Climate Solutions in California Agriculture: Achieving Greenhouse Gas Emission Reductions and Agricultural Resilience

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AB 32 recognizes that climate change will have detrimental effects on some of the state's largest industries, including agriculture. Much is at stake – California agriculture is a $43 billion per year industry, and supplies 90 percent of the nation's nut tree crops, more than half of the country's fruit and vegetables and more dairy products than any other state.

In a state where water is already scarce, climate change scenarios predict that water supplies will become increasingly constrained, limiting a fundamental resource for the state's agricultural industry to thrive.[1] Warming temperatures also threaten to shift the kinds of crops that can be grown in the state. For example, reduced winter chilling hours may significantly decrease production of the state's lucrative nut and fruit tree industry. [2] These and other predicted climate changes – more droughts, floods, and heat events – could severely strain important agricultural industries, impacting food production.

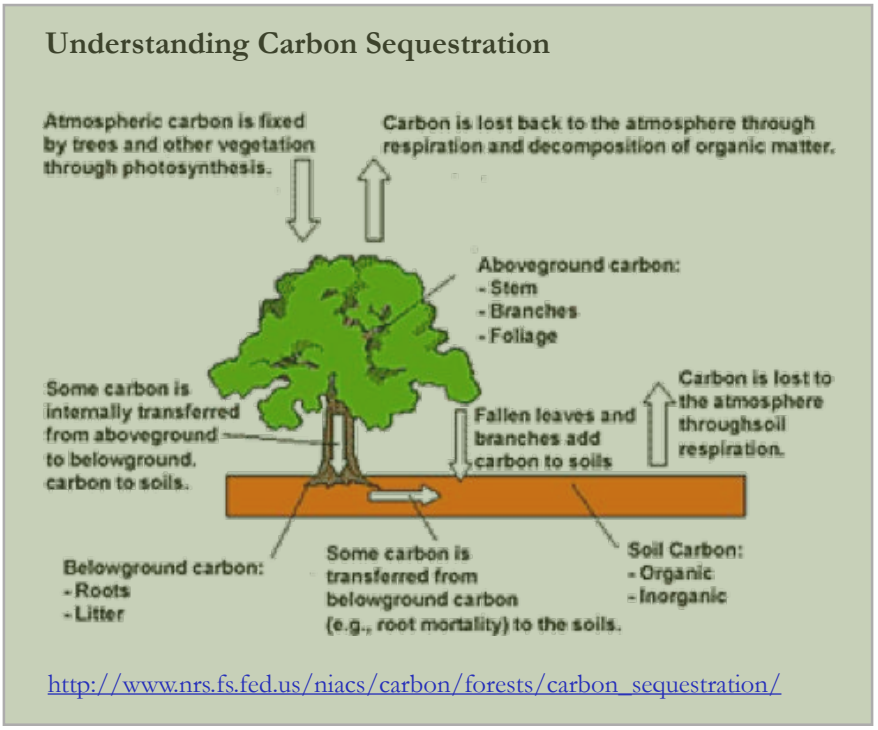
California agriculture can take steps to reduce greenhouse gas emissions and sequester atmospheric carbon, helping to meet the objectives of AB 32, and related measures such as SB 375, while supporting food security and providing multiple environmental, economic and health co-benefits. To inform the 2013 Scoping Plan Update, here we outline strategies in California agriculture to reduce GHG emissions and sequester carbon in soils and woody biomass. Many of these strategies will also better prepare agriculture to adapt to a changing climate.

Background: 2008 Scoping Plan

Leading up to the 2008 Scoping Plan, the Agriculture Climate Action Team (AgCAT) and the Economic Technology Advancement Advisory Committee (ETAAC) reviewed a subset of agricultural management practices that can provide climate benefits and estimated that agriculture can reduce GHG emissions by 9.1 to 16.7 $MMTCO_2E$, accounting for between 31 to 57 percent of the industry's total emissions.[3] However, few of the agricultural management strategies outlined in the AgCAT and ETAAC reports were included in the final Agriculture Sector Chapter of the 2008 Scoping Plan. This may have been because of lack of California specific research on agricultural mitigation activities.[4]

Since the 2008 Scoping Plan, new research[5] finds that a diversity of agricultural management strategies in California, along with farmland conservation, can reduce GHG emissions, sequester atmospheric carbon and provide significant co-benefits such as improved air and water quality, wildlife habitat and greater agricultural resilience.[6]

To achieve climate benefits in California agriculture, the state can remove barriers to innovation and support farmers and ranchers in implementing beneficial climate practices on California farms and ranches.



Linking Scoping and Investment Plans

It is important that the 2013 Scoping Plan link with the state's Cap-and-Trade Auction Proceeds Investment Plan, bringing together the Scoping Plan activities with investment opportunities to meet the AB 32 goals and the objectives of AB 1532, the investment plan guiding legislation. Making such connections will be critical for achieving GHG emissions reductions and carbon sequestration in California agriculture and maximizing efficiencies and the achievement of co-benefits.

As noted in the 2008 ETAAC report, "…the agricultural sector also offers the opportunity to reduce GHG emission reductions through the capture of carbon and/or production of renewable low-carbon fuels. Other specific farm-related GHG emission sources can also be controlled and mitigated. **Yet a concerted research, development and demonstration (RD&D) effort and new regulatory incentives and programs will be needed to meet the GHG emission reduction goals in AB 32.**"[7]

Little has changed since 2008 in terms of the need for resources to support California agriculture in addressing climate change. This was acknowledged in the May 2013 Auction Proceeds Investment plan[8] that outlined several areas of investment in agriculture to achieve climate benefits, including:

- Farmland conservation (including land-use strategies in rural areas to achieve SB 375 goals as listed under the Sustainable Communities Strategies Implementation)
- Water and energy use efficiency in agriculture
- Renewable energy/bioenergy production development
- Agricultural practices and fertilizing materials that reduce GHG emissions, improve water quality and provide other co-benefits
- Compost production

Achieving Environmental and Health Co-Benefits for a More Resilient California

Many of the agricultural practices that reduce GHG emissions and sequester carbon can offer environmental, health and economic co-benefits. For example, cover cropping, improved soil management and conservation tillage can improve air and water quality while reducing GHG emissions and sequestering carbon. Reduced reliance on fossil fuel inputs can also improve air and water quality and reduce costs for producers. Planting of riparian zones can improve carbon sequestration in soils and woody biomass and also provide pollinator and wildlife habitat.

As the state grapples with the complexities of bringing together its work on climate change mitigation and adaptation, supporting strategies in biological systems like agriculture that provide multiple benefits will be crucial in building a resilient, food secure California.

Scoping Plan 2013 Update: Recommendations for Agriculture Strategies

The 2013 Scoping Plan Update can build upon the 2008 Scoping Plan and link with the Investment Plan by detailing the climate strategies in agriculture that can be supported through research, technical assistance and incentives. They are:

- Energy and water resource efficiency
- Farm and food processor renewable energy development

Modeling the Effects of Agricultural Practices and Climate Change on Crop Production and Greenhouse Gas Emissions in California
http://www.plantsciences.ucdavis.edu/Agroecology/Outreach/Modeling.html

A recent UC Davis study used data from four long-term field experiments to calibrate the DAYCENT 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. Annual differences in weather or management conditions contributed more to the variance in annual GHG emissions than soil variability did.

4. In the long-term, model predictions suggest that climate change will decrease California crop yields for rice, tomato, cotton, corn, and winter wheat.

- On-farm conservation strategies that provide climate change mitigation and adaptation opportunities
- Farmland conservation

Energy and water resource efficiency

Increasing energy and water use efficiency are win-win strategies that result in both GHG reductions and cost savings for the farmer or rancher. Efficiency measures can also help reduce co-pollutants and improve air and water quality. But barriers to the adoption of efficiency measures remain. Many small and mid-scale producers lack dedicated employees on these issues and many may be unaware of current programs available to assist them with energy audits and use of efficiency measures.[9]

Increasing farmer, rancher and food processor knowledge of and access to voluntary energy audits of their operations and recommendations for energy and water use efficiency measures would be a cost-effective application of state resources. Providing technical assistance and financial support in the form of grants or low-interest loans for the implementation of efficiency measures would increase the adoption of those measures, create models that may be replicated by others and help achieve the state's GHG emission reduction goals.

We recommend that the Scoping Plan Update include strategies to accelerate the implementation of water and energy use efficiency measures, including:

- Increase access to voluntary and confidential energy audits that identify opportunities for energy savings and GHG emission reductions by coordinating with CEC, CPUC, utilities and irrigation districts resources
- Support the expansion of mobile irrigation labs operated by Resource Conservation Districts and/or irrigation districts to identify irrigation efficiency measures that reduce GHG emissions and provide energy savings
- Through utilities (IOUS and MUDs), irrigation districts and state programs, like EPIC, provide grants and/or low-interest loans for energy and water efficiency measures on farms, ranches and food processing facilities to achieve cost savings and reduce GHG emissions
- Provide cost-share grants, rebates or low-interest loans for research and development on cost-effective, GHG reducing energy and water efficiency technologies for food processors to improve on what is currently commercially available

Farm and food processor renewable energy development

Some of the greatest reductions in GHG emissions in agriculture can be achieved through the development of agriculture-based renewable energy projects. A 2009 U.S. Department of Agriculture survey found nearly 2,000 California farms and ranches reported using some form of self-generated renewable energy, leading the country in on-farm renewable energy projects.[10]

However, this is still a small fraction of the over 81,000 farms and ranches in the state. Many more farms, ranches and food processors can participate in the development of renewable energy projects that help run their operations, provide excess renewable energy to the grid and reduce overall GHG emissions. The Scoping Plan Update

Organic Farming Practices Have Climate Benefits at Fetzer Vineyards

photo credit: Fetzer Vineyard

The quality and health of the soil at Fetzer Vineyards are maintained by adding compost produced from leftover grape skins, stems, and seeds. Cover crops planted between the vine rows protect against soil erosion, attract beneficial insects to manage pests, and eliminate the need for fossil-fuel based synthetic chemicals that can damage the soil and environment and that require considerable energy inputs and GHG emissions to produce. On some of their property, they also use sheep grazing in the vineyards for weed control and soil fertility, as well as chickens for cutworm control and soil fertility. All of these practices are valuable for storing (sequestering) carbon.

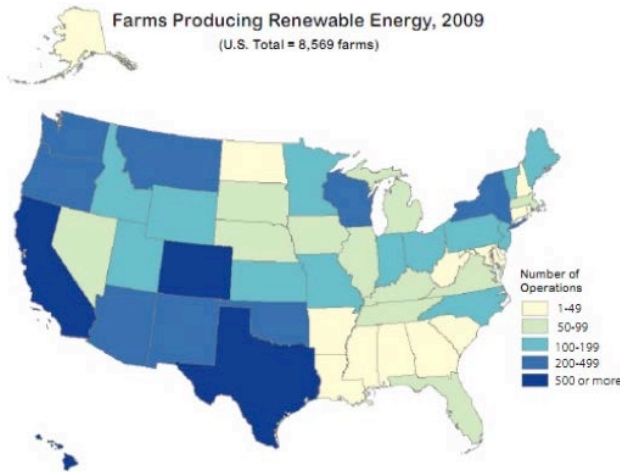
Fetzer protects and maintains the natural oak woodlands and riparian habitat on about 45 percent of its property. They also plant habitat corridors with dozens of species of perennial shrub, grasses and trees to protect riparian zones and harbor beneficial insects and native birds that help with pest control. These practices provide habitat for beneficial species and protect the natural resources upon which the vineyards depend and they also sequester carbon and build resilience to buffer against a changing climate.

Walnuts to Watts

Dixon Ridge Farms in Winters, CA is an organic walnut farm and processor. Owner Russ Lester became an innovator in on-farm renewable energy when, with a grant from the California Energy Commission in 2009, he installed a 50-kilowatt biomass powered generator that converts his major waste product — walnut shells — into heat and gas to dry the walnuts and electricity to power the 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 combined with their solar arrays they are close to meeting all of the energy needs of their processing facility. As a bonus, Russ applies the biochar residue of the burned shells to the walnut orchards as a soil amendment and carbon sequestration measure.

should provide guidance on how the state can support development of innovative renewable energy in agriculture, including:

- Provide grants and/or loans to farms, ranches and food processors for innovative renewable energy development, including sustainable biomass feedstocks to develop bioenergy projects, rooftop solar, wind and other qualified renewable energy projects[11]
- Invest in technical service providers with demonstrated expertise to provide assistance to producers and processors to develop on-farm and food processing renewable energy projects
- Remove policy barriers to grid interconnection of on-farm renewable energy generators by improving access to the Net Energy Metering and the Feed-in Tariff programs



http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Fact_Sheets/Practices/energy.pdf

On-farm conservation strategies

Agriculture and forestry offer the only currently available terrestrial "sinks" of carbon dioxide, the most predominant greenhouse gas. Natural processes in these sectors can remove carbon dioxide from the atmosphere and store it in soils and woody biomass. Additionally, agricultural practices, such as soil and manure management practices can reduce nitrous oxide and methane emissions – two potent greenhouse gases. The 2013 Investment plan and the 2008 ETAAC and AgCAT reports recommend investing in agriculture to achieve greater carbon sequestration. The updated Scoping Plan can build upon this.

Technical assistance, educational outreach and incentives for on-farm conservation strategies can reduce GHG emissions, sequester atmospheric carbon in soils and woody biomass and provide economic, environmental and health co-benefits. Examples of activities include, but are not limited to:

- Soil management practices that reduce N_2O and increase carbon sequestration (e.g., reduced fertilizer inputs, cover crops, compost or manure applications, conservation tillage
- Planting of riparian zones, establishment of hedgerows and incorporation of trees, shrubs and other types of woody vegetation to increase woody biomass and related carbon sequestration

- Limiting overgrazing, which can lead to soil erosion and riparian damage, will increase soil carbon stocks in rangelands.
- Transition to organic production practices to lower overall carbon footprint
- Wetlands restoration

ARB could provide technical and financial support for UC Cooperative Extension, Resource Conservation Districts and other nonprofit technical service providers to work with farmers and ranchers to conduct whole farm conservation planning to identify opportunities to conduct conservation practices that provide climate change mitigation and other economic, environmental and health benefits.

Moreover, ARB should continue to support agricultural research that expands our understanding of management strategies that provide climate and other benefits.

Farmland conservation

Until the current housing crisis, California was losing irrigated farmland at a rate of 30,000 to 50,000 acres per year, and that trend is likely to resume as the state's population grows and the economy recovers. Moreover, new pressures related to large infrastructure projects will exacerbate the loss of prime farmland.

Farmland offers unique carbon sinks and its protection avoids increases in transportation and energy-related emissions associated with development, offering an important strategy to meet SB 375 objectives.[12] A PIER study conducted by UC Davis researchers finds that an acre of developed city or town land in Yolo County emits 70 times more GHG emissions compared to an acre of irrigated cropland.[13] Protecting prime farmland from urban and suburban development also helps increase the albedo effect – the ability of land to reflect sunlight and cool temperatures. Thus, farmland conservation is not only an important AB 32 strategy, but is fundamental to achieving Sustainable Communities Strategies.

Protecting farm and rangelands from development provides additional benefits, including carbon sequestration, enhanced wildlife habitat, improved quality of life (by protecting recreational and open space) and food security for the state's residents. The Scoping Plan Update can provide strategies to improve farmland conservation in the state, especially on land most under threat from development, including:

- Grants to land trusts and local government for voluntary conservation easements on farmland, prioritizing land threatened by urban and suburban sprawl
- Funding of the Williamson Act state program and revision of the program to prioritize farmland conservation on the urban/suburban edge and related avoided GHG emissions
- Smart growth planning grants for local government that prioritize farmland protection in partnership with local farmers and ranchers
- Guidance from the state to local government on farmland mitigation requirements under CEQA and general plan guidelines

We provide additional policy recommendations in our report, Triple Harvest, found at http://calclimateag.org/triple-harvest/.

The Climate Benefits of Rotational Grazing

Markegard Family Grass-Fed uses intensive grazing techniques on land in San Mateo, Marin 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. The Markegards used an Environmental Quality Incentives Program (EQIP) cost share grant from the USDA NRCS to install $30,000 worth of fencing to manage their cattle grazing.

Farmland Protection in Brentwood

The 12,000 acres of prime farmland in the Brentwood region of East Contra Costa County is one of the largest, most productive farming regions remaining in the Bay Area. However, the region has experienced tremendous development pressure over the past 20 years as the City of Brentwood grew from 7,500 people to 56,000 people. Brentwood Agricultural Land Trust (BALT) protects farmland from development by acquiring agricultural conservation easements from farmers. While farmers continue to own and farm their land, easements prohibit future subdivision or development of the property. BALT holds conservation easements on seven Brentwood farms, a contribution to avoiding GHG emissions associated with urban sprawl.

Footnotes & Citations

[1] California Climate Adaptation Strategy: 2009. California Natural Resources Agency. http://www.climatechange.ca.gov/adaptation/

[2] Luedeling, E., Z. Minghua, E.H. Girvetz. July 2009. Climatic Changes Lead to Declining Winter Chill for Fruit and Nut Trees in California during 1950 – 2099. Plos ONE. Vol. 4. Issue 7.

[3] Forecast GHG emissions from agriculture, without actions to reduce emissions, are 29.1 MMTCO2E. http://www.arb.ca.gov/cc/inventory/data/forecast.htm

[4] For example, in 2008 we lacked data comparing the GHG emissions from an acre of cropland versus urban land. We know have case studies to inform our understanding the importance of farmland conservation to climate change mitigation.

[5] For a review of the science of climate change and agriculture mitigation strategies, please see: http://calclimateag.org/our-work/calcan-fact-sheets/ and http://nicholasinstitute.duke.edu/content/workshop-agricultural-greenhouse-gas-mitigation-opportunities-california#.UdsGTvlN8rV

[6] Agricultural resilience is the ability of an agricultural operation to recover and adapt from the effects of a changing climate (e.g. increases in input costs, extreme weather events, declining water resources, etc.). For more on a discussion of agricultural resilience and adaptation issues, see the OEC/FAO workshop (2012) on Building Resilience for Adaptation to Climate Change in the Agriculture Sector http://www.fao.org/agriculture/crops/news-events-bulletins/detail/en/item/134976/

[7] Page 6-1. ETAAC report. 2008.

[8] Cap-and-Trade Auction Proceeds Investment Plan. FY 2013-14 through 2015-16. May 14, 2013. Appendix B. http://www.arb.ca.gov/cc/capandtrade/auctionproceeds/final_investment_plan.pdf

[9] In the January 20011 Update of the California Energy Efficiency Strategy the authors acknowledge the need to reach out to small scale agricultural producers on available EE programs. Page 47. http://www.cpuc.ca.gov/NR/rdonlyres/A54B59C2-D571-440D-9477-3363726F573A/0/CAEnergyEfficiencyStrategicPlan_Jan2011.pdf

[10] For the USDA on-farm renewable energy survey, see: http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/On-Farm_Energy_Production/index.php

[11] Coordination of resources among the CPUC, CEC and ARB, as mentioned in recommendation #1, will be important to most effectively achieve renewable energy production in agriculture.

[12] Wassmer, R.W. Sept. 2008. California's Farmland Preservation Programs, Taxes, and Furthering the Appropriate Safeguarding of Agriculture at the Urban Fringe to Reduce Greenhouse Gas Emissions. CSU Sacramento. http://www.csus.edu/indiv/w/wassmerr/CAFarmLandUse.pdf

[13] Jackson, L., V.R. Haden, A. D. Hollander, H. Lee, M. Lubell, V.K. Mehta, T. O'Geen, M. Niles, J. Perlman, D. Purkey, W. Salas, D. Sumner, M. Tomuta, M. Dempsey, and S.M. Wheeler. 2012. Adaptation Strategies for Agricultural Sustainability in Yolo County, California. California Energy Commission. Publication number: CEC 500-2012-032.