June 22, 2022

California Air Resources Board

1001 I Street

Sacramento, California 95814

Re: CORRECTION: Comments to Notice of Public Meeting to Consider the Draft 2022 Climate Change Scoping Plan

To whom it concerns:

The following is taken from an executive summary from a white paper in development to review and present soil carbon sequestration potential in California soils and its potential to contribute to carbon market and protocols. A previous submission of this same comment was submitted on June 24, 2022 with an error describing the rate of soil carbon sequestration. The actually rate of carbon sequestration is 2.25 US tons of soil carbon per acre per 10 years.

The ability to sequester soil carbon in California is highly debated.  The warm, arid nature of the Mediterranean climate is generally thought to work against storing significant amounts of soil carbon.  In general soil carbon levels in California agricultural areas are lower compared to more temperate climates.  The intensification of agriculture following the completion of various phases of the State Water Project has led to soil carbon gains from irrigation due to increases in net primary productivity compared to lands prior to agriculture development.  Long-term decadal projects at the University of California Davis show additional soil carbon gains can be realized through agriculture practices such as winter cover cropping, manure additions, intercropping and any practice that will maintain annual soil cover with plants and or crop residues in addition to increasing carbon inputs to soil.  In general, the decadal projects show a range of up to 2.25 US tons of soil carbon per acre per 10 years can be achieved through practices that have been demonstrated to promote soil carbon sequestration. We believe the state’s climate objectives would be advanced by policies and programs to support and account for modified or new farming practices that result in additional SOC sequestration.  This is especially important since other state policies like the Sustainable Groundwater Management Act are projected to lead to the idling of large amounts of productive agricultural lands, which will cause SOM degradation and loss, setting back the state’s carbon reduction goals. The following summary (Authored by William R. Horwath, UCD; Sabina Dore, consultant; Xia Zhu-Barker, University of Wisconsin; Steve Kaffka, UCD) is based on a longer review of the science of soil carbon sequestration in California, and the potential for landowners to use protocols and participate in carbon markets.  Our full report is available, upon request.

There are barriers to increasing SOC above current rates in California. A twelve-month growing season, high year-round temperatures, and reliance on tillage can enhance SOC decomposition. The SOC responses are determined by water and N availability. Water availability for irrigation is often limited, which in turn limits the amount of plant-derived C added to soils, and restricts adoption of cover cropping, used primarily to increase SOC. In addition, crop production in California is very heterogeneous and market responsive. Constant technological innovation and market pressures make long-term commitments to carbon-focused farming practices difficult to sustain. Some crops and cropping systems are unsuited to conservation practices, creating a

barrier to their adoption. Measuring changes in SOC is difficult, and there is uncertainty about relationships between farming practices and SOC conservation or accumulation across regions, crops, and even farms. There is general agreement that the effect of farming practices focused on increasing SOC is controlled by multiple interacting factors, including climate, soil type, crop species, and management.

Given the dynamic character of farming in California, it is challenging to ensure the permanence of the C sequestered in soils. Added SOC can be emitted rapidly back to the atmosphere if conservation practices are stopped, or economic or environmental conditions change. Therefore, quantification of soil C sequestration requires continuous monitoring of site-specific changes in SOC over time. Quantification is complex, challenging, and expensive. Currently, it is not feasible to easily verify sequestration rates that typically increase total SOC stocks by <1% on an annual basis. Innovative approaches integrating digital maps, modeling, the use of new sensors, remote sensing, and web-based interfaces are rapidly evolving and improve the ability to predict the effects of GHG reduction strategies and quantify results.

For soil C sequestration, current carbon market and protocols have been applied with difficulty and have low rates of adoption because of the high costs for certification of offsets and the low price paid for voluntary carbon credits, which farmers can usually obtain in limited quantity. GHG mitigation from soil C sequestration can be more efficiently achieved by integrating a very large number of small annual increases in SOC by numerous farmers over large areas while adequately accounting for uncertainty. Public policies can create alternative systems to the traditional C market for the carbon capture and storage of atmospheric C in agricultural soils as SOC. Financial incentives may motivate farmers to adopt or modify management practices that support SOC accumulation that otherwise would not be adopted. Policies should prioritize simplicity and lower costs over accuracy at a high spatial resolution, adjusting for uncertainty and risk.

Adding organic matter to soils has multiple recognized benefits, including increased resilience to climate change. In this way, conservation practices will mitigate the effects of current GHG atmospheric levels independently from the permanence of the newly stored C in the soil. The following are additional factors specific to California to consider:

* Reductions in irrigation and increased fallowing would result in large losses of SOC from agricultural soils in California.
* Documenting SOC changes in a heterogeneous agricultural landscape like California’s, with a diversity of soils, climatic gradients, and a large range of crops, is more complicated than in other regions with simpler, more stable cropping patterns. Large scale perennial commodities in CA like tree nuts and grapes may provide a sufficiently large basis and consistency of management for evaluating landscape-scale changes in SOC.
* SOC accumulation is a function of crop residue amounts and the addition of manures and composts. Crop residue accumulation may not be sufficient compared to addition of compost to determine increases in SOC in a region with long growing seasons and conditions that support SOC oxidation.
* Cumulatively, crop, climate, and soil conditions in California, combined with the expense and uncertainty of measurement and certification of SOC, do not support the use of the traditional carbon market credit system. Since agriculture is dynamic and changes over time, a shorter-term credit system prioritizing simplicity and lower costs over accurate credit quantification may be more appropriate. It is uncertain if such a credit program would be worthwhile economically.

We believe the state’s climate objectives would be advanced by policies and programs to support and account for modified or new farming practices that result in additional SOC sequestration.  This is especially important since other state policies like the Sustainable Groundwater Management Act are projected to lead to the idling of large amounts of productive agricultural lands, which will cause SOM degradation and loss, setting back the state’s carbon reduction goals.  Our full report is available upon request.

Public policies can support additional C sequestration in agricultural soils. Barriers due to accurate quantification can be addressed by creating highly accurate, standardized, and widely available tools to quantify and verify annual SOC changes at the farm, region, and state scales. Policies could support soil carbon sequestration projects at a regional scale by creating large-scale SOC sequestration projects. Net annual SOC balances would not be determined by the outcome at a single site, but by net changes over a larger area, and reversal in one area can be compensated by net sequestration over the larger project area. Permanence can be addressed by using tools such as buffer pools, where part of the annual C sequestration is set aside so it can be used to repay forfeited credits from voluntary or involuntary project termination. Public policies can simplify permitting or other regulatory processes that may be barriers to GHG emission reduction projects. Payment amounts to farmers that are sufficient to incentivize conservation practices aiming to soil C sequestration and incorporate uncertainty and risk, can be developed

An example of a policy that supports innovation and is based on performance, accounting for risk and uncertainty, is California’s Low-Carbon Fuel Standard (LCFS), which provides economic incentives to reduce transportation GHG emissions. Among other innovations in the transportation sector, this policy supports biofuel production, including renewable natural gas production on farms. The LCFS has been successful in promoting the development of transformative innovations, and it promotes industry rather than government mitigation of transportation GHG emissions. It provides a model for a SOC focused program to support innovative changes in farming systems in California and elsewhere that currently have no viable pathways to adoption.

Sincerely,



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