Carbon Cycle Institute

March 22, 2022

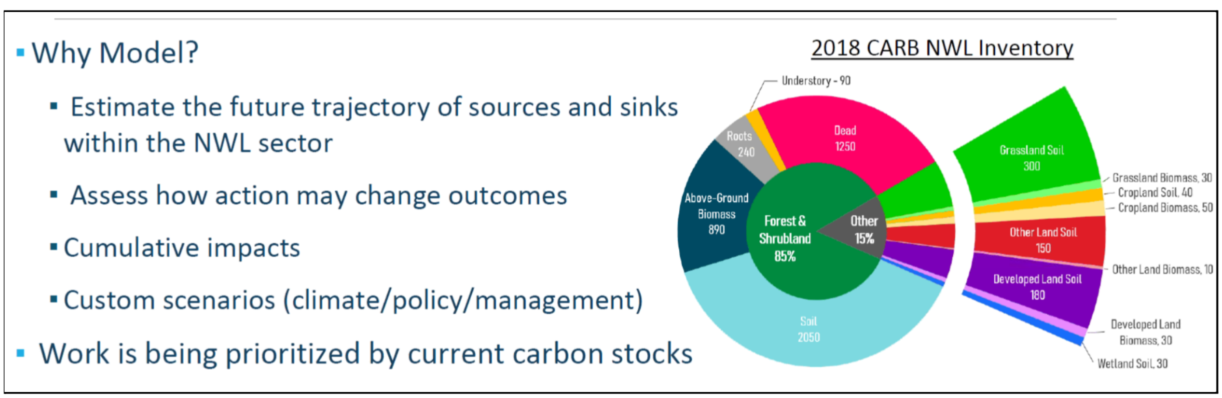
Shelby Livingston, Undersecretary
Matthew Botill, Branch Chief
CA Air Resources Board
1001 I Street
Sacramento, California 95814

Dear Ms. Shelby Livingston and Mr. Matthew Botill:

The Carbon Cycle Institute (CCI) wishes to raise several issues with respect to CARB's scenario modeling, as recently presented to the NWL Stakeholder Group and subsequent public webinar. The comments below point to a fundamental and pervasive concern; that CARB's NWL scenarios and modeling efforts do not adequately represent the potential of California's working lands for climate change mitigation and adaptation. Cementing CARB's current working land scenarios in the next NWL Scoping Plan would severely limit California's investments in leveraging one of its essential pillars of climate change mitigation, and would risk stifling the innovative and ambitious actions that are already taking place at the local scale across the State.

Soil Carbon Stocks Are Underrepresented at the State Scale

Critically, CARB's modeled soil carbon stocks, based on the 2018 Ecosystem Carbon Inventory (CARB 2018), appear to significantly underestimate the total soil carbon stocks of the state (see CARB figure below). CCI raised this issue in 2021as part of an earlier public comment period.



The CARB graphic above, presented by Dr. Adam Moreno at the March 15 Initial Modeling Results Workshop and displaying CARB's 2018 statewide carbon stocks inventory, indicates soils holding just over half of the estimated NWL carbon in the state. Yet globally, soils are known to hold as much as three times the amount of carbon as non-soil biomass. As noted by Köchy et al. (2015):

> "The global mass of soil organic carbon… is greater than the combined mass of carbon contained in the atmosphere and in the living biomass (Ciais et al., 2013). Therefore, small relative changes in the mass of SOC can have profound effects on the concentration of atmospheric CO_2 and hence climate change (Myhre et al.,

2013)."

As one illustrative example, using a conservative estimate for average soil organic carbon (SOC) stocks in California grassland soils of 50 Mg C ha^{-1} (Silver et al. 2010, Carey et al. 2020) across roughly 17 million ha of rangeland (Carey et al. 2020) indicates statewide grassland SOC stocks of 850 MMT C, or almost 3 times the grassland SOC stock stated in the NWL Inventory (CARB 2018). This severe underrepresentation of the magnitude of soil carbon stocks is especially consequential because, as CARB states in the figure above, "work is being prioritized by current carbon stocks."

30 cm Depth is Unsuitable for Inventory and Modeling

The decision to limit SOC inventorying and modeling to the standard IPCC depth of 30 cm is inappropriate, given significantly greater cropland soil depths statewide, and the availability of reasonably accurate estimates of both actual soil depth and soil organic matter content via databases noted below. Worldwide, an estimated 30–75% of SOC is located below 30 cm (Tautges et al. 2019), and these deeper SOC pools play a critical role in carbon accumulation and storage (Dynarski et al. 2020). 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 land soils in particular

Assumptions, Methods, and Choice of Datasets Lack Transparency and Justification

CARB does not justify its reliance on the SoilGrids soil organic carbon raster dataset (ISRIC World Soil Information 2020, Poggio et al. 2021) over finer scale soil survey data, for example, compiled under the Gridded National Soil Survey Geographic Database (NRCS Soil Survey 2021). CARB does utilize NRCS Soil Survey data, but only in its analysis of croplands, and again, only to a depth of 30 cm. Discrepancies between digital soil mapping data like SoilGrids and Soil Survey data, particularly over such such a large and geographically diverse area as California, merit a discussion of the uses and comparative accuracy of these datasets (Rossiter et al. 2021, Poggio et al. 2021).

Similarly, CARB does not justify its approach to estimating SOC in cropland, which is described as "SOC density to a 30 cm depth modeled with DNDC to produce the soil carbon stocks disaggregated by county and crop". How do these modeled estimates differ from querying existing soil survey data, and are they more reflective of actual soil conditions? We would also suggest that crop, given the dynamic nature of California's agriculture, is not a useful parameter to include in this analysis, beyond, perhaps, the broad categories of annual, woody perennial, and herbaceous perennial.

Further, DNDC, which was used by CARB to model presumptive SOC ***losses*** over time due to presumptive negative impacts of land use practices, could have been used to estimate SOC ***enhancement*** potentials for the state's soils, most particularly for its croplands (Li 2008). We believe this approach would provide more useful information going forward, as the state seeks to engage NWL as the 5th Pillar in its climate mitigation strategy.

Lastly, any detailed assessment of CARB's scenarios and modeling results is impossible without more information about the data and assumptions being used. In particular, we would like to see information included on the acreages of the regional land use types being used, which specific agricultural practices are being modeled, and implementation rates for each regional land use type.

Underrepresentation of State's Soil Organic Carbon Stocks Constrains Consideration of Agricultural Land Opportunities

It is particularly important that CARB utilize a credible estimate of the state's soil carbon stocks in relation to its total NWL carbon stocks, as ***CARB's modeling and resulting allocation of attention and resources is explicitly weighted towards those lands that are estimated to already contain higher quantities of carbon***. Underestimation of the state's SOC resources, and failure to recognize the significant potential to enhance those resources through management, leads to CARB's acceptance of extremely low acreage estimates for cropland soil carbon enhancement in each of its alternative scenarios. This framework also ignores significant historic carbon losses from, and thus the carbon restoration potential of, the state's working land soils (Sanderman et al. 2017, Ontle and Schulte 2012, Koteen et al. 2011, Suddick et al. 2010).

Scenarios are Inexplicably Constrained for Agricultural Lands

CARB's "maximum" cropland scenario represents fewer acres than are already being treated annually under existing NRCS and CDFA climate smart programs, engaging only 100,000 acres annually. This represents roughly one half of one percent of the state's 20 million cropland acres. Clearly more ambitious cropland scenarios must be considered.

It is unclear why CARB's four scenarios assume that crop land and forest land scenarios should be negatively correlated. Why does treated cropland acreage decline as forest land treatment increases? ***We strongly urge CARB to model scenarios that reflect the task at hand: how to mobilize realistic and ambitious targets for both natural and working lands to optimize carbon management, resilience, and ecosystem services.***

As noted at the March 15 Initial Modeling Results Workshop, there are many significant NWL opportunities that CARB has not modeled. For example, engaging rangelands as carbon sinks through the use of strategic compost applications has been modeled for a wide diversity of California rangelands, showing significant potentials (Silver et al. 2018), but was not considered. CARB also failed to model the significant GHG reductions and carbon sequestration potentials that would result annually from replacing cropland synthetic fertilizer inputs with existing organic sources contained in the state's multiple urban and agricultural waste streams, as consistent with SB1383 and the state's short-lived climate pollutant reduction efforts (Tautges et al. 2019, Almaraz et al. 2018, DeLonge et al. 2013). Contrary to CARB assumptions, forest fuel reduction efforts need not result in near-term carbon losses from those systems if efforts focus on converting removed fuels to soil amendments, through on-site mastication, biochar production and distribution, and/or prescribed grazing. Clearly, a long-term negative trend in NWL carbon, as modeled by CARB, demands both an alternative approach to management and consideration of alternative modeling scenarios.

Historically, ill-informed soil management practices have led to significant SOC losses in California. Yet, this in no way impedes these soil's capacity to sequester enormous quantities of organic carbon ***if managed for that purpose.*** The state's NWL strategy should reflect an ambitious attempt to enhance carbon capture and storage in the state's diverse ecosystems. California's croplands—far and away the state's most intensively managed systems—offer carbon storage potentials far beyond those suggested by CARB's analysis.

CARB's Analysis Does Not Model the Actual Potential of the State's Agricultural Lands

We encourage CARB staff to consult additional academic, agronomic, and soil experts to ensure ***the right questions*** and best available data and research, modeling assumptions, and resulting analyses, form a sound basis for its planning and interagency strategy development. Above all, we urge CARB to organize its modeling efforts using assumptions around existing carbon stocks that include the majority of the state's soil mass and avoid generic assumptions around ecosystem carbon change. If the NWL Scoping Plan is to serve the state's GHG reduction and carbon sequestration mandates, CARB must frame its analysis around the core question, ***"how might we increase carbon storage in the state's working land soils and associated ecosystems, and what are the potentials for carbon increase in those systems given enhanced management for that purpose."***

Thank you for the opportunity to comment on the draft NWL modeling scenarios. Please feel free to contact CCI with questions, or if there is any way CCI may be of help in supporting CARB's agricultural scenario development and modeling.

Sincerely,

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