ORAL ARGUMENT NOT YET SCHEDULED

**IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT**

No. 23-1177

(consolidated with Nos. 23-1240, 23-1243, 23-1244, 23-1246, 23-1247, and 23-1249)

CENTER FOR BIOLOGICAL DIVERSITY,
Petitioner,

v.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, et al.
Respondents.

ON PETITION FOR REVIEW OF AN ACTION OF THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

BRIEF OF AMICI CURIAE AGRICULTURAL, BIOMASS, AND GREENHOUSE GAS LIFECYCLE SCIENTISTS DAVID CLAY, KENNETH COPENHAVER, ISAAC EMERY, STEPHEN KAFFKA, MADHU KHANNA, KEITH KLINE, STEFFEN MUELLER, AND DEV SHRESTHA IN SUPPORT OF RESPONDENTS/AFFIRMANCE

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TABLE OF CONTENTS

TABLE OF AUTHORITIES

Page(s)

Statutes

Other Authorities

AUTHORITY TO FILE

Pursuant to Federal Rule of Appellate Procedure 29(a)(3) and Circuit Rule 29(b), Amici filed a motion for leave simultaneously with this brief. [1]

INTERESTS AND IDENTITY OF AMICI CURIAE

As experts and scientists practicing and publishing in the field of agricultural economics, biomass production, and greenhouse gas ("GHG") lifecycle analysis,[2] the Amici Curiae have an interest in promoting accurate representations of scientific research on the environmental impacts of biofuel production and how the Renewable Fuel Standard ("RFS") does, and does not, influence those impacts.

The Biological Evaluation ("BE") and Regulatory Impact Analysis ("RIA") at issue in this litigation, along with the Third Triennial Report to Congress on Biofuels and the Environment, cited and relied on research conducted by many of the Amici Curiae, all of whom have contributed significantly to the scientific consensus in this field.[3] In particular, the Amici Curiae have specialized knowledge related to agricultural land management, crop rotations, systematic

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[1] No party's counsel authored this brief in whole or in part, and no party, party's counsel, or person other than the Amici Curiae, its members, or its counsel, made a monetary contribution to the brief's preparation or submission.

[2] Biomass is renewable organic material that comes from plants and animals. Biomass sources for energy include agricultural crops and waste materials such as corn and soybeans.

[3] *See, e.g.*, BE at 33, 96–97, 174, 244 (JA__, __-__, __, __); *see also* Third Triennial Report at 5-1, 5-25, 6-47, 9-19, 12-17, 13-37 (JA__, __, __, __, __, __); RIA at 225, 228-30, 236, 242, 397 (JA__, __-__, __, __, __).

geospatial analysis of land cover (e.g., land-use changes), and the lifecycle of GHG emissions related to biofuel production.

Dr. David Clay is a Distinguished Professor of Soil Science at South Dakota State University, Fellow of the American Society of Agronomy, Editor-in-Chief for the American Society of Agronomy, and the South Dakota Corn Endowed Chair of Precision Farming. His research focuses on on-farm research, soil health, precision farming, land-use changes, water quality, and the development of Northern Great Plains Climate Smart agricultural systems. He has also edited or authored 13 books and has published more than 300 book chapters and research papers. Two of his papers have been awarded paper of the year and he was twice selected for the ASA precision Systems Impact Award and as the South Dakota State University College of Agriculture and Biological Sciences Outstanding Researcher. In 2009, he received the Precision AG Award of Excellence in Education and Research. He was also awarded the South Dakota State University F.O. Butler Award for Excellence in Research.

Kenneth Copenhaver began working with the National Aeronautics and Space Administration ("NASA") in the mid-2000s to utilize satellite data and remote sensing technology for operational use in agricultural crop management practices. He has also worked as a Senior Research Engineer at the University of Illinois at Chicago and as Director of Engineering, Ag and Biofuels Division, at

Genscape, Inc. He developed LandViewer, a subscription-based software that uses data to provide daily updates on the state of corn vegetation, incorporating nearly 30 variables that include NASA satellite data. He is also a founding principal of CropGrower LLC, which develops products for the agricultural community based on satellite and weather data related to acreage, crop conditions, soil conditions, and yield estimates.

Dr. Isaac Emery is an environmental sustainability scientist and consultant with more than a decade of experience in quantitative sustainability, systems thinking, and lifecycle assessment. He graduated with a Ph.D. from Purdue University's Agricultural and Biological Engineering Department through the Ecological Sciences and Engineering Interdisciplinary Graduate Program. His research, conducted at Purdue's Laboratory of Renewable Resources Engineering and Argonne National Laboratory, focused on the role of biomass storage and supply chains in assessing GHG emissions during biofuel production. That research led to updates in the GREET model of GHGs and criteria pollutants from fuels. As a postdoctoral scientist with the Air Force Institute of Technology and the Oak Ridge Institute of Science and Education, he developed models and reports to inform local and regional decision-making related to vehicle fleet management, air quality, and treatment of PFAS-contaminated groundwater. As Senior Environmental Scientist at the Good Food Institute, he developed environmental policy and communications materials on impacts of animal agriculture and the potential benefits of plant-based meat and cellular agriculture. He currently serves as Project Director at WSP USA.

Dr. Stephen Kaffka is Professor Emeritus of Cooperative Extension at the University of California Davis and Director of the California Biomass Collaborative. He serves as an advisor on bioenergy energy and sustainability issues to the Institute of Transportation Studies at UC Davis and has served as an ex officio member of California's Bioenergy Interagency Work Group. He was also a technical advisory committee member for the California Energy Commission's Alternative and Renewable Fuels and Transportation Program and participated on the California Air Resources Board's Sustainability Standards and Indirect Land Use Change workgroups. Dr. Kaffka was a member of a National Research Council's committee producing a congressionally mandated report on the Renewable Fuel Standard, Potential Economic and Environmental Effects of U.S. Fuel Policy. From 2003 to 2007, he was director of the Long Term Research on Agricultural Systems Project at UC Davis, which focused on the sustainability of farming systems in California. He was also recently selected nationally as one of the nine high-level reviewers for EPA's Third Report to Congress on the Environmental Effects of the Renewable Fuel Standard.

Dr. Madhu Khanna is the ACES Distinguished Professor of Environmental Economics in the Department of Agricultural and Consumer Economics and the Alivn H. Baum Family Chair and Director of the Institute for Sustainability, Energy, and Environment, at the University of Illinois at Urbana-Champaign. Her research is at the intersection of agricultural, energy, and environmental economics and has led to more than 170 peer-reviewed publications. She has also served on the EPA Science Advisory Board for 10 years and as a Chair/member of review panels for the National Institute of Food and Agriculture, the EPA, and the National Science Foundation, and has served as a member of the U.S. Department of Energy Technical Advisory Committee. She has served on the editorial boards of several disciplinary and interdisciplinary journals and is currently on the editorial boards of the Annual Review of Resource Economics, Australian Journal of Agricultural and Resource Economics, and GCB Bioenergy. She has also served on the National Academies of Sciences, Engineering, and Medicine Committee on Current Methods for Life Cycle Analyses of Low-Carbon Transportation Fuels in the United States. She also serves on the Board of Directors of the Agricultural and Applied Economics Association and the Association of Environmental and Resource Economists.

Keith Kline is a Distinguished Scientist in the Environmental Sciences Division and the Climate Change Science Institute of Oak Ridge National

Laboratory, and Adjunct Professor in the Biosystems Engineering and Soil Science Department at the University of Tennessee Institute of Agriculture, in Knoxville, Tennessee. He worked in developing nations for 24 years to improve livelihoods while conserving forests and biodiversity under environmental programs funded by the U.S. Agency for International Development. He has contributed to more than 100 publications on bioenergy and natural resource management and serves as an Expert for the U.S. Technical Advisory Group to the International Organization for Standardization Technical Committee that developed performance standards for a Circular Economy (international standards ISO52004 (2024) and ISO52020 (2024)). He also served as an expert on international committees that generated three additional relevant International Standards: ISO 13065 (2015) Sustainability Criteria for Bioenergy, ASTM E3066 (2020) Standard Practice for Evaluating Relative Sustainabiltiy Involving Energy or Chemicals from Biomass, and ASTM E3256 (2020) Standard Practice for Reference Scenarios when Evaluating the Relative Sustainabiltiy of Bioproducts. He serves as an advisor to International Research Networks on the nexus of Food-Energy-Water, at the University of Tennessee in Knoxville, and to the Clean Energy Ministerial Biofuture Initiative, and the Net Zero World Initiative.

Dr. Steffen Mueller leads the Bioenergy and Transportation Emissions Research Group at the University of Illinois Chicago. His research focuses on lifecycle analyses and the quantification of emissions and sequestration effects from production agriculture. He has collaborated with Purdue University and Argonne National Laboratory on various publications that estimate emissions from induced land-use change. Among other things, he has served on the National Academies of Sciences Committee on Current Methods for Life Cycle Analyses of Low-Carbon Transportation Fuels and, since 2013, has served on the Board of International Sustainability and Carbon Certification.

Dr. Dev Shrestha is a professor of chemical and biological engineering at the University of Idaho. His work focuses on biological and agricultural engineering. He has published more than 70 research articles, most of which are peer-reviewed publications, including on biofuel's impact on food prices index and land-use changes, and life-cycle analyses of GHG emissions for various biodiesels.

INTRODUCTION

The Environmental Petitioners[4] claim that the RFS and any related demand for biofuels will result in "converting" millions of acres of grasslands and wetlands to cropland, thereby degrading and destroying vital habitats for endangered species and otherwise harming the environment through increased GHG emissions. Br. at 7. Such claims are based on outdated, flawed, and disproven research. Although

[4] "Environmental Petitioners" or "Petitioners" refers to petitioners who joined in filing the Initial Brief for Center for Biological Diversity & National Wildlife Federation (Mar. 22, 2024), Doc. 2046391 (hereinafter "Br.").

the EPA conservatively noted this flawed research in its BE and the RIA, such research is an outlier. It contradicts the experiences of relevant farmers and land managers and does not reflect the scientific consensus. The EPA has correctly declined to rely on it to estimate land-use impacts.

Agricultural scientists and experts in the field of biomass production have identified and corrected the errors on which the outlier research relied. As corrected, updated analyses relying on improved methods, consistent land classification systems, and the accumulation of copious verifiable historic data, combined with life-cycle assessments from diverse sources, have repeatedly confirmed that low-carbon biofuels reduce GHG emissions in the transportation sector.

This brief explains the various classifications of agricultural land use in the context of biofuel production and how errors in these classifications led outlier studies to include false conclusions about the environmental impacts of biofuel production and the RFS. This brief then explains how, when those inaccurate assumptions are corrected, the lifecycle analysis of biofuel production demonstrates a GHG benefit over conventional gasoline.

ARGUMENT

When the RFS was first adopted in 2007, some analysts predicted its targets for producing ethanol in the United States would generate major land-use changes and that emissions associated with the conversion of "natural land" to "cropland" would result in higher GHG emissions than gasoline. *See, e.g.*, Timothy Searchinger et al., *Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change*, 319 SCI. 1238 (2008). Other studies emphasizing negative impacts of ethanol production have been reported in papers by Tyler Lark et al. *See, e.g.*, Tyler Lark et al., *Environmental Outcomes of the U.S. Renewable Fuel Standard*, 119 PNAS 9 (2022).

Although the EPA conservatively noted some of this research in its analysis, it does not align with evidence-based and scientific understandings as explained in this brief, and as confirmed by the U.S. Department of Agriculture ("USDA"), which noted that Lark et al.'s 2022 research methods are flawed and its conclusions "cannot be corroborated with USDA site level, modeled, or national datasets." USDA, Review of Recent PNAS Publication on GHG Impacts of Corn Ethanol at 10 (Dec. 14, 2022).

Experts in the field of biomass and agricultural economics have demonstrated that much of the outlier research was based on flawed assumptions and methods related to land use. Madhu Khanna et al., *Lessons Learned from U.S. Experience with Biofuels: Comparing the Hype with the Evidence*, 15 REV. OF ENV'T ECON. & POL'Y 67, 73 (2021) [hereinafter, "*Lessons Learned*"]; *see generally* Farzad Taheripour et al., *Response to Comments from Lark et al.*

Regarding Taheripour et al. March 2022 Comments on Lark et al., Original PNAS Paper (May 2022) [hereinafter "*Response to Comments*"]; Kenneth Copenhaver & Steffen Mueller, *Considering Historical Land Use When Estimating Soil Carbon Stock Changes of Transitional Croplands*, 16 SUSTAINABILITY 734 (2024) [hereinafter "*Considering Historical Land Use*"].

Farmland is privately owned, and farmers tend to plant crops on land under active cultivation, or in rotation with land previously tilled for annual crops, not through the "conversion" of native prairie grasslands or forests, as outlier research assumed. Xiaoguang Chen & Madhu Khanna, *Effect of Corn Ethanol Production on Conservation Reserve Program Acres in the US*, 225 APPLIED ENERGY 124 (Open Manuscript at 20) (2018), *available at* https://www.sciencedirect.com/science/article/abs/pii/S030626191830669X.

Consistent with this reality, the expansion of crop acreage attributed to biofuel production occurred through adjustments in crop rotations on farmland already under production in 2007. *Id*. In addition, approximately one-third of corn grown for ethanol ends up as distillers' dried grains and corn oil, which can be used for other purposes without the need to cultivate additional land. D.S. Shrestha et al., *Biofuel Impact on Food Prices Index and Land Use Change*, 24 BIOMASS & BIOENERGY 43, 45 (2019) [hereinafter, "*Biofuel Impact*"]. Neither biofuel production nor the RFS has been scientifically linked to the conversion of "natural" lands, such as native prairies, forests, and wetlands, to crop production. Farzad Taheripour et al., *Comments on "Environmental Outcomes of the US Renewable Fuel Standard"* at 15 (Mar. 2022) [hereinafter "*Comments on Environmental Outcomes*"].

Petitioners press on this Court a grossly simplified and erroneous model of agricultural economics in which the RFS is the primary driver of cultivation decisions farmers make, and farmers regularly convert previously untilled grasslands (native sod) to croplands.[5] As described below, such claims depend on flawed land-use classifications and interpretations of "change" based on limited or selective data and arbitrarily constrained time frames. When these and other related errors are corrected, the scientific basis for Petitioners' arguments dissipates. Lifecycle analyses incorporating corrected assumptions indicate that carbon intensity is lower for biofuels than conventional gasoline, and that biofuels have an important role to play in transitioning the transportation sector to cleaner fuel. *Lessons Learned* at 82.

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[5] *See* USDA, Native Sod Guidelines for Federal Crop Insurance, https://www.rma.usda.gov/en/Fact-Sheets/National-Fact-Sheets/Native-Sod-Guidelines-for-Federal-Crop-Insurance ("Native sod acreage is acreage that has never been tilled, or acreage that you cannot prove has been tilled for crop production.").

A. Flawed Research Misidentified "Converted" Lands

One of the flaws in outlier studies examining effects of biofuel production on land was that the studies considered only a short period of time, or were limited to simple two-point comparisons that can distort actual trends, and assumed that increases in biofuel production relied on "land conversion," i.e., bringing new lands into production that were not previously used as cropland. *Considering Historical Land Use* at 2. In part, this was because researchers relied on moderate resolution satellite imagery to inform their analysis of land use. It is now known, however, that satellite imagery at the resolution used in those studies failed to accurately distinguish between land that has never been tilled and cropland that was temporarily fallow. Kenneth Lee Copenhaver, *Combining Tabular and Satellite-Based Datasets to Better Understand Cropland Change*, 11 LAND 714, 1 (2022). Using more sophisticated tools, researchers have determined that, contrary to prior conclusions, much, if not all, land reported by Lark et al. as being "converted to crop" between 2007 and 2019 was likely previously in crop, and therefore not "converted." *Id*. at 16.

This error matters. When determining the environmental impacts of biomass production, whether cropland was previously used for farming is important. As explained in more detail below, cultivating land never before tilled to grow annual crops results in the release of carbon from soils, potentially offsetting other GHG emission reductions associated with the production and use of biofuel. By contrast, harvesting feedstocks for biofuels from existing agricultural lands releases less carbon and—especially in cases of good land management utilizing crop rotations, minimal tillage, and periods of rest—can increase soil carbon stocks over time.

As a matter of terminology, although the literature often uses the word "conversion" when discussing land-use changes in the biofuel context, without an understanding of how farmers actually manage land, the word can be misleading. The term "convert" often signifies a "change from one form or function to another." "Convert," *Merriam-Webster.com Dictionary*, https://www.merriam-webster.com/dictionary/convert (accessed June 27, 2024). But farmland is privately owned and managed for agricultural purposes. It does not generally consist of native sod. Indeed, farmland in the United States has been tilled since early settlement. The Homestead Act of 1862, 43 U.S.C. § 161 et seq. (repealed 1976), encouraged cultivation by giving titles to land only after people lived on and cultivated the land for five years. *See* National Archives, Homestead Act (1862), https://www.archives.gov/milestone-documents/homestead-act (summary).

Instead of changing the function or form of a parcel of land, farmers tend to rotate crops, sometimes allowing the land to rest in between uses (called fallowing) or rotating row crops with alfalfa or other grasses for hay and pasture. *Comments on Environmental Outcomes* at 29; *Considering Historical Land Use* at 8–9.

Rotating crops or employing fallow periods for lands to rest is a normal and historically common farming practice. In short, land used in the United States for farming is generally previously tilled and therefore not "converted" from natural land to crop land.

Although historic trends reflect declines in cultivated cropland in the United States due to economic factors and urban expansion, leveling off in recent years, the total area of U.S. cropland was the same in 2002, just prior to biofuel growth, as it was in 2017, following the growth in U.S. biofuel production. *See* USDA Natural Resources Conservation Service, Land Use & Cover Inventory Database, https://www.nrisurvey.org/lucid/. Annual crop production focuses increasingly on utilizing the most productive of the remaining farmlands.

Land-use analyses with limited time and spatial coverage can confuse long-term crop rotations and rest periods with new land conversion. Given the historical context of land use in the United States, however, it is highly unlikely modern farmers are creating "new" agricultural lands out of parcels never-before farmed. Instead, the agricultural function remains the same, even if the land-cover class or specific crop or other agricultural use changes.

Land is not "converted" for biofuel crop production. Rather, farmland is managed to grow crops farmers hope to sell for a profit, without much regard for the specific end use. *See, e.g.*, *Considering Historical Land Use* at 13–14.

Farmland can also be used repeatedly for cultivation of a range of crops (such as soybeans, wheat, other small grains or oilseeds and hay/pasture), and managed to increase yields, further lessening the need for new conversions over time. *Lessons Learned* at 76.

Despite the fact that farmers rarely "convert" previously unfarmed land to crop land, in the context of biomass for biofuel production, studies have found that land described as "converted" generally falls into three categories:[6] cropland in the Conservation Reserve Program ("CRP"); "cropland pasture," which is cropland that transitions between crop and livestock grazing uses; and other land not previously tilled. *Comments on Environmental Outcomes* at 15. The role of each in the context of biofuel production and the RFS is described below.

1. Croplands (Used for Biofuel Production)

i. CRP Land

Most of the land described by the Environmental Petitioners as "converted" for biofuel production was land from expiring CRP contracts. *Considering Historical Land Use* at 9. The CRP is a voluntary land set-aside program created in 1985 for private landowners. In exchange for a yearly rental payment, farmers

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[6] There are other more descriptive subcategories, such as fallow or idle cropland, unused land, cropland-grassland, cropland-pastureland, and combinations of these. We focus on the three categories described above because research examining land-use change in the context of biofuels has focused on these categories.

agree to temporarily remove cropland from agricultural production. CRP contracts are typically 10 to 15 years long. When a contract expires, farmers have the option of rotating the land back into crop production, using it for grazing, or leaving it idle. *Id*. A pre-requisite for obtaining a CRP contract is that *the land must have been previously cultivated*. *See* USDA, CRP Fact Sheet (2024), *available at* https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/2024/FSA_CRP-main-factsheet.pdf. It cannot be native sod.

Nonetheless, outlier reports have identified expiring CRP contract land as "conversions" associated with the fact that, between 2007 and 2021, land enrolled in the CRP declined by 14 million acres. Some reports also suggest the RFS caused farmers to exit the program and use their land for biofuel production. But these reports failed to account for the fact that Congress decreased funding for the program and lowered the total allowable acreage caps, making it impossible to maintain prior enrollment numbers. *Comments on Environmental Outcomes* at 6. The change in CRP enrollment aligned with legislation reducing the allowable CRP acreage by 14 million acres between 2007 (39.2 million acres) and 2017 (24 million acres). *See* USDA, The Conservation Reserve Program: A 35-year History, https://www.fsa.usda.gov/Assets/USDA-FSA-

Public/usdafiles/Conservation/PDF/35_YEARS_CRP_B.pdf (showing historical enrollment figures); *see also Comments on Environmental Outcomes* at 6.

Outlier reports incorrectly identified these CRP acreage reductions as "land conversion" attributed to the RFS. For reasons stated above, this was not "conversion," but rather a change in agricultural use due to expiring CRP contracts and enrollment caps. Recent data and analyses find that between zero and a small percentage of this change in land cover may be attributed to the RFS. *See* BE at 92–99 (JA__-__) (summarizing research).

Zero or minimal attribution to the RFS aligns with farmer surveys, in which farmers exercising their right to return CRP land to active agricultural use did not identify increased corn demand as a motivator. *Considering Historical Land Use* at 9. Instead of the RFS, farmers identified the difficulty of getting land re-enrolled in the CRP as the most common reason CRP land returned to active cropland. *Id*. Other factors included reduced cattle prices, improved yields based on soil quality, changes in weather patterns (in part a response to climate change), changing tax structures, and other location-specific considerations. *Id.* at 9, 12–13. This is consistent with data indicating that more fields transitioned to cropland before adoption of the RFS than after. *Id*.

In summary, contrary to Petitioners' arguments, there is no valid scientific evidence that the RFS was the primary cause of farmers "converting" millions of acres of exiting CRP land to active crop production. *Comments on Environmental Outcomes* at 15.

ii. Cropland Pasture

When calculating the amount of land that "converted" to biofuel production, outlier researchers have also erroneously treated "cropland pasture" as "natural" land not previously tilled. *Response to Comments* at 4. Cropland pasture is the second-most common type of farmland to be returned to crop production, after expiring CRP land. *Considering Historical Land Use* at 12–13. But "cropland pasture" is cropland managed for livestock grazing. It is not previously unfarmed "natural" land. *See* National Resources Inventory Glossary (updated Aug. 26, 2015), https://www.nrcs.usda.gov/sites/default/files/2022-12/NRI_glossary.pdf (defining "pastureland" as managed land used primarily to grow forage plants for livestock grazing).

The amount of cropland pasture in the United States fluctuates over time and, between 2007 and 2017, increased. *Response to Comments* at 5, 24. The reality is that farmers continuously rotate their land between "cropland pasture" and other crops. Between 2002 and 2017, about 10 million acres of cropland pasture rotated in and out of active crop production every five years. *Id.* at 5–6.

To evaluate the arguments in this appeal, it is important to understand that both CRP land and "cropland pasture" have been previously cultivated. This is important because land that has been previously farmed is unlikely to be as rich in soil carbon as native sod that has never been tilled. With good management, the use of previously cultivated land is unlikely to reduce carbon stocks and could increase soil organic carbon over time.

2. Land Not Previously Tilled (Generally Not Used for Biofuel Production)

Of the three general categories of land identified above, the most sensitive are lands that have never been tilled, such as native sod and old-growth forests. Such lands are likely to hold carbon stocks that active cultivation would release. *Comments on Environmental Outcomes* at 15. In research examining farmland over a 36-year period, only 1.8 percent of the 1,000 land parcels outlier researchers described as "converted" appeared to fall into the category of untilled grassland, while 98.2 percent was in agriculture and toggled between crop and non-crop uses. *Considering Historical Land Use* at 8, 13.

For the small percentage of previously untilled lands described as "converted," there is no causal evidence linking the RFS or biofuels to any such change in use. Instead, there are many reasons behind farmers' land-use choices, including tax structures, markets, weather, irrigation technology, and profits, among other considerations. *Id.* at 8, 12; *Comments on Environmental Outcomes* at 15. Nor is there any reason to expect such conversions in the future. More efficient land use, the use of idle cropland, and incentives to expand markets to help absorb the U.S. farm industry's surplus production of commodities such as corn and soybeans have further reduced incentives for such conversions. *Id.*

Without evidence linking the RFS to "conversion" of previously untilled land to cropland, Petitioners also lack support for their claim that the RFS results in harm to endangered species and habitats. Br. at 8. Statistics on waterfowl populations are carefully maintained and further undermine the Petitioners' arguments. The number of total ducks *increased* significantly between 2007 and 2015 to levels well above the long-term average and above federal management goals. *See* U.S. Fish & Wildlife Serv., Waterfowl Population Status, 2017 at 5 (Tbl. 2), 8 (Fig. 3), *available at* https://www.fws.gov/sites/default/files/documents/WaterfowlPopulationStatusReport17.pdf. Similarly, the trend for total agricultural land area in the United States has been decreasing since 1982. *Biofuel Impact* at 51 (noting that U.S. agricultural land decreased at an average of 5.9 thousand square kilometers each year between 2000 and 2015).[7]

This makes sense because, when markets incentivize farmers to increase crop production, the least costly option is to increase yields on previously farmed

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[7] *See also* USDA, Land Use Trends (2017), https://publicdashboards.dl.usda.gov/t/FPAC_PUB/views/RCADVLandUsebyStateNRI20171/StateLandUseTrend?%3Adisplay_count=n&%3Aembed=y&%3AisGuestRedirectFromVizportal=y&%3Aorigin=viz_share_link&%3AshowAppBanner=false&%3AshowVizHome=n.

lands, which are most accessible and suitable for cultivation. Land that has already been farmed is easier to use, and the cost return is better known. *Considering Historical Land Use* at 9, 13. Land-clearing costs associated with native sod or forest are also much higher than for land previously used for agricultural purposes. *Id.* at 13. The trend of higher yields on less land is reinforced by increasing efficiency, improving best land management practices, and using more advanced agricultural technology.

This process of more efficient use of existing cropland is referred to as "intensification" and is documented by the USDA in statistics showing increases in "total factor productivity" from agriculture even as land inputs are declining. *See, e.g.*, *Lessons Learned* at 75, 76 n.17; *Comments on Environmental Outcomes* at 15; *see also* USDA Economic Research Service, Agricultural Productivity in the U.S. (last updated Jan. 12, 2024), https://www.ers.usda.gov/data-products/agricultural-productivity-in-the-u-s/ (showing increases).

The development of profitable ethanol byproducts has further reduced the need to convert natural land. Modern biorefineries extract more co-products from each kilogram of corn, including mills that extract oil, fiber, and protein, in addition to ethanol. This results in an increased supply of biofuel and animal feed without requiring more input of land. *Biofuel Impact* at 45. An empirical study found that from 2002 to 2017, while agricultural land area in the United State declined by 38 million acres, annual ethanol production increased by 13.8 billion gallons. Melissa J. Scully et al., *Carbon Intensity of Corn Ethanol in the United States: State of the Science*, ENV'T RSCH. LETTERS 16:043001 at 7 (2021) [hereinafter "*Carbon Intensity*"]. In sum, there is simply no valid scientific evidence behind claims that RFS-driven demand for ethanol production leads to the conversion of grasslands not previously farmed.

B. Applying the Correct Land-Use Identifications to Updated Modeling Confirms that Biofuels Provide GHG Benefits over Gasoline.

Initial inaccurate assumptions about the extent of "conversion" that would occur due to the RFS, as described above, also led to concerns that biofuel production would result in GHG emissions exceeding those of gasoline. *Comments on Environmental Outcomes* at 15. Subsequent research has disproven these concerns. *Lessons Learned* at 73–74.

1. Incorrect Land-Use Classifications Led to Erroneous Estimates of Soil Organic Carbon Sequestration

One of the primary ways in which misinformation about land-use changes led to inaccurate assumptions about the environmental risks of biofuels concerns the sequestration of Soil Organic Carbon ("SOC"). SOC is carbon stored (or sequestered) in soil. It comes from decomposing plants and animals. Because of the role carbon plays in GHG emissions, changes in SOC levels can significantly influence the lifecycle GHG emissions of a biofuel. Nat'l Acads. of Scis., Eng'g, &

Med., CURRENT METHODS FOR LIFE-CYCLE ANALYSES OF LOW-CARBON TRANSPORTATION FUELS IN THE UNITED STATES at 6 (2022).

Generally, actively cultivated land contains lower levels of SOC than native sod supporting perennial grasses[8]—although efforts are underway to change farming practices to improve SOC sequestration in cultivated land. *See* Deepak R. Joshi et al., *A Global Meta-Analysis of Cover Crop Response on Soil Carbon Storage within a Corn Production System*, 115 AGRONOMY J. 1543 (2023) (describing efforts such as improved "cover cropping," which means using plants not typically intended for harvest to reduce erosion by covering the soil between two cash crops).

When estimating carbon emissions associated with the RFS, outlier reports compared SOC levels in native prairie grassland to SOC in actively cultivated cropland. *Comments on Environmental Outcomes* at 6 (summarizing prior research). There were two errors with this approach. First, the researchers treated CRP land as "native" previously undisturbed grassland. *Id*. at 7. For reasons stated above, however, CRP land is cropland previously farmed, not "native" grassland. CRP land is therefore less likely to be comparable to native prairie in terms of SOC. *Id*. Second, the methods and model these researchers used were flawed and

[8] One exception occurs in California, where farming under irrigation has resulted in increased SOC over time compared to soils under natural vegetation in semi-arid landscapes.

inconsistent with real-world observations. *Id*. These errors resulted in reports that "overestimate[d] soil carbon loss by a factor of two to eight." *Id*. at 6-7. The researchers also overlooked that emissions of nitrous oxide from fertilizer used for corn production were already included in the lifecycle analysis model, which lead to a double-counting of those emissions. *Id*. at 8-9.

2. <u>More Current and Accurate Lifecyle Analysis and Research Indicate that GHG Intensity for Biofuels Is Significantly Lower Than Gasoline and Steadily Decreasing</u>

Recent well-to-wheel GHG lifecycle analyses for biofuels use updated modeling systems and data, including corrected land-use classifications. *Carbon Intensity* at 1. Those analyses demonstrated that, over the past 30 years, GHG intensity for biofuels decreased by about 50 percent and is currently estimated to be more than 40 percent lower than gasoline produced from crude oil. *Id*. at 16.

This decrease reflects improvements in farming practices, such as a reduction in the use of nitrogen fertilizer and fossil fuels, increasing yields, and a general increase in total factor productivity. It also reflects more energy-efficient practices at corn ethanol plants, including a transition from coal to natural gas. *Id.* at 3, 7, 11; *Lessons Learned* at 73. Also, as discussed above, farmers have developed methods of intensifying crop production, allowing them to earn higher yields from the same amount of cropland and rendering "conversion" of never-tilled land with higher SOC levels unnecessary.

It is also expected that market conditions favoring the adoption of precision agriculture systems, the retention of organic carbon in soil, and demand for co-products from biofuel production will continue gradually to reduce the carbon intensity of corn ethanol. *Carbon Intensity* at 17; *see also* Gheorghe Cristian Popescu et al., *Agricultural Sciences and the Environment: Reviewing Recent Technologies and Innovations to Combat the Challenges of Climate Change, Environmental Protection, and Food Security*, 114 AGRONOMY J. 1895 (2022). Members of the Renewable Fuels Association have also announced a commitment to further reduce the carbon intensity of corn ethanol, aiming to achieve a 70-percent reduction compared to petroleum gasoline by 2030 and net neutral status by 2050. Isaac Emery, *Pathways to Net-Zero Ethanol*: *Scenarios for Ethanol Producers to Achieve Carbon Neutrality by 2050* at 1 (2022) [hereinafter "*Pathways*"].

3. Using "Food as Fuel" Does Not Negate the Implied GHG Benefits of Corn Ethanol

Claims by Petitioners that using "food crops as fuel" increases the carbon debt of biofuels due to the need to replace food production elsewhere, or due to the "opportunity costs" of land, Br. at 2, 10, are not supported by empirical evidence. Analyses of historical data increasingly illustrate how encouraging farmers to grow crops for biofuel generates benefits for producers and consumers across multiple markets and improves food security and rural incomes rather than undermining them. *See* Iris Vural Gursel et al., *Variable Demand as a Means to More Sustainable Biofuels and Biobased Materials*, 15 BIOFUELS, BIOPRODUCTS & BIOREFINING 15 (2021); Jeremy Woods et al., *Ch. 9, "Land and Bioenergy," in* SCI. COMM. ON PROBLEMS OF THE ENV'T (SCOPE), BIOENERGY & SUSTAINABILITY: BRIDGING THE GAPS (Souza et al. Eds) (2015); Mouman Afzal et al., *Benefits and Trade-Offs of Smallholder Sweet Potato Cultivation as a Pathway toward Achieving the Sustainable Development Goals*, 13 SUSTAINABILITY 552 (2021); Keith L. Kline et al., *Reconciling Food Security and Bioenergy: Priorities for Action*, 9 GLOBAL CHANGE BIOLOGY BIOENERGY 557 (2017).

Importantly, evidence and statistical analyses indicate that the use of corn for ethanol did not reduce U.S. corn exports or increase global corn prices. *See* Gbadebo A. Oladosu et al., *Structural Break and Causal Analyses of U.S. Corn Use for Ethanol and Other Corn Market Variables*, 11 AGRIC. 1 (2021); *see also Biofuel Impact* at 10 (concluding that "there has been no significant change in U.S. food prices due to biofuels and biofuels have not caused any significant agricultural land use change."). Until recently, researchers assumed the opposite and that an indirect effect of using corn for ethanol was associated with increases in GHG emissions and food shortages. While this might have been a reasonable precautionary assumption, there is now sufficient historical data to show otherwise.

Historical data further indicate that, over time, the supply of principal crops has increased consistent with demand for both food and industrial uses. Although initial research assumed demand for corn remained constant (was inelastic), which would have a greater effect on corn prices, subsequent analysis has demonstrated that demand for agricultural commodities tends to be elastic, mitigating food versus fuel effects. *Lessons Learned* at 71, 81; *Response to Comments* at 17-19.

Arguments Petitioners make regarding "opportunity costs" associated with the lost opportunity to sequester carbon in land when land not needed for food production is used to produce biomass, suffer from some of the same errors initial researchers made. The unsupported assumption baked into Petitioners' arguments is that, if not growing biofuel crops, farmers would dedicate the same land to carbon storage as grassland or forest. This assumption is not supported by historic evidence showing that, despite wide swings in prices and demand, U.S. cropland has remained stable for 40 years once set-aside programs such as CRP and urban expansion into farmland are accounted for.

Petitioners' assumption that current midwestern farmland would transition to a non-productive use lacks support in evidence and basic economics. Contrary to the assumptions on which Petitioners' arguments rely, farmers do not, in practice, choose to forego all economic value of their land in favor of carbon sequestration. *See Considering Historical Land Use* at 12–13 (describing factors farmers consider when deciding how to use their land). A primary cause for loss of farmland in the Midwest is urban and other development, which involves high GHG emissions. Given limited funding and acreage caps for CRP, farmland is more likely to be sold for development than returned to a "natural state" as assumed by Petitioners.

As also described above, long-standing U.S. policy has supported land use for farming and relied on various policies—such as Farm Bill price supports and subsidized insurance, and the CRP, which pays farmers to temporarily rest their land—to sustain farming activity in the face of chronic market surpluses. Petitioners discount these economic and social interests. Their arguments are contrary to current U.S. policies reflecting the importance of farming and ignore current data and research indicating a benefit to biofuel production over conventional gasoline.

Further undercutting concerns that biofuel production causes increased GHG emissions, biofuel producers are increasingly exploring options for capturing and storing geologically some of the biogenic carbon that passes through fermentation tanks at biorefineries. *Pathways* at 30. Doing so will reduce GHG emissions associated with ethanol production and use, further supporting adaptation to climate change. In sum, we now know enough to discount Petitioner's claims that biofuel is worse for the environment than petroleum as divorced from scientific evidence and reality.

CONCLUSION

For the reasons stated herein, we support respondents and urge this Court to reject the claims set forth in the Petitioners' brief. There is no compelling scientific evidence linking the RFS to the conversion of grasslands and loss of biodiversity. Research based on misclassifications of land use and flawed assumptions and methodologies spurred skepticism about the environmental and GHG emission reduction benefits of biofuels, but that research has since been disproven. Analyses based on more complete, updated data, found that the average carbon intensity of biofuels is significantly less than conventional gasoline. Over time, as technologies and practices advance, and with various incentives the federal government has put into place, that benefit is expected to continue growing at an accelerated pace. Although the EPA conservatively referenced some of the outdated and inaccurate research, Petitioners' arguments based on that research necessarily inherit its flaws.

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Dated: July 3, 2024

CERTIFICATE OF COMPLIANCE

Pursuant to Federal Rules of Appellate Procedure 29(a)(5), 32(a)(7)(B), and Circuit Rule 32(e)(1), I hereby certify that the foregoing Brief of Amici Curiae Agriculture, Biomass, and Greenhouse Gas Lifecycle Scientists in Support of Respondents has been prepared in a proportionally spaced typeface (using Microsoft Word 365, in 14-point Times New Roman font), contains 6,290 words total, excluding items exempted by Federal Rule of Appellate Procedure 32(f).

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that on July 3, 2024, I electronically filed this Brief with the Clerk of the Court for the United States Court of Appeals for the District of Columbia Circuit by using the CM/ECF system. I certify that all participants in the case are registered CM/ECF users and that service will be accomplished by the CM/ECF system.

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Dated: July 3, 2024