide technical assistance where appropriate. The NRCS TSP certification program enables the sector to grow in response to demand. We recommend that project collaboration with local NRCS technical assistance be encouraged.

Eligible entities may collaborate in regional groups or hubs to apply for joint funding for technical assistance projects under this program.

¹⁰ Other states offer programs to support farmers in developing conservation measures on their operations. For example, Minnesota offers the Sustainable Agriculture Loan Program, a revolving low-interest loan program aimed at supporting a diversity of conservation activities in agriculture. Such alternative funding mechanisms could be incorporated into the development of the Farmer and Rancher Program. For more information see: <http://www.mda.state.mn.us/grants/loans/esaploan.aspx>.

¹¹ Dr. Louise Jackson of UC Davis conducted a survey of Yolo County farmers on their perceptions of climate change, which may inform the outreach efforts of CPAC. Available at: http://environmentalpolicy.ucdavis.edu/files/cepb/Yolo_Climate_Attitudes_Policy_Brief_FINAL_2.pdf

We recommend that eligible projects include the following:

- Reduced greenhouse gas emissions and increased carbon sequestration, with priority given to those projects that also demonstrate climate adaptation benefits
- Co-benefits from the project, including environmental, economic and public health benefits
- Cost-effectiveness of management practices employed
- Farmer or rancher interest in the targeted practices and dissemination of project results to grower associations and other farm groups

Any of the following additional criteria may be included, with priority given to integrated projects that meet multiple criteria:

- Pilot projects that are used to test new ideas and improve implementation before scaling up and implementing multi-year or multi-region projects
- Longer-term projects that are designed to build momentum for expanded implementation of targeted practices with increasing numbers of farmer and rancher participation over time
- Projects that include conservation farm planning assistance to producers, such as NRCS comprehensive conservation planning services, self-assessments or sustainability certification
- Projects that engage regional hubs or involve multidisciplinary team collaborations
- Projects that emphasize permanent or long-term climate benefits beyond the financial incentive or the time frame of the project
- Projects that explore additional benefits for participating growers, such as reduced costs, payments for ecosystem services, regulatory compliance or certainty, solving multiple resource concerns, or assistance with permits required for the practice

We recommend that the outcomes of technical assistance projects be measured in two ways:

- The extent of on-farm implementation of the selected practices—with or without financial incentives—including the number of acres enrolled, number of grower participants, aggregation of practices used, and other indicators of successful grower adoption

Irrigation Efficiency (Santa Barbara County)

The Cachuma Resource Conservation District (CRCD) operates a mobile irrigation lab in Santa Barbara County to identify opportunities for water efficiency use improvements. Since the program began over 20 years ago, CRCD has made the lab available to more than 1,500 growers and other land managers. CRCD also produces educational materials for different farm and ranch systems, including outreach to Spanish-speaking land managers. Improvements in water use efficiency has four primary benefits: water conservation, especially important in this water scarce region; greenhouse gas emissions reductions due to decreased energy needs for water delivery; cost savings for growers; and increased resilience in the face of diminished water resources.



Kevin Peterson, Mobile Irrigation Lab Program Director at Cachuma RCD, checks an irrigation pressure gauge.
photo credit: Cachuma RCD

CRCD requires at least \$300,000 annually to offer this service, piecing funding together from a variety of federal, state and local sources. Many other RCDs could benefit from a similar mobile irrigation lab and education program.

- Net greenhouse gas emissions reductions and co-benefits to be calculated using appropriate tools and indices that predict site-specific outcomes. Data may be aggregated to protect individual privacy (see Section E and Appendix D).

Farmer and Rancher Financial Incentives

We recommend that the Farmer and Rancher Program include the option of offering financial incentives to aid and support individual farmers who sign a contract to implement recommended practices as part of a technical assistance project.

Fellow producers are often the most trusted sources of information in the farming and ranching communities. Seeing other producers successfully use a practice can create a multiplier effect. Financial incentives can spur the use of new practices by individual producers and ultimately their fellow producers by offsetting the costs and risks involved in adopting a new farming or ranching practice.

Incentives for practices that optimize greenhouse gas reductions and carbon sequestration along with co-benefits should be prioritized and could apply to the installation of equipment or a structure, or to management practices that are repeatedly carried out. With input from the advisory committee, the lead agency could establish specific practices eligible for financial incentives that demonstrate climate benefits and agriculture resiliency. We recommend that this list be updated every year or two, as more information becomes available. A preliminary list of the most promising practices can be found on page 15 in the sidebar titled “Greenhouse Gas Reduction Strategies in Agriculture.”

We recommend that financial incentive contracts be offered to farmers who agree to implement and maintain the practices for three to ten years. The lead agency could determine, with input from the advisory committee, to renew some contracts where additional support could assist with meeting program objectives.

The lead agency can work with NRCS and the advisory committee to seek efficiencies and leverage resources with existing NRCS incentive programs. NRCS Conservation Practice Standards and payment rates could be considered, with the understanding that regional differences may cause modifications to be made to both standards and payment rates for each practice (see Section E).



photo credit: USDA (www.flickr.com/photos/usdagov/11190099406/)

D. Measuring Program Performance

It is critical that performance metrics be selected and tracked with the first CPAC grant cycle. As an investment in both research and on-the-ground implementation, CPAC must be able to document both success and failure in order to accomplish the intended learning.

We recommend that the lead agency establish program performance measurements with the advice of the advisory committee and build the metrics into the overall program. Appendix D includes an overview of available methods for evaluating the effects of agriculture practices on greenhouse gas emissions and carbon sequestration.

We recommend that the development of methods for assessing individual project performance be evaluated with these considerations in mind:

- Each project must predict and then track actual implementation by acreage, number of participants, instances of practice change, or any other indicators that best measure success. Common metrics for reporting emission reductions or carbon sequestered should be used for all projects.
- Individual producers' performance on financial incentive contracts, as well as voluntary implementation and reporting by others, should measure and verify the change that took place, and report the predicted climate outcome.
- Researchers should conduct greenhouse gas emissions and carbon sequestration data analysis and modeling to inform public decisions about which practices produce the greatest climate mitigation benefits.
- Results on individual farms should be aggregated to protect privacy. NRCS data privacy policies might offer a model for use in CPAC.

Evaluating overall CPAC programmatic performance requires the sum total of the change in greenhouse gas emissions and carbon sequestration due to all technical assistance projects and financial incentives, as predicted from models. This should be done on a biennial basis.

Organic Farming Practices Have Climate Benefits (Mendocino County)

The health of the soil at Fetzer Vineyards is maintained by adding compost produced from leftover grape skins, stems, and seeds. Cover crops planted between the vine rows protect against soil erosion and attract beneficial insects to manage pests. The cover crops also eliminate the need for fossil-fuel based synthetic chemicals, helping to reduce the overall carbon footprint of the operation. On some of their property, they use sheep grazing and chickens in the vineyards for weed control and soil fertility. Combined these management practices improve soil quality and carbon sequestration.

The land management practices at Fetzer provide additional climate benefits. Fetzer protects and maintains the natural oak woodlands and riparian habitat on about 45 percent of its property. They plant habitat corridors with dozens of species of perennial shrub, grasses and trees to protect riparian zones and harbor beneficial insects and native birds that help with pest control. Not only do these practices provide protect the natural resources upon which the vineyards depend, they also sequester carbon and build resilience to buffer against a changing climate.



Cover crops planted between rows at Fetzer Vineyard build soil, help sequester carbon and provide pollinator habit.
photo credit: Fetzer Vineyard

E. Collaboration with USDA NRCS and CARCD

The USDA NRCS shares a similar mandate to this proposed new state program. NRCS has extensive technical and programmatic experience delivering the very kind of financial incentives this program can support, and it is trusted by growers and conservationists alike. However, the California NRCS lacks the funds to expand implementation or to focus solely on climate outcomes. At the local level, RCDs work in collaboration with NRCS and the lead agency to help implement state and federal agricultural conservation activities. Collaboration across these three entities can assure effective program delivery.

The CPAC Farmer and Rancher Program described above can be a great asset to NRCS and the RCDs by promoting agricultural practices that reduce greenhouse gas emissions, offering additional technical assistance to farmers, lining up applicants for financial incentives, and allowing cap-and-trade investment funds to provide financial incentives.

To build mutual capacity to carry out these projects, we strongly encourage the lead agency to consider a formal agreement with NRCS, whose staff has extensive technical knowledge, a foundation of conservation practice standards, and good models for farmer contracts and compliance mechanisms. These kinds of agreements and collaborations between USDA NRCS and state agencies are not uncommon and could improve efficiencies and further innovation.¹²

A well-designed memorandum of understanding between the lead agency and NRCS may spell out exactly how the partners can collaborate. For example, the collaboration could include the lead agency using NRCS practice standards for those agricultural practices with demonstrated greenhouse gas emissions reductions and co-benefits. The standards can inform the selection of practices eligible in the California financial incentives program. The lead agency could adapt its financial incentive contracts based on NRCS experience, including NRCS privacy practices, which are valued and trusted by farmers and ranchers.

Where the lead agency and NRCS are offering financial assistance for similar practices, strategic collaboration can ensure that more farmers are reached without duplication of efforts, since demand far exceeds the funds of either entity. Both agencies could explore transferring funds to each other if the funded work would be best accomplished by the other.

We strongly encourage the lead agency to consider a memorandum of understanding between the lead agency and the California Association of RCDs to assist with program outreach and project results dissemination. Such an MOU can ensure that the program objectives and opportunities are delivered effectively to producers throughout the state.

¹² For example, USDA NRCS has MOUs with the Minnesota Department of Agriculture to collaborate on organic and water quality initiatives. See: <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/newsroom/?cid=STELPRDB1046382> and <http://www.misa.umn.edu/NewsandEvents/Newsletters/NewsletterArchive/2003Vol11/May2003/index.htm>

IV. CONCLUSION

With the most comprehensive climate change law in the country, California is pioneering innovative programs to reduce greenhouse gas emissions and support a clean energy economy while adapting to the inevitable changes to our climate. However, too little attention has been paid to the state's agriculture and its unique opportunities to reduce greenhouse gas emissions and increase carbon sequestration.

California is the largest agricultural economy in the country, covering a quarter of the state's landmass, and producing the country's fruits, vegetables, nuts, and dairy products. The state agricultural sector also offers unique opportunities to sequester carbon in soils and woody biomass, produce renewable energy and reduce some of the most potent greenhouse gases, methane and nitrous oxide.

We cannot afford to address agriculture and climate change issues through piecemeal efforts. California agriculture's significance to the state economy and to our food security necessitates a comprehensive program of investment. Many of the activities that can reduce greenhouse gas emissions and sequester carbon in agriculture can also provide multiple benefits to our communities, including increasing agriculture's resilience to climate change impacts and improving our air and water quality. Agricultural solutions to climate change will be critical for meeting the objective of reducing pollution in our most disadvantaged communities, especially in the Central Valley.

This Blueprint lays out a vision for how cap-and-trade investments can be used to establish an innovative California Program on Agriculture and Climate to catalyze a wide range of climate-friendly farming and ranching activities.

Experience with federally funded agricultural conservation programs makes it clear that the potent combination of technical assistance for farmers and financial incentives to offset their risks in implementing new production methods can bring about significant and transformative change. A few successful examples are the wildlife-friendly practices now common with California rice farmers, the significant expansion of the state's organic farming operations, and the efforts of the ranching community to use grazing management practices that encourage biodiversity.

We can do the same to promote and expand climate-friendly agricultural systems that reduce reliance on fossil fuels, decrease methane and nitrous oxide emissions, produce renewable energy, and increase water and energy-use efficiency. But we cannot do that without a coordinated state effort that supports sustainable farming systems.

There is much work to be done if California is to meet its 2020 and 2050 greenhouse gas emissions reduction goals. California agriculture can be part of the solution, but we must invest now.



photo credit: Paolo Vesica

APPENDIX A: CLIMATE SOLUTIONS IN CALIFORNIA AGRICULTURE

A version of this document with citations is available on the CalCAN website at:
<http://calclimateag.org/our-work/calcan-fact-sheets/>

California agriculture is particularly vulnerable to the impacts of climate change. Climate scientists report that state water supplies will become increasingly limited, threatening a fundamental resource for the agriculture industry. Also predicted is greater pressure from weeds and pests, increased animal diseases, reduced winter chill hours, and changing intensity and number of storms.¹³

The significance of the impacts of climate change on California's important agriculture industry cannot be overstated. California's nearly 78,000 farms and ranches generated over \$42.6 billion in 2012. Producing over 400 food and fiber products, California agriculture represents nearly every crop produced in the U.S. Thus, the future of California agriculture in the face of a changing climate is important not just for the state's economy but also for the nation's food security.

To protect California agriculture in the coming decades, greenhouse gas (GHG) emissions must be reduced and the worst impacts of climate change must be averted. Agriculture can make significant, unique and profound contributions to meet this challenge.

Here we summarize the current peer-reviewed scientific literature on agriculture and climate mitigation, with a focus on studies specific to California conditions, and in consultation with several academic experts in the field.

While the focus of this review is on methods for reducing GHG emissions and sequestering carbon in agriculture, it is important to note that many of the climate-focused measures also prepare agriculture to better cope with the impacts of climate change and provide additional environmental and health benefits both on and off the farm.

Finally, as California considers GHG emissions issues in agriculture, it is important to take a whole-farm system approach rather than a practice-by-practice approach. Altering one agricultural practice to reduce GHG emissions may lead to the unintended consequence of increasing GHG emissions elsewhere in the farm system. Considering agricultural practices as integrated parts of the whole farming system will provide a more complete picture of the opportunities to reduce GHG emissions and provide multiple benefits. Sustainable agricultural systems, based on ecological principles, offer this holistic approach.

¹³ A more thorough summary of the expected impacts of climate change on California agriculture is available in a related CalCAN factsheet (<http://calclimateag.org/our-work/calcan-fact-sheets/>) and the state's 2014 Safeguarding California report (<http://resources.ca.gov/climate/safeguarding/>).

Water & Energy Efficiency, Renewable Energy Production

There is no “one size fits all” set of best practices for achieving on-farm water use efficiency and reduced dependence on fossil fuel-based energy. Instead, such activities must take into consideration the operation’s production, soils, water sources, and other regional variables. Growers must also consider the value of gains in on-farm water efficiency, balanced against potential trade-offs in diminished groundwater recharge or increased energy demand, described in more detail below.

Improving water use efficiency can deliver energy savings for farmers and reduce energy-related GHG emissions. Each year, California agricultural irrigation consumes over 10 billion kilowatt hours (kWh) of electricity—nearly enough energy to power 1.5 million residences. Furthermore, the vast majority of that power consumption occurs between the months of May and October, when the state’s energy demand is at its highest. During the summer months, energy used for groundwater pumping in California exceeds the amount of energy required to run the State Water Project, the Colorado River Aqueduct and the Central Valley Project combined. However, optimizing on-farm irrigation efficiency through close monitoring and evaluation can achieve significant water and energy savings.

The most widely used on-farm water use efficiency methods are drip and micro-sprinkler systems. These technologies can produce the highest crop yield per unit of water applied and can achieve irrigation efficiencies as high as 90 percent compared to flood irrigation at 60 to 85 percent. Studies have also found that subsurface drip irrigation—particularly when combined with reduced tillage practices and fertigation (the application of fertilizers through irrigation systems)—can significantly reduce nitrous oxide emissions.

The benefits of drip and micro-irrigation systems must be weighed against the potential for reduced groundwater recharge compared to flood or furrow irrigation, an important consideration as the state faces the diminished water availability predicted with climate change. The low energy requirements of flood irrigation should also be considered.

Additional management practices can improve water use efficiency and offer other benefits. For example, cover crops, reduced tillage practices, and organic soil amendments that can decrease evapotranspiration by 30 to 50 percent also help build soil organic matter, promoting water infiltration and storage. Dry farming techniques can improve soil moisture retention and reduce or eliminate the need for irrigation, instead relying on seasonal rainfall. On-farm ponds can reduce runoff, recharge groundwater, store rainfall, and contribute to regional flood management efforts.

Energy efficiency measures and on-farm renewable energy production can provide energy and cost savings to farms and ranches while reducing GHG emissions. Before investing in renewable energy production, growers should maximize energy efficiency on their farms and in packing, cooling, and shipping operations to avoid oversizing their renewable energy systems. Energy audits, available through California’s electric utilities and the Natural Resources Conservation Service (NRCS), can identify opportunities to increase efficiency.

In terms of renewable energy, wind turbines, solar panels, geothermal and bioenergy projects on agricultural land can increase the state’s production of renewable energy and also generate income for farmers and ranchers through the sale of excess energy. By 2012, the number of California farms reporting the installation of on-farm renewable energy systems nearly tripled to 5,845, up from the nearly 2,000 systems reported in 2009. There is considerable potential for growth with continued financing and outreach.

Soil Building

Agriculture and forestry can serve as terrestrial “sinks” of carbon dioxide, removing our most ubiquitous greenhouse gas from the atmosphere and storing it in soils, trees, and other plant biomass. This process is known as carbon sequestration. The ability of farm and rangeland to sequester carbon depends on soil type, regional climate, crop systems, and management practices.

Among the agricultural soil management practices that have significant potential to sequester carbon are conservation tillage, cover cropping, agroforestry techniques, improving rangeland and pasture management, adding organic amendments like compost, and reducing and properly timing the application of nitrogen fertilizer inputs.

Conservation tillage can stabilize soil carbon by decreasing the mechanical disturbance to soil aggregates and minimizing the conversion of carbon in soil and crops to atmospheric carbon dioxide. Also, replacing synthetic fertilizers with nitrogen-fixing cover crops can halve carbon dioxide emissions. Soil management practices used in combination, such as cover cropping and applying composted manure or plant material, show the greatest potential for building soil organic matter, sequestering carbon, and reducing emissions of carbon dioxide and the potent GHG, nitrous oxide.

Many of the soil management practices that increase carbon sequestration also reduce nitrogen inputs and therefore can lower nitrous oxide emissions. These practices include conservation tillage and the application of composted manure and green waste as an alternative to synthetic nitrogen fertilizers. These sources of nitrogen have the added benefit of releasing nitrogen slowly over time to better suit plant nutritional needs, rather than in periodic large applications that leach through soils more quickly. For example, the use of cover crops can reduce nitrate contamination in groundwater by as much as 83 percent.

Organic Farming

Organic systems integrate ecologically based practices to boost fertility, build soil organic matter, conserve natural resources, and mitigate GHG emissions. Organic farming operations provide multiple opportunities to reduce agricultural GHG emissions and sequester carbon. Many of the techniques used by organic producers are incorporated on conventional farms.

A critical distinction between conventional and organic systems is that organic farmers are prohibited from using the fossil fuel-based synthetic fertilizers, herbicides, and pesticides that can increase a farm’s carbon footprint. Instead, organic systems use inputs with up to 30 percent less embedded energy than conventionally managed systems, resulting in lower net GHG emissions. Although organic producers may use more fuel (because increased tillage may be necessary to deal with weeds in place of synthetic herbicides), organic systems often have smaller carbon footprints per acre than their conventional counterparts when all energy inputs are taken into account.

While there is considerable variability between farms, seasons, soils, and other conditions, studies have found that soils under organic management—including use of animal manures, compost and cover crops—exhibit significantly more carbon sequestration than soils managed conventionally using synthetic fertilizers.

In an eight-year study in California, soil organic carbon increased 19 percent in organic and low-input systems, compared to an increase of only 10 percent in conventional agriculture. A twelve-year study in California showed a 36 percent increase in carbon sequestration with the use of

organic practices like green manures and animal manures, despite increased tillage compared to the conventional system. USDA research shows that organic agriculture, even when using tillage, can sequester more carbon than no-till conventional agricultural systems.

Rangeland Management

Rangelands cover approximately half of California's total land area and approximately 34 million acres are actively grazed. The conservation and management of both grazed and ungrazed rangeland can be critical for addressing climate change because, while most rangeland has limited potential for carbon sequestration in soils and woodlands, over this vast acreage the combined potential for sequestering atmospheric carbon is significant.

While there is great variability in the soil carbon storage potential across California's diverse rangelands and climate conditions, management practices can improve carbon storage, particularly in the wetter areas of California.

Restoring woody vegetation (e.g., oak trees) and riparian habitats can increase carbon sequestration on rangelands, and there is evidence that increasing the population of native perennial grasses also stores more carbon.

Managing the timing, duration and intensity of livestock grazing can bolster aboveground species richness and productivity, which is correlated with increased soil carbon. Increasing forage quantity with fertilization and organic amendments has been shown to increase soil carbon. Whereas uncomposted manure additions have been correlated to increased GHG emissions, a model based on two field sites found that the application of compost to rangelands can lead to soil carbon sequestration that is expected to persist for many years. Carbon sequestration in rangeland soils has many benefits, including reduced erosion and increased water infiltration and storage in soils.

Livestock Production

Livestock-related methane emissions account for more than half of California agriculture's GHG emissions and over three percent of the state total, the majority from dairy and beef cattle manure management and the digestive processes (enteric fermentation) of the animals. Importantly, there are promising opportunities to reduce this impact by altering livestock diets, manure management techniques, breeding strategies, and managed grazing practices.

Improving the digestibility and nutrient composition of animal feed can reduce methane emissions generated by enteric fermentation, as can grazing that provides livestock with high quality forage. Furthermore, grassfed livestock may require less fossil fuel energy inputs compared to conventional feedlot livestock. One study found half the energy demand in grassfed systems.

Another source of GHG emissions in conventional livestock rearing systems is manure management. Stockpiling manure in ponds and lagoons leads to anaerobic decomposition, which emits methane and nitrous oxide. Capture of methane from manure storage lagoons and conversion to electricity via biodigestion offers a significant opportunity for both emissions reductions and emissions avoidance by offsetting fossil fuel use. The application of anaerobic digestate or composted manure to soils can add organic matter and likely reduce net GHG emissions. Alternatively, when animals are grazed, their manure is applied directly to rangelands, thereby avoiding anaerobic decomposition and the associated methane and nitrous oxide emissions of confined livestock systems.

Farmscaping

Farmscaping describes a broad range of land management practices that incorporate perennial and annual flora into agricultural production to achieve a variety of agronomic and environmental benefits. Reforesting rangelands, planting hedgerows along field margins, and installing tailwater ponds to capture irrigation runoff are common farmscaping techniques. The most important climate benefits of farmscaping include carbon storage in plants and soil and reduced nitrous oxide emissions.

Incorporating trees, shrubs, or other types of woody vegetation into rangeland or cropland can increase carbon sequestration. Studies on organic farms found that riparian and hedgerow habitats with woody vegetation stored up to 20 percent of the farm's total carbon, despite occupying less than six percent of the total area.

Planting hedgerows along the margins of farms, establishing woody biomass in riparian zones, and replanting oak woodlands on rangeland offer some of the best opportunities to sequester atmospheric carbon. Riparian areas can store nearly twice as much carbon per acre as adjacent rangeland and 25 percent more carbon compared to cropland.

Establishing riparian buffer zones and planting hedgerows also allow for the uptake of excess nitrogen that otherwise would have been lost, decreasing by 28 to 42 percent the nitrate that can pollute streams and groundwater. Tailwater ponds can reduce nitrate contamination in groundwater by as much as 97 percent.

Winter cover crops improve nitrogen use efficiency by scavenging for residual soil nitrogen and increasing its availability for target crops, which reduces the amount of fertilizer needed.

Farmscaping provides habitat for beneficial insects and pollinators, assisting with pest control and helping offset the recent decline in pollinator populations.

Conserving California Farm and Rangeland

California loses an average of over 50,000 acres of agricultural land annually, which has a negative impact on climate change mitigation and adaptation opportunities in the state. Due to the potential of rangelands to sequester small amounts of carbon over vast acreages, the ongoing loss of rangelands from urban development and the conversion to more intensive forms of agriculture have implications for climate mitigation.

Farmland conservation offers a multitude of climate benefits, such as carbon sequestration, reduced GHG emissions, renewable energy production, and greater resilience to climate change impacts for both cities and rural areas. An acre of urban land was found to emit 70 times more GHG emissions compared to an acre of irrigated, conventionally managed cropland.

Research suggests that conserving farmland at the urban edge slows the spread of sprawl and reduces transportation-related GHG emissions. Furthermore, agricultural land around urban areas may help cool the "hot spots" created by cities through the albedo effect (the tendency of urban areas to absorb more solar radiation). Such cooling will help offset the impacts of increased temperatures. Farmland preservation provides an array of additional benefits, such as maintaining local food sources for Californians, enhancing biodiversity and wildlife habitat, and aiding in water filtration and groundwater recharge.

Supporting Climate-Friendly Agriculture

Farmers and ranchers can be part of a climate solution for California and the nation as a whole. Encouraging sustainable agricultural practices can reduce GHG emissions, enhance on-farm capacity for carbon sequestration, and provide numerous environmental and health co-benefits.

More California-specific research on climate change and agriculture is needed. Technical assistance is required to translate those research findings into real opportunities for GHG emission reductions on California's farms and ranches. When there are costs or perceived risks of making the transition to climate-friendly practices, financial incentives for farmers and ranchers are essential.

Researchers at UC Davis find that California producers will adopt practices to mitigate climate change if they are given realistic payments and assistance. Increased funding from USDA conservation programs, as well as investments at the state and national levels from carbon pricing policies, are needed to support agriculture's role in climate protection.

California agriculture can be a leader in mitigating and adapting to climate change. With additional research, technical assistance and financial incentives, we can ensure that agriculture remains a viable, innovative, and ecologically and economically sustainable industry for years to come.

The Many Benefits of Climate-Friendly Farming

Many of the agricultural practices that reduce GHG emissions and sequester carbon can also provide numerous environmental and public health benefits. They can also enhance the resilience of California farms and ranches to climate impacts such as drought, flooding, new pests and diseases, and extreme weather events. For example:

- On-farm water conservation reduces agriculture's vulnerability to California's cycles of drought and water scarcity.
- Improved air quality results from the use of renewable energy and reduced fossil fuel-based inputs.
- Cover crops and tailwater ponds can reduce nitrate pollution in groundwater.
- Farmscaping provides habitat for beneficial insects, pollinators and wildlife.
- Increasing soil organic matter improves soil water retention, reduces soil erosion and provides flood control.

APPENDIX B:

CALIFORNIA CARBON MARKET

In addition to auction proceeds, another significant component of the cap-and-trade program is the offset credits market. Under the cap-and-trade program, regulated entities are required to reduce their greenhouse gas emissions through a variety of means, including the adoption of energy efficiency measures and the use of renewable energy.

Regulated entities can also pay non-regulated entities, like farmers and ranchers, to adopt practices that result in quantifiable greenhouse gas emissions reductions and thereby offset the emissions of the regulated entities.

The California Air Resources Board (CARB) approves offset credit protocols for the California carbon market. Farmers and ranchers who are interested in receiving payments for offset protocol activities sign up with a third-party verifier and demonstrate that their activities are providing the greenhouse gas emissions reductions outlined in the offset protocol. Credits for those activities are then made available to regulated entities for sale on the carbon market. Currently, California has six approved offset protocols, including one for agriculture for the use of methane capture digesters on dairy operations.

While the development of the California offset credits market may present future opportunities for agricultural producers to receive payment for activities that provide climate benefits, the opportunities for California agriculture are likely limited.¹⁴ A number of existing hurdles may limit state producer participation in the market, including:

Offset credits can come from anywhere in the country, not just California. Currently offset credits can be developed anywhere in the United States. It may be cheaper to source credits from outside California, a state where production costs may be higher compared to other regions and where more diverse cropping systems may limit widespread participation. California's cap-and-trade program is now linked with Quebec, allowing for offset credits from the Quebec system. CARB may further expand the offset credit market to eventually include credits generated in Mexico and other countries.

Participation in the offset market will be expensive for individual producers, especially small and mid-scale producers. Offset protocols require extensive documentation, monitoring and/or modeling to demonstrate emissions reduction benefits. For most producers the transaction costs will be prohibitive. And those interested in participating in the market will likely have to work with other producers to aggregate their emission reductions and make participation in the market more cost-effective. However, small and mid-scale producers, who make up the majority of farms and ranches in the state, do not typically have sustainability managers or other employees who can track the paperwork and ease participation in the carbon market. Thus, aggregation alone may not be enough to encourage their participation in the market.

Protocol adoption is slow. Currently only one agriculture-related offset protocol is approved by CARB for use on the California carbon market. Others will likely be developed over the years—a rice protocol will be considered for adoption in 2015—but the development of protocols is expensive and has been slow, limiting opportunities for producers to engage in the program.

¹⁴ CalCAN worked with farmer advisors and others in the sustainable agriculture community to develop a set of sustainable agriculture principles for the carbon market, available at <http://calclimateag.org/carbon-market/>.

APPENDIX C:

STAKEHOLDER INTERVIEW QUESTIONS

The following questions were used to guide discussion with the 41 expert stakeholders interviewed to inform the Blueprint.

1. Climate and Agriculture Research

What research on climate change mitigation strategies for California agriculture is already underway, and what research gaps need to be filled?

If a funding program for climate and agriculture research were created, what funding criteria should be used?

How could a funding program be designed to identify the best farming practices and systems for reducing greenhouse gas emissions in agriculture while also supporting additional environmental and health benefits?

Should research be limited to the sectors of agriculture with the highest greenhouse gas emissions or should all crop and livestock sectors be eligible?

Should producers be included in research projects? If so, in what aspects of the research? Should projects include incentives for participation or payments to offset costs to producers?

What are the optimal funding ranges and research project lengths?

Based on your knowledge of the status of current climate and agriculture science, what practices or systems are ready now to be incentivized to encourage greenhouse gas emissions reductions?

2. Technical Assistance and Financial Incentives for Producers

What could be accomplished by offering California producers technical assistance and incentives to reduce greenhouse gas emissions and sequester carbon?

Should incentives be offered to all crop and livestock producers or to those with the highest greenhouse gas emissions? Or, given limited funds, should certain crop sectors or geographic areas be prioritized? What might be the basis for prioritization?

If funding were available for technical assistance to producers, how do you envision it being provided? What entities should be eligible (e.g., NRCS, RCDs, Cooperative Extension, private crop advisors, nonprofit organizations)? What criteria should be used for selecting recipients?

In addition to receiving financial incentives to use management practices that reduce greenhouse gas emissions, are there other types of incentives we should consider (e.g., regulatory streamlining or regulatory certainty)? How could such non-monetary incentives be structured?

Should applicants be encouraged or required (as in some NRCS incentives programs) to include comprehensive farm planning in their projects as a method for maximizing greenhouse gas emis-

sions reductions across the whole farm system? Should funding be offered for farm planning or should it be a prerequisite for eligibility?

How should project outcomes be monitored and measured to provide meaningful information without compromising confidentiality or creating disincentives for applicants? How should the results be aggregated and distributed?

3. Program Implementation

What state government agency is best suited to administer a California Climate and Agriculture Program that provides funding for research, technical assistance and financial incentives, and why? Which partner organizations or agencies could be collaborators?

Are there opportunities to collaborate and find synergies with the federally funded NRCS conservation incentives programs, for example using matching funds?

APPENDIX D: EVALUATING GREENHOUSE GAS EMISSIONS IN AGRICULTURE

CPAC-funded projects will have to demonstrate greenhouse gas emissions reductions. There are multiple ways to measure the results of projects on greenhouse gas emissions and carbon sequestration, while maintaining the privacy of individual producers. Without such privacy guarantees, few producers will likely participate in the program.

Current tools exist to aggregate and demonstrate the greenhouse gas emissions reductions of CPAC projects. The lead agency, with input from the advisory committee and other stakeholders, should determine the best tools to use. Below we offer some options.

USDA NRCS Conservation Practice Standards

NRCS agronomists and scientists developed 160 National Conservation Practice Standards that contain the technical foundation for nearly everything the agency does. The agency created a Greenhouse Gas and Carbon Sequestration Ranking Tool and identified 35 standards that positively reduce greenhouse gas emissions and increase carbon sequestration. Each practice standard sets out the purpose of the practice, while general criteria describe how the practice must be designed or carried out to insure effectiveness. Plans and specifications, technical details, and operation and maintenance requirements are listed. Other accompanying documents detail specific resource concerns, deliverables for planning and installation, and conservation effects to be achieved. More is needed to make the NRCS climate change tools relevant in the California context, but collaboration with California state partners could bring focused attention to California-related greenhouse gas emissions reduction practices.

For more information on the NRCS Conservation Practice Standards:

http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/references/?cid=nrcsdev11_001020

For more information on the NRCS Greenhouse Gas and Carbon Sequestration Ranking Tool:

<http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/air/quality/?cid=stelprdb1044982>

NRCS COMET-Farm Tool

Total greenhouse gas emissions and carbon sequestration can be predicted for agricultural parcels by using COMET (Carbon Management Evaluation Tool)-Farm. This NRCS carbon management tool and greenhouse gas accounting system is applicable to several types of farms and ranches, but must be expanded to include specialty crops if it is to be relevant in California. Individuals can use the tool online, entering their county, soil type, crop rotation, tillage, nitrogen use, and fuel use. The model reports net soil carbon emissions or sequestration and net greenhouse gas emissions. Projected changes in operations reveal future changes in climate impacts.

NRCS Conservation Measurement Tool

The Conservation Measurement Tool was created for the Conservation Stewardship Program, a national conservation program, but has potential for adaptation to other programs. It uses farmers' answers to a number of questions about what and how they farm in order to score predicted outcomes on 27 micro-resource concerns. It is a whole-farm assessment of the overall environmental footprint and has been validated in the field.

Field Data Collection and Modeling

Collection of soil samples and greenhouse gas emissions data at the field level can be cost-prohibitive when considered for hundreds or thousands of acres. It is not likely, from a labor or cost perspective, that all fields in all CPAC projects can be sampled to monitor their greenhouse gas emissions and carbon sequestration over time. But a representative sample of fields, based on voluntary permission and with privacy protection for participants, could be taken to advance collective understanding of the effectiveness of CPAC projects and to increase the accuracy of models, like the DeNitrification-DeComposition (DNDC) tool and others used to predict outcomes from practices. Such models are used in the development and implementation of carbon market offset projects.

In deciding how best to measure greenhouse gas emissions reductions and carbon sequestration, the lead agency may initially limit CPAC technical assistance, education and financial incentive projects to those practices that are determined by NRCS to reduce greenhouse gas emissions, and are applicable to California agriculture. Additionally, the lead agency may work with advisory committee members to determine the use of other tools, as described here, to demonstrate CPAC program-wide impacts.

About CalCAN

The California Climate and Agriculture Network (CalCAN) is a coalition of the state's leading sustainable agriculture organizations and farmer allies. We came together out of concerns for climate change impacts on California agriculture and to advance sustainable agricultural solutions to a changing climate. Since 2009, we have cultivated farmer leadership to serve as the sustainable agriculture voice on climate change policy in California.



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