June 24, 2022

California Air Resources Board (CARB)
1001 I Street
Sacramento, California, 95814
Submitted Online

Re: Public Comments for CARB's 2022 Draft Scoping Plan

Dear Chair Randolph and Members of the Board,

On behalf of the undersigned organizations, we write to provide comments on California Air Resources Board's (CARB) Draft 2022 Scoping Plan and propose ways to strengthen several strategies for agriculture as part of the plan's focus on Natural and Working Lands (NWL).

California can achieve carbon neutrality much earlier than the 2045 goal outlined in the 2022 Draft Scoping Plan. Our analysis (attached as Appendix A) outlines how agriculture, a sector that currently constitutes 8 percent of California's greenhouse gas (GHG) emissions, can reach carbon neutrality by 2030.[1] The 2022 Scoping Plan is the roadmap for climate action across the state and without an ambitious roadmap, we cannot take ambitious climate action. We cannot afford to delay mitigation efforts; therefore, we strongly urge CARB to revisit its draft Scoping Plan and push for carbon neutrality by 2030 in agriculture and develop a more ambitious plan across the economy.

We appreciate the breadth of strategies proposed by CARB to scale climate action on agricultural lands, including expanding compost production and application, increasing the use of climate-smart practices,[2] transitioning acreage to organic agriculture, scaling up support for technical assistance, protecting farmland from conversion, reducing on-farm energy and water use, and investing in the development of new market infrastructure. These six areas align with our group's Vision for a Carbon Neutral Agricultural Sector by 2030 (Appendix A). With targeted investments in each of these areas, California's agricultural sector can become carbon neutral by 2030 and a carbon sink in perpetuity, much earlier than the goal outlined in CARB's Draft 2022 Scoping Plan.

Below, we share how CARB's Strategies for Success on NWL and croplands can be amended for more effective climate action.

Composting

Proper compost production and application can play a pivotal role in the carbon, water, and nutrient cycles that support our agricultural and climate systems. Compost offers an important strategy for increasing soil organic carbon in both natural and working lands. Displacing synthetic fertilizers, particularly synthetic nitrogen, with organic alternatives can address extensive nitrate pollution of the state's ground and surface waters,[3] sequester atmospheric carbon in soils,[4] and avoid significant emissions of nitrous oxide[5] across California.

CARB's Proposed Strategy in the Draft SPU: Increase adoption of compost production on farms and application of compost in appropriate grassland settings for improved vegetation and carbon storage, and to deliver waste diversion goals through nature-based solutions.

We recommend that the final SPU should include support for:

- Creating infrastructure grants that support equipment and materials needed for the wide scale implementation of on-farm healthy soils projects, including new equipment for compost production and compost application.
- Providing funds for long-term incentive payments that support compost infrastructure to meet the needs of S.B. 1383 implementation in addition to existing competitive grant programs.

CARB's Proposed Strategy in the Draft SPU: Work across state agencies to reduce regulatory and permitting barriers around some healthy soils practices (e.g., composting), where appropriate.

We recommend that the final SPU should include support for:

- Reviewing and updating the recommendations adopted pursuant to Assemblymember Irwin's A.B. 1045 and include an analysis of the state's progress to achieving the target established in 42649.87(b).

- Align CalRecycle rules with the State Water Resource Control Boards' (SWRCB) for on-farm compost producers to allow the sale of up to 5,000 cubic yards of on-farm compost annually.

Technical Assistance

Technical assistance, grounded in the best science, is crucial for supporting farmers and ranchers as they make the transition to climate smart and resilient farming systems. TA is also necessary for most farmers and ranchers to access local, state, federal, and private conservation incentive programs. Technical assistance is best provided in a way that recognizes and accounts for farmers' management objectives, existing management practices, unique location, crops/livestock raised, available resources, culture, knowledge, values, experiences, spoken language, and other aspects of their complex business operations and surrounding social and ecological systems.[6] Prioritizing outreach, education, TA, regulatory, and incentive program support for farmers of color and small and mid-scale diversified farms will help further repair the legacy of racial injustice and economic consolidation in the agriculture sector.

CARB's Proposed Strategy in the Draft SPU: Leverage and support technical assistance (TA) providers: such as UC Cooperative Extension and California's 98 Resource Conservation Districts, which have track records of providing technical assistance to local landowners and implementing agriculture, forestry, natural resource management, and restoration projects across the state.

We recommend that the final SPU include support for:

- Annual baseline funding for all Resource Conservation Districts and increasing UCANR funding to restore the number of UCCE farm advisors and specialists to 1990 levels.
- Training and employing a robust conservation workforce necessary for scaled conservation practice planning and implementation as well as a significant expansion of technical assistance provision for organic and organic transitioning farmers and ranchers.
- Encouraging and supporting TA providers in providing whole farm conservation planning and implementation and agricultural planning for climate and drought resilience in every agricultural county in the state.
- Prioritizing TA and financial incentives for farmers of color and small and mid-scale diversified family farms as the state implements the Climate Smart Agriculture programs as well as including farmers of color and small and mid-scale producers on state agricultural boards, committees, commissioners, and advisory panels, to address how climate issues impact their communities.
- Effective implementation of the Farmer Equity Act of 2017 to maximize participation from socially disadvantaged farmers in Healthy Soils and other state agricultural-related programs

Farmland Conservation

Agricultural land has a smaller climate footprint than its urban neighbors. A 2012 UC Davis study found that one acre of urban land in Yolo County emits 70 times more GHG emissions than one acre of irrigated cropland.[7] Preventing farmland conversion from urban sprawl and rural ranchette development puts California on a pathway towards sequestering more carbon and reducing GHGs associated with vehicle miles traveled. California loses an average of almost 40,000 acres of farmland to urban sprawl every year.[8] Since 2014, 140,000 acres of at-risk agricultural land have been protected through permanent conservation easements and fee title projects funded by the Sustainable Agricultural Lands Conservation Program (SALCP). Through SALCP, those 140,000 acres of protected farmland will prevent nearly 21.6 MMT of carbon dioxide from being emitted over 30 years.[9] California should support farmland conservation that helps small, diversified, and historically disenfranchised farmers secure their livelihoods. Combined with smart urban growth that prioritizes transit-rich, affordable housing and farmland conservation on the urban/suburban edge can create more livable communities with lower carbon footprints.

CARB's Proposed Strategy in the draft SPU: Establish and expand mechanisms that ensure NWL are protected from land conversion and parcelization (e.g., conservation easements or Williamson Act). Pair land conservation projects with management plans that increase carbon sequestration, where feasible.

We recommend that the final SPU include support for:

- Providing guidance to local governments on the creation of transfer of development rights programs that allow for the transfer of development rights from farm and rangelands to urban areas, including across jurisdictions.
- Improving and maximizing in-fill, affordable housing development and protection of at-risk agricultural lands.
- Requiring the siting of new and expanded local and state infrastructure improvement projects to avoid the most productive farmland soils.
- Land linking programs that connect next-generation farmers and ranchers to landowners.
- Credit enhancements, such as down-payment or interest assistance, to help working farmers and ranchers, including socially-disadvantaged farmers and ranchers, buy farmland protected by easements.

Organic Agriculture

Approximately 20 million pounds of just three fumigants are applied in California every year,[10] and the application of these fumigants are associated with a seven to 100-fold increase in N_2O emissions, which is nearly 300 times more potent than carbon dioxide.[11] Producing synthetic fertilizers and pesticides are energy-intensive processes.[12] Roughly 17 percent of California's agricultural pesticide use comes from fumigants, and fumigant production alone uses approximately 500,000 gigajoules of energy per year.[13] Synthetic pesticides contribute to climate change throughout their life cycle, from production to post-application.[14]

In contrast, organic farmers grow crops without most synthetic pesticides and all synthetic fertilizers, which translates into direct emissions reductions from natural and working lands.[15] Organic farms host on average 50 percent more organisms than conventional farms, particularly natural enemies of pests and pollinators.[16] A comprehensive meta-analysis of 30 years of research concludes that organic farming increases biodiversity by 30 percent compared to conventional farming.[17]

The health impacts of synthetic pesticide exposure will continue to fall primarily on residents of color in California if synthetic pesticide use reduction is not included in the 2022 Scoping Plan.[18] At a minimum, the 2022 Scoping Plan must analyze health impacts of proposed strategies on residents in California as recommended by the Environmental Justice Advisory Committee, particularly on people of color that already bear the brunt of many negative air and water quality impacts.

A Community Support Fund directed by the Department of Pesticide Regulation that provides protections from exposure to synthetic pesticide use should also be included in the 2022 Scoping Plan. Decisions on how the fund is spent should be left to community members most impacted by synthetic pesticide use. Examples of protections include enforceable buffer zones, indoor home air purifiers/filters, tarping, personal protective equipment and other actions that minimize synthetic pesticide exposure for residents of California.

CARB's Proposed Strategy in the draft SPU: Increase organic agriculture to 20 percent of all cultivated acres by 2045.

We recommend that the final SPU include support for:

- Transitioning farmers to organic agriculture and establishing a target that 30% of California's acreage be certified organic by 2030.
- Reducing synthetic pesticide use 50% by 2030 with a focus on reducing the most toxic synthetic pesticides including fumigants and organophosphates, in addition to other pesticides known to cause cancer, endocrine disruption, or developmental and reproductive harm.
- Reducing synthetic fertilizer use, especially through healthy soils practices and organic agriculture.
- The creation of a Community Support Fund that provides direct protections from exposure to pesticide exposure.

Healthy Soils

Healthy soil is a critical tool in mitigating climate change, protecting public and environmental health, and growing healthy food. The overuse of synthetic inputs damage soil health and prevent it from sequestering carbon while also contributing to greenhouse gas emissions. For example, the overapplication of fertilizer and water creates multiple conditions for nitrogen leakage including N_2O emissions, nutrient runoff, and nitrate leaching.[19] Management practices that build soil health–like cover cropping–and that more precisely apply water to crops can reduce nitrate leaching and associated emissions.[20] Furthermore, building soil organic matter by adding organic waste products such as manure, compost, and urban green waste captures CO_2 from the atmosphere[21] and improves soil aggregation and aggregate stability, which improves soil drainage and infiltration.[22] Soils with high soil organic matter in organically managed systems cycle nitrogen more effectively, increasing nitrogen retention on farms.[23]

The sector must offset its current emissions of 34 Million Metric Tons (MMT) of Carbon Dioxide Equivalent per year (CO_2e /year) to achieve carbon neutrality on California's agricultural lands.[24] The offset can be realized by 2030 and can contribute to the state's overall 2045 carbon neutrality goal by immediately transitioning toward agricultural systems and practices that build soil health, reduce emissions, and sequester carbon.

Table 1 illustrates one of many possible pathways to achieve carbon neutrality on a subset of the state's working lands by 2030. It employs a set of management practices that derive almost half their carbon sequestration benefits from compost applications on the state's arable lands and 30 percent from agroforestry practices. The remaining carbon sequestration benefits come from increased photosynthetic carbon capture by deploying, at scale, well-established soil and vegetation management conservation strategies in use since the Dust Bowl era. In addition to the practices below, organic and agroecological farming practices offer further opportunities for carbon sequestration.[25]

Table 1. One potential CDR scenario for a subset of California working lands from 2020 through 2030

Practice	**Annual Acreage (new)**	**Annual MMT CO2e (new acres)**	**2030 Acreage**	**2030 MMT CDR[26]**
Rangeland compost*	110,000	0.16	1,210,000	10.8
Pasture compost[27]	192,500	0.866	2,117,000	10.4
Cropland compost	200,000	0.9	2,200,000	9.9
Agroforestry	190,000	0.19	2,090,000	12.54
Riparian restoration	8,500	0.009	93,500	0.56
Prescribed grazing**	218,000	0.01	2,398,000	0.72
Avoided N fertilizer cropland	200,000	0. 19***	2,200,000	2.1
Cover Crops	200,000****	0.05****	2,200,000****	0.55
Total	916,500	2.05	10,081,500*****	47.57

*See Ryals and Silver 2013 for discussion on rangeland compost CDR metrics.
** Assumes grazing on private land.
***Assumes 1.5% N in compost and 15.6 Mg CO_2e /MT of N (Foucherot and Bellassen 2011). Because COMET-Planner assumes a 15% reduction in synthetic N use with compost application, a factor of 0.85 is used to estimate remaining volume of synthetic N reduced: 200,000 acres/year x 5.3 short tons compost x 0.909 = 963,540 MT compost x 0.015 %N x 15.6 MT CO_2e x 0.85 = 191,648 MT CO_2e.
****assumes practice occurs on same acreage as cropland compost at annual sequestration rate of 0.25 Mg/acre/year (COMET-Planner), and no cumulative benefit.
*****Practices are not applied on unique acreages; some acres may receive more than one practice, hence total acres treated may be less than total acres on a practice-by-practice basis.

CARB's Proposed Strategy in the draft SPU: Accelerate the pace and scale of healthy soils practices to 50,000 acres annually by 2025 and annually conserve at least 6,000 acres of annual crops.

CARB's Proposed Strategy in the draft SPU: Establish or expand financial mechanisms that support ongoing deployment of healthy soils practices and organic agriculture.

We recommend that the final SPU include support for:

- Achieving carbon neutrality in agriculture by 2030.
- Increasing funding and access to programs that build soil health, including the California Healthy Soils Program.
- Prioritizing farmers of color and small and mid-scale diversified family farms for all state agricultural-related programs, including the Healthy Soils Program.

On-Farm Energy Conservation

Agricultural irrigation consumes enough energy to power 1.5 million homes, or approximately 4 percent of the state's total electricity use.[28] Approximately 70 percent of total on-farm energy use is attributed to on-farm groundwater pumping, distributing or pressurizing water to operate irrigation systems.[29] With technology and training, farmers can significantly increase their on-farm irrigation efficiency through soil moisture monitoring, aerial imagery, high-efficiency irrigation systems, variable frequency drives, advanced irrigation scheduling, and proper irrigation system maintenance. Farmers can decarbonize their irrigation energy use by electrifying diesel irrigation pumps, installing solar, and participating in demand response programs with utilities. Furthermore, fertilization practices that reduce emissions include decreasing fertilizer application rates[30] and improving timing and placement of fertilizer applications.[31] Irrigation practices that direct water into the root zone such as buried drip and microjet irrigation systems can increase water use efficiency and reduce N_2O emissions.[32]

CARB's Proposed Strategy in the draft SPU: Utilize innovative agriculture energy use and carbon monitoring and planning tools to reduce on-farm GHG emissions from energy and fertilizer application or increase carbon storage, as well as to promote on-farm energy production opportunities.

We recommend the final SPU should include support for:

- Increasing funding and access to the State Water Efficiency and Enhancement Program to fund on-farm irrigation upgrades.
- Modernizing water suppliers' water delivery infrastructure to support more pressurized on-farm irrigation upgrades which reduces overall agricultural water use and increases water use efficiencies on farms.
- Including healthy soils outcomes in water policies and programs as a strategy for GHG reduction, water conservation and management, water quality improvement requirements, and agricultural water use efficiency.

New Infrastructure for Production, Processing and Manufacturing

The cost and accessibility of specialized equipment and materials is a challenge for organic and other climate-smart producers.[33] Farmers implementing organic and climate-smart practices need better access to nursery stock, compost, specialized equipment, and integrated pest management supplies. These equipment and materials are not currently available at the scale needed to achieve California's ambitious goals for adoption of climate-smart agriculture across the state. Furthermore, addressing existing gaps in regional processing, storage, aggregation, and distribution will ensure farmers adopting climate-smart agriculture practices can stay in business. Infrastructure investments are needed to support processing, distribution and consumption of certified organic, regenerative, and climate-smart, culturally-relevant foods and natural fiber products produced within local and regional food and fiber systems. Gaps in regional processing and supply chains inhibit viable regional value addition that could improve returns to producers and regional economies.[34] Food and nutrition insecurity has increased during the COVID-19 pandemic to record levels in the state - more than 8 million Californians are now food insecure.[35] To reduce food and nutrition insecurity, improve healthy food access, and realize ambitious climate goals for our agricultural sector, we must build the necessary infrastructure to support community-based resilient food and fiber systems.

CARB's Proposed Strategy in the Draft SPU: In partnership with communities and the private sector, expand and develop new infrastructure for manufacturing and processing of climate smart agricultural and biomass products.

We recommend that the final SPU include support for:

- Grants, tax incentives, and low-interest loans to build more production infrastructure and support equipment and materials needed for widespread adoption and implementation of organic and climate-smart agriculture and across the state.
- Farm-to-consumer supply chain and value addition infrastructure funded with the help of grants, low-interest loans, tax incentives.
- Business development and support services to address existing gaps in regional processing, storage, aggregation, and distribution.
- Grants, loans, and tax incentives, as well as procurement policies, to develop markets for products from farms implementing organic and climate-smart agriculture.

With ambitious and targeted actions, we believe the state can meet its carbon neutrality goals by 2030. We look forward to working with you to optimize emissions reductions strategies and increase natural and working lands' carbon sink potential.

Sincerely,

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Secretary, Board of Directors
We Advocate Through Environmental Review

Christine Farren
Executive Director
Foodwise

Dan Noble
Executive Director
Association of Compost Producers

[1] California Air Resources Board, *California Greenhouse Gas Emissions for 2000 to 2017: Trends of Emissions and Other Indicators,* 2019 Edition, (accessed November 14, 2019), https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2017/ghg_inventory_trends_00-17.pdf.

[2] Climate-smart agriculture is defined in the California Farm to School Program as "agriculture practices including those defined by the USDA Natural Resources Conservation Service (NRCS) Conservation Practice Standards (CPS) and those identified by the CDFA Office of Environmental Farming and Innovation via the Healthy Soils Program (HSP), Alternative Manure Management Program (AMMP), Dairy Digester Research and Development Program (DDRDP), and State Water Enhancement and Efficiency Program (SWEEP), including but not limited to cover cropping, no or reduced till, hedgerow plantings, compost application, and prescribed grazing. Climate smart agriculture production systems include certified organic or transitioning to certified organic. Other regenerative strategies include those that also increase resilience to climate change, improve the health of communities and soil, protect water and air quality, increase biodiversity, and help store carbon in the soil." https://www.cdfa.ca.gov/caf2sgrant/docs/2022_request_for_applications.pdf

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[9] California Climate and Agriculture Network, "Sustainable Agricultural Lands Conservation Program," January 2019, http://calclimateag.org/wp-content/uploads/2019/02/CSA-Fact-Sheet-2019-SALC.pdf.

[10] The approximate annual use of 20 million pounds of three fumigants - Metam-Sodium, Potassium N-Methyldithiocarbamate (Metam Potassium), and Chloropicrin - comes from: California Department of Pesticide Regulation, *2017 Pesticide Use Report*, California Department of Pesticide Regulation, (accessed November 2019), https://www.cdpr.ca.gov/docs/pur/pur17rep/17_pur.htm.

[11] K. Spokas and D. Wang, "Stimulation of nitrous oxide production resulted from soil fumigation with chloropicrin," *Atmospheric Environment* 37 (January 2003): 3501-3507, doi:10.1016/S1352-2310(03)00412-6. K. Spokas, D. Wang, and R. Venterea,"Mechanisms of N_2O production following chloropicrin fumigation," *Applied Soil Ecology* 31, no. 1-2 (2006), https://doi.org/10.1016/j.apsoil.2005.03.006. K. Spokas, D. Wang, and Venterea. R. 2004. "Greenhouse gas production and emission from a forest nursery soil following fumigation with chloropicrin and methyl isothiocyanate," *Soil Biology & Biochemistry* 37 (2005): 475–485, doi:10.1016/j.soilbio.2004.08.010.

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Appendix A

Vision for Carbon Neutral Agriculture in California by 2030: A Pathway to Economic, Ecological, and Social Resilience

Recommendations to Governor Newsom's Administration

GOAL: By 2030, California agriculture will achieve carbon neutrality, moving from a net source of greenhouse gasses to a net sink through an integrated approach that simultaneously builds climate resilience and garners economic, environmental, and social benefits.

INTRODUCTION

As outlined in the recent IPCC report, we must act immediately to avoid temperature increases beyond 1.5 degrees Celsius and avoid the worst impacts of climate change.[1] California has a goal of reducing greenhouse gas (GHG) emissions to 40 percent below 1990 levels by 2030 and achieve carbon neutrality as a state by 2045. California's agricultural sector is responsible for 8 percent of the state's GHG emissions.[2] Our analysis shows that, with immediate action, California agriculture could achieve net carbon neutrality by 2030 and become a significant carbon sink in perpetuity. From improvements on the farm to investments off the farm, this document proposes six pathways CARB should include in its 2022 Scoping Plan Update to transform the agricultural sector to help meet California's carbon neutrality goals. The six pathways included are:

- Increasing production, distribution, and application of compost;
- Increasing adoption of organic agriculture and setting targets to actively reduce the use of fossil-fuel produced fertilizers and pesticides;
- Prioritize farmland conservation and land access, particularly for farmers of color, small and midscale producers, and other historically underserved populations;
- Decarbonizing agricultural irrigation and improving water use efficiency;
- Significantly scaling up agricultural technical assistance to plan, implement, and monitor carbon plans on farms; and
- Leverage production and supply chain infrastructure and market development to build resilient regional economies.

The sequestration opportunities afforded in agriculture cannot replace direct emissions reductions strategies in other sectors. However, we can no longer ignore the potential that agricultural lands and the food and farming sector has in achieving California's climate goals. The six pathways we propose are all related components of any carbon neutral strategy for agriculture. For example, transitioning to organic agriculture requires the use of soil amendments that are not produced using fossil fuels, which is addressed by increasing composting production, distribution, and application. Scaling up agricultural technical assistance will help more farmers transition to organic, properly apply compost, and decarbonize their irrigation systems all contributing to carbon sequestration and emissions reductions from agriculture.

These six pathways can help California simultaneously achieve a wide range of important public health and environmental benefits and cost savings, including improved crop yields, enhanced management of increasingly limited water resources, improved resilience to floods and droughts, wildfire prevention, enhanced water quality (including drinking water), improved air quality, better and more equitable economic outcomes for farmers and ranchers, and more resilient food production systems. As a group representing diverse public interests, including production agriculture, rural economic development, public health and safety, farmworker wellbeing, rural communities, land conservation, and environmental stewardship, these recommendations represent an unprecedented consensus on a robust and achievable pathway to a resilient future for all Californians.

PATH TO ACHIEVING CARBON NEUTRALITY IN AGRICULTURE

The sector must offset its current emissions of 34 Million Metric Tons (MMT) of Carbon Dioxide Equivalent per year (CO_2e /year) to achieve carbon neutrality on California's agricultural lands.[3] The offset can be realized by 2030 and can contribute to the state's overall 2045 carbon neutrality goal by immediately implementing a comprehensive statewide strategy that addresses emissions reduction and carbon sequestration on the state's working lands and deploys working land carbon dioxide removal (CDR) practices at scale.

Table 1 illustrates one of many possible CDR scenarios deployed on a subset of the state's working lands by 2030. It employs a set of management practices that derive almost half their carbon sequestration benefits from compost applications on the state's arable lands and 30 percent from agroforestry practices. The remaining carbon sequestration benefits come from increased photosynthetic carbon capture by deploying, at scale, well-established soil and vegetation management conservation strategies in use since the Dust Bowl era. In addition to the practices below, organic and agroecological farming practices offer further opportunities for carbon sequestration.

Table 1. One potential CDR scenario for a subset of California working lands from 2020 through 2030

Practice	Annual Acreage (new)	Annual MMT CO2e (new acres)	2030 Acreage	2030 MMT CDR[4]
Rangeland compost*	110,000	0.16	1,210,000	10.8
Pasture compost[5]	192,500	0.866	2,117,000	10.4
Cropland compost	200,000	0.9	2,200,000	9.9

Agroforestry	190,000	0.19	2,090,000	12.54
Riparian restoration	8,500	0.009	93,500	0.56
Prescribed grazing**	218,000	0.01	2,398,000	0.72
Avoided N fertilizer cropland	200,000	0. 19***	2,200,000	2.1
Cover Crops	200,000****	0.05****	2,200,000****	0.55
Total	916,500	2.05	10,081,500*****	47.57

*See Ryals and Silver 2013 for discussion on rangeland compost CDR metrics.
** Assumes grazing on private land.
***Assumes 1.5% N in compost and 15.6 Mg CO_2e /MT of N (Foucherot and Bellassen 2011). Because COMET-Planner assumes a 15% reduction in synthetic N use with compost application, a factor of 0.85 is used to estimate remaining volume of synthetic N reduced: 200,000 acres/year x 5.3 short tons compost x 0.909 = 963,540 MT compost x 0.015 %N x 15.6 MT CO_2e x 0.85 = 191,648 MT CO_2e.
****assumes practice occurs on same acreage as cropland compost at annual sequestration rate of 0.25 Mg/acre/year (COMET-Planner), and no cumulative benefit.
*****Practices are not applied on unique acreages; some acres may receive more than one practice, hence total acres treated may be less than total acres on a practice-by-practice basis.

This document is presented in two parts—a description of guiding principles and a discussion of six pathways that can maximize sequestration and emissions reductions on NWL. We offer these pathways to help inform CARB ahead of the release of the Final 2022 Scoping Plan.

Guiding Principles

Our recommended actions adhere to the following principles to maximize climate benefits and mitigate unintended consequences. We recommend to CARB that any state-led agricultural climate strategy be designed with these principles in mind.

- **Enhance climate resiliency**: Help agricultural operations and rural communities better respond to climate-related changes such as drought and flooding, while also helping prevent wildfires.
- **Enhance the long-term viability of agricultural operations across scale and operation type**: Support the long-term economic health of agricultural businesses and foster stable land tenancy and market opportunities, taking explicit measures to be inclusive of our state's most vulnerable farmers, including socially disadvantaged farmers and small-to mid-scale operations.
- **Include all voices in decision making**: Enable full participation and representation of communities, particularly vulnerable and marginalized communities, in decision-making.
- **Advance environmental justice**: Eliminate the disproportionate burden of negative environmental impacts from climate change and agriculture borne by low-income and communities of color.
- **Promote collaboration**: Enhance meaningful collaboration and partnerships among a multiplicity and diversity of stakeholders.

- **Promote environmental health**: Improve water quality in surface and groundwater, reduce agriculture's negative impact on human health and the environment, reduce nutrient runoff, and reduce the use of synthetic inputs.
- **Promote and protect farmworker safety**: Ensure the farmworkers, families, and communities disproportionately harmed by industrial agricultural practices are protected.
- **Support equitable rural community economic development**: Support diversified and equitable rural economies.

Policy Pathways

This next section describes each of our proposed six pathways to transforming the agricultural sector into a carbon neutral one. We describe the climate and emissions reduction goal of the pathway and end each section with a list of 3-5 more specific policy recommendations to advance the pathway.

Pathway 1: LEVERAGE THE AMPLIFYING POWER OF COMPOST TO ACCELERATE SOIL CARBON SEQUESTRATION

GOAL: Utilize all appropriate organic waste materials for environmentally compliant compost production, and build new market opportunities focused on economic and environmental justice.

Proper compost production and application can play a pivotal role in the carbon, water, and nutrient cycles that support our agricultural and climate systems. Compost offers the most rapid means of directly increasing soil organic carbon in both natural and working lands. Directly adding stable organic matter in the form of compost enables the rapid elevation of soil organic carbon to levels that may take several years to achieve without it.[7] Displacing synthetic fertilizers, particularly synthetic nitrogen, with organic alternatives can contribute to addressing extensive nitrate pollution of the state's ground and surface waters, reduce NOx pollution in the state's non-attainment regions, sequester atmospheric carbon in soils and avoid significant emissions of methane and nitrous oxide across California.

Compost application on cropland and rangeland fosters soil carbon sequestration.

- A one-time, ¼ inch application of compost on grazed rangelands can stimulate carbon sequestration rates of one to three tons CO_2e per acre per year for a decade or more, while increasing the production of forage by 15 to 50 percent even during times of drought.[6]
- Compost use significantly accelerates the process of soil carbon sequestration when combined with cover crops.[7]
- Compost use deployed at scale on the state's NWL could increase the state soil's water holding capacity by at least 4.7-million-acre feet, more water than Shasta reservoir at full capacity.[8]

- Increasing soil organic matter from its current 1% to 5% on the state's 20 million arable acres would move over 1.3 billion metric tons of CO_2e from the atmosphere to the soil carbon pool[9]. Note that achieving this quantity of CO_2 transfer from the atmosphere to the soil engages only the plow layer (6.7" or 17 cm) of the state's arable lands. Engaging deeper soil layers through agroforestry practices, deep rooted cover crops, repeated compost applications, etc., will obviously result in greater quantities of C transferred to the soil profile. Engaging other land cover types, such as forests and rangelands, offers additional opportunity for soil C increases.

Compost can replace synthetic fertilizers, with water quality and GHG emission reduction benefits.

- Compost supports the reduction of synthetic fertilizer use, and thus can reduce emissions from both the manufacture and use of synthetic fertilizers, while directly increasing soil carbon. If all the roughly 500,000 tonnes of synthetic nitrogen fertilizer imported into the state each year were replaced by organic soil amendments generated within California, an estimated 7.8 million metric tons of CO_2e emissions could be avoided annually.[10]

Large GHG emission reductions are possible by diverting organic waste from landfills to compost.

- In 2016, California disposed roughly 35 MMT of waste in landfills, more than 60 percent of which was organic material that could have been source reduced, recycled, composted, used as mulch, or processed in anaerobic digesters and then composted.[9]
- Composting organic materials such as food scraps, yard trimmings, animal manure, orchard waste, and wood debris (instead of landfilling, lagoon storage, or open burning) is an effective strategy for mitigating the potent GHGs methane and nitrous oxide, as well as black carbon.
- Directing organic waste materials to composting is consistent with recent state statutory requirements to:
  - Recover 75% of organic waste from landfills by the year 2025,
  - Reduce short lived climate pollutants from food waste, livestock manures, orchard and crop waste, and fire fuel reduction biomass.

Scaling up compost production and use will create jobs and allows for community participation.

- To meet S.B. 1383 targets,[10] CalRecycle estimates the need for up to one hundred new and expanded composting facilities and transport infrastructure. Community participation in the design and development of compost projects will enable disenfranchised populations and people most affected by the location of waste management facilities to participate in and benefit from the new soil building economy, while addressing long-standing environmental justice issues of soil, water and air pollution associated with agricultural production.

Recommended Policy Actions:

1. CalEPA to review and update the recommendations adopted pursuant to AB 1045 (Irwin), including an analysis of the state's progress to achieving the target established in 42649.87(b).
2. California Department of Food and Agriculture (CDFA) to create infrastructure grants that support equipment and materials needed for the wide scale implementation of on-farm healthy soils projects, including new equipment for compost production and compost application.
3. Align CalRecycle rules with State Water Resources Control Board for on-farm compost producers to allow the sale of up to 5,000 cubic yards of on-farm compost annually.
4. CalRecycle to provide funds for long-term incentive payments that support compost infrastructure to meet the needs of S.B. 1383 implementation (CARB) in addition to existing competitive grant programs.

Pathway 2: INCREASE ORGANIC ADOPTION AND FACILITATE ALTERNATIVES TO SYNTHETIC INPUTS FOR CLIMATE, ENVIRONMENTAL, ECONOMIC, AND HUMAN HEALTH

Goal: Expand the benefits of organic agriculture, reduce harm from synthetic pesticide and fertilizer use, and provide support to impacted communities. While only 2.6 million acres, or roughly 10 percent of agricultural land, in California is in organic production,[11] the expansion of organic acreage is a key climate strategy with public health and biodiversity co-benefits. The 2022 Scoping Plan should accelerate implementation of organic agriculture with a 2030 timeline because of the public health benefits from reducing synthetic pesticide and fertilizer use and the feasibility of expanding organic agriculture quickly. Total sales for organic processed products in California hit a record $35 billion in 2021, more than doubling 2020 sales,[12] while organic farmgate sales in 2020 reached $11.9 billion.[13]

Transitioning to organic acreage can help reduce the use of fossil-fuel produced inputs contributing to emissions reductions goals.

- Approximately 20 million pounds of just three fumigants are applied in California every year,[14] and the application of these fumigants are associated with a seven to 100-fold increase in N_2O emissions, which is nearly 300 times more potent than carbon dioxide.[15, 16, 17]
- Producing synthetic fertilizers[18] and pesticides[19] are energy-intensive processes. Roughly 17 percent of California's agricultural pesticide use comes from fumigants, and fumigant production alone uses approximately 500,000 gigajoules of energy per year.[20]
- Synthetic pesticides contribute to climate change throughout their life cycle, from production[21] to post-application.[22]

- Organic farmers grow crops without synthetic pesticides and fertilizers, which translates into direct emissions reductions from natural and working lands.[23]

Reducing synthetic inputs enhances soil carbon sequestration on natural and working lands.

- A UC Davis Long-Term Research on Agricultural Systems study found that after 10 years, organic systems resulted in 14 times the rate of carbon sequestration as the conventional system.[24] After 20 years, organically managed soils sequestered significantly more soil organic carbon than conventionally managed soils.[25]
- Organic farming can result in higher stable soil organic matter compared to conventional, even continuous no-till, conventional farming.[26]
- University of California's in-depth 2018 review of climate science recommends practices implemented by organic farmers, such as crop diversification and cover cropping, because these practices lead to healthy carbon-sequestering soils.[27]
- Alternative agriculture systems that limit synthetic pesticide use, like organic farming, have been shown to significantly increase carbon stored in soils in California.[28]
- Over-application of synthetic fertilizer can have a negative impact on soil health.[29] The higher nitrogen, phosphorus, and potassium levels in synthetic fertilizer inhibit soil carbon sequestration and significantly reduce soil organic matter.[30]
- Synthetic pesticides can undercut carbon sequestration goals by damaging the soil microbiome and altering critical biochemical processes.[31]

Reductions in synthetic pesticide use also protects public and environmental health.

- In California, Latinx children are 91 percent more likely than White children to attend schools with the highest pesticide exposure.[32] This exposure is linked with impaired neurobehavioral development[33] as well as enhanced risk of diabetes[34] and asthma.[35]
- Organic agriculture's prohibition of toxic chemical use protects the health of workers and surrounding communities.
- Organic farms host on average 50 percent more organisms than conventional farms,[36] particularly natural enemies of pests and pollinators.[37,38]
- A comprehensive meta-analysis of 30 years of research concludes that organic farming increases biodiversity by 30 percent compared to conventional farming.[39]

Over application of synthetic inputs exacerbates climate impacts, wastes farmers' money, and undermines ecological and human health.

- Synthetic pesticides are linked to both acute and chronic disease in workers, rural community members, and to negative impacts on the soil microbiome.[40]
- The over-application of synthetic fertilizer contributes to the health and climate crises; it leaches into drinking water sources, resulting in unsafe drinking water for hundreds of thousands of Californians in agricultural regions that tend to be low-income communities of

color. These impacts can last for decades.[41] It also contributes to N_2O emissions and ground level ozone formation.[42, 43]

- Agricultural soil management including fertilizer application is the largest source of N_2O emissions in the United States, accounting for about 74% of total U.S. N_2O emissions in 2020.[44] In California, N_2O emissions accounted for 2.8% (on a CO2-equivalent basis) of statewide greenhouse gas emissions in 2014, of which agricultural soils made up 51% of emissions.[45]

Incorporating health impacts of strategies will help CARB track and collect necessary data.

The health impacts of synthetic pesticide exposure will continue to fall primarily on residents of color in California if synthetic pesticide use reduction is not included in the 2022 Scoping Plan.[46] At a minimum, the 2022 Scoping Plan must analyze health impacts of proposed strategies on residents in California as recommended by the Environmental Justice Advisory Committee, particularly on people of color that bear the brunt of many negative air and water quality impacts.

A Community Support Fund directed by the Department of Pesticide Regulation that provides protections from synthetic pesticide use should also be included in the 2022 Scoping Plan. Decisions on how the fund is spent should be left to community members most impacted by synthetic pesticide use. Examples of protections include enforceable buffer zones, indoor home air purifiers/filters, tarping, personal protective equipment, and other actions that minimize synthetic pesticide exposure for residents of California.

Recommended Policy Actions:

- Transitioning farmers to organic agriculture and establishing a target that 30% of California's acreage be certified organic by 2030.
- Reducing synthetic pesticide use 50% by 2030 with a focus on reducing the most toxic synthetic pesticides including fumigants and organophosphates, in addition to other pesticides known to cause cancer, endocrine disruption, or developmental and reproductive harm.
- Reducing synthetic fertilizer use, especially through healthy soils practices and organic agriculture.
- The creation of a Community Support Fund that provides protections from exposure to pesticide exposure.

Pathway 3: PRIORITIZE FARMLAND CONSERVATION AND LAND ACCESS, PARTICULARLY FOR FARMERS OF COLOR, SMALL AND MIDSCALE PRODUCERS, AND OTHER HISTORICALLY UNDERSERVED POPULATIONS

GOAL: Protect our finite agricultural lands from sprawl development, improve access to agricultural land for future generations of farmers and ranchers, and scale up adoption of healthy soils practices on protected lands.

Agricultural land has a smaller climate footprint than its urban neighbors.

- A 2012 UC Davis study found that one acre of urban land in Yolo County emits 70 times more GHG emissions than one acre of irrigated cropland.[25]

Preventing farmland conversion from urban sprawl development puts California on a pathway towards sequestering more carbon and reducing GHGs associated with vehicle miles traveled.

- California loses an average of almost 40,000 acres of farmland to urban sprawl every year.[26]
- 140,000 acres of at-risk agricultural land have been protected since 2014 through permanent conservation easements funded by the Sustainable Agricultural Lands Conservation Program (SALCP). Through SALCP, those 140,000 acres of protected farmland will prevent nearly 21.6 MMT of carbon dioxide from being emitted over 30 years.[27]
- California should support farmland conservation that helps small, diversified, and historically disenfranchised farmers secure their livelihoods.
- Combined with smart urban growth that prioritizes transit-rich, affordable housing farmland conservation on the urban/suburban edge can create more livable communities with lower carbon footprints.

Recommended Policy Actions:

1. Office of Planning and Research to provide guidance to local governments on the creation of transfer of development rights programs that allow for the transfer of development rights from farm and rangelands to urban areas, including across jurisdictions. Such efforts should enhance in-fill, affordable housing development and protection of at-risk agricultural lands.
2. Strategic Growth Council, Housing and Community Development, and Department of Conservation to develop an integrated regional strategy and funding approach to the Affordable Housing and Sustainable Communities Program and the SALCP to improve and maximize in-fill development and farmland conservation outcomes.
3. Office of Planning and Research to require the siting of new and expanded local and state infrastructure improvement projects to avoid the most productive farmland soils.
4. Department of Conservation to provide state funding for land linking programs that connect next-generation farmers and ranchers to landowners.
5. Strategic Growth Council and Office of Planning and Research to provide state funds and support to lenders for credit enhancements, such as down-payment or interest assistance to help working farmers and ranchers, including socially-disadvantaged farmers and ranchers, buy farmland protected by easements.

Pathway 4: IMPLEMENT HOLISTIC WATER SOLUTIONS THAT IMPROVE SOIL HEALTH AND REDUCE AGRICULTURAL WATER & ENERGY USE AND ASSOCIATED GHG EMISSIONS

GOAL: Improve agricultural water use efficiencies to reduce emissions associated with current water use while also helping agriculture adapt to a future with less surface water, which is critical with climate change causing uncertainty in future water supplies. Invest in practices that build soil health as an irrigation demand strategy that also reduces nitrous oxide emissions and nitrogen leaking. Include healthy soils outcomes in water policies and programs as a strategy for GHG reduction, water conservation and management, water quality improvement requirements, and agricultural water use efficiency.

Improving irrigation efficiency reduces GHG emissions associated with irrigation.

- Agricultural irrigation consumes enough energy to power 1.5 million homes, or approximately 4 percent of the state's total electricity use.[47]
- Approximately 70 percent of total on-farm energy use is attributed to on-farm groundwater pumping, distributing or pressurizing water to operate irrigation systems.[48]
- With technology and training, farmers can significantly increase their on-farm irrigation efficiency through soil moisture monitoring, aerial imagery, high-efficiency irrigation systems, variable frequency drives, advanced irrigation scheduling, and proper irrigation system maintenance.
- Farmers can decarbonize their irrigation energy use by electrifying diesel irrigation pumps, installing solar, and participating in demand response programs with utilities.

Modernizing water delivery infrastructure can reduce agricultural water use while encouraging more growers to switch to more energy and water efficient irrigation systems on farms.

- Furrow and flood irrigation account for more than 43 percent of the Central Valley's irrigated acres.[49] Only 65 percent of water and 73 percent of water delivered through furrow and flood irrigation respectively is absorbed by plants.[50] These are considerably low water use efficiency rates given advances in irrigation technology including micro sprinkler and drip irrigation systems.
- Micro-sprinkler systems apply low pressure water to a small area around the sprinkler head. Along with drip irrigation systems which also distribute low pressure water along rows of piping by dripping water via outlet holes to individual plants, micro-sprinkler systems are incredibly more water efficient because they target water applications to crops instead of water being lost to evaporation, as is the case with flood and furrow irrigation.[51]

- By switching to pressurized on-farm irrigation systems, farmers could achieve considerable water savings. A study by the Pacific Institute concluded that converting 3.3 million acres of flood irrigated land to 2.2 million acres of sprinkler irrigation and 1.1 million acres to drip could conserve roughly 0.9 and 1.2 million acre-feet per year in a wet and dry year, respectively.[52]
- A 2002 study showed that farms under on-demand schedules performed better economically while decreasing seasonal water demand by up to 37 percent.[53]
- Modernizing water suppliers' water delivery infrastructure increases compatibility with efficient on-farm irrigation methods, such as subsurface drip and micro-irrigation, which can result in overall water savings.[54]
- Unfortunately, there is often a disconnect between farmers' water demand and water suppliers' distribution schedules. Irrigation districts must upgrade and modernize their water delivery systems to help growers fully utilize the potential of their on-farm irrigation upgrades, which will also help irrigation districts use water more efficiently.

Modified irrigation and crop fertilization practices can decrease energy use and N_2O emissions.

- Fertilization practices that reduce emissions include decreasing fertilizer application rates[55] and improving timing and placement of fertilizer applications.[56]
- Irrigation practices that direct water into the root zone such as buried drip and microjet irrigation systems can increase water use efficiency and reduce N_2O emissions.[57]
- A newly released study on forage crop production under desert conditions shows that drip irrigation on sudangrass increased yield by 6% and per-yield soil CO_2 emissions by 9%, but decreased irrigation requirement by 49%, N_2O emissions by 59%, and NO by 49% compared to furrow irrigation.[58]
- Increasing soil drainage is a "well established" practice to reduce N_2O release to the atmosphere.[59]

Building soil health and improving water use efficiency can also reduce nitrous oxide emissions from soil.

- A statewide average increase in soil organic matter of just one percent on all of California's 26 million acres of working lands would decrease irrigation demand by 208,000 acre-feet annually.[60] With a more ambitious but technically feasible three percent increase, irrigation demand would be reduced by 580,000 acre-feet annually.[61]
- Overapplication of fertilizer and water create multiple conditions for nitrogen leakage – N_2O emissions, nutrient runoff, and nitrate leaching.[62]
- Management practices that build soil health like cover cropping and that more precisely apply water to crops can reduce nitrate leaching and associated emissions.[63]
- Building soil organic matter through additions of "organic waste products" such as manure, compost, and urban green waste captures CO_2 from the atmosphere[64] and improves soil aggregation and aggregate stability, which improves soil drainage and infiltration.[65]
- Soils with high soil organic matter in organically managed systems cycle nitrogen more effectively, increasing nitrogen retention on farms.[66]

Recommended Policy Actions:

1. Increase funding and access to programs that build soil health, including the California Healthy Soils Program.
2. Increase funding and access to the State Water Efficiency and Enhancement Program to fund on-farm irrigation upgrades.
3. Modernize water suppliers' water delivery infrastructure to support more pressurized on-farm irrigation upgrades which reduces overall agricultural water use and increases water use efficiencies on farms.
4. Include healthy soils outcomes in water policies and programs as a strategy for GHG reduction, water conservation and management, water quality improvement requirements, and agricultural water use efficiency.

Pathway 5: TECHNICAL AND FINANCIAL ASSISTANCE (TA): PROVIDE FUNDING AND TECHNICAL ASSISTANCE SUPPORT TO LAND MANAGERS FOR PLANNING, IMPLEMENTATION, AND MONITORING WHOLE FARM APPROACHES TO CARBON SEQUESTRATION AND CLIMATE RESILIENCE

GOAL: Significantly increase the capacity of institutions and scale up education, incentives, demonstration projects, and other opportunities to support farmers, ranchers, and frontline communities in adopting and implementing soil carbon sequestration and GHG reduction best practices to achieve Scoping Plan targets and goals for the NWL sector. Prioritize resources for small and mid-scale and socially disadvantaged farmers.

TA extends the reach and impact of transformative agricultural practices.

- Increase TA for farmers and ranchers. TA is also a key factor of market adoption in the agricultural sector and is most impactful when presented by trusted sources (e.g. Resource Conservation Districts, U.C. Cooperative Extension, USDA NRCS, trade associations, NGOs, and other farmers). TA is necessary for most farmers and ranchers to access local, state, federal, and private conservation incentive programs.
- TA should be provided in a way that recognizes and accounts for farmers' management objectives, existing management practices, unique location, crops/livestock raised, available resources, culture, knowledge, values, experiences, spoken language, and other aspects of their complex business operations and surrounding social and ecological systems.[33]
- Regional collaboration, outreach, and demonstration projects will accelerate adoption of best practices.
- Prioritizing outreach, education, TA, regulatory, and incentive program support for farmers of color and small and mid-scale diversified farms will help repair the legacy of racial injustice and economic consolidation in the agriculture sector.

- According to the 2017 Census of Agriculture, approximately one out of five farmers in California are farmers of color.[34] Taking these actions will assist the Newsom administration in implementing the Farmer Equity Act of 2017.[35]

Recommended Policy Actions:

1. Prioritize farmers of color and small and mid-scale diversified family farms for all state agricultural-related programs, including the Healthy Soils Program, and on all CDFA boards, committees, commissioners, and advisory panels.
2. Implement the Farmer Equity Act of 2017 to maximize participation from socially disadvantaged farmers in Healthy Soils and other state agricultural-related programs.
3. Provide annual baseline funding for all RCDs and increase UCANR funding to restore the number of farm advisors and specialists to 1990 levels.
4. Train and employ a robust conservation workforce necessary for scaled conservation practice planning and implementation.
5. Support increased capacity for a diversity of TA provider institutions (e.g. RCDs, UCCE, UC Climate Smart Ag Team) to support whole farm conservation planning and implementation and agricultural planning for climate and drought resilience in every agricultural county in the state.

Pathway 6: LEVERAGE PRODUCTION AND SUPPLY CHAIN INFRASTRUCTURE AND MARKET DEVELOPMENT TO BUILD RESILIENT REGIONAL ECONOMIES

GOAL: Fill existing gaps in production, supply chain and value addition infrastructure in order to expand adoption of organic, regenerative, and climate-smart agriculture practices and to ensure all communities have access to products coming from farms and ranches implementing ecological agriculture practices. Developing the market from the farm to the consumer for climate-smart products will increase carbon sequestration and greenhouse gas emissions reductions.

Expanding access to equipment and materials will support widespread adoption and implementation of organic, regenerative, and climate-smart agriculture and carbon farming across the state.

- The cost and accessibility of specialized equipment in organic production is a challenge for organic producers.[67] Farmers implementing organic, climate-smart practices need access to nursery stock, compost, specialized equipment, and integrated pest management supplies. These equipment and materials are not currently available at the scale needed to achieve California's ambitious goals for adoption of climate-smart agriculture across the state.

- Climate-smart agriculture improves soil health and the health of communities, protects water and air quality, increases biodiversity, and reduces GHG emissions as well as increases soil carbon content.

Addressing existing gaps in regional processing, storage, aggregation, and distribution will ensure farmers adopting climate-smart agriculture practices stay in business.

- Infrastructure investments are needed to support processing, distribution and consumption of certified organic, regenerative, and culturally relevant foods and natural fiber products produced within local and regional food and fiber systems. Gaps in regional processing and supply chains inhibit viable regional value addition that could improve returns to producers and regional economies.[68]
- Food and nutrition insecurity has increased during the COVID-19 pandemic to record levels in the state - more than 8 million Californians are now food insecure. To reduce food and nutrition insecurity and improve healthy food access we must build the necessary infrastructure to support community-based resilient food systems.

Developing the market for regional consumption of products from farms implementing organic, regenerative, and climate-smart agriculture will reduce greenhouse gas emissions and support a resilient regional economy.

- Reliable markets that reward climate-smart production practices within regional processing and supply chains must be strengthened to ensure that California producers and rural economies can remain financially viable while expanding climate-smart practices.
- Regional economies based in organic, regenerative, and climate-smart agricultural systems can supply a wide range of food and fiber products to meet regional consumer needs, reducing the lifecycle GHG impact of these products compared to other sources, supporting California's overall climate goals.
- The state can support market development, including necessary early-stage market development targeting regional production and processing systems, through procurement policies as well as direct assistance (grants and loans) for market development.

Recommended Policy Actions:

1. Invest in production infrastructure through grants, tax incentives, and low-interest loans that support equipment and materials needed for large-scale implementation of organic, regenerative, and climate-friendly agriculture.
2. Invest in farm-to-consumer supply chain and value addition infrastructure through grants, low-interest loans, tax incentives, and provide business development and support services to address existing gaps in regional processing, storage, aggregation, and distribution.

3. Invest in market development grants and loans, and tax incentives, as well as procurement policies for sourcing products from farms implementing organic, regenerative, and climate-friendly agriculture.

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[1] IPCC, 2022: Summary for Policymakers [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (eds.)]. In: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. In Press, https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf

[2] California Air Resources Board, *California Greenhouse Gas Emissions for 2000 to 2017: Trends of Emissions and Other Indicators,* 2019 Edition, (accessed November 14, 2019), https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2017/ghg_inventory_trends_00-17.pdf.

[3] 8 percent of the state's total annual 424.1 MMT CO_2e is 34 MMT. California Air Resources Board, *California Greenhouse Gas Emissions for 2000 to 2017: Trends of Emissions and Other Indicators,* 2019 Edition, (accessed November 14, 2019), https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2017/ghg_inventory_trends_00-17.pdf.

[4] Rates are derived from COMET-Planner, unless otherwise stated.

[5] Pasture is more intensively managed than rangeland using practices such as seeding, fertilization, mowing, and irrigation. Pasture may also include cropland that is seasonally or episodically grazed by livestock. Pasture is typically included in estimates of arable land in California, while rangeland is not.

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[9] A 4% increase in SOM/acre = 40 short tons/acre = 20 short tons C/acre
20 short tons of C x 20 M acres = 400M short tons of C = 363,600,000 metric tons C
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