Comments on: *Climate Resilience Strategy for California Agriculture*

Stephen Kaffka
November 20, 2025

These considerations form the basis for my comments about the draft *Climate Resilience Strategy for California Agriculture* recently released by CDFA.

CDFA performs many worthwhile services and functions that support the state's agricultural economy. These include programs that maintain standards, weights and measures, data collection, support for commodity groups, and prudent climate related programs like the FREP, DDRDP and AMMP. These have helped sustain the productivity and increasing efficiency of agriculture in California, including decreasing levels of CO2 emissions required to produce the diverse array of foods grown in California. For perspective, emissions from agriculture are estimated as approximately 8% of total state emissions. This estimate does not account for wildfire carbon emissions or potential losses of soil carbon from the SGMA program resulting from fallowing previously irrigated lands, for example, so total emissions are likely to be a smaller percentage than 8%.

More importantly, declining trends in emissions per unit product have been occurring in California agriculture long before any specifically climate-focused policies were enacted and will continue to occur if the sources of these emission declines continue to be supported. These include farmer innovation, technological innovation from supportive industries, and the state's land-grant system of basic and applied research, linked directly to extension and public outreach. The UC Davis campus and the related ANR cooperative extension system has been the most important sources of publicly supported improvements in agricultural productivity and efficiency.

Any new programs or emphasis at CDFA should be judged based on whether they sustain and support these proven and successful processes leading to adaptation or instead impede them. If new programs or emphases nominally focused on climate compete with and divert support from these primary sources of progress in agriculture, or weaken CDFA's core supportive functions, they should be reconsidered.

Care also should be taken not to consider the state's agricultural emissions only as part of the state's carbon budget. California agriculture has a significant role in food production nationally and internationally. Climate, soil, water, infrastructure and human capital support highly productive and efficient production of essential foods and related agricultural products in California. The state's agriculture is among the most efficient and productive in the world, with correspondingly low emissions for the many important types of foods produced. Given California agriculture's large role in national and international food production, limiting attention only to efforts to reduce carbon emissions within the state may be outweighed by increased emissions elsewhere resulting indirectly from policy choices in California that limit innovation and reduce productivity. Policies which sustain or increase this productivity are climate-smart by definition, policies which reduce it are the opposite. A policy which seems to improve the state's carbon balance may inadvertently have negative consequences on agricultural production and the environment outside of the state's boundaries. Policies and programs discussed in the Strategy should include consideration of the

state's role in providing important foods beyond the state's boundary. The state's transportation policies routinely include such considerations. So too should its agricultural policies.

General Comments

CDFA has developed a climate-focused strategy for the state's diverse agriculture that reflects the constraints of California's unusual political culture and legislative and executive mandates. In many ways, the state's political climate is exceptional. Absent in California is significant public policy debate, characterized elsewhere by divergent views, compromise, tradeoffs and alternation of political power. Analysis is constrained *a priori* by the assumptions and preferences that stem from the state's dominant political culture. Consequently, some alternative ideas and projections about the role and future of agriculture in the state and policies to support and strengthen the state's agriculture are likely to remain unexamined, underemphasized, or simply ignored, even if they might be more effective approaches to climate-related changes.

Unacknowledged assumptions and preferences are present immediately in the report. On Page 3 several assumptions (properly hypotheses) are stated as if they were facts:

"*Climate change is affecting all aspects of agriculture, and protecting our food system requires a concerted response*."

Hypothesis 1: *Climate change is affecting all aspects of agriculture*. This is only true in the sense that climate always and everywhere affects agriculture, variably from year to year. But it is untrue that there is a significant climate signal substantially altering agricultural practices in the state to date. While winter temperatures in parts of the state are modestly warmer, other effects cannot be attributed reliably to climate change in the commonly intended sense of increasing average temperatures. While there has been no systematic study of yield trends for all the diverse crops produced in the state, my perception is that yields have not declined, and in some crops continue to slowly increase. There were several years of below average rainfall in the last decades, but also some years of above-average rainfall or approximately average rainfall. Climate models offer conflicting predictions of both increased and decreased precipitation in the future. Adverse effects on agriculture in the state during low rainfall years resulted from a combination of precipitation levels and public policy (i.e. political) choices about the management of available water during those years, not simply due to precipitation levels alone. This will continue to be the case in the future. Higher winter minimum temperatures have reduced winter chilling hours, apparently affecting optimum locations for some deciduous tree species. But increases in atmospheric CO2 otherwise are largely beneficial for crop growth (especially C3 crop species) and can outweigh adverse effects of modestly warmer winter temperatures, some of which are also beneficial for winter crops generally.

However, the claim that all aspects of agriculture are adversely affected by projected climate change is simply an unsupportable exaggeration. Mixed effects have been observed, but mostly proposed, often based on assumptions embedded in modeling studies (page 21). The degree of potential (model-based) losses depends on the future climate scenarios chosen as a basis for evaluation, many of which use worst case assumptions. Moderate assumptions about future emissions result in less severe estimates of potential adverse climate effects. These differing

assumptions result in different judgements about the investments and sacrifices needed to meet future climate challenges.

It is unlikely that gradual changes in winter temperatures will create problems for agricultural producers that continued investment in research and outreach will be unable to address. With respect to water supply, other jurisdictions have been able to address chronic extreme water scarcity via recycling, conservation, improved infrastructure and desalination, under conditions likely more severe currently than the uncertain forecasts of future water scarcity in California. Investing in all these actions to ensure water surplus is a certain resilience strategy. The Climate Resilience Strategy, appropriately, supports some of these investments, but underemphasizes desalination, which holds significant promise.

The effects of regulation are far more important to the sustainability and financial well-being of farming enterprises in the state than the modest warming trends observed to date (Page 35). Regulatory rationalization is mentioned in the report and is properly emphasized.

Hypothesis 2: California has a "*food system*." Many crops are grown in California. It is the most agriculturally diverse region of the world and has a unique role in food production nationally and internationally. This is highlighted on pages 15 and 16 in the report. But agriculture in the state constantly evolves and has always done so due to a diverse set of influences. On page 17, the report highlights the leadership of California farmers in technology adoption and innovation, one important source of change.

This use of the term "system" here is meaningless in a strict sense. The state does not have a "food system" *per se,* one subject to manipulation or improvement by a central planning entity. There is no single food system in the state, rather there exists a collection of regionally adapted crop and livestock enterprises, with varying degrees of interconnection and dependency. This is pointed out starting on page 14 in the report. As evidence, there have been large changes in the relative positions or importance of major crops and livestock enterprises in the state in the past and this continues, absent central planning and industrial policy.

Food production in California is a public good, but not in the sense that it is "ours", i.e., owned publicly or collectively. In apparent self-contradiction to the idea of a single food system, the report itself highlights this reality. On page 9 the report notes that there are 63,000+ farms in the state, 90 % of which are privately owned. The state does not own its agriculture in a way that allows it to direct the choices made or plan the future of these diverse enterprises. Such false notions can result from poor uses of language, in this case the use of the word "system" to apply to the state's highly diverse and innovative agriculture.

The third hypothesis or assumption follows from this poor use:

Hypothesis 3: the state needs a "concerted response." The idea of a concerted response follows from the notion that there is a system that can be planned and directed. But the state's impressive agricultural output did not result from any central planning process and continues to evolve and improve in the absence of such a process. As noted above, CDFA provides many important supportive services to agriculture which aid the practice of farming. Incentive programs for specific

public objectives which require expensive investments (like the DDRDP) but improve overall functioning and reduce pollution from farming are sensible and might be expanded.

Regulatory rationalization is a key to climate resilience for the state's agriculture. That may be the most appropriate and productive area for a concerted response on the part of state agencies. But current circumstances are discouraging. There is little evidence that state government is capable of creating structural improvements in agriculture as practiced and as it evolves given many obvious and serious problems in the state that have their origin in state policy choices over the last several decades (housing shortages, the very high cost of living leading to the highest incidence of poverty in the nation, catastrophic wildfire threats and conditions, inadequacy of water supplies, the cost of energy, and others). Perceptive criticism exists that in combination, the collection of state policies reflects a very narrow set of interests and concentrated power in limited, unrepresentative groups, resulting in a two-tier society that disadvantages a large and growing underclass in the state. This underclass is overrepresented by people of color, especially in the rural, agricultural regions of the state. People in these groups and locations are identified for particular concern in the report. It is unclear how effective new CDFA programs can be in the larger context of California's political climate, itself the origin of many public policy problems, and seemingly refractory to fundamental change.

Comments on Individual Chapters

Chapter 1: (page 28 ff). Foster a robust and sustainable agricultural economy. California's agricultural economy has been both robust and sustainable up to the present. Will it remain so in an increasingly regulated future? Will state programs which attempt to direct the evolution of the state's agricultural economy be successful? Why should we expect success?

The recommendations for research and outreach highlighted in the chapter already are the focus of agricultural research and outreach in the state. If these efforts continue to be adequately supported, based on past experience and reasonable expectations for innovation, the goals listed will be achievable.

Carbon sequestration and other forms of carbon crediting are discussed in the chapter. This is an area for innovation but also one where significant cost/benefit analysis is required. It cannot be assumed that carbon sequestration *per se* will be beneficial compared to the financial costs or impediments to agricultural productivity growth that may occur inadvertently or even consciously from programs emphasizing sequestration over other agricultural objectives.

National and international collaborations can be beneficial, occur commonly in agriculture as part of the worldwide exchange of science and technology, and should continue to be supported as recommended in the report.

The dispersal of responsibility for different climate-related programs across diverse state agencies is mentioned and has been a long-term issue in the state, much predating this report. Better integration is desirable, as stated in the report. It's not clear how this can be achieved in practice.

Chapter 2: (page 88ff). Ensure a water system for food system resilience in a hotter, drier future.

On August 18, 1962, President John Kennedy, accompanied by Governor Pat Brown and many other public officials presided over the groundbreaking for the San Luis Reservoir (completed in 1967), a joint federal and state water abundance project. The provision of a secure and adequate water supply for agriculture was considered then to be an important public priority. The dam helped ensure surface water for irrigation to avoid overuse of groundwater in the western San Joaquin Valley and elsewhere, while insuring an abundant agricultural economy, leading to today's current abundance.

Over the last decade of the twentieth century, and especially in recent decades, the provision of surface water to agriculture has declined in favor of other uses. Recently, groundwater use has been curtailed through SGMA, especially in the San Joaquin Valley, further reducing resilience. The state and federal governments, once focused on abundance, now focus on scarcity and rationing of water supplies to agriculture. Inevitably, total agricultural output will decline. It is unclear how CDFA's draft plan will change this fundamental reality. Resilience is inescapably connected to the financial well-being of farm firms in the state. Water scarcity undermines that well-being.

It is not certain the future will be drier. Some climate models predict a wetter future for the state, though drier conditions would be more challenging. Predictions include forecasts of greater storm intensity, displacement of winter runoff periods, and related challenges for water management. While it is recognized that large-scale climate models are poor at predicting regional future outcomes compared to global level trends, preparing for drier or more erratic conditions is prudent.

The state's agricultural economy is dependent on irrigation. If sustaining water supplies for agriculture is important, then programs that focus on certainty and adequacy of supply like increased water conservation during wet years and high flow periods, retention of larger amounts of water originating in the central valley for use in that region, including recharging groundwater, support for drainage water reuse, and significantly increased use of desalination for water supplies in coastal cities now dependent on central valley water all should be priorities in a climate resilience plan. All these prudent adaptation strategies are within the realm of choice.

In each of these areas, the state has been negligent. Several storage and water conveyance projects are mentioned (page 79-80). These are needed but in most instances have been characterized by inaction, effective political opposition and years-long delay. In effect, the state's actual policies seem to lead to increasing scarcity for all types of water users, but especially for agriculture. This reflects the constraints imposed by California's political environment on water related issues for agriculture. It is not clear how the agency's plan affects those circumstances.

Responsible nutrient management (page 85). The term responsible is vague, and subject to subjective judgement. Improving nutrient use efficiency has been and remains a pathway to better human and climate-related outcomes. CDFA's FREP program and the new Dairy Plus Program support improved nutrient use. Continued support for these and related research and development efforts at CDFA , especially within the state's land grant universities will remain the best strategy to achieve resilience to uncertain or erratic weather events and gradual climate trends.

Water use efficiency. Significant advances in water use efficiency have characterized California's agriculture. The state is known for its leadership in this area. These advances come from farmer

innovation, related agricultural industries, and the research and outreach efforts of the state's land grant system. These remain the best sources of adaptation and improvement in the future. A Climate Resilient Strategy should emphasize these sources. Supporting these processes both now and into the future should be the foundation for CDFA's climate resilience strategy.

Chapter 5 (page 111ff), Advance energy efficiency and decarbonization for agricultural operations. Improved energy efficiency in the state's agriculture is occurring and will continue to occur even in the absence of new state policies, provided innovation is supported or otherwise not hindered by policy.

Prudence should guide any new policies. Agriculture in California is only a small part of the state's energy use and arguably has one of the best records at increasing energy efficiency of any sector in the state. All of us must eat, however, and there are more productive areas for policy to achieve GHG reductions than agriculture, especially given that reductions are occurring more or less steadily in any event. The steady increase in energy efficiency in agriculture can be sustained by adequate investment in research and outreach at the state's land grant institutions, and the rationalization of regulations affecting agriculture. These approaches should be sufficient to achieve steady, modest reductions in GHG emissions from agriculture, which are all that should be prudently expected.

There have been successful CDFA programs that support emission reductions and energy efficiency. Perhaps the most successful is the DDRDP program. It has reduced GHG emissions from the state's productive dairy sector and provided green renewable natural gas supplies for industrial decarbonization and transportation, increasing energy efficiency. The DDRDP is incentive based and stimulates significant private investment. Incentive based programs support the creativity of farmers, and public and private investment in innovation, the basis of progress in agriculture, including energy efficiency. The DDRDP is a good model for new programs at CDFA and elsewhere in state agencies that help agricultural producers overcome investment barriers in technology that serves a wider set of public goods.

Chapter 6 (Page 128ff). Conserve productive farmland. Chapter 6 discusses the preservation of productive farmland. How does this interact with other state policies like SGMA, and the installation of industrial scale solar systems on productive farmland? SGMA is discussed, but without any pragmatic ideas to conserve farming in areas of the SJV where land retirement and fallowing are likely to occur as a result of that policy. Between 500,000 to 1,000,000 acres of land fallowing are mentioned due to SGMA (page 129) but no one knows what the actual effects will be. This loss of highly productive land and the agriculture it supports contradicts many of the other goals and objectives highlighted in the report. While addressing a local problem in the SJV, it increases likely GHG emissions and other forms of pollution elsewhere outside the state through leakage.

The goals of SGMA to protect against overuse of groundwater resources and related subsidence are reasonable, but the means are flawed in that groundwater supplies no longer available for farming and other uses have not been replaced with additional surface water supplies. It is also extraordinary that a policy like SGMA, with clearly foreseen adverse effects on the financial well-being of large numbers of people in an important region of the state could be thought to be publicly

beneficial and then imposed. The loss of all this irreplaceable productive farmland more than offsets any marginal land conservation efforts elsewhere in the state.

In addition, some advocate the conversion of farmland in the SJV and elsewhere to solar PV installations as an alternative land use. Unfortunately, there are no other Californias anywhere in the world with equivalently beneficial conditions for farming compared to the San Joaquin Valley. Despite short term economic benefits to landowners from conversion to solar due to the loss of the opportunity to farm their land, it is a disastrous long-term policy, especially with a growing world population demanding more of the kinds of foods best grown in California.

Chapter 7: Support Sustainable, Adaptable and Integrated Pest Management (page 145ff)

Most discussion in Chapter 7 focuses on potential increases in pest and disease abundance associated with climate change (primarily warming), assumed in this report. Almost without exception, the potential changes forecast focus on increased difficulties in managing insects, pathogens and weeds. Most of these potential challenges are hypothetical and mention both wetter and drier future climates associated with higher average temperatures and longer growing seasons. Yet the only data presented is a graph (Fig 11, page 151) showing declining use of fungicides in almond production in recent years, with no significant trend.

The treatment of anticipated future changes to pest management broadly across the state is unbalanced and lacks nuance. While some pests and diseases may be favored, others may be disfavored. Pests and diseases are not uniformly found across diverse locations with differing average climates. Pest management issues in desert regions are not identical to those in coastal areas and not uniform throughout the central valley. Successful pest management occurs across all these environments and for a wide range of crop species. This highlights the diversity of species' responses to climate, which are a normal part of the challenge to agricultural producers and not unidirectional.

The relationships among crop growth, crop genetics, planting dates and locations, pest, disease and weed occurrence are complex. If adequately funded, the state's land grant based agricultural research and outreach system that has developed effective pest management approaches in the past, including creating IPM approaches and methods, should prove sufficient to help crop production and pest management practices adapt to whatever consistent trends in climate might develop in the future. Plant breeding and molecular genetics offer significant promise in this area.

CDFA's programs, along with those of the Department of Pesticide Regulation, which support monitoring and IPM research have been successful and should be continued and strengthened where necessary. Continued support for UC's world-renowned IPM program is essential. Funding for basic and applied pest management research is the key to successful adaptation to whatever types of issues arise in the future, including climate related ones. Adding the undefined adjective "sustainable" to IPM does not add substantively to any of the necessary actions that are necessary for successful adaptation to future environmental changes.

Chapter 8: Boost Biodiversity and Farmlands. (page 161ff)

(page 152). Two statements in the second paragraph seem contradictory:

(1) *"Many practices that have limited on-farm biodiversity and impacted off site biodiversity are related to ease of farming, **pest management**, and food safety." (emphasis added)*

(2) *"Bringing **nature** back to farms and ranches can help bolster California agriculture and our food system against climate changes and help stem the loss of **biodiversity** in our state." (emphasis added)*

The first statement asserts that practices that improve productivity, pest management and food safety have evolved in practice complementarily and from research, but have the inadvertent effect of reducing certain kinds of biodiversity.

The second asserts that bringing "nature" (undefined) back to farms will improve food production in diverse regions/crops across the state, while increasing biodiversity (undefined) in the state. This is stated as fact, but is in fact vague, more an hypothesis or unproven aspiration and contradicted in practice (statement 1). It is an hypothesis that is difficult to prove or quantify. It begs the question why simplification of agroecosystems has been found to be beneficial in the past, and occurs nearly universally in practice in California and elsewhere in high productivity regions of the world? It raises the question why increasing yields and increasing total factor productivity have characterized modern productive systems characterized by simplified agricultural landscapes.

This uncertainty is mentioned on page 173: *"Ongoing research is needed to continue to understand the connections between biodiversity, agricultural practices, and climate resilience – looking at not just the impacts of agriculture and changing climate on biodiversity, but how biodiversity supports a productive agricultural economy."*

One of CDFA's primary responsibilities is to help protect against invasive species. It is unclear how a blanket objective to increase biodiversity *per se* will support that objective, if not complicate it. This is acknowledged later in strategy 8.1 (page 165), to reduce or limit the negative effects of increased on-farm biodiversity. Food safety concerns (especially for fresh produce) are noted in connection with increased wildlife presence on farms. Contamination of produce has been linked to the presence of wildlife on farms.

In support of possible enhancements to biodiversity associated with farmland, several voluntary efforts and local approaches to favor certain species (especially birds) in the state without significantly diminishing productivity or private property rights are mentioned. These seem promising. The coexistence of rice production with waterfowl conservation in the state is an older, successful strategy already in existence and widely practiced, but unrelated to newer programs and efforts.

With respect to invasive species, an important omission in the report is any mention of wolf reintroduction in the Cascades region of northern California and its adverse economic and social effects on ranchers and the ranching community. The report would be improved by a frank discussion of this development and the difficulties associated with accommodating a new, significant predator in the state. Elsewhere in the report, concerns are raised about fairness of process and harms to underrepresented rural groups. Wolf reintroduction seems like a good example requiring an examination of how such general concerns are implemented in practice.

Chapter 9: Encourage resilient agricultural practices (page 179ff).

Attention in Chapter 9 is devoted to air quality affects from agriculture, especially from tillage, bare soil (fallow periods) and related dust, and from open burning of agricultural residues.

Page 186: Fallow land is highlighted as a source of dust pollution. Increased fallowing will result from the SGMA program. One state policy focused on an environmental improvement (reduction of subsidence associated with groundwater depletion) significantly worsens another environmental problem (dust pollution).

Cover crops are mentioned as a possible solution for idle land, but the expense and water costs of cover crops are mentioned as obstacles to their use (page187). A study arguing that water use by cover crops can be less than evaporative loss does not fully account for the fact that significant biomass only develops later in the spring season when water use increases. Without sufficient biomass generated later in the spring period there will be few measurable effects on soil organic matter.

In addition, delaying planting in spring due to the need to allow cover crops to accumulate sufficient biomass, and then to decompose before planting can lead to adverse effects on subsequent crops, including increased water use, due to forcing crop development into warmer time periods. Consequently, cover-cropping recommendations remain ambiguous in the report and are unlikely to achieve the benefits assumed, at least in the more water-limited areas of the state. Cost-benefit analysis should be emphasized here and elsewhere in the report associated with potential climate resilience strategies.

Chapter 10: Advance climate smart and healthy soils practices. (Pages 179ff)

The central valley has a year-round growing season due to climate and the availability of water for irrigation. Many crops are adapted to winter conditions in the central valley, and milder winter temperatures due to long term reductions over multiple decades in winter low temperatures and shorter winter seasons have improved the winter climate in the Central Valley from a crop production perspective. The Central Valley of California, and the state in general, is one of the most ideal places in the world for food, feed and fiber production. Yields for most crops are among the highest in the world on a per acre basis, and crops can be produced very efficiently, given the beneficial combination of climate, excellent soils, abundant sunlight, water for irrigation, high levels of human capital and supportive infrastructure.

Arguably, farming in California spares land for food production elsewhere, and uses fewer inputs per product generated than in most if not all other regions of the world, especially for many high value agricultural products thought to be essential for healthful diets. This set of conditions suggests that the fullest use of land and supporting resources for farming in California is an ecological good and smart from both an environmental and climate perspective. It requires consideration of the role of agriculture in California from a broader perspective than the state's border. Consequently, a climate smart agricultural policy suggests that farmland should never be idle in California. The best use of resources in California, including water, is to sustain and support the ever-increasing productivity and efficiency of farming in the state.

Policies which reduce the productivity of farmland in California have an adverse effect elsewhere, requiring additional land for crops to replace those that might have been grown in California. In the

area of biofuel production, this effect is referred to as indirect land use change. Reducing food production in California causes leakage of farming to other regions, with less certain but arguably more adverse environmental consequences. Crop production outside the US and Europe is likely to be less regulated as well, resulting in more environmental pollution per product produced, likely greater than and offsetting any climate or environmental savings and benefits achieved within the state's border.

The best climate smart policy then is to create conditions for the fullest possible use of farmland and the state's food production capacity. As cited in the report (page 15), many crops in California are grown nowhere else in the US, and it might also have been said that they are produced more efficiently and safely than elsewhere in the world as well (page 17). To advance both climate adaptation and the state's larger environmental and climate goals, crop production should be expanded, rather than curtailed.

This involves, first, provision of sufficient water to support year-round crop production. At times this might involve cover crops, especially in woody perennial crops like tree nuts and grapes. For arable land, supplemental winter irrigation, especially in the SJV, is likely necessary to support broader cover crop use. In this sense, a policy like SGMA, intended to reduce subsidence, but which does not replace lost water derived from groundwater with additional surface water supplies, is the opposite of a climate smart policy. When losses of soil organic matter from drying fallow soils no longer receiving carbon inputs from crop residues and manures are added to the adverse environmental effects of SGMA on efficient food production in the SJV's uniquely favorable location, it reverses progress in reducing the state's CO2 emissions made in other policy sectors like transportation and power generation. A climate resilient strategy necessarily must address this current conundrum. It should be forthrightly identified and addressed in the strategy.

Chapter 12. Increase dairy farming sustainability. (page 234ff).

The report rightly emphasizes the importance of the state's dairy industry. Producing milk in California is inherently climate smart, compared to milk production in many other areas of the world. Sustaining the state's dairy industry is a climate smart strategy. CDFA's DDRDP and AMMP programs and its newer Dairy Plus program have been among the most successful environmentally focused state programs to date and are widely admired elsewhere. These strategies should be sustained. In general, incentive-based programs that continue to address issues related to methane reduction, improved manure nutrient and organic matter management, and other related emissions will continue to support climate adaptation and resilience.

There are many innovative dairy operations in the state. Programs that support and incentivize farmer innovation and creativity will have a large return on investment in terms of achieving climate resilience for the state's dairy industry.