NRDC

January 5, 2022

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

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

Dear Chair Randolph and Members of the Board,

On behalf of Natural Resources Defense Council (NRDC) and NRDC Action Fund, we write to provide comments on California Air Resources Board's (CARB) draft Natural and Working Lands (NWL) Modeling Scenarios to inform its 2022 Scoping Plan Update.[1]

Thank you for taking the time to outline and present the different scenarios CARB intends to model for the NWL sector as part of the department's 2022 Scoping Plan. As currently written, the draft scenarios are very general and vague in their descriptions, so it is difficult to provide comprehensive feedback. Below, we raise specific concerns with the wetlands and agricultural model scenarios.

Broadly, the lack of data and modeling scenarios incorporating the livestock sector is concerning. Animal husbandry is a critical aspect of agriculture and the two should not be separated, especially since dairy and livestock make up more than half of California's total methane emissions.[2] For example, the climate smart agriculture practice of silvopasture integrates animals onto acreage with forage crops and trees, and compost used on agricultural lands can come from dairies. To meet the state's ambitious 2045 carbon neutrality goals, CARB should move toward holistically modeling agriculture to measure and address problems and opportunities across all agricultural lands.

We appreciate CARB's efforts to model various climate mitigation strategies on natural and working lands. We look forward to advancing this important work with you to reduce greenhouse gas emissions and to increase agricultural lands' carbon sink potential.

Sincerely,

Arohi Sharma
Water Policy Analyst

Concerns Regarding Wetlands Modeling and Scenarios

We urge CARB to be comprehensive in its modeling of a wide array of wetland types, and not limit its review to Delta and coastal wetlands. Multiple wetland types and riparian forests, in particular, have substantial capacity to sequester carbon, while providing considerable co-benefits in the form of improved water quality, better habitat and migratory corridors for fish and wildlife, replenished groundwater aquifers, and improved flood protection for downstream communities. [3] Indeed, restoring degraded riparian forests provides a highly effective tool to maximize both biodiversity and climate benefits.[4]

In addition, CARB should be transparent about: 1) the wetland and riparian footprint used to generate its estimate of carbon sequestration benefits, including whether and, if so where, rice fields are included; and 2) the underlying assumptions built into the selected models regarding the amount of carbon per unit area sequestered. California has lost the vast majority of its wetland habitat[5] and riparian forests,[6] but there is great potential to restore these habitats and maximize their benefits. Identifying restoration sites as well as existing habitats will be important to realizing the potential of natural climate solutions. In addition, carbon sequestration estimates will vary depending on the model and other factors, including soil type, management, frequency of inundation, and more. CARB should identify all of these assumptions so that it is clear where uncertainties lie and where management improvements are available.

Concerns Regarding Agriculture Modeling and Scenarios

1) <u>Provide Clear Definition and List of Climate Smart Agriculture Practices</u>

Any model of climate mitigation potential on NWL should provide a clear description of what agricultural practices are included. Several of the model scenarios listed in the draft call for "increases in climate smart agriculture practices."[7] CARB should provide a list of which practices are being modeled as 'climate smart agriculture' (CSA) practices. For consistency, CARB should reference the California Department of Food and Agriculture (CDFA)'s Healthy Soils Program, which funds climate smart practices on farms. CDFA provides a comprehensive list of CSA practices in its Healthy Soils Incentive Program Request for Grant Proposals.[8] Some of those practices include:

- Cover cropping
- No-till and reduced tillage
- Mulching and composting
- Hedgerows
- Riparian herbaceous cover and forest buffers
- Windbreaks
- Silvopasture

Due to the many climate, biodiversity, soil, water, and public health benefits of organic farming practices, we recommend certified organic agriculture and reductions in synthetic fertilizer and pesticide use also be included in CARB's list of climate smart agriculture practices. [9]

2) <u>Develop Model Based on Maximum Technically Feasible Adoption Rate of CSA Practices and Additional Models Based on Percentages of Maximum Model</u>

As is well known, the climate, biodiversity, and drought crises are inextricably linked.[10] Instead of modeling scenarios that divide mitigation efforts across these different values, we recommend that CARB model NWL scenarios based on percentages of agricultural land that use climate smart agricultural practices. To this end, we recommend CARB first develop a Model Scenario (MS) that models the maximum technically feasible adoption rate for all climate smart agriculture strategies on agricultural lands. For instance, we know that cover cropping cannot be implemented on all of California's croplands, so a MS for cover cropping may be 50% across all croplands. After developing the MS, we recommend CARB further model 75%, 50%, and 25% rates of adoption of the Model Scenario to show options for scaling climate smart agriculture across more acres in California. We recommend a total of five scenarios to model, including the business as usual model detailed by CARB in its draft.

All climate smart agriculture practices have the potential to mitigate climate impacts from NWL and should be modeled simultaneously. Unfortunately, the current proposal recommends a piecemeal approach which will yield a lower climate mitigation potential. For this reason, and because multiple climate smart agriculture practices can be stacked on agricultural lands, we urge CARB not to take a piecemeal approach to modeling different scenarios. Currently, for example, organic agriculture is only referenced in Model Scenarios #2 and #4 when it should be modeled across all scenarios.

3) Include Evaluations of Public Health and Equity Outcomes for Each of Our Five Proposed Scenarios

CARB's currently proposed list of model scenarios suggests evaluating each scenario based on outcomes including carbon sequestration, biodiversity restoration, wildfire reduction, and drought resilience. Unfortunately, public health and equity are missing from the list of outcomes that should also be evaluated with each scenario. Industrial agriculture is a significant source of climate emissions in California. It also poses a health threat to many agricultural communities across California, particularly for people of color, through water and air contamination and the overuse of chemical inputs like pesticides. Therefore, we recommend CARB include evaluations of the public health and equity outcomes for each of our proposed five scenarios outlined above. Certified organic agriculture and reductions in pesticide and synthetic fertilizer use are common climate smart agriculture practices, so it should be manageable for CARB to partner with universities, research experts, scientists, and community members to evaluate how each of our proposed five scenarios can benefit or harm public health and equity outcomes. We support the comments in the "2022 Scoping Plan Update – Natural and Working Lands Scenarios Technical Workshop" letter submitted by Californians for Pesticide Reform, Pesticide Action Network, and others related to this issue.

4) Include Methane, Nitrous Oxide, and Fumigant Pesticide Emissions in Models

We appreciate CARB's strong focus on increasing soil carbon stocks throughout the agriculture sections of the NWL scenarios. However, agriculture emits other greenhouse gases (GHG) in addition to carbon (C), including nitrous oxide (N_2O) and methane (CH_4), and it is critical to include these in the modeling. According to CARB's analysis of emissions trends, agriculture contributed 7.6% of statewide greenhouse gas emissions in 2019, mainly from CH_4 and N_2O; therefore models should capture the relationships between all relevant agricultural GHG emissions including C, N_2O, and CH_4.[11]

Furthermore, as mentioned in the "2022 Scoping Plan Update – Natural and Working Lands Scenarios Technical Workshop" letter submitted by Californians for Pesticide Reform, Pesticide Action Network, and others fumigants, a type of pesticide applied to soil, pose special public health hazards and contribute to greenhouse gas emissions from cradle to grave. Approximately 38 million pounds of fumigants are applied each year in California, making up about 20% of all pesticides used in California.[12] All 19 fumigants registered in California are listed by the state as Toxic Air Contaminants.[13] They are among the most toxic and drift-prone pesticides used in the state and must be modeled in the NWL scenarios due to their contributions to greenhouse gas emissions, particularly tropospheric ozone and nitrous oxide emissions.

Fumigants contribute to the formation of Volatile Organic Compounds (VOCs), creating smog as well as tropospheric ozone (O_3),[14] the third most important greenhouse gas after carbon dioxide (CO_2) and methane (CH_4).[15] In addition, at least three fumigants – chloropicrin, metam-sodium, and dazomet – significantly increase nitrous oxide emissions 7- to 100-fold, a greenhouse gas 300 times more potent than carbon dioxide.[16] Compared to fertilizer-induced nitrous oxide emissions, which generally return to background rates within two weeks after application, the effects of fumigant-induced nitrous oxide emissions were found to last more than 48 days.[17] Approximately 20 million pounds of these three fumigants are used in California each year.[18] Other fumigants can serve as greenhouse gases themselves; sulfuryl fluoride, the use of which in California makes up 50-60% all global use, has a Global Warming Potential of 6,840.[19]

All stages of fumigants' lifecycles can contribute to greenhouse gas emissions, including extraction of raw materials, manufacturing, transportation, storage, application, disposal and clean up. Chemical production, including pesticide manufacturing, is the largest consumer of primary energy in U.S. manufacturing, and many pesticides are in and of themselves petrochemicals, with petrochemical manufacturing being the most energy-intensive of all chemical manufacturing.[20] Therefore, we urge CARB staff to study and model full lifecycle greenhouse gas emissions from fumigants in California.

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[1] CARB, "2022 Scoping Plan Update Modeling and Scenario Workshop: Natural and Working Lands" (PowerPoint, December 2, 2021), https://ww2.arb.ca.gov/sites/default/files/2021-12/NWLPublicWorkshopSlides_Dec2_PublicDistribution.pdf.

[2] UC Davis CLEAR Center, "Methane, Cows, and Climate Change: California Dairy's Path to Climate Neutrality" (PowerPoint, September 2, 2020), https://clear.ucdavis.edu/sites/g/files/dgvnsk7876/files/inline-files/CLEAR-Center-Methane-Cows-Climate-Change-Sep-2-20_7.pdf.

[3] A recent study analyzing data from 117 publications, reports, and other data sets shows that the average amount of carbon stored in mature streamside forest rivals the highest estimates for any other forest type around the world, such as tropical or boreal forests, ranging from 168 to 390 tons of carbon per acre in the trees alone. Researchers also found that, on average, soil carbon can be expected to more than triple when converting from an unforested site to a mature streamside forest. Importantly, the authors also concluded that actively restoring forests by planting trees jump-starts this process, allowing the restored forest to gain carbon at more than twice the rate of naturally regenerating forests over the first ten years. *See* Kristen E. Dybala et al., "Carbon sequestration in riparian forests: A global synthesis and meta-analysis," *Global change biology* 25, no. 1 (2019): 57-67.

[4] Kristen E. Dybala et al, "Optimizing carbon storage and biodiversity co-benefits in reforested riparian zones," *Journal of Applied Ecology* 56, no. 2 (2019): 343-353.

[5] California has lost over 90% of its historic wetlands. CNRA, *Draft Pathways to 30x30 California* (CNRA, 2021), 11.

[6] Recent studies estimate that the state has lost around 95 percent of the Central Valley's riparian woodlands, along with the conditions they evolved in. *See* Liza Gross, "Forests of the Living Dead," *Inside Climate News*, July 6, 2021, https://insideclimatenews.org/news/06072021/forests-of-the-living-dead/.

[7] CARB, "2022 Scoping Plan Update Modeling and Scenario Workshop: Natural and Working Lands," 29.

[8] CDFA Office of Environmental Farming and Innovation, *2021 Healthy Soils Program: Incentives Program* (CDFA 2021), https://www.cdfa.ca.gov/oefi/healthysoils/docs/2021_HSP_Incentives_RGA.pdf.

[9] Teri Underwood et al., "Organic agriculture supports biodiversity and sustainable food production," *Journal of Hunger & Environmental Nutrition* 6, no. 4 (2011): 398-423; Janne Bengtsson, Johan Ahnström, and Ann-Christin Weibull, "The effects of organic agriculture on biodiversity and abundance: a meta-analysis," *Journal of Applied Ecology* 42, no. 2 (2005): 261-269; Sasha B. Kramer et al., "Reduced nitrate leaching and enhanced denitrifier activity and efficiency in organically fertilized soils," *Proceedings of the National Academy of Sciences* 103, no. 12 (2006): 4522-4527; Cynthia A. Cambardella, Kathleen Delate, and Dan B. Jaynes, "Water quality in organic systems," *Sustainable Agriculture Research* 4, no. 526-2016-37933 (2015); Dallas M. Williams et al., "Organic farming and soil physical properties: An assessment after 40 years," *Agronomy journal* 109, no. 2 (2017): 600-609.

[10] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and Intergovernmental Panel on Climate Change (IPCC), *IPBES-IPCC co-sponsored workshop report on biodiversity and climate change: Scientific Outcomes* (IPBES and IPCC, 2021), https://ipbes.net/sites/default/files/2021-06/2021_IPCC-IPBES_scientific_outcome_20210612.pdf.

[11] CARB, *California Greenhouse Gas Emissions for 2000 to 2019 Trends of Emissions and Other Indicators* (CARB, 2021).

[12] California Department of Pesticide Regulation (CDPR), *Summary of Pesticide Use Report Data – 2018* (CDPR, 2020), https://www.cdpr.ca.gov/docs/pur/pur18rep/18sum.htm.

[13] CDPR, *Toxic Air Contaminant Program* (CDPR), https://www.cdpr.ca.gov/docs/emon/pubs/tacmenu.htm.

[14] CDPR, *Volatile Organic Compound (VOC) Emissions from Pesticides* (CDPR), https://www.cdpr.ca.gov/docs/emon/vocs/vocproj/vocmenu.htm.

[15] D. Ehhalt, M. Prather, et al., *Atmospheric chemistry and greenhouse gases* (Richland, WA: Pacific Northwest National Lab (PNNL), 2001), https://www.ipcc.ch/site/assets/uploads/2018/03/TAR-04.pdf.

[16] K. Spokas and D. Wang, "Stimulation of nitrous oxide production resulted from soil fumigation with chloropicrin," *Atmospheric Environment* 37, no. 25 (2003): 3501-3507; K. Spokas, D. Wang, and R. Venterea, "Greenhouse gas production and emission from a forest nursery soil following fumigation with chloropicrin and methyl isothiocyanate," *Soil Biology and Biochemistry* 37, no. 3 (2005): 475-485.

[17] Spokas, Wang, and Venterea, "Greenhouse gas production and emission from a forest nursery soil following fumigation with chloropicrin and methyl isothiocyanate."

[18] CDPR, *Summary of Pesticide Use Report Data – 2018*.

[19] Glenn Gallagher et al., "High-global warming potential F-gas emissions in California: Comparison of ambient-based versus inventory-based emission estimates, and implications of refined estimates," *Environmental science & technology* 48, no. 2 (2014): 1084-1093.

[20] S. Brueske et al., *U.S. Manufacturing Energy Use and Greenhouse Gas Emissions Analysis* (Oak Ridge, TN: Oak Ridge National Lab (ORNL), 2012), https://www.energy.gov/sites/default/files/2013/11/f4/energy_use_and_loss_and_emissions.pdf.