April 4, 2022

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

Re: Comments on Natural and Working Lands Model Scenarios for 2022 Scoping Plan Update

Dear Chair Randolph and Members of the Board,

On behalf of the undersigned organizations, we write to provide comments on the California Air Resources Board's (CARB) draft Initial Modeling Results for the Natural and Working Lands (NWL) section of the 2022 Scoping Plan Update and to provide our recommendations on policy pathways to be included in the May draft Scoping Plan.

Thank you for taking the time to present the outcomes from the NWL scenario modeling. We appreciate the inclusion of organic agriculture, healthy soils practices, land-use conversion, grasslands restoration and more in the modeling. However, there are outstanding concerns about the modeling and its limitations, including the following:

1. Lack of synthetic fertilizers and related avoided emissions in organic farming and healthy soils systems in the croplands scenario: Our understanding from CARB staff about why synthetic fertilizers and their related N_2O emissions were not included in the croplands scenario modeling is because of limitations of the model, DAYCENT. However, that doesn't comport with our understanding of DAYCENT, which is a model that has been used by many researchers in California to model N_2O emissions from synthetic fertilizers used in croplands and to examine avoided N_2O emissions from organic and alternative cropping systems. For example, DAYCENT was used by California researchers, funded by the CEC PIER program back in 2009, to do an initial statewide assessment of the greenhouse gas mitigation potential of agricultural soils in the

state. The authors concluded that a 25 percent reduction in synthetic fertilizers offered one of the best approaches to reducing GHG emissions in conventional agricultural systems.[1]

Without including synthetic fertilizers and the avoided use of synthetic fertilizers in both organic farming systems and in systems using specific healthy soils practices, the Scoping Plan Update modeling provides no insight into the benefits of organic or healthy soils practices in reducing GHG emissions and contributing to an overall reduced carbon footprint in agriculture—a significant limitation and lost opportunity. While we support the inclusion of organic agriculture in CARB's cropland scenarios, we are concerned the full climate benefits of organic are not captured since a primary requirement of organic agriculture is to prohibit synthetic input use–including fertilizers–which reduces overall greenhouse gas emissions. Furthermore, multiple field trials in California show that reductions in synthetic input use also help increase carbon sequestration in soils.[2] Omitting reductions in synthetic fertilizer use results in a model that does not fully capture the scope of emissions reduction benefits from organic agriculture and healthy soils practices. Because of this, the model is skewed and may be a reason why annual croplands are shown as net emitters in CARB's model (see page 23).

2. 30-centimeter depth measurement for soil carbon underestimates soil carbon storage potential. Worldwide, an estimated 30–75% of SOC is located below 30 cm[3], and these deeper SOC pools play a critical role in carbon accumulation and storage.[4] Thus, by limiting its analysis to a soil depth of 30 cm, CARB is artificially constraining both the estimated size of existing SOC stocks and the magnitude of potential for soils to either lose or accumulate carbon under its NWL scenarios. CARB's modeling efforts should be expanded to include the actual volume of the state's soils to more accurately represent the carbon sequestration potential of its soils, generally, and its working lands soils, in particular.

3. Soil carbon sequestration modeling should be conducted for multiple land types, not just croplands. At minimum CARB should include soil carbon sequestration modeling in grasslands, woodlands/chaparral, and forests to more fully understand the carbon sequestration potential of the state's natural and working lands.

We recommend that CARB look to improve upon its natural and working lands modeling by addressing these issues and conducting additional modeling to more accurately document climate change mitigation potential on natural and working lands in California.

We recognize CARB's next step will be to publish its draft Scoping Plan, which will include different mechanisms and pathways for achieving the goals of each of the four model scenarios. Using a variety of strategies that increase carbon sequestration in soils and reduce emissions, California's agricultural lands can be carbon neutral by 2030 and a carbon sink in perpetuity. Below, we summarize the five policy pathways, describe how each pathway contributes to emissions reductions and carbon sequestration on NWL, and list specific mechanisms for each pathway. We believe CARB's May draft Scoping Plan should prioritize pathways and mechanisms in the following five areas:

1. Increase adoption of organic agriculture and facilitate alternatives to synthetic fertilizers and pesticides;
2. Increase production, distribution, and application of compost;
3. Promote water use efficiency and reduce irrigation demands;
4. Scale up agricultural technical assistance; and
5. Prevent farmland conversion from urban/suburban sprawl development.

To fully utilize the potential of natural and working lands in achieving carbon neutrality, it will be critical for CARB to consider and coordinate with other state efforts including implementation of the Natural Resource Agency's Climate Smart Strategy, 30x30 goals, the state adaptation strategy, and related budget priorities. With ambitious and targeted actions, we believe the state can meet its 2045 carbon neutrality goals. 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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CARBON NEUTRAL AGRICULTURE IN CALIFORNIA BY 2030:

MAXIMIZING SEQUESTRATION AND EMISSIONS REDUCTIONS ON NATURAL AND WORKING LANDS

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. [5] 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. There are opportunities to sequester significant quantities of atmospheric carbon dioxide (CO_2) as soil organic carbon and reduce greenhouse gas (GHG) emissions through changes in common agricultural practices.

With immediate action, California agriculture could achieve net carbon neutrality by 2030 and become a significant carbon sink in perpetuity. California's agricultural sector is responsible for 8 percent of the state's GHG emissions, and we encourage the agricultural sector to adopt a variety of strategies to reduce those emissions.[6] One critical way to offset those emissions is by increasing carbon sequestration via the soil. Other critical ways include reducing the use of energy-intensive synthetic inputs and upgrading irrigation technologies to be more energy efficient. We believe that complex and interconnected climate and other environmental challenges require similarly interconnected and cost-effective solutions.

Here, we offer five recommended pathways to increase sequestration and emissions reductions on natural and working lands (NWL) to meet our state's carbon neutrality goals. As a group representing diverse public interests, including production agriculture, rural economic development, public health and safety, farmworker wellbeing, organic agriculture, 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.[7] 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 and emissions reductions.[8]

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[9]
Rangeland compost*	110,000	0.16	1,210,000	10.8
Pasture compost[10]	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 five pathways that can maximize sequestration and emissions reductions on NWL. We offer our ideas to help inform CARB's possible pathways ahead of the release of the 2022 Scoping Plan Draft in early May.

Guiding Principles

Our recommended pathways adhere to the following principles to maximize benefits and mitigate unintended consequences. We believe that any strategy that proposes ways to reduce the climate impact of agriculture should 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, flooding, and wildfire.
- ***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 use efficiency, reduce agriculture's negative impact on human health and the environment, reduce nutrient runoff, and reduce the use of synthetic inputs.
- ***Build capacity to implement best practices for soil health***: Facilitate opportunities for land managers to learn about and adopt soil building practices that build soil organic matter.
- ***Support equitable rural community economic development***: Support diversified and equitable rural economies.
- ***Advance research for public interests:*** Ensure public funding for agricultural research and development is used for research that serves the public interest rather than private interests.

Five Pathways for Carbon Neutral Agriculture

The following pillars are needed to accelerate carbon neutrality in California agriculture:

- Increase adoption of organic agriculture and facilitate alternatives to synthetic fertilizers and pesticides;
- Increase production, distribution, and application of compost;
- Promote water use efficiency and reduce irrigation demands;
- Scale-up agricultural technical assistance; and
- Prevent farmland conversion from urban/suburban sprawl development.

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

GOAL: Expand the benefits of organic agriculture, reduce synthetic pesticide and other agri-chemical use, and reinvest in alternatives to conventional pesticides in both rural and urban land management.[11] Alternatives should improve the health, function, and diversity of the soil microbiome, increase soil organic matter accumulation and nutrient cycling, increase crops' resilience to pests and disease, improve nutritional density in food, improve water quality, reduce exposure for agricultural workers and communities, and bolster rural economies.

Organic agriculture and alternatives to synthetic inputs enhance soil carbon sequestration.

- 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.[12] After 20 years, organically managed soils sequestered significantly more soil organic carbon than conventionally managed soils.[13]
- Over-application of synthetic fertilizer can have a negative impact on soil health.[14] The higher nitrogen, phosphorus, and potassium levels in synthetic fertilizer inhibit soil carbon sequestration and significantly reduce soil organic matter.[15]
- Synthetic pesticides can undercut carbon sequestration goals by damaging the soil microbiome and altering critical biochemical processes.[16]
- Organic farming can result in higher stable soil organic matter compared to conventional, even continuous no-till, conventional farming.[17]

Reductions in synthetic inputs help achieve GHG emissions reduction targets.

- N_2O, a greenhouse gas, is nearly 300 times more potent than carbon dioxide. Approximately 20 million pounds of just three fumigants are applied in California every year,[18] and the application of these fumigants are associated with a seven to 100-fold increase in N_2O emissions.[19]
- Producing synthetic fertilizers and pesticides are energy-intensive processes.[20] 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.[21]

Over application of synthetic inputs exacerbate climate impacts, waste farmers' money, and undermine ecological and human health.

- In California, 204.7 million pounds of pesticide active ingredients were applied on agricultural lands in 2017 alone.[22] Those ingredients are linked to both acute and chronic disease in workers, rural community members, and to impacts on the soil microbiome.[23]

- In California, Latinx children are 91 percent more likely than White children to attend schools with the highest pesticide exposure.[24] This exposure is linked with impaired neurobehavioral development as well as enhanced risk of diabetes and asthma. [25]
- The over-application of synthetic fertilizer contributes to the health and climate crises; 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; and contributes to N_2O emissions and ground level ozone formation.[26]
- A comprehensive meta-analysis of 30 years of research concludes that organic farming increases biodiversity by 30 percent compared to conventional farming.[27]

INCREASE PRODUCTION, DISTRIBUTION, AND APPLICATION 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 rangeland and row crop systems. Directly adding nutrient stable organic matter enables the rapid elevation of soil organic carbon to levels that may take several years to achieve without it.[28] 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 deep application of compost on grazed rangelands can stimulate carbon sequestration rates of one to three tons CO_2e per acre per year while simultaneously increasing the production of forage by 15 to 50 percent even during times of drought.[29]
- Compost use significantly accelerates the process of soil carbon sequestration when combined with cover crops.[30]
- 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 is held in Shasta reservoir at full capacity.[31]
- Increasing soil organic matter from its current 1 to 3 percent on the state's 20 million arable acres would move over 6 billion metric tons of CO2e from the atmosphere to the soil organic carbon pool.[32]

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 with organic soil amendments generated within California, an estimated 7.8 million metric tons of CO_2e emissions could be avoided annually.[33]

Large emissions 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.[34]
- Composting 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 highly potent and short-lived methane, nitrous oxide, and black carbon.
- Directing suitable organic waste materials to composting is consistent with recent state statutory requirements to:
    a. Recover 75 percent of organic waste from landfills by the year 2025; and
    b. Reduce short lived climate pollutants from food waste, livestock manures, orchard 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, CalRecycle estimates the need for up to one hundred new and expanded composting facilities and transport infrastructure. [35] 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 the new soil building economy, while addressing long-standing environmental justice issues of soil, water and air pollution associated with agricultural production.

PROMOTE WATER USE EFFICIENCY TO REDUCE GREENHOUSE GAS EMISSIONS FROM IRRIGATION DEMANDS

GOAL: Climate change will cause uncertainty in future water supplies. Decision-makers should increase agricultural water use efficiencies to reduce emissions associated with current water use and irrigation systems.

Improving irrigation efficiency reduces GHG emissions associated with irrigation.

- Each year, agricultural irrigation consumes enough energy to power 1.5 million homes, or approximately 4 percent of the state's total electricity use.[36]
- Approximately 70 percent of total on-farm energy use is attributed to on-farm groundwater pumping, distributing or pressurizing water to operate irrigation systems.[37]
- 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.
- 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.[38] With a more ambitious but technically feasible three percent increase, irrigation demand would be reduced by 580,000 acre-feet annually.[39]

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

- Overapplication of fertilizer and water create multiple conditions for nitrogen leakage – N2O emissions, nutrient runoff, and nitrate leaching.[40]
- Management practices that build soil health like cover cropping and management practices that more precisely apply water to crops can reduce nitrate leaching, and associated emissions.[41]
- Soils with high soil organic matter in organically managed systems cycle nitrogen more effectively, increasing nitrogen retention on farms.[42]

TECHNICAL AND FINANCIAL PROVIDE FUNDING AND TECHNICAL ASSISTANCE (TA) SUPPORT TO LAND MANAGERS FOR PLANNING, IMPLEMENTING, 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 soil carbon sequestration and GHG reduction best practices. Prioritize resources for small and mid-scale and socially disadvantaged farmers.

Technical assistance extends the reach and impact of transformative agricultural practices.

- Increase TA for farmers and ranchers. TA is a key indicator 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.[43]
- 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.[44] Taking these actions will assist the Newsom administration in implementing the Farmer Equity Act of 2017.[45]

PRIORITIZE FARMLAND CONSERVATION AND LAND ACCESS, PARTICULARLY FOR PEOPLE OF COLOR 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.[46]

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

- California loses an average of almost 40,000 acres of farmland to urban sprawl every year.[47]
- 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.[48]

- 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.

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[7] 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.

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