Indigo Agriculture

See attached comments from Indigo Agriculture regarding Washington Department of Ecology's development of a Clean Fuels Program.

December 14, 2021

Joel Creswell
Climate Policy Section Manager
Department of Ecology
State of Washington
P.O. Box 47600
Olympia, WA 98504-7600

RE: Inclusion of field-based practices in Washington's Clean Fuels Program Rule

Dear Mr. Creswell:

Indigo Agriculture (Indigo Ag) applauds the significant efforts by the Washington Department of Ecology (WADOE) to develop its Clean Fuels Program Rule (Chapter 173-424 WAC). At 44.73 million metric tons, transportation represents 44.9 percent of the greenhouse gas (GHG) emissions in the state of Washington. As stated by the Department of Ecology, "Washington will still need to do more to reach the limits set by the Legislature."[1] The Clean Fuel Standard is a critical component of the state's portfolio of programs to reduce the GHG emissions associated with transportation. A significant low carbon fuel market will need to be created in the State to meet the Clean Fuel Standard's requirement to reduce the carbon intensity of fuels 20 percent by 2038.[2] We encourage WADOE to consider the opportunities that field-based agricultural practices can play in generating additional GHG reductions and support the State's transition to a carbon neutral economy.

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 testing, biogeochemical models and remote sensing (including satellite analytics), Indigo Ag can accurately determine the current carbon footprint of a farm and implement changes to decrease that footprint. Working across the 3M+ acres that have contracted to be a part of Carbon by Indigo, Indigo Ag is helping these growers to eventually decrease net GHG emissions by more than 1 metric ton per acre of farmland per year.

The State's 2038 clean fuel goal is ambitious and will require new technologies and practices if we are to meet it. Agricultural crops can play a significant role in meeting that goal. Historically the cultivation of crops to supply biofuels to the Washington market 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.[3] 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."[4]

[1] WADOE. 2018 Greenhouse gas data. https://ecology.wa.gov/Air-Climate/Climate-change/Tracking-greenhouse-gases/2018-Data
[2] WADOE. Reducing greenhouse gases. https://ecology.wa.gov/Air-Climate/Climate-change/Reducing-greenhouse-gases
[3] 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
[4] 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

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."[5]

In July 2020, Argonne National Laboratory, creator of the GREET model used to calculate the carbon intensity (CI) of fuels in California and Oregon, 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.[6]

Indigo Ag strongly supports including the crediting of field-based practices in the Clean Fuel Standard. Practices such as cover crops, conservation tillage, and crop rotations all show the 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.[7] 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.[8,9] Similar studies have found that conversion from conventional tillage to no-till agriculture stored more than 2 metric tons per acre per year.[10,11,12]

The Climate Action Reserve[13] and Verified Carbon Standard[14] in 2020 adopted carbon offset protocols which use a two-pronged approach to quantify the GHG reductions from field-based practices. This approach uses a biogeochemical model supported by field sampling to quantify the net changes in GHG emissions from implementing practices on croplands. Biogeochemical models are increasingly being used to calculate the methane, N_2O, and carbon sequestration from agronomic practices. A recent paper demonstrated that these models are capable of calculating seasonal and annual 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."[15]

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[5] ibid.

[6] 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

[7] USDA National Agricultural Statistics Service (NASS) (2021) 2017 U.S. Census of Agriculture. https://www.nass.usda.gov/Publications/AgCensus/2017/index.php

[8] 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

[9] 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

[10] 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

[11] 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

[12] 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

[13] Climate Action Reserve (2020) Soil Enrichment Protocol. Version 1.0 https://www.climateactionreserve.org/how/protocols/soil-enrichment/

[14] Verified Carbon Standard (2020) Methodology for Improved Agricultural Land Management. Version 1.0. https://verra.org/wp-content/uploads/2020/10/VM0042_Methodology-for-Improved-Agricultural-Land-Management_v1.0.pdf

[15] 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

We recognize there is uncertainty in the use of any model or calculation methodology. The protocols not only incorporate direct soil carbon sampling, but they also rigorously address uncertainty through mechanisms to account for sampling, measurement, and modeling uncertainty. The cost of measuring soil carbon has decreased to the point where it can be broadly scaled up, and peer-reviewed data are available for calibrating and validating models for an array of practices. Therefore, the practices farmers implement that reduce a fuel's CI can be supported both by a detailed model and the sampling and analysis of the fields at least every five years. This measurement approach provides a reconciliation between the modeled and directly measured approaches and ensures that the practices farmers implement are improving the fuel's CI. In addition, these samples can be used to further develop and improve the accuracy of these models.

Beyond the scientific basis for quantification, a key concern for any rigorous, modern low carbon fuels program is verifiability. Indigo is already able to collect annual management data, including historical baselines, from growers for every field enrolled in the project. Field-level data and disciplined approaches to data provenance and code documentation are the key to verifying CI scores that incorporate field-specific management practice changes. These components are scalable and in place today for Indigo's carbon offset project, which is currently undergoing independent verification.

We encourage the WADOE to include the crediting of field-based practices in the development of the Clean Fuels Program Rule scheduled to take effect in January of 2023. We believe these practices can generate valuable GHG reductions from the production of fuels as well as protect watersheds, increase biodiversity, and improve soil health and fertility.

We thank WADOE for the 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 DuBuisson

Head of Carbon Policy
Indigo