February 19, 2024

Liane Randolph, Chair
Members of the Board
California Air Resources Board
via electronic submittal

Comments on the Proposed Amendments to the Low Carbon Fuel Standard and Initial Statement of Reasons, released December 19, 2023

Dear Chair Randolph and Board Members,

Eliminating the use of fossil fuels in transport is crucial to California's goal of carbon neutrality by 2045. There seems to be agreement that this can best be accomplished by accelerating the transition to ZEVs in both private and public transport, and further improving and expanding public transit. The success of the Low Carbon Fuel Standard (LCFS) is exhibited by California's early and continuing adoption of electric vehicles.

Unfortunately, California Air Resources Board's (CARB's) latest Proposed Amendments to the Low Carbon Fuel Standard rely heavily on accelerating the rate of reduction of the LCFS Carbon Intensity (CI) benchmark without correcting flawed CI scoring. This would increase production of renewable diesel made from soybean oil, canola oil and other seed oils, increasing both food insecurity in the near term and unsustainability in the medium term as more primary forests and savannas are converted to croplands. CARB must go back to the drawing board for a major reset of California's LCFS.

The most important policies for keeping global warming well below 2 degrees C are those that work to eliminate either the burning of fossil fuels or the destruction of nature. The UN estimates that the world's lands and oceans each sequester about 25 percent of our carbon emissions annually. It is essential that we halt further destruction of the world's natural forests, savannas and grasslands—because they are our most effective tools for removing carbon emissions from the atmosphere. Far too often these undisturbed natural lands are carelessly destroyed or degraded because the policies and laws needed to protect them do not exist. The world needs to stop using land in a way that worsens climate change. We believe that CARB's review of the Low Carbon Fuel Standard (LCFS) offers an opportunity to do just that; and as we know, the eyes of the world are on our state.

Substantial evidence suggests that the carbon intensity scores used by CARB for biomass-based diesel produced from seed oils are flawed.

In this comment we suggest changes to the LCFS that we hope will be useful to CARB in its review. These recommendations include:

- Update and Improve, or replace, models used to calculate the carbon intensity (CI) of crop-based fuels (Recommendation 1)

- Beginning in 2025, institute annually declining caps on both the volume of seed oil-based diesel and corn ethanol eligible for LCFS credits, with a goal of phasing out credits for crop-based fuels by 2030 (Recommendations 2 and 3)
- In 2025, introduce a fixed cap on the volume of UCO- and tallow-based diesel eligible for LCFS credits (Recommendation 4)
- Consider eliminating tallow from tier 2 pathways for biomass-based diesel by 2030 (Recommendation 5)
- Delay a more rapid decline in the LCFS carbon intensity benchmark until caps on lipid-based fuels have been in place for a year or more (Recommendation 6)
- Identify and measure negative environmental effects of LCFS credits for crop-based biofuels (Recommendation 7)

Recommendation 1: Update and Improve, or Replace, Models used to calculate CI of crop-based fuels

Other well-respected models, both national and international, that we have seen referenced in scientific journals, workshops and European laws calculate carbon intensity values of transportation fuels made from fossil fuels virtually identical to CARB's GREET model estimates, for diesel the CI is 94gCO2e/MJ.[1] However, their **calculated values for the carbon intensity of crop-based biofuels made from oilseeds such as soybean, palm, canola or sunflower seed are vastly different from CARB's GREET/GTAP/AEZ-EF model estimates.** For example, the GLOBIOM Model used by the European Union (EU) estimates the carbon intensity of soybean oil to be 182.9gCO2e/MJ,[2] while CARB's GREET/GTAP/AEZ-EF models estimate it to be around 55gCO2e/MJ. Two well respected US models, ADAGE, Applied Dynamics of the Global Economy, developed and maintained by RTI International and GCAM, Global Change Assessment, developed and maintained by the University of Maryland, were studied by the EPA during its 2023 CI Model Wokshop related to the Renewable Fuel Standard (RFS). ADAGE and GCAM estimates of CI values for oil-seed diesel differed from each other but were both closer to those of GLOBIOM rather than the GTAP combo CARB uses. The substantial difference in CI estimates results primarily from the models' different estimates of indirect land use change (ILUC) emissions.

The **GLOBIOM, ADAGE and GCAM models** all estimate the carbon emissions of any increase in seed oil-based diesel to be greater than the fossil diesel they replace.[3] The GTAP and AEZ-EF models used by CARB, on the other hand, calculate lower indirect land use change (ILUC) effects for these fuels, and as a result lower CI scores. This difference explains why CARB is still encouraging the production of more crop-based renewable diesel.

Last year's EPA Workshop on CI Models looked at three models: ADAGE, GCAM and GTAP, as it sought to estimate the impact of an increase of 1 billion gallons of renewable diesel. The ADAGE model estimated a net increase in greenhouse gas emissions of 35.5 kgCO2e/gal, while the GCAM model

[1] A. Christensen, "Transportation Carbon Intensity Targets for the European Union—Road and Aviation Sectors", GAMS, 2012, Appendix D Baseline Data.
[2] Ibid.
[3] GLOBIOM: the New Basis for EU Biofuel Policy 2021-2030, Transport&Environment.

estimated a smaller, but still significant, net emissions increase of 5.4 kgCO2e/gal. Only GTAP estimated a net decrease in emissions of 5.4 kgCO2e/gal.

One is left puzzled as to why the EPA went ahead and increased the volume mandates under the RFS for 2023-2025 since 2 out of the 3 models it consulted indicated an increase of 1 billion gallons of biomass-based diesel would result in more not less carbon emissions.[4] A recent UCS blog suggests that the EPA raised volume requirements partly because of the large increase in US renewable diesel production capacity that was already in process, especially in California.[5] In other words, it appeared to be a fait accompli.

The IPCC's 2019: Climate Change and Land report comments on the "large variance in the outcomes of these models" and the "deep uncertainty" attached to their parameters, the associations they model and the data sets they use.[6] The report further notes that as a result of this uncertainty "it is important to assess the impact of mitigation actions on the broader environment such as biodiversity, ecosystem functioning, air quality, food security, desertification/degradation and water cycles."[7] But CARB continues to approve pathways solely on the basis of the deeply uncertain and narrow CI score calculated by its models.

CARB needs to reevaluate the GTAP and AEZ-EF models it uses to estimate carbon intensity and indirect land use change for its crop-based alternative fuel pathways. CARB CI scoring assumes that the rate of increase in a feedstock's supply or the size of its volume increase does not affect its CI score, but this is unlikely to be an accurate description of the relationship.[8] The crucial need for caps, that we discuss under Recommendations 2 and 3 in this comment, is partially a result of CARB's flawed CI scoring.

Several researchers have proposed abandoning computer modeling for land use change in favor of a more straight-forward carbon opportunity cost of land approach.[9] This approach is based on the idea that land is more valuable storing and sequestering carbon than producing biofuels.

Comparison Of CARB's GTAP and the EU's GLOBIOM models: There are many differences that explain the models very different ILUC results for oilseed feedstocks.[10] The GTAP-BIO model assumes greater productivity increases result from feedstock price increases, though historical data does not seem to support this assumption. The GTAP-BIO model also assumes that consumers will buy fewer vegetable oils as prices rise in response to greater biofuel production. However, world population and per capita incomes continue to increase and vegetable oil consumption is increasing more rapidly than most food types making this an unreasonable assumption. Crushing more soybeans to produce soybean oil for

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[4] Lashof, "EPA's New RFS Will Increase Global Carbon Emissions—Not Lower them", World Resources Institute, 7/3/23.
[5] Martin,J., A Cap on vegetable oil-based fuels will stabilize and strengthen California's Low Carbon Fuel Standard, The Equation, Union of Concerned Scientists, 1/30/23.
[6] IPCC, 2019: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security and greenhouse gas fluxes in terrestrial ecosystems, p. 95-96.
[7] Ibid, p.95.
[8] NRDC Letter to CARB RE Recommendations for Updates of the Low Carbon Fuel Standard, 6/14/23.
[9] Lashof, op. cit.
[10] C. Malins, "Understanding the indirect land use change analysis for CORSIA", Cerulogy, Transport&Environment, 12/2019.

biofuels also produces more of the co-product soybean meal which is used as animal feed. The GTAP-BIO model predicts that farmers will substitute this cheaper feed for other feeds, while the GLOBIOM model predicts that the lower price will encourage more livestock production and hence increase demand for complementary feeds such as cereals.

The two models categorize land differently. In the GTAP-BIO model there is a "cropland pasture" category that refers to pasture land that was previously cropland and is easily converted back to cropland with little loss of carbon. This is the category that accounts for most of the land conversion in the US and Brazil despite any evidence to support it.[11] In Brazil the Soy Moratorium for the Amazon Region has reduced land conversions for soybean cultivation in the rainforest area, but as a result the unprotected, partially forested Cerrado Region has seen dramatic clearing of land for soy. The GLOBIOM model includes an "other natural land" category which refers to unmanaged natural land that has a lower carbon stock than forests but higher than the cropland pasture category of the GTAP-BIO model. This is the land category that absorbs much of the land conversion resulting from increased biofuel production in the GLOBIOM model. Certainly for Brazil which has accounted for over 50% of the growth[12] in soybean production since 2008 the GLOBIOM model's description of land use change is more accurate.

Recommendation 2: Cap LCFS Credits for Crop-based Biofuels Immediately

In order to avoid existential threats to the global food supply, CARB must cap the volumes of biomass-based diesel eligible for LCFS credits, starting 1/1/25. The initial annual cap should be set at volume levels recorded from the end of 2020 through the beginning of 2021. According to CARB dashboard data, this would entail setting an annual cap for renewable diesel around 800 million gallons and for biodiesel around 350 million gallons.[13] The growth rate of renewable diesel credits jumped to unsustainable levels during the second half of 2021. Annual US renewable diesel production capacity increased from under 500,000 gallons in 2017 to close to 1 billion gallons in 2020, to about 1.75 billion gallons in 2021 and about 4 billion gallons in January 2024.[14] ***There is not enough feedstock currently being grown to allow all these facilities to operate at capacity without seriously harming both global vegetable oil markets and primary forests.***[15] The US needs to scrap further expansion plans, which are being driven mostly by California's LCFS credits.

The recent increase in renewable diesel capacity is primarily the result of converting old petroleum diesel refineries to renewable diesel refineries.[16] This is an attractive option for oil companies burdened with excess refining capacity since refinery conversion to biofuels is cheaper than refinery decommissioning.[17] Hence, capping the amount of renewable diesel eligible for LCFS credits at 2020 or 2021 levels would merely result in earlier decommissioning of old, converted refineries.

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[11] Ibid, p. 9.

[12] According to FAO data Brazil contributed over 50% of the increase in global production from 2008-2021. Ritchie, Ibid, Soybean Production Chart, World, Brazil and US.

[13] California Air Resources Board, LCFS Data Dashboard.

[14] Martin, J., "Everything You Wanted to Know about Biodiesel and Renewable Diesel. Charts and Graphs", The Equation, Union of Concerned Scientists, 1/10/24.

[15] Ibid.

[16] Ibid.

[17] Ibid.

In short, the growth in US renewable diesel production capacity needs to be reversed. There is still time to prevent some of the land use conversions being encouraged by the spike in vegetable oil prices the vast increase in US renewable diesel capacity has caused.

An annual cap for corn ethanol should also be set around 1 billion gallons.

The importance of these caps should not be underestimated. As the World Resources Institute recently stressed: "***Because vegetable oil markets are linked globally, increased demand for vegetable oil anywhere increases deforestation pressure everywhere.***"[18]

The Union of Concerned Scientists, among many other NGOs, has called for capping the volume of crop-based biofuels that qualify for LCFS credits.[19]

> Vegetable oil is expensive, its availability is limited, and expansion is linked to deforestation, so the large-scale diversion of vegetable oil to fuel production is an especially bad idea….The predictable next step is to move vegetable oils from renewable diesel production to jet fuel production; claiming generous tax credits while still generating Renewable Fuel Standard (RFS) and LCFS credits….The oil industry was once the primary opponent of the LCFS but they have found a way to work the system to their advantage.[20]

Based on the conviction that any increase in the supply of crop-based renewable diesel or biodiesel creates too much pressure to convert more land to agriculture, especially in the tropics, the EU government disallowed these fuels from counting toward recently mandated carbon emission reductions in the aviation and maritime industries. This exclusion includes intermediate crops, palm fatty acid distillates and all other palm- and soy- derived materials as well. The EU regulations for the aviation and maritime industries require **all** food- and feed crop-based fuels to assume the same emission factors as the least favorable pathway.[21]

CARB has proposed to deal with the deforestation risk associated with increasing renewable diesel and other crop-based biofuels by requiring independent feedstock certification for crop-based pathways. This would require tracking crop-based feedstocks back to their point of origin to verify that they were not produced on recently deforested cropland. The Union of Concerned Scientists clarifies why this is not a solution:

> Tracking the chain of custody won't work because there is more than enough soybean oil produced on existing cropland in the US, Argentina and Brazil to produce 100 percent of California's diesel fuel. The problem with chain of custody is that California won't be tracking the chain of custody of vegetable oils being used to replace those diverted from global markets.[22]

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[18] D. Lashof, op. cit.

[19] Martin, A Cap on vegetable oil based fuels, op. cit.

[20] Ibid.

[21] C. Baldino, "Provisions for Transport fuels in the European Union's finalized "Fit for 55" package", International Council on Clean Transportation Policy Update, July 2023, p. 6 and 8.

[22] Martin, op. cit.

China and India are large importers of soybeans and vegetable oils; they will become the buyers of the crops produced on newly converted natural lands.

When the EU adopted caps on crop-based biofuels in 2018, the EU Commission pushed for more stringent caps. While it could not convince the heavily lobbied EU Parliament to adopt them, countries were given the option of setting lower caps and subtracting any cap reduction from their overall road transport emissions reduction target. Several EU countries have adopted lower caps for crop-based biofuels. Germany's cap is about 40 percent lower than the EU cap, Spain's 50 percent lower, Finland's and Estonia's about 65 percent lower, and the Netherlands 80 percent lowerCountries were also given the option of not allowing high Indirect Land Use Change (ILUC) feedstocks to count towards their mandated emissions reductions targets.[23] So far only palm oil has been designated a high ILUC feedstock; hence it will not be allowed to count towards any EU country's emission reduction targets after 2030. But countries have been permitted to exclude both palm oil- and soybean oil-based biofuels from counting towards their mandates. France, the Netherlands and Denmark have all excluded both palm oil- and soybean oil-based biofuels from credits.[24] Discussions as to whether soybean oil-based biofuels should also be officially classified as a high ILUC feedstock are ongoing.[25]

Recommendation 3: Phase out LCFS credits for crop-based fuels by 2030

Cropland must be reserved for growing crops for people and animals. Our goal needs to be halting all conversion of natural land to agriculture despite population and income increases.[26] Instituting declining annual caps for crop-based biofuels is crucial to attaining this goal.

World population, slightly over 8 billion at the end of 2023, is forecast to increase to 8.5 billion by 2030 and 9.7 billion by 2050.[27] Per capita calorie intakes are trending upward for both developed and

[23] According to a supplemental regulation of the EU's second Renewable Energy Directive (RED II) "ILUC can occur when land previously devoted to food or feed production is converted to produce biofuels, bioliquids and biomass fuels. In that case, food and feed demand still need to be satisfied, which may lead to the extension of agricultural land into areas with
high carbon stock such as forests, wetlands and peat land, causing additional
greenhouse gas emissions…. Renewable fuels made from {oil crop} feedstocks are therefore widely considered as having a higher ILUC-risk…these crops are also...responsible for an overwhelming majority of the observed worldwide expansion of the production area of food and feed crops into land with high-carbon stock." EU criteria for determining feedstocks with high ILUC risk include "(a) the average annual expansion of the global production area of feedstock since 2008 is higher than 1% and affects more than 100,000hectares; (b) the share of such expansion into land with high-carbon stock is higher than 10%".

[24] Lieberz, S. and Rudolf, A., Biofuel Mandates in the EU by Member State–2023, Foreign Argicultural Service, USDA, 7/6/23,

[25] The global area harvested for soybeans increased 2.9% per year on average from 2008 to 2021, meeting the EU's first condition referred to above in footnote 13. According to a Transport&Environment briefing "Is soy the new palm oil?" in November 2020 there is data showing that this expansion into high-carbon stock land has been greater than 10%, meeting the second condition cited in footnote 13.

[26] Hanson, C. and Ranganathan, J., How to Manage the Global Land Squeeze? Produce, Protect, Reduce, Restore, World Resources Institute, 7/20/23.

[27] UN, Global Issues, Population, medium variant projection.

developing countries.[28] The global demand for vegetable oil and meat is growing especially fast.[29] Yield increases have not kept up with the increased demand for food.

The IPCC 2019 Special Report on Climate Change and Land estimated that "around" 2015 only 9 percent of all global land was primary forest and 7 percent unused grassland or wetlands, forests managed for timber, or other uses, accounted for 22 percent of global land, used grazing land for 37 percent, cropland for 12 percent and barren wilderness 12%.[30] It also set a large goal for the world, suggesting that **"Maintaining the resilience of biodiversity and ecosystem services at a global scale depends on effective and equitable conservation of approximately 30–50% of Earth's land, freshwater and ocean areas, including currently near-natural ecosystems."**[31] Unfortunately**,** the UN Food and Agriculture Organization (FAO) estimates that the world is currently losing an average of 10 million hectares per year to deforestation.[32] Natural grasslands may be disappearing at an even faster rate. The IPCC identifies preventing further deforestation as one of the most substantial policies available for reducing carbon emissions, able to deliver additional reductions of 4GtCO2e/yr by 2030.[33] Currently, forests absorb about 11GtCO2e/yr but annual forest conversions for agriculture increase carbon emissions by about 5 GtCO2/yr, leaving net removal of carbon by forests at about 6GtCO.[34]

Though the task appears daunting, the world's intent to preserve nature has been expressed. In 2022 at the Convention on Biological Diversity Conference, the US and most other countries pledged to identify, eliminate, phase out or reform subsidies harmful to biodiversity.[35] This would include California LCFS incentives for crop-based biofuels. The US also signed the Declaration on Forests and Land Use at the 2021 United Nations Climate Change Conference, which commits countries to halting and reversing global deforestation and land degradation by 2030.

The IPCC's Climate Change 2023: Synthesis Report recognized the many competing demands on land and the inherent conflicts between crop-based biofuels, food security, water security, biodiversity and forest conservation.[36] But the report highlighted that the mitigation pathways that limit global warming to 1.5 or 2 degrees C all **rely on emission reductions proceeding the fastest in the land use change sector** by halting deforestation and restoring recently deforested areas, "with reduced deforestation in tropical regions having the highest total mitigation potential"[37].

Eliminating incentives for crop-based biofuels could prove to be one of the world's best opportunities for stopping the conversion of natural land to agriculture. The dollar value of LCFS credits that have

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[28] Economic Research Service, US Department of Agriculture, "Feeding the world: Global food production per person has grown over time", Chart Gallery.

[29] Per capita consumption of meat and vegetable oil has more than doubled since the early 1960s. IPCC 2019: Climate Change and Land, p. 86.

[30] Ibid., p.85.

[31] IPCC Synthesis Report, op. cit., p. 73.

[32] UN Food and Agriculture Organization, Forest Resources Assessment, Annual Deforestation, 2015-2020, Our World in Data.

[33] Ibid, p.69.

[34] IPCC, Special Report on Climate Change and Land, op. cit.,p. 10.

[35] Target 18 in UN Convention on Biological Diversity, "COP15: Final Text of Kunming-Montreal Global Biodiversity Framework", 12/22/22.

[36] IPCC, Climate Change 2023: Synthesis Report, Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Geneva, Switzerland, 2023.

[37] Ibid, p. 58 and p.73.

been received by crop-based biofuels is large. Over half of all LCFS credits from 2011-2022, worth about $22 billion in 2023 dollars, went to providers of crop-based fuels.[38] Last year approximately $2 billion worth of LCFS credits went to suppliers of crop-based fuels.[39]

Recommendation 4: Put Caps on LCFS Credits for UCO and Tallow

CARB should cap the volumes of used cooking oil (UCO) and tallow eligible for LCFS credits, starting in 2025 when caps on crop-based fuels are introduced. The low CI scores of UCO encourage fraud**,** such as the mislabeling of either pure vegetable oil or UCO-vegetable oil mixtures as UCO. Capping crop-based diesel volumes without capping UCO volumes increases the likelihood of this happening.

UCO, often referred to as yellow grease, and category 3 tallow, the largest and cleanest category of tallow, are used for animal feed, pet food, cooking oil, cosmetics, soaps and lubricants. Category 2 tallow is clean enough to be used for some of these purposes. Because global tallow and UCO supplies are not easily increased, when they are used for biofuels the demand for vegetable oils, especially palm oil which is often the cheapest substitute, increases.

The UCO content share in the renewable diesel consumed in California has grown rapidly over the last few years, raising questions about its authenticity. A certification requirement, similar to the one used in the EU, regarding the origin of the tallow and UCO might be helpful.[40] However, substantial fraud in UCO imports to the EU despite such a certification scheme suggests that this alone will not solve the fraud problem.[41] Caps are needed to curb fraud.

The EU has capped the amount of UCO and tallow that can count toward its transportation mandates in 2030 at about 12%.[42] Both Germany and France have already introduced similar caps. LCFS caps should probably be at least this stringent since importing UCO and category 3 tallow should not be encouraged. They are already sought after to meet local needs.

There has been some concern about the recent decline in LCFS credit prices. Since the oil refiners who must buy credits to balance their deficits are now receiving substantial credits for the renewable diesel they are producing, overall credit demand is decreasing. Without guardrails in place any decrease in the carbon intensity benchmark will just further depress credit prices by encouraging even greater renewable diesel production. Declining caps on crop-based renewable diesel and fixed caps on UCO and tallow should help to increase credit prices.

Recommendation 5: Consider eliminating tallow pathways from the LCFS

Tallow provides another example of the danger of giving very different CI scores to different commodities that resemble each other. Under EU transportation regulations (RED III) Category 3 tallow receives a carbon intensity score similar to that of seed oils. Category 1 and 2 tallow, on the other hand, because they carry some health risk are eligible for double credits, essentially halving their CI scores. But any increase in the demand for category 1 and 2 tallow may result in the downgrading of category 3

[38] Velez,K., CARB Must Reform LCFS Program to Meet Climate Goals, Expert Blog, NRDC, 8/23/23.

[39] California's Low Carbon Fuel Standard Update, BioCycle, 12/19/23.

[40] UCS, A Cap on Vegetable Fuels…., op.cit.

[41] S. Carroll, "Biofuel certification schemes slammed for failing to halt fraud", Euractiv, 2/1/24.

[42] Lieberz, op. cit., p. 7. A 1.7 percent cap for UCO and animal fats out of a 14.5 percent transportation sector greenhouse gas intensity reduction target.

tallow. If a small amount of category 1 comes in contact with category 3 the entire batch of category 3 tallow must be downgraded to category 1.

Germany has excluded tallow-based diesel from meeting its transportation mandates even though EU regulations allow it. Germany decided that "using these materials for biofuels displaces them from uses in industry and leads to indirect GHG emissions". So categories 1 and 2 tallow continue to be burned for energy at rendering plants and category 3 tallow continues to be used for other needs.

Recommendation 6: Hold off on increasing LCFS stringency

CARB should not lower the LCFS carbon intensity benchmark more quickly, as outlined in its proposed amendments, until it has time to assess how caps on lipid feedstock biofuels are working. The recent rapid increase in renewable diesel production in the US spurred on by California's LCFS program has sent US soybean and soybean oil exports tumbling and global soybean oil prices climbing. Global soybean prices almost doubled from 2020-2022.[43]

CARB's proposal to lower the carbon intensity benchmark at a faster pace is irresponsible and unsustainable without safeguards in place. CARB's GTAP model, though frequently refined, has not been adapted to reflect the greater knowledge available about unsustainable land use conversion and its link to the greater use of crop-based alternative fuels.

Recommendation 6: Consider the negative environmental effects not taken into account by models used to estimate a fuel pathway's CI when deciding whether a pathway should receive LCFS credits

Many negative environmental impacts of crop-based alternative fuels are not considered when carbon intensity scores are calculated by CARB. These effects should be identified, monitored, and measured. This exercise could help to clarify which pathways need to be removed from the LCFS.

Negative Environmental Effects of Biofuels on US agriculture:

(1) Crops grown for the production of ethanol (corn) and biodiesel and renewable diesel (soybeans) cover at least **20 percent of the entire US cropland acreage**, according to the USDA's Census of Agriculture 2017 (results from the 2022 Census are not yet available).[44] The 2017 Census indicated that 320 million acres of cropland were harvested in 2017. Over half of the harvested acres were planted in either corn (almost 91 million acres) or soybeans (90 million acres). According to the USDA's Economic Research Service 45 percent of corn harvested in the US is used to produce ethanol and about 21 percent of soybeans harvested is used to produce biofuels.[45] Hence, about 41 million acres are being used annually to grow corn to produce ethanol and 19 million acres to grow soybeans for biodiesel or renewable diesel, suggesting that 60 million acres, almost one fifth of cropland, is being used to grow crops for biofuels. The amount of US cropland acreage used to produce biofuels is currently increasing. While the US has historically exported about half of its soybean crop, soybeans and their derived product exports have dropped significantly recently, as domestic renewable diesel production has increased. Also, in mid 2023, for the first time over 50 percent of US produced soybean oil was

[43] Statista, Average prices for soybean oil worldwide from 2014-2025.
[44] National Agricultural Statistics Service, "Table1. Historical Highlights: 2019 and Earlier Census Years", US Department of Agriculture.
[45] Economic Research Service, "Feed Grains Sector at a Glance", US Department of Agriculture.

used to produce biofuels.[46] Exports of soybean meal, the co-product of soybean oil, on the other hand reached record levels.

(2) Corn and soybeans grown to produce biofuels are major contributors to the **worsening biodiversity crisis in rural areas in the US**. The massive use of corn and soy output for biofuel production in the US has fostered a monoculture system of farming which has degraded soils and eliminated complex insect, bird and plant communities. Not only has this monoculture system reduced soil fertility it has reduced the ability of the ground to absorb water either for crops or aquifer recharge. Since corn and soy farmers do not require pollinators to produce their crops, the loss of bees and other pollinators in rural areas has not been a large concern to them, but has been a problem for other farmers. Crop-based biofuels and the monoculture they have encouraged have contributed mightily to the destruction of nature in our rural areas.

(3) Corn and soybeans grown to produce biofuels are major contributors to the **pollution of ground and surface water in the US.** Fertilizers are responsible for substantial ground and surface water pollution. The Farm Bureau estimates that about half of the fertilizer (nitrogen, phosphate and potash) consumed annually in the US is used to grow corn, another 10% is used to grow soybeans.[47] This suggests that 22 percent of the all the fertilizer used on crops in the US is used for corn to produce ethanol, and over 2 percent is used for soybeans to produce biofuels, i.e. **almost one fourth of synthetic fertilizer use in the US is used on crops grown to produce biofuels.**

(4) In addition, recent USDA NASS Chemical Use Surveys showed that corn farmers applied almost 2 pounds of herbicides per acre in 2021 and soy farmers almost 1.5 pounds of herbicides per acre in 2020. Corn and soy have traditionally been the **greatest users of pesticides per acre** (including insecticides and fungicides as well as herbicides).

(5) Corn and soybeans grown to produce biofuels are major contributors to the **unsustainable withdrawal of water from US aquifers**. The 2017 Census of Agriculture reported that 54 million acres of cropland were irrigated in 2017. (See Historical Census Table 1: 2017 and earlier years, NASS, USDA) The crop with the most irrigated acreage was corn which accounted for 12 million acres of irrigated cropland. Soy acreage was second with 9 million acres irrigated.[48] This suggests that 5.4 million acres of corn were irrigated to produce ethanol and 1.9 million acres of soy were irrigated to produce biofuels; or 13.5 percent of total irrigated acreage was used to produce biofuels. Increasingly, the source of water for irrigation is groundwater rather than surface water. As droughts are forecast to increase, the US will need to rely more on irrigation for both corn and soybeans. The Ogallala-High Plains Aquifer extends from South Dakota to Texas and provides water for eight states, but it is being depleted at an unsustainable rate. **Irrigation is responsible for 90 percent of Ogallala groundwater withdrawals.**

(6) The production of ethanol, biodiesel and renewable diesel from corn and soybeans are also major users of water. The production of water requires more water than the production of gasoline, requiring 3 gallons of water for every gallon of ethanol produced, compared to 2-2.5

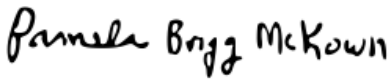
[46] Bukowski, M. And Swearingen, B., "Oilcrops outlook: September 2023", Economic Research Institute, US Department of Agriculture.
[47] Myers, S., Too Many to Count: Factors Driving Fertilizer Prices Higher and Higher, Farm Bureau, 12/13/21.
[48] Economic Research Service, USDA, Irrigation and Water Use.

gallons for gasoline. Most ethanol producers are located in the Midwest and rely on the Ogallala-High Plains Aquifer for their water needs.

In conclusion, when all the negative environmental consequences of the LCFS are considered it is clear that all credits for crop-based biofuels should be eliminated as soon as possible, but definitely no later than 2030. Credits for digester biogas should also be eliminated. These credits are encouraging expansion of the dairy industry which is responsible for substantial air and water pollution; the industry should be fined, not subsidized. Liquid or gas transportation fuels should no longer be receiving large subsidies. Rather subsidies should be reserved for accelerating the electrification of transportation, expanding the grid to enable faster connection of solar and wind energy and protecting natural land so it can better absorb carbon emissions.

Thank you for considering these comments. If you would like to discuss them on the phone or on Zoom, we would be very happy to meet with you.

Sincerely,



Pamela Brig McKown

Daniel Chandler