Innovations in Agricultural and Food Systems Sustainability in California

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ABSTRACT Despite the dominant trends toward farm consolidation and cheap food policies in California, there are many examples of producers who are adopting regenerative on-farm practices and supporting organizations that assist small, beginning, and sustainability-focused farmers to thrive in a challenging environment. Sustainability innovations profiled in this case study are variously related to the three broader concepts of socioecological systems, integrated landscape management, and rural-urban interface. After reviewing these concepts, this case study presents the main barriers to sustainable farming and sustainable food systems, which are identified in interviews with producers. This case study then profiles illustrative examples of economic, social, and environmental innovations at the farm and institutional levels, which have achieved success at overcoming these barriers and are sufficiently documented for sharing and scaling-up impact. Producer innovations to reduce climate and market risks are then classified on a scale continuum. Finally, this case study presents the diverse types and qualities of support available to sustainability-focused farmers and ranchers in California, with clear policy implications for broadening and deepening this support.

KEY MESSAGES
Students who are reading this case will gain the following: (1) an introduction to socioecological systems, integrated landscape management, and rural-urban interface concepts as they apply to sustainable agriculture in California; (2) an understanding of select cases of agricultural sustainability innovations across the three dimensions of sustainability: environmental, economic, and social; and (3) a framework for analyzing support networks and organizations focused on sustainable agriculture.

INTRODUCTION
California’s agricultural industry is vast, with over 400 commodities earning more than 50 billion USD in cash receipts in 2017 [1], which accounts for more than one-third of the vegetables [2] and two-thirds of the fruits and nuts produced in the United States [3]. California has been the birthplace of many innovations in agriculture and food systems increasingly driven by intensifying climate risk and labor shortages, as well as the perennial challenge of cheap food policies. These pressures also contribute to consolidation trends: larger farms are better able to access industrial supply chains, take advantage of government subsidies, and afford costly inputs and technology [4–8]. In 2017, the largest 5% of properties accounted for over 50% of California’s cropland, while 84% of properties accounted for only 25% of cropland [9, 10]. Very high land values in much of the state make land access difficult for smaller and beginning farmers, chasing away a potential new generation of sustainability-focused farmers. While immigrant labor accounts for 90% of labor, very few immigrants own farms (3%) [11]. Consolidation and large-scale operations are coupled with increasing corporate control over production decisions, which generally favor short-term profits over long-term economic, social, and environmental sustainability [4, 12].

The farms and ranches that we examine in California in this article are recognized leaders in direct marketing and regenerative on-farm practices to meet their sustainability goals and reduce market and climate-related risks. They offer an alternative to the conventional farm model that is dependent on fossil fuel inputs and cheap labor.
They also have considerable influence in farmer-to-farmer knowledge exchange in their respective regions and networks. Nevertheless, the social, economic, and environmental benefits of sustainable farming and integrated landscapes are poorly understood by the most conventional stakeholders in the food system. In California, dramatic changes in climate and demographics require strategic rethinking and mobilization to ensure agriculture and food systems that are more resilient. This case study presents results to be added to the growing toolbox of resources for this urgent multi-stakeholder effort.

After reviewing the three concepts that have informed this case analysis, we present the main barriers to sustainable farming and sustainable food systems, identified through interviews. We then provide illustrative examples of economic, social, and environmental innovations at the farm and institutional levels, which have achieved success at overcoming these barriers and are sufficiently documented for sharing and scaling-up impact. Next, we introduce our classification of producer innovations to reduce climate and market risks on a scale continuum. Finally, the diverse types and qualities of support available to sustainability-focused farmers and ranchers in California are presented, with clear policy implications.

CONCEPTUAL BACKGROUND

Since the 2002 World Sustainable Development Summit, there has been wide research and support for global and local transitions toward agricultural and food systems that are less dependent on fossil fuel inputs and are more harmonious with nature in terms of conserving biodiversity and other ecosystem services [13–15]. Debates on whether sustainable agriculture can supply adequate food and fiber for the projected world population in 2050 (9.7 billion) have not led to a definitive conclusion because of widely differing methodologies and ideologies. However, there is increasing evidence that diversified farming systems managed sustainably at the landscape scale are associated with high productivity [7, 14, 16]. For this case study, sustainable agriculture is defined as an integrated system of plant and animal production that is site-specific, conserves the health of surrounding ecosystems and produces in sync with natural systems, is economically viable, and enhances the quality of life for farmers, farmworkers, and society as a whole [17].

Sustainability innovations in agricultural and food systems analyzed in this case study are situated within three broader concepts: socioecological systems (SES), integrated landscape management (ILM), and the rural-urban interface. SES is rooted in the understanding that human behaviors profoundly affect and shape the biosphere and that human welfare is inextricably linked with the capacity of the biosphere to sustain humans [18–22]. Farmers committed to environmental sustainability are attuned to this perspective, which guides their sense of responsibility and behavior within the confines of the economic systems in which they operate. For instance, this sense of responsibility manifests itself in practical considerations of soil health. One farmer referred to the soil as a “thin blanket covering our planet and separating us from life and death” [23].

An application of SES to agriculture and food systems is the ILM of rural localities [24–26]. ILM is a scientific and governance framework that addresses the conservation, production, and livelihood priorities of stakeholders within a specific rural region. It requires a functioning multi-stakeholder platform to convene and address the diverse, and sometimes conflicting, interests in the landscape [27]. Successful platforms typically blend innovative marketing and financing with the scaling-up of farm-based agroecological practices to meet landscape objectives [27, 28]. An example profiled later in this case study is the non-governmental organization, Capay Valley Vision, which has been working since 2000 to bring diverse Valley constituencies together to develop a regional vision and branding around the common goal of sustainability.

The rural-urban interface is a concept that captures the heterogeneous mosaic of natural, agricultural, and urban systems connecting urban and rural geographies [29, 30]. “Urban-edge” agriculture and green belts supply cities with fresh food, flood protection, economically efficient water filtration, and sediment retention among other ecosystem services [31], pp. 2–5. Comprehensive analyses of the food system in a particular rural-urban interface, such as the nine counties of the San Francisco Bay Area, examine the food chain sectors in relation to wider regional goals, such as job development, community health, climate change, and cultural revitalization [31, 32], pp. 2–5. These analyses play a vital role when confronting urban encroachment on agricultural land. For example, the partnerships that developed the Santa Clara Valley Agricultural Plan (SCVAP) have been instrumental both in conserving Coyote Valley from urban encroachment and in long-term planning for a multi-functional sustainable landscape.
1. How do selected producers and support organizations view sustainability?

**CASE METHODOLOGY**

Researchers at the University of California, Berkeley conducted primary research with selected farmers, ranchers, and support organizations to understand the perceived barriers to sustainability and to analyze successful on-farm and landscape-scale innovations primarily to address climate and market risks. The research team conducted 6 in-depth interviews with local producers and 13 interviews with individuals representing 12 different organizations (Table 1), who are working to support diverse sustainability goals, such as climate change mitigation, healthy and affordable food supply, and biodiversity-friendly farming. In addition, researchers visited Coyote Valley, adjacent to the City of San Jose and Silicon Valley, and thereafter met representatives of the Open Space Authority and Agricultural Planning Department of Santa Clara County to discuss the innovative rural-urban interface initiative—SCVAP—featured later in this case study.

Farmers and support organizations were chosen based on their meeting at least two of the three following criteria: (1) previously established research relationships, (2) snowball recommendations from initial “key informant” interviews, and (3) recognized in the literature as sustainability innovation leaders (farmers/ranchers) or support organizations serving these groups of stakeholders. The research protocol was reviewed and approved by the Office for the Protection of Human Subjects, UC Berkeley. Since there are some risks associated with interviewing undocumented farmers/farmworkers, we elected to interview only staff members of the Agriculture and Land-Based Training Association (ALBA), the one surveyed support organization that works closely with undocumented residents. Interviews were divided into four different scales, such as producer, regional, state (nonprofits and government agencies), and national/international, although some of these stakeholders operate across multiple scales. Narratives from transcribed interviews, field notes, and follow-up communications were analyzed to identify patterns in sustainability practices and common themes in the stated barriers, as well as to develop an original framework for understanding producer—support organization linkages. An initial inventory of the innovations captured was sorted out by their primary contribution to “environmental,” “social,” or “economic” dimensions of sustainability, with some overlaps.

“Producer” and “organization” questionnaires guided each semi-structured interview and these questionnaires are available in the Supplementary Materials. Interviews were conducted in person ($n = 17$) or through Skype ($n = 2$). Data were collected on the following three research questions:

1. How do selected producers and support organizations view sustainability?
2. What are their perspectives on current barriers to sustainability?

3. What sustainability innovations are producers and other stakeholders adopting in response and why?

**Barriers to Sustainability**

The main barriers expressed by the interviewed producers originated either from relationships with the market or the government (Table 2). Market barriers, such as “cheap food” policies that favor urban consumers, highlight the need for more transparent disclosure of environmental costs in conventionally produced foods and for raising consumer awareness of the benefits of sustainably grown food. Government barriers, such as food safety regulations that curb animal life and riparian vegetation on farms, can defeat a farmer’s biodiversity goals with little evidence that such practices present a real danger to food safety. Farmers nearing retirement are also keenly concerned about the continuity of their sustainability practices by the next generation; their children often choose urban living over the farm and new entrants are discouraged by high land prices and equipment, especially in California [8]. Policy suggestions to increase the sustainability of the food system have included banning dangerous pesticides, reducing reliance on fossil fuel inputs, raising farmworker wages, and expanding cooperative marketing, among many others [33]. Analyzing the priority issues identified by farmers provides an opportunity to reimagine government policies and market relations to support sustainable practices completely. For more information on barriers to sustainability, see Carlisle [34], Brodt et al. [35], Iles and Marsh [5], Constance and Choi [36], and Carlisle et al. [8].

Selected quotes provide further examples of farmers’ perceptions on key sustainability barriers (Table 2).

**Economic Sustainability: Capay Valley Farm Shop**

Several producers identified market demand for cheap food and the policies that support cheap food, such as government subsidies for fossil fuels and select commodities, as the primary drivers of unsustainable production. The cultural perception of appropriate food prices is driven by many factors and reinforced by an industrial, input-based farming model that is inherently extractive and unsustainable. As Dave Runsten, Policy Director at Community Alliance with Family Farm (CAFF), points out, real farm prices have declined as a result of a “conscious government policy in the US over the last 100 years to cheapen food, [so that] people will have more money to spend on other things. It’s an urban driven policy.” These policies were clearly codified in the 1970s and embodied by Secretary of Agriculture Earl Butz’s famous mantra to “get big or get out” and his instruction to farmers was to plant “fencrow to fencerow” [17]. These policies encouraged farm consolidation and pushed many small to medium scale farmers off the land to drive down food prices [38]. Many agricultural sociologists argue that the desire for cheap food is further promoted by the separation of social and environmental values from the food that consumers eat and is exacerbated by the divide between urban consumers and rural producers [39, 40].

Innovative producers in California have tackled this challenge by reaching consumers directly through alternative supply chains that enable farmers and consumers to communicate their sustainability practices and desires [41] while fostering healthy agro-ecosystems and re-embedding some of the social and environmental values back into food [40]. The Capay Valley Farm Shop is one such innovation. Over the past 30 years in the Capay Valley of Yolo County, located less than 100 miles from high-value markets in the Bay Area (Figure 1), there has been an active movement by local farmers, ranchers, and community organizers to conserve the rural landscape, revitalize local communities, and support ecologically sound agriculture through an integrated landscape vision supported by the non-profit organization Capay Valley Vision. The Valley has capitalized on its regional identity as the producer of sustainably grown, high quality produce (through the “Capay Valley Grown” label) (Figure 2), to pioneer a number of innovative direct marketing channels with individuals, restaurants, schools, farmers markets, and more recently, corporate chefs, cultivating loyal customers willing to pay a “fair price” for their produce.

The Capay Farm Shop operates as a for-profit, quasi cooperative with a board informing its direction. Today, almost 80% of its business is concentrated on corporate food service for the tech industry, including companies such as Airbnb and Google, where chefs prize reliably high quality produce. The Farm Shop aggregates products from over 40 local farms, offering warehouse space, transportation, price transparency, and a “harvest to order” model, optimizing both freshness and efficiency. As Thomas Nelson, the Founder and President of the Farm Shop, said,
TABLE 2. Producer perceptions on barriers to sustainable farming.

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<th>Barrier</th>
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| Cheap Food                    | It’s kind of crazy that you can buy a whole chicken for $10 at Costco. How is that possible? It sets up a false belief that chicken needs to be super cheap [due to the way its subsidized]. That is part of the problem. It sets a standard of what people are willing to pay. Among industrialized countries, we spend the lowest percent of our income on food, and there’s no discussion about whether that should change.  
  *Alexis Robertson, Skyelark Ranch* |
| Food Safety Regulations       | They (regulators) don’t want to see hedgerows and weedy borders that perhaps support more life but looks un-kept. They’re driving farmers to a more sterile farm environment.  
  *Paul Muller, Full Belly Farm* |
| Government Bureaucracy        | Government programs are hard to navigate and time consuming to apply for.  
  *Paul Muller, Full Belly Farm* |
| Conventional Culture and Mindset | In general, I think there’s a mindset about how we do things. And a lot of people have a lot of money invested in that - in equipment. We’ve simplified our operations and practices. The culture is focused on equipment, machinery, and making it linear - it’s a factory model.  
  *Kelly Mulville, Paicines Ranch* |
| Lack of Capital               | Mostly just a function of capital. There’s nothing inhibiting me from doing anything, just the ability to afford the tools. A no-till drill is $30,000 used.  
  *Spencer Smith, Jefferson Center for Holistic Management* |
| Attracting Young Farmers      | . . . None of our kids want to do it. If we sell it, we’d sell it as a lifestyle place, but it would be much better to sell it to young farmers. There needs to be some program that allows young people to connect in a way that lets them sell to developers.  
  *Jim Durst, Durst Organics* |

“The reason we exist is the belief in local food. Embedded in that is the belief that local food systems are inherently more sustainable, more resilient. People need to know where their food comes from if we’re going to have any sense of responsibility to help protect [sustainable local food systems].” The movement to raise awareness about local food has had long-term support from CAFF and its “Buy Fresh, Buy Local” campaign.

By aggregating the harvest from many farmers, the Farm Shop can provide its customers with bulk quantities unrealistic for one small scale diversified farm. This enables producers to stay diversified and avoid the full force of market pressures to consolidate farms and specialize in one or a few crops. For participating farmers, crop diversification strengthens economic resiliency as their farms have multiple income streams and are protected in the case of a specific crop failure or dip in market price. Furthermore, diversification adds to the environmental health of the larger agroecosystem, as livestock, row crops, grains, flowers, and orchards all foster different beneficial relationships with soil ecosystems. At Full Belly Farm this diversification has facilitated several on-farm enterprises employing the children of the original owners, such as catering businesses, event spaces, and making value added products from traditional wastes streams like jam from misshapen fruit.

**Social Sustainability: ALBA and FarmLink**

In the United States, the average age of farmers has increased from 50 years to 58 years over the past 30 years, and today only 2% of the population is directly engaged in agriculture [42]. Many producers spoke about the lack of next-generation farmers and shared stories of their children leaving the farm to pursue more lucrative careers in urban areas. As established farmers continue to age, the question becomes how to attract new generations of farmers.

The ALBA located in the Salinas Valley, Monterey County, is one organization addressing this issue (Figure 3). ALBA is an organic farm incubator with the mission to create economic opportunities for limited-resource and aspiring organic farmer entrepreneurs [43], nearly all of whom are
first or second-generation immigrants, mainly from Mexico [44]. It is one of a growing farmer incubator initiatives in the United States aimed at reducing the entry barriers for new farmers [5, 8, 45, 46]. ALBA provides an intensive hands-on 10 months training course in organic horticulture practices and farm management techniques. Trainees spend 1–4 years trying out their new farming skills on ALBA-owned land and equipment, increasing their share of costs each year, before launching into competitive farming [5].

The multiple supports and gradual launching are essential for aspiring low resource farmers given the very high price of land and equipment in Salinas Valley and steep competition from established growers [46]. ALBA is working directly to address the intergenerational issue by empowering farmworkers. As Education Program Director Nate Harkleroad said, “when you look at who has the work ethic and skills to do the work, it’s the farm workers. At least they can be a major part of the next generation. The folks that come here to ALBA are farmworkers from Mexico, they have farmed in Mexico, so they have skills and a background they bring with them. What we find is that with the right kind of additional training, we can support folks who can go on to be successful farmers.” Over 400 trainees have graduated from the ALBA course and 120 have completed the farmer incubator program. Many graduates have achieved their dream of becoming farmer entrepreneurs producing organic fruits and vegetables, while others use their training to obtain higher paid skilled jobs within large farm operations. Calo and De Master’s interviews with ALBA graduates show that the primary motivation for becoming farm owners is achieving autonomy in their work. Others express a preference for organic production methods due to health and environmental concerns and others stated that farming independently allows many to imagine a better life for their children and grandchildren [46].

ALBA partners with FarmLink, another California-based support organization. Executive Director, Reggie Knox explains that their mission is “to help farmers access land and capital. In particular, the farmers who are...
FarmLink provides a listing and matching service between landowners and farmers looking for land, offers loans at discounted rates due to their status as a Community Development Financial Institution, and facilitates financial literacy workshops and support for negotiating fair lease terms, particularly for immigrant applicants. They provide approximately 50 loans a year, 70% of which are to Latino farmers, 90% of their loans are for organic production, and 20% are provided to ALBA graduates [47].

Environmental Sustainability: CalCAN, SAGE, and SCVAP

In California, water scarcity and climate change are interconnected and are major concerns for agriculture as well as the coastal urban areas from San Francisco to San Diego. For many farmers in California and globally, “climate smart” water and soil conservation practices are seen as necessary for survival, not an option. There is also increasing recognition among climate scientists that the adoption of sustainable land-use practices at scale can significantly mitigate global warming through reduced emissions and carbon capture [26, 48–50] (Figure 4). In recent years, the State of California has created several programs to incentivize farmer and rancher adoption of emissions-reducing and soil and water regenerative practices using funds from the state’s “cap and trade” initiative (e.g., Sustainable Agriculture Lands Conservation Program, State Water Efficiency and Enhancement Program, Healthy Soils Program, and Alternative Manure Management Program) [51, 52]. The California Climate and Agriculture Network (CalCAN), a collaborative alliance of NGOs involved in sustainable agriculture and climate change activism, has lobbied effectively for these programs and for increased and more secure budget allocations, as well as for technical advisors to assist small operations and immigrant farmers to navigate the bureaucratic hurdles to access these funds. As Jeanne Merrill, Policy Director at CalCAN, said, “the coalition wanted to help inform the state’s implementation of AB32 (Global Warming Solutions Act) and to forward sustainable ag solutions to climate change...” [51].
Increasingly, urban governments are seeking partnerships with peri-urban farmers and ranchers to jointly protect land and associated ecosystem services from destructive development, meet greenhouse gas reduction goals, and create economic value. The partnership of Santa Clara County and the Open Space Authority for Santa Clara Valley, resulting in the adoption of the SCVAP in 2018, is a notable example of such a partnership in the heart of Silicon Valley. The Plan aims to protect the 5,600 acres of prime farmland soils in Coyote Valley just south of the city of San Jose through fee purchase, conservation easements, and voluntary incentives [53]. The SCVAP’s detailed maps have helped to set conservation priorities by (1) identifying agricultural lands most at risk of development and (2) assessing their economic value and environmental co-benefits, such as habitat linkages, floodplains, and groundwater recharge [54] (Figure 5). The County also intends to partner with ALBA to open up affordable land leases for immigrant organic farmers.

The SCVAP drew heavily from the foundational study “Coyote Valley Landscape Linkage: A Vision for a Resilient Multi-Benefit Landscape,” prepared by the Santa Clara Valley Open Space Authority in collaboration with the Conservation Biology Institute [55]. The study’s findings and discussions were essential to overcome major opposition to conservation easements and agriculture protection from commercial development and housing interests, a classic “urban-edge” struggle. Kraus [56], Executive Director of Sustainable Agriculture Education (SAGE), believes that understanding the economics of the local food system for San Jose and surrounding communities were, and remains, pivotal for convincing residents and the local government to forgo the short-term gains of development. “While we’re there in Coyote Valley picturing a multi-functional agricultural and conservation landscape, the city was still picturing jobs and housing and not thinking about food systems at all. So we turned to the city and said, we’d like to take a look at your food sectors holistically across the supply chain and in terms of the City’s own goals for economic development, environmental sustainability, public health and sense of place.” SAGE got support to undertake this analysis and the result was the 2016 San Jose Food Works study [57].
Whether or not the SCVAP will be fully implemented largely depends on the County and the City of San Jose allocating sufficient funds over time. Meantime, the emergence of the Coyote Valley as a permanent multifunctional landscape is strongly advocated by the community mobilization and campaign activities of the “Save the Coyote Valley” movement. “We need to take action to preserve this remarkable place for people, wildlife and our environment” [58].

**DISCUSSION**

Strategies to overcome barriers to sustainability were identified during stakeholder interviews and are compiled in Figure 6, representing practices common among small to medium size sustainability-focused farmers in California, but which are not typical of the farming sector as a whole. We found that producer sustainability behavior is largely driven by climate and market-related risks. Innovations aimed at addressing climate risk are often intended to mitigate on-farm impacts and emphasize regenerative soil practices and nutrient cycling, including cover cropping, integrated animal and crop systems, rotational grazing, and other practices that increase the ecological resilience of the agro-ecosystem. Beyond the farm level toward landscape and regional scales, strategies to study, share and incentivize regenerative practices are increasingly important as well as regional collaboration and branding around common goals for the landscape. These include farmer to farmer workshops, collaborative research with universities, and participation in various government incentive programs. The innovations aimed at addressing market risk include “stacking” enterprises (referring to the addition of new farm products with minimal extra costs), strategically adding value, and diversification of crops, livestock, and direct markets. Although producers in California typically act independently of each other to manage climate and market risk, organizations that facilitate collective
producer action and mobilize government support are integral to scaling and multiplying impact.

Our interviews suggested that producers are also committed to social sustainability practices on-farm and in relationship with their local communities. Several farms purposefully organize their production and business cycles to employ year-round labor with livable wages and health benefits, providing greater security for farm-worker families and allowing them to settle in nearby rural communities and participate in community life. Most of the mid-size farms contract short-term additional labor at harvest, often attracting the same crews from year to year because of mutually respectful relationships and above-average wages. Farmers also donate surplus produce to local food banks regularly.

It is interesting to conjecture under what conditions the sustainability innovations presented in this study might spread and scale to make a difference in the wider Californian agricultural landscape. Producer—support linkages (limited to our interviews and not exhaustive) signal where beneficial relationships could be strengthened and barriers addressed (Figure 7). For instance, “farm to fork” consumers have driven strong growth in locally produced and “harvest to order” market practices, as in the Capay Valley Farm Shop example, but their overall impact is small compared to the overwhelming downward pressure the conventional markets exert on food prices, driven in part by “cheap food” expectations. Another example is the role of the government of California and the innovative programs established to incentivize conservation of working landscapes and sustainable agricultural practices, sharing of investment costs, and subsidizing of ecosystem services. At the same time, producers point out bureaucratic difficulties in accessing these funds, especially for smaller farmers. Moreover, government budget allocations need to be approved.
annually, making the lobbying efforts of organizations such as CalCAN and CAFF crucial for participating farmers. Institutions working on applied research, such as the University of California Cooperative Extension, help disseminate new research on topics ranging from pest management to farm economics, often tied to particular commodities. Although UC Extension now employs a few research advisors specialized in sustainable and organic production, historically and today, research programs have been focused on conventional, large-scale production. Furthermore, extension agents are stretched thin by covering large geographic regions and are unable to reach many small and beginning farmers.

Some of the highest impact institutional innovations are those that breakthrough barriers to access of land, financing, and training, such as ALBA at the regional level and Farmlink at the statewide level. More broadly, successful support organizations are those that work closely with farmers to address their climate and market risk challenges while pressing for structural changes at a higher scale to create a fairer playing field. These organizations work as follows: create and support farmer to farmer networks; facilitate aggregation and supply chain services; provide access to land, credit, and financial education; facilitate market and crop diversification; and advocate for government incentives to support sustainable working landscapes, especially those adjacent to urban areas and at high risk of development. These services are especially relevant to small and medium-diversified producers in California who receive limited or no government support and operate almost entirely in an open market.

**CASE STUDY QUESTIONS**

1. Discuss how the concepts of socioecological systems, integrated landscape management, and the urban-rural interface help to understand the key sustainability challenges in California’s agriculture and food systems. Research one of the three concepts to arrive at a fuller definition, real-life examples, and relevance for a particular innovation profiled in this case.

2. Choose one of the three sustainability components discussed (economic, social, and environmental). Identify and describe the main factors that contributed to the success of sustainability innovations. How did producers and support organizations collaborate to further their respective sustainability missions?
3. Select two profiled sustainability innovations and discuss potential challenges to scaling them to other farms and rural communities in California. What types of support may be needed to overcome these challenges?

4. Discuss the major threats to agricultural sustainability from urbanization and urban development. How can farmers and support organizations leverage the urban-rural interface to identify new opportunities for co-existence and collaboration?

5. Who will be the next generation of farmers in California? Discuss the issues related to the intergenerational transfer of land and farming enterprises. Design a farm transfer system that takes advantage of the talent, work ethic, and availability of immigrant and refugee populations.

AUTHOR CONTRIBUTIONS
RM led the field research and co-facilitated the interviews. ME and RM contributed equally to background research, text analysis, and write-up of this case.

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COMPETING INTERESTS
The authors declare that no competing interests exist.

SUPPLEMENTARY MATERIAL
Slides S1. On-Farm Sustainability Innovations and Institutional Support: Examples from California.pdf.
Text S1. US producer questionnaire.pdf.
Text S2. US organization questionnaire.pdf.

REFERENCES


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