December 16, 2016

Ms. Rajinder Sohota
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California Air Resources Board
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Submitted via ARB comments webpage:
https://www.arb.ca.gov/lispub/comm2/bcsubform.php?listname=sp2030disc-dec16-ws&comm_period=1

Re: Discussion Draft 2030 Target Scoping Plan Update: Natural & Working Lands

Dear Ms. Rajinder Sohota,

Please accept the following feedback from Environmental Defense Fund (EDF) in response to the public solicitation for comments on the Discussion Draft 2030 Target Scoping Plan (hereforward "Scoping Plan") released December 2, 2016.

EDF is pleased to see inclusion of updates that reflect comments and requests submitted after the last workshop on Natural and Working Lands that took place in Sacramento on November 7, 2016. We appreciate the hard work that has gone into updating the Scoping Plan and the efforts to solicit and include input from agricultural stakeholders raised during and after the November 7 workshop. EDF is committed to promoting science-based solutions for farmers, ranchers, and landowners to help the state address the impacts of climate change and bring greenhouse gas emissions to 40% below 1990 levels by 2030.

We do, however, have several significant concerns with the science used in the latest version of the Scoping Plan. Several of the recommendations made are not supported by the current science. EDF's team of scientists has thoroughly investigated the practices that can lead to mitigation and adaptation from Natural and Working Lands. Our comments can be grouped into two main areas – Sequestration and Mitigation.

Sequestration- Conservation Tillage and Cover Crops

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It is clear that ARB is thoughtfully considering a variety of agricultural working lands practices that can help mitigate greenhouse gas emissions and/or sequester carbon and we would strongly encourage additional research and investigation in this space. For all the practices recommended, the Scoping Plan should include references to the literature used to develop the estimates of sequestration from practices that "build soil organic matter" and thus, the ability of soils to "remove carbon from the atmosphere" (Scoping Plan, page 62). Given the state of the science on soil carbon sequestration, recommendations for practices that sequester carbon and targets for state-level sequestration must address potential constraints, as outlined in Powlson et al, 2010.[1] The practices identified in this version of the Scoping Plan (conservation tillage and the use of cover crops) have shown to improve soil health; EDF supports and promotes the use of such practices and the implementation of the Healthy Soils Initiative for incentivizing these practices. However, varied results in the scientific literature indicate that these practices, implemented individually, may actually increase or decrease overall sequestration depending on soil type, geography, and additional interacting practices. Therefore, it is not appropriate to make broad statements regarding the sequestration potential of these practices without additional research. Even then, the practices should be specified by crop, geography, and soil type at a minimum.

Specifically for no-till, early suggestions that this practice could sequester soil carbon have been discredited; it appears that no-till redistributes carbon within the soil profile but does not sequester additional carbon.[2] In addition, it appears that the effects of no-till on nitrous oxide (N_2O) emissions are highly variable, are not clearly expressed unless no-till is maintained for more than 10 years, and in some cases no-till may actually increase N_2O emissions.[3]

For cover crops, a recent meta-analysis concludes that cover crops can sequester soil carbon, although the extent of carbon uptake is ultimately limited by SOC saturation.[4] However, increasing soil organic carbon can increase N_2O emissions, leading to uncertain net impacts in greenhouse gas emissions.[5] Another recent meta-analysis likewise concluded that the impact of cover crops on N_2O emissions was extremely variable, in some cases leading to a decrease but in other cases leading to an increase in N2O emissions.[6]

The one practice where there is significant science to support carbon sequestration is the avoided conversion of rangelands to croplands or urban infrastructure. When grasslands are disturbed, such as when the land is tilled for crop cultivation, a significant portion of the stored carbon oxidizes and decays, releasing CO_2 into the atmosphere. This is carbon which has been stored in the soil over decades by natural cycles of growth and decay. By preserving intact grasslands or rangelands, ARB can maintain the carbon

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[1] Powlson, Whitmore and Goulding, 2010. Soil carbon sequestration to mitigate climate change: a critical re-examination to identify the true and the false. European Journal of Soil Science, Feb 2011, 62, pp.42-55

[2] Powlson, D.S., Stirling, C.M., Jat, M.L., Gerard, B.G., Palm, C.A., Sanchez, P.A. and Cassman, K.G., 2014. Limited potential of no-till agriculture for climate change mitigation. Nature Climate Change, 4(8), pp.678-683

[3] Kessel, C., Venterea, R., Six, J., Adviento-Borbe, M.A., Linquist, B. and Groenigen, K.J., 2013. Climate, duration, and N placement determine N2O emissions in reduced tillage systems: a meta-analysis. Global Change Biology, 19(1), pp.33-44

[4] Poeplau, C. and Don, A., 2015. Carbon sequestration in agricultural soils via cultivation of cover crops–A meta-analysis. Agriculture, Ecosystems & Environment, 200, pp.33-41.

[5] Bos, J.F., ten Berge, H.F., Verhagen, J. and van Ittersum, M.K., 2016. Trade-offs in soil fertility management on arable farms. Agricultural Systems

[6] Basche, A.D., Miguez, F.E., Kaspar, T.C. and Castellano, M.J., 2014. Do cover crops increase or decrease nitrous oxide emissions? A meta-analysis. Journal of Soil and Water Conservation, 69(6), pp.471-482

sequestered throughout the state. This is particularly important as rangeland ecosystems cover approximately half the land area of California.[7, 8] (Brown et al. 2004, Havstad et al. 2009).

In the next draft of the Scoping Plan, we recommend that ARB fully cite the literature sources used to justify the inclusion of these practices, along with information on the uncertainty associated with the projected sequestration benefits in order to provide agricultural proponents with a full picture of various working lands' sequestration capacity.

Mitigation

Given the complexity and uniqueness of California's diverse agricultural crops, sequestration and mitigation potential throughout the state will vary significantly and cannot be summarized by land type as is done through the modeling exercise for the Scoping Plan. Currently, efforts by EDF, the Almond Board of California, DNDC-ART and UC Davis through a Specialty Crop Block Grant can help inform the mitigation potential of various nitrogen management practices in almond orchards and potentially in other nut trees in different regions and on different soils in California. EDF will make the results of this work available to ARB and collaborating agencies.

Furthermore, on page 62, the Scoping Plan states,

> "Another source of emissions from agriculture is nitrous oxide resulting from nitrogen fertilizer applications. Optimizing the rate, timing, placement and type of nitrogen fertilizers has significant potential to reduce nitrous oxide emissions. Switching from synthetic to organic nitrogen sources (such as cover crops and compost) can achieve net greenhouse gas reductions as well."

While EDF promotes the smart use of nitrogen fertilizers and research of additional nitrogen management practices that reduce N_2O, a recent literature review found no consistent relationship between 4R fertilizer management practices (rate, timing, placement and type of nitrogen fertilizers) and N_2O emissions. As with sequestration above, significant variation is noted due to crop type and rotation, soil type and history, geography and climate, and effective implementation of the 4R practices. The only practice which is well-accepted by the scientific literature for reducing N_2O emissions from fertilizer in all crops and geographies is a reduction in rate. There are other nitrogen management practices that reduce N_2O, but must be identified on a case-by-case basis and well-documented in the literature – these extra practices cannot be applied to all croplands.

Additionally, EDF would encourage inclusion of the references for the life-cycle analyses conducted on the use of synthetic vs. organic nitrogen sources, as many times the type of cover crop and/or compost used as an organic fertilizer impacts the emissions released, sequestered or mitigated. More details are needed when looking into mitigation potential of organic nitrogen sources, including the impact on crop yield.

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[7] Brown, S., A. Dushku, T. Pearson, D. Shoch, J. Winsten, S. Sweet, J. Kadyszewski. 2004. Carbon supply from changes in management of forest, range, and agricultural lands of California. Winrock International, for the California Energy Commission, *PIER Energy-Related Environmental Research*. 500-04-068F. 144 p

[8] Havstad, K., D. Peters, B. Allen-Diaz, J. Bartolome, B. Besterlmeyer, D. Briske, J. Brown, M. W. Burnson, J. Herrick, L. Huntsinger. 2009. The Western United States Rangeland: A Major Resource. Grassland: quietness and strength for a new *American agriculture. American Society of Agronomy* 75-94

While there is a clear need to use natural and working lands as a carbon sink once the research has been conducted, there is significant potential for emissions reductions in agriculture from greenhouse gas mitigation opportunities, as outlined in ARB research results, including research by UC Davis researchers Martin Burger, [9] Will Horwath, and Chris van Kessel and as summarized in the Nicholas Institute's report series *Greenhouse Gas Mitigation Opportunities.*[10]

Table II-2. Land Management and Restoration Activities on page 64 of the Scoping Plan and the related table presented at the Natural Working Lands modeling workshop on December 14, includes no mention of quantification of cropland management for mitigation, only sequestration. With over 300 specialty crops in the state, many of which require large amounts of nitrogen fertilizer, there is a need to focus on emissions from suboptimal nitrogen applications, as demonstrated through research done through CDFA's FREP, UC Davis, the Almond Board of California and others.

We offer continued and strong support for all of the programs that allow for the implementation of various elements of this work, as mentioned on page 60 of the Scoping Plan, including the Healthy Soils Initiative and the Air Resources Board's offsets program. In order to quantify and document the results of these programs, it is necessary to streamline the process for agricultural participants. We hope the ARB continues down the path of searching for and aligning data requirements with pre-existing programs and reporting mechanisms, such as the Irrigated Lands Regulatory Program, Department of Pesticide Regulation requirements, NRCS practice standards, etc. so as to decrease the burden to our working land managers (Scoping Plan, page 68).

We thank ARB for the opportunity to provide comments. We look forward to continued collaboration with ARB and other stakeholders throughout the design and implementation of the Scoping Plan Update and the modeling to inform realistic, yet ambitious greenhouse gas mitigation and sequestration goals from natural and working lands in California.

Sincerely,

Robert Parkhurst
Director, Agriculture Greenhouse Gas Markets
Environmental Defense Fund

[9] https://www.arb.ca.gov/research/seminars/burger/burger.htm
[10] https://nicholasinstitute.duke.edu/focal-areas/technical-working-group-agricultural-greenhouse-gases-t-agg/california-project