August 3, 2021

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

Re: 2022 Scoping Plan Update – Natural and Working Lands Technical Workshop

Dear Members of the California Air Resources Board:

On behalf of the Natural Resources Defense Council (NRDC) and the NRDC Action Fund, and our nearly half a million members and activists across the state, we appreciate the opportunity to offer public comment about the need to address pesticide use reduction in the 2022 Scoping Plan Update.

As we have shared during meetings with California Air Resources Board (CARB) staff, we urge the agency to integrate climate, environmental justice and public health harms posed by pesticide use into the 2022 Scoping Plan update. At minimum, CARB ought to set benchmarks for the phase out of the hazardous, drift-prone and highly polluting fumigant pesticides chloropicrin, metam sodium, metam potassium and dazomet. In addition, and especially in light of the climate change impacts and harms to rural and Latino communities posed by pesticide use, CARB should also:

- Add pesticide reduction and organic farming to the practices under the agriculture pathway that the state will use to meet its AB 32 goals under the Natural and Working Lands program. Specific acreage and pesticide use reduction goals should be included.
- Add the Department of Pesticide Regulation (DPR) as a primary collaborating department with CARB on the 2022 Scoping Plan Update, in accordance with §38561(a) of the California Health and Safety Code.
- Develop a greenhouse gas (GHG) measurement tool that enables the state to measure full life cycle emissions from synthetic pesticides (from production to end use).
- Fully integrate the Environmental Justice Advisory Committee (EJAC) into future workshops and board meetings, rather than schedule separate EJAC sessions. EJAC ought to have every opportunity to provide meaningful input into all pre-scoping activities, research, workshops and the 2022 Scoping Plan itself.

- Coordinate efforts across agencies and departments to adopt the following solutions that will help move agriculture in California away from reliance on chemical pesticides in support of the state's climate change goals. Key solutions include:
    - (1) funding for research and technical assistance to help California farmers and ranchers - especially socially disadvantaged producers - transition away from agricultural pesticides and toward agroecological and organic farming practices that build resilience in the face of climate change; and
    - (2) establishing public procurement goals to gradually increase the percentage of their purchases from organic farmers, especially small- and medium-sized operations and farmers of color, with a goal of sourcing 100% organic by 2040.
- Adopt whole-farm solutions like organic certification to reflect the latest science and take advantage of a proven strategy that makes progress on climate-smart agriculture while also protecting farmworkers and their communities, pollinators, biodiversity, water quality and more.

Pesticide's Contribution to Climate Change

In the Natural and Working Lands Update workshop hosted by CARB on July 20, 2021, CARB staff responded to a public comment about inclusion of pesticides in the 2022 Scoping Plan with the statement that there are only two pesticides that contribute to GHG emissions - methyl bromide and sulfuryl fluoride. This response misrepresents and understates the scale of the problem.

Numerous studies conclude that use of synthetic pesticides results in GHG emissions. Current research provides a compelling case for why the reduction of pesticide use is critical to meeting California's GHG reduction targets:

Nitrous Oxide Emissions

- Soil fumigants, which are injected as a gas or applied via irrigation into soil to control weeds, pests and soil borne diseases, can emit nitrous oxide (N_2O). They represent roughly one-fifth of the pesticides used in California.[1] A 2003 study shows that the application of the third most commonly used fumigant in California -- chloropicrin -- can increase N_2O production by 700-800%[2]. Researchers concluded that similar classes of fumigants would yield similar increases in emissions.
- A later 2004 study found that, in addition to chloropicrin, two other fumigants (metam sodium and dazomet) also increase N_2O production significantly.[3] Altogether nearly 20 million pounds of these three fumigants are used every year on California fields.[4] This study didn't consider

[1] Department of Pesticide Regulation annual Pesticide Use Reports. https://www.cdpr.ca.gov/docs/pur/purmain.htm.

[2] Spokas K., Wang D. 2003. Stimulation of nitrous oxide production resulted from soil fumigation with chloropicrin. *Atmospheric Environment* 37 (2003) 3501–3507. https://doi.org/10.1016/S1352-2310(03)00412-6

[3] Spokas K., Wang D., 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. https://doi.org/10.1016/j.soilbio.2004.08.010.

[4] Department of Pesticide Regulation annual Pesticide Use Reports. https://www.cdpr.ca.gov/docs/pur/purmain.htm.

metam potassium, a common fumigant (approximately 8.5 million pounds are applied in California each year), which we expect would produce the same impact.

- A 2006 study found that the effect of fumigant-induced N_2O emission lasted 48 days, compared to fertilizer-induced N_2O emissions, which generally return to background rates within two2 weeks after application .[5]

Carbon Sequestration

- A recent review of almost 400 studies showed pesticide use was associated with damage to soil invertebrates in more than 70% of the studies.[6] Soil invertebrates are critical to carbon sequestration in soils, being responsible for the formation of more than 50% of soil aggregates, which are essential to building soil organic carbon.[7]
- Research shows that soil microbial activity decreases proportionally to the amount of pesticides applied to the soil.[8] Not only are soil microbes essential for the breakdown of carbon from organic matter, but they also help form stable soil organic carbon and persistent soil organic matter (SOM) through the formation of soil microaggregates, which protect SOM from decomposition.[9] This process is essential for carbon sequestration in soils.
- Organic agricultural systems, which avoid the use of synthetic fertilizers and pesticides, have been found to significantly reduce greenhouse gas emissions -- with one study showing organic management to increase soil organic carbon by 36% after 12 years in California cropping systems.[10]
- Multiple meta-analyses comparing thousands of farms nationwide have shown that organic farming results in higher stable soil organic carbon and reduced N_2O emissions when compared to conventional farming.[11]
    - One meta-analysis of 59 studies found total soil organic carbon to be on average 19% higher in organic than conventional systems.[12]
    - Another metaanalysis found that organic farming practices led to soil organic carbon stocks that were 3.50 ± 1.08 Mg C ha^{-1} higher than in nonorganic systems over a 14

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[5] Spokas, K., Wang, D., Venterea, R. & Sadowsky, M. (2006) Mechanisms of N2O production following chloropicrin fumigation. *Applied Soil Ecology* **31**, 101-109.

[6] Gunstone et al. (2021) Pesticides and Soil Invertebrates: A Hazard Assessment, Frontiers in Environmental Science. 9, 122. https://www.frontiersin.org/article/10.3389/fenvs.2021.643847.

[7] Stork, N. E., and Eggleton, P. (1992). Invertebrates as determinants and indicators of soil quality. Am. J. Altern. Agric. 7, 38–47. doi: 10.1017/S0889189300004446.

[8] AL-Ani, M. A., Hmoshi, R. M., Kanaan, I. A., & Thanoon, A. A. (2019, September). Effect of pesticides on soil microorganisms. *Journal of Physics: Conference Series* (Vol. 1294, No. 7, p. 072007). IOP Publishing.

[9] Gougoulias, C., Clark, J. M., & Shaw, L. J. (2014). The role of soil microbes in the global carbon cycle: tracking the below-ground microbial processing of plant-derived carbon for manipulating carbon dynamics in agricultural systems. *Journal of the Science of Food and Agriculture*, 94(12), 2362-2371.

[10] Horwath, W. R., Deveˆvre, O. C., Doane, T. A., Kramer, T. W., and van Kessel, C. (2002). Soil carbon sequestration management effects on nitrogen cycling and availability. In ‘‘Agricultural Practices and Policies for Carbon Sequestration in Soil’’ (J. M. Kimble, R. Lal, and R. F. Follett, Eds.), 155–164.

[11] Ghabbour E, G. Davies G, Misiewicz T, Alami R, Askounis E, Cuozzo N, Filice A, Haskell J, Moy A, Roach A, and Shade J. 2017. National Comparison of the Total and Sequestered Organic Matter Contents of Conventional and Organic Farm Soils. *Advances in Agronomy*.146: 1-35. https://doi.org/10.1016/bs.agron.2017.07.003.

[12] Lori M., Symnaczik S., Mäder P., De Deyn G., Gattinger A. 2017. Organic farming enhances soil microbial abundance and activity – A meta-analysis and meta-regression. *PLOS ONE*. 25. https://doi.org/10.1371/journal.pone.0180442 July 12.

year period and could offset 36% of total emissions from the agricultural sector in the United States.[13]

Sulfuryl Fluoride Emissions

- Sulfuryl fluoride is considered a toxic air contaminant and an extremely potent short-lived climate pollutant, reported in the CARB GHG Short-Lived Climate Pollutant Inventory to have a 20-year Global Warming Potential (GWP) of 6,840.[14] It's also one of the most common agricultural fumigants in the state, with almost 3 million pounds applied in California in 2018.[15] Between 50 to 60% of the entire global usage of sulfuryl fluoride takes place in California.[16] It is an extremely toxic pesticide and a neurotoxin, which causes illness, disabilities and death.

Energy Emissions

- GHG emissions also occur from pesticide production itself. Pesticide production is an energy-intensive process. One study on drip-irrigated tomato production found pesticides were responsible for 89.5% of carbon emission (15.3 kg C/kg substance) and 61% of agrochemical-GHG emissions (5991 kg CO_2-eq/ha) in this cropping system.[17]
- A review of multiple studies also shows that organic farming has consistently lower energy use per acre than conventional farming.[18] One study showed energy use to be reduced by up to 53% on organic farms compared to conventional.[19]

Because of the lack of scientific literature that analyze the full, cumulative effects of pesticide production, transport and application on climate change, gaps do exist, and the entire scope of the problem is likely underestimated. CARB's 2022 Scoping Plan creates the agency's next research agenda, and it's critically important that pesticides are included in the plan.

13 Gattinger, A., A. Muller, M. Haeni, C. Skinner., A. Fliessbach, N. Buchmann, P. Madder, M. Stolze, P. Smith, N.E. Scialabba, and U. Niggli. 2012. Enhanced topsoil carbon stocks under organic farming, *PNAS*. 109 (44) 18826-18231. https://doi.org/10.1073/pnas.1209429109

14 California Air Resources Board GHG Short-Lived Climate Pollutant Inventory. https://ww2.arb.ca.gov/ghg-slcp-inventory

15 Department of Pesticide Regulation annual Pesticide Use Reports. https://www.cdpr.ca.gov/docs/pur/purmain.htm.

16 Gallagher, G., Zhan, T., Hsu, Y. K., Gupta, P., Pederson, J., Croes, B., ... & Wolf, K. (2014). 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(2), 1084-1093.

17 Jones, C. D., Fraisse, C. W., & Ozores-Hampton, M. (2012). Quantification of greenhouse gas emissions from open field-grown Florida tomato production. *Agricultural Systems*, 113, 64-72.

18 Schader, C., Stolze, M., & Gattinger, A. (2011). Environmental performance of organic farming. *Green Technologies in Food Production and Processing*, 183–210. doi:10.1007/978-1-4614-1587-9_8

19 Mäder, P., A. Fließbach, D. Dubios, L. Gunst, P. Fried, and U. Niggli. 2002. Soil fertility and biodiversity in organic farming. *Science* 296: 1694–1697.

Pesticides Are a Critical Environmental Justice Issue

Pesticides also pose significant a public health risk to rural communities:

- According to the latest DPR data, about 20% of the 200 million pounds of pesticides applied each year in California are carcinogenic and many more are linked to a variety of health impacts including asthma, autism, Parkinson's Disease, and developmental and reproductive harms.[20]
- Research by the California Environmental Protection Agency found that "60% of zip codes with the highest proportion of residents of color host [more than] 95% of agricultural pesticide use in the state."[21] Pesticides were one of the top two pollutants whose distribution was most correlated with race and ethnicity.
- According to DPR, the top counties in terms of overall volume of pesticides applied are the Central Valley counties of Fresno, Kern and Tulare. All three counties are majority Latino.[22]
- A 2013 report from the Center for Biological Diversity found that more than half of all glyphosate applications in California occurred in the eight lowest-income counties in California, with a combined population that is 53% Latino, compared with 38% for California as a whole.[23]
- In California, more than 90% of farmworkers are from Mexico.[24] Farmworkers and their families experience high rates of exposure to pesticides because of lack of protective clothing or gear, their homes' proximity to pesticide application, crowded and low-quality housing, and lack of access to supplies needed to clean work clothes.[25]
- Pesticides also put Latino children at especially higher risk.
    - Pesticide exposure in children has been linked to severe illnesses including cancer, neurodevelopmental harms and learning disabilities.[26, 27]
    - Data from the California Department of Public Health shows Latino children are 91% more likely than white children to attend schools near the highest levels of most hazardous pesticide use.[28]

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[20] Department of Pesticide Regulation annual Pesticide Use Reports. https://www.cdpr.ca.gov/docs/pur/purmain.htm.

[21] Cushing, L., Faust, J., August, L. M., Cendak, R., Wieland, W., & Alexeeff, G. (2015). Racial/ethnic disparities in cumulative environmental health impacts in California: evidence from a statewide environmental justice screening tool (CalEnviroScreen 1.1). *American journal of public health*, 105(11), 2341-2348.

[22] US Census Bureau. https://www.census.gov/quickfacts/fact/table/tularecountycalifornia,kerncountycalifornia,fresnocountycalifornia/PST045219.

[23] Donnaly, N. (2015). Lost in the Mist. *The Center for Biological Diversity.* https://www.biologicaldiversity.org/campaigns/pesticides_reduction/pdfs/LostInTheMist.pdf.

[24] https://www.alrb.ca.gov/wp-content/uploads/sites/196/2018/05/CalifFarmLaborForceNAWS.pdf

[25] McCauley, L. A., Lasarev, M. R., Higgins, G., Rothlein, J., Muniz, J., Ebbert, C., & Phillips, J. (2001). Work characteristics and pesticide exposures among migrant agricultural families: a community-based research approach. *Environmental health perspectives*, 109(5), 533-538.

[26] Pesticide Action Network. (2016). Kids on the Frontline: How pesticides are undermining the health of rural children. *Pesticide Action Network North America.*

[27] Beyond Pesticides, Children and Pesticides Don't Mix. https://www.beyondpesticides.org/assets/media/documents/Pesticide.children.dontmix.pdf.

[28] California Department of Public Health. (2014). Agricultural Pesticide Use Near Public Schools in California. *California Environmental Health Tracking Program.* https://www.phi.org/thought-leadership/agricultural-pesticide-use-near-public-schools-in-california/.

- Research shows pesticide exposure to be a primary factor contributing to childhood asthma in the San Joaquin Valley.[29] The population of the San Joaquin Valley is 52% Latino.[30]
- CDC data show the childhood asthma rate in California is higher than the national average for children (15.4 vs 8.6 percent) and out of the 11 counties in California that have asthma rates over 20 percent, 10 are in rural, agricultural counties.[31]

Future iterations of CARB's Scoping Plan and the Natural and Working Lands Climate Change Implementation Plan should be amended to ensure environmental justice is fully considered for all recommendations and strategies.

We especially urge CARB to make public workshops fully inclusive by scheduling them in the evening and by providing Spanish language interpretation. While CARB staff in the July 20 workshop noted with regret that the workshop was scheduled at a time that made participation difficult for many stakeholders, the workshop was inaccessible to non-English speakers, despite the apparent effort to include environmental justice considerations in the presentation. Every effort should be made to ensure the inclusion of the most impacted communities in proposed plans that address their concerns.

Organic farming as a nature-based climate solution

Previous scoping plans and the Public Workshop Series do not incorporate the latest science that outlines the climate benefits of organic farming. Achieving carbon neutrality requires using proven tools for sequestering carbon and reducing emissions. The following studies show how organic farming practices build healthy soil, protect soil microbiomes, draw down carbon, and eschew fossil-fuel based inputs:

- A UC Davis Long-Term Research on Agricultural Systems (LTRAS) study found that after 10 years, organic systems resulted in 14 times the rate of carbon sequestration as the conventional system.[32] After 20 years, soil carbon in organically managed soils "increased significantly more" than in any other production system.[33]
- All organic producers must graze ruminant animals on pasture for a minimum of 120 days per year[34] while non-organic ruminants may be raised in confined feeding operations. UC Davis scientists found that dairy cow and heifer manure on pasture emits minimal GHGs compared to

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[29] von Glascoe, C. A., & Schwartz, N. A. (2019). Bad lungs/bad air: childhood asthma and ecosyndemics among Mexican immigrant farmworkers of California's San Joaquin Valley. *Human Organization*, 78(2), 110-121.
[30] https://cviic.org/wp-content/uploads/2019/01/SJVCRP_Survey_Findings_Report_011819-small.pdf
[31] Pesticide Action Network. (2016). Kids on the Frontline: How pesticides are undermining the health of rural children. *Pesticide Action Network North America.*
[32] Kong, A. Y., Six, J., Bryant, D. C., Denison, R. F., & Van Kessel, C. (2005). The relationship between carbon input, aggregation, and soil organic carbon stabilization in sustainable cropping systems. *Soil Sci Soc Am J.*, 69, 1078-1085.
[33] Wolf, K., Herrera, I., Tomich, T. P., & Scow, K. (2017). Long-term agricultural experiments inform the development of climate-smart agricultural practices. *California Agriculture, 71,* 120-124.
[34] Rinehart, L., & Baier, Ann. (2011). Pasture for organic livestock: understanding and implementing the national organic program (NOP) pasture rule. *U.S. Department of Agriculture, Agricultural Marketing Service.* Retrieved from https://www.ams.usda.gov/sites/default/files/media/NOP UnderstandingOrganicPastureRule.pdf.

lagoon storage, liquid slurry storage, and dry lot manure, which together account for 98% of dairy manure methane emissions in California.[35]

- Organic crop and livestock production practices build long-term soil fertility, creating healthy soils that can store increased levels of nutrients, including carbon.[36]
- The Rodale Farming Systems Trial, which is the longest running organic comparison study in the United States, documented that after 22 years, soil organic carbon increased by 15-28% in organically managed soils compared to 9% in the conventionally managed soils.[37]
- An extensive 2017 study comparing soils from 659 certified organic farms and 728 conventional farms across the nation found that organic farms across 48 states sequester significantly more carbon than conventional farms.[38]
- Globally, evidence shows that organically managed soils hold more carbon and have higher rates of carbon sequestration than soil from non-organic systems.[39]

Agricultural practices currently emphasized in the Scoping Plan and the Draft California 2030 Natural and Working Lands Climate Change Implementation Plan, such as no-till, could result in an increase in pesticide use. A recent meta-analysis of peer-reviewed articles from 1985–2016 showed a greater concentration of atrazine, cyanazine, dicamba, and simazine in runoff from no-till than conventional till fields.[40] Promoting certain agricultural practices in this context must be accompanied by a commitment and incentives to achieve ambitious pesticide use reduction goals.

Thank you again for the opportunity to comment, and we welcome continued discussion with you or your staff on these topics to address any further questions or comments.

Sincerely,

Lena Brook
Senior Advocate and Food Campaigns Director
NRDC

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[35] Kaffka, S., Barzhee, T., El-Mashad, H., Williams, R., Zicari, S., & Zhang, R. (2016). Evaluation of dairy manure management practices for greenhouse gas emissions mitigation in California. Final Technical Report to the State of California Air Resources Board

[36] Suddick, E. C., Scow, K. M., Horwath, W. R., Jackson, L. E., Smart, D. R., Mitchell, J., Six, J. (2010). The potential for California agricultural crop soils to reduce greenhouse gas emissions: a holistic evaluation. *Advances in Agronomy, 107,* 123-162.

[37] Pimentel, D., Hepperly, P., Hanson, J., Douds, D., & Seidel, R. (2005). Environmental, energetic and economic comparisons of organic and conventional farming systems. *Bioscience, 55*(7), 573-583.

[38] Ghabbour, E. A., Davies, G., Misiewicz, T., Alami, R. A., Askounis, E.M., Cuozzo, N.P., . . . Shade, J. (2017). Chapter one - national comparison of the total and sequestered organic matter contents of conventional and organic farm soil. *Advances in Agronomy, 146,* 1-35.

[39] Gattinger, A., Muller, A., Haeni, M., Skinner, C., Fliessbach, A., Buchmann, N., . . . Niggli, U. (2012). Enhanced top soil carbon stocks under organic farming. *Proc. Natl. Acad. Sci. U.S.A., 109,* 18226–18231.

[40] Elias, D., Wang, L., & Jacinthe, P. A. (2018). A meta-analysis of pesticide loss in runoff under conventional tillage and no-till management. Environmental monitoring and assessment, 190(2), 1-17.