June 21, 2022

Rajinder Sahota
Deputy Executive Officer for Climate Change
California Air Resources Board
P.O. Box 2815
Sacramento, California 95812

RE: Draft 2022 Climate Change Scoping Plan

Dear Ms. Sahota:

Indigo Agriculture (Indigo Ag) applauds the significant efforts by the California Air Resources Board (CARB) to reduce the greenhouse gas (GHG) emissions across the State's economy since the passage of the Global Warming Solutions Act (AB32) in 2006. California's climate change programs have been tremendously successful and are a model for the nation and the world. It is encouraging to see the state continue its leadership by including a goal for California to become carbon neutral by 2045, or earlier in the Draft 2022 Scoping Plan. Indigo Ag supports this goal and encourages CARB to incorporate opportunities and incentives for agricultural producers to implement practices that decrease GHG emissions through field-based practices in the Compliance Offset program and Low Carbon Fuel Standard (LCFS). Field-based agricultural practices can remove carbon dioxide from the atmosphere and support the State's transition to a carbon neutral economy. Our comments in this letter are related to recommended changes to the Cap-and-Trade offset program and LCFS.

About Indigo Ag

Indigo Ag uses microbiology and digital technology to improve the quality, yields and environmental sustainability of agriculture. We have recently expanded our expertise to streamline the ability of farms to tap into environmental markets. Using a combination of rigorous soil sampling, biogeochemical models and remote sensing (including satellite analytics), Indigo Ag can accurately determine the current carbon footprint of a farm and quantify the impacts of management changes over time. Working across the almost 5M acres that have contracted to be a part of Carbon by Indigo, Indigo Ag has helped implement practices with growers that have the opportunity to decrease net GHG emissions by more than 1 metric ton per acre of farmland per year. The credits from our initial project will be issued within the next several weeks.

Include agricultural offset protocols in the Cap-and-Trade program

California has effectively demonstrated how offsets can be integrated into a compliance cap-and-trade program, reducing the economic burden to businesses in California while also extending the climate benefits of the program beyond the sectors which fall under the cap. While the program has seen much success through its existing suite of compliance offset protocols (COPs), it has been almost six years since CARB adopted a new COP. During that time, we have seen significant advancements in the development of voluntary offset project protocols, especially around agriculture and land use.

The Compliance Offsets Protocol Task Force (Task Force), created under Assembly Bill (AB) 398,[1] conducted an extensive review of existing and potential protocols which could serve as new COPs as well as reviewed existing COPs. In March 2021, the Task Force issued a comprehensive report summarizing their significant efforts to review options for CARB to expand and improve its suite of COPs. The policy, technology, and business developments necessary to provide scalable agricultural offset projects are now in place, and we believe CARB must consider adopting COPs for agricultural land management activities.

California grows more than 400 commodity crops and is the sole source for many commodities enjoyed throughout the United States, including almonds, artichokes, dates, prunes, figs, garlic, kiwifruit, olives and olive oil, pistachios, raisins, table grapes, and walnuts. California crops generated almost $50 billion in value in 2018 alone.[2] Conducting research to understand what practices generate net GHG benefits of just the top 20 crop and livestock commodities, responsible for more than $42.8 billion in value in 2018, will take decades. Expanding the scope to all 400 commodities may never occur.

We cannot wait even a decade to conduct this research and then implement practices to reduce net GHG emissions. Recent studies have found that increased temperatures, highly variable precipitation patterns, and increased frequency and intensity of heat waves and drought are already impacting California agriculture. The impacts of these climatic changes include a decrease in chill hours and crop yields and an increase in pests and diseases.[3] The current statewide drought only underscores this impact making the future viability of many of these crops is uncertain.

Indigo Ag is currently implementing the Climate Action Reserve's (CAR) Soil Enrichment Protocol (SEP) with several hundred growers on almost 5 million of acres (Project ID CAR1459). The project expects to generate its first vintage of credits in the coming weeks. This project will demonstrate that the CAR SEP can provide new GHG benefits that meet the AB 32 requirements and should be considered as a future COP. This is the largest agriculture project in the history of environmental markets in terms of the scale of aggregation and practice change.

Expand the Low Carbon Fuel Standard to include field-based agricultural practices

One of the hallmarks of California's climate change programs is the LCFS, which, according to the Draft 2022 Scoping Plan, has grown from "approximately 1.8 million gallons in 2011 to nearly 589 million gallons in 2020."[4] The LCFS is one of the programs that have exceeded expectations and been copied by other states, such as Oregon and Washington, as well as countries from New Zealand to the European Union.

In the draft Scoping Plan Update, released on May 10, 2022, the Proposed Scenario calls for the state to achieve carbon neutrality by 2045 using a broad portfolio of solutions. As noted, the LCFS is an essential component of that plan, driving the market to produce low-carbon fuels. While there will be a significant increase in zero emissions vehicles (ZEVs) between now and 2045, "[Internal Combustion Engine (ICE)]

[1] Garcia, Chapter 135, Statues of 2014. (https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB398)
[2] Agricultural Production Statistics Review 2018-2019, 4 (2019). California Department of Food and Agriculture. (https://www.cdfa.ca.gov/statistics/PDFs/2018-2019AgReportnass.pdf)
[3] Pathak, T., Maskey, M.L., Dahlberg, J.A, Kearns, F., Bali, K.H., Zaccaria, D. (2018) Climate Change Trends and Impacts on California Agriculture: A Detailed Review. *Agronomy*, 8(3), 25. (https://doi.org/10.3390/agronomy8030025)
[4] CARB (2022) 2022 Draft Scoping Plan, https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents. 18.

vehicles from legacy fleets will remain on the road for some time, even after all new vehicle sales have transitioned to ZEV technology."[5] In order to fuel these vehicles while meeting the state's carbon neutrality goal, we will need to provide low-carbon fuels for the ICE vehicles that remain in use, and we must ensure that those fuels are produced with the lowest carbon emissions and environmental impacts as possible. One of the opportunities to minimize GHG emissions from transportation is through the use of biofuels. Biofuels have proven pivotal to the success of California's climate strategies over the past decade. Going forward, increased attention needs to be paid to the agricultural practices used in the cultivation of the feedstocks that go into these essential biofuels to minimize their impacts on the environment and maximize their displacement of fossil fuels.

Unfortunately, the historic cultivation of crops to supply biofuels has left soils severely depleted – croplands soils around the world have lost on average 26 percent of the carbon in the top 30 cm of soil.[6] Fortunately, the agricultural community recognizes the importance of soil carbon and is working to restore it. According to the National Academy of Sciences, there are many conservation practices that can "increase carbon stocks in soils and are successfully practiced by progressive farmers and ranchers."[7] Furthermore, these practices are not limited to their GHG benefits; they provide "additional ecosystem service benefits, including watershed protection, increased biodiversity, and improved soil health and fertility."[8]

In July 2020, Argonne National Laboratory, creator of the GREET model used to calculate the carbon intensity (CI) of fuels for the California LCFS, published a paper estimating that field-based practices can reduce the CI of gasoline or diesel by as much as 44.4 g CO_2/MJ. These practices include optimizing fertilizer application, reducing tillage, using enhanced- efficiency fertilizers, and planting cover crops.[9]

Practices such as cover crops, conservation tillage, and crop rotations all show significant potential to reduce nitrous oxide (N_2O) emissions and increase soil organic carbon. Unfortunately, these valuable practices are not widely adopted. For example, according to the 2017 U.S. Census of Agriculture, cover crops have only been adopted on about 4 percent (15 million acres) of U.S. cropland acres.[10] Multiple long-term studies have been conducted in North America that have found that the planting of cover crops increased soil organic carbon content with as good as or better crop yields.[11,12] Similar studies have found that conversion from conventional tillage to no-till agriculture stored more than 2 metric tons CO_2e per

[5] ibid. 152.
[6] Sanderman, J., Hengl, T., Fiske, G.J. (2017) Soil carbon debt of 12,000 years of human land use. *Proceedings of the National Academy of Sciences of the United States of America* 114 (36) 9575-9580. https://doi.org/10.1073/pnas.1706103114
[7] National Academies of Sciences, Engineering, and Medicine (2019) *Negative Emissions Technologies and Reliable Sequestration: A Research Agenda*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25259
[8] ibid.
[9] Liu, X. et. al. (2020) Shifting agricultural practices to produce sustainable, low carbon intensity feedstocks for biofuel production. *Environ. Res. Lett.* https://doi.org/10.1088/1748-9326/ab794e
[10] USDA National Agricultural Statistics Service (NASS) (2021) 2017 U.S. Census of Agriculture. https://www.nass.usda.gov/Publications/AgCensus/2017/index.php
[11] Chahal, I., Vyn, R. J., Mayers, D., Van Eerd, L. L. (2020) Cumulative impact of cover crops on soil carbon sequestration and profitability in a temperate humid climate. *Scientific Reports*. 10 (13381). https://doi.org/10.1038/s41598-020-70224-6
[12] Olson, K., Ebelhar, S. A., Lang, J. M. (2014) Long-Term Effects of Cover Crops on Crop Yields, Soil Organic Carbon Stocks and Sequestration. Open Journal of Soil Science. 4, 284-292. http://dx.doi.org/10.4236/ojss.2014.48030

acre per year.[13,14,15] In addition to providing essential carbon removal benefits, these practices increase soil health, promote ecosystem health, and provides resilience to the agricultural lands on which the biofuels are produced. The practices we are implementing with growers across the U.S. improve soil health, making the soils more resilient to the impacts of climate change, such as droughts, floods, and extreme temperatures. The increase water holding capacity of the soils also require less irrigation, a critical concern for the future of agriculture.

Throughout the Draft Scoping Plan, as well as recent state legislative and regulatory policies, the importance of sustainably produced biofuels is both directly and indirectly referenced. In the section focused on Proposed Strategies for Carbon Removal and Sequestration, the plan states that "there is no path to carbon neutrality without carbon removal and sequestration"[16] The draft plan also references Senate Bill 27, which directs CARB "to establish specified carbon dioxide removal targets for 2030 and beyond."[17] The section dedicated to Transportation Sustainability states that the state "must continue to support low-carbon liquid fuels."[18] The section goes on to state that "existing refineries could be repurposed to produce sustainable aviation fuel [and] renewable diesel."[19] The Proposed Scenario recognizes the role Natural and Working Lands (NWL) plays in meeting the State's climate neutrality goals. It prioritizes management actions on croplands that "reduce GHG emissions from these lands, protect ecosystems against future climate change, protect communities, and enhance the ecosystem benefits they provide to nature and society."[20]

Approach to measuring GHG reductions and carbon dioxide removal from agricultural practices

To quantify the GHG reductions from field-based practices, we propose a two-tiered method consisting of a biogeochemical model supported by field sampling to quantify the reductions in GHG emissions and carbon dioxide removal. Biogeochemical models are increasingly being used to calculate the methane, nitrous oxide (N_2O), and carbon sequestration from agronomic practices. A recent paper demonstrated that these models are capable of calculating seasonal and annual total N_2O emissions from a diverse array of crops and these calculations are more accurate "than the Intergovernmental Panel on Climate Change emission factor approach."[21] The state of California already uses biogeochemical models to calculate N_2O emissions from agricultural soil management in croplands.[22] These same models will be used in future versions of the State's NWL Inventory for the calculation of soil carbon fluxes.[23]

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[13] Marland, G., West, T.O., Schlamadinger, B., Canella, L. (2003) Managing soil organic carbon in agriculture: the net effect on greenhouse gas emissions. *Tellus 55B*, 2 https://doi.org/10.1034/j.1600-0889.2003.00054.x

[14] Nicoloso, R.S., Rice, C.W. (2021) Intensification of No-Till Agricultural Systems: an Opportunity for Carbon Sequestration. https://doi.org/10.1002/saj2.20260

[15] Six, J. and Paustian K. (2014) Aggregate-associated soil organic matter as an ecosystem property and a measurement tool. *Soil Biology & Biochemistry 68*, A4-A9 http://dx.doi.org/10.1016/j.soilbio.2013.06.014

[16] CARB (2022) Op. Cit. 66

[17] SB 27 (Skinner, Chapter 237, Statues of 2021)

[18] CARB (2022) Op. Cit. 152

[19] ibid. 153

[20] Ibid. 42

[21] Deng, J., Li, C., Burger, M., Horwath, W. R., Smart, D., Six, J., et al. (2018). Assessing short-term impacts of management practices on N_2O emissions from diverse Mediterranean agricultural ecosystems using a biogeochemical model. *Journal of Geophysical Research: Biogeosciences*, 123, 1557–1571. https://doi.org/10.1029/2017JG004260

[22] CARB. CARB GHG Inventory Updates Documentation, 2018 Edition. p.8. https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2016/ghg_inventory_00-16_method_update_document.pdf

[23] CARB. Technical Support Document for the Natural & Working Lands Inventory. December 2018 Draft. p.87. https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory_technical.pdf

The field sampling to measure soil carbon is advancing rapidly. For example, the U.S. Department of Energy's Advanced Research Projects Agency-Energy (ARPA-e) Systems for Monitoring and Analytics for Renewable Transportation Fuels from Agricultural Resources and Management (SMARTFARM) program has funded research to "develop and deploy a distributed carbon sensor system that is buried into the soil, capable of locally stimulating a surrounding volume of soils at multiple depths, and sensing carbon and carbon flux at ultra-low operational cost. The sensor will enable high-accuracy and real-time decision data for cost-effective carbon removal, storage, and management."[24]

We appreciate the attention and detail that CARB has put to roles agriculture must play in the state's journey to carbon neutrality. We encourage CARB to specifically state in the Scoping Plan that it plans to adopt additional COPs for agricultural practices and that biofuels produced for the LCFS must be grown in the most sustainable and environmentally sensitive manner. These objectives can be accomplished by including the crediting of field-based practices. Sustainable agriculture practices, such as cover crops, conservation tillage, and crop rotations, generate valuable GHG reductions and carbon dioxide removal as well as protect watersheds, increase biodiversity, and improve soil health and fertility all while increasing the resilience to the future impacts of climate change. These practices have been extensively researched and documented on all the largest commodities.

CARB has been an international leader in developing and implementing programs to reduce GHG emissions across the California economy; the inclusion of agricultural land practices will continue the State's leadership throughout the country, especially in the Midwest where a large portion of the corn is grown that supports the LCFS. We thank CARB for this opportunity to offer these comments and look forward to continued collaboration to implement policies and strategies that further reduce emissions from the transportation sector.

Sincerely,

Max DuBrisson

Head of Sustainability Policy & Engagement
Indigo

[24] US DOE ARPA-e (September 9, 2021) ARPA-E Announces $16.5 Million for Technologies Supporting the Biofuels Supply Chain (https://arpa-e.energy.gov/news-and-media/press-releases/arpa-e-announces-165-million-technologies-supporting-biofuels-supply-chain)