



# Room to Grow

*How California Agriculture Can Help Reduce  
Greenhouse Gas Emissions*

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## About this Report

This policy paper is the third in a series of reports on how climate change will create opportunities for specific sectors of the business community and how policy-makers can facilitate those opportunities. Each paper results from one-day workshop discussions that include representatives from key business, academic, and policy sectors of the affected industries. The workshops and resulting policy papers are sponsored by Bank of America and produced by a partnership of the UC Berkeley School of Law's Center for Law, Energy & the Environment, UCLA School of Law's Environmental Law Center & Emmett Center on Climate Change and the Environment, and the California Attorney General's Office.

## Authorship

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## Executive Summary: Climate Change & Agriculture

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Few business sectors in California have more to lose from the impacts of climate change than agriculture. Changed growing seasons, increased drought and limits on water supply, flooding, record temperature changes, invasive species, and pest infestations all threaten the industry's future. But farmers and ranchers control part of their destiny: the agricultural sector is a contributor to the greenhouse gases (GHG) that cause climate change and possesses unique opportunities to reduce overall GHG emissions.

To identify barriers and solutions for reducing GHG emissions, a group of agricultural leaders, academics, policy-makers, non-governmental organization representatives, and water experts met at the UC Berkeley School of Law in September 2009. The group identified and prioritized the most critical barriers to reducing agriculture's GHG emissions and offered recommendations for policy-makers and industry leaders to overcome these barriers. Based on that discussion, this paper identifies the immediate and longer-term actions that government leaders and key stakeholders should take to address the barriers.

In the short term, agriculture leaders can adopt immediate and cost-effective practices that will reduce GHG emissions, particularly the methane from livestock production and nitrous oxide from fertilizer usage (the two largest agricultural sources). Dairy farmers and ranchers can reduce methane emissions from livestock by exploring improvements to the animals' diet and by lengthening the productive life of dairy cows to generate fewer emissions per unit of milk produced. Farmers can reduce nitrous oxide emissions from too much fertilizer usage by employing more precise and well-timed methods of fertilizer application.

In the long-term, policy-makers will need to assist industry efforts to generate renewable energy from agricultural byproducts and to research new and cost-effective practices and technologies to reduce GHG emissions from agricultural commodities. Government leaders should simplify the permitting process for methane digesters and biomass gasification units that turn methane from manure and agricultural biomass into renewable energy. They should also improve the feed-in tariff policy, which provides payments to producers of renewable energy, to encourage more investment in these technologies. Finally, state and federal policy-makers should steer public investment in agriculture towards research on GHG-reducing techniques for each commodity, including ways to improve methane management, fertilizer application, and water usage. Public and private sector leaders will then need to lead outreach efforts to educate farmers and ranchers about these methods.

These efforts will help reduce the state's GHG emissions and potentially create jobs and technological innovation that the state can export to farmers and ranchers around the nation and world.

Changed growing seasons, increased drought and limits on water supply, flooding, record temperature changes, invasive species, and pest infestations all threaten the industry's future.



## Top Four Barriers to Reducing Greenhouse Gas Emissions from Agriculture

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- 1) **Lack of research on technologies and best practices that will reduce GHG emissions from each agricultural commodity**

Each of California's diverse commodities requires effective technologies and practices for GHG reduction that must be researched, developed, and verified.

- 2) **Insufficient financing for the necessary equipment and supplies**

The equipment, training and permitting time for many of the demonstrated GHG control technologies require upfront financing that most farmers and ranchers are reluctant or unable to provide.

- 3) **Regulatory conflicts**

Farmers and ranchers who want to innovate with renewable energy generation from biomass or biogas face a complicated maze of regulations that sometimes work at cross purposes.

- 4) **Lack of awareness of opportunities to reduce GHG emissions**

Many farmers and ranchers are unaware of the cost-saving and often low-technology means of reducing GHG emissions from agriculture.



## Short and Long-Term Solutions

### Farmers and Ranchers

Improve livestock diets to reduce methane emissions from the animals' digestive processes.

Adopt methods for more precise and well-timed fertilizer application to reduce nitrous oxide emissions from over-fertilization.

### Agriculture Industry Leaders

Research ways to lengthen the productive life of dairy cows to reduce methane emissions per unit of milk produced.

Prioritize agricultural research across all commodities for solutions to reduce GHG emissions that would yield the most climate benefit at the lowest cost and fastest timeframe.

Mobilize existing agriculture trade associations or form a new, climate-focused entity to lobby for the redirection of public and private funds, including cap-and-trade revenue from the auctioning of allowances, to research practices and technologies for reducing GHGs and sequestering carbon in farming and ranching systems.

Develop protocols for offset opportunities that reduce GHGs to shape future regulatory efforts and to capitalize on financing available in voluntary offset markets.

Advocate for the establishment of a long-term public and private investment fund to finance research on ways to reduce GHG emissions and sequester carbon in agriculture.

Document the regulatory barriers to climate-friendly technologies and practices and advocate for local and state regulatory reorganization to allow innovation and pilot programs in agriculture that reduce GHG emissions.

Partner with local nonprofit and public and private research groups to promote innovative climate-friendly practices to farmers and ranchers.

Develop a market niche for each commodity that informs consumers about the GHG emissions reduction measures associated with the production of the commodity for sale.

### Local Government

Provide regulatory and permit-fee safe harbors for certain research pilot projects that reduce GHGs and sequester carbon.

Agriculture industry leaders should advocate for the establishment of a long-term public and private investment fund to finance research on ways to reduce GHG emissions and sequester carbon in agriculture.

Develop “one-stop shopping” for permits and fees for biomass and biogas renewable energy facilities.

### State Government

Support university and community college efforts to conduct research projects for agriculture that demonstrate GHG-reducing potential.

Provide regulatory safe harbors for research and demonstration projects that reduce GHG emissions.

Prioritize research funding assistance to target GHG-reducing research for agriculture.

Direct some allowance auction revenue from the proposed state cap-and-trade program to help finance GHG-reducing technologies and practices for agriculture.

Implement payment or grant plans to support farmers and ranchers who are willing to invest in GHG-reducing equipment and practices.

Create an ombudsman’s office within state agencies to resolve regulatory inconsistencies that stymie innovation in the field of climate change and agriculture.

Develop plans for “one-stop shopping” permits for projects that reduce GHG emissions.

Encourage renewable energy production from biomass and biogas by implementing a more comprehensive feed-in tariff, which provides payments to owners of renewable energy generators for the electricity they feed into the grid, and by removing barriers to interconnecting these facilities to the grid.

Assist irrigation efficiency goals by altering on-farm water metrics to reflect efficiency outcomes rather than the volume of water utilized by growers.

Ensure that the regulatory process avoids “early adopter” penalties for farmers and ranchers who innovate GHG-reducing practices and technologies.

Develop a program modeled on the European Union “European Agricultural Guarantee Fund” program, which provides funding for farmers who comply with standards that promote environmentally and economically sustainable practices, among other requirements, to encourage farmers to reduce their GHG emissions and sequester carbon.

### Federal Government

Reprioritize existing federal grants for agricultural research to fund GHG-reducing technologies and best management practices and direct land-grant universities and agricultural extension programs to further this research.

Expand and target the Environmental Quality Incentives Program (EQIP), the Conservation Stewardship Program, and the Specialty Crop Research Initiative (SCRI) to fund cost-share dollars, financial rewards to farmers who achieve environmental goals, and projects and research that reduce GHG emissions from various agricultural commodities.

Provide regulatory safe harbors for pilot programs that reduce GHG emissions.

The Federal government should reprioritize existing federal grants for agricultural research to fund GHG-reducing technologies and best management practices.

Direct revenue from the federal Food, Conservation, and Energy Act of 2008 (known as the “2008 Farm Bill”) to finance GHG-reducing technologies, training, and technical assistance.

Dedicate revenue from the auctioning of allowances under the proposed federal cap-and-trade scheme to fund GHG-reducing practices and technologies for agriculture.

Develop simple and effective loan programs to help farmers provide the upfront costs for new technologies to reduce GHG-emissions.

Participate in state efforts to streamline, simplify, and reduce the cost of the regulatory process for agricultural businesses trying to reduce GHG emissions and sequester carbon.

As discussed above at the state level, develop a European Union-style program to fund, market, and provide technical assistance to farmers and ranchers to help them reduce GHG emissions and sequester carbon.

Implement an insurance program to cover farmers in case of losses from new GHG-fighting technologies and practices.

### **Conclusion: California Agriculture’s Opportunities and Influence**

The agriculture sector in California has significant potential both to reduce its own GHG emissions and to be a source of further climate change mitigation by providing carbon sequestration and renewable energy production. However, industry leaders, through existing trade associations and commodity groups or through a new, climate-focused industry association, must capitalize on proven cost-effective strategies and future opportunities presented by climate change laws and regulations. Ultimately, the progress that California agriculture makes in reducing GHG emissions could be a model for farmers and ranchers around the nation and world, creating jobs and technological innovation for export.





## Climate Change & Agriculture

While climate change threatens California's economy, natural resources, and quality of life,<sup>1</sup> the agricultural sector in California is particularly at risk from the impacts of climate change. Climate change forecasts call for changes in crop yield and types, new and expanded ranges of weed and pest invasions and diseases, increased flooding, changes in crop pollination, and more frequent and intense heat waves.<sup>2</sup> As these conditions worsen over the next century, the changed environment may threaten the industry's ability to produce food for the state, the nation, and the world.

With this long-term challenge to their livelihood, farmers and ranchers have an interest in efforts to mitigate the GHG emissions that cause climate change. In California, the threat of climate change and inaction at the federal level has prompted the state, through legislation, regulation, and executive orders, to mandate reductions in the GHG emissions that cause climate change. Most prominently, the state enacted the California Global Warming Solutions Act of 2006 (AB 32) to roll back statewide GHG emissions to 1990 levels by the year 2020, equivalent to a 30 percent cutback from business-as-usual projections for 2020.<sup>3</sup> Governor Arnold Schwarzenegger then issued Executive Order S-3-05, which calls for an eighty percent reduction from 1990 levels by 2050.<sup>4</sup>

The California Air Resources Board (CARB), responsible for implementing AB 32, estimates that emissions from agriculture comprise approximately six percent of the state's total GHG emissions, or almost 30 million metric tons of carbon dioxide equivalent annually.<sup>5</sup> Nationally, this figure is closer to seven percent,<sup>6</sup> and the United Nations Food and Agriculture Organization (FAO) stated that animal agriculture alone contributes eighteen percent of all GHG emissions worldwide.<sup>7</sup> CARB estimates for California agriculture GHG emissions would be substantially higher if the agency included emissions from the production of fertilizers and pesticides and from energy use associated with water pumping.<sup>8</sup>

In addition, agriculture represents a valuable source of carbon sequestration (a separate topic that this paper does not directly address) and renewable energy generation, measures that could significantly reduce the state's carbon footprint. For example, preliminary estimates indicate that renewable energy production from biogas and biomass could reduce between 7 and 16 million metric tons of carbon dioxide equivalent emissions.<sup>9</sup>

Failure to mitigate climate change and to reduce the state's carbon footprint will have significant economic consequences for agriculture, the state, the nation, and the world. California agriculture is a \$36 billion per year industry<sup>10</sup> and represents the world's fifth largest supplier of food and other agriculture commodities.<sup>11</sup> The sector is extremely diverse, producing over four hundred commodities, with intensively managed crops that receive high levels of nutrient input, mostly from

California Air Resources Board estimates for California agriculture GHG emissions would be substantially higher if the agency included emissions from the production of fertilizers and pesticides and from energy use associated with water pumping.



synthetic fertilizers. California agriculture also has a large physical footprint: out of the state's 101 million acres, 26.2 million acres are devoted to farming and ranching,<sup>12</sup> including over 10 million acres for irrigated cropland.<sup>13</sup>

Given the scale of the industry, the threat to agriculture from climate change, and the corresponding opportunities for GHG emissions reductions, as well as the state's position as a leader in innovative new technologies that can be used throughout the country and the world, policy-makers and agriculture leaders have much to gain from reducing the aggregate GHG emissions from this sector.

"Wine is the canary in the coal mine for climate change. Our alcohol content used to be 12.5 percent, but now we struggle to keep it below 15 percent due to rising temperatures."

-- Paul Dolan  
Paul Dolan Vineyards

## Reducing GHG Emissions from Agriculture

While California's crops reduce GHGs from the atmosphere through plant respiration and photosynthesis (estimated at 120 million metric tons per year),<sup>14</sup> the industry as a whole emits GHGs from three major sources: livestock, fertilizer usage, and energy from pumping water. These three sources contribute to one or more of the three major GHGs that cause climate change: methane, nitrous oxide, and carbon dioxide.<sup>15</sup> In addition, the industry possesses tremendous potential to generate renewable energy from methane digesters and biomass facilities and to sequester carbon in soil and above-ground biomass.

### How to Address Methane Emissions

California has the largest dairy industry in the nation, comprised of approximately 1.7 million dairy cows with over five billion dollars in annual sales. The state's dairy farms range in size from less than one hundred cows to several thousand, and the average herd size in California is about one thousand cows.<sup>16</sup> Methane emissions from the animals' digestive processes and manure contribute over 50 percent of the GHG emissions from agriculture.<sup>17</sup> Methane has 20 times more potency as a GHG than carbon dioxide and is relatively short-lived in the atmosphere compared to carbon dioxide, creating an efficient and immediate opportunity to reduce GHGs.

Emissions from digestive processes (enteric emissions) represent 70 percent of the methane produced by livestock.<sup>18</sup> Microbes in the stomachs of ruminants (animals that eat primarily plant-based feed that is digested anaerobically in a special organ called a rumen) release methane gas as they help the animals digest the feed. Studies have shown that roughly 4 to 12 percent of gross energy intake for livestock is converted to methane through this process.<sup>19</sup>

Manure represents the other critical source of methane emissions from California livestock. California's cows generate over 67 billion pounds of manure annually, which emit 450,000 tons of methane.<sup>20</sup> Most dairy farmers divert this manure into storage ponds, often called lagoons, for future use. The manure is used on cropland and pastureland for fertilizer and, if the washed solids are separated, for bedding for the livestock. Methanogenic bacteria that decompose the liquid waste in the lagoons form methane.

At our present rate, methane emissions will only worsen due to the increasing population of livestock. According to the United Nations FAO, total world meat production doubled from 1977 to 2002, and meat consumption per person grew by 35 percent during that same time. The FAO projects that world meat consumption will grow another 40 percent by 2030, particularly as developing countries like China and India consume more meat per capita.<sup>21</sup>

Proposed solutions for reducing methane emissions include using methane digesters, altering feeding practices to enhance digestion efficiency, and

"Climate change forecasts call for a future lack of chilling hours, which would destroy most tree crops if those predictions come true. We should act locally and soon."

-- Russ Lester  
Dixon Ridge Farms



improving production efficiency. Methane digesters involve placing livestock manure in sealed tanks or lagoons that capture the methane emissions. Methane is produced when the manure is allowed to decompose or “digest” without access to oxygen. The digesters or covers capture the resulting biogas, which is approximately 60 percent methane, 40 percent carbon dioxide, and trace amounts of hydrogen sulfide. Facility owners can employ various methods of biogas utilization to create renewable energy, including selling the treated natural gas to utilities via pipelines for off-site consumption and, most commonly, powering an on-site internal combustion engine that produces electricity. In addition to eliminating methane emissions, these digesters have the combined potential to generate up to 350 megawatts (MW) of renewable energy, with a single MW equating enough energy to supply electricity to roughly 750 homes in a year.<sup>22</sup>

Methane digesters, however, produce pollutants that often face strict governmental regulation. In particular, on-site renewable energy production from biogas burned in internal combustion engines creates emission byproducts that include nitrogen oxide, sulfur oxide, volatile organic compounds (VOCs), particulate matter, and carbon monoxide. Local air districts in California regulate these pollutants pursuant to a state implementation plan of the federal Clean Air Act, and the nitrogen oxide emissions in particular have faced the most restrictions from local regulators.<sup>23</sup>

Methane digesters are also expensive, often costing as much as three million dollars, and they entail a lengthy, costly, and often confusing permitting process. Digesters that sell the treated biogas to utilities as biomethane for off-site consumption can be even more costly due to the extra technology required to remove the impurities in the biogas in order to convert it to utility-grade natural gas.<sup>24</sup> California dairy farmers interested in getting permits for a digester to burn the biogas on-site have to receive approval from regional water quality control boards, the local air pollution control district, and the county in which the project is located. Depending on the project and the location, they may also need approval from the California Department of Fish & Game and rarely from the United States Army Corps of Engineers.<sup>25</sup> As of 2005, livestock producers used only two percent of dairy manure to produce biogas.<sup>26</sup> As one workshop participant stated, “getting a digester in this state takes an act of God.”

The equipment costs and lengthy permitting time could be mitigated by state renewable energy programs, such as an expanded feed-in tariff that would provide higher payments to renewable energy generators who supply power to the grid. However, the current dominant renewable energy incentive program, net metering, provides renewable energy generators with retail credit only to offset their on-site electricity bills. They receive no compensation for any surplus energy provided to the utility from their facilities. Given that most livestock production facilities do not use as much energy on-site as they can produce with methane digesters, this offset to the electric bill does not pay for the significant

“California agencies are not adapting to climate change. Despite thousands of meetings, things are getting worse. There is no metric for regulatory agencies to force them to change.”

-- Allen Dusault  
Sustainable  
Conservation

investment in the system. And many dairy farmers have experienced delays and processing challenges in getting the utilities to provide the digesters with interconnection to the electric grid.

The second method for reducing methane from livestock involves altering the animals' digestive processes that produce methane (enteric fermentation). Livestock producers can provide more digestible feed to the animals, although most confined livestock already have high levels of feed quality and digestibility. Where livestock diets are not optimal, however, producers can incorporate feed such as grain, silage, and legume hay (i.e., clover or alfalfa). Ranchers can also improve the forage quality for grazing animals on smaller livestock operations through better pasture management. Additionally, producers can employ feed additives, such as edible vegetable oils, which inhibit the rumen bacteria that produce methane.<sup>27</sup>

Low-technology fixes and improved practices may yield additional results. For example, one study documented a 50 percent reduction in methane emissions from livestock when the animals had access to high-quality pasture instead of mature grass. Livestock raised on legume-grass pastures emitted 25 percent less methane than animals raised on grass-only pastures. Methane reductions have also occurred with intensively-managed rotational grazing.<sup>28</sup>

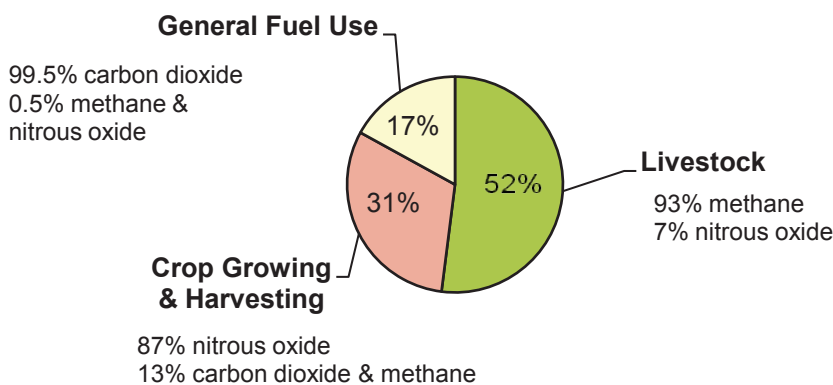
For livestock producers that use grain rather than the more-expensive grass, changes in the "grain-to-forage ratio," grinding and pelleting of feed, reduced protein content, addition of fats, and the use of enzymes all may have a significant impact on methane emissions. For example, Stonyfield Farms' "Green Cow Project" found that feeding dairy cows a diet high in natural omega-3 sources, such as from alfalfa, flax, hemp, and grasses, reduced methane emissions by an average of 12 percent and a high of 18 percent. The feeding regime also increased omega-3s in the milk by 29 percent. Improved feed storage and handling practices can also reduce emissions by reducing spoilage and loss.<sup>29</sup>

These changes in feeding regimes, however, require additional research into the optimal diets and additives that can successfully reduce GHGs. Financing may also pose a problem as any change in feed or added ingredients will likely cost ranchers money in new equipment and training. Unless new livestock diets can be proven to provide financial savings over time, most ranchers will lack the incentive to change. As a result, advocates for this feeding regime will have to promote the proper technologies and practices with proven research to ranchers across the state.<sup>30</sup>

Finally, improvements in the efficiency of production may reduce methane emissions from dairy livestock. For example, research from UC Davis suggests that increasing the productive life of milk cows by six months could significantly reduce the methane emissions per unit of milk produced, while also reducing harmful co-pollutants such as ammonia.<sup>31</sup>

## California's Agricultural GHG Emissions

30.13 million tons of CO<sub>2</sub> equivalent



**Figure 2. California's Agricultural Greenhouse Gas Emissions**

Source: California Air Resources Board

### Reducing Nitrous Oxide Emissions from Fertilizer

Nitrogen fertilizer use represents the second major source of emissions from agriculture. German scientist Fritz Haber developed the process for synthesizing ammonia, a critical ingredient for modern agricultural fertilizers (and explosives), in the early twentieth century. The Haber-Bosch process harnesses atmospheric nitrogen and oxidizes it to form the nitrates and nitrites needed for industrial fertilizers. The process is intensive, consuming as much as three percent of the total natural gas demand in the United States alone.<sup>32</sup>

Today, most farmers face incentives to over-fertilize their land with these industrially-produced sources of nitrogen, out of concern that using too little fertilizer will diminish crop yield. Farmers calculate the optimal rate of fertilizer application based in part on the cost of fertilizer, which varies primarily in response to energy prices.<sup>33</sup> Application rates will therefore adjust to fertilizer prices and not necessarily to the most efficient rate for limiting nitrous oxide emissions. (While there have been no comprehensive studies that collect data on the relationship between fertilizer application rate and nitrous oxide emissions across different soil types and growing regions of California,<sup>34</sup> researchers at UC Davis are collaborating with private institutions on the California Nitrogen Assessment to perform this needed research.<sup>35</sup>) As a result of over-application, the unused or surplus nitrogen in the soil can form nitrous oxide, a GHG with over three hundred times the climate impact of carbon dioxide.<sup>36</sup> Methane and nitrous oxide together constitute 80 percent of the GHG emissions from agriculture nationwide.<sup>37</sup>

In order to reduce nitrous oxide emissions from the imprecise or over-application of fertilizer, farmers need to become more efficient with nitrogen application and reduce dependence on fossil fuel-derived products. By employing more efficient fertilizer practices, such as timing fertilizer applications for key growth phases of the crop or using nitrogen inhibitors, farmers can ensure less overall use and fewer GHG emissions. Farmers may also be able to adopt new tilling practices and cover crops to reduce nitrous oxide, although in some cases researchers have not yet been able to demonstrate the effectiveness of these methods.<sup>38</sup> Finally, improved irrigation practices may decrease nitrous oxide emissions. For example, drip irrigation, in which water is delivered only to the soil below the plant (as opposed to flood or furrow irrigation), may limit nitrous oxide formation by more efficiently delivering fertilizer to the plant roots through the irrigation system.<sup>39</sup>

Widespread adoption of these new technologies and better fertilizer management practices face two critical barriers. First, there is a lack of information among farmers about the efficient use fertilizer and other management practices, in some cases due to a dearth of solid research and in other cases because of insufficient awareness of proven methods. Without this information, farmers are reluctant to employ new fertilizer or management practices and will require assurance that there will be no reduction in crop yield. They will want to know the proper amount of fertilizer application for each crop, the optimal nitrogen levels in the fertilizer, and the precise nitrous oxide reductions that they can achieve in order to claim credit for these improvements under future climate change regulatory systems. Second, farmers may need financial assistance to fund the upfront costs of implementing some of these technologies and practices, which may require new equipment and training.

### Improved Water Usage

Water use in California entails a significant amount of energy consumption. Pumping water around the state for farms and people consumes almost 20 percent of the state's total electricity supply.<sup>40</sup> The State Water Project alone is the single largest user of electricity in the state.<sup>41</sup> Approximately 70 percent of

“We need to shift from synthetic nitrogen to organic nitrogen. This will improve soil quality and fertility.”

-- Steve Shaffer  
Agriculture Consultant

the agricultural sector's energy use is for water pumping,<sup>42</sup> and the sector consumes more than 10,000 GW of electricity annually in order to pump and move roughly 34 million acre-feet of water. This electricity consumption for water for agriculture equals over four percent of the state's total overall electricity usage.<sup>43</sup>

Improved farming practices that maximize water use efficiency and increase pump efficiency can reduce this energy consumption. According to the Pacific Institute, some examples include more efficient irrigation technology that moves some of the crops irrigated by flooding to sprinkler and drip systems (although to the extent these more precise systems require pressurization, they may require more energy consumption). Improved irrigation scheduling may also reduce water consumption by relying on local climate and soil information to develop more precise irrigation methods that meet crop water needs.<sup>44</sup> However, like the GHG reduction techniques identified above, farmers will need research into what water technologies and practices work for each crop in order to demonstrate cost savings. They may also require that their irrigation districts have the capacity to deliver water on demand and to measure accurately the water deliveries to each field. Financing will also be a barrier for farmers who need assistance covering the upfront cost of investing in new irrigation equipment.

### Renewable Energy from Agricultural Biomass

Farmers and ranchers have tremendous opportunities to offset their on-farm energy use and provide significant amounts of renewable energy to the electric grid from biomass. Agriculture in California generates and collects nearly 21 million tons of biomass byproduct annually, most of which gets returned to the soil, burned, or disposed of by other means. Roughly eight million dry tons of this material could be utilized for renewable energy generation. This available biomass has the potential to generate as much as 1900 MW of electricity<sup>45</sup> – energy equivalent to 43 million barrels of oil.<sup>46</sup> The energy could not only offset on-site energy (although energy from biomass does not currently qualify for the net metering program) but could also contribute energy to the grid through a robust state feed-in tariff program. Recognizing this potential, Governor Schwarzenegger issued Executive Order S-06-06, which calls for 20 percent of the state's total renewable energy portfolio to come from biomass by 2010.<sup>47</sup>

The critical barriers to energy generation from biomass include lack of financing (high upfront costs to invest in the necessary facilities), inapplicable or weak state incentive programs under the net metering and feed-in tariff programs, and regulatory hurdles. Permitting for these renewable energy generators can require approval from several agencies. As a result, few biomass conversion plants have received approval in recent years, and current estimates project a five-year time horizon to permit and build a biomass plant in California under the current regulatory process.<sup>48</sup>

### California Must Improve its Efforts to Reduce GHG Emissions from Agriculture

The urgency of the climate change problem demands further research, innovation, regulatory reform, and instituting best practices. The state government, agriculture leaders, and other key stakeholders must take the initiative to address these issues. The following represents a guide to the policies needed to reduce the GHG emissions from agriculture in California.





## Barrier # 1: Lack of Research on Technologies & Best Practices for Reducing GHG Emissions from each Commodity

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### Lack of Research on Technologies & Best Practices

Each agricultural commodity requires specific practices and technologies to reduce its GHG emissions, but without demonstrated practices that have proven results and cost certainty, farmers and ranchers are unlikely to invest heavily in these technologies. Even low-technology solutions like cover cropping or reduced or modified fertilizer application may require additional research into how they can be used most effectively for each crop. The research, however, entails investments of money and time that many commodity growers, research institutions, and public and private entities do not have.

In response, producers of some of the more lucrative crops, such as rice, wine, and almonds, have already begun funding their own research into technologies and practices to reduce GHGs. However, commodity growers that lack the resources to make this investment require outside assistance from the public and private sectors. Researchers at various nonprofits, academic institutions, and government agencies will need to form partnerships with these commodity groups to develop demonstrable and innovative practices and technologies.

### SOLUTION: Improve and Expand Existing Research Programs

Industry leaders, either through existing agriculture trade associations or through the formation of a new coalition of agriculture leaders focused on climate change issues, must advocate for additional financial and logistical support for GHG research efforts. These organizers should enlist researchers at leading agricultural universities, such as the University of California, Davis, and agricultural representatives from across the grower groups to prioritize the most beneficial areas of research given the limited dollars currently available. They should focus on the areas of biggest potential gain with the least amount of investment required. Following this lead, the public sector should reprioritize its existing grant programs and research funding to focus on GHG reduction practices for agriculture. Private institutions, such as universities and nonprofits, should also focus their resources on performing the needed research for agriculture.

**Agricultural leaders must prioritize the most promising areas of research to target GHG-reducing research funds and then build the political will to secure those funds.**

**Prioritizing the research:** Industry leaders must help researchers identify the areas with the most potential for cost-effective solutions, while leveraging the existing research on lucrative commodities to attract more government and foundation funds. For each commodity, industry leaders should collect specific proposals for research, prioritize them, describe the results in writing, and share

“Currently research is being done on corn that produces its own nitrogen. This kind of R&D shows the opportunities to significantly reduce the amount of nitrogen in the soil from fertilizer. But while wealthy operations can invest in this kind of research, the edge crops can’t afford to.”

-- Cornelius Gallagher  
Bank of America

those results with farmers and ranchers, academics, private funders, and government leaders. Industry involvement in the prioritization process will help ensure that the research will be of maximum value for businesses. For example, industry leaders could encourage researchers to focus on profit-generating metrics like “highest output per unit.”

**Mobilize:** Agriculture leaders will need to build coalitions and the political will to redirect public and private research funds to projects that will reduce GHGs from agriculture. The industry may profit from this effort, to the extent that technologies to reduce GHG emissions present cost savings over time for farmers and ranchers. In support of this goal, agriculture leaders should consider joining forces with environmentalists who share their common vision on this issue, as well as renewable energy advocates who may see opportunities in biogas and biomass renewable energy production. Industry leaders may find other stakeholder groups to join this effort.

### Federal and state leaders must increase funding for GHG research and development programs.

**Redirect public funding:** Both the state and federal governments should direct discretionary grant and research funds to projects that analyze best management practices and new technologies that will reduce GHG emissions from agriculture. The federal government currently offers research grants for various agricultural purposes that often fund university or nonprofit projects. More of these grant opportunities should focus exclusively on GHGs. At the state level, policy makers may find a model in the Fertilizer Research and Education Program (FREP), an initiative of the California Department of Food and Agriculture (CDFA). FREP funds and coordinates research and demonstration projects on environmentally-sound methods of applying and handling fertilizer, including some GHG-related projects. The board of advisors that directs FREP research should ensure, where feasible, that more FREP funds are used for research on ways of reducing the nitrogen content of fertilizer and the optimal application levels of fertilizer for each commodity crop. Similarly, the United States Department of Agriculture (USDA), CDFA, and other agencies can work with other programs to coordinate and expand GHG-reduction research.

**Expand existing public research programs:** The Environmental Quality Incentives Program (EQIP), the Conservation Stewardship Program, and the Specialty Crop Research Initiative (SCRI) represent three government programs that could research methods of reducing GHG emissions from various agricultural commodities. Created by the federal Food, Conservation, and Energy Act of 2008 (also known as the “2008 Farm Bill,” the federal legislation expressing policy priorities for agricultural subsidies, research, and funding), EQIP is a voluntary conservation program for farmers and ranchers. It offers financial and technical support for installing or implementing management practices on agricultural lands that promote agricultural production and environmental quality. Second, the Conservation Stewardship Program, through the USDA, provides technical and financial support for farmers who voluntarily agree to conserve resources in a comprehensive manner. The program also provides financial rewards to farmers who achieve conservation goals.<sup>49</sup> Finally, the Specialty Crop Research Initiative (SCRI) is a federal program that finances research on broad initiatives to enhance agricultural productivity. While these programs fund projects that have multiple environmental benefits, federal policy-makers should increase the funds and research assistance and target them to reducing GHG emissions from various commodities.

“There’s a need for early inclusion of all stakeholders. We can’t just say, “Look at this new solution I have.” You need to get over the fear of inviting the major environmental groups because your neighbor doesn’t want to know they’re on your property.”

-- Karen Ross  
Former President,  
California Association  
of Winegrape Growers,  
currently with the United  
States Department of  
Agriculture

“In some cases, research can make the problem worse if you don’t do a lifecycle analysis of all the impacts from a new technology.”

-- Dan Sumner  
U.C. Davis



“With renewable fuels from biomass, we could do a different kind of R&D that’s not university-based, if we had the right regulatory structure. We could allow the facility to happen and then do the metrics afterwards so you actually have good, real-life data.”

-- Russ Lester  
Dixon Ridge Farms

### State and federal leaders should support public university efforts to develop and expand GHG research programs.

**University of California, California State Universities, and Community Colleges:** State leaders should encourage these institutions to undertake more research projects that demonstrate GHG-reducing potential for agriculture. The Division of Agriculture and Natural Resources at the University of California could take the lead on this effort, given that this institution oversees statewide research efforts on agriculture.

**Land-Grant Universities:** Land-grant universities are designated by each state to receive federal funds, with the mission to focus in part on researching and instructing modern agricultural innovations and practices. The federal and state governments could direct these universities to perform needed research on climate change and agricultural GHG emissions.

**Agricultural Extension:** Conceived as adult education for farmers and ranchers to update their practices based on current knowledge, the agricultural extension system presents a promising avenue for research on climate change and agriculture. Many extension agents come from universities doing this research and can work with farmers and ranchers in the field to target the research needs in an iterative process.<sup>50</sup>

### State and federal governments should provide targeted regulatory relief for pilot programs to encourage experimentation.

**Regulatory safe harbors:** Statutes like the federal Clean Air Act and the state Porter-Cologne Water Quality Control Act, which are designed to address local health impacts from air and water pollutants, may prevent pilot research programs from being implemented to test various GHG-reduction proposals. The state and federal governments should direct agencies to allow limited, pilot-scale experimentation for technologies that might have a total net benefit for air quality and GHG reduction. The advantage of these limited exemptions is that they encourage innovation that then produces demonstrable results, rather than requiring agencies to make predictions about the impacts of new technologies without having solid data to ensure that those estimates are accurate.

These types of exemptions already exist in some legal contexts and may provide a model, such as experimental use permits and air district research permits that the state’s air pollution laws allow. As another model, section five of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) permits the United States Environmental Protection Agency (EPA) to allow pesticide manufacturers to field test pesticides under development.<sup>51</sup> The manufacturers must obtain the experimental use permit first, which contains statutory limits on the number of acres on which the tests occur. A similar and more streamlined provision could be added to the Clean Air Act and Porter-Cologne Water Quality Control Act, possibly through agency rulemaking rather than legislative action. These exemptions could encourage limited, pilot-scale experimentation with a simple and low-cost process.





## Barrier # 2:

### Insufficient Financing for New Equipment & Supplies

The equipment, training, and permitting time for many of the demonstrated GHG control technologies and practices require financing for upfront costs that many farmers and ranchers are unwilling or unable to provide. Some technologies, like methane digesters, can cost ranchers millions of dollars. Low-technology solutions, like cover cropping or low- or no-till, may require training for individual farmers growing distinct commodities. And biomass renewable energy facilities can sometimes take years to permit, which requires more financing and occasionally the hiring of outside experts.

#### **SOLUTION: Strengthen and Expand Existing Incentive and Financing Programs**

The agriculture sector should seek financial assistance from both the public and private sector to help fund these GHG-reducing initiatives. From the public sector, local, state, and federal governments can provide financing assistance through innovative loan and grant programs that cover upfront costs. In addition, the proposed state and federal cap-and-trade programs may provide two options for financing agricultural GHG-reduction efforts. First, because agriculture will probably not be regulated directly under the proposed federal or state cap-and-trade programs, regulated entities can offset their emissions by purchasing credits from agricultural businesses that voluntarily reduce their GHGs (called “offsets”). Second, to the extent that the proposed federal and state cap-and-trade programs auction a percentage of the allowances that permit regulated entities to emit a fixed amount of GHGs, the programs could direct auction revenue to reducing agricultural GHGs. Finally, private investors may be willing to finance new technologies that farmers and ranchers can use to produce cost savings over time. If these technologies generate greater profits and a secure source of revenue over the long term, private investors would be assured of a payback.

“We would love to put in more solar power at our winery, but it’s too expensive.”

-- Paul Dolan  
Paul Dolan  
Vineyards

#### **Agricultural leaders must mobilize politically to take advantage of climate change and farm bill funds for new investment.**

**Cap-and-trade revenue:** Agriculture leaders should partner with progressive agriculture and environmental groups to organize a campaign to bring cap-and-trade revenue from the auctioning of allowances to agricultural projects. As discussed above, the United States Congress is currently debating the adoption of a federal cap-and-trade program that would allow regulated entities under the cap to bid for allowances for their GHG emissions or purchase offset reductions from non-regulated entities. The agriculture industry must lobby policy-makers to dedicate some of this revenue and investment money to help farmers and ranchers purchase equipment and training to reduce GHG emissions. If the agricultural sector is not organized to steer allowance-



purchase revenues to agriculture, it risks having these funds go to other, better-mobilized business sectors.

**Offset protocols:** Agriculture is likely to be a prime candidate to receive offset investment money under a cap-and-trade program. The proposed federal cap-and-trade program currently designates the United States Department of Agriculture as the agency to oversee offsets. But the industry itself can maximize its offset revenue and increase its chances to be first in line for investment if it develops offset protocols that federal regulators can then use as a basis for their regulations. To be legitimate under most offset regimes, an offset must be measurable, verifiable, additional, enforceable, and permanent.<sup>52</sup> Agricultural leaders, through organizations such as the California Farm Bureau Federation or groups representing various growers, must therefore develop an industry protocol that guarantees that offset opportunities meet these criteria. These offset investments will help farmers and ranchers finance GHG-reducing technologies and practices.

**Farm Bill:** Agricultural leaders and federal policy makers should advocate for funds from the farm bill to support GHG-reducing agriculture investments. This assistance could be in the form of direct support, grants, loans, technical assistance to help train farmers and ranchers to use new technologies or practices, or direct capital purchases for new equipment that will reduce GHGs from agriculture.

**State and Federal leaders as well as private investors should develop innovative financing programs, such as loan funds and targeted buyouts of old equipment.**

**Public loan programs:** Some of the climate-friendly practices and technologies discussed in this paper will pay for themselves over time, but farmers and ranchers may need capital advances that they can repay in installments from future savings from these technologies. For example, using less fertilizer or applying irrigation techniques that conserve water will save money. But it may require investment in equipment and training at the outset. A federal revolving loan fund or “green bank” could offer the necessary capital at a low interest rate.

**Public grants and capital support:** Farmers and ranchers who are willing to invest in GHG-reducing equipment and practices should be eligible for government grants and buy-out programs for purchases that will reduce emissions over time. Policy-makers could model such a program on the Carl Moyer Memorial Air Quality Standards Attainment Program, which is a collaborative program among CARB and local air districts to offer grants and financial support to projects that reduce air pollution. For example, similar to the recent federal “cash for clunkers” vehicle-buyback program, the program pays operators of dirty vehicles, tractors, equipment, and engines to purchase cleaner ones and/or install control technologies to reduce pollution. CARB or the federal government could develop a similar program to assist farmers and ranchers willing to install GHG-saving devices such as manure lagoon covers and improved irrigation and fertilizer technology.

**Long-term private investment fund:** Agricultural leaders should advocate for and help create a venture capital fund for promising innovations and programs that could reduce GHGs and yield greater profits for farmers and ranchers. Businesses could repay the investment money with future profits from the new technologies.



## Barrier # 3: Regulatory Conflicts & Permitting Delays

The wave of environmental statutes and regulations adopted in the 1960s and 1970s included many requirements designed to address discrete and often localized pollution problems. In some cases, the technologies and innovations that combat climate change can trigger controls under environmental laws designed to protect communities from air pollution. Greenhouse gas reduction measures may sometimes offer net benefits to the environment by reducing pollution from the energy use. But in other instances, the twin goals of reducing greenhouse gas emissions and localized air pollution may not be easily met. As a result, agencies with jurisdiction over distinct sources of pollutants can sometimes inhibit the research, experimentation, innovation, and implementation that could reduce GHGs. For example, farmers and ranchers who want to experiment with renewable energy generation from biomass or biogas face sometimes complicated regulations that stymie their efforts. And in some cases, the GHG-reducing technologies are so new that farmers and ranchers face inconsistent local regulations and a lack of standardization and guidance at the federal and state level.

### **SOLUTION: Streamline and Consolidate the Regulatory Environment for GHG-Reducing Projects**

Addressing climate change from agricultural sources requires streamlining the state's environmental regulatory regime. The effort must begin with the agriculture industry documenting the most pressing regulatory conflicts at the local, state, and federal levels that impede innovation. Next, representatives of various state agencies involved in agriculture and climate change, such as CARB, CDFA, the California Energy Commission, and the Natural Resources Conservation Service, should form an interagency task force to provide a forum for addressing these regulatory and other policy challenges. The previous State effort, the disbanded Agriculture Climate Action Team (AGCAT), was presumably a victim of budget constraints, but should be resurrected to address this need. The state should also create an ombudsman to arbitrate conflicts among regulations and GHG-reduction goals and enforce statewide standards at the local level.

### **Agriculture leaders should catalog and prioritize the most pressing areas that require regulatory streamlining to encourage innovation.**

**Documenting the problem:** Leaders from the agriculture sector must compile and prioritize a list of the regulations and regulatory problems that impede new GHG-reducing technologies. Critics may suspect that the industry wants to roll back regulatory standards, so a comprehensive analysis of the regulatory burdens, with specific examples, could create momentum for streamlining existing programs.

“There’s no system to resolve conflicting regulations. There’s over-regulation, conflicting regulation, cross-compliance approvals. They’re all impediments to innovation. Government regulators are in silos.”

-- Richard Rominger  
Former United States  
Deputy Secretary of  
Agriculture

“As a regulator, I understand the problem. But we’ve got the Clean Air Act, and the California Clean Air Act, and the principle of no backsliding on emissions. So before we go into this field, we still have to comply with the Act. And a lot of these systems produce NOx emissions.”

-- Dorene D’Adamo  
California Air Resources  
Board

Nonprofit organizations such as Sustainable Conservation have already made progress in tracking these conflicts, and the industry should use this work as a starting point. For example, together with UC Berkeley, Sustainable Conservation researchers have documented the regulatory uncertainty and conflicts associated with methane digesters that burn biogas on-site rather than purifying and selling it to utilities via pipeline for off-site consumption. In California, permit approval for these facilities fall to the state’s myriad air districts, with the vast majority of dairies located in the San Joaquin Valley Air District.<sup>53</sup> These districts must make a determination for each digester on a case-by-case basis, consistent with federal and state air pollution laws. Applying standards that call for use by the industry of the “Best Available Control Technology” (BACT), the air districts require that new facilities demonstrate performance standards “achieved in practice,” have “technological feasibility,” and document “cost effectiveness.” But in some cases, air districts have inadequate definitions governing these key terms.<sup>54</sup> As a result, regulators in these air districts should prioritize efforts to develop standardized BACT guidance for digesters. Stronger guidance will provide greater certainty for dairy operators who want to install on-site dairy biogas-fueled generators without compromising air quality.

**Mobilize politically:** Industry leaders may find coalition opportunities with renewable energy advocates, progressive agriculture groups, and some environmental organizations to advocate for regulatory clarification and streamlining that will encourage GHG-reduction through innovation and new technologies.

**Negotiate with regulators:** Methane digesters may result in an overall reduction of GHG emissions by generating renewable energy that offsets power produced by fossil fuel-based production. However, these digesters produce emissions of nitrogen oxide, which contribute to air pollution in the San Joaquin Valley (which has one of the worst levels of ozone pollution in the United States) and other impacted air basins. Advocates for methane digesters, including nonprofit organizations and representatives from the dairy industry, should work with CARB and the various local air districts and boards to craft a workable solution that would balance the need for more permitting certainty for renewable technologies with the air pollution requirements for local air districts.

**State leaders should create an ombudsman office within state agencies to resolve regulatory conflicts and simplify the permit process.**

**Regulatory Conflicts:** When state regulations work at cross-purposes, an ombudsman with a clear and focused directive should be able to arbitrate among them. The California Environmental Protection Agency has a solutions committee that could provide a model for the ombudsman approach. But conflicting regulations and the current regulatory approach, in which regulators focus only on their jurisdiction and regulated entities, may prevent critical innovation from happening and cause unnecessary delay and expense.

State leaders may be able to rely on the Cannella Environmental Farming Act of 1995 to increase oversight of conflicting regulations facing agriculture. The Cannella Act established a five-member “Scientific Advisory Panel” on environmentally-friendly farming, which has the authority to “research, review, and comment on data upon which proposed environmental policies and regulatory programs are based to ensure that the environmental impacts of agricultural activities are accurately portrayed and to identify incentives that may be provided to encourage agricultural practices with environmental benefits.”<sup>55</sup> This language is potentially broad enough to allow the panel to

review the underlying support for conflicting regulations and recommend methods of reforming them for consistency. The resulting modified regulations may provide the statutorily-required “incentives” to encourage climate-friendly agricultural practices.

**“One-stop shopping” permits:** For projects that reduce GHG emissions, an ombudsman should help create a streamlined permitting process that collapses the multiple permits into one. In addition, the state should have key agencies develop a regulatory process map to guide new adopters of climate-friendly practices and technology through the process. The agencies should also include an information clearinghouse that describes the potential costs, benefits, and funding sources of the GHG-reducing technology. When regulatory bodies such as local air districts have competing standards or definitions, state agencies such as CARB or the California Energy Commission should develop statewide standards to eliminate the uncertainty and inconsistency while addressing the needs of local air districts to control their unique pollution problems. The ombudsman should also ensure that local agencies implement these standards consistently.

### State leaders should promote better use of energy.

**Feed-in Tariff:** The governor, state legislators, California Energy Commission (CEC), and the California Public Utilities Commission (CPUC) should encourage biomass and other on-farm renewable energy production systems by improving the existing feed-in tariff and removing barriers to interconnecting the facilities to the grid. A feed-in tariff, as previously discussed, provides payments that decline over time for certain renewable energy fed into the grid. The existing feed-in tariff, however, provides a rate of payment that is too low to stimulate significant demand. If the CPUC or legislature improved the payment rate and increased the size limit on facilities eligible to participate in the program, the state could stimulate large-scale investment in renewable energy technology, as happened in Spain and Germany under their feed-in tariff programs. In addition, the CPUC and the electric utilities need to assist operators of renewable-fueled generation facilities who have had difficulty interconnecting their biomass and biogas facilities to the grid. They should standardize the interconnection requirements and contracts and require reasonable fees to encourage more participation.

“Many visitors to our [walnut shell biomass] facility have been other farmers. There’s an interest in expanding this among farmers. They’d like to diversify their business, reduce costs, and make money. But as soon as you mention air districts, investor-owned utilities, etc., they don’t want to deal with those entities.”

-- Russ Lester  
Dixon Ridge Farms

**Water metrics:** Federal officials and state legislators and regulators should assist irrigation efficiency goals by supporting research to help farmers measure irrigation performance outcomes rather than total water utilized. For example, the Stewardship Index for Specialty Crops, a collaborative initiative of farmers, environmental groups, and other stakeholders, is considering an on-farm water use efficiency metric that combines different metrics to encourage the best outcomes. The initiative examines metrics such as “Water Use Efficiency” (called “crop per drop”) and “Simple Irrigation Efficiency” (defined as a crop’s water needs relative to the amount of irrigation water applied) so that growers can assess their performance and seek ways to improve. Water regulators should support these efforts to promote more efficient use of water by farmers, while requiring accurate water measurement and accounting to assure the sustainable use of surface and ground-water resources.



## Barrier # 4: Lack of Awareness of Opportunities to Reduce GHG Emissions

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Farmers and ranchers generally are reluctant to adopt new technologies or change their practices without assurance that it will produce results. They tend to perceive investments in new technologies such as renewable energy from biomass or biogas as risky and “not farming.” They also may be unaware of some promising opportunities for solutions that bring cost savings over time.

### **SOLUTION: Promote GHG-Reducing Practices that have Demonstrated Cost-Savings Potential**

Advocates for GHG-reducing technologies will need to promote new practices and technologies while finding ways to minimize the risk for farmers and ranchers. Research and financial assistance are part of the solution, but advocates will need to promote promising methods directly to farmers and provide on-site technical assistance if necessary. Where a method provides cost savings over time, advocates must discover what non-financial barriers are preventing widespread adoption. Where the methods do not pay for themselves or entail significant upfront investment or risk, advocates will need to facilitate financial assistance.

### **Agricultural and state and federal leaders should improve outreach efforts to farmers and ranchers.**

**Local Nonprofits and Universities:** Agriculture leaders should partner with local nonprofit organizations and research groups to promote innovative practices. For example, the Conservation Tillage Workgroup, a project of UC Davis, researches the most cost-effective and sustainable methods of farming and shares the best practices on its website. This type of project and others like it should serve as a model for information sharing and promotion. In addition, the Division of Agriculture and Natural Resources of the University of California, discussed previously, should coordinate outreach efforts to farmers and ranchers across the state, and the agricultural extension program, also discussed previously, could perform this outreach at the state and national level through its extension agents.

**Federal and State Outreach Programs:** Agriculture leaders should persuade policy-makers to develop and implement a program modeled on the European Union’s European Agricultural Guarantee Fund and European Agricultural Fund for Rural Development programs, which provide funding and technical assistance for farmers who comply with standards that promote environmentally- and economically-sustainable practices, among other requirements. A similar program in California and throughout the nation could

“It needs to be simple. Dairy men don’t know solar. You have to be able to pick it off the shelf.”

-- Gary Conover  
Western United  
Dairymen

encourage agricultural businesses to adopt cutting-edge techniques for reducing GHG emissions. It could also serve as a vehicle to promote these methods to farmers and ranchers.<sup>56</sup>

Land grant universities can also deliver knowledge and training to farmers and ranchers. These institutions have an historic charge to develop new approaches and promote them to farmers. However, the service has withered over the years due to lack of funding. The resulting knowledge vacuum allows private actors, such as chemical and fertilizer companies, to promote their products and not necessarily the most cost-effective and environmentally-beneficial ones.

### **Government leaders should provide mechanisms to minimize risk-taking.**

**Insurance Programs:** Climate change advocates and agriculture leaders should lobby the government to implement an insurance program to cover farmers in case of losses from new GHG-fighting technologies and practices. The program would be funded by insurance premiums and function similar to a crop insurance program. This safety net may encourage farmers to adopt innovative technologies and practices without fear of significant losses. The Best Management Practices Challenge, funded by public and private sources, provides a model for such an insurance program. The program reimburses participating farmers for any losses they incur from adopting management practices that conserve resources. If the farmers profit from these new practices, they agree to pay a percentage of their profits back to the program.<sup>57</sup>

**Streamline the regulatory process to avoid “early adopter” penalties** (see previous regulatory discussion).

### **Agricultural leaders must promote climate-friendly practices and production.**

**Climate-Friendly Marketing:** Agriculture marketers should develop an environmentally-conscious marketplace for each commodity. Many agriculture leaders cite the role that winemakers and grape growers played in making sustainable growing practices a selling point for wine. Other commodity growers can take similar steps to market their products as climate-friendly based on their growing practices. Consumers may be willing to pay a premium for this kind of produce (similar to the market for grass-fed beef or cage-free chicken). As a result, this niche marketing may provide additional revenue to offset the costs associated with some of the best practices.

“Agriculture needs to get into marketing agriculture in the environmental marketplace. We can learn from the wine producers how they did it and apply it to ag in general.”

-- Russ Lester  
Dixon Ridge Farms

## **Conclusion**

The agriculture sector in California has significant potential both to reduce its own GHG emissions and to be a source of further GHG reductions through renewable energy production and improved practices. Moreover, the sector has significant incentives to do so, given the risks it faces if climate change is not limited or controlled. To take advantage of this potential, leaders in the industry must reorient existing trade organizations or develop new political coalitions to capitalize on existing cost-effective strategies and future opportunities presented by climate change laws and regulations. They must encourage and prioritize the research necessary to discover innovative, simple, and cost-effective solutions to reduce GHG emissions. Ultimately, the financial investments, research, and progress in implementation that California agriculture makes will benefit farmers, ranchers, and people around the nation and the globe, as well as benefit the state's economy from new technological innovation and job creation. Leaders from the sector and other stakeholder groups now have an opportunity to make California agriculture a global force for fighting climate change.

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## Participant Bios

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### **Dr. Juliet Christian-Smith** **Pacific Institute**

Dr. Juliet Christian-Smith is a Senior Research Associate with the Pacific Institute's Water Program. Her interests include agricultural water uses, comparative analyses of water governance structures, watershed restoration, and climate change. Prior to coming to the Pacific Institute, Dr. Christian-Smith was in Portugal on a Fulbright Fellowship studying the implementation of the European Union Water Framework Directive and examining agricultural water usage in the Alentejo region. During graduate school, she worked on several water policy projects in California through the University of California Cooperative Extension, managing the field work and data collection for one of the first voluntary and empirical studies of agricultural water demand in California. Dr. Christian-Smith holds a Ph.D. in Environmental Science, Policy and Management from UC Berkeley and a B.A. in Biology from Smith College.

### **Dorene D'Adamo** **California Air Resources Board**

Dorene D'Adamo was appointed as the Law Member to the California Air Resources Board (ARB) by Governor Gray Davis in 1999 and reappointed by Governor Arnold Schwarzenegger in 2004. She has served as Chair of the ARB's Task Force on the San Joaquin Valley's ozone plan and as Chair of ARB's Agriculture Air Quality Advisory Committee. Ms. D'Adamo is a graduate of the University of California, Davis (B.A. 1982) and of the University of the Pacific, McGeorge School of Law (J.D. 1986). She currently serves as Senior Policy Advisor to Congressman Dennis Cardoza (California's 18th Congressional District), a position she has held since 2003. She has served on the Governor's "Red Team" for the establishment of University of California, Merced and currently serves on the Valley Coalition for UC Merced's Medical School. She was also appointed by Governor Schwarzenegger to serve as a board member on the Governor's Partnership for the San Joaquin Valley.

### **Paul Dolan** **Paul Dolan Vineyards**

During his 27 years at Fetzer Vineyards, 12 as president, Paul Dolan led a transformation that put the company at the forefront of organic viticulture and sustainable business. With the purchase of Parducci winery and the creation of Mendocino Wine Company (MWC), a partnership of the Dolan and Thornhill families, the mantle of leadership in sustainable winegrowing shifted from Fetzer to MWC, while remaining cradled in the open, creative atmosphere of Mendocino County. His family's involvement in the wine industry extends back four generations through the Rossi and Concannon families. As an undergraduate at Santa Clara University, Paul studied



business and finance. Shortly before he graduated, he wrote a paper on the wine industry (advised by his winemaking uncle, Ed Rossi), and Paul's family legacy came alive. In 1975 he enrolled in the Enology program at California State University, Fresno ultimately receiving a Masters Degree with honors. In 1977 Paul joined forces with the Fetzer family as their first non-family winemaker. Paul resides in Healdsburg, California with his wife Diana and daughter Sassicaia. He spends leisure time in his Mendocino County vineyards and on horseback at Dark Horse Ranch.

### **Allen Dusault** **Sustainable Conservation**

Allen Dusault is the Program Director of Sustainable Agriculture for Sustainable Conservation. He is responsible for renewables fuels initiative which aims to promote sustainably produced biodiesel, biomethane and bioalcohol in California. He also manages a renewable energy program to generate carbon negative electricity from dairy biogas and a greenhouse gas (GHG) reduction program as part of California's Climate Change legislation implementation. In regards to the latter, Allen helped draft sections of the State's Economic and Technology Advancement and Advisory Committee (ETAAC) report, assisted in developing the first greenhouse gas reduction protocol (biogas digesters) in California with the California Climate Action Registry and, with USDA funding, promoted development of California's first carbon offset market. With EPA support, and in collaboration with California's dairy industry, he has been developing the first biomethane refueling stations creating a new biofuel platform for sustainable transportation. He has also been instrumental in getting approved California's first renewable electricity (sales) tariff that also recognizes GHG value of renewable electricity and was instrumental in the development of two net metering tariffs for the California Public Utilities Commission. He is also a Board Member of the California Biomass Collaborative. Allen received a BS in Natural Resources from the University of Wisconsin, Madison, an MBA from the University of Redlands and an MS in Resource Management from the University of Guelph in Ontario, Canada.

### **Cornelius Gallagher** **Bank of America**

Cornelius (Corny) Gallagher is the Global Agribusiness Executive for Bank of America. He is a member of a national team that coordinates management of the Bank's \$20 billion agribusiness and food products portfolio. Corny is the Bank's key representative in dealing with government agencies and elected officials on agribusiness and food system issues. He leads the Bank's Ag Appraisal team that provides appraisal and evaluation services for the Bank. He represents Bank of America on numerous state and national agricultural leadership boards and committees. He was appointed by Governor Arnold Schwarzenegger to the California Exposition and State Fair Board of Directors. He is a commissioner on the UC President's Advisory Commission on

Agriculture and Natural Resources. He is chair of the California Bankers Association Agricultural Lending Committee. Corny is a member of the Food Foresight global strategic trends panel, the Farm Foundation national board of trustees, the UC Davis College of Agricultural and Environmental Sciences, the CSU Agricultural Advisory board, the UC Ag Sustainability Institute and the UC Ag Issues Center Advisory board. He serves on the California Roundtable for Agriculture and the Environment working group. Corny joined the Bank 40 years ago and is a co-owner of his family's six generation Iowa farm. He lives in Fair Oaks, CA.

**Russ Lester**  
**Dixon Ridge Farms**

Russ Lester is co-owner of Dixon Ridge Farms and a fourth generation California farmer. Dixon Ridge Farms is a vertically integrated organic walnut farming and processing operation based in Winters, CA. Dixon Ridge Farms is the largest handler of organic walnuts in the US. Russ began farming organically in 1989 and has helped shape many sustainable organic farming concepts and practices for orchards. An advocate for farmland protection, Russ serves on the Board of Directors for Solano Land Trust and as a member of the California Advisory Committee for American Farmland Trust. He has been a featured speaker at national conferences on farmland protection and organic agriculture. In addition, Russ is past president of the Winters Joint Unified School District as well as a member of the Solano County Agricultural Advisory Board. He attended University of California at Davis and completed a two-year fellowship with the California Agricultural Leadership Program in 2001.

**Paul Martin**  
**Western United Dairywomen**

Paul Martin is Director of Environmental Services for Western United Dairywomen, a trade association representing California dairy families. Mr. Martin received his Bachelor of Science Degree in Agricultural Production (Agricultural Economics) from the University of California – Davis, in 1965 and his Master of Arts in Interdisciplinary Studies (Environmental Policy) from California State University – Sonoma, in 2003. He is a graduate of Class X of the California Agricultural Leadership Program. Prior to assuming his current position with Western United Dairywomen, he was a dairy farmer in the San Francisco Bay Area for 30 years. Mr. Martin has served in various capacities for the dairy industry regarding environmental issues. He is a member of the United States Department of Agriculture - Agricultural Air Quality Task Force and of the National Milk Producers Federation - Dairy Environmental Task Force. He also serves as chair of the Regulatory Committee of Dairy CARES - a coalition of California's dairy producers, processors and support businesses. A great deal of his responsibility in representing California dairy producers is to work with regulatory agencies to ensure that policies of the local, state and federal government are fair, practical, and costeffective.

**David Pegos****California Department of Food and Agriculture**

Governor Schwarzenegger appointed David Pegos assistant secretary of legislation for the Department of Food and Agriculture in 2007. He served as the advertising and promotions coordinator for the California Exposition and State Fair from 2005 to 2006. Pegos previously served as a legislative analyst for the Office of Planning and Research from 2003 to 2005 and as a legislative director for the California State Senate from 2000 to 2003.

**Richard Rominger**

Richard Rominger is a California farmer of alfalfa, beans, corn, rice and other crops, near Winters, California. He headed the California Department of Food and Agriculture from 1977 to 1982 and served as Deputy Secretary of Agriculture under President Clinton from 1993 to 2001. During his tenure, he assisted the Secretary of Agriculture, Dan Glickman, in supervising the USDA, charged with a mission that included management of farm programs, conservation programs, domestic food assistance, research and education and other functions. As President of the Alumni Associations of the University of California, Rominger is serving as an ex-officio Regent for a one-year term beginning July 1, 2005. He was on the board of the American Farmland Trust from 1986 to 1993 and later in 2001. He has been active in a number of professional agricultural organizations concerned with soil and water policy, education, research and development, and was an advisor to several universities in California, including UC Davis and UC Riverside. Rominger received his bachelor's degree in Plant Science from the University of California, Davis.

**Karen Ross****United States Department of Agriculture**

Karen Ross was president of the California Association of Winegrape Growers from 1996 to 2009 and is now with the United States Department of Agriculture. She was also executive director for Winegrape Growers of America, a coalition of state winegrower organizations, and executive director of the California Wine Grape Growers Foundation which sponsors scholarships for the children of vineyard employees. Ross is the editor of the 2003 publication, *California Vineyards and Wildlife Habitat*, that highlights 25 success stories about viticulturists who have found ways to improve productivity and enhance the environment. Ross helped lead the collaboration between her organization and Wine Institute to create the California Code of Sustainable Winegrowing Practices. She is an editor of *The Code of Sustainable Winegrowing Practices Self-assessment Workbook* for the California Wine Community. Ross serves on numerous industry boards, is a gubernatorial appointee to the State Board of Food and Agriculture, where she chairs a committee leading the development of a long-term strategic plan: AgVision 2030, and a

USDA-USTR appointee to the Agricultural Policy Advisory Committee. She is a University of Nebraska-Lincoln graduate and an alumna of the Nebraska Agricultural Leadership Program (LEAD). She and her husband, Barry, own an 800-acre farm in western Nebraska that has been in her family for four generations and is farmed by her younger brother.

**Steve Shaffer**  
**Consultant**

Steve Shaffer is an independent consultant providing services to agricultural and environmental clients interested in improving the economic and environmental performance of agricultural systems, from small farms to state-wide and national organizations. He retired from the California Department of Food and Agriculture in August 2008 as the Director of the Office of Agriculture and Environmental Stewardship, the position he held from November 2000. Steve spent more than thirty-three years at CDFA serving the public, agriculture, and the environment. With support from CDFA leadership, Steve created the Office, comprised of an outstanding group of scientists who address environmental issues related to agriculture using a multidisciplinary approach. In this capacity, Steve represented CDFA on a number of environmental, energy and natural resource management planning, implementation and monitoring activities as they relate to agriculture. Steve served on the Governor's Climate Action Team, the Interagency Bioenergy Workgroup, the Delta Protection Commission, and the Board of Directors of the California Biomass Collaborative.

**Daniel A. Sumner**  
**University of California, Davis**

Daniel A. Sumner is the Frank H. Buck, Jr., Professor in the Department of Agricultural and Resource Economics at the University of California, Davis and the Director of the University of California, Agricultural Issues Center. He participates in research, teaching, and directs an outreach program related to public issues facing agriculture. He has published broadly in academic journals, books, and industry outlets. His research and writing focuses particularly on the consequences of farm and trade policy on agriculture and the economy. Prior to beginning his current position in January 1993, Sumner was the Assistant Secretary for Economics at the United States Department of Agriculture where he was involved in policy formulation and analysis on the whole range of topics facing agriculture and rural America -- from food and farm programs to trade, resources, and rural development. In his role as supervisor of Agriculture's economics and statistics agencies, Sumner was also responsible for data collection, outlook and economic research. Sumner was raised on a fruit farm in Suisun Valley, California and was active in 4-H and FFA activities as a youth. He received a bachelors degree in agricultural management from California Polytechnic State University in San Luis Obispo in 1971, a masters degree from Michigan State in 1973, and a Ph.D. in economics from the University of Chicago in 1978.

**Ed Thompson, Jr.**  
**American Farmland Trust**

Edward Thompson, Jr., is the California State Director for American Farmland Trust. Thompson took over the position in the fall of 2003, having been AFT's general counsel and senior vice president, among the other capacities in which he has served the organization since joining it in 1981, shortly after it was founded. Although he lived on the east coast until moving to California in early 2005, Thompson has long been active in California. He helped draft the state's right-to-farm law and legislation establishing the California Farmland Conservancy Program. He orchestrated AFT's 1995 study Alternatives for Future Urban Growth in California's Central Valley, which helped put farmland preservation on the map in the state's most important agricultural region. And he collaborated with the late Marc Reisner, author of Cadillac Desert, on a study of how more secure water rights for California farmers could encourage farmland preservation. Thompson began his legal career in 1973 as Washington counsel for Environmental Defense (Fund) and has also worked as an attorney-advisor to the National Association of Counties. He earned a B.A. in government at Cornell and a law degree at George Washington University, and is a member of the bars of Maryland, Pennsylvania, the District of Columbia and the U.S. Supreme Court. He and his wife, Ann, live in Davis.

**Paul Wenger**  
**California Farm Bureau Federation**

Paul Wenger was elected president of the California Farm Bureau Federation in December 2009. Wenger, who farms in Modesto, became a statewide officer in 1997 when he was elected second vice president, and became first vice president in 2005. A third-generation farmer, Wenger farms almonds and walnuts on the family farm, which includes property purchased by his grandfather in 1910. His farming operations also include sharecropping, custom farm work and walnut hulling. He has expanded his operation to include processing and marketing of almonds and walnuts through his Wood Colony Nut Co., to provide an opportunity for the fourth generation of the family to vertically integrate into the family farming operation. Wenger attended Modesto Junior College before transferring to Cal Poly, San Luis Obispo, where he earned a degree in animal science. He has been active in community affairs, serving on the Salida Volunteer Fire Department, the Hart-Ransom School Board of Trustees, and the Stanislaus Land Trust and Agricultural Pavilion boards.

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