October 26, 2023

To: California Air Resources Board
From: Pamela Brigg McKown for Climate Action California
Daniel Chandler, Ph.D. for 350 Humboldt
Re: Comments on the October 5, 2023 California Public Workshop: Potential Amendments to the Cap-and-Trade Regulation

Comment: Biofuels (crop-based biofuels and woody biomass) should not be exempt from Cap-and-Trade

As made clear in the October 5 workshop, the Cap-and-Trade program (the Program) clearly intends to use the best available science to ensure that, from a lifecycle perspective, raw materials used to produce transportation fuels do not incentivize consumption of feedstocks with little to no greenhouse gas (GHG) reductions. In particular, production of alternative fuels must not come at the expense of global deforestation, unsustainable land conversion, or adverse food supply impacts. For the first time, the Program is also raising concerns that biogenic CO2 emissions from common transportation biofuels are exempt in the Program, regardless of biomass feedstock.

Recommendation 1: Biofuels from Crops and Waste Oils Should Not Be Incentivized—and should not be exempt from Cap-and-Trade.

We commend the program for this concern about unintended consequences of biofuels. Following is our perspective on the outsized negative effects of federal and state subsidies for crop-based biofuels. It does indeed matter what the feedstocks are. Production of crop-based biofuels uses too much land, water, and harmful chemicals to justify the subsidies it receives. The significant deleterious effects of both federal and state subsidies for crop-based biofuels are highlighted below.

1. **Crops grown for the production of ethanol (corn) and biodiesel and renewable diesel (soybeans) cover about 20 percent of all the cropland acreage in the US**. According to the USDA's 2017 Census of Agriculture (results from the 2022 Census are not yet available) 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 in the US is used to produce biofuels. This means that 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. Fully 60 million acres, almost one fifth of our nation's cropland, is being used to grow crops for biofuels.
2. **Corn and soybeans grown to produce biofuels are major contributors to the pollution of ground and surface water.** 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 percent is used to grow soybeans.

Thus 22 percent of the all the fertilizer used on crops in the US is used for corn grown for 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.** In addition, corn and soy have traditionally been the **greatest users of pesticides per acre** (including insecticides and fungicides as well as herbicides). Recent USDA National Agricultural Statistics Service (NASS) Chemical Use Surveys show 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.

3. **Corn and soybeans grown to produce biofuels are major contributors to nitrous oxide greenhouse gas emissions.** According to the EPA, nitrogen fertilizers (synthetic and organic) are responsible for the majority of US nitrous oxide (N2O) emissions, which have a 100-year global warming potential (GWP) of 265. On average, corn uses 246 pounds of fertilizer per acre of which 143 pounds (almost 60 percent) is nitrogen fertilizer, according to the USDA NASS Agricultural Chemical Use Survey of 2021, while soybeans use 70 pounds of fertilizer per acre of which only 5.5 pounds (8 percent) is nitrogen fertilizer, according to the USDA NASS Agricultural Chemical Use Survey of 2020.

4. **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. 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.**

5. **The *production* of ethanol, biodiesel and renewable diesel from corn and soybeans is also a major use of fresh water.** The production of ethanol is more water intensive than the production of gasoline, requiring 3 gallons of water for every gallon of ethanol produced, compared to 2-2.5 gallons for gasoline.

6. **Corn and soybeans grown to produce biofuels are major contributors to the worsening biodiversity crisis in rural areas**. The massive use of corn and soy output for biofuel production in the US has fostered a monoculture system of farming in the US 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. Corn and soy farmers do not require pollinators to produce their crops, so the loss of bees and other pollinators in rural areas has not been a large concern to them; but it has been a problem for other farmers. Monoculture planting of crops for biofuels has contributed mightily to the destruction of nature in our rural areas.

7. **Corn and soybeans grown to produce biofuels have been responsible for increasing global food prices—and hunger—in developing countries.** Corn, soybeans, ethanol, biodiesel, and renewable diesel diesel are commodities that are widely traded in global markets. Prices of corn and soybean oil used for biofuels influence the prices of varieties used for animal feed and human food. A 2008 World Bank study attributed the rapid increase in internationally traded food prices from 2002 to 2008 to EU and US policies that resulted in large increases in the production of corn ethanol and

soy biodiesel. The IMF index of internationally traded food commodity prices increased 130 percent over this period. From January 2005 to June 2006, maize (corn) prices almost tripled; wheat prices increased 127 percent; soybean oil prices increased 192 percent; and other vegetable oil prices increased by similar amounts. **The World Bank study concluded that 70-75 percent of the increase in food commodity prices from 2002-2008 was due to the rapid increase in crop quantities used to produce biofuels over this period**. Needless to say, the increase was devastating for the poor in developing countries who spend half their household income on food.

More recently, as renewable diesel production in the US has rapidly grown, soybean oil prices have increased rapidly. According to Statista, global soybean oil prices almost doubled from 2020 to 2022. The American Enterprise Institute recently attributed the large increase in all vegetable oil prices to the recent growth in renewable diesel production in the US. There is no doubt about the existence of a clear and substantial link between crop-based biofuel production and higher food prices .

8. Almost all gasoline in the US is E10 (10 percent ethanol). Recently, the average content of ethanol in gasoline reached 10.5 percent. By 2006-2007 ethanol had mostly replaced MTBE as an oxygenate for gasoline. The Clean Air Act requires that an oxygenate be added to gasoline to reduce carbon monoxide emissions in the winter in areas where carbon monoxide levels tend to increase. Yet even without a mandate, ethanol would be added to gasoline as an oxygenate, because it increases the octane level. Nevertheless, in 2006 the Renewable Fuel Standard (RFS) required that 4 billion gallons of ethanol be added to the almost 140 billion gallons of gasoline consumed, for a blend rate under 3 percent. European drivers use mostly E5. It costs more to produce a gallon of ethanol than a gallon of gasoline. Thus, **over time it seems reasonable to assume that, as use of ethanol in gasoline decreases, more than half the land (21 million acres) harvested for corn to produce ethanol could become available for conservation or for growing crops for food or feed**.

9. **Corn and soy grown for biofuels should be removed from the Program at the same time, in order to avoid the moral hazard of simply switching from one to the other.** For instance, if only corn grown for ethanol is removed, industrial corn farmers may just switch production to soybeans for renewable diesel or biodiesel. This would not solve any of the soil degradation, biodiversity crisis, water pollution or groundwater supply problems to which both of these biofuel monocrops contribute.

10. We find CARB's references to tallow and used cooking oil (UCO) as waste products misleading. Tallow is used as cooking oil and as an ingredient in soap, candles, salves, and lubricants. Used cooking oil is used as an animal feed and to make soap. Using tallow and UCO to produce biodiesel or renewable diesel requires the substitution of vegetable oils in the production of these other products. When this occurs, more crops must be grown. The global supply of tallow and UCO tends to grow very slowly. Also, it is relatively easy to disguise vegetable oil as UCO and practically impossible to set up and enforce certification programs that ensure this is not occurring. Providing larger credits for UCO and tallow creates incentives for this type of fraud. **We recommend that caps on the amount of UCO eligible for biofuel credits be instituted and edible tallow banned.** Also noteworthy, is the EU's goal of reserving all UCO and tallow for sustainable aviation fuel by 2030.

11. We recommend that CARB thoroughly study the EU-commissioned Global Biosphere Management Model (Globiom model) which led the EU to cap targets for crop-based biofuels at 2020 levels. **The Globiom report concluded that "palm and soy based biodiesel have LUC (land use change) emissions that exceed the full life cycle emissions of fossil diesel" even before adding direct**

emissions for soy or palm based biodiesel. This is because soybeans and palm are often grown in the tropics and this is where most new agricultural land is being developed. Vegetable oils are traded on global markets. When soy oil prices double as they have since 2020, largely because of the expansion of renewable diesel production in the US, soybean producers, especially in Brazil (the largest producer of soybeans) and neighboring South American soybean producers clear more rainforest land to create new farmland. Clearly the assumptions and structure of the Global Trade Analysis Project model that CARB is using to calculate LUCs associated with vegetable oil-based diesel is very different from those of the Globiom model.

12. We think **the approach used in a recent PNAS study which used actual land observations, biophysical models and partial equilibrium analysis is more appropriate for analyzing the effects of crop-based biofuels on greenhouse gas emissions than the emissions factors, trade model and general equilibrium approach CARB is currently using.** We note that this recent PNAS study on the environmental outcomes of the US Renewable Fuel Standard found that even modest changes in land use in US agriculture from 2006-2016 resulting from crop changes for increased biofuel production had considerable negative environmental effects. As a result, the study found the carbon intensity of corn ethanol to be definitely no less than gasoline and more likely 24 percent higher. It is impossible to have confidence in the carbon intensity numbers developed by CARB for crop-based biofuels because of the long-standing disagreement over whether these carbon intensities are greater or lower than those of fossil fuels. The methodology used by CARB to calculate the carbon intensities of crop-based fuels does not help. Consider the many environmental problems of monoculture corn and soy farms in the US for which the federal RFS and California state LCFS share responsibility. It is time to remove crop-based biofuels from California's incentive programs.

Recommendation 2: Eliminate or Limit Exemptions from Compliance Obligations for CO2-Emitting Woody Biomass Used to Generate Electricity

The Cap-and-Trade presentation on October 5th states: "Only biomass-derived fuels listed in section 95852.2(a) are eligible to have CO2 emissions exempt from a compliance obligation." Fuels listed include a variety of biogenic waste and residues; wood from timber management plans, for fire reduction, or forest improvement; biomethane and biogas generated from biogenic waste.

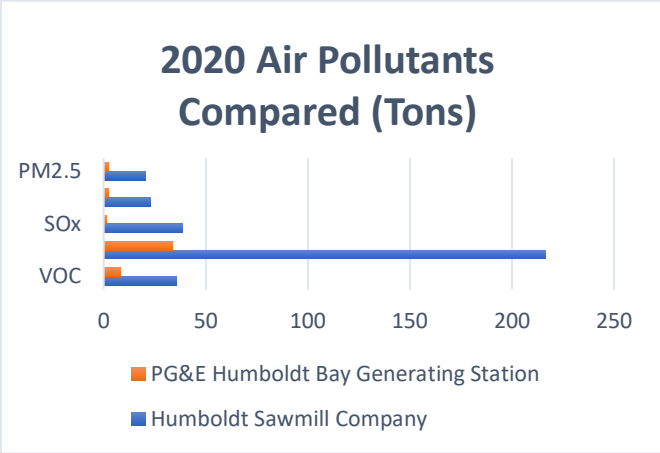
The policy needs to be revised to recognize that CO2 emissions from "biogenic" sources may indeed contribute to global warming and should not be exempt without a life-cycle assessment that shows that such emissions do not contribute to warming in a climate-policy relevant timeframe, basically 2050. Any CO2 emitted between now and 2050 is will threaten the IPCC 1.5°C goal and the 2050 net-zero goal.

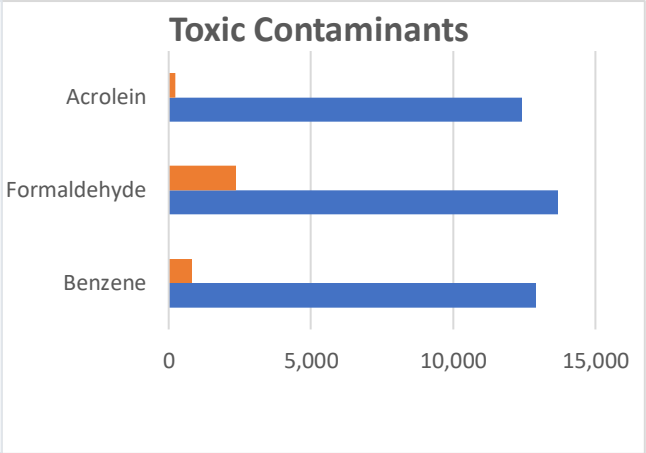
Biomass powerplants should not be exempted. As an example, consider the Humboldt Sawmill, Inc, biopower plant in Scotia, California. This plant emits 295,000 metric tons of CO2e a year.[1] When compared to the natural gas-fired Humboldt Bay Generating Station, HSC 2020 greenhouse gas emissions are 30 percent greater for the biomass plant despite the fact that Humboldt Sawmill produced only 27 percent as much power (130,427 vs 484,333 megawatt hours). That translates to 2.27 tons of CO2e for Humboldt Sawmill per megawatt hour vs. 0.47 for the Humboldt Bay Generating station.

[1] California Air Resource Board Pollution Mapping Tool https://ww2.arb.ca.gov/capp-resource-center/data-portal/carb-pollution-mapping-tool.

In a 2007 rulemaking, the California Public Utilities Commission set the emissions performance standard (EPS) for all load serving entities at 1,100 pounds of carbon dioxide (CO2) per megawatt hour (MWh) but exempted many biomass power plants.[2] Humboldt Sawmill Company in Scotia, which has been emitting CO2 and air pollution since 1989, produced in 2020 5,085 pounds of CO2 per MWh.[3] The statewide average is 375 pounds of CO2e per MWh for in-state electricity. Thus, HSC emits almost 5 times the EPS standard, and over 13 times the average emissions of powerplants in California.

When woody biomass is combusted, it produces large amounts of pollution as well as high levels of greenhouse gases – with local pollution greatly exceeding that of fossil gas. Below are graphs[4] comparing the Humboldt Sawmill biopower plant with a Humboldt County natural gas power plant.





Clearly, **combustion raises serious environmental justice concerns.**

To be *climate neutral* an industry like biopower needs to reach net-zero emissions before 2030, or at the latest by 2050. When industry touts carbon neutrality, they project sequestering an amount of carbon in the *future* equal to what is combusted and emitted *now*. Climate scientist Mary Booth writes: "[T]he cumulative additional CO_2 emitted from processing and burning biomass versus from an alternative fate, must be low, if not negligible, within a timeframe meaningful for climate mitigation….Actions that reduce or end emissions in the next ten years are thus essential, given that elevated CO2 is already driving essentially irreversible polar ice loss, permafrost melting, and ocean acidification, along with thermal sea-level rise, which has been shown to respond to temperature changes from short-lived climate pollutants in a ten-year timeframe." Booth's modeling shows the net warming effect of emissions from biopower for electricity continuing to increase 40 to 50 years after combustion.[5] Other

[2] "The Emissions Performance Standard is a facility-based emissions standard requiring that all new long-term commitments for baseload generation to serve California consumers be with power plants that have emissions no greater than a combined cycle gas turbine plant. That level is established at 1,100 pounds of CO_2 per megawatt-hour."

[3] https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/quarterly-fuel-and-energy-report-qfer-1 These are direct annual smokestack emissions not the life cycle emissions relevant to carbon neutrality over years.

[4] Data from: California Air Resource Board Pollution Mapping Tool https://ww2.arb.ca.gov/capp-resource-center/data-portal/carb-pollution-mapping-tool.

[5] Mary S Booth, Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, 2018 Environ. Res. Lett. 13 035001. https://iopscience.iop.org/article/10.1088/1748-9326/aaac88/pdf

recent research studies reach similar conclusions with regard to forest residues[6] and mill waste.[7] In the last two years, government agencies in Massachusetts, Hawaii, and Australia have reversed the outdated policy of labeling biomass power "carbon neutral."[8]

If we separate climate effects of burning woody biomass (warming) from the carbon cycle, it turns out that even if the combusted biomass was allowed to sequester carbon (rather than being cut and burned again in 40-100 years), regrowth of trees would still not result in a reduction in the warming caused by combustion.[9]

There are, however, uses of woody biomass that do not involve large releases of CO2e. If woody biomass is gasified (which does not involve combustion) it produces syngas which can be used as a fuel. There is now a great deal of interest in producing hydrogen from gasification. These operations are not carbon neutral, but they have much lower carbon intensity than combustion. Of course, using syngas as a fuel produces CO2 and there are methods of producing hydrogen, such as steam reformation, that are carbon intensive.

There are also increasing uses for woody biomass that don't involve fuels at all. These include biochar, compost and products like GluLam and Oriented Strand Board.

In conclusion, the cap-and-trade policy regarding biogenic release of CO2 needs a thorough-going and comprehensive review, with attention paid to specific applications. From a climate perspective, it is no longer tenable to view biogenic releases of carbon as climate neutral. The biogenic exemption given to combustion of woody biomass must be ended – or, alternatively, each proposed biogenic exemption must be justified by its own independent Life Cycle Assessment.

Thank you for considering these comments.

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[6] Also see Jerome Laganiere et al., Range and uncertainties in estimating delays in greenhouse gas mitigation potential of forest bioenergy sourced from Canadian forests, 9 GCB Bioenergy 358 (2017), https://doi.org/10.1111/gcbb.12327. IPCC, *Frequently Asked Questions*, *Intergovernmental Panel on Climate Change (IPCC) Task Force on National Greenhouse Gas Inventories*, http://www.ipcc-nggip.iges.or.jp/faq/faq.html.; Giuntoli, J., S. Searle, R. Jonsson, A. Agostini, N. Robert, Stefano Amaducci, L. Marelli, and A. Camia. "Carbon accounting of bioenergy and forest management nexus. A reality-check of modeling assumptions and expectations." *Renewable and Sustainable Energy Reviews* 134 (2020): 110368. Giuntoli, J., et al. (2021). "A systems perspective analysis of an increased use of forest bioenergy in Canada: Potential carbon impacts and policy recommendations." *Journal of Cleaner Production* 321. Morris, Gregory. "Bioenergy and greenhouse gases." *Green Power Institute, The Renewable Energy Program of the Pacific Institute* (2008). https://pacinst.org/wp-content/uploads/2008/05/Bioenergy_and_Greenhouse_Gases.pdf .

[7] "The results suggest that GHG emissions of mill residues-based pathways can be 15–52 percent lower than those of pulpwood-based pathways, with logging residues falling in between." Xu, Hui, Gregory Latta, Uisung Lee, Jan Lewandrowski, and Michael Wang. "Regionalized life cycle greenhouse gas emissions of forest biomass use for electricity generation in the United States." *Environmental Science & Technology* 55, no. 21 (2021): 14806-14816. The lower emissions come from not having the same upstream emissions as with pulpwood or logging residues. However, the study did not look at the *combustion* of the feedstocks. .

[8] https://www.masslive.com/news/2022/08/wood-burning-power-plants-in-mass-wont-qualify-for-renewable-energy-credits-local-activists-are-celebrating.html; https://minister.dcceew.gov.au/bowen/media-releases/native-forest-wood-waste-removed-renewable-energy-target ; https://climatecasechart.com/case/in-re-hawaii-electric-light-co-3/

[9] Zeke Hausfather. Will global warming 'stop' as soon as net-zero emissions are reached? CarbonBrief: https://www.carbonbrief.org/explainer-will-global-warming-stop-as-soon-as-net-zero-emissions-are-reached/