Growth Energy Comments on EPA's Workshop on Biofuel Greenhouse Gas Modeling

Docket # EPA-HQ-OAR-2021-0921

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INTRODUCTION:
EPA SHOULD MOVE EXPEDITIOUSLY TO UPDATE ITS LIFECYCLE ANALYSIS OF ETHANOL

Growth Energy respectfully submits these comments on the Environmental Protection Agency's Workshop on Biofuel Greenhouse (GHG) Gas Modeling.[1] Growth Energy is the world's largest association of biofuel producers, representing 89 biorefineries that produce nearly 9 billion gallons annually of low-carbon renewable fuel and 100 businesses associated with the biofuel production process.

Growth Energy appreciates EPA's facilitation of the Workshop on Biofuel Greenhouse Gas Modeling (Workshop) and the knowledgeable presentations from government, academicians, and other stakeholders over the two-day program. It is critical that EPA move forward expeditiously in updating its 2010 lifecycle analysis (LCA) of ethanol given how outdated that analysis is and the advancements in modeling since 2010. EPA substantially undervalues the GHG emissions benefits of ethanol due to its failure to update its methodology for assessing lifecycle GHG emissions. Specifically, over a decade ago, EPA projected that lifecycle GHG emissions from corn ethanol would be only 21% better than the representative 2005 baseline for petroleum lifecycle GHG emissions, but the best available and most recent science–including studies published by the DOE's Argonne National Laboratory and USDA–place the lifecycle GHG reductions from corn ethanol in the range of 39-46% below the petroleum baseline. These results are bolstered by other studies, including the expert analyses of Environmental Health & Engineering, Inc. (EH&E) and Life Cycle Associates, LLC attached to this comment letter and included in Growth Energy's comment letter on the reset rulemaking.[2] As explained below, it is also important that EPA not rely on a fundamentally flawed recent study of ethanol's lifecycle GHG emissions that uses improper assumptions and unreliable modeling to assert demonstrably incorrect findings related to ethanol's GHG emissions.

Updating the LCA of ethanol is critical not only to faithfully implementing the Renewable Fuel Standard (RFS) program (the only Clean Air Act program explicitly aimed at reducing GHG emissions), but for sound policymaking on a range of future potential rulemakings designed to facilitate the use of E15, flex fuel vehicles, higher-level ethanol blends like E85, and sustainable aviation fuel (SAF). Robust and accurate cost-benefit analyses depend on accurate assessment of the GHG impacts of biofuels, particularly given this Administration's use of the social cost of carbon (SCC) to monetize the societal benefits of projected GHG emission reductions and the associated avoidance of incremental damages from climate change.

Further, an updated LCA is necessary to achieving the Administration's ambitious climate goals. The President has declared that climate change poses an "existential threat" and established national goals of realizing a 50-52% reduction in GHG emissions by 2030 and net-

[1] Workshop on Biofuel Greenhouse Gas Modeling, https://www.epa.gov/renewable-fuel-standard-program/workshop-biofuel-greenhouse-gas-modeling.

[2] *See* Scully, et. al., *Carbon intensity of corn ethanol in the United States: state of the science* (2021) (showing reduction of 46%); Lee, et. al., *Retrospective analysis of the U.S. corn ethanol industry for 2005–2019: implications for greenhouse gas emission reductions* (2021) (showing reduction of 44%%); Rosenfeld, et. al. *A Life-Cycle Analysis of the Greenhouse Gas Emissions from Corn-Based Ethanol* (Sept. 5, 2018) (showing reduction of 39%).

zero emissions by 2050.[3] As the largest contributor to U.S. GHG emissions, the transportation sector must play a major role if these goals are to be achieved. Moreover, projections from the International Energy Agency, the U.S. Energy Information Agency, and Bloomberg agree that liquid fuels will retain a major share of transportation sector energy demand for at least the short and medium term.[4] The fact is that liquid fuels will be needed to keep the American transportation system running for the foreseeable future. It is therefore impossible to achieve the Administration's climate goals in the transportation sector without harnessing the full potential of biofuels to substitute for the petroleum that will otherwise dominate the liquid fuels market for years to come.

EPA has highlighted that the "impacts of climate change are affecting people in every region of the country, threatening lives and livelihoods and damaging infrastructure, ecosystems, and social systems in communities across the nation."[5] Failure to utilize all available pathways of reducing carbon emissions increases the likelihood of "climate disaster" with "devastating" impacts, particularly on the most vulnerable communities.[6] Choosing to leave the GHG emissions reductions benefits of biofuels on the table would be such a failure. EPA must accurately account for the GHG lifecycle benefits of renewable fuels and appropriately incentivize production and use of these fuels consistent with the RFS's mandates.

In February, Growth Energy submitted a comprehensive 643-page comment on EPA's proposed RFS Program Annual Rule for 2020-2022.[7] A large portion of this submission was dedicated to providing information to aid EPA in its development of an accurate, updated LCA value for ethanol that is based on and consistent with the best available science. Specifically, an analysis of the literature demonstrates that the best available science has coalesced around a credible range of indirect land use change (iLUC) values that are substantially lower than EPA's 2010 projections. This downward trend in iLUC estimates is attributable to improvements in the model's methodologies, designs, data, and parameters, including the (1) addition of new modules that allow for more accurate simulation of real-world agricultural practices; (2) addition of more spatially resolved information on land cover; and (3) tuning of parameters that describe rates of land conversion and land. Factors other than iLUC have also contributed to the decrease in LCA

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[3] *See* Exec. Order 14008, *Tackling the Climate Crisis at Home and Abroad* (Jan. 27, 2021); *Remarks by President Biden Before Signing Executive Actions on Tackling Climate Change, Creating Jobs, and Restoring Scientific Integrity*, White House Briefing Room (Jan 27, 2021), https://www.whitehouse.gov/briefing-room/speeches-remarks/2021/01/27/remarks-by-presidentbiden-before-signing-executive-actions-on-tackling-climate-change-creating-jobs-and-restoringscientific-integrity/ ("I'm signing today an executive order to supercharge our administration ambitious plan to confront the existential threat of climate change. And it is an existential threat.").

[4] *See* Section II-A-3 of Growth Energy's Comment on EPA's Proposed RFS Annual Rules for 2020-2022 (Feb. 4, 2022), Comment ID # EPA-HQ-OAR-2021-0324-0521, excerpts attached as Exhibit 1.

[5] U.S. Environmental Protection Agency Policy Statement on Climate Change Adaptation (May 26, 2021), in U.S. Environmental Protection Agency Climate Adaptation Plan (Oct. 2021), https://www.epa.gov/system/files/documents/2021-09/epa-climate-adaptation-planpdf-version.pdf.

[6] U.S. Dep't of State, *The Long-Term Strategy of the United States* (Nov. 2021), https://unfccc.int/sites/default/files/resource/US_accessibleLTS2021.pdf.

[7] *See supra* note 4.

estimates, including reduced energy consumption of ethanol plants, reduced GHG intensity of the U.S. electric grid, and increased utilization of ethanol co-products.

Since Growth Energy's previous submission, the Biofuels GHG Workshop has furthered scientific discussion on LCA analysis. In this comment and in multiple attached expert reports, Growth Energy now addresses some of the issues raised by Workshop presenters.

First, we encourage EPA to closely review Argonne National Laboratory's multidisciplinary response to a deeply flawed study, *Environmental Outcomes of the US Renewable Fuel Standard* by Lark, et. al. ("Lark, et al. 2022"), which was repeatedly mentioned by certain presenters at the Workshop. Below we summarize key considerations from that response as well as an additional analysis by EH&E of the Lark, et al. 2022 paper.

Second, Growth Energy also offers two additional expert reports to facilitate EPA's consideration of materials presented in the workshop and move expeditiously to updating ethanol's GHG LCA. Life Cycle Associates discusses the importance of accurate model parameters and that updated models are reliable and accurate tools to incorporate real-world data from the past decade into calculating a new LCA of ethanol. Net Gain Ecological Services (Net Gain) provides recommendations of key areas for EPA to focus on as the Agency confronts both the immediate task of accurately updating the LCA of biofuels and longer-term efforts to improve scientific understanding of the environmental impacts of biofuel use. Each report is briefly summarized below.

Finally, we offer comments on an appropriate approach to addressing uncertainty in GHG lifecycle modeling, as addressed by EH&E in its report included with Growth Energy's comment letter on EPA's proposed 2020-2022 RFS Annual Rule and provided for ease of reference again here. Specifically, consistent with the interagency working group's approach in the SCC context, EPA should address the issue of uncertainty by utilizing central estimates, embracing the principle of best available science, and updating its LCA for corn ethanol without undue delay.

Nothing raised by the Workshop or published since February alters the fundamental conclusions put forth in Growth Energy's comprehensive comment on the EPA's 2020-2022 proposed rule. **EPA must swiftly update its lifecycle GHG emissions analysis for conventional corn ethanol using the best currently available science.** Through extensive expert analyses submitted in comments both to the Workshop and the proposed RFS Annual Rule for 2020-2022, EPA has the tools available to develop LCA values that incorporate the many scientific and industry advancements that have been achieved since 2010. Continued delay on this critical issue is contrary to the congressional purposes of the RFS Program, undermines national climate goals, and leaves substantial GHG emissions reductions on the table.

I. ARGONNE NATIONAL LABORATORY HAS HIGHLIGHTED SUBSTANTIAL AND SYSTEMIC FLAWS IN THE LARK, ET AL. 2022 STUDY

At the Workshop, several presenters referred to the Lark, et al. 2022 study released two weeks prior. The study is an extreme outlier compared to credible recent studies on the LCA of ethanol in that it concludes that lifecycle GHG emissions of ethanol are 21% *higher* than those of petroleum gasoline. Growth Energy previously submitted a preliminary response to this study, noting that the results presented in Lark, et al. 2022 are not new, and that its methodologies have been extensively criticized.[8] Since that time, the Department of Energy's Argonne National Laboratory (ANL) has published a thorough rebuttal of the Lark, et al. 2022 study. EPA must consider the comments from ANL, attached as Exhibit 2, when evaluating the best available science. Noting usage of "remarkably poor" modeling[9] and "difficult to rationalize" results,[10] the ANL paper concludes that "the results and conclusions provided by the authors [Lark, et. al.] are based on several questionable assumptions and a simple modeling approach that has resulted in overestimation of the GHG emissions of corn ethanol."[11] Specifically, flaws identified by ANL include:

1. **Simplistic assumptions, which vastly overstate the demand effect of the RFS Program.** The Lark, et al. 2022 authors use "no integrative modeling exercise" to calculate the contribution of the RFS program to new ethanol demand. Instead, the authors make the simplistic assumption that the entirety of increased ethanol consumption between 2008 and 2016 is attributable to RFS. This assumption discounts many additional market and non-RFS policy forces that contributed to the growth of the ethanol industry, including the elimination of MTBE, changes in oil prices, increases in gasoline demand, and changes in the livestock industry's demand for feed crops.[12]
2. **Consideration of only three crops (corn, soybeans, and wheat), which is a vast oversimplification of the multi-crop U.S. agricultural economy.** Lark, et al. 2022 "turned the whole U.S. agriculture and its related industries into three crops…, and even dismissed interactions between these crops from both the supply and demand side." Such a superficial analysis falls well short of providing the full picture of the impacts of biofuels.[13]
3. **Failure to consider the effect of decreased Conservation Reserve Program (CRP) funding or decreased statutory CRP acreage limits on the decrease of CRP acreage.** The Lark, et al. 2022 study's counterfactual scenario assumes that increases in CRP enrollment would have occurred if not for the RFS program. This ignores obvious confounding factors including major caps on new enrollment since 2007 and changes to congressionally-authorized CRP funding. CRP statutory acreage limits were reduced from 13 million hectares in 2008 to 9.71 million hectares in 2020, and actual CRP acreage totals closely track this

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[8] *See* Growth Energy Supplemental Comments on EPA's Renewable Fuel Standard (RFS) Program: RFS Annual Rules, Docket # EPA-HQ-OAR-2021-0324.

[9] Taheripour, et al. *Comments on Environmental Outcomes of the US Renewable Fuel Standard*, Argonne National Laboratory (March 2022) at 7. (hereinafter "ANL 2022"), attached as Exhibit 2.

[10] ANL 2022 at 9.

[11] ANL 2022 at 2.

[12] ANL 2022 at 24.

[13] ANL 2022 at 28.

statutory decrease.[14] Simplistically attributing these changes to the RFS program is misleading.

4. **Deficiencies in modeling land transition, including a failure to recognize cropland-pasture as a land use category.** This omission "artificially push[es] the need for additional active cropland to CRP land" by ignoring the ability of cropland-pasture to meet increased demand.[15] By considering cropland-pasture as pastureland, Lark, et al. 2022 engages in a "misleading practice" that does not accurately reflect real-world impacts.[16]

5. **Inaccurate classification of satellite data resulting in fallow acreage assigned as permanent grassland.** As Workshop presenter Dr. Dev Shrestha highlighted and as addressed in Net Gain and Ramboll's prior reports attached to this letter, the use of remote sensing technology with automatic classification can result in substantial and one-directional errors. Multiple investigators have noted the flaws in Lark's reliance in prior works on satellite imagery and the skewed results it produces.[17] Again, Lark, et al. 2022 uses remote sensing with little or no ground truthing that results in significant classification errors. In particular, the Lark, et al. 2022 methodology frequently classifies temporary rotations of fallow land as cropland expansion. As seen in the example below, comparisons with the National Agriculture Imagery Program show that Lark, et al. 2022 misclassifies temporarily idle land as permanent grasslands. Conversion of fallow land to cropland generates a much smaller carbon debt than conversion of grassland.[18]

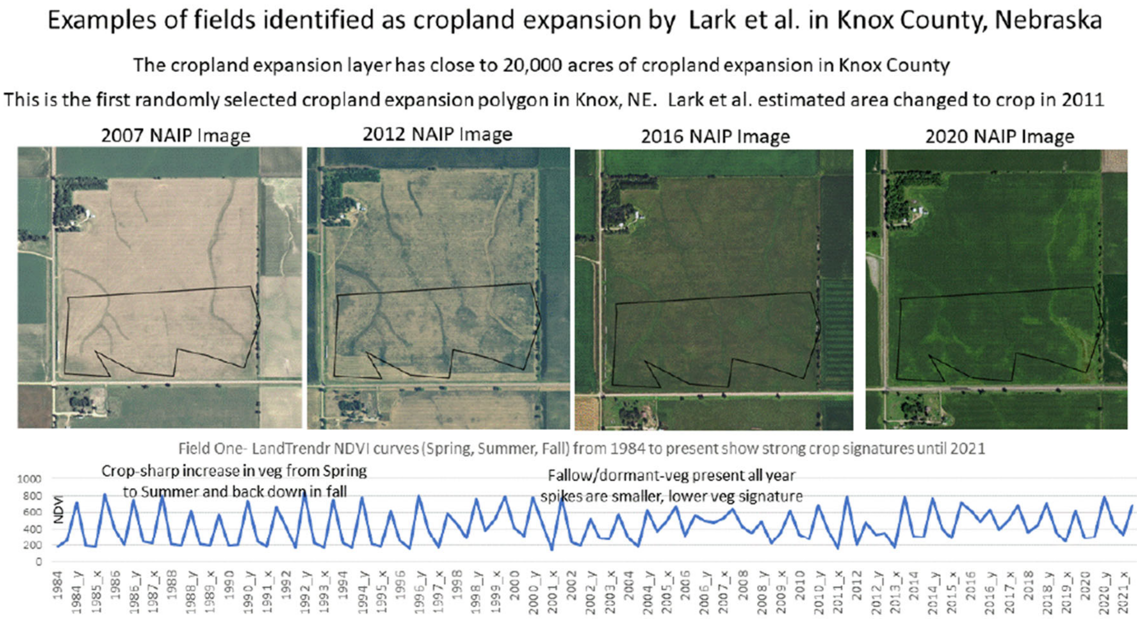
[14] ANL 2022 at 20.

[15] ANL 2022 at 31.

[16] *Id.*

[17] *See* Exhibit 3.1, Section 3.4; Dunn, et. al. *Comments on Cropland expansion outpaces agricultural and biofuel policies in the United States*, ANL (2015).

[18] ANL 2022 at 3-6.



6. **Double-counting of N2O emissions.** Lark, et al. 2022, "appeared to have double-counted the N2O emissions with fertilizer use for corn farming by adding 9 gCO2e/MJ of ethanol" which was already included in the GREET model's LCA.[19] Removing the double-counted fertilizer emissions by itself "reduces the Lark et al. estimate for LUC emissions by 23% from 38.7 to 29.7 gCO2e/MJ."[20]

7. **Systemic overestimation of soil organic carbon changes.** The Lark, et al. 2022 report "likely overestimated soil carbon loss by a factor of two to eight for land use change."[21] The model it used to measure soil organic carbon emissions (which was previously published in Spawn-Lee et. al. 2019) showed "remarkably poor fit" to real-world measurements taken across dozens of locations.[22]

8. **Inconsistencies in results that are "extreme" and "difficult to rationalize."** For example, a comparison of the ratio of the projected changes in cropland area to the projected changes in corn area presented in the Lark, et al. 2022 results reveals that Lark "inexplicabl[y]" found that a one hectare change in corn area would cause a 2,000 hectare increase in cropland area.[23] Lark, et al. 2022 provides no justification for what would cause such extremely large changes.

9. **Substantial underestimation of the impacts of yield increases and co-products to offset demand.** As shown in the table below, increases in yield and demand offsets from co-products are important factors influencing agro-economic responses to increased biofuels demand. As also underscored in the attached Net

[19] ANL 2022 at 9.

[20] *Id.*

[21] ANL 2022 at 6.

[22] ANL 2022 at 7

[23] ANL 2022 at 8-9.

Gain report, underestimation of these impacts can significantly affect LCA results.[24]

Table 2: Summary of Results of Potential Net Corn Acreage.

Base Year	Acres
1. Gross acres needed for increased ethanol volume	+10,862,266
2. Land area spared from DDG production	-5,539,158
3. Land area spared from corn yield increases on 2008 corn acres (no ethanol production)	-9,585,000
4. Net land area (1+2+3) after considering DDG with ethanol production and corn yield increases on 2008 corn acres	-4,261,892

10. **Arbitrary and non-representative selection of time period for price effects analysis.** Lark, et al. 2022 purports to study the impacts of the RFS program between 2008 and 2015,[25] yet chooses the time period of 2006-2010 to evaluate crop prices. The choice of this shortened timeframe is particularly odd and misleading because it ignores the significant decrease in crop prices between 2010 and 2015. For example, corn prices increased by an average of 23.9% per year between 2006 and 2010, but only increased by an average of 0.8% per year between 2008 and 2015. The selection of the alternative 2006-2010 time period to avoid crop price decreases in 2010-2015 is highly arbitrary.[26]

Table 3: Wholesale prices for corn, soybeans, and wheat: 2006 to 2015[3]

year		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average of annual % changes 2006-10	Average of annual % changes 2008-15
Wholesale prices $/Bushel	com	2.36	2.06	2.49	2.26	3.25	3.56	2.44	1.93	1.83	1.85	-	-
	Soybeans	5.58	5.55	6.40	5.47	6.72	6.72	6.48	4.93	4.63	4.55	-	-
	Wheat	2.91	3.24	3.27	3.46	4.55	4.76	3.37	2.64	2.48	2.61	-	-
Annual % changes	com	51.9	37.5	-3.0	-12.5	45.7	20.1	10.6	-35.1	-17.0	-2.7	23.9	0.8
	Soybeans	13.5	57.2	-1.3	-3.8	17.9	10.6	15.3	-9.6	-22.4	-11.3	16.7	-0.6
	Wheat	24.6	51.6	4.6	-28.1	16.8	27.3	7.5	-11.9	-12.7	-18.2	13.9	-1.8

Time period chosen by Lark et al. for crop price impacts

Time period chosen by Lark et al. for other RFS impacts

[24] ANL 2022 at 13.

[25] Lark et al. has several internal inconsistencies on whether the study period includes 2008-2015 or 2009-2016, *see* ANL 2022 fn. 1.

[26] ANL 2022 at 14. Emphasis and comments added to ANL Table 3 by Growth Energy.

Each of these flaws, and others, are described in greater detail in Exhibit 2 and are echoed in another independent analysis by EH&E, *Comments on the 2022 Workshop on Biofuel Greenhouse Gas Modeling*, submitted to the docket for the Workshop by POET, LLC. For example, EH&E determines that the Lark, et al. 2022 report's finding that the RFS caused a 31% increase in corn prices is inaccurate as an empirical matter and the authors should have evaluated a more representative, longer timeframe to avoid this misleading conclusion. Net Gain also highlighted this issue in its preliminary critique attached again in Exhibit 3. This is a critical flaw because the high LUC and associated inflated LCA GHG emissions for ethanol stem from this basic, unsubstantiated nexus between corn prices and ethanol demand. EPA should consider these detailed critiques of Lark, et al. 2022 and avoid incorporating its flawed approaches and model inputs into the agency's own LCA of ethanol.

II. GIVEN THE PARAMOUNT IMPORTANCE OF ACCURATE MODEL PARAMETERS, EPA SHOULD UTILIZE THE CCLUB MODEL TO EFFICIENTLY CONDUCT ITS LCA UPDATE IN ACCORDANCE WITH BEST AVAILABLE SCIENCE

The Life Cycle Associates report attached as Exhibit 4 addresses Workshop presenters' comments on modeled land use change, observed land cover change, uncertainty across models, and soil carbon stocks. Life Cycle Associates previously conducted a comprehensive assessment of the lifecycle GHG emissions of corn ethanol and concluded that they are 48% below the appropriate petroleum baseline.[27]

While the EPA Workshop introduced a variety of predictive LUC models, Life Cycle Associates explains why increased understanding of model parameters should be prioritized over the introduction of additional models. Model results are highly dependent on the model's inputs; for example, if a model is run with parameters that correspond to high LUC, the model will produce a high LUC result. Indeed, the selection of inputs is likely more important than the choice of model. This can also exaggerate the extent of uncertainty existing between different LUC models if results from models run with substantially different inputs are compared. As the report notes, the high LUC values cited in some Workshop presentations were the result of clearly identifiable modeling inputs, rather than improvements or advancements in the model itself.

Data developed over the past twelve years of the RFS program can be highly useful in deepening the understanding of these model inputs. Models which rely on updated and accurate parameters should be prioritized in an evaluation of the best available science. For example, for the critical element of international iLUC, EPA should utilize the updated international iLUC analysis presented in the CCLUB model. CCLUB estimates that corn ethanol international LUC emissions are 6 gCO_2e/MJ, and total iLUC emissions are 3.7 gCO_2e/MJ.[28]

In sum, to effectively and efficiently utilize model predictions in its LCA, EPA should clearly define its modeling objective. These defined objectives should incorporate the best

[27] *See* Life Cycle Associates, *Review of GHG Emissions of Corn Ethanol under the EPA RFS2* (Feb. 4, 2022), submitted as Exhibit 2 to Growth Energy's Comments on EPA's Renewable Fuel Standard (RFS) Program: RFS Annual Rules, Docket # EPA-HQ-OAR-2021-0324, attached as Exhibit 5.

[28] *See* Exhibit 4, Figure 2.5.

available science by utilizing updated modeling tools that account for real-world data developed over the past twelve years.

III. EPA Should Carefully Consider the Impacts of Intensification, Urban Development, Automatic Classification Errors in Remote Sensing, Co-Product Demand Offsets And the Relationship Between Crop Prices and Petroleum Prices In Its LCA Modeling

The attached Net Gain report recommends key areas raised by Workshop presenters that EPA should keep in mind as it updates its LCA for biofuels. Net Gain has previously conducted extensive analysis of the environmental impacts of biofuels, and has submitted prior work on multiple recent rulemakings related to the Renewable Fuel Standard.

First, EPA must ensure that an update to the LCA of biofuels includes consideration of the role that intensification and cropland loss due to development have on LUC estimates. Since the RFS was enacted, corn yields have consistently increased, and considerable amounts of cropland have been lost to urban development. Studies which underestimate the ability of technological advances and improved farming techniques to respond to increased demand with increased yield overestimate the LUC impacts of increased biofuel demand. Likewise, studies that attribute cropland extensification to biofuel use without accounting for the decrease in cropland acreage near sprawling urban areas overestimate the LUC impacts of biofuels.

EPA must also ensure that a full LCA of ethanol adequately accounts for the important offsetting benefits of co-product production. The ethanol production process creates several valuable co-products including DDGS, CO_2, biopolymers, and oils. As Workshop presenters from both the Department of Energy and USDA highlighted, the ability of ethanol co-products to offset demand for feed corn and other products reduces the GHG emissions attributable to ethanol.

As noted above in ANL's comments on Lark, et al. 2022, accurate use of remote sensing is another area that is of high importance for EPA to consider as it updates its LCA. As several Workshop presenters indicated, significant errors can occur when relying entirely on automatic classification of satellite imaging. Presenters noted that the distinction between pastureland and cropland is both the area with the greatest fluctuation between uses and the area with the greatest rate of classification errors. Dr. Shrestha also demonstrated that these errors are one-directional: with almost 10% more non-agricultural land erroneously classified as agricultural than agricultural classified as non-agricultural. The result of these one-directional classification errors is a substantial overestimate of LUC impacts by investigators who rely heavily on automatic classification, such as Lark, et al. 2015 and Lark, et al. 2022. Net Gain's principal has previously examined the remote sensing results from Lark, et al. 2015 and, like Argonne National Laboratory's review of Lark, et al. 2022, found that empirical data frequently contradicts their results.[29] EPA must take into account these known automatic classification errors when updating its LCA.

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[29] *See* Exhibit 3.1 Section 3.3; Exhibit 3.2 Section 3.4.

Finally, EPA should address the close relationship between petroleum prices and crop prices. At the workshop, presenter Dr. Shrestha noted that crop prices are 90% attributable to the price of petroleum. This relationship is examined in greater detail in Section 3.4 of Exhibit 3.1, attached to this comment letter. Studies which fail to adequately account for this relationship, such as the Second Triennial Report and Lark, et al. 2022, significantly overestimate the effect that increased biofuel use has on crop prices, which in turn significantly distort estimates of land use change.

IV. EPA SHOULD ADDRESS UNCERTAINTIES IN LCA MODELING BY USING CENTRAL BEST ESTIMATES AND THE PRINCIPLE OF BEST AVAILABLE SCIENCE

Uncertainty is, to an extent, an unavoidable challenge in modeling complex agro-economic relationships. But there are scientific tools and practices available to allow an agency to move forward through uncertainty and avoid regulatory paralysis. Indeed, EPA has confronted considerable amounts of uncertainty before in various contexts. For example, there is substantial inherent uncertainty in quantifying a social cost of carbon. Despite this, the Interagency Working Group was able to use central estimates, interim values, and the best available science to develop a workable value in the face of uncertainty.

As several Workshop presenters noted, it will not be possible to resolve every uncertainty related to biofuels' LCAs in the time remaining before EPA must promulgate upcoming major rulemakings. Instead, the agency should identify a path forward to develop an accurate LCA with the best available science, and processes to periodically update that value as technologies, models, and modeling inputs improve and develop over time. To that end, the attached report by EH&E provides a blueprint for comparing LCA estimates across multiple models to develop a central best estimate.[30] EH&E is a multi-disciplinary team of environmental health scientists and engineers with expertise in measurements, models, data science, LCA, and public health, who recently published a study titled "Carbon intensity of corn ethanol in the United States: state of the science."[31] This study conducted a meta-analysis of available LCA methodologies to derive a central estimate LCA for corn starch ethanol of 51gCO_2e/MJ, or 46% below the 2005 petroleum baseline.[32]

Indirect land use change (iLUC) in particular is an important factor in the LCA that is subject to significant uncertainty due to variability in modeling results. Analyses of iLUC confront four main categories of uncertainty: (1) methodology, (2) model design, (3) data, and (4) parameters.[33] EPA can manage these uncertainties by relying on the existing literature to

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[30] Environmental Health & Engineering, Inc., *Response to 2020, 2021, and 2022 Renewable Fuel Standard (RFS) Proposed Volume Standards* (Feb. 3, 2022), submitted as Exhibit 1 to Growth Energy's Comments on EPA's Renewable Fuel Standard (RFS) Program: RFS Annual Rules, Docket # EPA-HQ-OAR-2021-0324 ("EH&E Report"), attached as Exhibit 6.

[31] Scully, et. al. 2021.

[32] *Id.*

[33] ICAO. CORSIA Supporting Document: CORSIA Eligible Fuels – Life Cycle Assessment Methodology, (June 2019).

derive an updated central estimate of iLUC emissions from available estimates in the numerous credible studies using generally accepted and commonly used models.[34]

Use of EH&E's central best estimate method demonstrates that the weight of best available scientific evidence on GHG modeling supports a significantly reduced LCA value for ethanol as compared with the value EPA estimated in 2010. As explained in more detail in EH&E's report, updates to two models in particular, GTAP-BIO and FAPRI, warrant EPA's close attention, as EPA previously relied on these models for its 2010 analysis and enhanced data inputs yield substantially different results a decade later.[35] Taking these updates into account, most credible studies using these models reflect an iLUC estimate for corn ethanol of 1.3 to 11 gCO_2e/MJ.[36] Analyses by European investigators of iLUC using different models similarly arrive at a substantially-reduced iLUC estimate of 8 to 9 $gCO_2e\ MJ^{-1}$.[37]

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Growth Energy appreciates this opportunity to provide input on EPA's Workshop investigating techniques for estimating the lifecycle GHG emissions for ethanol. This work could not be more important. EPA should proceed expeditiously to update its outdated 2010 lifecycle analysis and replace it with an updated estimate that reflects best available science, including significant improvements in modeling, and more accurately captures the GHG and climate change benefits of renewable fuels, consistent with the Administration's drive to decarbonize the transportation economy.

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[34] EH&E Report at 8-11.

[35] EH&E Report at 5-8.

[36] Scully, et. al. at 7.

[37] EH&E Report at 5.