Carbon Cycle Institute

11/20/25

Secretary Karen Ross/Deputy Secretary Virginia Jameson
California Department of Food and Agriculture
1220 N Street
Sacramento, CA 95814

RE: CCI Comment on CDFA Climate Resilience Strategy for California Agriculture

Dear Secretary Ross and Deputy Secretary Jameson;

Thank you for the opportunity to comment on the CDFA *Climate Resilience Strategy for California Agriculture*. In light of the urgency of the climate crisis and its severe implications for California agriculture and the global food system, the *Strategy* is timely and important.

CDFA staff gave this matter serious consideration and overall did a good job of addressing the subject. The report contains a number of links to useful documents and programs, enabling it to serve as a useful reference. Having worked on this question for almost two decades, we are gratified to observe how much the landscape surrounding this crisis has progressed over that time; what were once marginal efforts are now entering the mainstream as emerging programs and policies. If this trend continues, California agriculture may have a fighting chance to weather the coming storms, droughts, groundwater depletion, soil salinization, and associated socioecological crises now looming inevitably before us.

The CDFA *Strategy* is a strong first step toward addressing the urgent question: *can California agriculture become a driving force in the restoration and enhancement of the ecosystems from which it has derived so much wealth over the past 176 years and in which it has played such an overwhelmingly, if innocently, destructive role; and in so doing, ensure its own survival and that of the People of the Great State of California, while contributing significantly to the restabilization of the world's climate?*

This essential effort must recognize the state's soils as the quintessential key to resolving multiple ecological crises we now face. Agriculture, and agricultural soils, have a pivotal role to play in addressing virtually every environmental crisis faced by the state, including the climate crisis; a truly resilient agricultural ecology will engage all of these, for its own benefit as well as that of the state as a whole. As the state's principal carbon sink and the source of much of the state's wealth, care of our soils has been egregiously neglected. The CDFA Healthy Soils Program is a valiant effort to begin addressing this historical error, but the need made evident by the linked crises of climate destabilization, biodiversity loss, groundwater pollution and a host of other environmental issues demands an effort that is orders of magnitude greater than what the state and its partners have brought to bear to date.

In short, recognition of the pivotal role of soils is lacking in the report. The state MUST take seriously working land soils as the foundation for all of its natural climate solutions and quickly build policy and funding support around agricultural practices and food systems that enable producer engagement with soils as key elements in their farm system economic planning. Working land soils remain a vast, untapped carbon sink waiting for us to seriously engage with the opportunity they represent; not only to build resilience in the state's agricultural ecology, but to address virtually every natural resource issue the state faces, while simultaneously offering the only viable near and long-term drawdown strategy available to us. While the state squanders time and money on hypothetical technological solutions to carbon capture and storage, our working lands, and working land stewards, are withering under the benign neglect of a land use policy framework established in the 19th Century. Granted the challenges presented by measuring ecosystem change, including soil carbon change, we know enough about our working land systems to evaluate system trends, whether improving, degrading or stable. The NRCS Conservation Security Program (CSP) is built around this fact, and rewards farmers with on-farm conservation funding without the need to measure beyond the practice implementation itself. The state HSP program similarly covers some or all of the costs of practice implementation, but needs to be significantly increased, including increases in associated technical and implementation assistance, if even the state's modest 2024 healthy soil goals are to be met.

Obviously, this work cannot be undertaken by CDFA alone. We thus applaud the efforts at interagency cooperation noted in the report, and strongly urge deeper and more comprehensive collaboration among all levels of state government, while supporting and uplifting local/regional partnerships as vital to engaging producers, planning projects at scale, and program implementation.

Once again, thank you for the opportunity to comment on the CDFA *Climate Resilience Strategy*. We look forward to further dialog -and action- on this critical issue.

Our comments on specific content in the report are appended here, with CDFA language in plain text and CCI comments in ***bold italics.***

Sincerely,

Jeffrey Creque, Ph.D.
Torri Estrada

Carbon Cycle Institute
245 Kentucky Street, Suite B1 Petaluma, CA 94952
Email: info@carboncycle.org www.carboncycle.org

Carbon Cycle Institute Comment: CDFA Climate Resilience Strategy for California Agriculture, 2025

Note that the pdf version and online version of this document have page numbering that is off by one; hence page 87 in the pdf is page 86 in the on-line version. We have used both below, depending on the version we were pulling from, so it may be necessary to scroll up or down one page to find our reference point. Note we only commented on those sections of the document for which we have experience and/or expertise, so there are large sections that are not addressed here. For the most part, we have used plain text for directly excerpted language and *italics* or ***bold italics*** for our comments. We also inserted many, but not all, of these comments into the on-line version of the report.

A note on carbon markets: We caution CDFA around the wholesale consideration and adoption of carbon markets to address climate resilience and broader agricultural conservation and climate-smart agriculture. To date, carbon markets, especially those deploying offset protocols and related frameworks, have had very limited participation by CA agriculture, especially by small-to medium sized farms and BIPOC farmers. As conventionally conceived, these carbon market approaches do not serve agriculture well, in general, and do not convey sufficient financial or technical support to producers, specifically. We intend to share more guidance on carbon markets in early 2026, including what we have learned through our USDA-funded project, and thoughts on possible alternative market approaches, including those focused on climate resilience, carbon, and agroecosystem services..

P 18; defining key terms; Resilience: A state of readiness to face climate risks. In this strategy, we explore gaps in readiness for California agriculture, actions taken, and actions needed to fill these gaps. ***This definition of resilience is not consistent with the definition of resilience commonly used in ecological literature; we suggest using: the capacity to "resist and recover from disturbance due to climate change". OR: the Encyclopedia Britannica definition:, the ability of an ecosystem to maintain its normal patterns of nutrient cycling and biomass production after being subjected to damage caused by an ecological disturbance; or this, from Science Direct: ...the capacity of a system to undergo disturbance and reorganize so as to still maintain essentially the same functions, structures, and controls...; or this, from Ecology and Society: ...agroecological resilience considers the capacity of the holistic agroecosystem (including practical, social, and economic aspects) to respond continuously and dynamically to external and internal disturbances, such as drought and landscape-related management.***

Page 85. These fertilizers have allowed us to feed many more people than was previously possible. From 1908 to 2008, the number of people supported per hectare of farmland increased from 1.9 to 4.3. The Green Revolution, which began in the 1940s, combined improved high-yielding crop varieties, irrigation, and fertilizers to significantly boost global food production and saved a billion people from starvation. Synthetic N fertilizer has supported about 4 billion people born since 1908. ***These propositions are offered as fact, but are of arguable accuracy; correlation is not causation. Many factors have contributed to the current gross overpopulation of the planet; the "green revolution" involved much more than N fertilizer, and came at much greater environmental cost (including human lives) than is suggested here. According to the CA N Assessment (UCD 2016), an amount of N equivalent to 69% of that imported into the state each year ends up in the state's ground water annually. Note too that globally we are far outside the planetary boundary for N (https://www.stockholmresilience.org/research/planetary-boundaries.html).***

Page 86. Furthermore, intensive farming can reduce soil nutrient availability, including nitrogen, which can lead farmers to increase their use of synthetic fertilizers over time. ***"Intensive farming" is not defined and could just as readily be applied to multi-functional farm systems that build, rather than deplete, soils; perhaps use "intensive tillage" or "high input agriculture".***

P. 87. Responsible nutrient management practices, such as soil testing, precision and timing of fertilizer application to match crop needs, use of organic and other slow-release forms of fertilizer, and companion planting or cover cropping with nitrogen-fixing plants, help farmers improve soil health, reduce input costs, and protect nearby waterways. ***Delete "nearby;" water and its associated burden of N pollution moves long distances; through the soil to groundwater and via creeks, streams and rivers to deltas and the sea.***

Page 87. Fortunately, alternatives are on the horizon. Ammonia, another key ingredient in nitrogen-based fertilizers, can be produced by using renewable energy and derives its hydrogen from water and nitrogen from the air. Cheaper renewable energy prices are helping bring down the cost of producing ammonia this way, and have the potential not only to reduce reliance on fossil fuels for fertilizer, but can help states that are net importers of fertilizer ***like*** California become more self-sufficient and further decarbonize agriculture as a sector, potentially driving down its carbon footprint by 90 percent for some crops. ***This statement needs unpacking and citations; see: https://www.mckinsey.com/industries/agriculture/our-insights/from-green-ammonia-to-lower-carbon-foods; "... employing green fertilizer could reduce greenhouse-gas emissions from agricultural end products by about 5 percent."***

Over 600 square miles of the San Joaquin Valley are underlain by nitrate-contaminated groundwater, the San Joaquin Valley remains in a state of non-attainment for ozone, and soil emissions are a major contributor to the State's nitrous oxide emissions. Green fertilizer may address the methane question viz fertilizer production, but it does nothing to address the State and planetary nitrogen surfeit.

Page 88. The Healthy Soils Program funds a "nutrient management" practice that requires a 15 percent reduction of synthetic nitrogen fertilizers. ***This is presumably a reference to COMET-Planner's organic soil amendment assumptions; the 15% reduction is an assumption in the model, not a requirement in practice.***

NB: organic farms do not use ANY synthetic N, so the modeled 15% reduction (20% maximum over 4 years) is in fact extremely low. We need to focus on dramatic reductions in the importation of 500,000 tonnes of N into the state each year, and closing the loop on the state's N cycle. The CA N assessment (UCD) makes this clear; CA already has enough N resources if they are recycled and stewarded properly. Granted the significant exports of N each year in CA ag products and inevitable denitrification losses, that export can be addressed through integration of N biologically fixed on farm and diligent recycling of N in the state's waste streams, including human waste. The State's ozone and groundwater and nitrous oxide pollution with its 275x CO2 global warming potential, can all be significantly reduced through a holistic, mass balance approach to managing the state's N resources. The time for timid half steps on this issue is long past.

P. 89. ***Mention might be made in this section of the recent legalization of composting of animal mortalities and butchering by-products. (Assembly Bill (AB) 411, signed into law Oct. 11, 2025).***

P. 89-91. ***CA should consider issuing a voluntary "Model Water Efficient Agriculture Guidance" around soil amendments and soil management, similar to its Model Water Efficient Landscape Ordinance.: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Water-Use-And-Efficiency/MWELO-Rulemaking/Final-MWELO-Text-and-Appendices_20250103.pdf***

Page 92. Climate change is necessitating the way work on-farm looks to protect those working on agricultural operations. ***This sentence needs rewriting and further explication for clarity; surely more***

than the way on-farm work looks will have to change to protect farm workers from climate change impacts.

Page 120. Agrivoltaics: This type of research takes aim at solving a common problem associated with agrivoltaics, the shading out of crops. ***But shade from solar panels has been shown to increase production for some crops and increase economic production per acre from dual use, which should also be mentioned here. https://www.nrel.gov/manufacturing/news/program/2019/benefits-of-agrivoltaics-across-the-food-energy-water-nexus and https://doi.org/10.1016/j.nxener.2025.100474***

Page 126. 5.2.2 Improve energy efficiency and flexible electricity demand through technological upgrades. ***It would be nice to see specific supports for agrivoltaics and on-farm wind, along with biogas....***

Page 132. **Nature based solutions targets;** In 2022, the state established Nature Based Solutions climate targets for cropland conservation:

- 12,000 acres per year between 2030 and 2037
- 16,000 acres per year between 2038 and 2044
- 19,500 acres per year in 2045

This would total an additional 275,000 protected acres through 2045. Additionally, the state set a target for the conservation of grasslands, which includes lands used for grazing: 33,000 additional acres per year between 2030 and 2045 for a total of 528,000 acres of additional protected acres of grasslands, including grazing lands. ***These acreage targets represent 3% of cropland and 1.6% of total grazing lands; ARB may regard these targets as ambitious, but viewed with the urgency demanded by the climate crisis, they suggest the State is planning for minimal impact from agriculture as a climate change solution.***

P. 132. Currently, approximately 12.2 million acres of farm and grazing land are enrolled in Williamson Act contracts, more than any other program. This does not mean those lands are permanently protected, however; ***"Protection" should be tied explicitly to management strategies for climate mitigation and resilience. Integrate management strategies for climate mitigation and resilience into the update of the Office of Land Use and Climate Innovation General Plan Guidelines, to be released in early 2027.***

P 137. To address this and ensure resilient landscapes in California's uncertain groundwater future, the California legislature appropriated funds for the Department of Conservation to launch the Multibenefit Land Repurposing Program, or MLRP, which provides block grants to regional organizations who can coordinate strategic land repurposing while providing community health, economic well-being, water supply, habitat, and other benefits. To date. ***Hence the need for more incentives for eco- and agrivoltaics and cessation of ag land displacement for single use solar fields.***

P 139. By 2050, farmers will need to produce 70 percent more food to meet demand. ***Given that 40% of food produced is wasted (https://www.cdfa.ca.gov/is/foodrecovery/), and ongoing efforts to reduce food waste, this is probably an overstatement....***

P.161. farms are positioned to mitigate some challenges from climate change, mainly by providing habitat and habitat connectivity in landscapes that lack significant natural habitat. ***Hence the critical importance of programs supporting biodiversity on farm, including many climate-beneficial practices, such as agroforestry, riparian restoration, soil carbon enhancement, etc., as expanded upon in the following paragraph, page 162. Soils, as the single largest terrestrial carbon sink, offer climate change mitigation opportunity far beyond habitat provision.***

P. 167. The US EPA determined that three of the most popular neonicotinoid pesticides were likely to drive more than 25 insect species and 160 insect pollinator-dependent plant species to extinction. DPR also enacted regulations to mitigate risks from neonicotinoids; ***Are these DPR regulations specific to mitigating risks of extinction for these species?***
P. 167. Practices key to organic agriculture, such as the reduction or elimination of external inputs like conventional pesticides and synthetic fertilizers, can protect and enhance biodiversity by limiting beneficial species loss. ***and enhancing habitat and sequestering atmospheric carbon.***

P. 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. Research is also needed to better understand climate-driven changes in hydrology to better mitigate impacts from longer droughts and wetter storm and their impacts on farmlands and adjacent ecosystems. ***While more research into these questions is welcome, we already have sufficient understanding of these connections -and an extensive peer reviewed literature going back decades- to act on this knowledge. What is missing is the economic and policy framework to enable the work at scale.***

P. 175. A decline in belowground biodiversity via climate change and some land management practices removes a critical role in ecosystem function***. More correctly: ... climate change and some land management practices compromise critical ecosystem functions, including belowground biodiversity.***

P. 181. ...concentrations of Disadvantaged Communities, who suffer from a variety of economic, health, and environmental burdens, including issues plaguing the region such as extreme heat and high levels of particulate matter. ***Note how CA externalizes the health effects of its "efficient and highly productive" agricultural system...this crisis will only worsen with climate change.***

P. 181. In fact, there is evidence that ozone may be even more damaging to yields than the warming effects of climate change ...***more damaging to yields <u>today</u> than the warming effects....long term effects of climate change remain unknown but are anticipated to be catastrophic, well beyond the yield impacts of ozone.***

P 183. As discussed in Chapter 1, there is a concerted effort to reconceptualize agricultural waste as useful inputs to return to the soil and/or for new products in the new circular bioeconomy. ***Subsequent discussion makes no mention of soil carbon and highlights air curtain burners (vs compost or whole orchard recycling); please develop a meaningful discussion of the central role of agricultural and urban organics in building ag resilience through soil C enhancement.***

P. 184. Uncovered manure storage from livestock operations is susceptible to the volatilization of ammonia and the ***anaerobic*** decomposition of organic material, which releases methane. ***Add anaerobic ahead of "decomposition".***

In some cases, air curtain burners can be designed to produce biochar, ***Suggest: can be operated to produce biochar.***

P. 184. Recently a CARB expert panel evaluated nitrogenous emissions from soils in California to improve the accuracy of the state's inventory and provide guidance for future research. This report identifies a likely under estimate of soils contributions to NOx and recommends additional data collection to better validate modeling results. ...***Note too that N fertilizer is the single largest source of N2O in the nation (USEPA), and that a quantity of N equivalent to 69% of the state's annual N imports ends up in the state's groundwater each year (CA N Assessment). N fertilizer is a serious problem from both a climate change and overall environmental perspective. 3R approaches are a step forward, but the state needs to adopt a mass balance approach to N management, recycling N stocks and drastically reducing imports of synthetic N into CA. As one of the largest agricultural producers in the world, California***

has a particularly significant role to play in addressing the transgression of the planetary boundary for N. (https://www.stockholmresilience.org/research/planetary-boundaries.html).

P 187. This catastrophe was the impetus for the creation of the USDA Natural Resource Conservation Service and the development of soil conservation measures, including cover cropping, which we now know has benefits beyond simply anchoring soil to the land; this includes increasing the water-holding capacity of soil, increasing water infiltration and improving water quality, supporting soil biodiversity, scavenging excess nutrients to project water quality, and adding additional fertility. ***Note misspelling of Natural Resources Conservation Service, which is repeated elsewhere in the report. Soil carbon benefits are not mentioned, again. Of serious concern is the impression that the report fails to recognize the critical and central role of soil in the climate resilience discussion.***

P 195. What is healthy soil? ... organic matter typically comprises up to about 5 percent....***this paragraph provides a stock definition of HS, but also speaks more generally to "what is soil." This is somewhat misleading. Organic matter certainly does not typically comprise 5% of most ag soils in CA. One to 2% is more typical. This whole section needs rewriting; suggestions below:***

A healthy agricultural soil ~~generally has~~ ***is well*** structured, ***(all soil has structure of some kind)*** meaning ~~more~~ ***it is aggregated through the interaction of soil mineralogy and soil biology into*** small and large clumps, ~~that will allow~~ ***which creates*** spaces between them, ***allowing movement of*** air and water. Those spaces ~~will~~ make the soil more workable, more drainable, and able to host more biological activity as compared to compacted, ***less aggregated*** soil. Increased ***soil organic matter will generally increase soil*** biological activity, and higher plant diversity will ~~also~~ generally increase the soil's organic matter, which in turn boosts nutrient cycling ~~beneficial for~~ ***and*** crop~~s and~~ nutrient use efficiency and ~~also~~ feeds back to improved aggregation ~~and better soil structure~~.
Healthy soils also ~~have benefits for more than crops. They~~ are associated with lower pest pressure and ***reduced need for*** pesticide use because ~~their~~ ***more*** highly functioning biological systems are ~~less vulnerable to widespread~~ ***more resilient to such disruptions*** ~~damage.~~ Improving soil health ***generally*** leads to lower ~~pathogen presence and reduces the~~ prevalence of crop pathogens. Healthy soils also contribute to cleaner water by reducing runoff, improving water infiltration, filtering contaminants, tightening nutrient cycling, and improving nutrient use efficiency. Additionally, healthy soils are less susceptible to erosion and thus can reduce the presence of dust ***and greenhouse gas emissions***, improving air quality. Actively managing soil to improve its health can result in increased fertility, reduced need for inputs, carbon protection and sequestration, and beneficial impacts on water holding capacity. Farmers and ranchers can build soil health through ~~changes in~~ their ***land*** management systems.
In row crop systems, ***effective*** practices ***include:*** ~~such as~~ planting cover crops; ~~or~~ applying compost and mulch to ***increase soil organic matter,*** reduce erosion and enhance moisture infiltration and retention; rotating ~~the~~ crops ~~grown~~ to improve soil nutrient status and reduce pest pressure; ~~dedicating space for~~ ***adding*** permanent plantings, ***including*** ~~of~~ native plants to build up biodiversity and create habitat for pollinators; ***and*** reducing or eliminating tillage to minimize soil disturbance to preserve soil structure and reduce erosion.
In orchards, there may be ~~additional~~ opportunities to reduce tractor passes, or use ***livestock*** ~~animals like sheep or goats~~ for weeding or mowing, as well as returning orchard biomass to the soil via ***chipping of prunings and*** whole orchard recycling.
On grazing land, ranchers can plant trees and shrubs ~~or~~ ***and*** use ~~practices like~~ prescribed grazing to strategically move animals ~~around large~~ ***through*** pastures, giving the soil and plants time to recover ***between grazing periods*** and depositing manure more evenly (for more climate-smart agriculture solutions on rangeland, see chapter 12 on Ranching Sustainability).
These practices can be broken into different categories as illustrated below – each with their own subset of associated soil health benefits. These soil health benefits are all in addition to the ***associated*** climate mitigation benefits of carbon sequestration, and nitrous oxide and methane emission reductions.

P 196. 2024 State Targets Related to Healthy Soils. ***Given it is 2025, supplying this callout box without an assessment of where these targets stand is of little utility. These targets were arbitrary and ungrounded in policy change to begin with and in fact we are failing to meet them. The state MUST take seriously working land soils as the foundation for all of its natural climate solutions and quickly build policy and funding support around agricultural practices and food systems that enable producer engagement with soils as key elements in their farm system economic planning. Working land soils remain a vast, untapped carbon sink waiting for us to seriously engage with the opportunity they represent; not only to build resilience in the state's agricultural ecology, but to address virtually every natural resource issue the state faces, while simultaneously offering the only viable near and long-term drawdown strategy available to us. While the state squanders time and money on hypothetical techno solutions to carbon capture and storage, our working lands, and working land stewards, are withering under the benign neglect of a land use policy framework established in the 19th Century. Granted the challenges presented by measuring ecosystem change, including soil carbon change, we know enough about our working land systems to evaluate system trends, whether improving, degrading or stable. The NRCS Conservation Security Program (CSP) is built around this fact, and rewards farmers with on-farm conservation funding without the need to measure beyond the practice implementation. The state HSP program similarly covers some or all of the costs of practice implementation, but needs to be significantly increased, including increases in associated technical and implementation assistance, if even the state's modest 2024 healthy soil goals are to be met.***

P. 197. Principles of Soil Health: The USDA Natural Resource Conservation Service: *per previous, note* Natural ***Resources*** Conservation Service
1) Maximizing soil cover. Keeping soil covered by plants or mulch conserves moisture, ~~keeps~~ ***moderates*** temperatures ~~down~~, suppresses weed growth, prevents erosion, ~~provides material for the creation of~~ ***increases*** soil organic matter, and provides habitat.
2) Maximizing the presence of living roots. Living plant roots feed microorganisms in the soil and aid in maintaining soil structure, nutrient cycling, and carbon storage.
3) Minimizing disturbance. Minimizing soil disturbance helps ***avoid destruction of*** ~~build~~ soil aggregates (clumps of soil formed by physical, chemical, and biological activity), ***increases*** pore spaces that allow oxygen, water, and nutrients to pass through, and ~~builds~~ ***avoids oxidation of*** soil organic matter. Disturbance can result from overgrazing, tillage, and overapplication of inputs like fertilizers and pesticides.
4) Maximizing soil biodiversity. Soil organisms, including plants, animals, and microorganisms, are the primary mechanism for driving nutrient cycling, sequestering carbon, improving soil structure, and enhancing plant health. Maintaining or enhancing ***soil biodiversity*** can help build resilience to stressors and support the long-term health and functioning of soils.

P. 198. The healthy soils practices funded through CDFA's Healthy Soils Program (HSP), such as planting cover crops or applying compost, fit within this definition. As shown in Figure 12, healthy soils practices ~~also~~ have been shown to ~~have several positive benefits that~~ build soil health and make agricultural systems ***more resilient*** ~~better able to adapt to~~ ***in the face of*** our changing climate, ***including*** ~~Examples of outcomes from utilizing healthy soils practices include increased soil organic matter that~~

~~helps soil soak up and hold onto water better,~~ improving water use efficiency and buffering the impacts of heat and drought.

P. 201. The state is already working to ensure that climate-smart and healthy soils practices continue throughout the state. These efforts should ***be expanded and*** continue to be coordinated across state agencies and ~~throughout~~ the state's farmers and ranchers.

re soil amendments: Coordinating efforts with other state agencies will help avoid redundancy and prevent silos between agencies. Specifically, coordination is necessary to create the conditions in which a circular economy for soil organic amendments can develop. CDFA's efforts to incentivize adoption of these products will have limited effects in the long run if the products themselves remain difficult or expensive to secure in many agricultural areas. ***This highlights the state's failure to understand compost; viewing it as a "product" to be added, like fertilizer. Compost is more accurately viewed as a system of engagement with the carbon cycle for the benefit of agricultural production and agroecosystem integrity. Without this perspective and policy and financial supports for its implementation at scale, California will be unable to effectively engage its soils as a climate change solution, nor sustain its agriculture into the next century, let alone actualize a circular bioeconomy. (but see page 213 for a more holistic view of compost).***

P. 202; Practices such as conservation cover, vegetat***ed*** barriers, filter strips, or grassed waterways can reduce soil erosion of fallowed lands, build soil carbon and ~~even~~ help retain water. ***(use of "vegetative" in this context is common, but incorrect.)***

P. 203. The targets for croplands require significant additional acreage of healthy soils practices be implemented each year between now and 2045 to result in over 3 million new acres of cropland managed using healthy soils practices. ***Page 196 shows a date of 2024 for this target.***

To be funded, a practice must have been shown to reduce GHG emissions, ***or increase carbon sequestration.***

P. 204. Demonstration Grants also support research into experimental practices that have not been sufficiently studied for CARB to model their GHG reduction benefits. Demonstration grantees collect on-farm GHG emissions data, crop yield, and soil water parameters, such as soil water infiltration and aggregate stability. ***Is the data derived from these projects sufficiently robust, and consistently gathered, to provide a basis for CARB to model GHG benefits? If yes, has CARB done so? If not, what is the purpose of this program?***

P. 205. Ag Burn Grant Program, which funds several management practices, including whole orchard recycling (WOR). Also incentivized by CDFA's Healthy Soils Program, this practice involves reincorporating ground-up trees back into the soil via on-site grinding or chipping of whole trees during orchard removal and subsequent incorporation of the biomass into the topsoil. This process adds ~~back~~ the carbon ***drawn from the atmosphere by the*** trees into the soil to bolster soil organic matter, ***and avoids emissions of GHG, including black carbon, associated with more conventional disposition strategies.***

Federal Efforts....The National Resource Conservation Service's; ***Natural Resources*** *Conservation Service*

These two programs NRCS programs are expected to continue, but now under Farm Bill; ***Note typo; but also note EQIP and CSP have always been under Farm Bill, existing long before IRA.***

P. 207. Long Term Soil Organic Matter and Soil Health Data Collection. Many healthy soils practices build or protect soil organic matter. The current requirement under HSP is that each grantee collect soil organic matter (SOM) measurements from project fields prior to practice implementation, each year ***during the project***, and then one year after the end of the grant term – 4 years of measurements to monitor the ***any*** changes ~~of the~~ ***in*** soil organic matter ***content*** over the term of the funded project. The primary goal of this data collection is to familiarize recipients with monitoring their ~~soil health~~ ***organic matter***. However, research has shown that while soils with lower ***initial*** SOM may see changes within ~~3~~ ***1 to 5*** years ***of HSP practice implementation***, ***soils with*** larger ***higher initial*** SOM changes may take 7-10 years, or even longer, ***for increases in response to HSP practices*** to become apparent. Additionally, early HSP SOM data is inherently variable due to inconsistencies in sampling methods, sample locations, and different laboratories used to conduct the analyses. A goal of the HSP in coming years is to standardize SOM data collection and analyses, and to start sampling from long term adopters of HSP practices to ~~have~~ ***build*** longitudinal data sets looking at SOM changes ***over time***. ~~Alongside that, seeing that much~~ ***Given*** progress ~~has been~~ ~~made~~ in recent years in the definition and analysis of soil health, HSP is launching a pilot effort to measure soil health changes which are ~~more~~ ***most*** likely to be measurable over the course of three-year ***HSP grants***, and ~~are~~ more likely to be of direct interest to farmers.

P. 208. HSP Demonstration Grants Soil Water MetricData Collection

The passing of the Sustainable Groundwater Management Act has put a greater focus on on-farm water usage and conservation. In response to this growing concern, as of 2023, HSP requires soil water data metrics to be collected through the Demonstration Grant projects. These parameters include soil water infiltration, aggregate stability, and soil water ~~content~~ ***holding capacity***. The desired goal for these additions is to provide insight into the water savings ***impacts*** of healthy soils practices.

P. 211. 10.4 Other organizations often provide technical assistance free of charge to growers~~., including.~~ UCANR Community Education Specialists, statewide Resource Conservation Districts, regional Climate Hubs, and nonprofit organizations are all examples of current technical assistance providers that offer these services.

P. 213. 10.5 Ensure the availability of high-quality compost for agricultural operations statewide.

Compost is not the only organic amendment that is useful in agricultural soils, but it is an important tool for improving soil health and increasing organic matter and an important tool for cycling carbon, **energy** and nutrients through the agroecosystem and food system. California is poised to ~~develop a~~ **increase the** steady stream of compost that will ***conserve terrestrial carbon,*** provide vital nutrients to soils and reduce the need for petroleum-based and imported fertilizers. There are a number of challenges to overcome, however, the availability of high quality compost can increase through ensuring compliance with regulations and standards, implementation of best management practices at compost facilities ***and on farms***, and adequate testing and monitoring. ***Encouraging on-farm compost production, and*** prioritizing education and outreach regarding ***on farm composting and*** **urban** collection programs to maximize participation and reduce contamination, as well as infrastructure to remove contamination pre- and post-processing, are other ways to support clean feedstocks entering the composting process.

The importance of Compost

... Creating compost ~~requires~~ ***is*** a ~~controlled~~ ***managed*** process of **aerobic (oxygen-required) microbial** ~~decomposing organic (carbon-based) materials~~ **decomposition of organic (carbon-based) materials** ~~in an aerobic (oxygen-required) environment using microorganisms.~~ The organic materials can include food waste, crop byproducts, biomass from forest management, ***manures*** and Municipal green waste such as grass clippings, leaves, and yard and tree trimmings. Microorganisms, which are naturally present, feed on organic materials during the composting process, using nitrogen, ***carbon*** ~~to grow and reproduce~~, water ~~to digest materials~~, and oxygen ~~to breathe~~ **to digest materials, to breathe, grow and reproduce.**

When properly managed, the activity and growth of microbes causes the ***organic materials*** compost to heat up to temperatures beyond 131 degrees F, killing pathogens and weed seeds in the process.

P. 214 ***Finished*** Compost has a number of attributes that make it a highly desirable soil amendment:
Finished compost is:
• Reduced of potential contaminants, such as pathogens, pests, and viable weed seeds, because of ***biophagy and*** the heat produced during the composting process;
• Considerably lighter ***lower volume*** than its original materials, making it more transportable;
• A soil "conditioner" that can increase water retention, ***reduce soil bulk density, support soil aggregation and increase soil fertility by increasing*** soil organic matter.
• Relatively odor-free; ***Free of unpleasant odors***
• Stable over a few months in the open, even if exposed to rain;
• High ***in organic*** carbon and rich in micro-and macronutrients;
• Relatively slow to break down in soil, releasing nutrients to crops gradually;
• Widely shown to increase biological activity in soils; and
• A much lower emitter of GHGs than most alternative ***disposition*** methods for organic wastes.

P. 215. These legislative actions drive healthy soils efforts by directing the production, use, and funding of compost (on and off-farm composting facilities), which is the principal organic soil amendment used by farmers. ***This statement needs a citation; livestock manures (cow, chicken, horse, swine, etc) may in fact be the principal organic soil amendment currently used by farmers.***

P. 216. Currently ***state permits for*** on-farm compost production is limited by the amount of compost and feedstocks held on-site, the amount of compost allowed to be sold or given away annually, and the source of the materials. To increase these amounts can require intensive ***involve an extensive*** permitting process, and coordination between local Air Districts, LEAs, and Water Boards, that can deter those interested. In an effort to increase local bioeconomies and improve efficiency of on-farm waste management ***and encourage soil carbon sequestration***, state agencies and legislators are currently working on clarification and updates for on-farm composting, including assurances for food safety and implementation functionality. ***What is meant by implementation functionality?***

P. 217. Scientific s Subjects requiring study include the remediation of ***both organic and inorganic*** contaminants, the use of biosolids ***in compost production***, the processing of food waste in wastewater treatment plants and recapture of organics from digester slurries. Then, r Research aimed at ***removing*** regulatory improvements ***barriers*** could compare compost's GHG, VOC, and ammonia emissions with likely alternative fates ***for similar feedstocks***, which is often not done ***largely absent from regulatory decision making***.

P. 223. As discussed in the introduction to this strategy, Geologic history, ***topography, organisms***, and precipitation ***climate*** patterns ***(Hans Jenny, Factors of Soil Formation, 1941)*** play a primary role in establishing baseline soil conditions across all lands, including ecosystems used for grazing in California.

Research has shown that the presence of grazing can positively affect soil carbon in California soils~~ with higher clay content,~~ but more work is still needed to understand ~~the effects of grazing on~~ ***how grazing livestock can be managed to increase*** soil carbon in specific circumstances.

P. 225. In addition, ~~animals~~ ***livestock*** do not consume all plants equally which can lead to ~~a~~ ***shifts*** in plant ***community*** species ***composition in both desirable and undesirable directions,*** ~~if overgrazed,~~ reinforcing the need to ~~properly~~ manage rangelands and grazing animals ***as appropriate to achieve specific land management objectives*** ~~amounts~~.

P. 225-226. This process provides ranchers access to state-owned land for ~~their~~ livestock grazing while also helping to maintain ecosystem health. Additionally, CalFIRE's California Vegetation Treatment Program utilizes prescribed herbivory, which is the targeted grazing by livestock to reduce wildland ~~plant populations.~~ ***fuel loads.***

P. 230. 11.3: Manure also produces methane ~~as~~ ***if*** it decomposes ***under anaerobic conditions***, and the amount of methane produced during the decomposition process is strongly influenced by how the manure is managed. Manure from animals grazing in pastures is considered "dry" management ***and produces little or no methane.***

This makes addressing methane both from manure and enteric pathways a challenge. This is because ~~enteric~~ emissions solutions that work well in dairy (manure management techniques and feed additives) are harder to implement when the animals and their manure are spread across great distances and they are ~~eating~~ ***grazing*** vegetation rather than being fed. ***However, as noted above, manure deposited on pasture generates little or no methane, and enteric emissions on well managed grassland can be offset by growing pasture vegetation and the action of soil methanotrophs that consume methane.***

P. 236. Air Quality
There is concern with the environmental impact of dairies, as many of our state's leading counties for dairy production are also among the worst in air quality nationwide. ***Please elaborate; what dairy emissions specifically contribute to poor air quality in these counties? Ammonia? NOx? dust? PMxx? etc. The preceding discussion has all been about methane, but methane is not the reason these counties are in a state of non-attainment for air quality.***

END, CCI Comments on CDFA Climate Resilience Strategy for California Agriculture, 2025