UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

NATIONAL WILDLIFE FEDERATION, HEALTHY GULF, AND SIERRA CLUB,	No. 19-1039
Petitioners,	
v.	
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, and ANDREW R. WHEELER, Acting Administrator, United States Environmental Protection Agency,	Petition for Review
Respondent.	

PETITION FOR REVIEW

1. Pursuant to section 307(b)(1) of the Clean Air Act, 42 U.S.C. § 7607(b)(1), and Rule 15(a) of the Federal Rules of Appellate Procedure, Petitioners National Wildlife Federation, Healthy Gulf, and Sierra Club (collectively, "Environmental Petitioners") hereby petition this Court to review the final action of Respondent United States Environmental Protection Agency ("EPA") titled, "Renewable Fuel Standard Program: Standards for 2019 and Biomass-Based Diesel Volume for 2020," 83 Fed. Reg. 63,704 (Dec. 11, 2018) (to be codified at 40 C.F.R. pt. 80). The Final Rule was published in the Federal Register on December 11, 2018. *See* 83 Fed. Reg. 63,704. That same day, Petitioners Healthy Gulf and Sierra Club submitted a 60-day notice letter to EPA pursuant to the

citizen suit provision of the Endangered Species Act ("ESA"), 16 U.S.C. § 1536(a)(2), 50 C.F.R. § 402.14(a). This Petition is timely filed within 60 days the promulgation of the Final Rule, and 60 days after submission of the 60-day notice.

2. A copy of the Final Rule is attached as Exhibit 1.

3. A copy of the 60-day notice letter and its attachments is attached as Exhibit 2.

4. Pursuant to 42 U.S.C. § 7607(b)(1), "[a] petition for review of the Administrator's action in approving or promulgating . . . any [] nationally applicable regulations . . . under this chapter may be filed only in the United States Court of Appeals for the District of Columbia." Environmental Petitioners seek review of EPA's promulgation of a final rule under the Clean Air Act that applies nationally, and thus jurisdiction properly lies in this Court.

5. Environmental Petitioners seek review by this Court of EPA's failure to comply with the ESA, 16 U.S.C. §§ 1531-1544, when promulgating the Final Rule without first consulting with the United States Fish and Wildlife Service ("FWS") and the National Marine Fisheries Service ("NMFS") as required by 16 U.S.C. § 1536(a)(2). Specifically, EPA violated § 1536(a)(2) by promulgating the Final Rule – which increases total renewable fuel volumes, which in turn leads to conversion of land to grow renewable biomass such as corn for ethanol and soy for biodiesel and attendant water pollution, thus causing destruction of wildlife and

wildlife habitat – without first consulting with FWS and NMFS to ensure that this action would not jeopardize any federally listed endangered or threatened species or destroy or adversely modify their designated critical habitat.

6. Environmental Petitioners likewise petition this Court to review EPA's failure to comply with the Administrative Procedure Act, 5 U.S.C. § 706, when promulgating the Final Rule by relying on an ESA "No Effect" determination that arbitrarily and capriciously ignored evidence – including from EPA's own reports – that indicates that the agency action is likely to jeopardize the continued existence of threatened or endangered species or result in the degradation of critical habitat.

7. Finally, Environmental Petitioners petition this Court to review EPA's failure to comply with the Clean Air Act, 42 U.S.C. § 7545(o), when promulgating the Final Rule. Specifically, the Final Rule violates the Clean Air Act in two ways. *First*, in the Final Rule, EPA continues to rely on an approach to land use – known as aggregate compliance – that permits land that was not in cultivation prior to 2007 to be converted to cropland to produce corn for ethanol and soy for biodiesel, in direct contravention of the explicit land-use restrictions contained in the statute, *see* 42 U.S.C. § 7545(o)(1)(I), as well as the climate and environmental goals of the statute. *See, e.g.*, 153 Cong. Rec. H14,451 (Dec. 6, 2007), 2007 WL 4270020; 153 Cong. Rec. H14,434, H14,442 (Dec. 6, 2007), 2007 WL 4269999; 153 Cong.

Rec. H14,453 (Dec. 6, 2007), 2007 WL 4270023. *Second*, EPA abused its discretion by failing to invoke its general waiver authority to reduce renewable fuel volumes despite clear evidence of severe environmental harms. *See* 42 U.S.C. § 7454(o)(7)(A).

Respectfully submitted,

/s/Peter Lehner

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<u>RULE 26.1 CORPORATE DISCLOSURE STATEMENT</u>

Pursuant to Fed. R. Civ. P. 26.1 and D.C. Cir. R. 26.1, Petitioners National Wildlife Federation, Healthy Gulf, and Sierra Club ("Environmental Petitioners") respectfully submit their Corporate Disclosure Statements as follows:

1. National Wildlife Federation has no parent companies, and there are no companies that have a 10 percent or greater ownership interest in the corporation. National Wildlife Federation is a national non-profit corporation organized under the laws of the State of District of Columbia, and its mission is to unite all Americans to ensure wildlife thrive in a rapidly changing world.

2. Healthy Gulf has no parent companies, and there are no companies that have a 10 percent or greater ownership interest in the corporation. Healthy Gulf is a non-profit corporation organized under the laws of the State of Louisiana committed to uniting and empowering people to protect and restore the resources of the Gulf Region, forever protecting it for future generations.
3. Sierra Club has no parent companies, and there are no companies that have a 10 percent or greater ownership interest in the corporation. Sierra Club is a national non-profit corporation organized under the laws of the State of California dedicated to the protection and enjoyment of the environment.

Respectfully submitted,

/s/Peter Lehner

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Exhibit 1

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 80

[EPA–HQ–OAR–2018–0167; FRL–9987–66–OAR]

RIN 2060–AT93

Renewable Fuel Standard Program: Standards for 2019 and Biomass-Based Diesel Volume for 2020

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: Under section 211 of the Clean Air Act, the Environmental Protection Agency (EPA) is required to set renewable fuel percentage standards every year. This action establishes the annual percentage standards for cellulosic biofuel, biomass-based diesel, advanced biofuel, and total renewable fuel that apply to gasoline and diesel transportation fuel produced or imported in the year 2019. Relying on statutory waiver authority that is available when the projected cellulosic biofuel production volume is less than the applicable volume specified in the statute, EPA is establishing volume requirements for cellulosic biofuel, advanced biofuel, and total renewable fuel that are below the statutory volume targets. We are also establishing the applicable volume of biomass-based diesel for 2020.

DATES: This final rule is effective on February 11, 2019.

ADDRESSES: The EPA has established a docket for this action under Docket ID No. EPA–HQ–OAR–2018–0167. All documents in the docket are listed on the *https://www.regulations.gov* website. Although listed in the index, some information is not publicly available, *e.g.,* CBI or other information whose disclosure is restricted by statute. Certain other material is not available on the internet and will be publicly available only in hard copy form. Publicly available docket materials are available electronically through *http://www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT: Julia MacAllister, Office of Transportation and Air Quality, Assessment and Standards Division, Environmental Protection Agency, 2000 Traverwood Drive, Ann Arbor, MI 48105; telephone number: 734–214–4131; email address: *macallister.julia@epa.gov.*

SUPPLEMENTARY INFORMATION: Entities potentially affected by this final rule are those involved with the production, distribution, and sale of transportation fuels, including gasoline and diesel fuel or renewable fuels such as ethanol, biodiesel, renewable diesel, and biogas. Potentially affected categories include:

Category	NAICS [1] codes	SIC [2] codes	Examples of potentially affected entities
Industry	324110	2911	Petroleum refineries.
Industry	325193	2869	Ethyl alcohol manufacturing.
Industry	325199	2869	Other basic organic chemical manufacturing.
Industry	424690	5169	Chemical and allied products merchant wholesalers.
Industry	424710	5171	Petroleum bulk stations and terminals.
Industry	424720	5172	Petroleum and petroleum products merchant wholesalers.
Industry	221210	4925	Manufactured gas production and distribution.
Industry	454319	5989	Other fuel dealers.

[1] North American Industry Classification System (NAICS).
[2] Standard Industrial Classification (SIC).

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be affected by this action. This table lists the types of entities that EPA is now aware could potentially be affected by this action. Other types of entities not listed in the table could also be affected. To determine whether your entity would be affected by this action, you should carefully examine the applicability criteria in 40 CFR part 80. If you have any questions regarding the applicability of this action to a particular entity, consult the person listed in the **FOR FURTHER INFORMATION CONTACT** section.

Outline of This Preamble

I. Executive Summary

The Renewable Fuel Standard (RFS) program began in 2006 pursuant to the requirements in Clean Air Act (CAA) section 211(o) that were added through the Energy Policy Act of 2005. The statutory requirements for the RFS program were subsequently modified through the Energy Independence and Security Act of 2007 (EISA), leading to the publication of major revisions to the regulatory requirements on March 26, 2010.[1] EISA's stated goals include moving the United States (U.S.) toward ''greater energy independence and security [and] increase[ing] the production of clean renewable fuels.''[2]

The statute includes annual volume targets, and requires EPA to translate those volume targets (or alternative volume requirements established by EPA in accordance with statutory waiver authorities) into compliance obligations that obligated parties must meet every year. In this action we are finalizing the applicable volumes for cellulosic biofuel, advanced biofuel, and total renewable fuel for 2019, and biomass-based diesel (BBD) for 2020.[3] We are also finalizing the annual percentage standards (also known as ''percent standards'') for cellulosic biofuel, BBD, advanced biofuel, and total renewable fuel that would apply to all gasoline and diesel produced or imported in 2019.[4]

Today, nearly all gasoline used for transportation purposes contains 10 percent ethanol (E10), and on average diesel fuel contains nearly 5 percent biodiesel and/or renewable diesel.[5] However, the market has fallen well short of the statutory volumes for cellulosic biofuel, resulting in shortfalls in the advanced biofuel and total renewable fuel volumes. In this action, we are finalizing a volume requirement for cellulosic biofuel at the level we project to be available for 2019, along with an associated applicable percentage standard. For advanced biofuel and total renewable fuel, we are finalizing reductions under the ''cellulosic waiver authority'' that would result in advanced biofuel and total renewable fuel volume requirements that are lower than the statutory targets by the same magnitude as the reduction in the cellulosic biofuel reduction. This would effectively maintain the implied statutory volumes for non-cellulosic advanced biofuel and conventional biofuel.[6]

The resulting final volume requirements for 2019 are shown in Table I–1 below. Relative to the levels finalized for 2018, the 2019 volume requirements for advanced biofuel and total renewable fuel would be higher by 630 million gallons. Approximately 130 million gallons of this increase would be due to the increase in the projected production of cellulosic biofuel in 2019 relative to 2018. The cellulosic biofuel volume is 37 million gallons greater than the proposed cellulosic biofuel volume for 2019. The advanced biofuel and total renewable fuel volumes are each 40 million gallons higher than the proposed volumes, as a result of an increased projection of cellulosic biofuel production in 2019 (see Section III for a further discussion of our cellulosic biofuel projection). We are also establishing the volume requirement for BBD for 2020 at 2.43 billion gallons. This volume is 330 million gallons higher than the volume for 2019.

TABLE I–1—FINAL VOLUME REQUIREMENTS [a]

	2018 [b]	2019 Statutory volumes	2019 Proposed volumes	2019 Final volumes	2020 Final volumes
Cellulosic biofuel (million gallons)	288	8,500	381	418	n/a
Biomass-based diesel (billion gallons)	2.1	≥1.0	N/A	[c] 2.1	[d] 2.43
Advanced biofuel (billion gallons)	4.29	13.00	4.88	4.92	n/a
Renewable fuel (billion gallons)	19.29	28.00	19.88	19.92	n/a

[a] All values are ethanol-equivalent on an energy content basis, except for BBD which is biodiesel-equivalent.
[b] The 2018 volume requirements for cellulosic biofuel, advanced biofuel, and renewable fuel were established in the 2018 final rule (82 FR 58486, December 12, 2017). The 2018 BBD volume requirement was established in the 2017 final rule (81 FR 89746, December 12, 2016).
[c] The 2019 BBD volume requirement was established in the 2018 final rule (82 FR 58486, December 12, 2017).
[d] EPA proposed 2.43 billion gallons of BBD in 2020 in the 2019 NPRM.

A. Summary of Major Provisions in This Action

This section briefly summarizes the major provisions of this final rule. We are finalizing applicable volume requirements and associated percentage standards for cellulosic biofuel, advanced biofuel, and total renewable fuel for 2019; for BBD we are finalizing the percentage standard for 2019 and the applicable volume requirement for 2020.

[1] 75 FR 14670, March 26, 2010.

[2] Public Law 110–140, 121 Stat. 1492 (2007). Hereinafter, ''EISA.''

[3] The 2019 BBD volume requirement was established in the 2018 final rule.

[4] For a list of the statutory provisions for the determination of applicable volumes, see the 2018 final rule (82 FR 58486, December 12, 2017; Table I.A–2).

[5] Average biodiesel and/or renewable diesel blend percentages based on EIA's October 2018 Short Term Energy Outlook (STEO).

[6] The statutory total renewable fuel, advanced biofuel and cellulosic biofuel requirements for 2019 are 28.0, 13.0 and 8.5 billion gallons respectively. This implies a conventional renewable fuel applicable volume (the difference between the total renewable fuel and advanced biofuel volumes, which can be satisfied by with conventional (D6) RINs) of 15.0 billion gallons, and a non-cellulosic advanced biofuel applicable volume (the difference between the advanced biofuel and cellulosic biofuel volumes, which can be satisfied with advanced (D5) RINs) of 4.5 billion gallons.

1. Approach to Setting Volume Requirements

For advanced biofuel and total renewable fuel, we are finalizing reductions based on the ''cellulosic waiver authority'' that would result in advanced biofuel and total renewable fuel volume requirements that are lower than the statutory targets by the same magnitude as the reduction in the cellulosic biofuel applicable volume. This follows the same general approach as in the 2018 final rule. The volumes for cellulosic biofuel, advanced biofuel, and total renewable fuel exceed the required volumes for these fuel types in 2018.

Section II provides a general description of our approach to setting volume requirements in today's rule, including a review of the statutory waiver authorities and our consideration of carryover Renewable Identification Numbers (RINs). Section III provides our assessment of the 2019 cellulosic biofuel volume, based on a projection of production that reflects a neutral aim at accuracy. Section IV describes our assessment of advanced biofuel and total renewable fuel. Finally, Section VI describes the 2020 BBD volume requirement, reflecting our analysis of a set of factors stipulated in CAA section 211(o)(2)(B)(ii).

2. Cellulosic Biofuel

EPA must annually determine the projected volume of cellulosic biofuel production for the following year. If the projected volume of cellulosic biofuel production is less than the applicable volume specified in section 211(o)(2)(B)(i)(III) of the statute, EPA must lower the applicable volume used to set the annual cellulosic biofuel percentage standard to the projected production volume. In this rule we are finalizing a cellulosic biofuel volume requirement of 418 million ethanol-equivalent gallons for 2019 based on our production projection. Our projection reflects consideration of the Energy Information Administration's (EIA) projection of cellulosic biofuel production in 2019; RIN generation data for past years and 2018 to date that is available to EPA through the EPA Moderated Transaction System (EMTS); the information we have received regarding individual facilities' capacities, production start dates, and biofuel production plans; a review of cellulosic biofuel production relative to EPA's projections in previous annual rules; and EPA's own engineering judgment. To project cellulosic biofuel production for 2019 we used the same basic methodology as in our proposed rule, described further in the 2018 final rule. However, we have used updated data to derive percentile values used in our production projection for liquid cellulosic biofuels and to derive the year-over-year change in the rate of production of compressed natural gas and liquified natural gas (CNG/LNG) derived from biogas that is used in the projection for CNG/LNG.

3. Advanced Biofuel

If we reduce the applicable volume of cellulosic biofuel below the volume specified in CAA section 211(o)(2)(B)(i)(III), we also have the authority to reduce the applicable volumes of advanced biofuel and total renewable fuel by the same or a lesser amount. We refer to this as the ''cellulosic waiver authority.'' The conditions that caused us to reduce the 2018 volume requirement for advanced biofuel below the statutory target remain relevant in 2019. As for 2018, we investigated the projected availability of non-cellulosic advanced biofuels in 2019. We took into account the various constraints on the ability of the market to make advanced biofuels available, the ability of the standards we set to bring about market changes in the time available, the potential impacts associated with diverting biofuels and/or biofuel feedstocks from current uses to the production of advanced biofuel used in the U.S., the fact that the biodiesel tax credit is currently not available for 2019, the tariffs on imports of biodiesel from Argentina and Indonesia, as well as the cost of advanced biofuels. Based on these considerations we are reducing the statutory volume target for advanced biofuel by the same amount as we are reducing the statutory volume target for cellulosic biofuel. This results in an advanced biofuel volume requirement for 2019 of 4.92 billion gallons, which is 630 million gallons higher than the advanced biofuel volume requirement for 2018.

4. Total Renewable Fuel

We believe that the cellulosic waiver authority is best interpreted to require equal reductions in advanced biofuel and total renewable fuel. Consistent with our proposal, we are reducing total renewable fuel by the same as the reduction in advanced biofuel, such that the resulting implied volume requirement for conventional renewable fuel will be 15 billion gallons, the same as the implied volume requirement in the statute.

5. 2020 Biomass-Based Diesel

In EISA, Congress specified increasing applicable volumes of BBD through 2012. Beyond 2012 Congress stipulated that EPA, in coordination with DOE and USDA, was to establish the BBD volume taking into consideration implementation of the program during calendar years specified in the table in CAA 211(o)(B) and various specified factors, provided that the required volume for BBD could not be less than 1.0 billion gallons. For 2013, EPA established an applicable volume of 1.28 billion gallons. For 2014 and 2015 we established the BBD volume requirement to reflect the actual volume for each of these years of 1.63 and 1.73 billion gallons.[7] For 2016 and 2017, we set the BBD volume requirements at 1.9 and 2.0 billion gallons respectively. Finally, for 2018 and 2019 the BBD volume requirement was set at 2.1 billion gallons. In this rule we are finalizing an increase to the BBD volume for 2020 to 2.43 billion gallons.

Given current and recent market conditions, the advanced biofuel volume requirement is driving the production and use of biodiesel and renewable diesel volumes over and above volumes required through the separate BBD standard, and we expect this to continue. While EPA continues to believe it is appropriate to maintain the opportunity for other advanced biofuels to compete for market share, the vast majority of the advanced biofuel obligations in recent years have been satisfied with BBD. Thus, after a review of the implementation of the program to date and considering the statutory factors, we are establishing, in coordination with USDA and DOE, an applicable volume of BBD for 2020 of 2.43 billion gallons.[8]

6. Annual Percentage Standards

The renewable fuel standards are expressed as a volume percentage and are used by each refiner and importer of fossil-based gasoline or diesel to determine their renewable fuel volume obligations.

Four separate percentage standards are required under the RFS program, corresponding to the four separate renewable fuel categories shown in Table I.A–1. The specific formulas we use in calculating the renewable fuel

[7] The 2015 BBD standard was based on actual data for the first 9 months of 2015 and on projections for the latter part of the year for which data on actual use was not available at the time.

[8] The final 330 million gallon increase for BBD would generate approximately 500 million RINs, due to the higher equivalence value of biodiesel (1.5 RINs/gallon) and renewable diesel (generally 1.7 RINs/gallon).

percentage standards are contained in the regulations at 40 CFR 80.1405. The percentage standards represent the ratio of the national applicable volume of renewable fuel volume to the national projected non-renewable gasoline and diesel volume less any gasoline and diesel attributable to small refineries granted an exemption prior to the date that the standards are set. The volume of transportation gasoline and diesel used to calculate the percentage standards was based on projections provided by EIA as required under the statute. The final applicable percentage standards for 2019 are shown in Table I.B.6–1. Detailed calculations can be found in Section VII, including the projected gasoline and diesel volumes used.

TABLE I.B.6–1—FINAL 2019 PERCENTAGE STANDARDS

	Final percentage standards
Cellulosic biofuel	0.230
Biomass-based diesel	1.73
Advanced biofuel	2.71
Renewable fuel	10.97

B. RIN Market Operations

In the rulemaking notices proposing the 2018 and 2019 RFS volume requirements, we noted that various stakeholders had raised concerns regarding lack of transparency and potential manipulation in the RIN market. We asked for comment from the public on those issues, and received multiple suggestions from stakeholders in response. Since receiving those comments, we have continued to hold meetings with stakeholders on these topics, through which we have continued to hear various perspectives on RIN market operations and potential changes.

A number of the comments received in response to the 2019 Notice of Proposed Rulemaking (NPRM) suggested increasing the amount of data related to the RIN market that EPA makes publicly available. In response to these comments, we have made additional information available through our public website.[9] The website publishes data on a number of items of interest to stakeholders, including the number of small refinery exemption petitions received, granted, and denied by year; the fuel volume exempted by year; weekly volume-weighted average RIN prices by D-code;[10] and weekly aggregated RIN transaction volumes by D-code. We intend to update these data regularly going forward. We believe this additional information will increase the transparency of the RIN market, and improve EPA's administration of the RFS program.

We also received a number of comments on the potential impacts of changing the regulations related to who may purchase RINs, the duration for which RINs could be held, and other rules related to the buying, selling, or holding of RINs. On October 9, President Trump directed EPA to undertake a CAA rulemaking that would change certain elements of the RIN compliance system under the RFS program to improve both RIN market transparency and overall functioning of the RIN market. EPA is currently considering a number of regulatory reforms that could be included in the proposal, such as: Prohibiting entities other than obligated parties from purchasing separated RINs; requiring public disclosure when RIN holdings held by an individual actor exceed specified limits; limiting the length of time a non-obligated party can hold RINs; and changing the timelines that apply to obligated parties regarding when RINs must be retired for compliance purposes. We are not currently considering changing the point of obligation in the RFS program.[11] While we have determined that RIN market issues will be addressed separately and are not being considered as part of the present rulemaking, EPA will consider comments received on this topic on the proposed 2019 annual rule as we develop this separate action.

II. Authority and Need for Waiver of Statutory Applicable Volumes

The CAA provides EPA with the authority to enact volume requirements below the applicable volume targets specified in the statute under specific circumstances. This section discusses those authorities. As described in the executive summary, we are finalizing the volume requirement for cellulosic biofuel at the level we project to be available for 2019, and an associated applicable percentage standard. For advanced biofuel and total renewable fuel, we are establishing volume requirements and associated applicable percent standards, based on use of the "cellulosic waiver authority" that would result in advanced biofuel and total renewable fuel volume requirements that are lower than the statutory targets by the same magnitude as the reduction in the cellulosic biofuel reduction. This would effectively maintain the implied statutory volumes for non-cellulosic advanced biofuel and conventional renewable fuel.[12]

A. Statutory Authorities for Reducing Volume Targets

In CAA section 211(o)(2), Congress specified increasing annual volume targets for total renewable fuel, advanced biofuel, and cellulosic biofuel for each year through 2022, and for BBD through 2012, and authorized EPA to set volume requirements for subsequent years in coordination with USDA and DOE, and after consideration of specified factors. However, Congress also recognized that under certain circumstances it would be appropriate for EPA to set volume requirements at a lower level than reflected in the statutory volume targets, and thus provided waiver provisions in CAA section 211(o)(7).

1. Cellulosic Waiver Authority

Section 211(o)(7)(D)(i) of the CAA provides that if EPA determines that the projected volume of cellulosic biofuel production for a given year is less than the applicable volume specified in the statute, then EPA must reduce the applicable volume of cellulosic biofuel required to the projected production volume for that calendar year. In making this projection, EPA may not "adopt a methodology in which the risk of overestimation is set deliberately to outweigh the risk of underestimation" but must make a projection that "takes neutral aim at accuracy." *API* v. *EPA,* 706 F.3d 474, 479, 476 (D.C. Cir. 2013). Pursuant to this provision, EPA has set the cellulosic biofuel requirement lower than the statutory volume for each year since 2010. As described in Section III.D, the projected volume of cellulosic biofuel production for 2019 is less than the 8.5 billion gallon volume target in the statute. Therefore, for 2019, we are requiring a cellulosic biofuel volume lower than the statutory applicable volume, in accordance with this provision.

CAA section 211(o)(7)(D)(i) also provides EPA with the authority to reduce the applicable volume of total renewable fuel and advanced biofuel in

[9] *https://www.epa.gov/fuels-registration-reporting-and-compliance-help/public-data-renewable-fuel-standard.*

[10] Each RIN has a "D-code" that identifies the category of fuel (D3 for cellulosic biofuel, D7 for cellulosic diesel, D4 for biomass-based diesel, D5 for advanced biofuel, or D6 for conventional biofuel) for which the RIN was generated.

[11] EPA previously considered, and ultimately denied, petitions for reconsideration of the point of obligation in the RFS program. See "Denial of Petitions for Rulemaking to Change the RFS Point of Obligation" EPA–420–R–17–008, November 2017.

[12] See supra n. 6.

years when it reduces the applicable volume of cellulosic biofuel under that provision. The reduction must be less than or equal to the reduction in cellulosic biofuel. For 2019, we are reducing the applicable volumes of advanced biofuel and total renewable fuel under this authority.

EPA has used the cellulosic waiver authority to lower the cellulosic biofuel, advanced biofuel and total renewable fuel volumes every year since 2014. Further discussion of the cellulosic waiver authority, and EPA's interpretation of it, can be found in the preamble to the 2017 final rule.[13] See also *API* v. *EPA,* 706 F.3d 474 (D.C. Cir. 2013) (requiring that EPA's cellulosic biofuel projections reflect a neutral aim at accuracy); *Monroe Energy* v. *EPA,* 750 F.3d 909 (D.C. Cir. 2014) (affirming EPA's broad discretion under the cellulosic waiver authority to reduce volumes of advanced biofuel and total renewable fuel); *Americans for Clean Energy* v. *EPA* (''*ACE*''), 864 F.3d 691 (D.C. Cir. 2017) (discussed below).

In *ACE,* the court evaluated EPA's use of the cellulosic waiver authority in the 2014–2016 annual rulemaking to reduce the advanced biofuel and total renewable fuel volumes for 2014, 2015, and 2016. There, EPA used the cellulosic waiver authority to reduce the advanced biofuel volume to a level that was reasonably attainable, and then provided a comparable reduction under this authority for total renewable fuel.[14] The Court of Appeals for the District of Columbia, relying on the analysis in *Monroe Energy,* reaffirmed that EPA enjoys ''broad discretion'' under the cellulosic waiver authority ''to consider a variety of factors—including demand-side constraints in the advanced biofuels market.''[15] The Court noted that the only textual limitation on the use of the cellulosic waiver authority is that it cannot exceed the amount of the reduction in cellulosic biofuel.[16] The Court contrasted the general waiver authority under CAA section 211(o)(7)(A) and the biomass based diesel waiver authority under CAA section 211(o)(7)(E), which ''detail the considerations and procedural steps that EPA must take before waiving fuel requirements,'' with the cellulosic waiver authority, which identifies no factors regarding reductions in advanced and total renewable fuel other than the limitation that any such reductions may not exceed the reduction in cellulosic biofuel volumes.[17] The Court also concluded that the scope of EPA's discretionary authority to reduce advanced and total volumes is the same under the cellulosic waiver provision whether EPA is declining to exercise its authority to waive volumes, or choosing to do so.[18]

In this action we are using the cellulosic waiver authority to reduce the statutory volume targets for advanced biofuels and total renewable fuel by equal amounts, consistent with our long-held interpretation of this provision and our approach in setting the 2014–2018 standards. This approach considers the Congressional objectives reflected in the volume tables in the statute, and the environmental objectives that generally favor the use of advanced biofuels over non-advanced biofuels. See 81 FR 89752–89753 (December 12, 2016). See also 78 FR 49809–49810 (August 15, 2013); 80 FR 77434 (December 14, 2015). We are concluding, as described in Section IV, that it is appropriate for EPA to reduce the advanced biofuel volume under the cellulosic waiver authority by the same quantity as the reduction in cellulosic biofuel, and to provide an equal reduction under the cellulosic waiver authority in the applicable volume of total renewable fuel. We are taking this action both because we do not believe that the statutory volumes can be achieved, and because we do not believe that backfilling of the shortfall in cellulosic with advanced biofuel would be appropriate due to high costs, as well as other factors such as feedstock switching and/or diversion of foreign advanced biofuels. The volumes of advanced and total renewable fuel resulting from this exercise of the cellulosic waiver authority provide for an implied volume allowance for conventional renewable fuel of 15 billion gallons, and an implied volume allowance for non-cellulosic advanced biofuel of 4.5 billion gallons, equal to the implied statutory volumes for 2019. We also believe that the volume of renewable fuel made available after reductions using the cellulosic waiver authority is attainable, as discussed in Section IV.

2. General Waiver Authority

Section 211(o)(7)(A) of the CAA provides that EPA, in consultation with the Secretary of Agriculture and the Secretary of Energy, may waive the applicable volumes specified in the Act in whole or in part based on a petition by one or more States, by any person subject to the requirements of the Act, or by the EPA Administrator on his own motion. Such a waiver must be based on a determination by the Administrator, after public notice and opportunity for comment that: (1) Implementation of the requirement would severely harm the economy or the environment of a State, a region, or the United States; or (2) there is an inadequate domestic supply.

EPA received comments suggesting that EPA should use the general waiver to further reduce volumes under findings of inadequate domestic supply, and/or severe harm to the economy or environment. Based on our review of the comments and updated data, and consistent with EPA's rationale and decisions in setting the 2018 standards, we decline to exercise our discretion to reduce volumes under the general waiver authority. Further discussion of these issues is found in the RTC document and a memorandum to the docket.[19]

B. Treatment of Carryover RINs

Consistent with our approach in the final rules establishing the RFS standards for 2013 through 2018, we have also considered the availability and role of carryover RINs in evaluating whether we should exercise our discretion to use our waiver authorities in setting the volume requirements for 2019. Neither the statute nor EPA regulations specify how or whether EPA should consider the availability of carryover RINs in exercising the cellulosic waiver authority.[20] As noted in the context of the rules establishing the RFS standards for 2014 through 2018, we believe that a bank of carryover RINs is extremely important

[13] See 81 FR 89752–89753 (December 12, 2016).

[14] See 80 FR 77433–34 (December 14, 2015).

[15] *ACE,* 864 F.3d at 730.

[16] *Id.* at 733.

[17] *Id.*

[18] *Id.* at 734.

[19] See ''Endangered Species Act No Effect Finding and Determination of Severe Environmental Harm under the General Waiver Authority for the 2019 Final Rule'' Memorandum from EPA Staff to EPA Docket EPA–HQ–OAR–2018–0167.

[20] CAA section 211(o)(5) requires that EPA establish a credit program as part of its RFS regulations, and that the credits be valid to show compliance for 12 months as of the date of generation. EPA implemented this requirement though the use of RINs, which can be used to demonstrate compliance for the year in which they are generated or the subsequent compliance year. Obligated parties can obtain more RINs than they need in a given compliance year, allowing them to ''carry over'' these excess RINs for use in the subsequent compliance year, although use of these carryover RINs is limited to 20 percent of the obligated party's renewable volume obligation (RVO). For the bank of carryover RINs to be preserved from one year to the next, individual carryover RINs are used for compliance before they expire and are essentially replaced with newer vintage RINs that are then held for use in the next year. For example, if the volume of the collective carryover RIN bank is to remain unchanged from 2017 to 2018, then all of the vintage 2017 carryover RINs must be used for compliance in 2018, or they will expire. However, the same volume of 2018 RINs can then be ''banked'' for use in 2019.

in providing obligated parties compliance flexibility in the face of substantial uncertainties in the transportation fuel marketplace, and in providing a liquid and well-functioning RIN market upon which success of the entire program depends.[21] Carryover RINs provide flexibility in the face of a variety of circumstances that could limit the availability of RINs, including weather-related damage to renewable fuel feedstocks and other circumstances potentially affecting the production and distribution of renewable fuel.[22] On the other hand, carryover RINs can be used for compliance purposes, and in the context of the 2013 RFS rulemaking we noted that an abundance of carryover RINs available in that year (2.666 billion RINs or approximately 16 percent of the total renewable fuel volume requirement for 2013), together with possible increases in renewable fuel production and import, justified maintaining the advanced and total renewable fuel volume requirements for that year at the levels specified in the statute.[23] EPA's approach to the consideration of carryover RINs in exercising our cellulosic waiver authority was affirmed in *Monroe Energy* and *ACE*.[24]

An adequate RIN bank serves to make the RIN market liquid. Just as the economy as a whole functions best when individuals and businesses prudently plan for unforeseen events by maintaining inventories and reserve money accounts, we believe that the RFS program functions best when sufficient carryover RINs are held in reserve for potential use by the RIN holders themselves, or for possible sale to others that may not have established their own carryover RIN reserves. Were there to be no RINs in reserve, then even minor disruptions or other shortfalls in renewable fuel production or distribution relative to petroleum fuel supply, or higher than expected transportation fuel demand (requiring greater volumes of renewable fuel to comply with the percentage standards that apply to all volumes of transportation fuel, including the unexpected volumes) could lead to the need for a new waiver of the standards, undermining the market certainty so critical to the RFS program. Moreover, a significant drawdown of the carryover RIN bank leading to a scarcity of RINs may stop the market from functioning in an efficient manner (*i.e.,* one in which there are a sufficient number of reasonably available RINs for obligated parties seeking to purchase them), even where the market overall could satisfy the standards. For all of these reasons, the collective carryover RIN bank provides a needed programmatic buffer that both facilitates individual compliance and provides for smooth overall functioning of the program.[25]

1. Carryover RIN Bank Size

At the time of the 2019 NPRM, we estimated that there were approximately 3.06 billion total carryover RINs available and proposed that carryover RINs should not be counted on to avoid or minimize the need to reduce the 2019 statutory volume targets. We also proposed that the 2019 volume should not be set at levels that would intentionally lead to a drawdown in the bank of carryover RINs (*e.g.,* volumes that were significantly beyond the market's ability to supply renewable fuels).[26]

Since that time, obligated parties have performed their attest engagements and submitted revised compliance reports for the 2017 compliance year and we now estimate that there are currently approximately 2.59 billion total carryover RINs available,[27] a decrease of 470 million RINs from the 3.06 billion total carryover RINs that were estimated to be available in the 2019 NPRM.[28] This decrease in the total carryover RIN bank compared to that projected in the 2019 NPRM results from various factors, including market factors, regulatory and enforcement actions, and judicial proceedings. This estimate also includes the millions of RINs that were not required to be retired by small refineries that were granted hardship exemptions in recent years,[29] along with the RINs that Philadelphia Energy Solutions Refining and Marketing, LLC (''PESRM'') was not required to retire as part of its bankruptcy settlement agreement.[30] This total volume of carryover RINs is approximately 13 percent of the total renewable fuel volume requirement that EPA is finalizing for 2019, which is less than the 20 percent maximum limit permitted by the regulations to be carried over for use in complying with the 2019 standards.[31]

The above discussion applies to total carryover RINs; we have also considered the available volume of advanced biofuel carryover RINs. At the time of the 2019 NPRM, we estimated that there were approximately 700 million advanced carryover RINs available. Since that time, obligated parties have performed their attest engagements and submitted revised compliance reports for the 2017 compliance year and we now estimate that there are currently approximately 600 million advanced carryover RINs available,[32] a decrease of 100 million RINs from the 700 million total carryover RINs that were estimated to be available in the 2019 NPRM.[33] This volume of advanced carryover RINs is approximately 12 percent of the advanced renewable fuel volume requirement that EPA is finalizing for 2019, which is less than the 20 percent maximum limit permitted by the regulations to be carried over for use in complying with the 2019 standards.[34]

However, there remains considerable uncertainty surrounding the number of carryover RINs that will be available for use in 2019 for a number of reasons, including the potential impact of any future action to address the remand in *ACE,* the possibility of additional small

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[21] See 80 FR 77482–87 (December 14, 2015), 81 FR 89754–55 (December 12, 2016), and 82 FR 58493–95 (December 12, 2017).

[22] See 72 FR 23900 (May 1, 2007), 80 FR 77482–87 (December 14, 2015), 81 FR 89754–55 (December 12, 2016), and 82 FR 58493–95 (December 12, 2017).

[23] See 78 FR 49794–95 (August 15, 2013).

[24] *Monroe Energy* v. *EPA,* 750 F.3d 909 (D.C. Cir. 2014), *ACE,* 864 F.3d at 713.

[25] Here we use the term ''buffer'' as shorthand reference to all of the benefits that are provided by a sufficient bank of carryover RINs.

[26] See 83 FR 32024 (July 10, 2018).

[27] The calculations performed to estimate the number of carryover RINs currently available can be found in the memorandum, ''Carryover RIN Bank Calculations for 2019 Final Rule,'' available in the docket.

[28] See ''Carryover RIN Bank Calculations for 2019 NPRM,'' Docket Item No. EPA–HQ–OAR–2018–0167–0043.

[29] Information about the number of small refinery exemptions granted and the volume of RINs not required to be retired as a result of those exemptions can be found at *https://www.epa.gov/fuels-registration-reporting-and-compliance-help/rfs-small-refinery-exemptions.*

[30] Per PESRM's bankruptcy filings, PESRM had an RVO of 467 million RINs for 2017 (including its deficit carryforward from 2016). Pursuant to the settlement agreement, which was based on the unique facts and circumstances present in this case, including the insolvency and risk of liquidation, PESRM agreed to retire 138 million RINs to meet its 2017 RVO and the portion of its 2018 RVO during the bankruptcy proceedings (approximately 97 million RINs). See docket for PES Holdings, LLC, 1:18bk10122, ECF Document Nos. 244 (proposed settlement agreement), 347 (United States' motion to approve proposed settlement agreement), 376 (order approving proposed settlement agreement), and 510 (Stipulation between the Debtors and the United States on behalf of the Environmental Protection Agency relating to Renewable Identification Number Retirement Deadlines under Consent Decree and Environmental Settlement Agreement) (Bankr. D. Del.). PESRM has emerged from bankruptcy and EPA does not anticipate further relief being granted under the RFS program.

[31] See 40 CFR 80.1427(a)(5).

[32] The calculations performed to estimate the number of carryover RINs currently available can be found in the memorandum, ''Carryover RIN Bank Calculations for 2019 Final Rule,'' available in the docket.

[33] See ''Carryover RIN Bank Calculations for 2019 NPRM,'' Docket Item No. EPA–HQ–OAR–2018–0167–0043.

[34] See 40 CFR 80.1427(a)(5).

refinery exemptions, and the impact of 2018 RFS compliance on the bank of carryover RINs. In addition, we note that there have been enforcement actions in past years that have resulted in the retirement of carryover RINs to make up for the generation and use of invalid RINs and/or the failure to retire RINs for exported renewable fuel. Future enforcement actions could have similar results, and require that obligated parties and/or renewable fuel exporters settle past enforcement-related obligations in addition to the annual standards, thereby potentially creating demand for RINs greater than can be accommodated through actual renewable fuel blending in 2019. In light of these uncertainties, the net result could be a bank of total carryover RINs larger or smaller than 13 percent of the 2019 total renewable fuel volume requirement, and a bank of advanced carryover RINs larger or smaller than 12 percent of the 2019 advanced biofuel volume requirement.

2. EPA's Decision Regarding the Treatment of Carryover RINs

We have evaluated the volume of carryover RINs currently available and considered whether they would justify a reduced use of our cellulosic waiver authority in setting the 2019 volume requirements in order to intentionally draw down the carryover RIN bank. We also carefully considered the comments received, including comments on the role of carryover RINs under our waiver authorities and the policy implications of our decision.[35] For the reasons described throughout Section II.B, we do not believe we should intentionally draw down the bank of carryover RINs and limit the exercise of our cellulosic waiver authority. The current bank of carryover RINs provides an important and necessary programmatic buffer that will both facilitate individual compliance and provide for smooth overall functioning of the program. We believe that a balanced consideration of the possible role of carryover RINs in achieving the statutory volume objectives for advanced and total renewable fuels, versus maintaining an adequate bank of carryover RINs for important programmatic functions, is appropriate when EPA exercises its discretion under the cellulosic waiver authority, and that the statute does not specify the extent to which EPA should require a drawdown in the bank of carryover RINs when it exercises this authority. Therefore, for the reasons noted above and consistent with the approach we took in the final rules establishing the RFS standards for 2014 through 2018, we have decided to maintain our proposed approach and are making a determination to not set the 2019 volume requirements at levels that would envision an intentional drawdown in the bank of carryover RINs. We note that we may or may not take a similar approach in future years; we will assess the situation on a case-by-case basis going forward and take into account the size of the carryover RIN bank in the future and any lessons learned from implementing past rules.

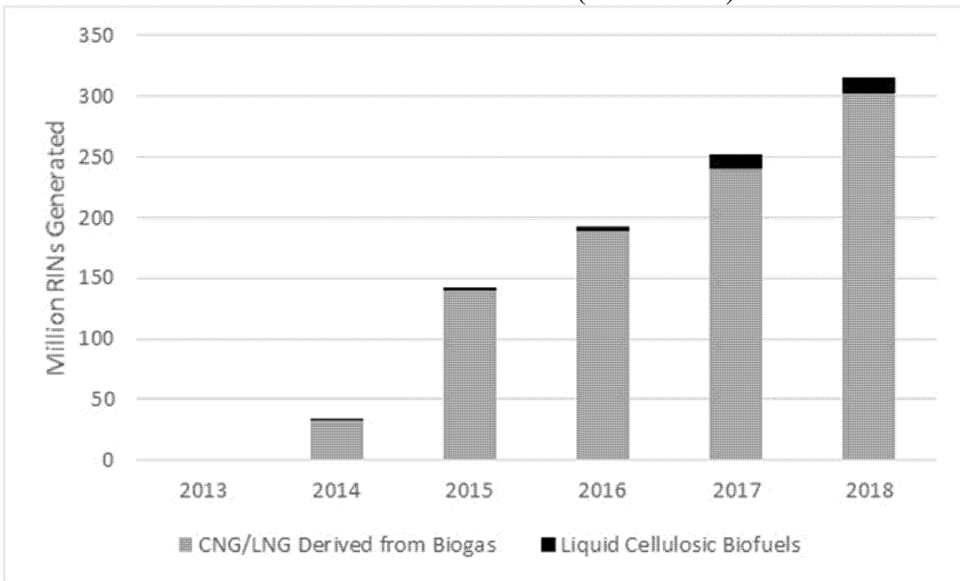
III. Cellulosic Biofuel Volume for 2019

In the past several years, production of cellulosic biofuel has continued to increase. Cellulosic biofuel production reached record levels in 2017, driven largely by CNG and LNG derived from biogas. Production volumes through September 2018 suggest production in 2018 will exceed production volumes in 2017.[36] Production of liquid cellulosic biofuel has also increased in recent years, even as the total production of liquid cellulosic biofuels remains much smaller than the production volumes of CNG and LNG derived from biogas. This section describes our assessment of the volume of cellulosic biofuel that we project will be produced or imported into the U.S. in 2019, and some of the uncertainties associated with those volumes.

[35] In their comments on the 2019 NPRM, parties generally expressed two opposing points of view. Commenters representing obligated parties supported EPA's proposed decision to not assume a drawdown in the bank of carryover RINs in determining the appropriate volume requirements, reiterating the importance of maintaining the carryover RIN bank in order to provide obligated parties with necessary compliance flexibilities, better market trading liquidity, and a cushion against future program uncertainty. Commenters representing renewable fuel producers, however, stated that not accounting for carryover RINs goes against Congressional intent of the RFS program and deters investment in cellulosic and advanced biofuels. A full description of comments received, and our detailed responses to them, is available in the RTC document in the docket.

[36] The majority of the cellulosic RINs generated for CNG/LNG are sourced from biogas from landfills; however, the biogas may come from a variety of sources including municipal wastewater treatment facility digesters, agricultural digesters, separated municipal solid waste (MSW) digesters, and the cellulosic components of biomass processed in other waste digesters.

Figure III-1
Cellulosic RINs Generated (2013-2018)[a]



[a]Cellulosic RIN generation data from EMTS; 2018 volumes are projected based on data through September 2018

In order to project the volume of cellulosic biofuel production in 2019, we considered EIA's projection of cellulosic biofuel production in 2019, the accuracy of the methodologies used to project cellulosic biofuel production in previous years, data reported to EPA through EMTS, and information we collected through meetings with representatives of facilities that have produced or have the potential to produce qualifying volumes of cellulosic biofuel in 2019 for consumption as transportation fuel, heating oil, or jet fuel in the U.S.

There are two main elements to the cellulosic biofuel production projection: Liquid cellulosic biofuel and CNG/LNG derived from biogas. To project the range of potential production volumes of liquid cellulosic biofuel we used the same general methodology as the methodology used in the proposed rule, as well as the 2018 final rule. However, we have adjusted the percentile values used to select a point estimate within a projected production range for each group of companies based on updated information (through the end of September 2018) with the objective of improving the accuracy of the projections. To project the production of cellulosic biofuel RINs for CNG/LNG derived from biogas, we used the same general year-over-year growth rate methodology as in the 2019 proposed rule and 2018 final rule, with updated RIN generation data through September 2018. This methodology reflects the mature status of this industry, the large number of facilities registered to generate cellulosic biofuel RINs from these fuels, and EPA's continued attempts to refine its methodology to yield estimates that are as accurate as possible. This methodology is an improvement on the methodology that EPA used to project cellulosic biofuel production for CNG/LNG derived from biogas in the 2017 and previous years (see Section III.B below for a further discussion of the accuracy of EPA's methodology in previous years). The methodologies used to project the production of liquid cellulosic biofuels and cellulosic CNG/LNG derived from biogas are described in more detail in Sections III.D–1 and III.D–2 below.

The balance of this section is organized as follows. Section III.A provides a brief description of the statutory requirements. Section III.B reviews the accuracy of EPA's projections in prior years, and also discusses the companies the EPA assessed in the process of projecting qualifying cellulosic biofuel production in the U.S. in 2018 in Section III.B. Section III.C discusses EIA's projection of cellulosic biofuel production for 2019 and how this projection compares to EPA's projection. Section III.D discusses the methodologies used by EPA to project cellulosic biofuel production in 2019 and the resulting projection of 381 million ethanol-equivalent gallons.

A. Statutory Requirements

CAA section 211(o)(2)(B)(i)(III) states the statutory volume targets for cellulosic biofuel. The volume of cellulosic biofuel specified in the statute for 2019 is 8.5 billion gallons. The statute provides that if EPA determines, based on a letter provided to the EPA by EIA, that the projected volume of cellulosic biofuel production in a given year is less than the statutory volume, then EPA shall reduce the applicable volume of cellulosic biofuel to the projected volume available during that calendar year.[37]

In addition, if EPA reduces the required volume of cellulosic biofuel below the level specified in the statute, we may reduce the applicable volumes of advanced biofuels and total renewable fuel by the same or a lesser volume,[38] and we are also required to make cellulosic waiver credits

[37] CAA section 211(o)(7)(D)(i). The U.S. Court of Appeals for the District of Columbia Circuit evaluated this requirement in *API* v. *EPA,* 706 F.3d 474, 479–480 (D.C. Cir. 2013), in the context of a challenge to the 2012 cellulosic biofuel standard. The Court stated that in projecting potentially available volumes of cellulosic biofuel EPA must apply an ''outcome-neutral methodology'' aimed at providing a prediction of ''what will *actually* happen.'' *Id.* at 480, 479. EPA has consistently interpreted the term ''projected volume of cellulosic biofuel production'' in CAA section 211(o)(7)(D)(i) to include volumes of cellulosic biofuel likely to be made available in the U.S., including from both domestic production and imports (see 80 FR 77420 (December 14, 2015) and 81 FR 89746 (December 12, 2016)). We do not believe it would be reasonable to include in the projection all cellulosic biofuel produced throughout the world, regardless of likelihood of import to the U.S., since volumes that are not imported would not be available to obligated parties for compliance and including them in the projection would render the resulting volume requirement and percentage standards unachievable.

[38] CAA section 211(o)(7)(D)(i).

available.[39] Our consideration of the 2019 volume requirements for advanced biofuel and total renewable fuel is presented in Section IV.

B. Cellulosic Biofuel Industry Assessment

In this section, we first explain our general approach to assessing facilities or groups of facilities (which we collectively refer to as ''facilities'') that have the potential to produce cellulosic biofuel in 2019. We then review the accuracy of EPA's projections in prior years. Next, we discuss the criteria used to determine whether to include potential domestic and foreign sources of cellulosic biofuel in our projection for 2019. Finally, we provide a summary table of all facilities that we expect to produce cellulosic biofuel in 2019.

In order to project cellulosic biofuel production for 2019 we have tracked the progress of a number of potential cellulosic biofuel production facilities, located both in the U.S. and in foreign countries. As we have done in previous years, we have focused on facilities with the potential to produce commercial-scale volumes of cellulosic biofuel rather than small research and development (R&D) or pilot-scale facilities.[40] We considered a number of factors, including EIA's projection of cellulosic biofuel production in 2019, information from EMTS, the registration status of potential biofuel production facilities as cellulosic biofuel producers in the RFS program, publicly available information (including press releases and news reports), and information provided by representatives of potential cellulosic biofuel producers, in making our projection of cellulosic biofuel production for 2019. As discussed in greater detail below, our projection of liquid cellulosic biofuel is based on a facility-by-facility assessment of each of the likely sources of cellulosic biofuel in 2019, while our projection of CNG/LNG derived from biogas is based on an industry wide assessment. To make a determination of which facilities are most likely to produce liquid cellulosic biofuel and generate cellulosic biofuel RINs in 2019, each potential producer of liquid cellulosic biofuel was investigated further to determine the current status of its facilities and its likely cellulosic biofuel production and RIN generation volumes for 2019. Both in our discussions with representatives of individual companies and as part of our internal evaluation process we gathered and analyzed information including, but not limited to, the funding status of these facilities, current status of the production technologies, anticipated construction and production ramp-up periods, facility registration status, and annual fuel production and RIN generation targets.

1. Review of EPA's Projection of Cellulosic Biofuel in Previous Years

As an initial matter, it is useful to review the accuracy of EPA's past cellulosic biofuel projections. The record of actual cellulosic biofuel production and EPA's projected production volumes from 2015–2018 are shown in Table III.B–1 below. These data indicate that EPA's projection was lower than the actual number of cellulosic RINs made available in 2015,[41] higher than the actual number of RINs made available in 2016 and 2017, and lower than the actual number of RINs projected to be made available in 2018. The fact that the projections made using this methodology have been somewhat inaccurate, under-estimating the actual number of RINs made available in 2015 and 2018, and over-estimating in 2016 and 2017, reflects the inherent difficulty with projecting cellulosic biofuel production. It also emphasizes the importance of continuing to make refinements to our projection methodology in order to make our projections more accurate.

TABLE III.B.1–1—PROJECTED AND ACTUAL CELLULOSIC BIOFUEL PRODUCTION (2015–2018); MILLION GALLONS [a]

	Projected volume [b]			Actual production volume [c]		
	Liquid cellulosic biofuel	CNG/LNG derived from biogas	Total cellulosic biofuel [d]	Liquid cellulosic biofuel	CNG/LNG derived from biogas	Total cellulosic biofuel [d]
2015 [e]	2	33	35	0.5	52.8	53.3
2016	23	207	230	4.1	186.2	190.3
2017	13	298	311	11.8	239.5	251.3
2018 [f]	14	274	288	14.0	309.0	323.0

[a] As noted in Section III.A. above, EPA has consistently interpreted the term ''projected volume of cellulosic biofuel production'' to include volumes of cellulosic biofuel likely to be made available in the U.S., including from both domestic production and imports. The volumes in this table therefore include both domestic production of cellulosic biofuel and imported cellulosic biofuel.

[b] Projected volumes for 2015 and 2016 can be found in the 2014–2016 Final Rule (80 FR 77506, 77508, December 14, 2015); projected volumes for 2017 can be found in the 2017 Final Rule (81 FR 89760, December 12, 2016); projected volumes for 2018 can be found in the 2018 Final Rule (82 FR 58503, December 12, 2017).

[c] Actual production volumes are the total number of RINs generated minus the number of RINs retired for reasons other than compliance with the annual standards, based on EMTS data.

[d] Total cellulosic biofuel may not be precisely equal to the sum of liquid cellulosic biofuel and CNG/LNG derived from biogas due to rounding.

[e] Projected and actual volumes for 2015 represent only the final 3 months of 2015 (October–December) as EPA used actual RIN generation data for the first 9 months of the year.

[f] Actual production in 2018 is projected based on actual data from January–September 2018 and a projection of likely production for October–December 2018.

EPA's projections of liquid cellulosic biofuel were higher than the actual volume of liquid cellulosic biofuel produced each year from 2015 to 2017.[42] As a result of these over-projections, and in an effort to take into account the most recent data available and make the liquid cellulosic biofuel projections more accurate, EPA adjusted our methodology in the 2018 final

[39] See CAA section 211(o)(7)(D)(ii); 40 CFR 80.1456.

[40] For a further discussion of EPA's decision to focus on commercial scale facilities, rather than R&D and pilot scale facilities, see the 2019 proposed rule (83 FR 32031, July 10, 2018).

[41] EPA only projected cellulosic biofuel production for the final three months of 2015, since data on the availability of cellulosic biofuel RINs (D3+D7) for the first nine months of the year were available at the time the analyses were completed for the final rule.

[42] We note, however, that because the projected volume of liquid cellulosic biofuel in each year was very small relative to the total volume of cellulosic biofuel, these over-projections had a minimal impact on the accuracy of our projections of cellulosic biofuel for each of these years.

rule.[43] The adjustments to our methodology adopted in the 2018 final rule appear to have resulted in a projection that is very close to the volume of liquid cellulosic biofuel expected to be produced in 2018 based on data through September 2018. In this 2019 final rule we are again using percentile values based on actual production in previous years, relative to the projected volume of liquid cellulosic biofuel in these years (the approach first used in 2018). We have adjusted the percentile values to project liquid cellulosic biofuel production based on actual liquid cellulosic biofuel production in 2016 to 2018. Use of this updated data results in slightly different percentile values than we used to project production of liquid cellulosic biofuel in the 2019 proposed rule and the 2018 final rule. We believe that the use of the methodology (described in more detail in Section III.D.1 below), with the adjusted percentile values, results in a projection that reflects a neutral aim at accuracy since it accounts for expected growth in the near future by using historical data that is free of any subjective bias.

We next turn to the projection of CNG/LNG derived from biogas. For 2018, EPA for the first time used an industry-wide approach, rather than an approach that projects volumes for individual companies or facilities, to project the production of CNG/LNG derived from biogas. EPA used a facility-by-facility approach to project the production of CNG/LNG derived from biogas from 2015–2017. Notably this methodology resulted in significant over-estimates of CNG/LNG production in 2016 and 2017, leading EPA to develop the alternative industry wide projection methodology first used in 2018. This updated approach reflects the fact that this industry is far more mature than the liquid cellulosic biofuel industry, with a far greater number of potential producers of CNG/LNG derived from biogas. In such cases, industry-wide projection methods can be more accurate than a facility-by-facility approach, especially as macro market and economic factors become more influential on total production than the success or challenges at any single facility. The industry wide projection methodology slightly under-projected the production of CNG/LNG derived from biogas in 2018. However, the difference between the projected and actual production volume of these fuels was smaller than in 2017.

As described in Section III.D.2 below, EPA is again projecting production of CNG/LNG derived from biogas using the industry wide approach. We calculate a year-over-year rate of growth in the renewable CNG/LNG industry by comparing RIN generation for CNG/LNG derived from biogas from October 2016–September 2017 to the RIN generation for these same fuels from October 2017–September 2018 (the most recent month for which data are available). We then apply this year-over-year growth rate to the total number of cellulosic RINs generated and available to be used for compliance with the annual standards in 2017 to estimate the production of CNG/LNG derived from biogas in 2019.[44] We have applied the growth rate to the number of available 2017 RINs generated for CNG/LNG derived from biogas as data from this year allows us to adequately account for not only RIN generation, but also for RINs retired for reasons other than compliance with the annual standards. While more recent RIN generation data is available, the retirement of RINs for reasons other than compliance with the annual standards generally lags RIN generation, sometimes by up to a year or more.[45] Should this methodology continue to under predict in the future as it did in 2018, then we may need to revisit the methodology, but with only 2018 to compare to it is premature to make any adjustments.

2. Potential Domestic Producers

There are several companies and facilities[46] located in the U.S. that have either already begun producing cellulosic biofuel for use as transportation fuel, heating oil, or jet fuel at a commercial scale, or are anticipated to be in a position to do so at some time during 2019. The financial incentive provided by cellulosic biofuel RINs,[47] combined with the fact that to date nearly all cellulosic biofuel produced in the U.S. has been used domestically[48] and all the domestic facilities we have contacted in deriving our projections intend to produce fuel on a commercial scale for domestic consumption and plan to use approved pathways, gives us a high degree of confidence that cellulosic biofuel RINs will be generated for any fuel produced by domestic commercial scale facilities. To generate RINs, each of these facilities must be registered with EPA under the RFS program and comply with all the regulatory requirements. This includes using an approved RIN-generating pathway and verifying that their feedstocks meet the definition of renewable biomass. Most of the domestic companies and facilities considered in our assessment of potential cellulosic biofuel producers in 2019 have already successfully completed facility registration, and have successfully generated RINs.[49] A brief description of each of the domestic companies (or group of companies for cellulosic CNG/LNG producers and the facilities using Edeniq's technology) that EPA believes may produce commercial-scale volumes of RIN generating cellulosic biofuel by the end of 2019 can be found in a memorandum to the docket for this final rule.[50] General information on each of these companies or group of companies considered in our projection of the potentially available volume of cellulosic biofuel in 2019 is summarized in Table III.B.3–1 below.

3. Potential Foreign Sources of Cellulosic Biofuel

In addition to the potential sources of cellulosic biofuel located in the U.S., there are several foreign cellulosic biofuel companies that may produce cellulosic biofuel in 2019. These include facilities owned and operated by Beta Renewables, Enerkem, Ensyn, GranBio, and Raizen. All of these facilities use fuel production pathways that have been approved by EPA for cellulosic RIN generation provided eligible sources of renewable feedstock are used and other regulatory requirements are satisfied. These

[43] 82 FR 58486 (December 12, 2017).

[44] To project the volume of CNG/LNG derived from biogas in 2019 we multiply the number of 2017 RINs generated for these fuels and available to be used for compliance with the annual standards by the calculated growth rate to project production of these fuels in 2018, and then multiply the resulting number by the growth rate again to project the production of these fuels in 2019.

[45] We note that we do not ignore this more recent data, but rather use it to calculate the year-over-year growth rate used to project the production of CNG/LNG derived from biogas in 2019.

[46] The volume projection from CNG/LNG producers and facilities using Edeniq's production technology do not represent production from a single company or facility, but rather a group of facilities utilizing the same production technology.

[47] According to data from Argus Media, the price for 2018 cellulosic biofuel RINs averaged $2.40 in 2018 (through September 2018). Alternatively, obligated parties can satisfy their cellulosic biofuel obligations by purchasing an advanced (or biomass-based diesel) RIN and a cellulosic waiver credit. The price for 2017 advanced biofuel RINs averaged $0.55 in through September 2018 while the price for a 2018 cellulosic waiver credit is $1.96 (EPA–420–B–17–036).

[48] The only known exception was a small volume of fuel produced at a demonstration scale facility exported to be used for promotional purposes.

[49] Most of the facilities listed in Table III.B.3–1 are registered to produce cellulosic (D3 or D7) RINs with the exception of several of the producers of CNG/LNG derived from biogas and Ensyn's Port-Cartier, Quebec facility.

[50] "Cellulosic Biofuel Producer Company Descriptions (November 2018)," memorandum from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167.

companies would therefore be eligible to register their facilities under the RFS program and generate RINs for any qualifying fuel imported into the U.S. While these facilities may be able to generate RINs for any volumes of cellulosic biofuel they import into the U.S., demand for the cellulosic biofuels they produce is expected to be high in their own local markets.

EPA's projection of cellulosic biofuel production in 2019 includes cellulosic biofuel that is projected to be imported into the U.S. in 2019. For the purposes of this final rule we have considered all the registered foreign facilities under the RFS program to be potential sources of cellulosic biofuel in 2019. We believe that due to the strong demand for cellulosic biofuel in local markets, the significant technical challenges associated with the operation of cellulosic biofuel facilities, and the time necessary for potential foreign cellulosic biofuel producers to register under the RFS program and arrange for the importation of cellulosic biofuel to the U.S., cellulosic biofuel imports from foreign facilities not currently registered to generate cellulosic biofuel RINs are generally highly unlikely in 2019. For purposes of our 2019 cellulosic biofuel projection we have, with one exception (described below), excluded potential volumes from foreign cellulosic biofuel production facilities that are not currently registered under the RFS program.

Cellulosic biofuel produced at three foreign facilities (Ensyn's Renfrew facility, GranBio's Brazilian facility, and Raizen's Brazilian facility) generated cellulosic biofuel RINs for fuel exported to the U.S. in 2017 and/or 2018; projected volumes from each of these facilities are included in our projection of available volumes for 2019. EPA has also included projected volume from two additional foreign facilities. One of these facilities has completed the registration process as a cellulosic biofuel producer (Enerkem's Canadian facility). The other facility (Ensyn's Port-Cartier, Quebec facility), while not yet registered as a cellulosic biofuel producer, is owned by a Ensyn, a company that has previously generated cellulosic biofuel RINs using the same technology at a different facility. We believe that it is appropriate to include volume from these facilities in light of their proximity to the U.S., the proven technology used by these facilities, the volumes of cellulosic biofuel exported to the U.S. by the company in previous years (in the case of Ensyn), and the company's stated intentions to market fuel produced at these facilities to qualifying markets in the U.S. All of the facilities included in EPA's cellulosic biofuel projection for 2019 are listed in Table III.B.3–1 below.

4. Summary of Volume Projections for Individual Companies

General information on each of the cellulosic biofuel producers (or group of producers, for producers of CNG/LNG derived from biogas and producers of liquid cellulosic biofuel using Edeniq's technology) that factored into our projection of cellulosic biofuel production for 2019 is shown in Table III.B.3–1. This table includes both facilities that have already generated cellulosic RINs, as well as those that have not yet generated cellulosic RINs, but are projected to do so by the end of 2019. As discussed above, we have focused on commercial-scale cellulosic biofuel production facilities. Each of these facilities (or group of facilities) is discussed further in a memorandum to the docket.[51]

TABLE III.B.4–1—PROJECTED PRODUCERS OF CELLULOSIC BIOFUEL IN 2019

Company name	Location	Feedstock	Fuel	Facility capacity (million gallons per year) [52]	Construction start date	First production [53]
CNG/LNG Producers [54]	Various	Biogas	CNG/LNG	Various	Various	August 2014.
Edeniq	Various	Corn Kernel Fiber	Ethanol	Various	Various	October 2016.
Enerkem	Edmonton, AL, Canada	Separated MSW	Ethanol	10 [55]	2012	September 2017.[56]
Ensyn	Renfrew, ON, Canada	Wood Waste	Heating Oil	3	2005	2014.
Ensyn	Port-Cartier, QC, Canada	Wood Waste	Heating Oil	10.5	June 2016	January 2018.
GranBio	São Miguel dos Campos, Brazil.	Sugarcane bagasse	Ethanol	21	Mid 2012	September 2014.
Poet-DSM	Emmetsburg, IA	Corn Stover	Ethanol	20	March 2012	4Q 2015.
QCCP/Syngenta	Galva, IA	Corn Kernel Fiber	Ethanol	4	Late 2013	October 2014.
Raizen	Piracicaba City, Brazil	Sugarcane bagasse	Ethanol	11	January 2014	July 2015.

[51] ''Cellulosic Biofuel Producer Company Descriptions (November 2018),'' memorandum from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167.

[52] The Facility Capacity is generally equal to the nameplate capacity provided to EPA by company representatives or found in publicly available information. Capacities are listed in physical gallons (rather than ethanol-equivalent gallons). If the facility has completed registration and the total permitted capacity is lower than the nameplate capacity then this lower volume is used as the facility capacity. For companies generating RINs for CNG/LNG derived from biogas the Facility Capacity is equal to the lower of the annualized rate of production of CNG/LNG from the facility at the time of facility registration or the sum of the volume of contracts in place for the sale of CNG/LNG for use as transportation fuel (reported as the actual peak capacity for these producers).

[53] Where a quarter is listed for the first production date EPA has assumed production begins in the middle month of the quarter (*i.e.,* August for the 3rd quarter) for the purposes of projecting volumes.

[54] For more information on these facilities see ''November 2018 Assessment of Cellulosic Biofuel Production from Biogas (2019),'' memorandum from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167.

[55] The nameplate capacity of Enerkem's facility is 10 million gallons per year. However, we anticipate that a portion of their feedstock will be non-biogenic MSW. RINs cannot be generated for the portion of the fuel produced from non-biogenic feedstocks. We have taken this into account in our production projection for this facility (See ''November 2018 Liquid Cellulosic Biofuel Projections for 2018 CBI'').

[56] This date reflects the first production of ethanol from this facility. The facility began production of methanol in 2015.

C. Projection From the Energy Information Administration

Section 211(o)(3)(A) of the CAA requires EIA to ''provide to the Administrator of the Environmental Protection Agency an estimate, with respect to the following calendar year, of the volumes of transportation fuel, biomass-based diesel, and cellulosic biofuel projected to be sold or introduced into commerce in the United States.'' EIA provided these estimates to EPA on October 12, 2018.[57] With regard to liquid cellulosic biofuel, the EIA estimated that the available volume in 2019 would be 10 million gallons.

In its letter, EIA did not identify the facilities on which their estimate of liquid cellulosic biofuel production was based. EIA did, however, indicate in the letter that it only included domestic production of cellulosic ethanol in their projections. These projections, therefore, do not include cellulosic biofuel produced by foreign entities and imported into the U.S., nor estimates of cellulosic heating oil or CNG/LNG produced from biogas, which together represent approximately 98 percent of our projected cellulosic biofuel volume for 2019. When limiting the scope of our projection to the companies assessed by EIA, we note that our volume projections are equal. EPA projects approximately 10 million gallons of liquid cellulosic biofuel will be produced domestically in 2019, all of which is expected to be cellulosic ethanol.

D. Cellulosic Biofuel Volume for 2019

1. Liquid Cellulosic Biofuel

For our 2019 liquid cellulosic biofuel projection, we use the same general approach as we have in projecting these volumes in previous years. We begin by first categorizing potential liquid cellulosic biofuel producers in 2019 according to whether or not they have achieved consistent commercial scale production of cellulosic biofuel to date. We refer to these facilities as consistent producers and new producers, respectively. Next, we define a range of likely production volumes for 2019 for each group of companies. Finally, we use a percentile value to project from the established range a single projected production volume for each group of companies in 2019. As in 2018, we calculated percentile values for each group of companies based on the past performance of each group relative to our projected production ranges. This methodology is briefly described here, and is described in detail in memoranda to the docket.[58]

We first separate the list of potential producers of cellulosic biofuel (listed in Table III.B.3–1) into two groups according to whether the facilities have achieved consistent commercial-scale production and cellulosic biofuel RIN generation. We next defined a range of likely production volumes for each group of potential cellulosic biofuel producers. For the final rule, we have updated the companies included in our projection, the categorization of these companies, and the low and high end of the potential production range for each company for 2019 based on updated information. The low end of the range for each group of producers reflects actual RIN generation data over the last 12 months for which data are available at the time our technical assessment was completed (October 2017–September 2018).[59] For potential producers that have not yet generated any cellulosic RINs, the low end of the range is zero. For the high end of the range, we considered a variety of factors, including the expected start-up date and ramp-up period, facility capacity, and the number of RINs the producer expects to generate in 2019.[60] The projected range for each group of companies is shown in Tables III.D.1–1 and III.D.1–2 below.[61]

TABLE III.D.1–1—2019 PRODUCTION RANGES FOR LIQUID CELLULOSIC BIOFUEL PRODUCERS WITHOUT CONSISTENT COMMERCIAL SCALE PRODUCTION

[Million ethanol-equivalent gallons]

Companies included	Low end of the range	High end of the range [a]
Enerkem, Ensyn (Port Cartier facility)	0	10

[a] Rounded to the nearest million gallons.

[57] ''EIA letter to EPA with 2019 volume projections 10–12–18,'' available in docket EPA–HQ–OAR–2018–0167.

[58] ''November 2018 Liquid Cellulosic Biofuel Projections for 2018 CBI'' and ''Calculating the Percentile Values Used to Project Liquid Cellulosic Biofuel Production for the 2019 FRM,'' memorandums from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167.

[59] Consistent with previous years, we have considered whether there is reason to believe any of the facilities considered as potential cellulosic biofuel producers for 2019 is likely to produce a smaller volume of cellulosic biofuel in 2019 than in the previous 12 months for which data are available. At this time, EPA is not aware of any information that would indicate lower production in 2019 from any facility considered than in the previous 12 months for which data are available.

[60] As in our 2015–2018 projections, EPA calculated a high end of the range for each facility (or group of facilities) based on the expected start-up date and a six-month straight line ramp-up period. The high end of the range for each facility (or group of facilities) is equal to the value calculated by EPA using this methodology, or the number of RINs the producer expects to generate in 2019, whichever is lower.

[61] More information on the data and methods EPA used to calculate each of the ranges in these tables in contained in ''November 2018 Liquid Cellulosic Biofuel Projections for 2018 CBI'' memorandum from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167. We have not shown the projected ranges for each individual company. This is because the high end of the range for some of these companies are based on the company's production projections, which they consider confidential business information (CBI). Additionally, the low end of the range for facilities that have achieved consistent commercial scale production is based on actual RIN generation data in the most recent 12 months, with is also claimed as CBI.

TABLE III.D.1–2—2019 PRODUCTION RANGES FOR LIQUID CELLULOSIC BIOFUEL PRODUCERS WITH CONSISTENT COMMERCIAL SCALE PRODUCTION

[Million ethanol-equivalent gallons]

Companies included	Low end of the range [a]	High end of the range [b]
Facilities using Edeniq's technology (registered facilities), Ensyn (Renfrew facility), Poet-DSM, GranBio, QCCP/Syngenta, Raizen	14	44

[a] Rounded to the nearest million gallons.

After defining likely production ranges for each group of companies, we next determined the percentile values to use in projecting a production volume for each group of companies. In this final rule we have calculated the percentile values using actual production data from January 2016 through September 2018 (the last month for which actual data is available) and projected production data for the remaining months of 2018 (October—December 2018). This approach is consistent with the approach taken in the 2018 final rule.

For each group of companies and for each year from 2016—2018, Table III.D.1–3 below shows the projected ranges for liquid cellulosic biofuel production (from the 2014–16, 2017, and 2018 final rules), actual production, and the percentile values that would have resulted in a projection equal to the actual production volume.

TABLE III.D.1–3—PROJECTED AND ACTUAL LIQUID CELLULOSIC BIOFUEL PRODUCTION IN 2016–2018

[Million gallons]

	Low end of the range	High end of the range	Actual production [62]	Actual percentile
New Producers: [63]				
2016	0	76	1.06	1st
2017	0	33	8.79	27th
2018	0	47	4.16	9th
Average [a]	N/A	N/A	N/A	12th
Consistent Producers: [64]				
2016	2	5	3.28	43rd
2017	3.5	7	3.02	−14th
2018	7	24	9.86	17th
Average [a]	N/A	N/A	N/A	15th

[a] We have not averaged the low and high ends of the ranges, or actual production, as we believe it is more appropriate to average the actual percentiles from 2016–2018 rather than calculating a percentile value for 2016–2018 in aggregate. This approach gives equal weight to the accuracy of our projections from 2016–2018, rather than allowing the average percentiles calculated to be dominated by years with greater projected volumes.

Based upon the above analysis, EPA has projected cellulosic biofuel production from new producers at the 12th percentile of the calculated range and from consistent producers at the 15th percentile.[65] These percentiles are calculated by averaging the percentiles that would have produced cellulosic biofuel projections equal to the volumes produced by each group of companies in 2016–2018. Prior to 2016, EPA used different methodologies to project available volumes of cellulosic biofuel, and thus believes it inappropriate to calculate percentile values based on projections from those years.[66]

EPA also considered whether or not to include the percentile value from 2016 in our calculation of the percentile value to use in projecting liquid cellulosic biofuel production in 2019. Including a larger number of years in our calculation of the percentile value for 2019 would result in a larger data set that is less susceptible to large fluctuations that result from unexpectedly high or low production volumes in any one year that may not be indicative of future production. However, including a larger number of years also necessarily requires including older data that may no longer reflect the likely production of liquid cellulosic biofuel in a future year, especially given the rapidly changing nature of this industry.

We ultimately decided to include data from 2016 in calculating the percentile values to project liquid cellulosic biofuel production in 2019, determining that there was significant value in including this additional data. Even though the liquid cellulosic biofuel industry has changed since 2016, these changes are not so significant as to render this data obsolete. In determining the percentile values to use for 2019 we have also decided to weight the observed actual percentile values from 2016–2018 equally. While the percentile

[62] Actual production is calculated by subtracting RINs retired for any reason other than compliance with the RFS standards from the total number of cellulosic RINs generated.

[63] Companies characterized as new producers in the 2014–2016, 2017, and 2018 final rules were as follows: Abengoa (2016), CoolPlanet (2016), DuPont (2016, 2017), Edeniq (2016, 2017), Enerkem (2018), Ensyn Port Cartier (2018), GranBio (2016, 2017), IneosBio (2016), and Poet (2016, 2017).

[64] Companies characterized as consistent producers in the 2014–2016, 2017, and 2018 final rules were as follows: Edeniq Active Facilities (2018), Ensyn Renfrew (2016–2018), GranBio (2018), Poet (2018), and Quad County Corn Processors/Syngenta (2016–2018).

[65] For more detail on the calculation of the percentile values used in this final rule see ''Calculating the Percentile Values Used to Project Liquid Cellulosic Biofuel Production for 2018 and 2019,'' available in EPA docket EPA–HQ–OAR–2018–0167.

[66] EPA used a similar projection methodology for 2015 as in 2016–2018, however we only projected cellulosic biofuel production volume for the final 3 months of the year, as actual production data were available for the first 9 months. We do not believe it is appropriate to consider data from a year for which 9 months of the data were known at the time the projection was made in determining the percentile values used to project volume over a full year.

value from 2018 represents the most recent data available, it is also dependent on the performance of a relatively small number of companies in a single year, as well as a projection of the performance of these facilities during the final three months of 2018. Using data from multiple years, especially years in which we have complete production data, is likely more representative of the future performance of these groups of companies than data from any single year.

Commenters generally supported EPA's use of updated data (data not available at the time of the proposed rule, but expected to be available for the final rule) in calculating the percentage standards for 2019. Several commenters objected to EPA's use of a single percentile value based on historical production performance for each group of companies. These commenters often described this approach as ''backwards looking'' and generally requested that EPA not discount facility's projected production at all, determine a unique percentile value for each facility based on facility specific factors, or return to the percentile values used in the 2016 and 2017 rules (25th percentile for new producers and 50th percentile for consistent producers).

EPA disagrees with the commenters characterization of the projection methodology used in this final rule as ''backwards looking.'' As discussed above, and in more detail in a memorandum to the docket,[67] EPA has used data specific to 2019 in determining the high end of the potential production range for these facilities. While we acknowledge that we have relied on data from previous years in calculating the percentile value we use to select a volume within the potential production range for each group of companies, we believe that this approach is appropriate and consistent with EPA's direction to project cellulosic biofuel volumes with a neutral aim at accuracy. We do not believe that we have significant data or expertise to individually consider all of the potential variables associated with each individual facility and produce a reasonably accurate projection. Indeed, in the early years of the RFS program (2010–2013) EPA attempted this approach with very poor results. Similarly, using the 25th and 50th percentiles to project potential production produced overly optimistic projections in both 2016 (0.5 million gallons actual production versus 2 million gallons projected production) and 2017 (4.1 million actual, 12 million projected). By contrast, the approach used in the 2018 rule, which is also the approach used in this action, produced a much more precise estimate (14 million actual, 14 million projected). We believe the approach used today is likely to produce a more accurate projection of liquid cellulosic biofuel production.[68] This approach is therefore appropriate for projecting liquid cellulosic biofuel production in 2019. As this approach incorporates new data each year, we anticipate that we will be able to use it consistently in future years. However, as in previous years, EPA will continue to monitor the success of this approach going forward and will make adjustments to increase accuracy as necessary.

Finally, we used these percentile values, together with the ranges determined for each group of companies discussed above, to project a volume for each group of companies in 2019. These calculations are summarized in Table III.D.1–4 below.

TABLE III.D.1–4—PROJECTED VOLUME OF LIQUID CELLULOSIC BIOFUEL IN 2019

[Million ethanol-equivalent gallons]

	Low end of the range [a]	High end of the range [a]	Percentile	Projected volume [a]
Liquid Cellulosic Biofuel Producers; Producers without Consistent Commercial Scale Production	0	10	12th	1
Liquid Cellulosic Biofuel Producers; Producers with Consistent Commercial Scale Production	14	44	15th	19
Total	N/A	N/A	N/A	20

[a] Volumes rounded to the nearest million gallons.

2. CNG/LNG Derived From Biogas

For 2019, EPA is using the same methodology as in the 2018 final rule, an industry wide projection based on a year-over-year growth rate, to project production of CNG/LNG derived from biogas used as transportation fuel.[69] For this final rule, EPA has calculated the year-over-year growth rate in CNG/LNG derived from biogas by comparing RIN generation from October 2017 to September 2018 (the most recent 12 months for which data are available) to RIN generation in the 12 months that immediately precede this time period (October 2016 to September 2017). These RIN generation volumes are shown in Table III.D.2–1 below.

TABLE III.D.2–1—GENERATION OF CELLULOSIC BIOFUEL RINS FOR CNG/LNG DERIVED FROM BIOGAS

[Million gallons][70]

RIN generation (October 2016–September 2017)	RIN generation (October 2017–September 2018)	Year-over-year increase
216	278	29.0%

[67] ''November 2018 Liquid Cellulosic Biofuel Projections for 2018 CBI,'' memorandum from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167.

[68] The comments discussed in this paragraph are discussed in additional detail in Section 3.2.1 of the RTC document.

[69] Historically RIN generation for CNG/LNG derived from biogas has increased each year. It is possible, however, that RIN generation for these fuels in the most recent 12 months for which data are available could be lower than the preceding 12 months. We believe our methodology accounts for this possibility. In such a case, the calculated rate of growth would be negative.

[70] Further detail on the data used to calculate each of these numbers in this table, as well as the projected volume of CNG/LNG derived from biogas used as transportation fuel in 2019 can be found in ''November 2018 Assessment of Cellulosic Biofuel Production from Biogas (2019)'' memorandum from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167.

EPA then applied this 29 percent year-over-year growth rate to the total number of 2017 cellulosic RINs generated and available for compliance for CNG/LNG. This methodology results in a projection of 399 million gallons of CNG/LNG derived from biogas in 2019.[71] We believe that projecting the production of CNG/LNG derived from biogas in this manner appropriately takes into consideration the actual recent rate of growth of this industry, and that this growth rate accounts for both the potential for future growth and the challenges associated with increasing RIN generation from these fuels in future years. This methodology may not be appropriate to use as the projected volume of CNG/LNG derived from biogas approaches the total volume of CNG/LNG that is used as transportation fuel, as RINs can be generated only for CNG/LNG used as transportation fuel. We do not believe that this is yet a constraint as our projection for 2019 is well below the total volume of CNG/LNG that is currently used as transportation fuel.[72]

EPA has also reviewed data on potential producers of CNG/LNG derived from biogas that is used as transportation fuel. Compared to EPA, these potential producers projected greater total production of CNG/LNG derived from biogas in 2019 based on the capacity of such projects. Since producers of CNG/LNG derived from biogas have historically over-estimated their production of these fuels, it would not be appropriate to simply adopt the capacity of these projects as our projection of CNG/LNG derived from biogas for 2019. The fact that the industry projections exceed EPA's projected volume, however, indicates that the volume of these fuels projected for 2019 can be satisfied by a combination of projects currently producing CNG/LNG derived from biogas for these purposes and projects expected to product biogas by the end of 2019.

A number of commenters requested that, in addition to projecting volume of CNG/LNG derived from biogas using a year-over-year growth rate, EPA project additional volume to account for new projects and those currently in development. We believe that the industry-wide projection methodology used in this final rule already adequately accounts for new facilities and those currently in development. The growth rate used to project the production of CNG/LNG derived from biogas in 2019 includes both increased production from existing facilities, as well as new facilities that began producing fuel in the last 12 months for which data are available. Thus, adding additional volume to account for new facilities would effectively be double counting production from new facilities.

Other commenters suggested that the industry wide projection was inappropriate, and that EPA should return to a facility-by-facility assessment, as was used to project CNG/LNG derived from biogas in 2016 and 2017. We believe that the mature nature of the industry producing CNG/LNG derived from biogas lends itself well to an industry-wide projection methodology and that this methodology can be more accurate than a facility-by-facility approach, especially as macro market and economic factors have apparently become more influential on total production than the success or challenges at any single facility; especially as producers are vying for business relationships with the same pool of CNG/LNG fueled transportation fleets to enable them to generate RINs. We further note that the facility-by-facility approach used to project production of CNG/LNG produced from biogas in 2016 and 2017 significantly over-estimated production of these fuels.

While our projection methodology uses a growth rate based on historical data it adequately anticipates higher production volumes in future years, including both increased production from existing facilities as well as production from new facilities. In this way it satisfies our charge to project future cellulosic biofuel production in a reasonable manner, and with neutrality, even though it does not consider all potential producers of these fuels on a facility-by-facility basis.

3. Total Cellulosic Biofuel in 2019

After projecting production of cellulosic biofuel from liquid cellulosic biofuel production facilities and producers of CNG/LNG derived from biogas, EPA combined these projections to project total cellulosic biofuel production for 2019. These projections are shown in Table III.D.3–1. Using the methodologies described in this section, we project that 418 million ethanol-equivalent gallons of cellulosic biofuel will be produced in 2019. We believe that projecting overall production in 2019 in the manner described above results in a neutral estimate (neither biased to produce a projection that is too high nor too low) of likely cellulosic biofuel production in 2019.

TABLE III.D.3–1—PROJECTED VOLUME OF CELLULOSIC BIOFUEL IN 2019

[Million gallons]

	Projected volume [a]
Liquid Cellulosic Biofuel Producers; Producers without Consistent Commercial Scale Production	1
Liquid Cellulosic Biofuel Producers; Producers with Consistent Commercial Scale Production	19
CNG/LNG Derived from Biogas	399
Total	[b] 418

[a] Volumes rounded to the nearest million gallons.

[b] Total projection of cellulosic biofuel appears less than the sum of the projected volume for each group of companies due to rounding.

[71] To calculate this value, EPA multiplied the number of 2017 RINs generated and available for compliance for CNG/LNG derived from biogas (239.5 million), by 1.290 (representing a 29 percent year-over-year increase) to project production of CNG/LNG in 2018, and multiplied this number (309 million RINs) by 1.290 again to project production of CNG/LNG in 2019.

[72] EPA projects that 538 million ethanol-equivalent gallons of CNG/LNG will be used as transportation fuel in 2019 based on EIA's October 2018 Short Term Energy Outlook (STEO). To calculate this estimate, EPA used the Natural Gas Vehicle Use from the STEO Custom Table Builder (0.12 billion cubic feet/day in 2019). This projection includes all CNG/LNG used as transportation fuel from both renewable and non-renewable sources. EIA does not project the amount of CNG/LNG from biogas used as transportation fuel. To convert billion cubic feet/day to ethanol-equivalent gallons EPA used conversion factors of 946.5 British Thermal Units (BTU) per cubic foot of natural gas (lower heating value, per calculations using ASTM D1945 and D3588) and 77,000 BTU of natural gas per ethanol-equivalent gallon per 40 CFR 80.1415(b)(5).

Further discussion of the companies expected to produce cellulosic biofuel and make it commercially available in 2019 can be found in a memorandum to the docket.[73]

IV. Advanced Biofuel and Total Renewable Fuel Volumes for 2019

The national volume targets for advanced biofuel and total renewable fuel to be used under the RFS program each year through 2022 are specified in CAA section 211(o)(2)(B)(i)(I) and (II). Congress set annual renewable fuel volume targets that envisioned growth at a pace that far exceeded historical growth and, for years after 2011, prioritized that growth as occurring principally in advanced biofuels (contrary to previous growth patterns where most growth was in conventional renewable fuel). Congressional intent is evident in the fact that the implied statutory volume requirement for conventional renewable fuel is 15 billion gallons for all years after 2014, while the advanced biofuel volume requirements, driven largely by growth in cellulosic biofuel, continue to grow each year through 2022 to a total of 21 billion gallons.

Due to a shortfall in the availability of cellulosic and advanced biofuel, and consistent with our long-held interpretation of the cellulosic waiver authority as best interpreted and applied by providing equal reductions in advanced biofuel and total renewable fuel, we are reducing the statutory volume targets for both advanced biofuel and total renewable fuel for 2019 using the full extent of the cellulosic waiver authority.

In this Section we discuss our use of the discretion afforded by the cellulosic waiver authority at CAA 211(o)(7)(D)(i) to reduce volumes of advanced biofuel and total renewable fuel. We first discuss our assessment of advanced biofuel and the considerations that have led us to conclude that the advanced biofuel volume target in the statute should be reduced by the full amount permitted under the cellulosic waiver authority. We then address total renewable fuel in the context of our interpretation, articulated in previous annual rulemakings, that advanced biofuel and total renewable fuel should be reduced by the same amount under the cellulosic waiver authority. We also address several comments we received in response to the July 10, 2018 proposal; the remaining comments are addressed in a separate RTC document.

To begin, we have evaluated the capabilities of the market and are making a finding that the 13.0 billion gallons specified in the statute for advanced biofuel cannot be reached in 2019. This is primarily due to the expected continued shortfall in cellulosic biofuel; production of this fuel type has consistently fallen short of the statutory targets by 95 percent or more, and as described in Section III, we project that it will fall far short of the statutory target of 8.5 billion gallons in 2019. For this and other reasons described in this section we are reducing the advanced biofuel statutory target by the full amount of the shortfall in cellulosic biofuel for 2019.

In previous years when we have used the cellulosic waiver authority, we have determined the extent to which we should reduce advanced biofuel volumes by taking into account the availability of advanced biofuels, their energy security and greenhouse gas (GHG) impacts, the availability of carryover RINs, the apparent intent of Congress as reflected in the statutory volumes tables to substantially increase the use of advanced biofuels over time, as well as factors such as increased costs associated with the use of advanced biofuels and the increasing likelihood of adverse unintended impacts associated with use of advanced biofuel volumes achieved through diversion of foreign fuels or substitution of advanced feedstocks from other uses to biofuel production. Until the 2018 standards rule, the consideration of these factors led us to conclude that it was appropriate to set the advanced biofuel standard in a manner that would allow the partial backfilling of missing cellulosic volumes with non-cellulosic advanced biofuels.[74] For the 2018 standards, we placed a greater emphasis on cost considerations in the context of balancing the various considerations, ultimately concluding that partial backfilling with non-cellulosic advanced biofuels was not warranted and the applicable volume requirement for advanced biofuel should be based on the maximum reduction permitted under the cellulosic waiver authority.

Although we continue to believe that the factors earlier considered in exercising the cellulosic waiver authority are relevant and appropriate, we project that there will be insufficient reasonably attainable volumes of non-cellulosic advanced biofuels in 2019 to allow any backfilling for missing volumes of cellulosic biofuel.[75] As a result of this projection, the high cost of advanced biofuels, and our consideration of carryover RINs, we are reducing the statutory volume target for advanced biofuel by the same amount as the reduction in cellulosic biofuel. This will result in the non-cellulosic component of the advanced biofuel volume requirement being equal to the implied statutory volume target of 4.5 billion gallons in 2019.

Several stakeholders commented that it was inappropriate for EPA to change its policy with regard to backfilling of missing cellulosic biofuel with other advanced biofuel as it had done prior to 2018. However, in making such comments, stakeholders misinterpreted our approach in those years. While we permitted some backfilling, we did so only after considering such factors as described above. The approach we have taken for the 2019 volume requirements is no different than it was in previous years, though the outcome of that approach is different due to the different circumstances.

We note that the predominant non-cellulosic advanced biofuels available in the near term are advanced biodiesel and renewable diesel.[76] We expect limited growth in the availability of feedstocks used to produce these fuel types, absent the diversion of these feedstocks from other uses. In addition, we expect diminishing incremental GHG benefits and higher per gallon costs as the required volumes of advanced biodiesel and renewable diesel increase. These outcomes are a result of the fact that the lowest cost and most easily available feedstocks are typically used first, and each additional increment of advanced biodiesel and renewable diesel requires the use of feedstocks that are generally incrementally more costly and/or more difficult to obtain. Moreover, to the extent that higher advanced biofuel requirements cannot be satisfied through growth in the production of advanced biofuel feedstocks, they would instead be satisfied through a re-direction of such feedstocks from competing uses. Products (other than qualifying advanced biofuels) that were

[73] ''Cellulosic Biofuel Producer Company Descriptions (November 2018),'' memorandum from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167.

[74] For instance, see 81 FR 89750 (December 12, 2016).

[75] As described further below, ''reasonably attainable'' volumes are not merely those that can be attained given available biofuel production capacity and feedstocks, but also take into consideration factors such as costs and feedstock and/or fuel diversions that could create disruptions in other markets.

[76] While sugarcane ethanol, as well as a number of other fuel types, can also contribute to the supply of advanced biofuel, in recent years supply of these other advanced biofuels has been considerably lower than supply of advanced biodiesel or renewable diesel. See Table IV.B.3–1.

formerly produced using these feedstocks are likely to be replaced by products produced using the lowest cost alternatives, likely derived from palm oil (for food and animal feed) or petroleum sources (non-edible consumer products). This in turn could increase the lifecycle GHG emissions associated with these incremental volumes of non-cellulosic advanced biofuel, since fuels produced from both palm oil and petroleum have higher estimated lifecycle GHG emissions than qualifying advanced biodiesel and renewable diesel.[77] There would also likely be market disruptions and increased burden associated with shifting feedstocks among the wide range of companies that are relying on them today and which have optimized their processes to use them. Higher advanced biofuel standards could also be satisfied by diversion of foreign advanced biofuel from foreign markets, and there would also be an increased likelihood of adverse unintended impacts associated with such diversions. Taking these considerations into account, we believe, as discussed in more detail below, that it is appropriate to exercise our discretion under the cellulosic waiver authority to set the advanced biofuel volume requirement at a level that would minimize such diversions.

Furthermore, several other factors have added uncertainty regarding the volume of advanced biofuels that we project are attainable in 2019. The first is the fact that the tax credit for biodiesel has not been renewed for 2019. The second is the final determination by the Department of Commerce that tariffs should be imposed on biodiesel imports from Argentina and Indonesia, and the potential for those tariffs to increase.[78] [79] Finally, China has recently imposed new tariffs on soybean imports. Each of these factors is discussed in more detail in Section IV.B.3 below.

We believe that the factors and considerations noted above are all appropriate to consider under the broad discretion provided under the cellulosic waiver authority, and that consideration of these factors supports our use of this authority. Many of the considerations discussed in this final rule are related to the availability of non-cellulosic advanced biofuels (*e.g.,* historic data on domestic supply, expiration of the biodiesel blenders' tax credit, potential imports of biodiesel in light of the Commerce Department's determination on tariffs on biodiesel imports from Argentina and Indonesia, potential imports of sugarcane ethanol, and anticipated decreasing growth in production of feedstocks for advanced biodiesel and renewable diesel), while others focus on the potential benefits and costs of requiring use of available volumes (*e.g.,* relative cost of advanced biofuels in comparison to the petroleum fuels they displace, GHG reduction benefits, and energy security benefits).

As discussed in further detail in the following sections, our assessment of advanced biofuel suggests that achieving the implied statutory volume target for non-cellulosic advanced biofuel in 2019 (4.5 billion gallons) is attainable. While it may also be possible that a volume of non-cellulosic advanced biofuel greater than 4.5 billion gallons may be attainable, a volume equal to or higher than 4.5 billion gallons would likely result in the diversion of advanced feedstocks from other uses or diversion of advanced biofuels from foreign sources, and thus is not reasonably attainable. In that case, our assessment of other factors, such as cost and GHG impacts, indicate that while such higher volumes may be attainable, it would not be appropriate to set the advanced biofuel volume requirement so as to require use of such volumes to partially backfill for missing cellulosic volumes.

The impact of our exercise of the cellulosic waiver authority is that after waiving the cellulosic biofuel volume down to the projected available level, and applying the same volume reduction to the statutory volume target for advanced biofuel, the resulting volume requirement for advanced biofuel for 2019 would be 630 million gallons more than the applicable volume used to derive the 2018 percentage standard. Furthermore, after applying the same reduction to the statutory volume target for total renewable fuel, the volume requirement for total renewable fuel would also be 630 million gallons more than the applicable volume used to derive the 2018 percentage standard.

A. Volumetric Limitation on Use of the Cellulosic Waiver Authority

As described in Section II.A, when making reductions in advanced biofuel and total renewable fuel under the cellulosic waiver authority, the statute limits those reductions to no more than the reduction in cellulosic biofuel. As described in Section III.D, we are establishing a 2019 applicable volume for cellulosic biofuel of 418 million gallons, representing a reduction of 8,082 million gallons from the statutory target of 8,500 million gallons. As a result, 8,082 million gallons is the maximum volume reduction for advanced biofuel and total renewable fuel that is permissible using the cellulosic waiver authority. Use of the cellulosic waiver authority to this maximum extent would result in volumes of 4.92 and 19.92 billion gallons for advanced biofuel and total renewable fuel, respectively.

TABLE IV.A–1—LOWEST PERMISSIBLE VOLUMES USING ONLY THE CELLULOSIC WAIVER AUTHORITY

[Million gallons]

	Advanced biofuel	Total renewable fuel
Statutory target	13,000	28,000
Maximum reduction permitted under the cellulosic waiver authority	8,082	8,082
Lowest 2019 volume requirement permitted using only the cellulosic waiver authority	4,918	19,918

We are authorized under the cellulosic waiver authority to reduce the advanced biofuel and total renewable fuel volumes "by the same or a lesser" amount as the reduction in the cellulosic biofuel volume.[80] As discussed in Section II.A, EPA has broad discretion in using the cellulosic

[77] For instance, see the draft GHG assessment of palm oil biodiesel and renewable diesel at 77 FR 4300 (January 27, 2012).

[78] "Affirmative Final Antidumping Duty Determinations on Biodiesel From Argentina and Indonesia," available in docket EPA–HQ–OAR–2018–0167.

[79] "US adds more duties on biodiesel from Argentina & Indonesia," Reuters article available in docket EPA–HQ–OAR–2018–0167.

waiver authority in instances where its use is authorized under the statute, since Congress did not specify factors that EPA must consider in determining whether to use the authority to reduce advanced biofuel or total renewable fuel, nor what the appropriate volume reductions (within the range permitted by statute) should be. This broad discretion was affirmed in both *Monroe* and *ACE*.[81] Thus, we have the authority set the 2019 advanced biofuel volume requirement at a level that is designed to partially backfill for the shortfall in cellulosic biofuel. However, based on our consideration of a number of relevant factors, we are using the full extent of the cellulosic waiver authority in deriving volume requirements for 2019.

B. Attainable Volumes of Advanced Biofuel

We have considered both attainable and reasonably attainable volumes of advanced biofuel to inform our exercise of the cellulosic waiver authority. As used in this rulemaking, both ''reasonably attainable'' and ''attainable'' are terms of art defined by EPA.[82] Volumes described as ''reasonably attainable'' are those that can be reached with minimal market disruptions, increased costs, and/or reduced GHG benefits, and with minimal diversion of advanced biofuels or advanced biofuel feedstocks from existing uses. We use this phrase in today's action in the same way that we used it in previous actions. Volumes described as ''attainable,'' in contrast, are those we believe can be reached, but would likely result in market disruption, higher costs, and/or reduced GHG benefits. Neither ''reasonably attainable'' nor ''attainable'' are meant to convey the ''maximum achievable'' level, which as we explained in the 2017 final rule, we do not consider to be an appropriate target under the cellulosic waiver authority.[83] Finally, we note that our assessments of the ''reasonably attainable'' and ''attainable'' volumes of non-cellulosic advanced biofuels are not intended to be as exacting as our projection of cellulosic biofuel production, described in Section III of this rule.

As in prior rulemakings, we begin by considering what volumes of advanced biofuels are reasonably attainable. In *ACE,* the Court noted that in assessing what volumes are ''reasonably attainable,'' EPA had considered the availability of feedstocks, domestic production capacity, imports, and market capacity to produce, distribute, and consume renewable fuel.[84] These considerations include both demand-side and supply-side factors.[85] We are taking a similar approach for 2019, with the added consideration of the possibility that higher volume requirements would lead to ''feedstock switching'' or diversion of advanced biofuels from use in other countries. We also took these factors into account in setting the 2017 and 2018 volume requirements, and we continue to believe that they are appropriate considerations under the broad discretion provided by the cellulosic waiver authority. We are establishing the advanced biofuel volume requirement at a level that would seek to minimize such feedstock/fuel diversions within the discretion available under the cellulosic waiver authority.

Our individual assessments of reasonably attainable volumes of each type of advanced biofuel reflect this approach. As discussed in further detail in this section, we find that 100 million gallons of advanced ethanol, 60 million gallons of other advanced biofuels, and 2.61 billion gallons of advanced biodiesel and renewable diesel are reasonably attainable. Together with our projected volume of 418 million gallons of cellulosic biofuel, the sum of these volumes falls short of 4.92 billion gallons, which is the lowest advanced biofuel requirement that EPA can require under the cellulosic waiver authority.

Therefore, we also have considered whether the market can nonetheless make available 4.92 billion gallons of advanced biofuel, notwithstanding likely feedstock/fuel diversions. That is, we assess whether 4.92 billion gallons is merely ''attainable,'' as opposed to reasonably attainable. In particular, we assess whether additional volumes of advanced biodiesel and renewable diesel are attainable. We conclude that 2.8 billion gallons of advanced biodiesel and renewable diesel are attainable, notwithstanding potential feedstock/fuel diversions. This quantity of advanced biodiesel and renewable diesel, together with the cellulosic biofuel, sugarcane ethanol, and other advanced biofuels described above, would enable the market to make available 4.92 billion gallons of advanced biofuels.

1. Imported Sugarcane Ethanol

The predominant available source of advanced biofuel other than cellulosic biofuel and BBD is imported sugarcane ethanol. Imported sugarcane ethanol from Brazil is the predominant form of imported ethanol and the only significant source of imported advanced ethanol. In setting the 2018 standards, we estimated that 100 million gallons of imported sugarcane ethanol would be reasonably attainable.[86] This was a reduction from the 200 million gallons we had assumed for 2016 and 2017, and was based on a combination of data from 2016 and part of 2017 as well as an attempt to balance the lower-than-expected imports from recent data with indications that higher volumes were possible based on older data. We also noted the high variability in ethanol import volumes in the past (including of Brazilian sugarcane ethanol), increasing gasoline consumption in Brazil, and variability in Brazilian production of sugar as reasons that it would be inappropriate to assume that sugarcane ethanol imports would reach the much higher levels suggested by some stakeholders.

Since the 2018 final rule, new data reveals a continued trend of low imports. At the time of the 2018 standards final rule, we had used available data from a portion of 2017 to estimate that import volumes of sugarcane ethanol were likely to fall significantly below the 200 million gallons we had assumed when we set the 2017 standards. Import data for all of 2017 is now available, and indicates that imports of sugarcane ethanol reached just 77 million gallons. Moreover, EIA data on monthly ethanol imports in 2018 through July indicate that no ethanol was imported.[87]

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[80] CAA section 211(o)(7)(D)(i).

[81] See *ACE,* 864 F.3d at 730–35 (citing *Monroe,* 750 F.3d 909, 915–16).

[82] Our consideration of ''reasonably attainable'' volumes is not intended to imply that ''attainable'' volumes are unreasonable or otherwise inappropriate. As we explain in this section, we believe that an advanced biofuel volume of 4.92 billion gallons, although not reasonably attainable, is attainable, and that establishing such volume is an appropriate exercise of our cellulosic waiver authority.

[83] 81 FR 89762 (December 12, 2016). The maximum achievable volume may be relevant to our consideration of whether to exercise the general waiver authority on the basis of inadequate domestic supply. In 2019, we have determined that the after exercising our cellulosic waiver authority the advanced biofuel volume is achievable, and therefore further reductions using the general waiver authority on the basis of inadequate domestic supply are not necessary.

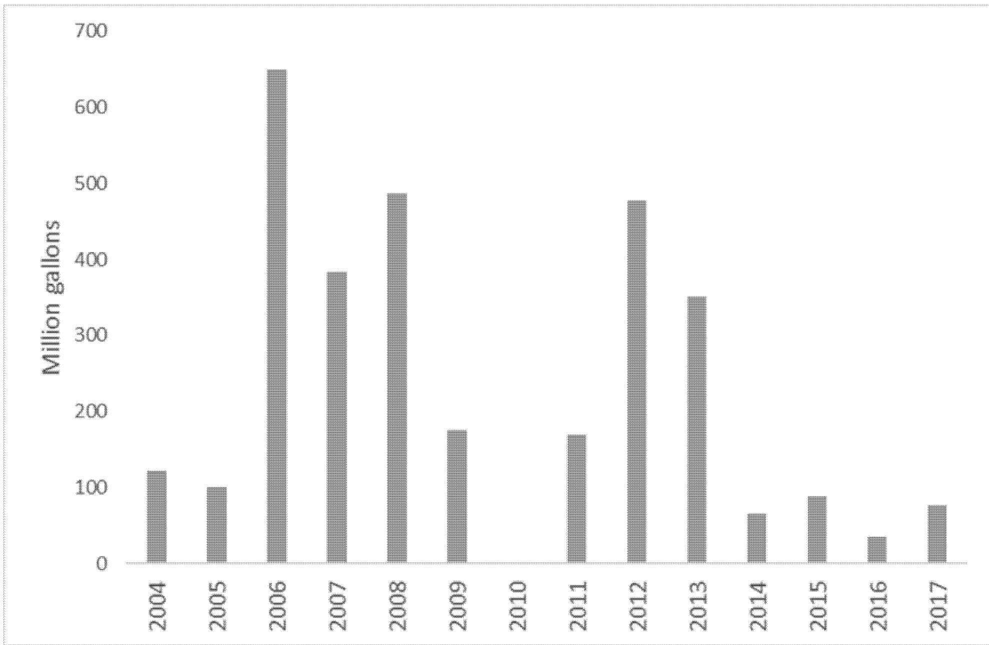
[84] See *ACE,* 864 F.3d at 735–36.

[85] See id. at 730–35.

[86] 82 FR 58507 (December 12, 2017).

[87] However, EIA data on weekly imports of ethanol does indicate that some ethanol was imported in August and October of 2018, totaling 37 million gallons. This volume was not reflected in the monthly EIA data as of September 28, 2018.

Figure IV.B.1-1
Historical Sugarcane Ethanol Imports



Source: "US Imports of Fuel Ethanol from EIA," docket EPA-HQ-OAR-2018-0167. Includes imports directly from Brazil and those that are transmitted through the Caribbean Basin Initiative and Central America Free Trade Agreement (CAFTA).

While it is difficult to predict imports for 2019, we believe it would be reasonable not to increase the assumed volume above 100 million gallons for purposes of determining whether an advanced biofuel volume requirement of 4.92 billion gallons is reasonably attainable for 2019. Although the advanced biofuel volume requirement for 2019 is about 630 million gallons higher than that for 2018, creating some incentive for increases in imports, we note that an even larger increase in the required volume of advanced biofuel between 2016 and 2017 was accompanied by only a very small increase in imports of sugarcane ethanol, from 34 million gallons in 2016 to 77 million gallons in 2017. Moreover, the E10 blendwall and the fact that imported sugarcane ethanol typically costs more than corn ethanol create disincentives for increasing imports above the levels in recent years, though the difference in RIN values between conventional and advanced ethanol may offset the cost difference to some degree.[88] Even so, we do not believe it would be appropriate to reduce the volume of imported sugarcane ethanol below 100 million gallons for the purposes of determining the 2019 volume requirement for advanced biofuel because imports have typically been higher in the second half of the year compared to the first half of the year, and have reached considerably more than 100 million gallons in the past.[89] Taking all of these considerations into account, we are using 100 million gallons of imported sugarcane ethanol for the purposes of projecting reasonably attainable volumes of advanced biofuel for 2019.[90] This level reflects a balancing of the information available to EPA at this time; both the lower import volumes that have occurred more recently with the higher volumes that are possible based on earlier years and under the influence of the higher standards in 2019. Additional discussion on this topic can be found in the RTC document.

We note that the future projection of imports of sugarcane ethanol is inherently imprecise, and that actual imports in 2019 could be lower or higher than 100 million gallons. Factors that could affect import volumes include uncertainty in the Brazilian political climate, weather and harvests in Brazil, world ethanol demand and prices, constraints associated with the E10 blendwall in the U.S., world demand for and prices of sugar, and the cost of sugarcane ethanol relative to that of corn ethanol. After considering these factors, and in light of the high degree of variability in historical imports of sugarcane ethanol, we believe that 100 million gallons is reasonably attainable for 2019.

2. Other Advanced Biofuel

In addition to cellulosic biofuel, imported sugarcane ethanol, and advanced biodiesel and renewable diesel, there are other advanced biofuels that can be counted in the determination of reasonably attainable volumes of advanced biofuel for 2019. These other advanced biofuels include non-cellulosic CNG, naphtha, heating oil, and domestically-produced advanced ethanol. However, the supply of these fuels has been relatively low in the last several years.

[88] For example, see the relative costs of imported sugarcane ethanol and corn ethanol in Tables V.D–2 and V.D–3 in the final rulemaking that established the 2017 standards (81 FR 89746, December 12, 2016).

[89] "US Imports of Fuel Ethanol from EIA," available in docket EPA–HQ–OAR–2018–0167.

[90] We note that even if sugarcane ethanol imports fall below our projection of 100 million gallons in 2019, the advanced biofuel volume would still be achievable. For example, if sugarcane ethanol imports were only 50 million gallons in 2019, the market could still supply 4.5 billion gallons of non-cellulosic advanced biofuel by supplying an additional 33 million gallons of advanced biodiesel.

TABLE IV.B.2–1—HISTORICAL SUPPLY OF OTHER ADVANCED BIOFUELS

[Million ethanol-equivalent gallons]

	CNG/LNG	Heating oil	Naphtha	Domestic ethanol	Total [a]
2013	26	0	3	23	52
2014	20	0	18	26	64
2015	0	1	24	25	50
2016	0	2	26	27	55
2017	2	2	32	26	62

[a] Excludes consideration of D5 renewable diesel, as this category of renewable fuel is considered as part of BBD in Section IV.B.3 below.

The downward trend over time in CNG/LNG from biogas as advanced biofuel with a D code of 5 is due to the re-categorization in 2014 of landfill biogas from advanced (D code 5) to cellulosic (D code 3).[91] Total supply of these other advanced biofuels has exhibited no consistent trend during 2013 to 2017. Based on data from EMTS for these same categories of biofuel in 2018 through August, we estimate that total RIN generation in 2018 will be approximately the same as in 2017.[92] Based on this historical record, we believe that 60 million gallons is reasonably attainable in 2019.

We recognize that the potential exists for additional volumes of advanced biofuel from sources such as jet fuel, liquefied petroleum gas (LPG), butanol, and liquefied natural gas (as distinct from CNG), as well as non-cellulosic CNG from biogas produced in digesters. However, since they have been produced, if at all, in only de minimis and sporadic amounts in the past, we do not have a reasonable basis for projecting substantial volumes from these sources in 2019.[93]

3. Biodiesel and Renewable Diesel

Having projected the production volume of cellulosic biofuel, and the reasonably attainable volumes of imported sugarcane ethanol and ''other'' advanced biofuels, we next assess the potential supply of advanced biodiesel and renewable diesel. First, we calculate the amount of advanced biodiesel and renewable diesel that would need to be supplied to meet the advanced requirement were we to exercise our maximum discretion under the cellulosic authority: 2.8 billion gallons. This calculation, shown in Table IV.B.3–1 below, helps inform the exercise of our waiver authorities. Second, we consider the historical supply of these fuels and the impact of the biodiesel tax policy on advanced biodiesel and renewable diesel use in the U.S. Next, we consider factors that could potentially limit the supply of advanced biodiesel including the production capacity of advanced biodiesel and renewable diesel production facilities, the ability for the market to distribute and use these fuels, the availability of feedstocks to produce these fuels, and fuel imports and exports. Based on our projection of the domestic growth in advanced biodiesel and renewable diesel feedstocks we project a reasonably attainable volume of 2.61 billion gallons of advanced biodiesel and renewable diesel in 2019. Since this volume is lower than the 2.8 billion gallons we calculated would need to be supplied to meet the advanced requirement were we to exercise our maximum discretion under the cellulosic authority, we finally consider if additional supplies of advanced biodiesel and renewable diesel are attainable. Ultimately, we conclude that a volume of at least 2.8 billion gallons of advanced biodiesel and renewable diesel is attainable in 2019. We note that we have not attempted to determine the maximum attainable volume of these fuels. While the maximum attainable volume of advanced biodiesel and renewable diesel in 2019 is greater than 2.8 billion gallons we do not believe it would be appropriate to require a greater volume of these fuels (by establishing a higher advanced biofuel volume for 2019) due to the high cost and the increased likelihood of adverse unintended impacts associated with these fuels.

Calculating the volume of advanced biodiesel and renewable diesel that would be needed to meet the volume of advanced biofuel for 2019 is an important benchmark to help inform EPA's consideration of our waiver authorities. In situations where the reasonably attainable volume of biodiesel and renewable diesel exceeds the volume of these fuels that would be needed to meet the volume of advanced biofuel after reducing the advanced biofuel volume by the same amount as the cellulosic biofuel volume, as was the case in 2017 and 2018, EPA may consider whether or not to allow additional volumes of these fuels to backfill for missing cellulosic biofuel volumes. In situations where the reasonably attainable volume of advanced biodiesel and renewable diesel is less than the volume of these fuels that would be needed to meet the volume of advanced biofuel after reducing the advanced biofuel volume by the same amount as the cellulosic biofuel volume, EPA may consider whether or not to use additional waiver authorities, to the extent available, to make further reductions to the advanced biofuel volume.

[91] 79 FR 42128 (July 18, 2014).

[92] See ''Projecting Advanced Biofuel Production and Imports for 2018 (November 2018)'' Memorandum from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167.

[93] No RIN-generating volumes of these other advanced biofuels were produced in 2017, and less than 1 million gallons total in prior years.

TABLE IV.B.3–1—DETERMINATION OF VOLUME OF BIODIESEL AND RENEWABLE DIESEL NEEDED IN 2019 TO ACHIEVE 4.92 BILLION GALLONS OF ADVANCED BIOFUEL

[Million ethanol-equivalent gallons except as noted]

Lowest 2019 advanced biofuel volume requirement permitted using under the cellulosic waiver authority	4,918
Cellulosic biofuel	418
Imported sugarcane ethanol	100
Other advanced	60
Calculated advanced biodiesel and renewable diesel needed (ethanol-equivalent gallons/physical gallons) [94]	4,340/2,800

Having calculated the volume of advanced biodiesel and renewable diesel that would need to be supplied to meet the volume of advanced biofuel for 2019 after reducing the advanced biofuel volume by the same amount as the cellulosic biofuel volume, EPA next projected the reasonably attainable volume of these fuels for 2019. With regard to advanced biodiesel and renewable diesel, there are many different factors that could potentially influence the reasonably attainable volume of these fuels used as transportation fuel or heating oil in the U.S. These factors include the availability of qualifying biodiesel and renewable diesel feedstocks, the production capacity of biodiesel and renewable diesel facilities (both in the U.S. and internationally), and the availability of imported volumes of these fuels.[95] A review of the volumes of advanced biodiesel and renewable diesel used in previous years is especially useful in projecting the potential for growth in the production and use of such fuels, since for these fuels there are a number of complex and inter-related factors beyond simply the total production capacity for biodiesel and renewable diesel (including the availability of advanced feedstocks, the expiration of the biodiesel tax credit, recent tariffs on biodiesel from Argentina and Indonesia, and other market-based factors) that are likely to affect the supply of advanced biodiesel and renewable diesel.

In addition to a review of the volumes of advanced biodiesel and renewable diesel used in previous years, we believe the likely growth in production of feedstocks used to produce these fuels, as well as the total projected available volumes of these feedstocks, are important factors to consider. This is because while there are many factors that could potentially limit the production and availability of these fuels, the impacts of increasing production of advanced biodiesel and renewable diesel on factors such as costs, energy security, and GHG emissions are expected to vary depending on whether the feedstocks used to produce these fuels are sourced from waste sources or by-products of other industries (such as the production of livestock feed or ethanol production), are sourced from increased oilseed production, or are sourced from the diversion of feedstocks from existing uses. The energy security and GHG reduction value associated with the growth in the use of advanced biofuels is greater when these fuels are produced from waste fats and oils or feedstocks that are byproducts of other industries (such as soybean oil from soybeans primarily grown as animal feed), rather than a switching of existing advanced feedstocks from other uses to renewable fuel production or the diversion of advanced biodiesel and renewable diesel from foreign markets. This is especially true if the parties that previously used the advanced biofuel or feedstocks replace these oils with low cost palm oil [96] or petroleum derived products, as we believe would likely be the case in 2019.[97] In this case the global production of advanced biodiesel and renewable diesel would not increase, and the potential benefits associated with increasing the diversity of the supply of transportation fuel (energy security) and the production of additional volumes of advanced biodiesel and renewable diesel (low GHG sources of transportation fuel) would be reduced.

Before considering the projected growth in the production of qualifying feedstocks that could be used to produce advanced biodiesel and renewable diesel, as well as the total volume of feedstocks that could be used to produce these fuels, it is helpful to review the volumes of biodiesel and renewable diesel that have been used in the U.S. in recent years. While historic data and trends alone are insufficient to project the volumes of biodiesel and renewable diesel that could be provided in future years, historic data can serve as a useful reference in considering future volumes. Past experience suggests that a high percentage of the biodiesel and renewable diesel used in the U.S. (from both domestic production and imports) qualifies as advanced biofuel.[98] In previous years, biodiesel and renewable diesel produced in the U.S. have been almost exclusively advanced biofuel.[99] Imports of advanced biodiesel increased through 2016, but were lower in 2017 and 2018, as seen in Table IV.B.2–1. Volumes of imported advanced biodiesel and renewable diesel have varied significantly from year to year, as they are impacted both by domestic and foreign policies, as well as many economic factors.

[94] To calculate the volume of advanced biodiesel and renewable diesel that would generate the 4.34 billion RINs needed to meet the advanced biofuel volume EPA divided the 4.34 billion RINs by 1.55. 1.55 is the approximate average (weighted by the volume of these fuels expected to be produced in 2019) of the equivalence values for biodiesel (generally 1.5) and renewable diesel (generally 1.7).

[95] Throughout this section we refer to advanced biodiesel and renewable diesel as well as advanced biodiesel and renewable diesel feedstocks. In this context, advanced biodiesel and renewable diesel refer to any biodiesel or renewable diesel for which RINs can be generated that satisfy an obligated party's advanced biofuel obligation (*i.e.,* D4 or D5 RINs). While cellulosic diesel (D7) also contributed towards an obligated party's advanced biofuel obligation, these fuels are discussed in Section III rather than in this section. An advanced biodiesel or renewable feedstock refers to any of the biodiesel, renewable diesel, jet fuel, and heating oil feedstocks listed in Table 1 to 40 CFR 80.1426 or in petition approvals issued pursuant to section 80.1416, that can be used to produce fuel that qualifies for D4 or D5 RINs. These feedstocks include, for example, soy bean oil; oil from annual cover crops; oil from algae grown photosynthetically; biogenic waste oils/fats/greases; non-food grade corn oil; camelina sativa oil; and canola/rapeseed oil (See pathways F, G, and H of Table 1 to section 80.1426).

[96] For instance, see the draft GHG assessment of palm oil biodiesel and renewable diesel at 77 FR 4300 (January 27, 2012).

[97] We believe palm or petroleum derived products would likely be used replace advanced biodiesel and renewable diesel diverted to the U.S. as these products are currently the lowest cost sources.

[98] From 2011 through 2017 approximately 95 percent of all biodiesel and renewable diesel supplied to the U.S. (including domestically-produced and imported biodiesel and renewable diesel) qualified as advanced biodiesel and renewable diesel (11,701 million gallons of the 12,323 million gallons) according to EMTS data.

[99] From 2011 through 2017 over 99.9 percent of all the domestically produced biodiesel and renewable diesel supplied to the U.S. qualified as advanced biodiesel and renewable diesel (10,089 million gallons of the 10,096 million gallons) according to EMTS data.

TABLE IV.B.3–2—ADVANCED (D4 AND D5) BIODIESEL AND RENEWABLE DIESEL FROM 2011 TO 2017

[Million gallons] [a]

	2011	2012	2013	2014 [b]	2015 [b]	2016	2017	2018 [c]
Domestic Biodiesel (Annual Change)	967 (N/A)	1,014 (+47)	1,376 (+362)	1,303 (−73)	1,253 (−50)	1,633 (+380)	1,573 (−60)	1,896 (+323)
Domestic Renewable Diesel (Annual Change)	58 (N/A)	11 (−47)	92 (+81)	155 (+63)	175 (+20)	221 (+46)	258 (+37)	255 (−3)
Imported Biodiesel (Annual Change)	44 (N/A)	40 (−4)	156 (+116)	130 (−26)	261 (+131)	561 (+300)	462 (−99)	212 (−250)
Imported Renewable Diesel (Annual Change)	0 (N/A)	28 (+28)	145 (+117)	129 (−16)	121 (−8)	170 (+49)	193 (+23)	197 (+4)
Exported Biodiesel and Renewable Diesel (Annual Change)	48 (N/A)	102 (+54)	125 (+23)	134 (+9)	133 (−1)	129 (−4)	157 (+28)	103 (−54)
Total (Annual Change)	1,021 (N/A)	991 (−30)	1,644 (+653)	1,583 (−61)	1,677 (+94)	2,456 (+779)	2,329 (−127)	2,457 (+128)

[a] All data from EMTS. EPA reviewed all advanced biodiesel and renewable diesel RINs retired for reasons other than demonstrating compliance with the RFS standards and subtracted these RINs from the RIN generation totals for each category in the table above to calculate the volume in each year.
[b] RFS required volumes for these years were not established until December 2015.
[c] Data for 2018 is based on actual production and import data through September 2018, and a projection for October–December 2018. For more information on how the volumes for 2018 were determined see ''Projecting Advanced Biofuel Production and Imports for 2018 (November 2018)'' Memorandum from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167.

TABLE IV.B.3–3—CONVENTIONAL (D6) BIODIESEL AND RENEWABLE DIESEL FROM 2011 TO 2017

[Million gallons] [a]

	2011	2012	2013	2014 [b]	2015 [b]	2016	2017	2018 [c]
Domestic Biodiesel (Annual Change)	0 (N/A)	0 (+0)	6 (+6)	1 (−5)	0 (+0)	0 (+0)	0 (+0)	0 (+0)
Domestic Renewable Diesel (Annual Change)	0 (N/A)	0 (+0)	0 (+0)	0 (+0)	0 (+0)	0 (+0)	0 (+0)	0 (+0)
Imported Biodiesel (Annual Change)	0 (N/A)	0 (+0)	31 (+31)	52 (+21)	74 (+22)	113 (+39)	0 (−113)	0 (+0)
Imported Renewable Diesel (Annual Change)	0 (N/A)	0 (+0)	53 (+53)	0 (−53)	106 (+106)	43 (−63)	144 (+101)	123 (−21)
Exported Biodiesel and Renewable Diesel (Annual Change)	0 (N/A)	0 (+0)	0 (+0)	0 (+0)	0 (+0)	1 (+1)	0 (−1)	0 (+0)
Total (Annual Change)	0 (N/A)	0 (+0)	90 (+90)	53 (−37)	180 (+127)	155 (−25)	144 (−11)	123 (−21)

[a] All data from EMTS. EPA reviewed all conventional biodiesel and renewable diesel RINs retired for reasons other than demonstrating compliance with the RFS standards and subtracted these RINs from the RIN generation totals for each category in the table above to calculate the volume in each year.
[b] RFS required volumes for these years were not established until December 2015.
[c] Data for 2018 is based on actual production and import data through September 2018, and a projection for October–December 2018. For more information on how the volumes for 2018 were determined see ''Projecting Biodiesel and Renewable Diesel Production and Imports for 2018 (November 2018)'' Memorandum from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167.

Since 2011, the year-over-year changes in the volume of advanced biodiesel and renewable diesel used in the U.S. have varied greatly, from a low of 127 million fewer gallons from 2016 to 2017 to a high of 779 million additional gallons from 2015 to 2016. These changes were likely influenced by multiple factors such as the cost of biodiesel feedstocks and petroleum diesel, the status of the biodiesel blenders tax credit, growth in marketing of biodiesel at high volume truck stops and centrally fueled fleet locations, demand for biodiesel and renewable diesel in other countries, biofuel policies in both the U.S. and foreign countries, and the volumes of renewable fuels (particularly advanced biofuels) required by the RFS. This historical information does not indicate that the maximum previously observed increase of 779 million gallons of advanced biodiesel and renewable diesel would be reasonable to expect from 2018 to 2019, nor does it indicate that the low (or negative) growth rates observed in other years would recur in 2019. Rather, these data illustrate both the magnitude of the changes in advanced biodiesel and renewable diesel in previous years and the significant variability in these changes.

The historic data indicates that the biodiesel tax policy in the U.S. can have a significant impact on the volume of biodiesel and renewable diesel used in the U.S. in any given year.[100] While the biodiesel blenders tax credit has applied in each year from 2010 to 2017, it has only been prospectively in effect during the calendar year in 2011, 2013 and 2016, while other years it has been applied retroactively. The biodiesel blenders tax credit expired at the end of 2009 and was re-instated in December 2010 to apply retroactively in 2010 and extend through the end of 2011. Similarly, after expiring at the end of 2011, 2013, and 2014 the tax credit was re-instated in January 2013 (for 2012 and 2013), December 2014 (for 2014), December 2015 (for 2015 and 2016), and February 2018 (for 2017). Each of the years in which the biodiesel blenders tax credit was in effect during the calendar year (2013 and 2016) resulted in significant increases in the volume of advanced biodiesel and renewable diesel used in the U.S. over the previous year (653 million gallons and 779 million gallons respectively). However, following these large increases in 2013 and 2016, there was little to no growth in the use of advanced biodiesel and renewable diesel in the following years, only 33 million gallons from 2013 to 2015 and negative 127 million gallons from 2016 to 2017. This decrease from 2016 to 2017 occurred even though the required volume of advanced biofuel increased from 3.61 in 2016 to 4.28 billion gallons in 2017. This pattern is likely the result of both accelerated production and/or importation of biodiesel and renewable diesel in the final few months of years during which the tax credit was available to take advantage of the expiring tax credit, as well as relatively lower volumes of biodiesel and renewable diesel production and import in 2014, 2015,

[100] The status of the tax credit does not impact our assessment of the reasonably attainable volume of advanced biodiesel and renewable diesel in 2019 as our assessment is primarily based on feedstock availability. The status of the tax credit may affect the maximum attainable volume of these fuels, but our assessment demonstrates that 2.8 billion gallons of advanced biodiesel and renewable diesel is attainable whether or not the tax credit is renewed prospectively (or retrospectively) for 2019.

and 2017 than would have occurred if the tax credit had been in place.[101]

Some commenters stated that the tax credit has no impact on the potential supply of advanced biodiesel and renewable diesel. They generally argued that while the tax credit impacted the cost of biodiesel, as well as the RIN price needed to make advanced biodiesel and renewable diesel cost competitive with petroleum diesel, the RIN price was ultimately capable of incentivizing the production and use of advanced biodiesel and renewable diesel with or without the tax credit. We recognize that this is theoretically true; because the RIN prices vary with the supply and demand for RINs, the RIN price can rise to provide the same value as the tax credit in its absence. However, we note that it is this very aspect of the price of RINs, the potential that RIN prices may rise or fall depending on market conditions, that can hinder their ability to incentivize increased production and use of advanced biodiesel and renewable diesel. Further, higher advanced biofuel RIN prices can incentivize the production of other advanced fuels if these fuels can be produced at a price that is cost competitive with advanced biodiesel and renewable diesel. Conversely, the tax credit provides a fixed price incentive for all biodiesel and renewable diesel blended into the diesel fuel pool in the U.S., and is not available to other advanced biofuels. Ultimately, as discussed above the supply of biodiesel and renewable diesel is likely to be influenced by a number of factors, including the 2019 RFS volume requirements, the advanced and BBD RIN prices, expectations about the availability of the biodiesel blenders tax credit, and a number of other market-based factors.

The historical data suggests that the supply of advanced biodiesel and renewable diesel could potentially increase from the projected 2.54 billion gallons in 2018 to 2.8 billion gallons in 2019 (the projected volume needed to meet the advanced biofuel volume for 2019 after reducing the statutory advanced biofuel volume by the same amount as the cellulosic biofuel reduction). This would represent an increase of approximately 250 million gallons from 2018 to 2019, slightly higher than the average increase in the volume of advanced biodiesel and renewable diesel used in the U.S. from 2011 through 2017 (218 million gallons per year) and significantly less than the highest annual increase during this time (779 million gallons from 2015 to 2016).

After reviewing the historical volume of advanced biodiesel and renewable diesel used in the U.S. and considering the possible impact of the expiration of the biodiesel tax credit (discussed above), EPA next considers other factors that may impact the production, import, and use of advanced biodiesel and renewable diesel in 2019. The production capacity of registered advanced biodiesel and renewable diesel production facilities is highly unlikely to limit the production of these fuels, as the total production capacity for biodiesel and renewable diesel at registered facilities in the U.S. (4.1 billion gallons) exceeds the volume of these fuels that are projected to be needed to meet the advanced biofuel volume for 2019 after exercising the cellulosic waiver authority (2.8 billion gallons).[102] Significant registered production also exists internationally. Similarly, the ability for the market to distribute and use advanced biodiesel and renewable diesel appears unlikely constrain the growth of these fuels to a volume lower than 2.8 billion gallons. The investments required to distribute and use this volume of biodiesel and renewable diesel are expected to be modest, as this volume is less than 200 million gallons greater than the volume of biodiesel and renewable diesel produced, imported, and used in the U.S. in 2016.

Conversely, the availability of advanced feedstocks that can be used to produce advanced biodiesel and renewable diesel, as well as the availability of imported advanced biodiesel and renewable diesel, may be limited in 2019. We acknowledge that an increase in the required use of advanced biodiesel and renewable diesel could be realized through a diversion of advanced feedstocks from other uses, or a diversion of advanced biodiesel and renewable diesel from existing markets in other countries. Furthermore, the volume of advanced biodiesel and renewable diesel and their corresponding feedstocks projected to be produced globally exceeds the volume projected to be required in 2019 (2.8 billion gallons of advanced biodiesel and renewable diesel and the corresponding volume of advanced feedstocks) by a significant margin.[103] It is also the case that actions unrelated to the RFS program, such as recent tariffs on soybeans exported to China, could result in increased supplies of domestic biodiesel feedstocks.[104] However, we expect that further increases in advanced biofuel and renewable fuel volumes would be increasingly likely to incur adverse unintended impacts.

We perceive the net benefits to be lower both because of the potential disruption and associated cost impacts to other industries resulting from feedstock switching, and the potential adverse effect on lifecycle GHG emissions associated with feedstocks for biofuel production that would have been used for other purposes and which must then be backfilled with other feedstocks. Similarly, increasing the supply of biodiesel and renewable diesel to the U.S. by diverting fuel that would otherwise have been used in other countries results in higher lifecycle GHG emissions than if the supply of these fuels was increased by an increased collection of waste fats and oils or increased production of feedstocks that are byproducts of other industries, especially if this diversion results in increased consumption of petroleum fuels in the countries that would have otherwise consumed the biodiesel or renewable diesel. By focusing our assessment of the potential growth in the attainable volume of biodiesel and renewable diesel on the expected growth in the production of advanced feedstocks (rather than the total supply of these feedstocks in 2018, which would include feedstocks currently being used for non-biofuel purposes), we are attempting to minimize the incentives for the RFS program to increase the supply of advanced biodiesel and renewable diesel through feedstock switching or diverting biodiesel and renewable diesel from foreign markets to the U.S.

Advanced biodiesel and renewable diesel feedstocks include both waste oils, fats, and greases; and oils from planted crops. We received many comments from parties projecting that

[101] We also acknowledge that EPA not finalizing the required volumes of renewable fuel under the RFS program for 2014 and 2015 until December 2015 likely affected the volume of advanced biodiesel and renewable diesel supplied in these years. Further, the preliminary tariffs on biodiesel imported from Argentina and Indonesia announced in August 2017 likely negatively affected the volume of biodiesel supplied in 2017.

[102] The production capacity of the sub-set of biodiesel and renewable diesel producers that generated RINs in 2017 is approximately 3.1 billion gallons. See ''Biodiesel and Renewable Diesel Registered Capacity (May 2018)'' Memorandum from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167.

[103] The October 2018 WASDE projects production of vegetable oils in 2017/2018 in the World to be 203.33 million metric tons. This quantity of vegetable oil would be sufficient to produce approximately 58.1 billion gallons of biodiesel and renewable diesel. Global production of biodiesel is projected to be 38.0 billion liters (10.0 billion gallons) according to the 2018 OECD–FAO Agricultural Outlook.

[104] The potential impacts of this tariff on the availability of biodiesel feedstocks is discussed in our discussion of available vegetable oils below.

available feedstocks from both of these sources are expected to increase in 2019. We agree that increases in the availability of advanced feedstocks would in 2019 and we have projected the magnitude of these increases using the best available data, including data received in comments on this rule. The projected growth in advanced feedstocks, however, is expected to be modest relative to the volume of these feedstocks that are currently being used to produce biodiesel and renewable diesel. Most of the waste oils, fats, and greases that can be recovered economically are already being recovered and used in biodiesel and renewable diesel production or for other purposes. The availability of animal fats will likely increase with beef, pork, and poultry production. Most of the vegetable oil used to produce advanced biodiesel and renewable diesel that is sourced from planted crops comes from crops primarily grown for purposes other than providing feedstocks for biodiesel and renewable diesel, such as for livestock feed, with the oil that is used as feedstock for renewable fuel production a co-product or by-product.[105] This is true for soybeans and corn, which are the two largest sources of feedstock from planted crops used for biodiesel production in the U.S.[106] We do not believe that the increased demand for soybean oil or corn oil caused by a higher 2019 advanced biofuel standard would result in an increase in soybean or corn prices large enough to induce significant changes in agricultural activity.[107] However, we acknowledge that production of these feedstocks is likely to increase as crop yields, oil extraction rates, and demand for the primary products increase in 2019.

We believe the most reliable source for projecting the expected increase in vegetable oils in the U.S. is USDA's World Agricultural Supply and Demand Estimates (WASDE). At the time of our assessment for this final rule, the most current version of the WASDE is from October 2018. The projected increase in vegetable oil production in the U.S. from 2017/2018 to 2018/2019 is 0.14 million metric tons per year. This additional quantity of vegetable oils could be used to produce approximately 40 million additional gallons of advanced biodiesel or renewable diesel in 2019 relative to 2018.[108] We recognize that oilseed production is projected in increase by a much greater amount (6.89 million metric tons).[109] However, it is the vegetable oil, rather than oilseed production, that is of relevance as an advanced biodiesel and renewable diesel feedstock.

A number of commenters mentioned the tariffs recently enacted by China on soybean exports from the U.S. as a potential source of additional feedstock for advanced biodiesel and renewable diesel. The potential impacts of these tariffs are significant, as approximately 25 percent of the U.S. soybean crop is currently exported to China.[110] However, the duration and ultimate impacts of these tariffs on total exports of U.S. soybeans are highly uncertain. In recent months, the price premium for soybeans from Brazil (the largest global exporter of soybeans), which are not impacted by the tariffs, have increased to approximately $2 per bushel.[111] A likely result of this price premium is that countries other than China will turn to U.S. sources of soybeans, rather than sourcing soybeans from Brazil. Ultimately, the tariffs could have little impact on the overall exports of soybeans from the U.S.

The most recent WASDE report projects that exports of oilseeds will decrease by approximately 2 million metric tons (approximately 3 percent) from 2017/2018 to 2018/2019. In addition, the WASDE projects that exports of vegetable oils will decrease by 0.10 million metric tons during this same time period. The October WASDE appears to take the recent tariffs into account, as there is a notable decrease in the expected trade of oilseeds in the recent WASDE projections relative to WASDE projections made prior to the announcement of Chinese tariffs on U.S. soybeans.[112] If the 2 million metric tons of soybeans were crushed to produce vegetable oil, this oil, along with the 0.10 million metric ton decrease in vegetable oil exports, could be used to produce approximately 130 million gallons of biodiesel and renewable diesel, less than 6 percent of the current market.[113] We believe this is a reasonable estimate of the volume of biodiesel and renewable diesel that could be produced from a decrease in exports of oilseeds and vegetable oil from the U.S. in 2019. However, any biodiesel and renewable diesel produced from soybeans previously exported to China are necessarily diverted from other uses (even if the reason for this diversion is the tariffs, rather than the RFS program), and are therefore more likely to have the adverse unintended impacts associated with diverted feedstocks. We therefore have not included this potential volume increase in our assessment of the reasonably attainable volume of these fuels in 2019. These feedstocks are a likely source of additional supply of advanced biodiesel and renewable diesel that could contribute towards satisfying the difference between the reasonably attainable volume of these fuels and the 2.8 billion gallons of these fuels projected to be used to satisfy the advanced biofuel volume for 2019. We further note that even if the 130 million gallons of biodiesel and renewable diesel that could be produced from a

[105] For example, corn oil is a co-product of corn grown primarily for feed or ethanol production, while soy and canola are primarily grown as livestock feed.

[106] According to EIA data 6,230 million pounds of soy bean oil and 1,579 million pounds of corn oil were used to produce biodiesel in the U.S. in 2017. Other significant sources of feedstock were yellow grease (1,471 million pounds), canola oil (1,452 million pounds), and white grease (591 million pounds). Numbers from EIA's September 2018 Monthly Biodiesel Production Report.

[107] This position is supported by several commenters, including the South Dakota Soybean Association (EPA–HQ–OAR–2018–0167–0389), the International Council on Clean Transportation (EPA–HQ–OAR–2018–0167–0531), and the Union of Concerned Scientists (EPA–HQ–OAR–2018–0167–0535).

[108] To calculate this volume, we have used a conversion of 7.7 pounds of feedstock per gallon of biodiesel. This is based on the expected conversion of soybean oil (*http://extension.missouri.edu/p/G1990*), which is the largest source of feedstock used to produce advanced biodiesel and renewable diesel. Conversion rates for other types of vegetable oils used to produce biodiesel and renewable diesel are similar to those for soybean oil.

[109] *World Agricultural Supply and Demand Estimates.* United States Department of Agriculture. October 11, 2018.

[110] Hart, Chad and Schulz, Lee. *China's Importance in U.S. Ag Markets.* CARD Agricultural Policy Review. Available online: *https://www.card.iastate.edu/ag_policy_review/article/?a=41.*

[111] Durisin, Megan and Dodge, Sam. *Why Soybeans Are at the Heart of the U.S.-China Trade War.* Bloomberg. Published July 5, 2018. Updated July 9, 2018.

[112] Projected trade of oilseeds decreased from 63.46 million metric tons for 2018/2019 in the June 2018 WASDE report to 57.20 million metric tons for 2018/2019 in the October 2018 WASDE.

[113] To calculate the quantity of oil that can be produced from 2 million metric tons of oilseeds we converted this total to approximately 73 million bushels of soybeans, assuming 60 pounds per bushel. We then calculated that this quantity of soybeans could produce approximately 800 million pounds of oil assuming each bushel of soybeans produced 11 pounds of oil. To this, we added the approximately 220 million pounds (0.10 million metric tons) of decreased exports of vegetable oils for a total of 1.02 billion pounds of vegetable oils. Finally, we divided this total by 7.7 pounds of vegetable oil per gallon of biodiesel (or renewable diesel) to estimate that 130 million gallons of biodiesel and renewable diesel could be produced from these feedstocks. Support for the 7.7 pounds of vegetable oil per gallon of biodiesel conversion factor can be found here: *http://extension.missouri.edu/p/G1990. All other conversion factors are from* Irwin, S. ''The Value of Soybean Oil in the Soybean Crush: Further Evidence on the Impact of the U.S. Biodiesel Boom.'' *farmdoc daily* (7):169, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, September 14, 2017.

decrease in exports of oilseeds and vegetable oil from the U.S. in 2019 were included in our projection of the reasonably attainable volume of advanced biodiesel and renewable diesel, this projection would still be less than 2.8 billion gallons.

In addition to virgin vegetable oils, we also expect increasing volumes of distillers corn oil [114] to be available for use in 2019. The WASDE report does not project distillers corn oil production, so EPA must use an alternative source to project the growth in the production of this feedstock. For this final rule EPA is using results from the World Agricultural Economic and Environmental Services (WAEES) model to project the growth in the production of distillers corn oil.[115] In assessing the likely increase in the availability of distillers corn oil from 2018 to 2019, the authors of the WAEES model considered the impacts of an increasing adoption rate of distillers corn oil extraction technologies at domestic ethanol production facilities, as well as increased corn oil extraction rates enabled by advances in this technology. The WAEES model projects that production of distillers corn oil in 2018 will increase by approximately 120 million pounds from the 2017/2018 to the 2018/2019 agricultural marketing year. This quantity of feedstock could be used to produce approximately 15 million gallons of biodiesel or renewable diesel. We believe it is reasonable to use these estimates from the WAEES model for these purposes.

While much of the increase in advanced biodiesel and renewable diesel feedstocks produced in the U.S. from 2018 to 2019 is expected to come from virgin vegetable oils and distillers corn oil, increases in the supply of other sources of advanced biodiesel and renewable diesel feedstocks, such as biogenic waste oils, fats, and greases, may also occur. These increases, however, are expected to be modest, as many of these feedstocks that can be recovered economically are already being used to produce biodiesel or renewable diesel, or in other markets. In fact, the WAEES model projects an increase of only 5 million gallons in the volume of biodiesel produced from feedstocks other than soybean oil, canola oil, and distillers corn oil from 2018 to 2019.[116] Conversely, an assessment conducted by LMC in 2017 and submitted in comments on our proposed rule projected that the waste oil supply in the U.S. could increase by approximately 2.4 million metric tons from 2016 to 2022.[117] This estimate represents a growth rate of approximately 0.4 billion tons per year, or enough feedstock to produce approximately 115 million gallons of biodiesel and renewable diesel per year. This estimate, however, only accounts for potential sources of feedstock, and not for the economic viability of recovering waste oils. While we acknowledge that additional waste oils could be collected in 2019, these waste oils will only be collected if it is economically viable to do so. Neither the results of the WAEES model, nor the future prices of soybean oil,[118] suggest the prices for waste oils will increase to a level that will incentivize significantly more wasted oil collection in 2019 relative to previous years. We have therefore included an additional 5 million gallons of advanced biodiesel and renewable diesel from wasted oils in our assessment of the reasonably attainable volume for 2019, consistent with the results of the WAEES model.

In total, we expect that increases in feedstocks produced in the U.S. are sufficient to produce approximately 60 million more gallons of advanced biodiesel and renewable diesel in 2019 relative to 2018. This number includes 40 million gallons from increased vegetable oil production, 15 million gallons from increased corn oil production, and 5 million gallons from increased waste oil collection. This number does not include additional volumes related to decreases in exported volumes of soybeans to China as a result of tariffs and/or increased collection of waste oils. Decreased exports of soybeans and soybean oil, represent feedstocks diverted from use in other countries, while any increase in the collection of waste oils is highly uncertain. Our projection also does not consider factors which could potentially decrease the availability of advanced biofuel feedstocks that could be used to produce biodiesel or renewable diesel, such as an increase in the volume of vegetable oils used in food markets or other non-biofuel industries. In our 2018 final rule, we determined that 2.55 billion gallons of advanced biodiesel and renewable diesel were reasonably attainable in 2018,[119] therefore our projection of the reasonably attainable volume of advanced biodiesel and renewable diesel in 2019 is 2.61 billion gallons.

EPA's projections of the growth of advanced feedstocks does not, however, suggest that the total supply of advanced biodiesel and renewable diesel to the U.S. in 2018 will be limited to 2.61 billion gallons. Rather, this is the volume of these fuels that we project could be supplied while seeking to minimize quantities of advanced feedstocks or biofuels from existing uses. The October 2018 WASDE reports that production of vegetable oil in the U.S. in the 2018/2019 market year will be sufficient to produce approximately 3.5 billion gallons of biodiesel and renewable diesel (including both advanced and conventional biofuels) if the entire volume of vegetable oil was used to produce these fuels. Additional advanced biodiesel and renewable diesel could be produced from waste fats, oils, and greases. The global production of vegetable oil projected in the 2018/2019 marketing year would be sufficient to produce approximately 58.1 billion gallons of biodiesel and renewable diesel (including both advanced and conventional biofuels).[120] While it would not be reasonable to assume that all, or even a significant portion, of global vegetable oil production could be available to produce biodiesel or renewable diesel supplied to the U.S. for a number of reasons,[121] the large global supply of vegetable oil strongly suggests that under the right market conditions 2.8 billion gallons of advanced biodiesel and renewable diesel is attainable in 2019. Reaching these levels, however, may result in the diversion of advanced feedstocks currently used in other markets and/or the import of biodiesel and renewable diesel from these feedstocks.

Further, the supply of advanced biodiesel and renewable diesel to the U.S. in 2019 could be increased by

[114] Distillers corn oil is non-food grade corn oil produced by ethanol production facilities.

[115] For the purposes of this rule, EPA relied on WAEES modeling results submitted as comments by the National Biodiesel Board on the 2019 proposed rule (Kruse, J., ''Implications of an Alternative Advanced and Biomass Based Diesel Volume Obligation for Global Agriculture and Biofuels'', August 13, 2018, World Agricultural Economic and Environmental Services (WAEES)).

[116] Id.

[117] LMC International. *Global Waste Grease Supply.* August 2017.

[118] CME Group Soybean Oil Futures Quotes. Accessed online October 23, 2018.

[119] 82 FR 58512 (December 12, 2017).

[120] The October 2018 WASDE projects production of vegetable oils in 2018/19 in the U.S. and the World to be 12.27 and 203.33 million metric tons respectively. To convert projected vegetable oil production to potential biodiesel and renewable diesel production we have used a conversion of 7.7 pounds of feedstock per gallon of biodiesel.

[121] These reasons include the demand for vegetable oil in the food, feed, and industrial markets both domestically and globally; constraints related to the production, import, distribution, and use of significantly higher volumes of biodiesel and renewable diesel; and the fact that biodiesel and renewable diesel produced from much of the vegetable oil available globally would not qualify as an advanced biofuel under the RFS program.

approximately 150 million gallons if all of the exported volumes of these fuels were used domestically. Diverting this fuel to markets in the U.S. may be complicated, however, as doing so would likely require higher prices for these fuels in the U.S. (to divert the fuels from foreign markets that are presumably more profitable currently). It may also be more difficult and costly to distribute this additional volume of biodiesel and renewable diesel to domestic markets than the current foreign markets. Finally, reducing advanced biodiesel and renewable diesel exports may indirectly result in the decreased availability of imported volumes of these fuels, as other countries seek to replace volumes previously imported from the U.S.

EPA next considered potential changes in the imports of advanced biodiesel and renewable diesel produced in other countries. In previous years, significant volumes of foreign produced advanced biodiesel and renewable diesel have been supplied to markets in the U.S. (see Table IV.B.2–1 above). These significant imports were likely the result of a strong U.S. demand for advanced biodiesel and renewable diesel, supported by the RFS standards, the low carbon fuel standard (LCFS) in California, the biodiesel blenders tax credit, and the opportunity for imported biodiesel and renewable diesel to realize these incentives. As in 2018, we have not included the potential for increased volumes of imported advanced biodiesel and renewable diesel in our projection of the reasonably attainable volume for 2019. There is a far higher degree of uncertainty related to the availability and production of advanced biodiesel and renewable diesel in foreign countries, as this supply can be impacted by a number of unpredictable factors such as the imposition of tariffs and increased incentives for the use of these fuels in other countries (such as tax incentives or blend mandates). EPA also lacks the data necessary to determine the quantity of these fuels that would otherwise be produced and used in other countries, and thus the degree to which the RFS standards are simply diverting this fuel from use in other countries as opposed to incentivizing additional production.

The RFS requirements and California's LCFS are expected to continue to provide an incentive for imports of advanced biodiesel and renewable diesel in 2019. Several other factors, however, may negatively impact the volume of these fuels imported in 2019. In February 2018 the biodiesel blenders tax credit, which had expired at the end of 2016, was retroactively reinstated for biodiesel blended in 2017 but was not extended to apply to biodiesel blended in 2018 or 2019.[122] Perhaps more significantly, in December 2017 the U.S. International Trade Commission adopted tariffs on biodiesel imported from Argentina and Indonesia.[123] According to data from EIA,[124] no biodiesel was imported from Argentina or Indonesia since September 2017, after a preliminary decision to impose tariffs on biodiesel imported from these countries was announced in August 2017. Biodiesel imports from these countries were significant prior to the imposition of tariffs, accounting for over 550 million gallons in 2016 and approximately 290 million gallons in 2017.

Despite these tariffs, imports of biodiesel and renewable diesel have not ceased. From January to June 2018, biodiesel and renewable diesel imports (according to EIA data) are approximately 172 million gallons, suggesting an annual volume of approximately 390 million gallons if the current import rates and seasonal trends hold through the end of the year.[125] This suggests that imported volumes of advanced biodiesel and renewable diesel from countries other than Argentina and Indonesia may increase by approximately 100 million gallons in 2018 (from approximately 290 million gallons in 2017). However overall imports have not returned to the levels observed prior to the tariffs. At this time, the ultimate impact these tariffs will have on overall imports of advanced biodiesel and renewable diesel to the U.S. remains uncertain. It appears likely that imports of advanced biodiesel and renewable diesel from other countries not impacted by these tariffs will continue to increase, however these increases may not be sufficient to replace all of the biodiesel imported from Argentina and Indonesia in previous years by 2019.

In addition to EPA's assessment of the market's ability to produce, import, distribute, and use the 2.8 billion gallons of advanced biodiesel and renewable diesel projected to be used in 2019 to meet the advanced biofuel volume requirement, EPA compared the projected increase in these fuels to the increases observed in recent years. While each year's circumstances are unique, a projected increase comparable to pas increases further confirms that the volume is attainable. Domestic production of advanced biodiesel and renewable diesel in 2016 and 2017 was approximately 1.85 billion gallons, and is expected to increase to approximately 2.15 billion gallons in 2018 based on production data through September 2018. Of this total, approximately 150 million gallons of domestically produced biodiesel was exported in 2016 and 2017. If imported biodiesel and renewable diesel volumes continue to increase through 2019 by approximately 100 million gallons per year (to approximately 500 million gallons in 2019) domestic production would need to increase by approximately 300 million gallons in 2019 to reach a total advanced biodiesel and renewable diesel supply of 2.8 billion gallons by 2019.[126] This growth is attainable, as it is approximately equal to the increase in the domestic production of advanced biodiesel and renewable diesel from 2017 to 2018 (approximately 300 million gallons), and significantly lower than the rate of growth observed in previous years (for example the increase of 653 million gallons from 2012 to 2013 or the increase of 779 million gallons from 2015 to 2016). We note, however, that using this volume of advanced biodiesel and renewable diesel in the U.S. may result in the diversion of advanced biodiesel and renewable diesel and/or feedstocks used to produce these fuels, as advanced biodiesel and renewable diesel that is currently exported may instead be used in the U.S. and alternative sources for significant volumes of these fuels would need to be found.

After a careful consideration of the factors discussed above, EPA has determined that the 2.8 billion gallons of advanced biodiesel and renewable diesel projected needed to satisfy the implied statutory volume for non-cellulosic advanced biofuel in 2019 (4.5 billion gallons) are attainable. The total

[122] Bipartisan Budget Act of 2018, Public Law 115–123, 132 Stat. 64 sections 40406, 40407, and 40415 (2018).

[123] ''Biodiesel from Argentina and Indonesia Injures U.S. Industry, says USITC,'' Available online at: *https://www.usitc.gov/press_room/news_release/2017/er1205ll876.htm.*

[124] See ''U.S. Imports of Biodiesel'' available in docket EPA–HQ–OAR–2018–0167.

[125] See ''U.S. Imports of Biodiesel'' available in docket EPA–HQ–OAR–2018–0167 and ''Projecting Biodiesel and Renewable Diesel Production and Imports for 2018 (November 2018)'' Memorandum from Dallas Burkholder to EPA Docket EPA–HQ–OAR–2018–0167.

[126] This estimate assumes that the U.S. continues to export approximately 150 million gallons of biodiesel per year in 2019. Alternatively, if the U.S. consumes all domestically produced biodiesel and renewable diesel, rather than exporting any of this fuel, domestic production of advanced biodiesel and renewable diesel would have to increase by approximately 150 million gallons in 2019. This volume is approximately equal to the increase in the domestic production of advanced biodiesel and renewable diesel from 2018 to 2019, which we also believe is attainable.

production capacity of registered biodiesel and renewable diesel producers is significantly higher than 2.8 billion gallons, even if only those facilities that generated RINs for advanced biodiesel and renewable diesel in 2017 are considered (3.1 billion gallons). This volume (2.8 billion gallons) is only 200 million gallons higher than the total volume of biodiesel and renewable diesel supplied in 2016 (approximately 2.6 billion gallons), strongly suggesting that production capacity and the ability to distribute and use biodiesel and renewable diesel will not limit the supply of advanced biodiesel and renewable diesel to a volume below 2.8 billion gallons in 2018. Sufficient feedstocks are expected to be available to produce this volume of advanced biodiesel and renewable diesel in 2019, however doing so may result in some level of diversion of advanced feedstocks and/or advanced biodiesel and renewable diesel from existing uses. Finally, the increase in the production and import of advanced biodiesel and renewable diesel projected from 2018 to 2019 is comparable to (or has been exceeded) by the increases observed in recent years. While we do not believe it will be necessary, in the event that the supply of advanced biodiesel and renewable diesel falls short of the projected 2.8 billion gallons in 2019, obligated parties could rely on the significant volume of carryover advanced RINs projected to be available in 2019 (See Section II.B for a further discussion of carryover RINs).

C. Volume Requirement for Advanced Biofuel

In exercising the cellulosic waiver authority for 2017 and earlier, we determined it was appropriate to require a partial backfilling of missing cellulosic volumes with volumes of non-cellulosic advanced biofuel we determined to be reasonably attainable, notwithstanding the increase in costs associated with those decisions.[127] For the 2018 standards, in contrast, we placed a greater emphasis on cost considerations in the context of balancing the various considerations, ultimately concluding that the applicable volume requirement should be based on the maximum reduction permitted under the cellulosic waiver authority. For 2019 we concluded that while it may be possible that more than 4.92 billion gallons of advanced biofuel is attainable in 2019, requiring additional volumes would lead to higher costs, and would likely result in feedstock switching and/or diversion of foreign advanced biofuels.[128] We do not believe that it would be appropriate to set the advanced biofuel volume requirement higher than 4.92 billion gallons given that it could lead to these results.

We further note that while there is some uncertainty in the volume of advanced biofuel that may be attainable or reasonably attainable, even if greater volumes of advanced biofuel are attainable or reasonably attainable, the high cost of these fuels provides sufficient justification for our decision to reduce the advanced biofuel volume for 2019 by the maximum amount under the cellulosic waiver authority. In Section V we present illustrative cost projections for sugarcane ethanol and soybean biodiesel in 2019, the two advanced biofuels that would be most likely to provide the marginal increase in volumes of advanced biofuel in 2019 in comparison to 2018. Sugarcane ethanol results in a cost increase compared to gasoline that ranges from $0.39–$1.04 per ethanol-equivalent gallon. Soybean biodiesel results in a cost increase compared to diesel fuel that ranges from $0.74–$1.23 per ethanol-equivalent gallon. The cost of these renewable fuels is high as compared to the petroleum fuels they displace.

Based on the information presented above, we believe that 4.92 billion gallons of advanced biofuel is attainable in 2019. After a consideration of the projected volume of cellulosic biofuel and reasonably attainable volumes of imported sugarcane ethanol and other advanced biofuels, we determined that 2.8 billion gallons of advanced biodiesel and renewable diesel would be needed to reach 4.92 billion gallons of advanced biofuel. Based on a review of the factors relevant to the supply of advanced biodiesel and renewable diesel as discussed in Section IV.B.2 above, including historic production and import data, the production capacity of registered biodiesel and renewable diesel producers, and the availability of advanced feedstocks, we have determined that 2.8 billion gallons of advanced biodiesel and renewable diesel is attainable in 2019.

However, we also acknowledge that 2.8 billion gallons of advanced biodiesel and renewable diesel is higher than the approximately 2.5 billion gallons projected to be supplied in 2018 based on available data through September 2018. While 2.8 billion gallons would require an increase in supply of approximately 300 million gallons between 2018 and 2019, this is approximately equal to the increase in domestic production of these fuels from 2017 to 2018, and approximately 100 million gallons less than the increase in the supply of advanced biodiesel and renewable diesel between 2017 and 2018 after adjusting for imported volumes of these fuels from Argentina and Indonesia in 2017.[129] Nevertheless, there is some uncertainty regarding whether the market will actually supply 2.8 billion gallons in 2019.

In the event that the market does not supply this volume, the carryover RIN bank represents a source of RINs that could help obligated parties meet an advanced biofuel volume requirement of 4.92 billion gallons in 2019 if the market fails to supply sufficient advanced biofuels in 2019. As discussed in greater detail in Section II.B.1 of the preamble, carryover RINs provide obligated parties compliance flexibility in the face of substantial uncertainties in the transportation fuel marketplace, and provide a liquid and well-functioning RIN market upon which success of the entire program depends. We currently estimate that there are approximately 620 million advanced carryover RINs available.

In response to the proposal, we received comments supporting our proposed volume requirement of 4.92 billion gallons, as well as comments requesting higher or lower volumes. EPA's assessment of these comments is provided in the RTC document.

It should be noted that by exercising the full cellulosic waiver authority for advanced biofuel, the implied statutory volume target for non-cellulosic advanced biofuel of 4.5 billion gallons in 2019 would be maintained. This represents an increase of 0.5 billion gallons from the 2018 volume requirements.

[127] See, *e.g.,* Renewable Fuel Standards for 2014, 2015 and 2016, and the Biomass-Based Volume for 2017: Response to Comments (EPA–420–R–15–024, November 2015), pages 628–631, available in docket EPA–HQ–OAR–2015–0111–3671.

[128] There will likely be some feedstock switching and/or diversion of foreign advanced biofuels to achieve an advanced biofuel volume of 4.92 billion gallons. However, further reductions in the advanced biofuel volume requirement would require the use of the general waiver authority, which we do not believe is warranted.

[129] To calculate the increase in the supply of advanced biodiesel and renewable diesel between 2017 and 2018 after adjusting for imported volumes of these fuels from Argentina and Indonesia in 2017, we subtracted the volume of biodiesel imported from Argentina and Indonesia in 2017 from the total volume of these fuels supplied in 2017 and compared this volume of advanced biodiesel and renewable diesel supplied in 2018. There have been no imports of biodiesel from Argentina and Indonesia since August 2017, when tariffs on biodiesel imported from these countries were announced.

D. Volume Requirement for Total Renewable Fuel

As discussed in Section II.A.1, we believe that the cellulosic waiver provision is best interpreted to reduce the advanced biofuel and total renewable fuel volumes by equal amounts. For the reasons we have previously articulated, we believe this interpretation is consistent with the statutory language and best effectuates the objectives of the statute. If we were to reduce the total renewable fuel volume requirement by a lesser amount than the advanced biofuel volume requirement, we would effectively increase the opportunity for conventional biofuels to participate in the RFS program beyond the implied statutory volume of 15 billion gallons. Applying an equal reduction of 8.12 billion gallons to both the statutory target for advanced biofuel and the statutory target for total renewable fuel results in a total renewable fuel volume of 19.92 billion gallons as shown in Table IV.A–1.[130] This volume of total renewable fuel results in an implied volume of 15 billion gallons of conventional fuel, which is the same as in the 2018 final rule.

In response to the July 10, 2018 proposal, some stakeholders said that EPA had not evaluated whether 19.92 billion gallons of total renewable fuel was attainable as it did for advanced biofuel. As a result, they indicated that EPA had not fulfilled its responsibilities under the statute and had not given stakeholders meaningful opportunity to evaluate the proposed volume requirement. In response, we note first of all that we proposed, and are finalizing, the maximum reduction possible under the cellulosic waiver authority, and thus no additional reductions are possible under that authority. Secondly, while the general waiver authority does provide a means for further reductions in the applicable volume requirement for total renewable fuel, the record before us does not indicate that a waiver is warranted as described in Section II of the RTC.

Notwithstanding the fact that we did not propose to use, and in this final rule are not using the general waiver authority, we did in fact provide a description of the ways in which the market could make 19.92 billion gallons volume of total renewable fuel available in 2019 in a memorandum to the docket.[131] Some stakeholders pointed specifically to a lack of any analysis of the volumes of E0, E15, and E85 as a reason that the assessment in that memorandum was insufficient. However, the supply and use of these gasoline-ethanol blends is strongly influenced by consumer demand. We noted in the proposal that, regardless of the outcome of such an assessment, we were precluded from waiving volumes due to inadequate domestic supply insofar as our assessment depended on a consideration of demand-side factors.

More importantly, an analysis of the volumes of E0, E15, and E85 that could be supplied in 2019 was not necessary to determine whether the volume requirement of 19.92 billion gallons could be reached.[132] This is because it is the total volume of ethanol that can be consumed that is the relevant consideration in evaluating the reasonableness of 19.92 billion gallons, not the specific volumes of E0, E15, and E85.[133] To this end, we began with the assumption that the nationwide average ethanol concentration could reach 10.11 percent in 2019 because it had reached this same level in 2017. In the context of a market wherein nearly all gasoline contains 10 percent ethanol, the average ethanol concentration provides a better indication of the net effect of all E0, E15, and E85 without the need to estimate the volumes of each. In essence, our assumption that the average ethanol concentration would be at least 10.11 percent provided a surrogate for attempting to separately estimate volumes of E0, E15, and E85, which would contain a high degree of uncertainty. Thus, as a result our use of the average ethanol content is both more straightforward and more robust. In addition to a consideration of the volumes of non-ethanol renewable fuel that could be available in 2019, our consideration of 10.13 percent nationwide average ethanol concentration led us to a proposed determination that the market could make available 19.88 billion gallons of total renewable fuel in 2019. Following this same approach, the updated market impacts for this final rule similarly demonstrates that the market can make available 19.92 billion gallons of total renewable fuel in 2019.

V. Impacts of 2019 Volumes on Costs

In this section, EPA presents its assessment of the illustrative costs of the final 2019 RFS rule. It is important to note that these illustrative costs do not attempt to capture the full impacts of this final rule. We frame the analyses we have performed for this rule as ‘‘illustrative’’ so as not to give the impression of comprehensive estimates. These estimates are provided for the purpose of showing how the cost to produce a gallon of a ‘‘representative’’ renewable fuel compares to the cost of petroleum fuel. There are a significant number of caveats that must be considered when interpreting these illustrative cost estimates. For example, there are many different feedstocks that could be used to produce biofuels, and there is a significant amount of heterogeneity in the costs associated with these different feedstocks and fuels. Some renewable fuels may be cost competitive with the petroleum fuel they replace; however, we do not have cost data on every type of feedstock and every type of fuel. Therefore, we do not attempt to capture this range of potential costs in our illustrative estimates.

Illustrative cost estimates are provided below for this final rule. The volumes for which we have provided cost estimates and are described in Sections III and IV, and result from reducing the cellulosic, advanced, and total renewable fuel volume requirements using the cellulosic waiver authority under CAA section 211(o)(7)(D)(i). For this rule we examine two different cases. In the first case, we provide illustrative cost estimates by comparing the final 2019 renewable fuel volumes to 2019 statutory volumes. In the second case, we examine the final 2019 renewable fuel volumes to the final 2018 renewable fuel volumes to estimate changes in the annual costs of the final 2019 RFS volumes in comparison to the 2018 volumes.

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[130] EPA also considered the availability of carryover RINs in determining whether reduced use of the cellulosic waiver authority would be warranted. For the reasons described in Section II.B, we do not believe this to be the case.

[131] ‘‘Updated market impacts of biofuels in 2019,’’ memorandum from David Korotney to docket EPA–HQ–OAR–2018–0167. In prior actions including the 2019 proposed rule and the 2018 annual rule proposal, similar analyses indicated that the market was capable of both producing and consuming the required volume of renewable fuels, and that as a result there was no basis for finding an inadequate domestic supply of total renewable fuel. See 82 FR 34229 & n.82 (July 21, 2017). Given the D.C. Circuit's decision in *ACE,* however, assessment of demand-side constraints is no longer relevant for determining inadequate domestic supply. However, we believe consideration of the ways that the market could make this volume available may still be generally relevant to whether and how EPA exercises its waiver authorities, such as our consideration of whether the volumes will cause severe economic harm.

[132] Cf. *API,* 706 F.3d at 481 (‘‘Nothing in the text of § 7545(o)(7)(D)(i), or any other applicable provision of the Act, plainly requires EPA to support its decision not to reduce the applicable volume of advanced biofuels with specific numerical projections.’’).

[133] Importantly, EPA is not requiring the use of any specific ethanol blend; rather, the market chooses which biofuels and blends to use to satisfy the biofuel standards. See 42 U.S.C. 7545(o)(2)(A)(iii)(II)(bb) (the RFS program ‘‘shall not’’ ‘‘impose any per-gallon obligation for the use of renewable fuel’’).

A. Illustrative Costs Analysis of Exercising the Cellulosic Waiver Authority Compared to the 2019 Statutory Volumes Baseline

In this section, EPA provides illustrative cost estimates that compare the final 2019 cellulosic biofuel volume requirements to the 2019 cellulosic statutory volume that would be required absent the exercise of our cellulosic waiver authority under CAA section 211(o)(7)(D)(i).[134] As described in Section III, we are finalizing a cellulosic volume of 418 million gallons for 2019, using our cellulosic waiver authority to waive the statutory cellulosic volume of 8.5 billion gallons by 8.082 billion gallons. Estimating the cost savings from volumes that are not projected to be produced is inherently challenging. EPA has taken the relatively straightforward methodology of multiplying this waived cellulosic volume by the wholesale per-gallon costs of cellulosic biofuel production relative to the petroleum fuels they displace.

While there may be growth in other cellulosic renewable fuel sources, we believe it is appropriate to use cellulosic ethanol produced from corn kernel fiber as the representative cellulosic renewable fuel. The majority of liquid cellulosic biofuel in 2019 is expected to be produced using this technology, and application of this technology in the future could result in significant incremental volumes of cellulosic biofuel. In addition, as explained in Section III, we believe that production of the major alternative cellulosic biofuel—CNG/LNG derived from biogas—is limited to approximately 538 million gallons due to a limitation in the number of vehicles capable of using this form of fuel.[135]

EPA uses a ''bottom-up'' engineering cost analysis to quantify the costs of producing a gallon of cellulosic ethanol derived from corn kernel fiber. There are multiple processes that could yield cellulosic ethanol from corn kernel fiber. EPA assumes a cellulosic ethanol production process that generates biofuel using distiller's grains, a co-product of generating corn starch ethanol that is commonly dried and sold into the feed market as distillers dried grains with solubles (DDGS), as the renewable biomass feedstock. We assume an enzymatic hydrolysis process with cellulosic enzymes to break down the cellulosic components of the distiller's grains. This process for generating cellulosic ethanol is similar to approaches currently used by industry to generate cellulosic ethanol at a commercial scale, and we believe these cost estimates are likely representative of the range of different technology options being developed to produce ethanol from corn kernel fiber. We then compare the per-gallon costs of the cellulosic ethanol to the petroleum fuels that would be replaced at the wholesale stage, since that is when the two are blended together.

These cost estimates do not consider taxes, retail margins, or other costs or transfers that occur at or after the point of blending (transfers are payments within society and are not additional costs). We do not attempt to estimate potential cost savings related to avoided infrastructure costs (*e.g.,* the cost savings of not having to provide pumps and storage tanks associated with higher-level ethanol blends). When estimating per-gallon costs, we consider the costs of gasoline on an energy-equivalent basis as compared to ethanol, since more ethanol gallons must be consumed to travel the same distance as on gasoline due to the ethanol's lower energy content.

Table V.A–1 below presents the cellulosic fuel cost savings with this final rule that are estimated using this approach.[136] The per-gallon cost difference estimates for cellulosic ethanol ranges from $0.27–$2.80 per ethanol-equivalent gallon.[137] Given that cellulosic ethanol production is just starting to become commercially available, the cost estimates have a significant range. Multiplying those per-gallon cost differences by the amount of cellulosic biofuel waived in this final rule results in approximately $2.2–$23 billion in cost savings.

TABLE V.A–1—ILLUSTRATIVE COSTS OF EXERCISING THE CELLULOSIC WAIVER AUTHORITY COMPARED TO THE 2019 STATUTORY VOLUMES BASELINE

Cellulosic Volume Required (Million Ethanol-Equivalent Gallons)	418
Change in Required Cellulosic Biofuel from 2019 Statutory Volume (Million Ethanol-Equivalent Gallons)	(8,082)
Cost Difference Between Cellulosic Corn Kernel Fiber Ethanol and Gasoline Per Gallon ($/Ethanol-Equivalent Gallons) [138]	$0.27–$2.80
Annual Change in Overall Costs (Million $) [139]	$(2,200)–$(23,000)

B. Illustrative Costs of the 2019 Volumes Compared to the 2018 RFS Volumes Baseline

In this section, we provide illustrative cost estimates for EPA exercising its cellulosic waiver authority to reduce statutory cellulosic volumes for 2019 (with corresponding reductions to the advanced and total renewable fuel volumes) compared to the final 2018 RFS volumes. This results in an increase in cellulosic volumes for the 2019 RFS of 130 gallons (ethanol-equivalent) and an increase in the non-cellulosic advanced biofuel volumes for 2019 of 500 million gallons (ethanol-equivalent).

1. Cellulosic Biofuel

We anticipate that the increase in the final 2019 cellulosic biofuel volumes would be composed of 5 million gallons of liquid cellulosic biofuel and 125

[134] Since the implied non-cellulosic advanced biofuel and implied conventional renewable fuel volumes are unchanged from the statutory implied volumes, see supra note, there is no need to estimate cost impacts for these volumes.

[135] EPA projects that 538 million ethanol-equivalent gallons of CNG/LNG will be used as transportation fuel in 2019 based on EIA's October 2018 Short Term Energy Outlook (STEO). To calculate this estimate, EPA used the Natural Gas Vehicle Use from the STEO Custom Table Builder (0.12 billion cubic feet/day in 2019). This projection includes all CNG/LNG used as transportation fuel from both renewable and non-renewable sources. EIA does not project the amount of CNG/LNG from biogas used as transportation fuel. To convert billion cubic feet/day to ethanol-equivalent gallons EPA used conversion factors of 946.5 BTU per cubic foot of natural gas (lower heating value, per calculations using ASTM D1945 and D3588) and 77,000 BTU of natural gas per ethanol-equivalent gallon per 40 CFR 80.1415(b)(5).

[136] Details of the data and assumptions used can be found in a Memorandum available in the docket entitled ''Cost Impacts of the Final 2019 Annual Renewable Fuel Standards'', Memorandum from Michael Shelby, Dallas Burkholder, and Aaron Sobel available in docket EPA–HQ–OAR–2018–0167.

[137] For the purposes of the cost estimates in this section, EPA has not attempted to adjust the price of the petroleum fuels to account for the impact of the RFS program, since the changes in the renewable fuel volume are relatively modest. Rather, we have simply used the wholesale price projections for gasoline and diesel as reported in EIA's October 2018 STEO.

[138] For this table and all subsequent tables in this section, approximate costs in per gallon cost difference estimates are rounded to the cents place.

[139] For this table and all subsequent tables in this section, approximate resulting costs (other than in per-gallon cost difference estimates) are rounded to two significant figures.

million gallons of CNG/LNG derived from landfill biogas. Based upon the methodology outlined in Section V.A, we use corn kernel fiber as the representative liquid cellulosic biofuel to develop cost estimates of cellulosic ethanol. We estimate a cost difference between cellulosic corn fiber-derived ethanol and gasoline of $0.27–$2.80 on an ethanol-equivalent gallon basis. Next, the per-gallon costs of cellulosic renewable fuel are multiplied by the 5 million gallon increase between the final 2019 cellulosic volume and the final 2018 cellulosic RFS volume requirements to estimate the total costs from the increase in cellulosic ethanol.

For CNG/LNG-derived cellulosic biogas, we provide estimates of the cost of displacing natural gas with CNG/LNG derived from landfill biogas to produce 125 million ethanol-equivalent gallons of cellulosic fuel. To estimate the cost of production of CNG/LNG derived from landfill gas (LFG), EPA uses Version 3.2 of the Landfill Gas Energy Cost Model, or LFG cost-Web. EPA ran the financial cost calculator for projects with a design flow rate of 1,000 and 10,000 cubic feet per minute with the suggested default data. The costs estimated for this analysis exclude any pipeline costs to transport the pipeline quality gas, as well as any costs associated with compressing the gas to CNG/LNG. These costs are not expected to differ significantly between LFG or natural gas. In addition, the cost estimates excluded the gas collection and control system infrastructure at the landfill, as EPA expects that landfills that begin producing high BTU gas in 2019 are very likely to already have this infrastructure in place.[140]

To estimate the illustrative cost impacts of the change in CNG/LNG derived from LFG, we compared the cost of production of CNG/LNG derived from LFG in each case to the projected price for natural gas in 2019 in EIA's October 2018 STEO.[141] Finally, we converted these costs to an ethanol-equivalent gallon basis. The resulting cost estimates are shown in Table V.B.2–1. Adding the cost of cellulosic ethanol to the costs of CNG/LNG landfill gas, the total costs of the final 2019 cellulosic volume compared to 2018 RFS cellulosic volume range from $(2.9)–$23 million.

2. Advanced Biofuel

EPA provides a range of illustrative cost estimates for the increases in the advanced standard of 500 million ethanol-equivalent gallons using two different advanced biofuels. In the first scenario, we assume that all the increase in advanced biofuel volumes is comprised of soybean oil BBD. In the second scenario, we assume that all the increase in the advanced volume is comprised of sugarcane ethanol from Brazil.

Consistent with the analysis in previous annual RFS volume rules, a ''bottom-up'' engineering cost analysis is used that quantifies the costs of producing a gallon of soybean-based biodiesel and then compares that cost to the energy-equivalent gallon of petroleum-based diesel. We compare the cost of biodiesel and diesel fuel at the wholesale stage, since that is when the two are blended together and represents the approximate costs to society absent transfer payments and any additional infrastructure costs. On this basis, EPA estimates the costs of producing and transporting a gallon of biodiesel to the blender in the U.S.

To estimate the illustrative costs of sugarcane ethanol, we compare the cost of sugarcane ethanol and gasoline at the wholesale stage, since that is when the two are blended together and represents the approximate costs to society absent transfer payments and any additional infrastructure costs (*e.g.,* blender pumps). On this basis, EPA estimates the costs of producing and transporting a gallon of sugarcane ethanol to the blender in the U.S. More background information on the cost assessment described in this Section, including details of the data sources used and assumptions made for each of the scenarios, can be found in a Memorandum available in the docket.[142]

Table V.B.2–1 below also presents estimates of per energy-equivalent gallon costs for producing: (1) Soybean biodiesel (in ethanol-equivalent gallons) and (2) Brazilian sugarcane ethanol, relative to the petroleum fuels they replace at the wholesale level. For each of the fuels, these per-gallon costs are then multiplied by the increase in the 2019 non-cellulosic advanced volume relative to the 2018 final advanced standard volume to obtain an overall cost increase of $190–$610 million.

In addition, in Table V.B.2–1, we also present estimates of the total cost of this final rule relative to 2018 RFS fuel volumes. We add the increase in cost of the final 2019 cellulosic standard volume, $(2.9)–$23 million, with the additional costs of the increase in non-cellulosic advanced biofuel volumes resulting from the final 2019 advanced standard volume, $190–$610 million. The overall total costs of this final rule range from $190–$630 million (after rounding to two significant figures).

TABLE V.B.2–1—ILLUSTRATIVE COSTS OF THE 2019 VOLUMES COMPARED TO THE 2018 RFS VOLUMES BASELINE

Cellulosic Volume	
Corn Kernel Fiber Cellulosic Ethanol Costs:	
Cost Difference Between Cellulosic Corn Kernel Fiber Ethanol and Gasoline Per Gallon ($/Ethanol-Equivalent Gallons)	$0.27–$2.80
Change in Volume (Million Ethanol-Equivalent Gallons)	5
Annual Increase in Overall Costs (Million $)	$1.4–$14
CNG/LNG Derived from Biogas Costs:	
Cost Difference Between CNG/LNG Derived from Landfill Biogas and Natural Gas Per Gallon ($/Ethanol-Equivalent Gallons)	$(0.03)–$0.07
Change in Volume (Million Ethanol-Equivalent Gallons)	125
Annual Increase in Overall Costs (Million $)	$(4.3)–$9.0
Range of Annual Increase in Costs with Cellulosic Volume (Million $)	$(2.9)–$23

[140] Details of the data and assumptions used can be found in a Memorandum available in the docket entitled ''Cost Impacts of the Final 2019 Annual Renewable Fuel Standards'', Memorandum from Michael Shelby, Dallas Burkholder, and Aaron Sobel available in docket EPA–HQ–OAR–2018–0167.

[141] Henry Hub Spot price estimate for 2019. EIA, Short Term Energy Outlook (STEO) available in docket EPA–HQ–OAR–2018–0167.

[142] Details of the data and assumptions used can be found in a Memorandum available in the docket entitled ''Cost Impacts of the Final 2019 Annual Renewable Fuel Standards'', Memorandum from Michael Shelby, Dallas Burkholder, and Aaron Sobel available in docket EPA–HQ–OAR–2018–0167.

TABLE V.B.2–1—ILLUSTRATIVE COSTS OF THE 2019 VOLUMES COMPARED TO THE 2018 RFS VOLUMES BASELINE—Continued

Advanced Volume	
Soybean Biodiesel Scenario:	
Cost Difference Between Soybean Biodiesel and Petroleum Diesel Per Gallon ($/Ethanol-Equivalent Gallons)	$0.74–$1.23
Change in Volume (Million Ethanol-Equivalent Gallons)	500
Annual Increase in Overall Costs (Million $)	$370–$610
Brazilian Sugarcane Ethanol Scenario:	
Cost Difference Between Sugarcane Ethanol and Gasoline Per Gallon ($/Ethanol-Equivalent Gallons)	$0.39–$1.04
Change in Volume (Million Ethanol-Equivalent Gallons)	500
Annual Increase in Overall Costs (Million $)	$190–$520
Range of Annual Increase in Overall Costs with Non-Cellulosic Advanced Volume (Million $)	$190–$610
Cellulosic and Advanced Volumes	
Range of Annual Increase in Overall Costs with Cellulosic and Advanced Volume (Million $) [143]	$190–$630

The annual volume-setting process encourages consideration of the RFS program on a piecemeal (*i.e.,* year-to-year) basis, which may not reflect the full, long-term costs and benefits of the program. For the purposes of this final rule, other than the estimates of costs of producing a ''representative'' renewable fuel compared to cost of petroleum fuel, EPA did not quantitatively assess other direct and indirect costs or benefits of changes in renewable fuel volumes. These direct and indirect costs and benefits may include infrastructure costs, investment, climate change impacts, air quality impacts, and energy security benefits, which all are to some degree affected by the annual volumes. For example, we do not have a quantified estimate of the lifecycle GHG or energy security benefits for a single year (*e.g.,* 2019). Also, there are impacts that are difficult to quantify, such as rural economic development and employment changes from more diversified fuel sources, that are not quantified in this rulemaking. While some of these impacts were analyzed in the 2010 final rulemaking that established the current RFS program,[144] we have not analyzed these impacts for the 2019 volume requirements.

VI. Biomass-Based Diesel Volume for 2020

In this section we discuss the BBD applicable volume for 2020. We are setting this volume in advance of those for other renewable fuel categories in light of the statutory requirement in CAA section 211(o)(2)(B)(ii) to establish the applicable volume of BBD for years after 2012 no later than 14 months before the applicable volume will apply. We are not at this time setting the BBD percentage standards that would apply to obligated parties in 2020 but intend to do so in late 2019, after receiving EIA's estimate of gasoline and diesel consumption for 2020. At that time, we will also set the percentage standards for the other renewable fuel types for 2020. Although the BBD applicable volume sets a floor for required BBD use, because the BBD volume requirement is nested within both the advanced biofuel and the total renewable fuel volume requirements, any BBD produced beyond the mandated 2020 BBD volume can be used to satisfy both of these other applicable volume requirements.

A. Statutory Requirements

The statute establishes applicable volume targets for years through 2022 for cellulosic biofuel, advanced biofuel, and total renewable fuel. For BBD, applicable volume targets are specified in the statute only through 2012. For years after those for which volumes are specified in the statute, EPA is required under CAA section 211(o)(2)(B)(ii) to determine the applicable volume of BBD, in coordination with the Secretary of Energy and the Secretary of Agriculture, based on a review of the implementation of the program during calendar years for which the statute specifies the volumes and an analysis of the following factors:

1. The impact of the production and use of renewable fuels on the environment, including on air quality, climate change, conversion of wetlands, ecosystems, wildlife habitat, water quality, and water supply;
2. The impact of renewable fuels on the energy security of the United States;
3. The expected annual rate of future commercial production of renewable fuels, including advanced biofuels in each category (cellulosic biofuel and BBD);
4. The impact of renewable fuels on the infrastructure of the United States, including deliverability of materials, goods, and products other than renewable fuel, and the sufficiency of infrastructure to deliver and use renewable fuel;
5. The impact of the use of renewable fuels on the cost to consumers of transportation fuel and on the cost to transport goods; and
6. The impact of the use of renewable fuels on other factors, including job creation, the price and supply of agricultural commodities, rural economic development, and food prices.

The statute also specifies that the volume requirement for BBD cannot be less than the applicable volume specified in the statute for calendar year 2012, which is 1.0 billion gallons.[145] The statute does not, however, establish any other numeric criteria, or provide any guidance on how the EPA should weigh the importance of the often competing factors and the overarching goals of the statute when the EPA sets the applicable volumes of BBD in years after those for which the statute specifies such volumes. In the period 2013–2022, the statute specifies increasing applicable volumes of cellulosic biofuel, advanced biofuel, and total renewable fuel, but provides no guidance, beyond the 1.0 billion gallon minimum, on the level at which BBD volumes should be set.

In establishing the BBD and cellulosic standards as nested within the advanced biofuel standard, Congress clearly intended to support development of BBD and especially cellulosic biofuels, while also providing an incentive for the growth of other non-specified types of advanced biofuels. In general, the advanced biofuel standard provides an

[143] Summed costs are presented using two significant figures.

[144] RFS2 Regulatory Impact Analysis (RIA). U.S. EPA 2010, Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis. EPA–420–R–10–006. February 2010. Docket EPA–HQ–OAR–2009–0472–11332.

[145] See CAA section 211(o)(2)(B)(v).

opportunity for other advanced biofuels (advanced biofuels that do not qualify as cellulosic biofuel or BBD) to compete with cellulosic biofuel and BBD to satisfy the advanced biofuel standard after the cellulosic biofuel and BBD standards have been met.

B. Review of Implementation of the Program and the 2020 Applicable Volume of Biomass-Based Diesel

One of the primary considerations in determining the BBD volume for 2020 is a review of the implementation of the program to date, as it affects BBD. This review is required by the CAA, and also provides insight into the capabilities of the industry to produce, import, export, and distribute BBD. It also helps us to understand what factors, beyond the BBD standard, may incentivize the production and import of BBD. Table VI.B.1–1 below shows, for 2011–2017, the number of BBD RINs generated, the number of RINs retired due to export, the number of RINs retired for reasons other than compliance with the annual BBD standards, and the consequent number of available BBD RINs; and for 2011–2019, the BBD and advanced biofuel standards.

TABLE VI.B.1–1—BIOMASS-BASED DIESEL (D4) RIN GENERATION AND ADVANCED BIOFUEL AND BIOMASS-BASED DIESEL STANDARDS IN 2011–2019

[Million RINs or gallons][146]

	BBD RINs generated	Exported BBD (RINs)	BBD RINs retired, non-compliance reasons	Available BBD RINs[a]	BBD standard (gallons)	BBD standard (RINs)	Advanced biofuel standard (RINs)
2011	1,692	110	98	1,483	800	1,200	1,350
2012	1,737	183	90	1,465	1,000	1,500	2,000
2013	2,739	298	101	2,341	1,280	1,920	2,750
2014	2,710	126	92	2,492	1,630	[b] 2,490	2,670
2015	2,796	133	32	2,631	1,730	[b] 2,655	2,880
2016	4,008	203	52	3,753	1,900	2,850	3,610
2017	3,849	244	35	3,570	2,000	3,000	4,280
2018[c]	3,898	154	40	3,740	2,100	3,150	4,290
2019	N/A	N/A	N/A	N/A	2,100	3,150	4,920

[a] Available BBD RINs may not be exactly equal to BBD RINs Generated minus Exported RINs and BBD RINs Retired, Non-Compliance Reasons, due to rounding.

[b] Each gallon of biodiesel qualifies for 1.5 RINs due to its higher energy content per gallon than ethanol. Renewable diesel qualifies for between 1.5 and 1.7 RINs per gallon, but generally has an equivalence value of 1.7. While some fuels that qualify as BBD generate more than 1.5 RINs per gallon, EPA multiplies the required volume of BBD by 1.5 in calculating the percent standard per 80.1405(c). In 2014 and 2015 however, the number of RINs in the BBD Standard column is not exactly equal to 1.5 times the BBD volume standard as these standards were established based on actual RIN generation data for 2014 and a combination of actual data and a projection of RIN generation for the last three months of the year for 2015, rather than by multiplying the required volume of BBD by 1.5. Some of the volume used to meet the BBD standard in these years was renewable diesel, with an equivalence value higher than 1.5.

[c] ''2018 BBD RINs generated,'' ''Exported BBD,'' and ''BBD RINs retired, Non-Compliance Reasons'' are projected based on data through September 2018.

In reviewing historical BBD RIN generation and use, we see that the number of RINs available for compliance purposes exceeded the volume required to meet the BBD standard in 2011, 2012, 2013, 2016 and 2017. Additional production and use of biodiesel was likely driven by a number of factors, including demand to satisfy the advanced biofuel and total renewable fuels standards, the biodiesel tax credit,[147] and favorable blending economics. The number of RINs available in 2014 and 2015 was approximately equal to the number required for compliance in those years, as the standards for these years were finalized at the end of November 2015 and EPA's intent at that time was to set the standards for 2014 and 2015 to reflect actual BBD use.[148] In 2016, with RFS standards established prior to the beginning of the year and the blenders tax credit in place, available BBD RINs exceeded the volume required by the BBD standard by 859 million RINs (30 percent). In 2017, the RFS standards were established prior to the beginning of the year, and the blenders tax credit was only applied retroactively; even without the certainty of a tax credit, the available BBD RINs exceeded the volume required by the BBD standard by 570 million RINs (19 percent). Extrapolated data for 2018 also indicates that available BBD RINs will exceed the BBD standard. This indicates that in certain circumstances there is demand for BBD beyond the required volume of BBD. We also note that while EPA has consistently established the required volume in such a way as to allow non-BBD fuels to compete for market share in the advanced biofuel category, since 2016 the vast majority of non-cellulosic advanced biofuel used to satisfy the advanced biofuel obligations has been BBD.

The prices paid for advanced biofuel and BBD RINs beginning in early 2013 through September 2018 (the last month for which data are available) also support the conclusion that advanced biofuel and/or total renewable fuel standards provide a sufficient incentive for additional biodiesel volume beyond what is required by the BBD standard. Because the BBD standard is nested within the advanced biofuel and total renewable fuel standards, and therefore can help to satisfy three RVOs, we would expect the price of BBD RINs to exceed that of advanced and conventional renewable RINs.[149] If,

[146] Available BBD RINs Generated, Exported BBD RINs, and BBD RINs Retired for Non-Compliance Reasons information from EMTS.

[147] The biodiesel tax credit was reauthorized in January 2013. It applied retroactively for 2012 and for the remainder of 2013. It was once again extended in December 2014 and applied retroactively to all of 2014 as well as to the remaining weeks of 2014. In December 2015 the biodiesel tax credit was authorized and applied retroactively for all of 2015 as well as through the end of 2016. In February 2018 the biodiesel tax credit was authorized and applied retroactively for all of 2017.

[148] See 80 FR 77490–92, 77495 (December 14, 2015).

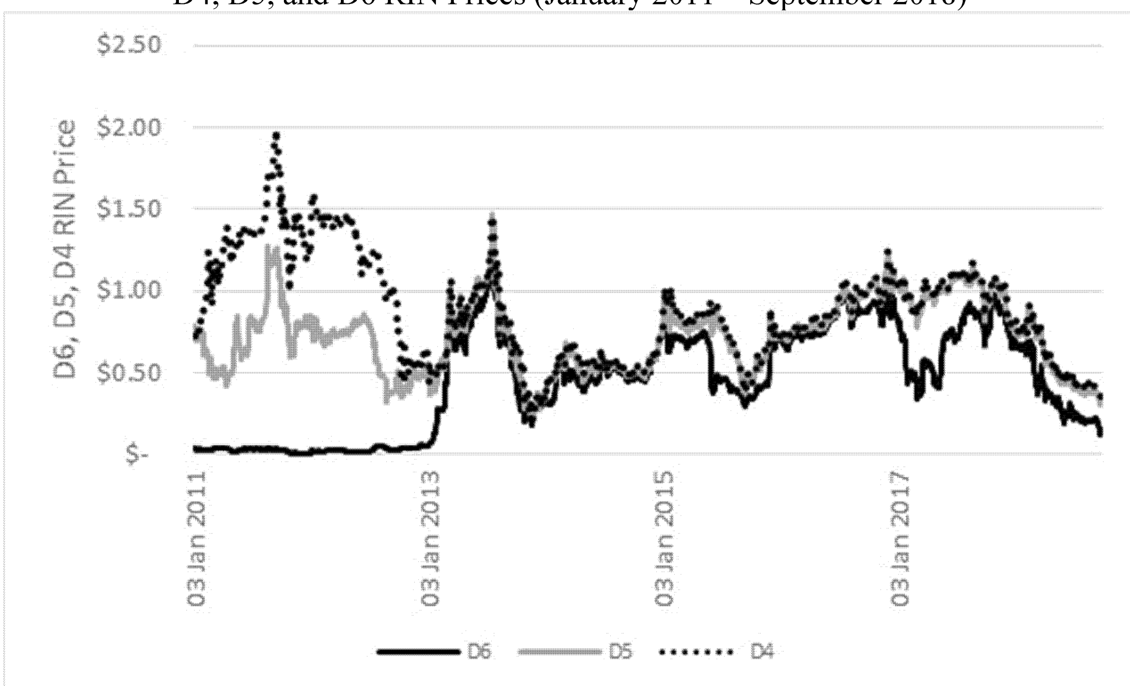
[149] This is because when an obligated party retires a BBD RIN (D4) to help satisfy their BBD obligation,

Continued

however, BBD RINs are being used (or are expected to be used) by obligated parties to satisfy their advanced biofuel obligations, above and beyond the BBD standard, we would expect the prices of advanced biofuel and BBD RINs to converge.[150] Further, if BBD RINs are being used (or are expected to be used) to satisfy obligated parties' total renewable fuel obligation, above and beyond their BBD and advanced biofuel requirements, we would expect the price for all three RIN types to converge.

When examining RIN price data from 2012 through September 2018, shown in Figure VI.B.2–1 below, we see that beginning in early 2013 and through September 2018 the advanced RIN price and BBD RIN prices were approximately equal. Similarly, from early 2013 through late 2016 the conventional renewable fuel and BBD RIN prices were approximately equal. This suggests that the advanced biofuel standard and/or total renewable fuel standard are capable of incentivizing increased BBD volumes beyond the BBD standard. The advanced biofuel standard has incentivized additional volumes of BBD since 2013, while the total standard had incentivized additional volumes of BBD from 2013 through 2016.[151] While final standards were not in place throughout 2014 and most of 2015, EPA had issued proposed rules for both of these years.[152] In each year, the market response was to supply volumes of BBD that exceeded the proposed BBD standard in order to help satisfy the proposed advanced and total biofuel standards.[153] Additionally, the RIN prices in these years strongly suggests that obligated parties and other market participants anticipated the need for BBD RINs to meet their advanced and total biofuel obligations, and responded by purchasing advanced biofuel and BBD RINs at approximately equal prices. We do note, however, that in 2012 the BBD RIN price was significantly higher than both the advanced biofuel and conventional renewable fuel RIN prices. In 2012 the E10 blendwall had not yet been reached, and it was likely more cost effective for most obligated parties to satisfy the portion of the advanced biofuel requirement that exceeded the BBD and cellulosic biofuel requirements with advanced ethanol.

Figure VI.B.2-1
D4, D5, and D6 RIN Prices (January 2011 – September 2018)



RIN Price Source: Argus Media Group

In raising the 2013 BBD volume above the 1 billion gallon minimum mandated by Congress, the EPA sought to "create greater certainty for both producers of BBD and obligated parties" while also acknowledging that, "the potential for somewhat increased costs is appropriate in light of the additional certainty of GHG reductions and enhanced energy security provided by the advanced biofuel volume requirement of 2.75 billion gallons." [154] Unknown at that

the nested nature of the BBD standard means that this RIN also counts towards satisfying their advanced and total renewable fuel obligations. Advanced RINs (D5) count towards both the advanced and total renewable fuel obligations, while conventional RINs (D6) count towards only the total renewable fuel obligation.

[150] We would still expect D4 RINs to be valued at a slight premium to D5 and D6 RINs in this case (and D5 RINs at a slight premium to D6 RINs) to reflect the greater flexibility of the D4 RINs to be used towards the BBD, advanced biofuel, and total renewable fuel standard. This pricing has been observed over the past several years.

[151] Although we did not issue a rule establishing the final 2013 standards until August of 2013, we believe that the market anticipated the final standards, based on EPA's July 2011 proposal and the volume targets for advanced and total renewable fuel established in the statute. (76 FR 38844, 38843 July 1, 2011).

[152] See 80 FR 33100 (2014–16 standards proposed June 10, 2015); 78 FR 71732 (2014 standards proposed Nov. 29, 2013).

[153] EPA proposed a BBD standard of 1.28 billion gallons (1.92 billion RINs) for 2014 in our November 2013 proposed rule. The number of BBD RINs available in 2014 was 2.67 billion. EPA proposed a BBD standard of 1.70 billion gallons (2.55 billion RINs) for 2015 in our June 2015 proposed rule. The number of BBD RINs available in 2015 was 2.92 billion.

[154] 77 FR 59458, 59462 (September 27, 2012).

time was the degree to which the required volumes of advanced biofuel and total renewable fuel could incentivize volumes of BBD that exceeded the BBD standard. In 2012 the available supply of BBD RINs exceeded the required volume of BBD by a very small margin (1,545 million BBD RINs were made available for compliance towards meeting the BBD requirement of 1,500 million BBD RINs). The remainder of the 2.0 billion-gallon advanced biofuel requirement was satisfied with advanced ethanol, which was largely imported from Brazil.[155] From 2012 to 2013 the statutory advanced biofuel requirement increased by 750 million gallons. If EPA had not increased the required volume of BBD for 2013, and the advanced biofuel standard had proved insufficient to increase the supply of BBD beyond the statutory minimum of 1.0 billion gallons, an additional 750 million gallons of non-BBD advanced biofuels beyond the BBD standard would have been needed to meet the advanced biofuel volume requirement.

The only advanced biofuel other than BBD available in appreciable quantities in 2012 and 2013 was advanced ethanol, the vast majority of which was imported sugarcane ethanol. EPA had significant concerns as to whether or not the supply of advanced ethanol could increase this significantly (750 million gallons) in a single year. These concerns were heightened by the approaching E10 blendwall, which had the potential to increase the challenges associated with supplying increasing volumes of ethanol to the U.S. If neither BBD volumes nor advanced ethanol volumes increased sufficiently, EPA was concerned that some obligated parties might be unable to acquire the advanced biofuel RINs necessary to demonstrate compliance with their RVOs in 2013. Therefore, as discussed above, EPA increased the volume requirement for BBD in 2013 to help create greater certainty for BBD producers (by ensuring demand for their product above the 1.0 billion gallon statutory minimum) and obligated parties (by ensuring that sufficient RINs would be available to satisfy their advanced biofuel RVOs). Since 2013, however, EPA has gained significant experience implementing the RFS program. As discussed above, RIN generation data has consistently demonstrated that the advanced biofuel volume requirement, and to a lesser degree the total renewable fuel volume requirement, are capable of incentivizing the supply of BBD above and beyond the BBD volume requirement. The RIN generation data also show that while EPA has consistently preserved the opportunity for fuels other that BBD to contribute towards satisfying the required volume of advanced biofuel, these other advanced biofuels have not been supplied in significant quantities since 2013.

TABLE VI.B.1–2—OPPORTUNITY FOR AND RIN GENERATION OF "OTHER" ADVANCED BIOFUELS

[Million RINs]

	Opportunity for "other" advanced biofuels[a]	Available advanced (D5) RINs	Available BBD (D4) RINs in excess of the BBD requirement[b]
2011	150	225	283
2012	500	597	-35
2013	829	552	421
2014[c]	192	143	2
2015[c]	162	147	−24
2016	530	97	903
2017	969	144	570
2018[d]	852	121	590

[a] The required volume of "other" advanced biofuel is calculated by subtracting the number of cellulosic biofuel and BBD RINs required each year from the number of advanced biofuel RINs required. This portion of the advanced standard can be satisfied by advanced (D5) RINs, BBD RINs in excess of those required by the BBD standard, or cellulosic RINs in excess of those required by the cellulosic standard.

[b] The available BBD (D4) RINs in excess of the BBD requirement is calculated by subtracting the required BBD volume (multiplied by 1.5 to account for the equivalence value of biodiesel) required each year from the number of BBD RINs available for compliance in that year. This number does not include carryover RINs, nor do we account for factors that may impact the number of BBD RINs that must be retired for compliance, such as differences between the projected and actual volume of obligated gasoline and diesel.

[c] The 2014 and 2015 volume requirements were established in November 2015 and were set equal to the number of RINs projected to be available for each year.

[d] Available Advanced RINs and available D4 RINs in excess of the BBD requirement are projected based on data through September 2018.

In 2014 and 2015, EPA set the BBD and advanced standards at actual RIN generation, and thus the space between the advanced biofuel standard and the biodiesel standard was unlikely to provide an incentive for "other" advanced biofuels. EPA now has data on the amount of "other" advanced biofuels produced in 2016 and 2017 as shown in the table above. For 2016 and 2017, the gap between the BBD standard and the advanced biofuel provided an opportunity for "other" advanced biofuels to be generated to satisfy the advanced biofuel standard. While the RFS volumes created the opportunity for up to 530 million and 969 million gallons of "other" advanced for 2016 and 2017 respectively to be used to satisfy the advanced biofuel obligation, only 97 million and 144 million gallons of "other" advanced biofuels were generated. This is significantly less than the volumes of "other" advanced available in 2012–2013. Despite creating space within the advanced biofuel standard for "other" advanced, in recent years, only a small fraction of that space has been filled with "other" advanced, and BBD continues to fill most of the gap between the BBD standard and the advanced standard.

Thus, while the advanced biofuel standard is sufficient to drive biodiesel volume separate and apart from the BBD standard, there would not appear to be a compelling reason to increase the "space" maintained for "other" advanced biofuel volumes. The overall

[155] 594 million advanced ethanol RINs were generated in 2012.

volume of non-cellulosic advanced biofuel in this final rule increases by 500 million gallons for 2019. Increasing the BBD volume by the same amount would preserve the space already available for other advanced biofuels to compete.

At the same time, the rationale for preserving the ''space'' for ''other'' advanced biofuels remains. We note that the BBD industry in the U.S. and abroad has matured since EPA first increased the required volume of BBD beyond the statutory minimum in 2013. To assess the maturity of the biodiesel industry, EPA compared information on BBD RIN generation by company in 2012 and 2017 (the most recent year for which complete RIN generation by company is available). In 2012, the annual average RIN generation per company producing BBD was about 11 million RINs (about 7.3 million gallons) with approximately 50 percent of companies producing less than 1 million gallons of BBD a year.[156] The agency heard from multiple commenters during the 2012 and 2013 rulemakings that higher volume requirements for BBD would provide greater certainty for the emerging BBD industry and encourage further investment. Since that time, the BBD industry has matured in a number of critical areas, including growth in the size of companies, the consolidation of the industry, and more stable funding and access to capital. In 2012, the BBD industry was characterized by smaller companies with dispersed market share. By 2017, the average BBD RIN generation per company had climbed to almost 33 million RINs (22 million gallons) annually, a 3-fold increase. Only 33 percent of the companies produced less than 1 million gallons of BBD in 2017.[157]

We are conscious of public comments claiming that BBD volume requirements that are a significant portion of the advanced volume requirements effectively disincentivize the future development of other promising advanced biofuel pathways.[158] A variety of different types of advanced biofuels, rather than a single type such as BBD, would increase energy security (*e.g.,* by increasing the diversity of feedstock sources used to make biofuels, thereby reducing the impacts associated with a shortfall in a particular type of feedstock) and increase the likelihood of the development of lower cost advanced biofuels that meet the same GHG reduction threshold as BBD.[159]

We received comments from stakeholders suggesting that the BBD volume standard is unique, as it is required to be set 14 months prior to beginning of the compliance year, in contrast to the advanced standard which is often modified only a month prior to the compliance year. These commenters suggested that EPA should therefore increase the BBD standard to allow for industry to utilize the 14-month notice to make investments. EPA acknowledges this unique aspect of the BBD volume, but still believes a volume of 2.43 billion appropriately provides a floor for guaranteed BBD volume, while also providing space for other advanced biofuels to compete in the market. Based on our review of the data, and the nested nature of the BBD standard within the advanced standard, we conclude that the advanced standard continues to drive the ultimate volume of BBD supplied. However, given that BBD has been the predominant source of advanced biofuel in recent years and the 500 million gallon increase in non-cellulosic advanced biofuel we are finalizing in this rule, we are setting a volume of 2.43 billion gallons of BBD for 2020.

We recognize that the space for other advanced biofuels in 2020 will ultimately depend on the 2020 advanced biofuel volume. While EPA is not establishing the advanced biofuel volume for 2020 in this action, we anticipate that the non-cellulosic advanced biofuel volume for 2020, when established, will be greater than 3.65 billion gallons (equivalent to 2.43 billion gallons of BBD, after applying the 1.5 equivalence ratio). This expectation is consistent with our actions in previous years. Accordingly, we expect that the 2020 advanced biofuel volume, together with the 2020 BBD volume established today, will continue to preserve a considerable portion of the advanced biofuel volume that could be satisfied by either additional gallons of BBD or by other unspecified and potentially less costly types of qualifying advanced biofuels.

C. Consideration of Statutory Factors Set Forth in CAA Section 211(o)(2)(B)(ii)(I)–(VI) for 2020 and Determination of the 2020 Biomass-Based Diesel Volume

The BBD volume requirement is nested within the advanced biofuel requirement, and the advanced biofuel requirement is, in turn, nested within the total renewable fuel volume requirement.[160] This means that any BBD produced beyond the mandated BBD volume can be used to satisfy both these other applicable volume requirements. The result is that in considering the statutory factors we must consider the potential impacts of increasing or decreasing BBD in comparison to other advanced biofuels.[161] For a given advanced biofuel standard, greater or lesser BBD volume requirements do not change the amount of advanced biofuel used to displace petroleum fuels; rather, increasing the BBD requirement may result in the displacement of other types of advanced biofuels that could have been used to meet the advanced biofuels volume requirement. EPA is increasing the BBD volume for 2020 to 2.43 billion gallons from 2.1 billion gallons in 2019 based on our review of the statutory factors and the other considerations noted above and in the 2020 BBD Docket Memorandum. This increase, in conjunction with the statutory increase of 500 million gallons of non-cellulosic advanced biofuel in 2019, would preserve a gap for ''other'' advanced biofuels, that is the difference between the advanced biofuel volume and the sum of the cellulosic biofuel and BBD volumes. This would allow other advanced biofuels to continue to compete with excess volumes of BBD for market share under the advanced biofuel standard, while also supporting further growth in the BBD industry.

Consistent with our approach in setting the final BBD volume requirement for 2019, EPA's primary assessment of the statutory factors for the 2020 BBD applicable volume is that because the BBD requirement is nested within the advanced biofuel volume requirement, we expect that the 2020 advanced volume requirement, when set next year, will determine the level of BBD use, production and imports that occur in 2020.[162] Therefore, EPA

[156] ''BBD RIN Generation by Company 2012, 2016, and 2017 CBI,'' available in EPA docket EPA–HQ–OAR–2018–0167.

[157] Id.

[158] See, *e.g.,* Comments from Advanced Biofuel Association, available in EPA docket EPA–HQ–2018–0167–1277.

[159] All types of advanced biofuel, including BBD, must achieve lifecycle GHG reductions of at least 50 percent. See CAA section 211(o)(1)(B)(i), (D).

[160] See CAA section 211(o)(2)(B)(i)(IV), (II).

[161] While excess BBD production could also displace conventional renewable fuel under the total renewable standard, as long as the BBD applicable volume is lower than the advanced biofuel applicable volume our action in setting the BBD applicable volume is not expected to displace conventional renewable fuel under the total renewable standard, but rather other advanced biofuels. We acknowledge, however, that under certain market conditions excess volumes of BBD may also be used to displace conventional biofuels.

[162] Even though we are not establishing the 2020 advanced biofuel volume requirement as part of this rulemaking, we expect that, as in the past, the 2020 advanced volume requirement will be higher than the 2020 BBD requirement, and, therefore, that the BBD volume requirement for 2020 would not be expected to impact the volume of BBD that is

continues to believe that approximately the same overall volume of BBD would likely be supplied in 2020 even if we were to mandate a somewhat lower or higher BBD volume for 2020 in this final rule. Thus, we do not expect our 2020 BBD volume requirement to result in a significant difference in the factors we consider pursuant to CAA section 211(o)(2)(B)(ii)(I)–(VI) in 2020.

As an additional assessment, we considered in the 2020 BBD docket memorandum [163] the potential impacts on the statutory factors of selecting an applicable volume of BBD other than 2.43 billion gallons in 2020 and also in the longer term. While BBD volumes and resulting impact on the statutory factors found in 211(o)(2)(B)(ii), will not likely be significantly impacted by the 2020 BBD standard in the short term, leaving room for growth of other advanced could have a beneficial impact on certain statutory factors in the long term. Even if BBD volumes were to be impacted by the 2020 BBD standard, setting a requirement higher or lower than 2.43 billion gallons in 2020 would only be expected to affect BBD volumes and the statutory factors found in CAA section 211(o)(2)(B)(ii)(I)–(VI) minimally in 2020. However, we find that over a longer timeframe, providing support for other advanced biofuels could have beneficial effects for a number of the statutory factors.

With the considerations discussed above in mind, as well as our analysis of the factors specified in the statute, we are setting the applicable volume of BBD at 2.43 billion gallons for 2020. This increase, in conjunction with the statutory increase of 500 million gallons of non-cellulosic advanced biofuel in 2019, would continue to preserve a significant gap between the advanced biofuel volume and the sum of the cellulosic biofuel and BBD volumes. This would allow other advanced biofuels to continue to compete with excess volumes of BBD for market share under the advanced biofuel standard. We believe this volume sets the appropriate floor for BBD, and that the volume of advanced biodiesel and renewable diesel actually used in 2020 will be driven by the level of the advanced biofuel and total renewable fuel standards that the Agency will establish for 2020. It also recognizes that while maintaining an opportunity for other advanced biofuels is important, the vast majority of the advanced biofuel used to comply with the advanced biofuel standard in recent years has been BBD. Based on information now available from 2016 and 2017, despite providing a significant degree of space for ''other'' advanced biofuels, smaller volumes of ''other'' advanced have been utilized to meet the advanced standard. EPA believes that the BBD standard we are finalizing today still provides sufficient incentive to producers of ''other'' advanced biofuels, while also acknowledging that the advanced standard has been met predominantly with biomass-based diesel. Our assessment of the required statutory factors, as well as the implementation of the program, supports a volume of 2.43 billion gallons.

VII. Percentage Standards for 2019

The renewable fuel standards are expressed as volume percentages and are used by each obligated party to determine their Renewable Volume Obligations (RVOs). Since there are four separate standards under the RFS program, there are likewise four separate RVOs applicable to each obligated party. Each standard applies to the sum of all non-renewable gasoline and diesel produced or imported.

Sections II through V provide our rationale and basis for the final volume requirements for 2019.[164] The volumes used to determine the percentage standards are shown in Table VII–1.

TABLE VII–1—VOLUMES FOR USE IN DETERMINING THE FINAL 2019 APPLICABLE PERCENTAGE STANDARDS

Cellulosic biofuel	Million ethanol-equivalent gallons	418
Biomass-based diesel	Billion gallons	2.1
Advanced biofuel	Billion ethanol-equivalent gallons	4.92
Renewable fuel	Billion ethanol-equivalent gallons	19.92

For the purposes of converting these volumes into percentage standards, we generally use two decimal places to be consistent with the volume targets as given in the statute, and similarly two decimal places in the percentage standards. However, for cellulosic biofuel we use three decimal places in both the volume requirement and percentage standards to more precisely capture the smaller volume projections and the unique methodology that in some cases results in estimates of only a few million gallons for a single producer.

A. Calculation of Percentage Standards

To calculate the percentage standards, we are following the same methodology for 2019 as we have in all prior years. The formulas used to calculate the percentage standards applicable to producers and importers of gasoline and diesel are provided in 40 CFR 80.1405. The formulas rely on estimates of the volumes of gasoline and diesel fuel, for both highway and nonroad uses, which are projected to be used in the year in which the standards will apply. The projected gasoline and diesel volumes are provided by EIA, and include projections of ethanol and biodiesel used in transportation fuel. Since the percentage standards apply only to the non-renewable gasoline and diesel produced or imported, the volumes of renewable fuel are subtracted out of the EIA projections of gasoline and diesel.

Transportation fuels other than gasoline or diesel, such as natural gas, propane, and electricity from fossil fuels, are not currently subject to the standards, and volumes of such fuels are not used in calculating the annual percentage standards. Since under the regulations the standards apply only to producers and importers of gasoline and diesel, these are the transportation fuels used to set the percentage standards, as well as to determine the annual volume obligations of an individual gasoline or diesel producer or importer under 40 CFR 80.1407.

As specified in the RFS2 final rule,[165] the percentage standards are based on energy-equivalent gallons of renewable fuel, with the cellulosic biofuel, advanced biofuel, and total renewable fuel standards based on ethanol equivalence and the BBD standard based on biodiesel equivalence. However, all RIN generation is based on ethanol-equivalence. For example, the

actually used, produced and imported during the 2020-time period.

[163] ''Memorandum to docket: Statutory Factors Assessment for the 2020 Biomass-Based Diesel (BBD) Applicable Volumes.'' See Docket EPA–HQ–OAR–2018–0167.

[164] The 2019 volume requirement for BBD was established in the 2018 final rule.

[165] See 75 FR 14670 (March 26, 2010).

RFS regulations provide that production or import of a gallon of qualifying biodiesel will lead to the generation of 1.5 RINs. The formula specified in the regulations for calculation of the BBD percentage standard is based on biodiesel-equivalence, and thus assumes that all BBD used to satisfy the BBD standard is biodiesel and requires that the applicable volume requirement be multiplied by 1.5 in order to calculate a percentage standard that is on the same basis (*i.e.,* ethanol-equivalent) as the other three standards. However, BBD often contains some renewable diesel, and a gallon of renewable diesel typically generates 1.7 RINs.[166] In addition, there is often some renewable diesel in the conventional renewable fuel pool. As a result, the actual number of RINs generated by biodiesel and renewable diesel is used in the context of our assessment of the applicable volume requirements and associated percentage standards for advanced biofuel and total renewable fuel, and likewise in obligated parties' determination of compliance with any of the applicable standards. While there is a difference in the treatment of biodiesel and renewable diesel in the context of determining the percentage standard for BBD versus determining the percentage standard for advanced biofuel and total renewable fuel, it is not a significant one given our approach to determining the BBD volume requirement. Our intent in setting the BBD applicable volume is to provide a level of guaranteed volume for BBD, but as described in Section VI.B, we do not expect the BBD standard to be binding in 2019. That is, we expect that actual supply of BBD, as well as supply of conventional biodiesel and renewable diesel, will be driven by the advanced biofuel and total renewable fuel standards.

B. Small Refineries and Small Refiners

In CAA section 211(o)(9), enacted as part of the Energy Policy Act of 2005, and amended by the Energy Independence and Security Act of 2007, Congress provided a temporary exemption to small refineries[167] through December 31, 2010. Congress provided that small refineries could receive a temporary extension of the exemption beyond 2010 based either on the results of a required DOE study, or based on an EPA determination of ''disproportionate economic hardship'' on a case-by-case basis in response to small refinery petitions. In reviewing petitions, EPA, in consultation with the Department of Energy, determines whether the small refinery has demonstrated disproportionate economic hardship, and may grant refineries exemptions upon such demonstration.

EPA has granted exemptions pursuant to this process in the past. However, at this time no exemptions have been approved for 2019, and therefore we have calculated the percentage standards for 2019 without any adjustment for exempted volumes. We are maintaining our approach that any exemptions for 2019 that are granted after the final rule is released will not be reflected in the percentage standards that apply to all gasoline and diesel produced or imported in 2019.

C. Final Standards

The formulas in 40 CFR 80.1405 for the calculation of the percentage standards require the specification of a total of 14 variables covering factors such as the renewable fuel volume requirements, projected gasoline and diesel demand for all states and territories where the RFS program applies, renewable fuels projected by EIA to be included in the gasoline and diesel demand, and exemptions for small refineries. The values of all the variables used for this final rule are shown in Table VII.C–1.[168]

TABLE VII.C–1—VALUES FOR TERMS IN CALCULATION OF THE FINAL 2019 STANDARDS[169]

[Billion gallons]

Term	Description	Value
RFV_{CB}	Required volume of cellulosic biofuel	0.418
RFV_{BBD}	Required volume of biomass-based diesel	2.10
RFV_{AB}	Required volume of advanced biofuel	4.92
RFV_{RF}	Required volume of renewable fuel	19.92
G	Projected volume of gasoline	142.62
D	Projected volume of diesel	56.31
RG	Projected volume of renewables in gasoline	14.53
RD	Projected volume of renewables in diesel	2.75
GS	Projected volume of gasoline for opt-in areas	0
RGS	Projected volume of renewables in gasoline for opt-in areas	0
DS	Projected volume of diesel for opt-in areas	0
RDS	Projected volume of renewables in diesel for opt-in areas	0
GE	Projected volume of gasoline for exempt small refineries	0.00
DE	Projected volume of diesel for exempt small refineries	0.00

Projected volumes of gasoline and diesel, and the renewable fuels contained within them, were provided by EIA in a letter to EPA that is required under the statute, and represent consumption values from the October 2018 version of EIA's Short-Term Energy Outlook.[170]

Using the volumes shown in Table VII.C–1, we have calculated the final percentage standards for 2019 as shown in Table VII.C–2.

TABLE VII.C–2—FINAL PERCENTAGE STANDARDS FOR 2019

Cellulosic biofuel	0.230
Biomass-based diesel	1.73
Advanced biofuel	2.71

[166] Under 40 CFR 80.1415(b)(4), renewable diesel with a lower heating value of at least 123,500 Btu/gallon is assigned an equivalence value of 1.7. A minority of renewable diesel has a lower heating value below 123,500 BTU/gallon and is therefore assigned an equivalence value of 1.5 or 1.6 based on applications submitted under 40 CFR 80.1415(c)(2).

[167] A small refiner that meets the requirements of 40 CFR 80.1442 may also be eligible for an exemption.

[168] To determine the 49-state values for gasoline and diesel, the amount of these fuels used in Alaska is subtracted from the totals provided by EIA because petroleum-based fuels used in Alaska do not incur RFS obligations. The Alaska fractions are determined from the June 29, 2018 EIA State Energy Data System (SEDS), Energy Consumption Estimates.

[169] See ''Calculation of final % standards for 2019'' in docket EPA–HQ–OAR–2018–0167.

[170] ''EIA letter to EPA with 2019 volume projections 10–12–18,'' available in docket EPA–HQ–OAR–2018–0167.

TABLE VII.C–2—FINAL PERCENTAGE STANDARDS FOR 2019—Continued

Renewable fuel	10.97

VIII. Administrative Actions

A. Assessment of the Domestic Aggregate Compliance Approach

The RFS regulations specify an ''aggregate compliance'' approach for demonstrating that planted crops and crop residue from the U.S. complies with the ''renewable biomass'' requirements that address lands from which qualifying feedstocks may be harvested.[171] In the 2010 RFS2 rulemaking, EPA established a baseline number of acres for U.S. agricultural land in 2007 (the year of EISA enactment) and determined that as long as this baseline number of acres was not exceeded, it was unlikely that new land outside of the 2007 baseline would be devoted to crop production based on historical trends and economic considerations. The regulations specify, therefore, that renewable fuel producers using planted crops or crop residue from the U.S. as feedstock in renewable fuel production need not undertake individual recordkeeping and reporting related to documenting that their feedstocks come from qualifying lands, unless EPA determines through one of its annual evaluations that the 2007 baseline acreage of 402 million acres agricultural land has been exceeded.

In the 2010 RFS2 rulemaking, EPA committed to make an annual finding concerning whether the 2007 baseline amount of U.S. agricultural land has been exceeded in a given year. If the baseline is found to have been exceeded, then producers using U.S. planted crops and crop residue as feedstocks for renewable fuel production would be required to comply with individual recordkeeping and reporting requirements to verify that their feedstocks are renewable biomass.

The Aggregate Compliance methodology provided for the exclusion of acreage enrolled in the Grassland Reserve Program (GRP) and the Wetlands Reserve Program (WRP) from the estimated total U.S. agricultural land. However, the 2014 Farm Bill terminated the GRP and WRP as of 2013 and USDA established the Agriculture Conservation Easement Program (ACEP) with wetlands and land easement components. The ACEP is a voluntary program that provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Agricultural Land Easements (ACEP–ALE) component, USDA helps Indian tribes, state and local governments, and non-governmental organizations protect working agricultural lands and limit non-agricultural uses of the land. Under the Wetlands Reserve Easements (ACEP–WRE) component, USDA helps to restore, protect and enhance enrolled wetlands. The WRP was a voluntary program that offered landowners the opportunity to protect, restore, and enhance wetlands on their property. The GRP was a voluntary conservation program that emphasized support for working grazing operations, enhancement of plant and animal biodiversity, and protection of grassland under threat of conversion to other uses.

USDA and EPA concur that the ACEP–WRE and ACEP–ALE represent a continuation in basic objectives and goals of the original WRP and GRP. Therefore, in preparing this year's assessment of the total U.S. acres of agricultural land, the acreage enrolled in the ACEP–WRE and ACEP–ALE was excluded.

Based on data provided by the USDA Farm Service Agency (FSA) and Natural Resources Conservation Service (NRCS), we have estimated that U.S. agricultural land reached approximately 381 million acres in 2018, and thus did not exceed the 2007 baseline acreage. This acreage estimate is based on the same methodology used to set the 2007 baseline acreage for U.S. agricultural land in the RFS2 final rulemaking, with the GRP and WRP substitution as noted above. Specifically, we started with FSA crop history data for 2018, from which we derived a total estimated acreage of 381,694,332 acres. We then subtracted the ACEP–ALE and ACEP–WRE enrolled areas by the end of Fiscal Year 2018, 798,023 acres, to yield an estimate of 380,896,309 acres or approximately 381 million acres of U.S. agricultural land in 2018. The USDA data used to make this derivation can be found in the docket to this rule.[172] [173]

B. Assessment of the Canadian Aggregate Compliance Approach

The RFS regulations specify a petition process through which EPA may approve the use of an aggregate compliance approach for planted crops and crop residue from foreign countries.[174] On September 29, 2011, EPA approved such a petition from the Government of Canada.

The total agricultural land in Canada in 2018 is estimated at 118.5 million acres; below the 2007 baseline of 123 million acres. This total agricultural land area includes 96.3 million acres of cropland and summer fallow, 12.4 million acres of pastureland and 9.8 million acres of agricultural land under conservation practices. This acreage estimate is based on the same methodology used to set the 2007 baseline acreage for Canadian agricultural land in EPA's response to Canada's petition. The data used to make this calculation can be found in the docket to this rule.

IX. Public Participation

Many interested parties participated in the rulemaking process that culminates with this final rule. This process provided opportunity for submitting written public comments following the proposal that we published on July 3, 2018 (83 FR 31098), and we also held a public hearing on July 18, 2018, at which many parties provided both verbal and written testimony. All comments received, both verbal and written, are available in Docket ID No. EPA–HQ–OAR–2018–0167 and we considered these comments in developing the final rule. Public comments and EPA responses are discussed throughout this preamble and in the accompanying RTC document, which is available in the docket for this action.

X. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review

This action is an economically significant regulatory action that was submitted to the Office of Management and Budget (OMB) for review. Any changes made in response to OMB recommendations have been documented in the docket. EPA prepared an analysis of illustrative costs associated with this action. This analysis is presented in Section V of this preamble.

[171] 40 CFR 80.1454(g).

[172] USDA also provided EPA with 2018 data from the discontinued GRP and WRP programs. Given this data, EPA estimated the total U.S. agricultural land both including and omitting the GRP and WRP acreage. In 2018, combined land under GRP and WRP totaled 2,975,165 acres. Subtracting the GRP, WRP, ACEP–WRE, and ACEP–ALE acreage yields an estimate of 377,921,144 acres or approximately 378 million total acres of U.S. agricultural land in 2018. Omitting the GRP and WRP data yields approximately 381 million acres of U.S. agricultural land in 2018.

[173] In providing the 2018 agricultural land data to EPA, USDA provided updated data from 2017. An explanation of this data and a revised estimate of 2017 total U.S. agricultural land can be found in the docket to this rule.

[174] 40 CFR 80.1457.

B. Executive Order 13771: Reducing Regulations and Controlling Regulatory Costs

This action is considered an Executive Order 13771 regulatory action. Details on the estimated costs of this final rule can be found in EPA's analysis of the illustrative costs associated with this action. This analysis is presented in Section V of this preamble.

C. Paperwork Reduction Act (PRA)

This action does not impose any new information collection burden under the PRA. OMB has previously approved the information collection activities contained in the existing regulations and has assigned OMB control numbers 2060–0637 and 2060–0640. The final standards will not impose new or different reporting requirements on regulated parties than already exist for the RFS program.

D. Regulatory Flexibility Act (RFA)

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. In making this determination, the impact of concern is any significant adverse economic impact on small entities. An agency may certify that a rule will not have a significant economic impact on a substantial number of small entities if the rule relieves regulatory burden, has no net burden, or otherwise has a positive economic effect on the small entities subject to the rule.

The small entities directly regulated by the RFS program are small refiners, which are defined at 13 CFR 121.201. We have evaluated the impacts of this final rule on small entities from two perspectives: As if the 2019 standards were a standalone action or if they are a part of the overall impacts of the RFS program as a whole.

When evaluating the standards as if they were a standalone action separate and apart from the original rulemaking which established the RFS2 program, then the standards could be viewed as increasing the cellulosic biofuel volume by 130 million gallons and the advanced biofuel and total renewable fuel volume requirements by 630 million gallons between 2018 and 2019. To evaluate the impacts of the volume requirements on small entities relative to 2018, we have conducted a screening analysis [175] to assess whether we should make a finding that this action will not have a significant economic impact on a substantial number of small entities. Currently available information shows that the impact on small entities from implementation of this rule will not be significant. We have reviewed and assessed the available information, which shows that obligated parties, including small entities, are generally able to recover the cost of acquiring the RINs necessary for compliance with the RFS standards through higher sales prices of the petroleum products they sell than would be expected in the absence of the RFS program.[176] This is true whether they acquire RINs by purchasing renewable fuels with attached RINs or purchase separated RINs. The costs of the RFS program are thus generally being passed on to consumers in the highly competitive marketplace. Even if we were to assume that the cost of acquiring RINs were not recovered by obligated parties, and we used the maximum values of the illustrative costs discussed in Section V of this preamble and the gasoline and diesel fuel volume projections and wholesale prices from the October 2018 version of EIA's Short-Term Energy Outlook, and current wholesale fuel prices, a cost-to-sales ratio test shows that the costs to small entities of the RFS standards are far less than 1 percent of the value of their sales.

While the screening analysis described above supports a certification that this rule will not have a significant economic impact on small refiners, we continue to believe that it is more appropriate to consider the standards as a part of ongoing implementation of the overall RFS program. When considered this way, the impacts of the RFS program as a whole on small entities were addressed in the RFS2 final rule, which was the rule that implemented the entire program as required by EISA 2007.[177] As such, the Small Business Regulatory Enforcement Fairness Act (SBREFA) panel process that took place prior to the 2010 rule was also for the entire RFS program and looked at impacts on small refiners through 2022.

For the SBREFA process for the RFS2 final rule, we conducted outreach, fact-finding, and analysis of the potential impacts of the program on small refiners, which are all described in the Final Regulatory Flexibility Analysis, located in the rulemaking docket (EPA–HQ–OAR–2005–0161). This analysis looked at impacts to all refiners, including small refiners, through the year 2022 and found that the program would not have a significant economic impact on a substantial number of small entities, and that this impact was expected to decrease over time, even as the standards increased. For gasoline and/or diesel small refiners subject to the standards, the analysis included a cost-to-sales ratio test, a ratio of the estimated annualized compliance costs to the value of sales per company. From this test, we estimated that all directly regulated small entities would have compliance costs that are less than one percent of their sales over the life of the program (75 FR 14862, March 26, 2010).

We have determined that this final rule will not impose any additional requirements on small entities beyond those already analyzed, since the impacts of this rule are not greater or fundamentally different than those already considered in the analysis for the RFS2 final rule assuming full implementation of the RFS program. This final rule increases the 2019 cellulosic biofuel volume requirement by 130 million gallons and the advanced biofuel and total renewable fuel volume requirements by 630 million gallons relative to the 2018 volume requirements, but those volumes remain significantly below the statutory volume targets analyzed in the RFS2 final rule. Compared to the burden that would be imposed under the volumes that we assessed in the screening analysis for the RFS2 final rule (*i.e.,* the volumes specified in the Clean Air Act), the volume requirements proposed in this rule reduce burden on small entities. Regarding the BBD standard, we are increasing the volume requirement for 2020 by 330 million gallons relative to the 2019 volume requirement we finalized in the 2018 final rule. While this volume is an increase over the statutory minimum value of 1 billion gallons, the BBD standard is a nested standard within the advanced biofuel category, which we are significantly reducing from the statutory volume targets. As discussed in Section VI, we are setting the 2020 BBD volume requirement at a level below what is anticipated will be produced and used to satisfy the reduced advanced biofuel requirement. The net result of the standards being finalized in this action is a reduction in burden as compared to implementation of the statutory volume targets as was assumed in the RFS2 final rule analysis.

While the rule will not have a significant economic impact on a substantial number of small entities, there are compliance flexibilities in the program that can help to reduce impacts

[175] "Screening Analysis for the Final Renewable Fuel Standards for 2019," memorandum from Dallas Burkholder, Nick Parsons, and Tia Sutton to EPA Air Docket EPA–HQ–OAR–2018–0167.

[176] For a further discussion of the ability of obligated parties to recover the cost of RINs see "Denial of Petitions for Rulemaking to Change the RFS Point of Obligation," EPA–420–R–17–008, November 2017.

[177] 75 FR 14670 (March 26, 2010).

on small entities. These flexibilities include being able to comply through RIN trading rather than renewable fuel blending, 20 percent RIN rollover allowance (up to 20 percent of an obligated party's RVO can be met using previous-year RINs), and deficit carry-forward (the ability to carry over a deficit from a given year into the following year, providing that the deficit is satisfied together with the next year's RVO). In the RFS2 final rule, we discussed other potential small entity flexibilities that had been suggested by the SBREFA panel or through comments, but we did not adopt them, in part because we had serious concerns regarding our authority to do so.

Additionally, we realize that there may be cases in which a small entity may be in a difficult financial situation and the level of assistance afforded by the program flexibilities is insufficient. For such circumstances, the program provides hardship relief provisions for small entities (small refiners), as well as for small refineries.[178] As required by the statute, the RFS regulations include a hardship relief provision (at 40 CFR 80.1441(e)(2)) that allows for a small refinery to petition for an extension of its small refinery exemption at any time based on a showing that the refinery is experiencing a ''disproportionate economic hardship.'' EPA regulations provide similar relief to small refiners that are not eligible for small refinery relief (see 40 CFR 80.1442(h)). EPA has currently identified a total of 9 small refiners that own 11 refineries subject to the RFS program, all of which are also small refineries.

We evaluate these petitions on a case-by-case basis and may approve such petitions if it finds that a disproportionate economic hardship exists. In evaluating such petitions, we consult with the U.S. Department of Energy and consider the findings of DOE's 2011 Small Refinery Study and other economic factors. To date, EPA has adjudicated petitions for exemption from 29 small refineries for the 2017 RFS standards (8 of which were owned by a small refiner).[179]

In sum, this final rule will not change the compliance flexibilities currently offered to small entities under the RFS program (including the small refinery hardship provisions we continue to implement) and available information shows that the impact on small entities from implementation of this rule will not be significant viewed either from the perspective of it being a standalone action or a part of the overall RFS program. We have therefore concluded that this action will have no net regulatory burden for directly regulated small entities.

E. Unfunded Mandates Reform Act (UMRA)

This action does not contain an unfunded mandate of $100 million or more as described in UMRA, 2 U.S.C. 1531–1538, and does not significantly or uniquely affect small governments. This action implements mandates specifically and explicitly set forth in CAA section 211(o) and we believe that this action represents the least costly, most cost-effective approach to achieve the statutory requirements.

F. Executive Order 13132: Federalism

This action does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

G. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

This action does not have tribal implications as specified in Executive Order 13175. This action will be implemented at the Federal level and affects transportation fuel refiners, blenders, marketers, distributors, importers, exporters, and renewable fuel producers and importers. Tribal governments will be affected only to the extent they produce, purchase, or use regulated fuels. Thus, Executive Order 13175 does not apply to this action.

H. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks

EPA interprets Executive Order 13045 as applying only to those regulatory actions that concern environmental health or safety risks that EPA has reason to believe may disproportionately affect children, per the definition of ''covered regulatory action'' in section 2–202 of the Executive Order. This action is not subject to Executive Order 13045 because it implements specific standards established by Congress in statutes (CAA section 211(o)) and does not concern an environmental health risk or safety risk.

I. Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use

This action is not a ''significant energy action'' because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. This action establishes the required renewable fuel content of the transportation fuel supply for 2019, consistent with the CAA and waiver authorities provided therein. The RFS program and this rule are designed to achieve positive effects on the nation's transportation fuel supply, by increasing energy independence and security and lowering lifecycle GHG emissions of transportation fuel.

J. National Technology Transfer and Advancement Act (NTTAA)

This rulemaking does not involve technical standards.

K. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

EPA believes that this action does not have disproportionately high and adverse human health or environmental effects on minority populations, low income populations, and/or indigenous peoples, as specified in Executive Order 12898 (59 FR 7629, February 16, 1994). This regulatory action does not affect the level of protection provided to human health or the environment by applicable air quality standards. This action does not relax the control measures on sources regulated by the RFS regulations and therefore will not cause emissions increases from these sources.

L. Congressional Review Act (CRA)

This action is subject to the CRA, and EPA will submit a rule report to each House of the Congress and to the Comptroller General of the United States. This action is a ''major rule'' as defined by 5 U.S.C. 804(2).

XI. Statutory Authority

Statutory authority for this action comes from section 211 of the Clean Air Act, 42 U.S.C. 7545. Additional support for the procedural and compliance related aspects of this final rule comes from sections 114, 208, and 301(a) of the Clean Air Act, 42 U.S.C. 7414, 7542, and 7601(a).

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[178] See CAA section 211(o)(9)(B).

[179] EPA is currently evaluating 7 additional 2017 petitions (1 of which is owned by a small refiner) and 15 additional 2018 petitions (7 of which are owned by a small refiner), bringing the total number of petitions for 2017 to 36 and for 2018 to 15. More information on Small Refinery Exemptions is available on EPA's public website at: *https://www.epa.gov/fuels-registration-reporting-and-compliance-help/rfs-small-refinery-exemptions.*

List of Subjects in 40 CFR Part 80

Environmental protection, Administrative practice and procedure, Air pollution control, Diesel fuel, Fuel additives, Gasoline, Imports, Oil imports, Petroleum, Renewable fuel.

Dated: November 30, 2018.

Andrew R. Wheeler,

Acting Administrator.

For the reasons set forth in the preamble, EPA is amending 40 CFR part 80 as follows:

PART 80—REGULATION OF FUELS AND FUEL ADDITIVES

■ 1. The authority citation for part 80 continues to read as follows:

Authority: 42 U.S.C. 7414, 7521, 7542, 7545, and 7601(a).

Subpart M—Renewable Fuel Standard

■ 2. Section 80.1405 is amended by adding paragraph (a)(10) to read as follows:

§ 80.1405 What are the Renewable Fuel Standards?

(a) * * *

(10) *Renewable Fuel Standards for 2019.*

(i) The value of the cellulosic biofuel standard for 2019 shall be 0.230 percent.

(ii) The value of the biomass-based diesel standard for 2019 shall be 1.73 percent.

(iii) The value of the advanced biofuel standard for 2019 shall be 2.71 percent.

(iv) The value of the renewable fuel standard for 2019 shall be 10.97 percent.

* * * * *

[FR Doc. 2018–26566 Filed 12–10–18; 8:45 am]

BILLING CODE 6560–50–P

Exhibit 2

SIERRA CLUB
FOUNDED 1892

December 11, 2018

VIA ELECTRONIC MAIL AND CERTIFIED MAIL, RETURN RECEIPT REQUESTED

Andrew Wheeler, Acting Administrator
USEPA Headquarters
1101A
William Jefferson Clinton Building
1200 Pennsylvania Avenue, N. W.
Washington, DC 20460
Wheeler.andrew@epa.gov

RE: NOTICE OF VIOLATIONS OF THE ENDANGERED SPECIES ACT IN CONNECTION WITH THE ENVIRONMENTAL PROTECTION AGENCY'S FINAL RENEWABLE FUEL STANDARDS FOR 2019, AND THE BIOMASS-BASED DIESEL VOLUME FOR 2020, APPROVING INCREASED VOLUMES OF RENEWABLE FUELS AND OTHER ACTIONS UNDER THE ENERGY INDEPENDENCE AND SECURITY ACT'S RENEWABLE FUELS STANDARD PROGRAM

Dear Acting Administrator Wheeler:

On behalf of Gulf Restoration Network and Sierra Club, I write to provide you with 60 days' notice of the U.S. Environmental Protection Agency's ("EPA") violations of Section 7 of the Endangered Species Act ("ESA"), 16 U.S.C. § 1536, and its implementing regulations, 50 C.F.R. Part 402.

By failing to complete consultation with the U.S. Fish and Wildlife Service ("FWS") or the National Marine Fisheries Service (NOAA Fisheries or NMFS) in promulgating the Renewable Fuel Standard for 2019, and the Biomass-based Diesel Volume for 2020 (hereafter "2019 Rule") and in administering the Energy Independence and Security Act's (EISA) Renewable Fuels Standard Program (RFS) by taking several actions under the Program, including but not limited to: 1) setting the Renewable Fuel standards for 2019, and the Biomass-based Diesel Volume for 2020; 2) setting annual volumetric standards for renewable fuels; 3) exercising, or failing to exercise, its general waiver authority; and 4) approving new fuel pathways that use new renewable feedstocks and advanced technologies, EPA has violated its procedural and substantive obligations under ESA Section 7(a)(2), 16 U.S.C. § 1536(a)(2), to insure that its actions are not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. Also, EPA has not used the best scientific and commercial data available in fulfilling the requirements of that paragraph. In addition, EPA is in violation of ESA §7(a)(1), 16 U.S.C. §1536(a)(1), by not carrying out its Renewable Fuels Standard Program for the conservation of endangered and

and its implementing regulations for not consulting with EPA on these matters, as set forth more fully below.

On June 26, 2018, EPA proposed its renewable fuel volumetric standards for 2019 and biomass-based diesel volume standard for 2020. The undersigned and other members of the public submitted comments into the rulemaking record identifying EPA's ESA Section 7 consultation duties and set forth facts supported by expert studies and EPA's own 2018 Triennial Report on harm to protected species resulting from the proposed 2019 Rule and EPA's ongoing programmatic actions to expand U.S. biofuels production without the requisite checks on land conversion and protected species. See comment letters attached as Exhibits A and B. On November 30, 2018, EPA announced the final standards, which increase the current total renewable fuel volume requirements from 19.29 billion gallons to 19.92 billion gallons, and maintain the statute's implied maximum conventional ethanol fuel volumes of 15 billion gallons. Based on this and other information described below, it appears that EPA has failed to conduct its required Endangered Species Act consultation in executing the 2019 Rule promulgation, associated general waiver authority determination on whether to reduce biofuel volumes based on severe environmental harm, and other actions in its administration of the Renewable Fuels Standard Program.

If the statutory violations described herein are not promptly and diligently rectified within the 60-day period commencing with receipt of this letter, Sierra Club and Gulf Restoration Network intend to file suit in federal court to seek appropriate legal and equitable remedies. This notice is provided in fulfillment of the requirements of the citizen suit provision of the ESA, 16 U.S.C. § 1540(g)(2)(A)(i).

I. LEGAL FRAMEWORK

A. THE ENDANGERED SPECIES ACT (ESA)

Congress enacted the Endangered Species Act in 1973 to provide for the conservation of endangered and threatened fish, wildlife, plants, and their natural habitats.[1] The ESA imposes substantive and procedural obligations on all federal agencies with regard to listed and proposed species and their critical habitats.[2]

Section 7 of the ESA and its implementing regulations require each federal agency, in consultation with the appropriate wildlife agency – here, the FWS and NMFS (hereafter "wildlife agencies") – to insure that any action authorized, funded, or carried out by the agency is not likely to (1) jeopardize the continued existence of any threatened or endangered species or (2) result in the destruction or adverse modification of the critical habitat of such species. 16 U.S.C. § 1536(a)(2); 50 C.F.R. § 402.14(a).

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[1] *See id.* § 1531. Congress defined "conservation" as "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to [the Act] are no longer necessary." *Id.* § 1532(3).

[2] *See id.* § 1536(a)(1), (a)(2), (a)(4); *id.* § 1538(a); 50 C.F.R. § 402.01.

"Action" is broadly defined to include actions that may directly or indirectly cause modifications to the land, water, or air, and actions that are intended to conserve listed species or their habitat. 50 C.F.R. § 402.02. An action would "jeopardize the continued existence of" a species if it "reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." *Id*. "Destruction or adverse modification" of critical habitat means "a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical." *Id.*

For each federal action, the federal action agency – here, EPA – must request from the wildlife agencies a list of any ESA-listed or proposed species that may be present in the area of the agency action. 16 U.S.C. § 1536(c)(1); 50 C.F.R. § 402.12. "Action area" is defined by regulation to be broader than simply the project area: it means "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." 50 C.F.R. § 402.02.

If the action agency determines that its proposed action will not affect listed species or critical habitat, it is not obligated to consult with wildlife agencies. 50 C.F.R. § 402.14. Effects determinations must be based on the sum of the direct, indirect, and cumulative effects of the action, added to the environmental baseline and interrelated and interdependent actions. *Id.* § 402.02 (defining "effects of the action."). The threshold for triggering consultation is low: if the action agency determines that its proposed action may affect any listed species or critical habitat, it must engage in formal or informal consultation with the wildlife agencies. 50 C.F.R. §§ 402.13, 402.14; *see also Heartwood v. Kempthorne*, 302 Fed. Appx. 394, 395 (6th Cir. 2008).

To complete informal consultation, the action agency must determine, with the written concurrence of the wildlife agencies, that the action is not likely to adversely affect listed species or critical habitat. 50 C.F.R. § 402.13(a). If the action is likely to adversely affect listed species or critical habitat, the action agency and wildlife agencies must engage in formal consultation. *Id.* § 402.14. To complete formal consultation if the agency action is not likely to result in jeopardy or destruction or adverse modification of critical habitat, the wildlife agency must provide the action agency with a biological opinion, explaining how the proposed action will affect the listed species or habitat, together with an incidental take statement and any reasonable and prudent measures necessary to avoid jeopardy. 16 U.S.C. § 1536(b); 50 C.F.R. §§ 402.14(g)-(i). If the relevant wildlife agency, however, determines that the action is likely to jeopardize the species or result in the destruction or adverse modification of critical habitat, the agency "shall suggest those reasonable and prudent alternatives which [it] believes" would not result in jeopardy or adverse modification. 16 U.S.C. § 1536(b)(3).

The action agency also has a mandatory duty to confer with wildlife agencies on any actions that are "likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat." 50 C.F.R. § 402.10(a). Although prior to final listing or final critical habitat designation, the conference opinion is advisory, not binding, the conference process "is designed to assist the Federal agency and any applicant in identifying and resolving potential conflicts at an early stage in the planning process." *Id.*

Throughout the consultation process, the wildlife agencies must use "the best scientific and commercial data available" to evaluate the impacts the action will have on listed species and to provide its "biological opinion" whether, as a result of those impacts, the action is likely to result in jeopardy or destruction of critical habitat. 16 U.S.C. §§ 1536(a)(2) & (b)(3); 50 C.F.R. § 402.14(g). The action agency also has an independent obligation to "use the best scientific and commercial data available" under Section 7. 16 U.S.C. § 1536(a)(2).

Once the action agency has initiated consultation, Section 7(d) prohibits it from making "any irreversible or irretrievable commitment of resources with respect to the agency action which has the effect of foreclosing the formulation or implementation of any reasonable and prudent alternative measures which would avoid violating ESA Section 7(a)(2). 16 U.S.C. § 1536(d); 50 C.F.R. § 402.09.

In addition, an action agency will engage in "programmatic consultation" with wildlife agencies when the action agency carries out a program comprised of multiple actions that have regional or nationwide impacts that may affect a wide variety of listed species over a long period of time. Programmatic consultation is appropriate in situations where it may not be feasible to conduct site specific and species specific effects analyses, or in a rulemaking context because of its programmatic nature and the fact that a rule may not be self-effecting (i.e. it is implemented only through some future action). In the context of a rulemaking, agencies conduct programmatic consultation to examine whether and to what degree the action agency has structured a rule to ensure that its implementation is not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of critical habitat. Programmatic consultation helps to better assess several factors related to the agency action, including but not limited to: better understanding the scope of its action; reliably estimating the physical, chemical, or biotic stressors that are likely to be produced as a direct or indirect result of their action; minimizing adverse effects of such activities on ESA-listed species and designated critical habitat; continuous monitoring and evaluating of likely adverse effects on listed species and critical habitat; better monitoring and enforcement of program compliance; modifying its action if new information (including inadequate protection for species or low levels of compliance) becomes available. Programmatic consultation helps to ensure the action agency is meeting its section 7(a)(2) obligations when overseeing the implementation of a program and carrying out multiple actions to administer the program.[3] Importantly, programmatic consultation does not necessarily mean that individual actions taken under the program would avoid action-specific consultation.

Section 9 of the ESA prohibits any person, including any federal agency, from "taking" any listed species without proper authorization through a valid incidental take permit. 16 U.S.C. § 1538(a)(1)(B); 50 C.F.R. § 17.31(a) (extending the "take" prohibition to threatened species).

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[3] *See* "Endangered Species Act Section 7 Consultation Programmatic Biological Opinion on the U.S. Environmental Protection Agency's Issuance and Implementation of the Final Regulations Section 316(b) of the Clean Water Act," at 35-36, (May 2014), available at https://www.epa.gov/sites/production/files/2015-04/documents/final_316b_bo_and_appendices_5_19_2014.pdf..

The term "take" is statutorily defined broadly as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." 16 U.S.C. § 1532(19). The definition of "harm" has been defined broadly by regulation as "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." 50 C.F.R. § 17.3; *see also Babbitt v. Sweet Home Ch. Of Communities for a Great Oregon*, 515 U.S. 687 (1995) (upholding regulatory definition of harm). Courts have found federal agencies liable for unlawful take of listed species where agency-authorized activities resulted in the killing or harming of such species. *See, e.g.*, *Defenders of Wildlife v. Adm'r, Envtl. Prot. Agency*, 882 F.2d 1294 (8th Cir. 1989).

B. THE ENERGY INDEPENDENCE AND SECURITY ACT (EISA) AND THE RENEWABLE FUEL STANDARD (RFS)

The Energy Policy Act of 2005 (EPAct), which amended the Clean Air Act, created the national Renewable Fuel Standard Program (RFS1). 42 U.S.C. § 7546. RFS1 required reduction and replacement of petroleum-based transportation fuel, heating oil and jet fuel with a certain volume of renewable fuel. Under the EPAct, Congress mandated the use of a minimum of 4 billion gallons of renewable fuel in the nation's gasoline supply in 2006, and increased the threshold to 7.5 billion gallons by 2012.

The Energy Independence and Security Act of 2007 (EISA) further amended the Clean Air Act by expanding the RFS Program (RFS2) in several significant ways. 42 U.S.C. § 7545(o). RFS2 increased the long-term volume goals for total renewable fuels to 36 billion gallons by 2022, subdivided the total renewable fuel requirement into four categories – total renewable fuels, advanced biofuels, biomass-based diesel, and cellulosic biofuels – each with explicit qualifying criteria and standards, and established grandfathering allowances exempting existing facilities producing renewable fuels from greenhouse gas reduction requirements. 42 U.S.C. § 7545(o)(2)(B)(i)(I),(II),(III),(IV).

EPA administers the Renewable Fuels Standard Program which is comprised of several ongoing and annual actions and determinations to fulfill its statutory mandates.[4] Under RFS2, EPA determines whether a fuel qualifies as a renewable fuel based on statutory and regulatory criteria and determines the annual volume mandate for each category of biofuel. 42 U.S.C. § 7545(o)(2)(A)(i).[5] Each fuel is subject to biomass feedstock criteria as well as a minimum lifecycle greenhouse gas emission reduction threshold as compared to the lifecycle greenhouse gas emissions of the 2005 petroleum based fuels that it replaces. 42 U.S.C. § 7545(o)(1)(C).

The RFS further defines the four categories of renewable fuels as follows:

- Total renewable fuel – These biofuels are required to

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[4] *See* https://www.epa.gov/renewable-fuel-standard-program for an overview of the Renewable Fuels Standard Program.

[5] EPA conducts public notice and comment with each of these agency actions.

reduce lifecycle greenhouse gas ("GHG") emissions by at least 20% relative to conventional fuels to qualify as a renewable fuel. Most biofuels, including corn-starch ethanol from new facilities, qualify for this mandate. However, under the EISA the volume of corn-starch ethanol included in the Renewable Fuel Standard was capped at 13.8 billion gallons in 2013, but grew to 15 billion gallons by 2015 and became fixed thereafter.

- Advanced biofuels – Advanced biofuels must reduce lifecycle GHG emissions by 50% to qualify. Advanced biofuels are a subcomponent of the total renewable fuels mandate. Corn-starch ethanol is expressly excluded from this category. Cellulosic biofuel and biomass-based diesel (defined below) are considered advanced biofuels. Potential feedstock sources include grains such as sorghum and wheat. Imported Brazilian sugarcane ethanol, as well as biomass-based biodiesel and biofuels from cellulosic materials (including non-starch parts of the corn plant such as the stalk and cob) also qualify. The total advanced biofuel statutory mandate for 2013 was 2.75 billion gallons (ethanol equivalent) but increases to 21 billion gallons by 2022.

- Cellulosic and agricultural waste-based biofuel – Cellulosic biofuels must reduce lifecycle GHG emissions by at least 60% to qualify. Cellulosic biofuels are derived from cellulose, hemicellulose, or lignin. This includes cellulosic biomass ethanol as well as any biomass-to-liquid fuel such as cellulosic gasoline or diesel. The statutory mandate requires 100 million gallons in 2010 and grows to 16 billion gallons in 2022. From 2010 to 2017, EPA lowered the Renewable Fuel Standard mandate for this category using its waiver authority.

- Biomass-based biodiesel – Any diesel fuel made from biomass feedstocks (including algae) qualifies, including biodiesel (mono-alkyl esters) and non-ester renewable diesel (e.g., cellulosic diesel). The lifecycle GHG emissions reduction threshold is 50%. EPA established the 2013 mandate at 1.28 billion gallons (actual volume). The mandate grew from 0.5 billion gallons in 2009 to

1 billion gallons in 2012.[6]

Importantly, there is no statutory volume requirement for "conventional" biofuels which are the biofuels that do not qualify as “advanced biofuels,” i.e., corn-based ethanol, and are included as part of the “total renewable fuels” category. Conventional volumes are calculated by subtracting “advanced biofuels” from “total renewable fuels.”

EPA also reviews and approves on an ongoing basis new pathways for fuels using new feedstocks and advanced technologies to meet the RFS2. 40 C.F.R. 80 § 1416. A renewable fuel pathway includes three components: 1) feedstock, 2) production process, and 3) fuel type. Each combination of the three components is a separate fuel pathway which is assigned one or more “D-codes” representing Renewable Fuel Identification Numbers (RINs) that reflect the volume and renewable composition (i.e., renewable fuels, advanced biofuel, biomass-based diesel, cellulosic biofuel or cellulosic diesel) of each gallon of renewable fuel. RINs are the credits generated when fuel is produced. Regulated parties must obtain sufficient quantities of RIN credits on an annual basis to demonstrate compliance with the Program. 40 C.F.R. 80 §§ 1125, 1126.

In setting the annual volumetric standard for each biofuel category and corresponding compliance percentages for regulated parties, 42 U.S.C. § 7545(o)(3)(B)(i), EPA is guided by targets set out in the statute. However, EPA has a specific general authority to waive RFS volumes, in whole or in part, (1) if there is inadequate domestic supply, or (2) if “implementation of the requirement would severely harm the economy or environment of a State, a region, or the United States.” 42 U.S.C. § 7545(o)(7)(A). To date, EPA has never exercised its general waiver authority on the basis of severe environmental harm, despite EPA’s own Triennial Reports and authoritative studies providing that biofuels production associated with increasing renewable fuel volume mandates, and specifically conventional biofuels, are causing deleterious effects on native grasslands, water quality and federally protected species and their critical habitat.

II. ETHANOL GROWTH RESULTING FROM INCREASED RENEWABLE FUEL VOLUME MANDATES HAVE RESULTED IN SIGNIFICANT LAND CONVERSION AND IMPACTS TO ECOSYSTEMS AND HABITAT

Although the push for renewable fuels in creating the RFS was well intentioned – to secure energy independence, reduced greenhouse gas emissions and other harmful pollution and to spur economic development in rural America – the policy’s drive to increase plant-based fuels has had unanticipated impacts on our land, water, and wildlife habitat. The statutory requirement to increase renewable fuels and EPA’s corresponding annual standards that have steadily increased renewable fuel volumes have led to significant ethanol growth across America’s

[6] Schnepf & Yacobucci, Congressional Research Service, *Renewable Fuel Standard: Overview and Issues*, available at: https://www.ifdaonline.org/IFDA/media/IFDA/GR/CRS-RFS-Overview-Issues.pdf (Mar. 14, 2013).

landscape. By 2015 and continuing through 2022, the law's renewable fuel targets suggest annual corn ethanol volumes of 15 billion gallons. Accordingly, EPA's 2017 and 2018 volumetric standards set ethanol volumes at 15 billion gallons. 81 Fed. Reg. 89746 (Dec. 12, 2016); 82 Fed. Reg. 58486 (Dec. 12, 2017). The recently announced 2019 volumetric standards maintain this same maximum level.[7] In addition, the law sets targets for increasing volumes of "advanced" biofuels derived from other feedstocks to total 21 billion gallons by 2022. 42 U.S.C. § 7545(o). Even though advanced biofuel development has not kept pace with statutory targets, prompting EPA to exercise its waiver authority and set annual advanced biofuel standards at levels below the statutory target, ethanol growth has kept pace with targets. In fact, its growth has gone unchecked, causing significant negative impacts in return for arguably uncertain carbon reduction benefits.[8]

The policy has propelled historically high levels of corn production for ethanol. Over 97 percent of biofuels produced in the United States are derived from corn and there is little potential to spur growth of new fuels from other feedstocks.[9] To meet federal mandates, approximately 40 percent of the U.S. corn crop is diverted to biorefineries for fuel production (up from 9 percent in 2001).[10] At more than 90 million acres, corn production dominates the agricultural landscape.[11]

Farmers have achieved increased corn productivity for ethanol through various methods. On lands already under cultivation, farmers are changing crop rotations in favor of consecutive years of corn, double-cropping, increasing chemical fertilizer and pesticide application to maximize crop density. In addition, farmers have brought large new swaths of land under cultivation for the first time causing the elimination of valuable ecosystems.[12]

A University of Wisconsin study found overall land conversion of 7.3 million acres into crop land from 2008 to 2012, the first four years of the expanded renewable fuel mandate.[13]

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[7] *See* https://www.epa.gov/sites/production/files/2018-11/documents/rfs-2019-annual-rule-frm-2018-11-30.pdf.

[8] David DeGennaro, National Wildlife Federation, *Fueling Destruction: The Unintended Consequences of the Renewable Fuel Standard on Land, Water, and Wildlife*, (2016), available at: http://www.nwf.org/~/media/PDFs/Education-Advocacy/Fueling-Destruction_Final.ashx (hereafter DeGennaro).

[9] *Id*. at 6.

[10] *Id.* It should be noted that the use of dried distillers grain – a byproduct of ethanol production – as livestock feed reduces ethanol's overall impact. U.S. Department of Agriculture & Economic Research Service. http://www.ers.usda.gov/topics/crops/corn/background.aspx.

[11] *Id*.

[12] *Id*. at 3.

[13] Lark, T.J., Salmon, J.M. & Gibbs, H.K. Cropland expansion outpaces agricultural and biofuel polices in the United States, *Environmental Research Letters*, Vol. 10, 044003 (2015); DeGennaro at 7. "Taking into account other land use fluctuations during that time, the net expansion was 2.9 million acres of cropland – an area larger than the state of Massachusetts. However, this is likely an underestimate since

Much of these lands were comprised of grassland, wetlands and forest that had not been cropland for more than 20 years. The greatest total expansion was concentrated in the Dakotas, along the border of Southern Iowa and Northern Missouri, and in the Western parts of Kansas, Oklahoma, and the Texas panhandle.[14] Studies in the "corn belt" states found conversion of more than 1.3 million acres of grassland into corn or soy crops between 2006 and 2011.[15] Expansion also occurred in the Western Plains from South Dakota to New Mexico, which traditionally have not been locations suitable for agriculture. Northern Minnesota, Wisconsin, Southern Missouri, Eastern Oklahoma, and parts of the Appalachians experienced conversion along forest boundaries. A recent study on land conversion in Michigan, Minnesota and Wisconsin between 2008 and 2013 documents a loss of 2 million acres, or a 37% loss of non-agricultural open space. At the same time corn acreage in those states increased by 36 percent.[16]

Certain parts of the country identified as "hot spots" due to intense land conversion are of particular concern because they serve as particularly unique and valuable habitat for wildlife, such as the Prairie Pothole Region wetlands of the Upper Midwest which function as the primary North American breeding ground for ducks and other waterfowl.[17] In this region land conversion to corn and soy steadily increased between 2006 and 2012, with the region experiencing a 27 percent increase in corn and soy acreage between 2010 and 2012 alone. The total acreage was equivalent to an area larger than the state of Connecticut.[18]

The University of Wisconsin study also determined that the majority of the landscapes lost as a result of the RFS are grasslands, including native prairie, pasture, and federal Conservation Reserve Program lands, accounting for 77 percent of new farmland. One-quarter of these grasslands, which were in grass for more than 20 years, are known for their high value for wildlife and carbon sequestration.[19] In addition, forest lands comprised three percent of new cropland while wetlands comprised two percent of new cropland.[20] Of particular concern is the loss of grassland immediately surrounding wetlands, which, like wetlands, serve the critical function of providing habitat and food for nesting waterfowl and other species.[21] Ethanol

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the study evaluated only parcels of land 15 acres or greater in size, leavening out smaller areas converted along the periphery of existing fields."

[14] Tyler J Lark *et al* 2015 *Environ. Res. Lett.* Vol. 10, 044003 (2015).

[15] Wright, C.K. & Wimberly, M.S. Recent land use change in the Western Corn Belt threatens grasslands and wetlands. *Proceedings of the National Academy of Sciences*, Vol. 110, 4134-4139 (2013).

[16] Mladenoff, D.J., Sahajpal, R., Johnson, C.P. & Rothstein, D.E. Recent Land Use Change to Agriculture in the US Lake States: Impacts on Cellulosic Biomass Potential and Natural Lands. *PloS one*, Vol. 11, e0148566 (2016).

[17] DeGennaro at 3.

[18] Johnston, C.A. Agricultural expansion: land use shell game in the US Northern Plains. *Landscape ecology*, Vol. 29, 81-95 (2014).

[19] Tyler J Lark *et al* 2015 *Environ. Res. Lett.* Vol. 10, 044003 (2015).

[20] *Id.*

[21] Wright, C.K. & Wimberly, M.S. Recent land use change in the Western Corn Belt threatens grasslands and wetlands. *Proceedings of the National Academy of Sciences*, Vol. 110, 4134-4139 (2013).

production has also wiped out other uniquely important ecosystems, including marginal lands at the edge of existing cropland supporting pollinators like bees and monarch butterflies, and buffer strips along waterways that filter polluted farm runoff before depositing into waterways that serve as drinking water sources and support aquatic species.[22]

Corn production's expansion, in large part, can be attributed to the RFS's Congressionally-mandated use of corn ethanol in transportation fuels.[23] There is a body of evidence demonstrating that the RFS mandate, particularly corn-based ethanol and soy-based biodiesel, at increasing rates, has directly contributed to the large scale destruction of sensitive and critical natural areas and ecosystems.[24]

EPA's Second Triennial Report, published in June 2018, on the environmental and resource conservation impacts of the RFS program relies on similar studies and provides that biofuels mandates under the RFS policy has led to increased land conversion, with increased rates of conversion closer to biorefineries. The Report also indicates that biofuels production associated with the RFS policy has had adverse impacts on water quality from fertilizer nutrient loading, and impacts on biodiversity, including harm to bird, duck and pollinator and aquatic species populations. U.S. EPA, *Biofuels and the Environment: Second Triennial Report to Congress* (June 29, 2018) at ix, 14-18, 53-54, 67-72, 84-91.[25]

Despite clear documentation, EPA has refused to implement land conversion protections built into the law. Under the law, renewable biomass is defined to include seven categories of biomass feedstock including feedstock derived from planted crops or crop residue which must be harvested from "agricultural land cleared or cultivated at any time prior to [EISA's enactment in] December 2007, that is actively managed or fallow, and non-forested." 42 U.S.C. § 7545(o)(1)(I). EPA further defined "agricultural land" from which crops and crop residue can be harvested to qualify as a renewable fuel to include cropland, pastureland, and land enrolled in the Conservation Reserve Program. 75 Fed. Reg. 58 at 14681 (Mar. 26, 2010). Rather than directly requesting information from ethanol producers to verify that their feedstock originated on eligible land, EPA established an "aggregate compliance" approach that compares total "agricultural land" each year to a baseline level of "agricultural land" production that existed in 2007. Specific recordkeeping and reporting requirements to prevent impermissible land use conversion for fuel producers using plant crops or crop residues would be triggered only if a certain agricultural production threshold is exceeded. *Id.* The "aggregate compliance" method to determine impermissible land use conversion is based on several flawed assumptions and EPA

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[22] DeGennaro at 4.
[23] *Id*.
[24] *Id*.
[25] Available at: https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=IO&dirEntryId=341491.

has never taken action or made efforts to reign in producers responsible for land conversion despite clear evidence of land clearing for corn biofuel production.[26]

III. ENDANGERED SPECIES ACT LISTED SPECIES AND DESIGNATED CRITICAL HABITAT MAY BE AFFECTED BY EPA'S POLICY OF UNABATED LAND USE CHANGE UNDER THE RENEWABLE FUEL STANDARD PROGRAM

Dramatic land conversion that has occurred as a result of the RFS ethanol mandate has had adverse impacts on habitat and the species that depend on these ecosystems. The loss of natural areas to cultivation has resulted in direct mortality to species as well as loss of seasonal habitat provided by grasslands for spring nesting, brooding, fawning cover, loss of winter food and cover.[27] Expansion of corn and soybean production has been identified as the greatest source of wetland loss in the North and South Dakota Prairie Pothole Region, which produces more than 60 percent of the country's total duck population.[28] The expansion of corn agriculture in particular also has significantly affected waterfowl, grassland birds, monarch butterflies, bees, other native pollinators, and mammals.[29] Adding to the loss of habitat for diverse species is the push toward intensively managed monocultures under the RFS rather than a diversity of vegetation.[30]

In addition, widespread cultivation of corn for ethanol has significant impacts on water quality and aquatic habitat. Corn production is associated with high levels of nutrient loss and soil erosion, leading to contamination of water supplies.[31] Corn, as opposed to other biofuel crops, requires the highest level of fertilizer and pesticide application resulting in higher runoff from fields into waterways.[32] Ethanol production, which is largely sourced by corn grown in the Mississippi River watershed and Great Lakes Basin, places the largest burden of potential water

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[26] *Id.* at 12; U.S. Department of Agriculture & Farm Service Agency. *Crop Acreage Data*, https://www.fsa.usda.gov/news-room/efoia/electronic-reading-room/frequently-requested-information/crop-acreage-data/index. (USDA reported an increase in planted acres of commodity crops from 242.6 million in 2007 to 249 million in 2013, and the conversion of almost 400,000 acres of non-cropland to cropland over between 2011 and 2012. Studies also have confirmed that the dramatic increase in corn production and associated land conversion are the result of the RFS, with conversion rates after passage of the RFS in 2007 at nine times higher than the years prior.)

[27] DeGennaro at 13.

[28] *Id*.

[29] *Id*. at 14.

[30] *Id*. at 15.

[31] DeGennaro at 16.

[32] National Research Council & Committee on Economic and Environmental Impacts of Increasing Biofuels Production. *Renewable fuel standard: potential economic and environmental effects of US biofuel policy.*(National Academies Press, 2011); Housh, M., M. Khanna & Cai, X. Mix of First and Second Generation Biofuels to meet Multiple Environmental Objectives: Implications for Policy as a Watershed Scale. *Water Economics and Policy*, Vol. 1, 26 (2015).

quality impacts on the Great Lakes and the Gulf of Mexico.[33] Recent land conversion studies demonstrate that conversion from pasture to corn leads to increased sediment yields of up to 127 percent.[34]

Excessive nutrient runoff from more intensive agriculture has led to severe algal blooms in water bodies including the Great Lakes. The majority of land in the Mississippi River watershed, which drains into the Gulf of Mexico, is farmland. Massive land based nutrient runoff into rivers and streams that flow into the Mississippi River and ultimately drain into the Gulf of Mexico is the largest contributor to the documented hypoxic area known as the "Dead Zone." [35] Located at the mouth of the Mississippi in the Gulf, the Dead Zone threatens marine habitat on an enormous scale.[36] In fact, studies show that addressing the annual Dead Zone to improve conditions for marine life is practically impossible under the current RFS volume mandates, without huge shifts in food production.[37]

This phenomenon is described by NOAA:

> Scientists have found this year's [2015] Gulf of Mexico dead zone — an area of low to no oxygen that can kill fish and marine life — is, at 6,474 square miles, above average in size and larger than forecast by NOAA in June. The larger than expected forecast was caused by heavy June rains throughout the Mississippi River watershed.
>
> The measured size this year — an area about the size of Connecticut and Rhode Island combined — is larger than the 5,052 square miles measured last year, indicating that nutrients from the Mississippi River watershed are continuing to affect the nation's coastal resources and habitats in the Gulf. The size is larger than the Gulf of Mexico / Mississippi River Watershed Nutrient Task Force (Hypoxia Task Force) target of 1,900 square miles.

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[33] Wallander, S., Claassen, R. &Nickerson, C. The ethanol decade: an expansion of US corn production, 2000-09. *USDA-ERS Economic Information Bulletin* (2011); U.S. Congressional Budget Office. The Renewable Fuel Standard: Issues for 2014 and Beyond. Report No. 45477, (Congressional Budget Office, Washington, DC, 2014).

[34] Shao, Y., Lunetta, R.S. Macpherson, A.J., Luo, J. &Chen, G. Assessing sediment yield for selected watersheds in the Laurentian great lakes basin under future agricultural scenarios, *Environmental management*, Vol. 51, 59-69 (2013).

[35] Joyce, Christopher. 2010. "Massive 'Dead Zone' Threatens Gulf Marine Life" (radio report). National Public Radio, Morning Edition Transcript, available at www.npr.org/templates/story/story.php?storyId=128946110.

[36] Donner, S.D. & Kucharik, C.J. Corn-based ethanol production compromises goal of reducing nitrogen export by the Mississippi River. *Proceedings of the National Academy of Sciences,*Vol. 2015, 4513-4518 (2008).

[37] Donner, S. D. & Kucharik, C. J., *Corn-based ethanol production compromises goal of reducing nitrogen export by the Mississippi River,* Proceedings of the National Academy of Sciences, Vol. 105, 4513- 4518 (2008)

> . . .
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> The hypoxic zone off the coast of Louisiana and Texas forms each summer threatening the ecosystem that supports valuable commercial and recreational Gulf fisheries. NOAA-funded research in the past decade shows hypoxia results in habitat loss, displacement of fish (including shrimp and croaker) from their preferred areas, and a decline in reproductive ability in some species.[38]

An article, entitled "Corn boom could expand 'dead zone' in Gulf," summarizes the contribution of corn ethanol production to the Dead Zone:

> JEFFERSON, Iowa — Because of rising demand for ethanol, American farmers are growing more corn than at any time since World War II. And sea life in the Gulf of Mexico is paying the price.
>
> The nation's corn crop is fertilized with millions of pounds of nitrogen-based fertilizer. And when that nitrogen runs off fields in Corn Belt states, it makes its way to the Mississippi River and eventually pours into the Gulf, where it contributes to a growing "dead zone" — a 7,900-square-mile patch so depleted of oxygen that fish, crabs and shrimp suffocate.
>
> The dead zone was discovered in 1985 and has grown fairly steadily since then, forcing fishermen to venture farther and farther out to sea to find their catch. For decades, fertilizer has been considered the prime cause of the lifeless spot.
>
> With demand for corn booming, some researchers fear the dead zone will expand rapidly, with devastating consequences.
>
> "We might be coming close to a tipping point," said Matt Rota, director of the water resources program for the New Orleans-based Gulf Restoration Network, an environmental group. "The ecosystem might change or collapse as opposed to being just impacted."
>
> Environmentalists had hoped to cut nitrogen runoff by encouraging farmers to apply less fertilizer and establish buffers along waterways. But the demand for the corn-based fuel additive ethanol has driven up the price for the crop, which is selling for about $4 per bushel, up from a little more than $2 in 2002.
>
> That enticed American farmers — mostly in Iowa, Illinois, Minnesota, North Dakota and South Dakota — to plant more than 93 million acres of corn in 2007, the most since 1944. They substituted corn for other crops, or made use of land not previously in cultivation.

[38] NOAA, "2015 Gulf of Mexico dead zone 'above average'," (Aug. 4, 2015), available at http://www.noaanews.noaa.gov/stories2015/080415-gulf-of-mexico-dead-zone-above-average.html

> Corn is more "leaky" than crops such as soybean and alfalfa — that is, it absorbs less nitrogen per acre. The prime reasons are the drainage systems used in corn fields and the timing of when the fertilizer is applied.
>
> The Environmental Protection Agency estimates that up to 210 million pounds of nitrogen fertilizer enter the Gulf of Mexico each year. Scientists had no immediate estimate for 2007, but said they expect the amount of fertilizer going into streams to increase with more acres of corn planted.
>
> "Corn agriculture practices release a lot of nitrogen," said Donald Scavia, a University of Michigan professor who has studied corn fertilizer's effect on the dead zone. "More corn equals more nitrogen pollution."
>
> Farmers realize the connection between their crop and problems downstream, but with the price of corn soaring, it doesn't make sense to grow anything else. And growing corn isn't profitable without nitrogen-based fertilizer.
>
> "I think you have to try to be a good steward of the land," said Jerry Peckumn, who farms corn and soybeans on about 2,000 acres he owns or leases near the Iowa community of Jefferson. "But on the other hand, you can't ignore the price of corn."
>
> Peckumn grows alfalfa and natural grass on the 220 or so acres he owns, but said he cannot afford to experiment on the land he rents.
>
> The dead zone typically begins in the spring and persists into the summer. Its size and location vary each year because of currents, weather and other factors, but it is generally near the mouth of the Mississippi.[39]

The Dead Zone impacts endangered and threatened species such as the Gulf sturgeon, Loggerhead turtle and Sperm whale. The huge influx of nutrients such as nitrogen and phosphorous cause massive phytoplankton blooms leading to a large increase in zooplankton that feed on phytoplankton. Large amounts of dead phytoplankton and zooplankton waste then accumulates on the seafloor, burying bottom dwellers and prey for larger fish and mammals that frequent these waters for food, nesting and raising young. The decomposition of plankton matter depletes the oxygen in the area faster than it can be replaced, causing the large hypoxic Dead Zone.[40] Although the federal government promised to find ways to reduce the flow of nutrients almost 20 years ago, average nutrient loads continue to rise to record levels and the "Dead Zone"

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[39] Environment on NBC News.com, "Corn boom could expand 'dead zone' in Gulf," (Dec. 17, 2007), available at: http://www.nbcnews.com/id/22301669/ns/us_news-environment/t/corn-boom-could-expand-dead-zone-gulf/#.WUrSE7i2aSo.

[40] National Oceanic and Atmospheric Administration (NOAA). 2009a. "Dead Zones. Hypoxia in the Gulf of Mexico," (factsheet) at 1-2, available at http://www.noaanews.noaa.gov/stories2009/pdfs/new%20fact%20sheet%20dead%20zones_final.pdf.

becomes more expansive every year, nearly doubling its size since the 1980s.[41] The Dead Zone's inhospitable conditions are threatening federally listed species and may be impairing essential behavioral patterns such as breeding, feeding or sheltering.

Overall, the impacts described above are taking a toll on sensitive and vulnerable species, many of which are federally listed as threatened or endangered under the Endangered Species Act. Specifically, there are numerous listed species with designated critical habitat in regions in which land conversion is taking place due to corn production growth for ethanol. Species that have experienced direct and/or indirect impacts from land conversion occurring in critical habitat areas or in areas near designated critical habitat may include, but are not limited to:

<u>Piping plover</u> *(Charadrius melodus)*:

The Piping plover, listed as endangered in the Great Lakes region and threatened elsewhere,[42] is a small shorebird that nests in the Great Plains states and the shores of the Great Lakes. Critical habitat for the bird located in North Dakota may be directly or indirectly impacted by land conversion.

<u>Whooping Crane</u> *(Grus Americana)*:

The endangered Whooping Crane previously pushed to the brink of extinction to just 21 wild birds due to unregulated hunting and loss of habitat. Although conservation efforts have led to limited recovery,[43] recent land conversion has likely occurred within the Whooping Crane's critical habitat.

<u>Topeka shiner</u> (*Notropis topeka*):

The endangered Topeka shiner is a small minnow that can be found in prairie streams in parts of Iowa, Kansas, Minnesota, Missouri, and Nebraska. Its survival is threatened by habitat destruction, sedimentation, and changes in water quality likely associated with increased agricultural activity.[44] It is likely that land conversion for ethanol production has occurred within or near critical habitat zones in southwest Minnesota and northwest Iowa.

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[41] Joyce, Christopher. 2010. "Massive 'Dead Zone' Threatens Gulf Marine Life" (radio report). National Public Radio, Morning Edition Transcript, available at www.npr.org/templates/story/story.php?storyId=128946110.

[42] U.S. Fish and Wildlife Service, *Piping Plover,* August 2016, https://www.fws.gov/Midwest/endangered/pipingplover/index.html.

[43] U.S. Fish and Wildlife Service, North Florida Ecological Services Office, *Species Status and Fact Sheet: Whooping Crane,* June 2016, https://www.fws.gov/northflorida/whoopingcrane/whoopingcrane-fact-2001.htm.

[44] U.S. Fish and Wildlife Service, *Questions and Answers About the Topeka Shiner,* September 2016, https://www.fws.gov/midwest/endangered/fishes/pdf/tosh-qas.pdf

Dakota Skipper (*Hesperia dacotae*):

The threatened Dakota skipper is a small butterfly that lives in high-quality mixed and tallgrass prairie.[45] It has been extirpated from Illinois and Iowa and now occurs in remnants of native mixed and tallgrass prairie in Minnesota, the Dakotas and southern Canada. Land conversion likely has occurred directly adjacent to critical habitat.

Purple bankclimber *(Elliptoideus sloatianus)*:

The threatened Purple bankclimber, a filter feeder that feeds on plankton and detritus, inhabits Georgia and Florida rivers with moderate currents and sandy floors. Sedimentation and pesticide application pose a significant threat to the species. Although the Purple bankclimber is a target species in a 7-species Federal Recovery Plan,[46] significant land conversion has likely occurred in areas surrounding the species designated critical habitat in southwest Georgia, leading to potential water quality impacts that could jeopardize the species.

Fat threeridge *(Amblema neislerii)*:

The endangered[47] Fat threeridge is a fresh water mussel found in small to large rivers of southern Georgia and Florida. Sedimentation due to inadequate riparian buffer zones is a significant threat to the species. Significant land conversion has likely occurred in areas surrounding the species designated critical habitat, leading to potential alteration of the species' aquatic environment.

Oval pigtoe *(Pleurobema pyriforme)*:

The endangered Oval pigtoe, a small freshwater mussel filter feeder of plankton and detritus, inhabits medium-sized rivers and small creeks. Sedimentation, pesticide and other chemical pollution pose a direct threat to the species. Although it is a target species in a 7-species Federal Recovery Plan,[48] significant land conversion likely has occurred in areas surrounding the species' designated critical habitat located in rivers of southwest Georgia.

Gulf sturgeon *(Acipenser oxyrinchus desotoi):*

The threatened Gulf sturgeon is an anadromous fish that migrates into coastal rivers from Louisiana to Florida in the spring and summer to spawn, and inhabits the Gulf of Mexico and its estuaries and bay in the winter months. In the winter, the sturgeon forages in the Gulf of

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[45] U.S. Fish and Wildlife Service, *Dakota Skipper*, October 2014, https://www.fws.gov/midwest/Endangered/insects/dask/pdf/DakotaSkipperFactSheet22Oct2014.pdf

[46] Florida Fish & Wildlife Conservation Commission, Purple bankclimber, http://myfwc.com/wildlifehabitats/imperiled/profiles/invertebrates/purple-bankclimber/

[47] Georgia Department of Natural Resources, Wildlife Resources Division, Fat threerdige, http://www.georgiawildlife.org/sites/default/files/uploads/wildlife/nongame/pdf/accounts/invertebrates/amblema_neislerii.pdf.

[48] Florida Fish and Wildlife Conservation Commission, Oval pigtoe, http://myfwc.com/media/2211676/Oval-pigtoe.pdf.

Mexico's brackish and marine waters. Sturgeon require a clean, rocky substrate for spawning.[49] The Gulf sturgeon's critical habitat encompasses spawning rivers and adjacent estuarine areas including parts of the Gulf of Mexico around the mouth of the Mississippi River. These areas are directly impacted by eutrophication from agricultural runoff, resulting in low dissolved oxygen levels and hypoxia that contribute to the region's "Dead zone." Gulf sturgeon and the benthic organisms it feeds on are vulnerable to these conditions.

Loggerhead turtle *(Caretta caretta):*

The threatened loggerhead turtle inhabits three different ecosystems during their lives – beaches, open ocean waters, and nearshore coastal areas. The loggerhead nests on ocean beaches. Soon after birth, hatchlings move to the surf and eventually swim or get swept out to open ocean waters. During adolescence, ages 7 to 12 years, the juvenile loggerhead makes its way back to coastal waters where it matures into adulthood. These coastal areas provide important habitat for juveniles, as well as crucial adult habitat for foraging, inter-nesting and migration. The loggerhead turtle's critical habitat encompasses waters and beaches of the Gulf of Mexico directly impacted by the Dead Zone's hypoxic conditions.

Sperm whale (*Physeter microcephalus*):

There appears to be a resident population of Sperm whales in the Gulf of Mexico that has a year-round presence in the region. The population doesn't migrate like other populations of the endangered species found at mid-latitudes.[50] The Sperm whale is impacted by a range of threats including poor water quality from nutrient runoff and other pollution. Currently, there is a pending petition before NOAA to separately list the Gulf of Mexico sperm whale as a distinct population segment because it is a discrete population that faces additional unique threats to its survival. Coastal pollution in the region, in particular the uninhabitable hypoxic Dead Zone caused by agricultural run-off from the Mississippi River poses a threat to this distinct sperm whale habitat.[51]

IV. EPA'S ACTIONS TAKEN UNDER THE RENEWABLE FUEL STANDARD VIOLATE THE ENDANGERED SPECIES ACT

EPA must consult with the FWS and NMFS on any of its agency actions "in which there is discretionary Federal involvement or control." 50 C.F.R. § 402.03. EPA has discretion in setting annual volumetric standards for renewable fuels, in exercising its authority to waive renewable fuel volumes, and in approving new pathways for renewable fuels using new feedstocks and advanced technologies. In fact, EPA's general waiver authority permits EPA to

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[49] NOAA Fisheries, Gulf Sturgeon, http://www.fisheries.noaa.gov/pr/species/fish/gulf-sturgeon.html
[50] NOAA Fisheries, Sperm Whale, http://www.fisheries.noaa.gov/pr/species/mammals/whales/sperm-whale.html.
[51] "Petition to list the Gulf of Mexico Distinct Population Segment of Sperm Whale (Physeter macrocephalus) Under the U.S. Endangered Species Act," Petition Submitted to the U.S. Secretary of Commerce, Acting through the National Oceanic and Atmospheric Administration and the National Marine Fisheries Service by Wild Earth Guardians, (Dec. 2011), http://www.fisheries.noaa.gov/pr/species/petitions/spermwhale_gom_dps.pdf.

reduce RFS volumes below statutory targets "when implementation of the requirements would severely harm the environment."

Over the past five years, EPA has engaged in a number of actions pursuant to the Renewable Fuels Standard Program, including but not limited to:

1) Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. 1320 (Jan. 9 2012);
2) Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards, 78 Fed. Reg. 49794 (Aug. 15, 2013);
3) Renewable Fuel Standard Program: Standards for 2014, 2015, and 2016 and Biomass-Based Diesel Volume for 2017, 80 Fed. Reg. 77420 (Dec. 14, 2015). This rulemaking includes EPA's determination to exercise its general waiver authority based on slow development of cellulosic biofuels and marketplace constraints to supplying certain biofuels to consumers. *Id.* at 77422.
4) Renewable Fuel Standard Program: Standards for 2017 and Biomass Based Diesel Volume for 2018, 89 Fed. Reg. 89746 (Dec. 12, 2016). This rulemaking includes EPA's determination not to exercise its general waiver authority to reduce total renewable fuels. *Id.* at 89750.
5) Renewable Fuel Standard Program: Standards for 2018 and Biomass-Based Diesel Volume for 2019. 82 Fed. Reg. 58486 (Dec. 12, 2017). This rulemaking includes EPA's determination not to exercise it general waiver authority to further reduce renewable fuel volumes below statutory targets on the basis of environmental harm, and maintains the maximum volumes of conventional fuels implied under the law.
6) The approval of 22 new fuel pathways in 2017 and 2018 alone, 18 of which are pathways derived from conventional corn.[52]
7) Renewable Fuel Standard Program: Standards for 2019 and Biomass-Based Diesel Volume for 2020.[53] This rulemaking includes EPA's determination not to exercise it general waiver authority to further reduce renewable fuel volumes below statutory targets on the basis of environmental harm, and maintains the maximum volumes of conventional fuels implied under the law, as well as increases total renewable fuels from 19.29 billion gallons in 2018 to 19.92 billion gallons in 2019.

On August 18, 2016, Sierra Club submitted requests under the Freedom of Information Act to the EPA, FWS, and NMFS for all relevant documentation on whether EPA had initiated and conducted consultation with FWS and NMFS in its discretionary activity under the Renewable Fuel Standard. On September 26, September 28, and October 7, 2016 we received responses to our requests from NMFS, EPA, and FWS, respectively. On December 19, 2016, we submitted an appeal of the initial response returned by FWS, as several hundred pages of the produced documents had been redacted without citing an exemption as described in the FOIA. In the letter accompanying the initial release of the documents containing the redacted pages, FWS stated only "Because portions of these documents originate with or substantially concern U.S.

[52] *See* EPA, Renewable Fuel Standard Program, "Approved Pathways for Renewable Fuel," available at https://www.epa.gov/renewable-fuel-standard-program/approved-pathways-renewable-fuel.
[53] Pre-publication available at https://www.epa.gov/sites/production/files/2018-11/documents/rfs-2019-annual-rule-frm-2018-11-30.pdf.

Environmental Protection Agency (EPA), the unredacted versions of these documents will be provided to EPA so that they can make a release determination on their portions." On December 30, 2016, EPA released the unredacted versions of the documents via FOIA online.

The FOIA responses reveal that contrary to ESA §7, there has been no consultation by any of these agencies concerning the RFS program or associated land conversions, formal or informal. There have been no biological assessments by EPA, concurrence letters by FWS or NFMS, no biological opinions or jeopardy findings, no reasonable and prudent alternatives and no incidental take statements, all as required by ESA §7. In short, the agencies have not complied with §7 at all.

A. EPA VIOLATED SECTION 7(A)(1) AND 7(A)(2) BY FAILING TO CARRY OUT THE RENEWABLE FUEL STANDARD PROGRAM TO ENSURE THE CONSERVATION OF FEDERALLY LISTED SPECIES AND BY FAILING TO INITIATE CONSULTATION BEFORE TAKING ACTION UNDER THE RENEWABLE FUEL STANDARD

EPA violated its duty, in consultation with FWS and NMFS, to utilize its authority in furtherance of the purposes of the Endangered Species Act "by carrying out programs for the conservation of endangered species and threatened species." 16 U.S.C. § 1546 (a)(1). As the above responses indicate, EPA failed to conduct or initiate the required Section 7 consultation for any of its individual actions taken under the Renewable Fuels Standard Program, including the 2019 Rule, or to initiate programmatic consultation for the program as a whole to assess impacts to federally listed species and to take action to ensure against jeopardy of those species or the destruction or adverse modification of designated critical habitat.

The foregoing responses also indicate that EPA did not even initiate consultation by requesting from the wildlife agencies a list of any ESA-listed or proposed species that may be present in the area of the agency action. 16 U.S.C. § 1536(c)(1); 50 C.F.R. § 402.12. Given this information and the foregoing documentation of the expansive land conversion taking place under the RFS impacting ecosystems including critical habitat for federally listed species, EPA has failed to meet its obligations of ensuring against jeopardy to listed species or destruction or adverse modification of critical habitat. As such, EPA has violated its procedural and substantive obligations under ESA Section 7(a)(2), 16 U.S.C. § 1536(a)(2).

"The ESA mandates that defendants place conservation above any of the agency's competing interests." *Kentucky Heartwood v. Worthington*, 20 F. Supp. 2d 1076, 1083 (E.D. Ky. 1998). These procedural and substantive violations cannot be separated. Congress established the Section 7(a)(2) consultation procedure explicitly "to ensure compliance with the [ESA's] substantive provisions." *Thomas v. Peterson*, 753 F.2d 754, 764 (9th Cir. 1985). "If a project is allowed to proceed without substantial compliance with those procedural requirements, there can be no assurance that a violation of the ESA's substantive provisions will not result." *Id.* (citing *Tenn. Valley Auth. v. Hill*, 437 U.S. 153 (1978)); *see also Conner v. Burford*, 848 F.2d 1441, 1458 (9th Cir. 1988) (the ESA's "strict substantive provisions . . . justify more stringent enforcement of its procedural requirements, because the procedural requirements are designed to ensure compliance with the substantive provisions."); *Washington Toxics Coal. v. Envtl. Prot. Agency*, 413 F.3d 1024, 1034-35 (9th Cir. 2005).

Moreover, in failing to initiate and conduct consultation, EPA ignores significant and relevant peer reviewed research and literature about land conversion and the impacts of the Renewable Fuels Standard Program on listed species and critical habitat. Notably, EPA even relied on this research in its recent Triennial Report published in June 2018. As such, EPA has violated its Section 7(a)(2) requirements to "use the best scientific and commercial data available."

EPA's violations of ESA Section 7(a)(2) in connection with the Renewable Fuels Standard Program and specifically in setting annual renewable fuel volumes, determining whether to exercise its general authority to waive renewable fuel volumes, and reviewing and approving fuel pathways using new feedstocks and advanced technologies are actionable under the ESA's citizen suit provision, 16 U.S.C. § 1540(g)(1)(A). Should EPA fail to remedy these violations within the 60-day notice period, the undersigned may commence suit to obtain all available judicial remedies.

B. EPA VIOLATED ITS SECTION 7(D) PROHIBITIONS AGAINST ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES THAT WOULD FORECLOSE THE FORMULATION AND IMPLEMENTATION OF REASONABLE AND PRUDENT ALTERNATIVES TO JEOPARDY

Moreover, by taking these actions without first completing consultation with wildlife agencies in accordance with ESA Section 7(a)(2), EPA has violated the ESA's prohibitions against any irreversible and irretrievable commitment of resources that would foreclose the formulation and implementation of reasonable and prudent alternatives to jeopardy. *See* 16 U.S.C. § 1536(d).

Congress specifically enacted Section 7(d) "to prevent Federal agencies from 'steamrolling' activity in order to secure completion of the projects regardless of their impact on endangered species." *Pac. Rivers Council v. Thomas*, 936 F. Supp. 738, 745 (D. Idaho 1996) (quoting *N. Slope Borough v. Andrus*, 486 F. Supp. 332, 356 (D.D.C. 1980), *aff'd in part and rev'd in part on other grounds*, 642 F.2d 589 (D.C. Cir. 1980)). Section 7(d) "clarifies the requirements" of Section 7(a)(2) to "ensur[e] that the status quo will be maintained during the consultation process." *Conner v. Burford*, 836 F.2d 1521, 1536 & n.34 (9th Cir. 1988).

In light of the myriad of harmful effects that land conversion resulting from renewable fuel mandates is having on listed species and designated critical habitats, EPA's annual renewable fuel standard setting, which consistently ramp up biofuel fuel production, in particular ethanol, without obtaining input from FWS and NMFS, constitutes an irreversible and irretrievable commitment of resources that would foreclose the formulation and implementation of reasonable and prudent alternatives to jeopardy. Moreover, EPA's failure to explicitly monitor feedstock origin after each rulemaking allows regulated entities to freely increase biofuel production in a manner that threatens federally listed species.

EPA's violations of ESA Section 7(d) in connection with its administration of the Renewable Fuels Standard Program including its annual renewable fuel volume promulgation and its failure to consider exercising its waiver authority to reduce volumes based on potential severe harm to the environment, are actionable under the ESA's citizen suit provision, 16 U.S.C.

§ 1540(g)(1)(A). Should EPA fail to remedy these violations within the 60-day notice period, the undersigned may commence suit to obtain all available judicial remedies.

C. EPA'S ACTIONS UNDER THE RENEWABLE FUEL STANDARD ARE CAUSING TAKE OF ESA PROTECTED SPECIES

EPA is in violation of the prohibition on the "take" of listed species in Section 9 of the ESA. 16 U.S.C. § 1538(a)(1)(C) (prohibiting take by any person); *id.* § 1532(13) ("person" includes "any officer, employee, agent, department or instrumentality of the Federal Government"). Federal agencies are liable for take resulting from activities they approve. *Strahan v. Coxe*, 127 F.3d 155, 163 (1st Cir. 1997); *Loggerhead Turtle v. Cty. Council of Volusia Cty.*, 148 F.3d 1231, 1251 (11th Cir. 1998); *Defenders of Wildlife v. Adm'r, Envtl. Prot. Agency*, 882 F.2d 1294 (8th Cir. 1989). By approving annual renewable fuel volumes and new fuel pathways without initiating and/or completing consultation with FWS and NMFS, EPA is operating without take liability coverage.

EPA's annual renewable fuel volumes and the attendant increase in feedstock production and land conversion will cause take, including death and injury to ESA-listed species, either from direct impacts or from habitat modification. The approval of new fuel pathways using new feedstocks that take a toll on ecosystems and habitat without consultation could have similar impacts on ESA-listed species. These adverse effects will harass, harm, injure, and even lead to the death of ESA-protected species including, but not limited to, the Piping plover, Whooping crane, Topeka shiner, Dakota skipper, Purple bankclimber, Fat threeridge, Oval pigtoe, Gulf sturgeon, Loggerhead turtle, and Sperm whale.

In order to achieve safe harbor from ESA take liability for its renewable fuel standards and approvals, EPA must have written authorization from the FWS and/or NMFS in the form of an incidental take statement ("ITS") issued as part of the FWS's biological opinion at the conclusion of formal consultation under Section 7. Because EPA has failed to carry out its obligations to comply with Section 7 and obtain an ITS from the wildlife agencies as part of a biological opinion, EPA is liable for violations of Section 9 of the ESA.

EPA's violations of ESA Section 9 in connection with setting renewable fuel standards and approving new renewable fuel pathways are actionable under the ESA's citizen suit provision, 16 U.S.C. § 1540(g)(1)(A). Should EPA fail to remedy these violations within the 60-day notice period, Sierra Club may commence suit to obtain all available judicial remedies.

V. PERSONS PROVIDING NOTICE

As required by 40 C.F.R. § 54.3, the persons providing this notice are:

Devorah Ancel
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Sierra Club Environmental Law Program
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While EPA regulations require the above notice information, please direct all correspondences and communications regarding this matter to the undersigned counsel.

CONCLUSION

If you believe any of the facts described above are in error or have any information indicating that you have not violated the ESA we urge you to contact the undersigned counsel immediately. If the EPA, FWS and NMFS do not act to remedy these violations within 60 days, Gulf Restoration Network and Sierra Club intend to initiate litigation in federal court against the agencies and the appropriate agency officials concerning these violations to seek declaratory and injunctive relief and reasonable attorneys' fees and costs. Sierra Club and Gulf Restoration Network are interested in obtaining early and prompt resolution of these allegations. If you have any questions or would like to discuss potential remedies prior to the expiration of this notice, please do not hesitate to contact us at the telephone numbers or email addresses below.

Sincerely,

Devorah Ancel
Attorney for the
Sierra Club and Gulf Restoration Network

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cc: Ryan Zinke, Secretary of the Interior
RDML Tim Gallaudet, Assistant Secretary of Commerce for Oceans and Atmosphere
Chris Oliver, Assistant Administrator for NOAA Fisheries
Margaret Everson, Principal Deputy Director U.S. Fish and Wildlife Service
Matthew G. Whitaker, Department of Justice Acting Attorney General of the United States
Jessie K. Liu, United States Attorney for the District of Columbia

Matthew Z. Leopold, USEPA General Counsel
Daniel Jorjani, Department of the Interior Acting Solicitor
Kristen L. Gustafson, NOAA Acting General Counsel
Jeffrey S. Dillen, NOAA Acting General Counsel

Exhibit A

August 17, 2018

Mr. Andrew Wheeler
Acting Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, D.C. 20460

Submitted via regulations.gov

RE: Comments from ActionAid USA, Clean Air Task Force, Earthjustice, Mighty Earth, National Wildlife Federation, and Sierra Club on the U.S. Environmental Protection Agency's Proposed Rule - "Renewable Fuel Standard Program: Standards for 2019 and Biomass-Based Diesel Volume for 2020" 83 Federal Register 32024 (July 10, 2018); EPA–HQ–OAR–2018–0167

Dear Acting Administrator Wheeler:

As national environmental, conservation, and development organizations representing millions of members and supporters across the country who are profoundly harmed by the Renewable Fuel Standard (RFS) program as it currently is implemented, we respectfully submit these joint comments on the Environmental Protection Agency's (EPA) proposed rule - Docket No. EPA–HQ–OAR–2018–0167 - "Renewable Fuel Standard Program: Standards for 2019 and Biomass-Based Diesel Volume for 2020" published in the Federal Register at 83 Fed. Reg. 32024 on July 10, 2018. Our members are deeply concerned with fighting global warming, protecting human health, promoting human rights, preserving natural habitats, halting deforestation, and advocating for clean energy. We believe that setting appropriate volumes for the RFS and effectively implementing both the Endangered Species Act (ESA) and habitat-conversion protections in the RFS (as set forth in the Energy Independence and Security Act (EISA)) are critical to achieving these goals. As explained below, modifications to the RFS are necessary not only to accomplish these objectives, but also to ensure compliance with both the letter and spirit of the governing law.

Our comments are centered around six primary aspects of the proposed rule, which are listed below. More details on many of these issues can be found in joint comments that many of our groups submitted to EPA on previous proposed rules, which can be found here: http://www.catf.us/resources/filings/biofuels/.

I. Reducing Corn Ethanol Volumes

As EPA's Second Triennial Report to Congress (hereinafter "Second Triennial") acknowledges, the expansion of first-generation biofuels (particularly corn ethanol and soy biodiesel) over the last decade has resulted in numerous negative impacts to water quality and quantity, soil and air quality, ecosystem health, and biodiversity.[1] Government-mandated biofuels demand has also led to environmentally-damaging international and domestic land use changes that have increased greenhouse gas (GHG) emissions and contributed to "cropland expansion and natural habitat loss (including forests)."[2] For these reasons, the undersigned groups urge EPA to finalize 2019 Renewable Volume Obligations (RVOs) that limit the consumption of corn ethanol, a

[1] US Environmental Protection Agency (EPA), Biofuels and the Environment: The Second Triennial Report to Congress (2018 Final Report) (hereinafter "Second Triennial") (https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=341491).
[2] *Id.* at 48.

biofuel that has not only resulted in numerous environmental problems but also constrained commodity markets.

More specific impacts of corn ethanol production, many of which are detailed in the Second Triennial, include the following:

- **Greater GHG emissions:** According to EPA's own data, current corn ethanol production may *increase* – instead of *decrease* – lifecycle GHG emissions.[3] Multiple independent analysts agree that corn ethanol may be worse for the climate than gasoline.[4]
- **Land use impacts on wildlife habitat and biodiversity:** Increased production of corn ethanol (and greater demand for corn) has resulted in the loss of millions of acres of native grasslands and wetlands,[5] important wildlife habitat for more than 60 percent of the nation's ducks and other waterfowl, monarch butterflies, and numerous threatened and endangered species. EPA's Second Triennial estimates that "…actively managed cropland in the U.S. [has increased] since the passage of EISA by roughly 4-7.8 million acres…"[6] This includes at least 1.6 million acres of prairie land that remained untouched since at least the 1970s and only became cropland after EISA's enactment.[7] This land conversion has caused "negative impacts to ecosystem health and biodiversity," according to EPA's Second Triennial[8] and other recent academic literature.[9] For example, EPA noted that "degradation and loss of wetlands has been found to adversely affect grassland bird populations," while "the loss of wetlands to row crops and related production practices is associated with reduced duck habitat and productivity of duck food sources, including aquatic plants and invertebrates."[10]
- **Land conversion results in significant loss of soil carbon and increase in nitrogen:** Conversion of previously uncultivated land significantly exacerbates climate change, thereby undermining a fundamental objective of EISA and harming the very farmers the RFS program aimed to support. It does this in three primary ways. *First*, when land is cultivated, carbon stored in soil is exposed to oxygen, forming CO_2 – a harmful GHG – that is then released into the atmosphere. *Second*, when vegetation is cleared to prepare the grassland for cropland use, it must be burned or left to decompose, and each of these processes releases CO_2 into the atmosphere. *Third*, newly cultivated land requires increased nitrogen fertilizer, which is energy intensive to produce – releasing additional GHGs. Excess nitrogen not taken up by crops is converted by bacteria to N_2O – a highly potent GHG – that is then released into the atmosphere. Given the environmental and climate harms resulting from land conversion, EISA prohibits

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[3] Lester Lave, *et al.* 2011. *Renewable Fuel Standard: Potential Economic and Environmental Effects of U.S. Biofuel Policy* (Report by the National Research Council Committee on Economic and Environmental Impacts of Increasing Biofuels Production) (internal citations omitted) (http://www.nap.edu/openbook.php?record_id=13105); Clean Air Task Force (CATF), Corn Ethanol GHG Emissions Under Various RFS Implementation Scenarios (April 2013) (http://www.catf.us/resources/whitepapers/files/20130405-CATF%20White%20Paper-Corn%20GHG%20Emissions%20Under%20Various%20RFS%20Scenarios.pdf).
[4] *See, e.g.,* Lave, *et al*. (2011); Congressional Budget Office. 2014. *The Renewable Fuel Standard: Issues for 2014 and Beyond* (internal citations omitted) (https://www.cbo.gov/publication/45477).
[5] Tyler Lark, *et al.* 2015. Cropland Expansion Outpaces Agricultural and Biofuel Policies in the United States. *Environmental Research Letters* 10. DOI: 10.1088 (http://iopscience.iop.org/article/10.1088/1748-9326/10/4/044003/meta).
[6] Second Triennial at 44.
[7] Lark, *et al.* (2015) at 1.
[8] Second Triennial at 87.
[9] S. Kent Hoekman and Amber Broch. 2018. Environmental Implications of Higher Ethanol Production and Use in the U.S.: A Literature Review. Part II–Biodiversity, Land Use Change, GHG Emissions, and Sustainability. *Renewable and Sustainable Energy Reviews* 81(2): 3159-3177. DOI: 10.1016 (https://www.sciencedirect.com/science/article/pii/S1364032117306883?via%3Dihub).
[10] Second Triennial at 87.

biofuels produced from feedstocks grown on recently cleared farmland from qualifying as "renewable fuel" under the RFS.[11]

- **Water pollution:** Hoekman and Broch (2018) also note that "extensification of corn cropping into Conservation Reserve Program (CRP) lands is occurring, which raises concerns about erosion, nutrient runoff, and other adverse environmental impacts."[12] The expansion of corn production and associated nitrogen fertilizer runoff has contributed to harmful algal blooms and dead zones in the Gulf of Mexico and Great Lakes, respectively, in recent years.[13] In addition, the expansion of corn production to meet greater biofuels demand has led to "elevated nitrate pollutant levels in drinking water sources" and public health concerns, according to Hoekman *et al.* (2018).[14]
- **Air quality:** As Hoekman *et al.* (2018) also found, "upstream emissions of most air pollutants of concern are considerably higher for corn ethanol compared to gasoline... [and] [c]urrent fuel ethanol levels do not provide any benefit with respect to ground level ozone…"[15]
- **Food security:** Increased demand for corn ethanol and substitute crops has also been linked to food security risks due to volatile commodity prices.[16]

II. Limiting Growth of Vegetable-Based Biofuels by Ending Practice of Backfilling and Setting Appropriate RVOs

We commend EPA for ending the practice of backfilling gaps in cellulosic and advanced biofuel consumption with other food-based biofuels such as soy biodiesel and sugar ethanol in the final 2018 RVOs and for proposing to do so again in 2019. By reducing the overall renewable fuel and advanced biofuel mandates by the same amount that the cellulosic biofuel mandate is reduced (via EPA's cellulosic waiver authority), EPA proposes to limit incentives to further increase production of biofuels derived from food crops, especially vegetable oils. Ending the use of backfilling is something that the undersigned groups have supported for several years.[17] We share EPA's view that if gaps in cellulosic consumption are backfilled with food-based biofuels such as soy or palm biodiesel, we would "expect diminishing GHG benefits and higher per gallon costs as the required volumes of advanced biodiesel and renewable diesel increase."[18] Soy and palm biodiesel may lead to GHG emissions that

[11] CAA §211(o)(1)(I), (J).
[12] Hoekman and Broch (2018).
[13] Second Triennial at 73.
[14] S. Kent Hoekman, *et al.* 2018. Environmental Implications of Higher Ethanol Production and Use in the U.S.: A Literature Review. Part I – Impacts on Water, Soil, and Air Quality. *Renewable and Sustainable Energy Reviews* 81(2): 3140-3158. DOI: 10.1016 (https://www.sciencedirect.com/science/article/pii/S1364032117306871?via%3Dihub).
[15] Hoekman, *et al.* (2018).
[16] International Food Policy Research Institute, Biofuels and Food Security: Balancing Needs for Food, Feed, and Fuel (2008) (http://www.ifpri.org/publication/biofuels-and-food-security).
[17] Joint comments from ActionAid USA, Clean Air Task Force (CATF), Environmental Working Group, and National Wildlife Federation (NWF) (hereinafter "Joint NGO 2017 RVO Comments") on the U.S. Environmental Protection Agency's Proposed Rule - "Renewable Fuel Standard Program: Standards for 2017 and Biomass-Based Diesel Volume for 2018" 81 Federal Register 34778 (May 31, 2016) (EPA-HQ-OAR-2016-0004), at 8-9 (http://www.catf.us/resources/filings/biofuels/20160711-2017_RVO_Joint_ENGO_Comments_Final.pdf); joint comments from ActionAid USA, CATF, Earthjustice, NWF, Oxfam America, and Sierra Club (hereinafter "Joint NGO 2018 RVO Comments") on the U.S. Environmental Protection Agency's Proposed Rule - "Renewable Fuel Standard Program: Standards for 2018 and Biomass-Based Diesel Volume for 2019" 82 Federal Register 34206 (July 21, 2017) (EPA-HQ-OAR-2017-0091), at 2 (http://www.catf.us/resources/filings/biofuels/Joint_NGO_comments_on_2018_RVO.pdf).
[18] EPA, Renewable Fuel Standard Program Standards for 2019 and Biomass-Based Diesel Volume for 2020 – Proposed Rule, 83 Fed. Reg. 32038/3 (July 10, 2018).

are two to three times higher than those from fossil diesel, according to a 2015 report produced by Hugo Valin *et al.* for the European Commission.[19]

Finalizing an RVO that does not backfill "missing" cellulosic biofuel will also reduce incentives for further production of palm oil, as EPA acknowledges in the proposed rule:

> "Moreover, to the extent that higher advanced biofuel requirements cannot be satisfied through growth in the production of advanced biofuel feedstocks, they would instead be satisfied through a re-direction of such feedstocks from competing uses. Products that were formerly produced using these feedstocks are likely to be replaced by products produced using the lowest cost alternatives, likely derived from palm or petroleum sources. This in turn could increase the lifecycle GHG emissions associated with these incremental volumes of non-cellulosic advanced biofuel. There would also likely be market disruptions and increased burden associated with shifting feedstocks among the wide range of companies that are relying on them today and which have optimized their processes to use them. Higher advanced biofuel standards could also be satisfied by diversion of foreign advanced biofuel from foreign markets, and there would also likely be diminished benefits associated with such diversions."[20]

Palm biodiesel not only fails to meet even the minimum 20 percent GHG reduction threshold in the RFS (and may actually triple GHG emissions as compared to fossil diesel[21]), but it is also tied to the destruction of forests and loss of carbon-rich peatlands in countries such as Malaysia, Indonesia, and Thailand, leading to increased GHG emissions and other environmental, social, and land rights problems. Deforestation and the draining of peat lands in Southeast Asia are a major source of GHG emissions.[22] As EPA acknowledges, even if palm biodiesel is not directly being incentivized through the RFS, feedstock switching due to higher RVOs can still impact vegetable oil markets, including palm.

For these reasons, EPA should also reduce the 2020 volume of biomass-based diesel (BBD) and 2019 volumes of advanced biofuels and total renewable fuel below the proposed levels of 4.88 billion gallons and 19.88 billion gallons, respectively, to levels that do not result in an increase in the demand for vegetable-oil based biofuels or, indirectly, for the vegetable oils (primarily palm and soy) that are used to make those fuels, thereby avoiding competition with food markets and other industries that use vegetable oil. The Second Triennial found that internationally, "demands for biofuel feedstocks have led to market-mediated land use impacts (both direct and indirect land use changes) in the past decade."[23] For instance, in Argentina, deforestation rates have reached levels seen in the early 2000s in the Amazon rainforest due to the expansion of soy production for biodiesel and other uses.[24] The expansion of soybeans into previously forested areas has increased water pollution from pesticide sprayings, led to health problems for residents of local communities, and resulted in vast swaths of

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[19] Hugo Valin, *et al*. 2015. The Land Use Change Impact of Biofuels Consumed in the EU: Quantification of Area and Greenhouse Gas Impacts, at 39 (Fig. 15) (https://ec.europa.eu/energy/sites/ener/files/documents/Final%20Report_GLOBIOM_publication.pdf).

[20] 83 Fed. Reg. 32038/3 (July 10, 2018).

[21] Valin, *et al.* (2015) at 39 (Fig. 15).

[22] Jukka Miettinen, *et al.* 2012. *Historical Analysis and Projection of Oil Palm Plantation Expansion on Peatland in Southeast Asia* (commissioned by the International Council on Clean Transportation (ICCT)) (internal citations omitted) (https://www.theicct.org/sites/default/files/publications/ICCT_palm-expansion_Feb2012.pdf).

[23] Second Triennial at 108.

[24] Matthias Baumann, *et al.* 2016. Land-Use Competition in the South American Chaco. *Land Use Competition:* 215-229 (https://link.springer.com/chapter/10.1007/978-3-319-33628-2_13).

biodiverse forests being burned to make way for agriculture production.[25] The undersigned groups urge EPA to set RVOs at levels that avoid both direct and indirect biofuels-induced land use changes given their negative social and environmental impacts.[26]

III. Consideration of Severe Environmental Harm Waiver

While EPA does not propose to use severe environmental harm as justification for invoking its general waiver authority to reduce RFS volumes, the Agency again requests comments on such an approach.[27] As our organizations have commented in the past[28] and as the Second Triennial found, increased production of first-generation biofuels such as soy biodiesel and corn ethanol has caused a wide range of environmental problems for soil, water, air, and wildlife habitat. As EPA noted in its Second Triennial, some of these impacts have worsened since the last triennial report was released in 2011 (see Section I above for more details).[29] While the corn ethanol industry has touted a 2017 report claiming that ethanol reduces GHG emissions by up to 43 percent,[30] that claim is severely undermined by a subsequent analysis that finds that the U.S. Department of Agriculture-commissioned report relies on several inaccurate assumptions and flawed methodologies.[31] In addition to the other resource concerns already discussed, additional GHG emissions from corn ethanol production contribute to climate change, which constitutes a severe environmental harm.

As detailed in comments submitted to this docket by the International Council on Clean Transportation (ICCT), EPA's proposal to significantly increase the BBD RVO for 2020 will push demand for suitable BBD feedstocks to an unsustainable level by exacerbating the effect of international trade restrictions, rising demand for vegetable oil in the US food market, and other factors. We agree with ICCT that EPA should consider using the waiver authority at CAA §211(o)(7)(A) to reduce the total renewable fuel and advanced biofuel standards below the statutory minimum in 2019.

Moreover, even with application of the cellulosic waiver, EPA has consistently set renewable fuel volumes at levels that imply conventional biofuel volumes at or near the maximum statutory level of 15 billion gallons.[32] Further the 2018 final rule documented that conventional corn-based biofuel production is higher than 15 billion gallons.[33] EPA has set maximum conventional biofuel volumes without providing any consistent and comprehensive assessment of severe environmental harm despite peer reviewed publications providing evidence of harm and EISA's requirement to do so.[34] Nor has EPA engaged in Section 7 ESA consultation with US

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[25] Garr, R. and S. Karpf. 2017. *Burned: Deception, Deforestation and America's Biodiesel Policy* (commissioned by Mighty Earth and ActionAid) (internal citations omitted) (https://www.actionaidusa.org/wp-content/uploads/2018/01/AAUSA_MightyEarth_Burned_FINAL_web.pdf).

[26] Garr and Karpf (2017).

[27] 83 Fed. Reg. 32048/1 (July 10, 2018).

[28] Joint NGO 2017 RVO Comments at 2-7.

[29] Second Triennial at 97.

[30] ICF. 2017. *A Life-Cycle Analysis of the Greenhouse Gas Emissions of Corn-Based Ethanol* (prepared for the U.S. Department of Agriculture Climate Change Program Office) (https://www.usda.gov/oce/climate_change/mitigation_technologies/USDAEthanolReport_20170107.pdf).

[31] Malins, C. 2017. *Navigating the Maize - A critical review of the report 'A Life-Cycle Analysis of the Greenhouse Gas Emissions of Corn-Based Ethanol'* (commissioned by CATF and NWF) (http://www.catf.us/resources/publications/files/Navigating-the-maize_July2017.pdf).

[32] 82 Fed. Reg. 58486 (Dec. 12, 2017); 80 Fed. Reg. 77419 (Dec. 14, 2015); 81 Fed. Reg. 89746 (Dec. 12, 2016).

[33] 82 Fed. Reg. at 58517 n.135.

[34] U.S. EPA Office of Inspector General, EPA Has Not Met Certain Statutory Requirements to Identify Environmental Impacts of Renewable Fuel Standard (Aug. 18, 2016) (https://www.epa.gov/sites/production/files/2016-

Fish and Wildlife Service or National Marine Fisheries Service (NMFS) to determine if the induced land conversion and attendant environmental impacts from setting maximum level corn-based ethanol standards will jeopardize the continued existence of federally listed endangered and threatened species.[35] Although EISA does not specify what constitutes "severe" environmental harm, Congress in the ESA already determined that preventing jeopardy to listed species takes highest priority.[36] As such, it would be a per se "severe" adverse effect under EISA to set biofuel volumes at a level that adversely impacts listed species or critical habitat. EPA must do a comprehensive assessment of severe environmental harm in this rulemaking to determine if total renewable volumes should be further reduced to levels that adequately ensure against severe harm to the environment, and specifically to federally listed species.

IV. Resetting Future RFS Volumes

As discussed in previous comments to EPA,[37] the RFS's reset provision offers the Agency an important opportunity to establish a more rational, environmentally sensible path forward for RFS volumes. The provision requires EPA to assess the impact of biofuels "on the environment, including on air quality, climate change, conversion of wetlands, ecosystems, wildlife habitat, water quality, and water supply" in addition to energy security, future production of renewable fuels, impact on infrastructure, consumer costs, and "other factors, including job creation, the price and supply of agricultural commodities, rural economic development, and food prices."[38] Our organizations look forward to working with EPA as the Agency soon begins to reevaluate each of the RFS mandates to ensure that the environmental benefits envisioned by Congress are best realized.

V. Ending Unlawful RFS-Induced Land Use Conversion and Loss of Sensitive Land

EPA should stringently implement the statutory requirement that RFS biofuel feedstocks be derived from "renewable biomass," as defined by EISA,[39] rather than from feedstocks grown on recently cleared land. Currently, EPA violates this requirement in two ways. First, EPA's "aggregate compliance" approach to the RFS permits feedstock production on previously uncultivated land as long as the aggregate amount of land in cultivation at any given time does not exceed the amount of land used for cropland at the time of EISA's passage. This approach to renewable biomass runs directly counter to the language and clear intent of the statute and fails to consider the destructive environmental and climate impacts of land conversion – including, but not limited to: the emission of millions of tons of GHGs into the atmosphere; reduction in water quality and supply; and destruction of wildlife habitat and diversity.[40] As stated in the Second Triennial,

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08/documents/_epaoig_20160818-16-p-0275.pdf). (2016 Inspector General investigation concluding EPA violated its EISA duties by failing to complete the Program's Triennial Reports and air quality impact study, and that the violations impede EPA's decision making, including its general waiver authority determination.); EPA issued the June 29, 2018 Triennial Report the day Sierra Club filed its motion for summary judgment in the pending lawsuit challenging EPA's failure to prepare the Triennial Reports and conduct the air quality study. *Sierra Club v. Pruitt*, D.D.C. no. 1:17-cv-02174-APM. The June 29, 2018 Triennial Report was four-and-one-half years overdue, another Triennial Report due December 2016 is past due, and EPA still has not conducted its air quality impact study of the program, due in June 2009.

[35] 16 U.S.C. 1536(a).

[36] *Tennessee Valley Auth. v. Hill*, 437 U.S. 153, 185 (1978).

[37] Joint NGO 2017 RVO Comments at 7-8; Joint NGO 2018 RVO Comments at 3.

[38] CAA 211(o)(2)(B)(ii).

[39] CAA §211(o)(1)(J).

[40] *See, e.g.*, Lark, *et al.* (2015); C. K. Wright and M. C. Wimberly. 2013. Recent Land Use Change in the Western Corn Belt Threatens Grasslands and Wetlands. *Proc Natl Acad Sci USA* 110(10): 4134-9. DOI: 10.1073 (http://www.ncbi.nlm.nih.gov/pubmed/23431143).

> "Evidence since enactment of EISA suggests an increase in acreage planted with soybeans and corn, with strong indications from observed changes in land use that some of this increase is a consequence of increased biofuel production... There are strong indications that biofuel feedstock production is responsible for some of the observed changes in land used for agriculture since enactment of EISA."[41]

The report goes on to cite five distinct national studies that have documented this cropland expansion – four of them conducted by federal agencies – and specifies that "there is a consistent signal emerging that demonstrates an increase in actively managed cropland by roughly 4-7.8 million acres,"[42] despite the annual determination by the Agency that crop acreage has not increased in a significant way to breach the limit established under its aggregate approach. An increase of 4-7.8 million acres is non-trivial, and it clearly warrants a new approach to verify that biofuels being produced and blended to meet the obligations under the RFS are coming from lands that meet the statutory definition of "renewable biomass." EPA should end the practice of unchecked land conversion under the RFS program by implementing a land use tracking and mapping system that robustly enforces EISA's land use protections and EPA's own prohibition on the conversion of native grasslands for biofuel crop production.

The second way in which EPA's implementation of the RFS violates EISA land use protections is allowing the production of renewable biomass on land exiting CRP. EPA should modify its treatment of lands coming out of CRP to exclude them from eligibility under the definition of renewable biomass. CRP lands were previously cultivated and purposefully taken out of production as part of a US Department of Agriculture (USDA) program aimed at improving environmental health and quality, the benefits of which taxpayers have paid for through annual rental payments to landowners. The lands are then maintained in a state of non-production and conservation cover for a minimum of 10 years, with some now having been in the program for 30 or more years. This amount of time is sufficient for these lands to lose their status as actively managed cropland and to build up the important environmental qualities for which the program was established: soil and water conservation, wildlife habitat, nutrient filtering and retention, water quality improvements, and carbon sequestration.

Land eligible for use to grow renewable biomass must be actively managed or fallow, and well as nonforested. CRP land is none of these. It is not fallow, as it is not kept in a state of non-production for the purpose of regenerating the land for future agricultural use, but rather is kept idle for the express purpose of improving long-term environmental health and quality. It is also not actively managed, as it is not tilled, fertilized, or irrigated like cropland. Cultivation of this land threatens the release of GHGs and a loss of biodiversity. CRP land is also not nonforested, as much CRP land does, in fact, contain forests. Thus, under EISA's limitations on the landscape that can be used to produce renewable biomass, feedstocks grown on former CRP land do not qualify as "renewable biomass."

Though corn and soy produced on this former CRP land does not meet the definition of renewable biomass under EISA, EPA expressly permits use of this land under the RFS program. And as EPA acknowledges, since EISA's enactment, there has been extensive conversion of expiring CRP lands into crop production, particularly of corn and soy, for use as biofuels. Use of this land contravenes both the language and intent of EISA and causes significant climate and environmental harm. For these reasons, lands coming out of CRP should be treated as other non-cropped lands and should not be deemed eligible for biofuel feedstock production under the RFS.

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[41] Second Triennial at xi.

[42] Second Triennial at 37.

VI. Assessing Impacts under the Endangered Species Act

EPA should also evaluate the impacts to water and air quality and biodiversity that would result from the Agency's proposed RVOs. Specifically, the Agency also must fulfill its ESA Section 7 duties by consulting with wildlife agencies (U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration Fisheries) to ensure that any loss of habitat, including modification or pollution resulting from land use changes associated with the increased production of biofuels, does not jeopardize the continued existence of any federally-listed endangered and threatened species or cause the destruction or adverse modification of designated critical habitat.[43]

To date, EPA has never completed or even initiated Section 7 consultation to ensure against jeopardy to federally listed species in taking any discretionary actions under the RFS program, including, but not limited to, setting annual renewable fuel volumes, approving new renewable fuel pathways using new feedstocks and advanced technologies, and determining whether to exercise its general waiver authority on the basis of severe environmental harm. Nor has EPA engaged in programmatic consultation given the nationwide scope of the RFS program and its geographic impacts, as federal agencies have done in other similar contexts.[44] However, recent studies, including the June 29, 2018 Triennial Report, and expert reports have documented induced land conversion and the attendant environmental impacts, including potential effects on federally listed endangered and threatened species. In fact, documented land conversion is occurring in or adjacent to designated critical habitat for listed species and could decrease the critical habitat's functionality through landscape fragmentation, microclimate modification, encroachment of anthropogenic activities, or other proximity effects, and thereby alter the physical or biological features that were the basis for critical habitat designation. Thus, any critical habitat located in agriculturally active areas and especially those in areas with large amounts of conversion or even in close proximity to an ethanol refinery may be directly affected by the RFS and should be evaluated and mitigated pursuant to ESA.[45]

Federally listed species that may be affected by the RFS span the entire Midwest down through the Mississippi River watershed into the Gulf of Mexico where nutrient loading from biofuel production is a major contributor to the region's growing dead zone. Affected listed species include, but are not limited to: the endangered Poweshiek Skipperling butterfly; the threatened Dakota Skipper butterfly; the endangered Rusty Patched Bumble Bee; the endangered Hine's emerald dragonfly; the endangered Salt Creek Tiger beetle; the endangered Whooping crane bird; the threatened Yellow Billed Cuckoo bird; the endangered Piping Plover bird; the endangered Black-footed ferret; the endangered Topeka shiner minnow; the threatened Purple Bankclimber mussel; the endangered Fat Threeridge mussel; endangered Oval Pigtoe mussel; the threatened Gulf Sturgeon;

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[43] 16 U.S.C. § 1536(a); 50 C.F.R. § 402.14(a).

[44] *See Am. Rivers, Inc. v. U.S. Army Corps of Eng'rs*., 421 F.3d 618, 626-627 (8th Cir. 2005) (consultation on future impacts of multiple structures spread over hundreds of river miles and multiple endangered species upheld); *See, e.g., Dow AgroSciences LLC v. Nat'l Marine Fisheries Serv*., 707 F.3d 462 (4th Cir. 2013) (BiOp covering EPA's re-registration of decades old, commonly used pesticides must evaluate their continuing uses); *Ctr. for Marine Conservation v. Brown*, 917 F. Supp. 1128, 1137 (S.D. Tex. 1996) (BiOp regarding Gulf Coast shrimp fisheries asks whether "the continued long-term operation of the shrimp fishery … [is] likely to jeopardize the continued existence of the Kemp's ridley sea turtle. . . ."); *Greenpeace v. Nat'l Marine Fisheries Serv*., 80 F. Supp. 2d 1137, 1143-1144 (W.D. Wash. 2000) (quoting *Conner v. Burford*, 848 F.2d 1441, 1458 (9th Cir. 1988)) (BiOp reviewing the fishery management plans (FMPs) governing annual Alaskan groundfish catches must "be equal in scope to the FMPs" because "biological opinions under the ESA must be 'coextensive' with the agency action.").

[45] 16 U.S.C. § 1536(b); 50 C.F.R. §§ 402.14(g)-(i).

the threatened Loggerhead Turtle; and the endangered Sperm whale. See attached Affidavit of Dr. Tyler Lark,[46] included in the addendum to Environmental Petitioners' [Initial] Opening Brief, Sierra Club v. EPA, No. 18-1040 (D.C. Cir. July 27, 2018) (current litigation challenging the Renewable Fuel Standards for 2018 and Biomass-Based Diesel Volume for 2019), incorporated verbatim herein. Dr. Lark's affidavit documents the RFS program's induced land use conversion, associated environmental impacts, and potential effects on federally listed species. The EPA must complete its long overdue ESA Section 7 duties to evaluate the impacts of the RFS on listed species and ensure against their jeopardy.

VII. Conclusion

The undersigned groups urge EPA to ensure that the 2019 RVOs (and those for biomass-based diesel for 2020) do not allow for the expansion of food-based biofuels, which have had numerous unintended consequences on our environment, not to mention impacts on food and feed prices. In addition to limiting volumes of corn ethanol, we urge EPA to alleviate demand for soy and palm biodiesel (and other market effects leading to greater demand for these vegetable oils), which have been linked to destructive land use changes, deforestation in countries such as Indonesia and Argentina, and other social and environmental problems. EPA can limit these impacts by finalizing a 2020 volume requirement for biomass-based diesel and 2019 volume requirements for advanced and total renewable fuels that do not incentivize increased production of food-based biodiesel and various vegetable oils. We also urge EPA to exercise its authority to reduce RFS volumes based on severe environmental harm, to comprehensively adjust future RFS volume mandates based on the statutorily required "reset" provision, fulfill its ESA Section 7 duties, and give full effect to the "renewable biomass" definition in the RFS that was enacted to limit land use change from increased biofuel production.

Finally, these joint comments are based on information provided in the proposed rule, as published in the Federal Register on July 10, 2018. Some signatories to these comments also submitted a separate letter to EPA on July 30, 2018, that urges the Agency to issue a new, more comprehensive, more coherent RVO proposal to account for the effect of small refiner waivers on overall RFS compliance and hence, allow for a fuller assessment of the RVO proposal.

Thank you for the opportunity to provide comments. We hope that our remarks provide useful guidance for EPA's final decision. We appreciate your consideration.

Respectfully submitted,

Kelly Stone
ActionAid USA

Jonathan Lewis
Clean Air Task Force

Peter Lehner
Earthjustice

[46] Tyler Lark is an associate researcher at the University of Wisconsin-Madison's Center for Sustainability and the Global Environment. He leads research on U.S. agricultural land-use change and its impacts on land and water resources. Dr. Lark received his Ph.D. from University of Wisconsin-Madison's Nelson Institute Environment & Natural Resources program in 2017 for his research on America's changing "Food- and Fuel-Scapes."

Rose Garr
Mighty Earth

David DeGennaro
National Wildlife Federation

Andrew Linhardt
Sierra Club

AFFIDAVIT OF DR. TYLER LARK

1.

My name is Tyler Lark, and I give this affidavit for use by petitioners Sierra Club and Gulf Restoration Network in *Sierra Club et al. v. Environmental Protection Agency;* case number 18-1040. This affidavit is based on my own personal knowledge, experience, training, and review of the data and literature set forth below.

2.

Currently, I am an associate researcher at the University of Wisconsin-Madison's Center for Sustainability and the Global Environment, where I have been researching U.S. agriculture, land use, and bioenergy for the past 6 years. I received my Ph.D. from UW-Madison's Nelson Institute Environment and Resources program in 2017 and continue to perform research on U.S. agricultural land use change and its impacts on our nation's natural resources.

3.

I have lead- and co-authored reports and published scientific studies on topics including U.S. agricultural land use and its implications for biofuel policies, best practices for measuring U.S. land use change, the accuracy of mapping crops and cropland conversions in the U.S., the location and rates of native prairie conversion, and the relationship between grassland conversion and ethanol refinery locations. My 2015 paper, entitled "Cropland expansion outpaces agricultural and biofuel policies in the United States" received "highly commended" accolades as a top paper of 2015 by the journal Environmental Research Letters and has been highly cited since its publication. My 2016 presentation, entitled "Mapping grassland and cropland conversion across the United States" was awarded "best presentation" at the North American Congress for Conservation Biology, and I have been invited and given presentations on U.S. land use change and federal biofuel policy at academic conferences and industry workshops across the nation. A list of my relevant publications and presentations from the last 6 years is included in my CV and attached as Appendix 1.

4.

Executive Summary

I have been asked to provide a summary of the potential impacts to federally listed endangered and threatened species from the United States' Renewable Fuel Standard (RFS) program. I review these potential impacts in section 5.6 of the report attached hereto as Appendix 2 and incorporated as part of this declaration as if repeated verbatim herein. I make reference to it as the "Expert Report" throughout this declaration. In the Expert Report, I conclude that the existing body of research on this matter ties the Renewable Fuel Standard to documented land use changes and ensuing environmental consequences which may potentially have detrimental impacts on federally listed species and their designated critical habitat. Following the passage of the amended Renewable Fuel Standard (RFS2) in 2007 there was a steady pattern of conversion of uncultivated land to biofuel feedstock crops such as corn and soybeans, leading to increases in active cropland area in the U.S. Both the initial conversion of land to biofuel feedstock crops as well as ongoing cultivation of these crops can lead to negative environmental outcomes. Such potential environmental outcomes can include, but are not limited to, decreased water quality, increased water usage, increased greenhouse gas emissions, and loss or degradation of biodiversity and habitat. Any of these outcomes could negatively affect listed species. For example, nutrient pollution from expanded corn production in the Mississippi river basin contributes to hypoxia in the Gulf of Mexico, which could impair aquatic listed species that inhabit the region. While increased knowledge and documentation of the land and environmental impacts of the Renewable Fuel Standard have recently emerged in the scientific literature, the effects of these impacts on threatened and endangered species has not been comprehensively assessed. However, given the role of the Renewable Fuel Standard in land use change, the known environmental impacts of associated changes, and the potential mechanisms for influence on listed species described here or reported by the listing wildlife services, I believe further review and evaluation is warranted.

5.

There are two key pathways by which the Renewable Fuel Standard can induce agricultural land use changes—intensification and extensification—and both of these processes have the potential to jeopardize threatened and endangered species. "Intensification" is the process of getting more production from a fixed area of land. This often is achieved by increasing use of agronomic inputs such as nitrogen fertilizer, implementing irrigation, or switching to continuous production of a single crop rather than crop rotation, for example. "Extensification," also known as land conversion, means bringing new land into cultivation by converting uncropped land into cropland, thus changing the structure and function of the land and affecting interactions with water, soils, and other natural resources. Biofuel production requires large amounts of feedstocks to use as input, and as such, available data suggests it has contributed significantly to both intensification and extensification (see Expert Report and Appendices 3 and 4).

6.

Corn has played a uniquely strong role in the conversion of land to cropland—it was the most common crop planted on newly converted land after 2007. Between 2008 and 2012 corn was planted on 27% of newly converted agricultural land in the U.S. (Lark et al. 2015). This finding has been supported by multiple other studies, including several focused on particular regions. For example, Mladenhoff et al. (2016) found most previously open land converted to crop production between 2008 and 2013 in the Great Lakes region was planted to corn; Morefield et al. (2016) found that for newly cultivated cropland exiting the federal Conservation Reserve Program in the Midwest, corn and soybeans (both potential biofuel feedstock crops) were planted on 34% and 40% of converted land, respectively.

7.

Many studies have tied the Renewable Fuel Standard to increased corn and commodity crop prices as well as increased cropland acreage. Carter, Rausser, and Smith (2016) found that corn prices on average were 30% higher each year from 2006 to 2014 than they would have been without the Renewable Fuel Standard. A synthesis of 29 studies published between 2007 and 2014 found that the Renewable Fuel Standard likely raised corn prices between <1% to over 80%, depending on various conditions, and that corn prices rose on average 3-8% per billion gallon increase in ethanol mandate (Condon, Klemick, and Wolverton 2015).

8.

Yet another study found that from 2007 to 2009, for every 1% increase in crop price, there was an expected 0.029% increase in U.S. cultivated area (Barr et al. 2011). Similar response elasticities have been found to be even greater within specific regions like the cornbelt—for example, 0.059 by Langpap and Wu (2011). Using the more conservative of these two numbers (an expected response elasticity of 0.029) in combination with the above-referenced price increases (specifically a 30% increase in the price of corn due to the RFS; Carter, Rausser, and Smith, 2016) and an approximate base U.S. cropland area of 236 million acres in 2007 as accounted by Barr et al. (2011), this would translate to roughly 2 million acres of expected cropland expansion due to the impact of the Renewable Fuel Standard on national corn prices. This widespread conversion of land to cropland presents a large opportunity for impact on listed species and the habitat upon which they rely.

9.

The placement of an ethanol refinery in a community can also have significant impacts locally. In areas surrounding ethanol refineries, local demand for corn increases, which in turn induces increases in local corn prices and planted acreage (Fatal and Thurman 2014). A study of new ethanol production facilities built between 2002 and 2008 found that every million gallons of new ethanol capacity in a county was estimated to trigger an additional 5.21 acres of corn in that county. This effect is frequently compounded by many refineries sited in a single region, and can be felt across hundreds of counties. The study found that the typical refinery increased corn planting in its home county by over 500 acres, and increased planted acreage in surrounding counties up to nearly 300 miles away. Once converted, cropland in close proximity to an ethanol refinery is likely to stay that way: Wright et al. (2017) found that existing cropland is less likely to be abandoned or restored to grassland if it is close to a refinery.

10.

Conversion of nonagricultural land to cropland often disrupts habitat and reduces biodiversity by simplifying the landscape and reducing the number of species it supports (Meehan, Hurlbert, and Gratton 2010; Fletcher et al. 2011). Grasslands were the most common land cover converted to crop production after implementation of the Renewable Fuel Standard, accounting for approximately 80% of the land converted to crop production across the U.S. from 2008 to 2012 (Lark, Salmon, and Gibbs 2015). Furthermore, the rate of grassland conversion to crop production has been shown to be significantly higher near ethanol production refineries, with the rate of conversion decreasing linearly as the distance to refineries increases (Wright et al., 2017, Figure 2). Grasslands have higher species carrying capacities and harbor significantly greater plant, microbial, and animal diversity than croplands (Werling et al. 2014). Thus, in addition to any impairment of listed species through direct conversion or adverse modification of critical habitat, the conversion of grasslands to cropland to expand or maintain biofuel production volumes likely resulted in a reduction in wildlife-supporting services and resources and therefore may have also indirectly impaired grassland-dependent species.

11.

The Renewable Fuel Standard may also harm biodiversity and habitat by disincentivizing participation in the federal Conservation Reserve Program, a program which helps support farmers to remove environmentally sensitive lands from crop production for periods of 10-15 years and restore the areas to grasslands or other types of conservation land covers. By driving up corn prices (Carter, Rausser, and Smith 2016; Condon, Klemick, and Wolverton 2015), the Renewable Fuel Standard increases the profitability of growing corn for ethanol relative to keeping land in the Conservation Reserve Program. From 2007 to 2012, approximately 50% of all land converted to cropland came from acreage previously enrolled in the Conservation Reserve Program (USDA 2015).

12.

Loss of Conservation Reserve Program land has been clearly tied to negative environmental outcomes. These include decreased pheasant populations (Sullivan et al. 2004; Haroldson et al. 2006; Errington and Gewertz 2015), decreased bird diversity and prevalence (Fletcher et al. 2011; Ryan, Burger, and Kurzejeski 1998), and increased water pollution with risk of nitrogen contamination (Randall et al. 1997; Feather, Hellerstein, and Hansen 1999; Secchi et al. 2009). Any listed species which inhabit or benefit from Conservation Reserve Program land would similarly be affected.

13.

The Renewable Fuel Standard may also affect listed species through the loss of native grasslands which, unlike Conservation Reserve Program lands, have never been used for agricultural production. Under the EPA's 2010 rule implementing the Renewable Fuel Standard program, native grasslands specifically qualify as nonagricultural lands and thus should be ineligible for renewable feedstock production. However, the 2010 rule did not implement a feedstock mapping and tracking system to explicitly enforce the land protections required under the Energy Independence and Security Act, nor have any annual volumetric Renewable Fuel Standards, including the Renewable Fuel Standards for 2018 and Biomass-Based Diesel Volume for 2019. The absence of such a feedstock tracking system means that areas converted from native sod can currently be used for renewable feedstock production without restriction, thus enabling the Renewable Fuel Standard to contribute to ongoing prairie loss. Indeed, native grasslands and prairie have specifically been identified as having been converted to cropland in recent years (Wimberly et al. 2017; Lark, 2017). Native grasslands provide habitat that is superior to restored or planted grasslands (Bakker and Higgins 2009) and supply critical food and nesting resources for grassland dependent wildlife like wild bees and other pollinators (Moranz et al. 2012; Kwaiser and Hendrix 2008; Pleasants 2016).

14.

The conversion of land for increased biofuel feedstock production may also affect endangered and threatened species through the destruction or adverse modification of critical habitat. For example, conversion of land near designated critical habitat could decrease the critical habitat's functionality through landscape fragmentation, microclimate modification, encroachment of anthropogenic activities, or other proximity effects, and thereby alter the physical or biological features that were the basis for critical habitat designation. Thus, any critical habitat located in agriculturally active areas and especially those in areas with large amounts of conversion and in close proximity to an ethanol refinery (e.g. Figure 6b of Wright et al. 2017) may potentially be affected by the Renewable Fuel Standard. Note that while land converted to biofuel feedstock crops such as corn and soybeans is most directly linkable to the Renewable Fuel Standard, any conversion of land to cropland (including for other crops) could be induced by the policy due to its cascading impacts on multiple commodity crop markets beyond those directly used as feedstocks (see Expert Report, section 4). Thus, the Renewable

Fuel Standard may affect endangered species through the conversion of habitat to any type of crop production.

Based on the locations of recent land conversion, feedstock crop production, and ethanol refineries, there are a number of federally listed species and critical habitats at heightened risk of impairment. Potentially impacted species groups include insects, birds, fishes, mussels, and others. Examples of specific species as well as potential mechanisms of impairment are described below.

15.

Poweshiek skipperlings (*Oarisma poweshiek*) are endangered butterflies that inhabit tallgrass prairies in Minnesota, Wisconsin, North Dakota, South Dakota, and Iowa. Habitat fragmentation poses a key threat to the Poweshiek skipperling, and there are several instances where land has recently been converted to cultivate either corn or soybeans within close proximity to its critical habitat in Minnesota, North Dakota, and South Dakota (see Appendix 6 for an example map and imagery). Loss of habitat and especially tallgrass native prairie over the years has led to isolated pockets of Poweshiek skipperling populations, making it difficult for them to recolonize, as they are only able to fly for short periods at a time and therefore are unable to travel necessary distances in search of a new home (Pogue et al., 2016). Furthermore, if the Poweshiek skipperling is lost in one locale, there are often no nearby populations to recolonize (USFWS, 2018). Adult Poweshiek skipperlings feed on nectar from prairie flowers, and thus the species may also be affected indirectly by the Renewable Fuel Standard due to the loss of nectar sources from the spraying of pesticides during crop production. Because they do not burrow into the ground in their larval stages, the species may also be vulnerable to airborne wafting pesticides (Gould, 2013).

16.

Other insects which could potentially be affected by biofuel feedstock production via similar and/or other mechanisms of influence include the threatened Dakota skipper (*Hesperia dacotae*), the endangered Rusty patched bumble bee (*Bombus affinis*), the endangered Hine's emerald dragonfly (*Somatochlora hineana*), and the endangered Salt Creek tiger beetle (*Cicindela nevadica lincolniana*).

17.

Whooping Cranes (*Grus Americana*) are endangered birds that inhabit prairie wetlands of North America and may be negatively affected by the Renewable Fuel Standard through the loss and fragmentation of habitat. There is substantial conversion of land to biofuel feedstock crops near the species' designated critical habitat in Kansas (see Appendix 7), as well as conversion to crop production adjacent to its critical habitat and wintering grounds on the Texas coast, which could adversely influence the conservation of the species and the effectiveness of its habitat. Furthermore, the Whooping crane frequently inhabits wetlands throughout its species range, and thus may be impacted by the widespread conversion and drainage of wetlands for crop production that has occurred throughout the region (Lark et al., 2015). Other birds which may be impacted include the threatened Yellow Billed Cuckoo and the endangered Piping Plover.

18.

The threatened Yellow Billed Cuckoo (*Coccyzus americanus*) is a medium-sized bird found in Texas, New Mexico, Arizona, Utah, Colorado, Wyoming, Nevada, Montana, Idaho, Oregon, Washington, and California. The Yellow Billed Cuckoo inhabits riparian areas especially under willows, cottonwoods, and woodlands. They use the vegetation underneath the trees to nest, breed, and search for food, and their threatened status is due in large part to the destruction of these habitats from anthropogenic activities, including agriculture. Pesticide use may also harm the yellow-billed cuckoo, as reproduction problems caused by eggshell thinning have been documented in the population (USFWS, 2014).

19.

Piping Plovers (*Charadrius melodus*) are small shorebirds that live along the Atlantic coast, the Great Lakes, and rivers in the Northern Great Plains. They are threatened on the Atlantic coast and Northern Great Plains and are endangered in the Great Lakes region, and may be affected by habitat fragmentation or water quality contamination.

Piping plovers lay only a few eggs in shallow nests along shorelines, and rely on the associated wildlife and resources for both food and nesting material. Land conversion for crop production could affect this population, as disruption of plover habitat has specifically been shown to be destructive in the Great Lakes endangered population (Cohen, 2009), and human activity near the nest can cause abandonment or can interrupt incubation, resulting in egg mortality due to exposure (Lingle 1989). There has been substantial conversion of land to corn and soybean production throughout the Piping plover's range, including the conversion of riparian areas along its designated critical habitat (Appendix 8). Agricultural pollution to waterways could also affect the species. Northern Great Plains Piping plovers nest around small alkaline lakes, river islands, and other shorelines (Haig and Pilsner, 1993), and pesticides or other contaminants from agricultural practices could jeopardize the birds' egg survival near streams and watersheds where Piping plovers nest (Fannin, 1993).

20.

Black-footed ferrets (*Mustela nigripes*) are listed as endangered across their entire range, which overlaps with substantial amounts of cropland expansion for corn production across the Great Plains (Lark et al., 2015). Although a critical habitat area has not been designated, the loss of habitat—including the conversion of native grasslands to agricultural land—has specifically been cited as a key risk to Black-footed ferrets (USFWS, 2017). The conversion of grasslands to croplands also has been detrimental to populations of prairie dogs, a species upon which the Black-footed ferret is heavily reliant for both food and nesting habitat. Given the connection between the Renewable Fuel Standard and the conversion of grasslands to agricultural land within the Black-footed ferret's range, further assessment seems warranted.

21.

The Renewable Fuel Standard's contribution to land use change has likely also led to adverse outcomes for water quality and thus may have affected aquatic species. Corn has the highest fertilizer application rates of any feedstock crop (U.S. EPA 2011), and approximately one-fourth of all nutrients applied to corn are lost to the environment. The application of synthetic fertilizers, animal manure, and pesticides during crop production contributes to pollution in runoff and pesticide contamination and exposure. Fertilizer and manure inputs contain high levels of nitrogen and phosphorus, which are routed to waterways through surface erosion and runoff, or can leach into groundwater. In waterways, this nutrient loading promotes the growth of plants and algae. This is known as eutrophication, leading to dissolved oxygen depletion and thus hypoxia, making waterways inhospitable to many forms of life. Other effects of eutrophication and excessive nutrient loading include increases in algal toxin levels and the frequency of harmful algal bloom events (U.S. EPA 2017a; Carpenter et al. 1998).

22.

Nutrient runoff, eutrophication, and hypoxia due to increased corn production and the associated decreases in water clarity and oxygen content could jeopardize the health of federally threatened and endangered aquatic species. As of 2007, according to the U.S. Fish and Wildlife Service's endangered species database, 139 fish, 70 mussels, four crayfish, 23 amphibians, and one water dependent dragonfly had endangered or threatened status, and it was estimated that approximately 60 of these species are at least partially imperiled by eutrophication (Dodds et al. 2009). Species within the corn belt and other agriculturally intensive regions and their watersheds may be at greatest risk of impairment from increased ethanol production and associated land use changes.

23.

Based on the location of designated critical habitat in relation to recently expanded corn production and its estimated effects, potentially affected endangered and threatened aquatic species include the endangered Topeka Shiner, the threatened Arkansas River Shiner, and the threatened Purple Bankclimber, endangered Fat Threeridge, endangered Gulf Moccasinshell, endangered Shinyrayed Pocketbook, and endangered Oval Pigtoe mussels.

24.

The Topeka Shiner (*Notropis topeka*) is a small endangered minnow that resides in prairie streams in the central United States where it is usually found in pool and run areas. Its range includes Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, and South Dakota (USFWS, 2018). There has been substantial conversion of land to corn and soy production throughout the Topeka Shiner's habitat range as well as within the immediate vicinity of its designated critical habitat in southwest Minnesota and northwest Iowa (Lark et al., 2015). A primary threat to the Topeka shiner that requires special management in its critical habitat watersheds includes agricultural practices that increase sedimentation and other water quality impacts (Federal Register / Vol. 69, No. 143 / Tuesday, July 27, 2004 / Rules and Regulations). Given this impact mechanism, it is feasible that increased corn production due to the Renewable Fuel Standard could negatively affect the survival or recovery of this endangered species. The Arkansas River shiner (*Notropis girardi*) is a minnow found in Texas, New Mexico, and Oklahoma that faces similar threats as the Topeka shiner. An example of conversion near the Arkansas River shiner's critical habitat is included in Appendix 9.

25.

Mussels can experience habitat fragmentation through the processes of sedimentation and impoundment. The sediment buildup that may occur due to an increase in agricultural practices can lead to the covering of mussels which can result in both resource deprivation as well as isolation of different populations (USFWS, 2006). Excessive chemicals and nutrients in water systems are also a major threat to mussels such as the Purple Bankclimber due to its lifestyle as a filter feeder (McCann and Neves, 1992; Havlik and Marking, 1987), and the inflow of chemicals from nearby cultivated fields can be directly ingested by and harm these mussels. For example, ammonia is linked to fertilizers and is most often found in streams at the interface of the substrate and water, where mussels reside (Frazier et al., 1996), and ammonia has been shown to be lethal to mussels at concentrations of 5.0 ppm (Havlik and Marking, 1987). Young mussels are especially susceptible to these negative impacts (Robison et al., 1996), and deadly levels of pesticides and fertilizers from crop agriculture have been specifically reported in the Apalachicola-Chattahoochee-Flint river basin where many mussels inhabit (Frick et al., 1998).

26.

Recent extensive conversion of land to crop production occurred within the watersheds of many mussels' designated critical habitat in Southwestern Georgia and the surrounding states (see Appendix 10). Potential species impacted include the Fat Threeridge (*Amblema neislerii)*, Purple Bankclimber (*Elliptoideus sloatianus)*, Gulf Moccasinshell (*Medionidus penicillatus)*, Oval Pigtoe (*Pleurobema pyriforme)*, and Shinyrayed Pocketbook (*Lampsilis subangulata)*. Fat Threeridges, Gulf Mocassinshells, Oval Pigtoes, and Shinyrayed Pocketbooks are all endangered mussels found in Georgia and Florida. Purple Bankclimbers are threatened mussels found in Georgia, Florida, and Alabama.

27.

The link between the Renewable Fuel Standard, increased cropping intensification, and hypoxia in the Gulf of Mexico has also been well established (Hendricks et al. 2014; Donner and Kucharik 2008) (see section 5 of Expert Report). Many Americans may be familiar with the Gulf "dead zone"—a major hypoxic zone which forms seasonally in the northern Gulf of Mexico and that is caused by the interaction of environmental conditions, water stratification, and excess nutrient pollution from the Mississippi River (NOAA 2017). Harms to aquatic life in the "dead zone" include reduced growth and reproduction, habitat destruction, and death (Mississippi River/Gulf of Mexico Watershed Nutrient Task Force 2015; U.S. EPA 2017b; NOAA 2017).

28.

Corn and soybean cultivation is the greatest source of nitrogen loading to the Gulf of Mexico, contributing approximately half the total loading (Alexander et al.

2008; Mississippi River/Gulf of Mexico Watershed Nutrient Task Force 2015). Donner and Kucharik (2008) estimated that increases in corn ethanol production specifically related to the Renewable Fuel Standard would increase the annual average flux of dissolved inorganic nitrogen exported by the Mississippi and Atchafalaya Rivers to the Gulf of Mexico by 10–34% (Donner and Kucharik 2008). Another study, which focused only on Iowa, Illinois, and Indiana, estimated that for each additional billion gallons of corn ethanol produced under the Renewable Fuel Standard in these states, the size of the Gulf dead zone would grow by approximately 33 square miles.

The large seasonal dead zone in the Gulf may affect the critical habitat or migration and feeding ranges of current and pending federally listed species, including the threatened Gulf Sturgeon, threatened Loggerhead Turtle, and endangered Sperm Whale.

29.

The Gulf Sturgeon (*Acipenser oxyrhynchus desotoi*) has designated critical habitat immediately at the mouth of the Mississippi river, and the species is vulnerable to low dissolved oxygen levels and hypoxia, which could be impacted by eutrophication and agricultural runoff due to the Renewable Fuel Standard.

30.

Loggerhead sea turtles (*Caretta caretta*) spend the majority of their lives in coastal and offshore waters of the Gulf of Mexico, Caribbean Sea, and Atlantic Ocean. The nearshore waters of the Gulf provide valuable foraging habitat for juvenile and adult sea turtles, as well as important mating and inter-nesting habitat. Loggerheads in the near-shore northern Gulf of Mexico waters may be exposed to hypoxia (Hart et al. 2013) and thus could be affected by the expanded Gulf hypoxic zone due to the Renewable Fuel Standard. The increasing frequency of red tides and harmful algae blooms in the Gulf of Mexico as well as the increased duration and extent of the hypoxic dead zone caused by agricultural runoff in the Mississippi River have been reported to both directly and indirectly affect sea turtles (NMFS et al. 2011). Thus, further review of the potential impacts is recommened.

31.

The Sperm whale (*Physeter macrocephalus*) is listed as endangered throughout its range, which includes a substantial year-round population in the Gulf of Mexico. Sperm whales may experience a potential reduction in their food sources due to the annual Gulf hypoxic zone, and consequently a possible reduction in their presence and number of sightings in this region.

32.

Increases in cultivated cropland and ethanol production spurred by the Renewable Fuel Standard also influence water use and availability both through the biofuel production process at refineries, as well as through the demands of growing large volumes of corn and other feedstocks.

33.

Corn ethanol refineries use approximately 2.5 to 3 gallons of water per gallon of ethanol produced (Hoekman, Broch, and Liu 2017). While these numbers may not sound particularly alarming, they can strain water resources where supplies are limited, such as the semi-arid Great Plains. The impact of these refineries is shocking when compared to typical human use: a corn ethanol refinery with production capacity of 100 million gallons per year is estimated to consume as much water as a community of 5000 people (Hoekman, Broch, and Liu 2017; Service 2009). Furthermore, the water requirements associated with production of corn for ethanol can be far greater depending on whether the crop is irrigated or rainfed. As of 2009, approximately 70% of the corn used to produce ethanol was estimated to have water requirements of 10-17 gallons of water per gallon of ethanol produced. In some regions high in irrigation and water use, the ratio can be over 300 gallons of water per gallon of ethanol produced (Hoekman, Broch, and Liu 2017). Example listed species potentially impacted by water use and consumption for biofuel feedstock production and refining, as described below, include the aforementioned Hine's emerald dragonfly and Piping Plover.

34.

Hine's emerald dragonflies (*Somatochlora hineana*) are endangered dragonflies that inhabit marshes and meadows that are calcium carbonate-rich in Missouri, Wisconsin, Michigan, and Illinois. High capacity pumping of groundwater for agricultural irrigation, as is common in the agricultural locations like Central Wisconsin, Michigan, and Illinois, may lead to habitat fragmentation due to water level alteration. Groundwater is vital to maintaining a healthy wetland environment, and changes in water flow rates due to upstream pumping may also lead to a reduction in available habitats to successfully reproduce (USFWS, 2001).

35.

Similarly, water use and consumption for irrigated biofuel feedstock production as well as flooding from increased erosion may influence the Piping Plover, whose nests are very dependent on the stability of water levels (Haig, 1992). When water levels rise too much, the nests of Piping Plovers flood; if water levels dip too low, vegetation that is destructive to successful nesting may grow (USFWS, 1996).

36.

While one of the stated intentions of the Renewable Fuel Standard is to reduce greenhouse gas (GHG) emissions from motor vehicles, any induced land use conversion from the Renewable Fuel Standard can be a major contributor of atmospheric greenhouse gases. Nonagricultural or non-cropped land is typically a significant carbon sink and also contains substantial carbon stocks, so the clearing of these lands, as well as the cultivation and perturbation of the soil, usually generates a net release of greenhouse gases to the atmosphere (Hoekman and Broch 2017). In general, conversion from grassland to crop production releases an estimated 68 to 134 Mg CO_2 per hectare (Fargione et al. 2008; Gelfand et al. 2011). As such, the conversion of noncropland to corn and soy cultivation following implementation of the Renewable Fuel Standard (2008-2012) was estimated to have led to emissions of 94 to 186 Tg CO_2e. This is equivalent to a year's worth of CO_2 release from 34 coal-fired power plants or an additional 28 million cars on the road (Lark, Salmon, and Gibbs 2015). The processes by which these releases occur are detailed further in section 5.4 of the Expert Report. The U.S. Fish and Wildlife Service specifically identifies climate change as a key threat to many of the species listed in this declaration. Thus, any of the species and their critical habitat that are sensitive to climate change may thereby be impacted by emissions of greenhouse gases associated with crop production and expansion induced by the Renewable Fuel Standard.

37.

To date, little research has been performed regarding the potential impact of the Renewable Fuels Standard on federally threatened and endangered species. Given this lack of information as well as the potential mechanisms of influence enumerated here, further evaluation and review of the possible impacts is recommended.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct to the best of my knowledge.

Dated this 27th of July, 2018

Signed,

Dr. Tyler Lark

Appendix 1 to Declaration of Dr. Tyler Lark

Tyler J. Lark

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EDUCATION

Ph.D. Environment & Resources, University of Wisconsin-Madison, 2017 *GPA: 4.0*
Dissertation: Quantifying agricultural land-use change across the United States. Advisor: Holly Gibbs

B.S. Biomedical Engineering, 2nd major in Mathematics, University of Wisconsin-Madison, May 2011 *GPA: 3.9*

HONORS & AWARDS

"Innovation in Teaching" university-wide Teaching Assistant (TA) award, *UW-Madison*, 2017
"Administrative Improvement Award" for receipt waste reduction project, *UW-Madison*, 2016
"Best Oral Presentation" – *North American Congress for Conservation Biology*, 2016
"Highly Commended Paper" – *Environmental Research Letters'* Top Papers of the Year, 2015
Kurt F. Wendt award for outstanding character, dedication, and leadership in a UW program, 2011
Global Stewards Committee's Climate Leadership Challenge award winner, 2010
"Best Presentation Award" and Schoofs Prize for Creativity, *UW Innovation Days*, 2010
"Gold project for International Outreach" *United Nations Mondialogo challenge*, 2009

PROFESSIONAL EXPERIENCE:

Associate Researcher, University of Wisconsin-Madison, *December 2017 – present*

Lead research on U.S. agriculture, land use, and conservation as part of the Gibbs Land Use and Environment lab at the Center for Sustainability and the Global Environment (SAGE). Manage multi-institutional projects and a local team of analysts, graduate students, and researchers to answer policy-relevant research questions and share the results with stakeholders.

Graduate Research Assistant, University of Wisconsin-Madison, *January 2012 – December 2017*

Research Intern/Co-op, Kimberly-Clark Corporation, Neenah, WI & Roswell, GA, *Summer 2014, 2010, Spring 2009, Fall 2007*

Conducted research of renewable & bio-based products and materials as a member of the Environmentally Sustainable Technology team. Considered the full life-cycle impact of product development and use.

Project Manager, Engineers Without Borders UW-Madison Haiti Program, *Spring 2009 – Summer 2011*

Coordinated and co-directed an international community development program with over 30 students and 5 professionals. Managed partner relations, project finances, and full process assessment, design, and implementation of projects including irrigation canal construction, reforestation, and land surveying technical education.

RESEARCH GRANTS AND FUNDING

2018	Nations Wildlife Federation: *Mapping irrigation and endangered species in the Ogallala aquifer and Apalachicola-Chatahooche-Flint (ACF) basin.* ($23,374 – PI; Co-PI H. Gibbs)
2018	World Wildlife Fund: *Mapping undisturbed lands in support of HOS grassland sustainability.* (39,886 – PI)
2017-2018	Great Lakes Bioenergy Research Center: *Estimating marginal lands available for cellulosic biofuel feedstock production.* ($70,000 – Project co-lead with PI Holly Gibbs)
2017-2018	National Wildlife Federation: *Quantifying the impact of the Renewable Fuel Standard on America's land and water resources.* ($544,500, Project co-lead with PI Holly Gibbs; Co-PIs C. Kucharik, N. Hendricks, A. Smith, and J. Brown)
2017	American Carbon Registry / Ducks Unlimited: *Avoided grassland conversion modeling support.* ($20,000 – PI)
2017-2018	Packard Foundation / National Wildlife Federation: *Mapping global biomass and estimating carbon emissions from U.S. cropland expansion.* ($144,000 – Project co-lead with PI Holly Gibbs)
2015-2016	UW Sustainability Innovation in Research and Education grant: *Solutions for Food Waste Reduction--Integrating teaching with research on Sustainability.* ($20,634 – Co-I with Holly Gibbs)
2014-2015	National Wildlife Federation: *Assessing native prairie conversion in Minnesota.* ($6,000 – Co-I with Holly Gibbs)
2013	Roy F. Weston Distinguished Graduate Fellowship in Sustainability Science, Technology, and Policy. ($44,000 – PI)
2010-2012	Ira and Ineva Reilly Baldwin Wisconsin Idea Endowment: *Alternative Energy: Plant-based Biofuels and Sustainable Stove Design for Haiti and Deforested Nations.* ($12,000 – PI)
2010-2012	Morgridge Center for Public Service: *Expanding student and community involvement via greenhouse and agroforestry test plots in Madison, Wi, and Bayonnais, Haiti.* ($6,000 – PI)

MEDIA OUTREACH & SCIENCE COMMUNICATION:

Interviews: National Public Radio, Washington Post, Minnesota Public Radio news, Pacific Standard, Frontiers in Ecology and the Environment, Grist, Environmental Research Web, Mongabay

Research Coverage: Associated Press, ClimateWire, ThinkProgress.org, Harvest Public Media, Inhabitat, TreeHugger.com, NSAC, Land Stewardship Project, Environmental Working Group, World Wildlife Fund, National Wildlife Federation,

TEACHING EXPERIENCE:

Spring 2014. Enviro St. 600: Consumer-driven sustainability. Co-designed and co-taught a new environmental studies capstone section focused on campus food connections.

Spring 2015 & Fall 2016. Geography 309: People, Land, and Food. Developed and delivered 4 weeks of lectures, discussions, and assessments as a special instructor for classes of 60 and 95 undergraduate geography students.

Spring 2016. Enviro St. 600: Solutions for Food Waste Reduction. Proposed, created, and instructed a new special topics capstone section on the local to global causes and consequences of food waste.

MENTORED STUDENTS

Calder Sell, "Impacts of Biofuel Feedstock Production Land Conversion on Endangered Species in the United States", 2-cr. Independent Project (Bio 152), 2018

*+Stephanie Herbst, "Coupled land and water availability in the United States", Masters Thesis, Environment and Resources program, x2018

+Seth Spawn, "Carbon implications of U.S. and global land use change and conservation efforts". Master's Thesis, Geography, x2019

Jumana Dahleh, "Policy recommendations for municipal food waste reduction in Madison, WI", 2-cr. Independent Study (IES 699), 2017

Megan Bohl, "Food waste reduction in campus dining halls", 1-cr. Independent Study (IES 699), 2017

+Liu Luo, "Multiple Cropping Systems for China under Climate Change", Chinese Exchange Workshop on Research Innovation and Scientific Writing, April 3-17, 2016

Madeline Fischer, "Food Waste media communication strategies", 3-cr. Independent Study (IES 699), 2015

Collin Higgins, "Urban turf grass as Potentially Available Cropland", Sophomore Honors Program, 2013

Aaron Schroeder, "The potential of home gardens to reduce food waste in the U.S.", Undergraduate Research Scholars Program (2012-2013)

Maxwell Albrecht, "Supply chain analysis of commercial vs home vegetable production". Undergraduate Scholars Program (2012-2013)

*Served as thesis committee member

+graduate student

SERVICE:

Campus Advisory Board, *Morgridge Center for Public Service*, 2016-present
Advisory Committee, *UW-Madison Arboretum*, 2015-present
Board Member & Parks committee chair, *Tenney-Lapham Neighborhood Council*, 2013-present
Advisory Board member, *UW-Madison Office of Sustainability*, 2013-present
University Shared Governance Member – *Associated Students of Madison*, 2012-2017
Regular reviewer for journals including *Global Change Biology*, *GCB-Bioenergy, Geo: Geography & Environment*, *Journal of Land Use Science*, *Land Use Policy*, *Mitigation and Adaptation Strategies for Global Change*, and *Ecosphere*

JOURNAL PUBLICATIONS

Published:

Lark, TJ, R. M. Mueller, D. M. Johnson, H. K. Gibbs. Measuring land-use and land-cover change using the USDA Cropland Data Layer: Cautions and Recommendations. *Intl J of Applied Earth Obs and Geoinformatics.* (2017) (IF=3.9)

Wright, CK, B Larson, **TJ Lark**, HK Gibbs. Recent grassland losses are concentrated around U.S. ethanol refineries. *Environmental Research Letters. (*2017*) (IF=4.1)*

Lark, TJ, JM Salmon, HK Gibbs. Cropland expansion outpaces biofuel policies in the United States. *Environmental Research Letters.* (2015) (IF=4.1)

Submitted / In review:

Lark, TJ, B. Larson, I. Schelley, S. Batish, H. K. Gibbs. Conversion of native prairie grasslands in the Midwest, USA. *Environmental Conservation*.

Available as report / In preparation for journal submission:

Lark TJ, I Schelley, HK Gibbs. Accuracy of mapping crops and cropland conversions in the United States. *Published as dissertation chapter / In prep for Remote Sensing.*

Lark TJ and HK Gibbs. The land gap and Potentially Available Cropland in the United States. *Published as dissertation chapter / In prep for Agricultural Systems.*

Lark TJ. Protecting our prairies: A science and policy agenda for conserving America's grasslands. *In prep for Land Use Policy.*

PRESENTATIONS

Lark, T.J., and H.K. Gibbs. "Mapping Potentially Available Cropland in the United States." American Geophysical Union, San Francisco, CA. Dec. 3-7, 2012.

Lark, T.J., J.M. Salmon, and H.K. Gibbs. "Mapping agricultural land-use change in the U.S. 2008-2012." American Geophysical Union, San Francisco, CA. December 18, 2014.

Lark, T.J. "Conservation and Biofuel Policy Implications of Recent Cropland Expansion in the United States." Nelson Institute Brownbag Public Lecture Series. Madison, WI. February 12, 2015.

Lark, T.J. "Post-Renewable Fuels Standard domestic land use change." Seminar presentation for the Union of Concerned Scientists and National Wildlife Federation, Washington, D.C. February 18, 2015.

Lark, T.J. "Land-use change and biofuels." Presentation to the U.S. Environmental Protection Agency, Office of Transportation & Air Quality. Washington, D.C. February 18, 2015.

Lark, T.J. "Policy implications of U.S. cropland expansion 2008-2012." Official commentary to the White House Office of Information and Regulatory Affairs, in support of Renewable Fuels Standard (RFS) Program final rule. Washington, D.C. February 18, 2015.

Lark, T.J. "Cropland Expansion and its impacts on Grassland and Wetlands Nationwide." Public teleconference and interview hosted by National Wildlife Federation, Washington, D.C. April 2, 2015.

Lark, T.J., J.M. Salmon, and H.K. Gibbs. "Recent U.S. cropland expansion and implications for carbon and policy." Invited presentation to the National Association of Clean Air Agencies, Committee on Agriculture. (online) April 21, 2015.

*Lark, T.J., J.M. Salmon, and H.K. Gibbs. "Cropland expansion outpaces agricultural and biofuel policies in the United States. American Association of Geographers annual meeting. Chicago, IL. April 23, 2015.

Lark, T.J. and Gibbs, H.K. "Mapping agricultural land-use change in the United States." Stakeholder presentation to the Wisconsin Corn Growers, Wisconsin BioFuels Association, and the Renewable Fuels Association. May 21, 2015

Lark, T.J. "Agricultural land-use change and implications for conservation organizations." Presentation to state and federal grasslands and wetlands working groups. (online). August 13, 2015.

Lark, T.J. "Mapping agricultural land-use change in the United States." Recorded webinar for The Nature Conservancy's national grasslands network. September 21, 2015.

**Lark, T.J. "Grassland conversion across the United States: Status, impacts, and policy implications." America's Grasslands Conference hosted by the National Wildlife Federation and Colorado State University. Fort Collins, CO. September 30, 2015.

*Lark, T.J. and Gibbs, H.K. "Land-use change in the US: Recent results, accuracy, and implications." Coordinating Research Council Workshop on Life Cycle Analysis of Transportation Fuels, Argonne National Lab, Chicago, IL. October 28, 2015

Lark, T.J. "Mapping grassland and cropland conversion across the United States." Society for Conservation Biology (SCB) North American Congress. Madison, WI. July 20, 2016 (Best presentation award)

*Lark, T.J. "Monitoring land use for agricultural sustainability." International Sustainability and Carbon Certification (ISCC) North American Stakeholder Dialogue and Technical Committee Meeting on implementation of sustainable supply chains. Las Vegas, NV. September 29, 2016.

Lark, T.J., Mueller, R.J., Johnson D.M., and Gibbs, H.K. "Measuring Land-Use and Land-Cover Change Using the USDA Cropland Data Layer: Cautions and Recommendations." American Geophysical Union, San Francisco, CA. December 16, 2016

Lark, T.J. "U.S. agricultural land use change Data: Opportunities for monitoring habitat conversion." Workshop on High-Oleic Soybean sustainability hosted by World Wildlife Fund and United Soybean Board. Washington, D.C. February 14, 2017

Lark, T.J. "Mapping U.S. agricultural land-use change using remote sensing products: Recent results, methods, and future directions." Seminar at the USGS Center for Earth Resources Observation and Science (EROS). Sioux Falls, SD. November 1, 2017

**Lark, T.J. "State of America's Grasslands: Recent Conversion & Research Frontiers." America's Grasslands Conference. Fort Worth, TX. November 15, 2017

*Lark, T.J. "Land use and environmental implications of the RFS." America's Grasslands Conference. Fort Worth, TX. November 15, 2017

Lark, T.J. "America's Food- and Fuel-Scapes: Agricultural land-use change across the United States." Public PhD seminar. Madison, WI. November 29, 2017

Lark, T.J. "Identifying undisturbed lands to support HOS sustainability criteria. Webinar hosted by the World Wildlife Fund. March 23, 2018.

Lark, T.J. "Biofuels and Land Use: Opportunities and challenges for sustainability." Recorded public seminar at WI Energy Institute. Madison, WI. April 2, 2018

Lark, T.J. "The scales of marginal lands and availability for cellulosic biofuel feedstock production." Great Lakes Bioenergy Research Center, Annual Science Meeting. Lake Geneva, WI. May 9, 2018.

*Invited conference presentation

**Plenary/Keynote Speaker

Appendix 2 to Declaration of Dr. Tyler Lark

Potential Land Use and Environmental Impacts of the United States Renewable Fuel Standard

Tyler J. Lark, Ph.D.

2/21/2018

1 EXECUTIVE SUMMARY

In 2011, the U.S. Environmental Protection Agency (EPA) completed its first triennial report to Congress on the environmental and resource conservation impacts associated with increased biofuel production and use in the United States. At the time, many of the impacts were uncertain and had been estimated using predictive models of anticipated land use change and potential responses. Since that report's release, sufficient time has passed to quantify observed changes on the landscape and document them in scientific literature and government reports. The purpose of this current account is to highlight a selection of that recent data and research, with a focus on land use changes relevent to corn ethanol production and associated impacts on the environment and conservation.

The Renewable Fuels Standard (RFS) is the federal policy which mandates the production and use of biofuels in the U.S. Following passage of the expanded RFS in 2007, total actively cultivated cropland area in the U.S. increased. Part of this cropland expansion came from the conversion of non-agricultural land and was used to grow biofuel feedstock crops such as corn and soybeans. According to land protections written into the RFS, this land should be ineligible for renewable biomass feedstock production. However, to date, converted lands have not been explicitly monitored under the RFS program and consequently have not yet been restricted from use for feedstock production.

Since 2007 there has also been widespread conversion of other types of land to active crop production including the conversion of pasture and previously idled cropland. These lands *are* considered eligible for renewable feedstock production under RFS definitions. Regardless of eligibility though, any conversion of land to grow the crops commonly used for biofuels can lead to negative environmental outcomes. Potential impacts include degradation of water quality that engenders both environmental and human health repercussions, direct emissions of carbon dioxide and other greenhouse gases to the atmosphere, loss of wildlife habitat and declines in plant and animal biodiversity, and the possible impairment of endangered species.

Due to an absence of chain-of-custody tracking in U.S. commodity crop supply chains, there is uncertainty regarding the exact location and magnitude of land conversion and impacts that are directly attributable to biofuel production and the RFS. Despite this limitation, a growing body of economic and statistical research has shown a direct causal link between the RFS, increased crop prices, and resultant effects on land use and natural resources. The available findings indicate that the RFS has stimulated national corn prices and total cropland area expansion, and that land conversion and increased corn cultivation is locally concentrated around ethanol refineries.

The influx of recent evidence that ties the RFS to documented land use changes and ensuing environmental consequences stresses the need to update comprehensive assessments of biofuel production impacts. Such a review would enable accurate and timely evaluation of the merits and drawbacks of existing renewable fuel volumes and policy. To inform these efforts, it will be important that the scientific and regulatory communities continue to conduct and support research on the evolving impacts of the RFS including those from biofuel feedstock production and associated land use changes.

TABLE OF CONTENTS

2 BACKGROUND

2.1 EISA AND EPA'S 2010 RULES ON IMPLEMENTATION

The Renewable Fuel Standard program (RFS) was established as part of the Energy Policy Act of 2005, which was passed as an amendment to the Clean Air Act. The RFS functions as a mandate: it sets minimum levels of renewable fuels that must be blended into the nation's transportation fuel supply. The original RFS required that at least 4 billion gallons of renewable fuel be blended in 2006 and at least 7.5 billion gallons by 2012. In 2007, the RFS was revised and expanded as part of the Energy Independence and Security Act of 2007 (EISA), a further amendment to the Clean Air Act. EISA increased the mandated volume of renewable fuels to 36 billion gallons by 2022 and established specific annual volumetric targets for individual fuel categories, including total renewable fuels, advanced biofuels, biomass-based diesel, and cellulosic biofuels.

Given its responsibility for implementing Clean Air Act rules, the U.S. Environmental Protection Agency (EPA) was charged with the responsibility of implementing and regulating the RFS. After proposal and review, the EPA established its initial plan for enforcing the RFS which was published in the Federal Register as 40 CFR Part 80 "Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program; Final Rule" on March 26, 2010 (Federal Registrar 2010). This final rule continues to guide implementation of the RFS, and outlines how the statutorily-mandated program has thus far been administered in practice.

Under EISA, the EPA also has authority to waive or adjust the volumetric targets specified in the RFS (U.S. EPA Office of Inspector General 2016). Targets may be waived based on inadequate domestic supply of renewable fuels or if implementation of mandated levels would cause severe harm to the economy or environment. To date, the EPA has only waived blending targets based on inadequate domestic supply. However, up-to-date information regarding the environmental impacts of renewable fuels has not been available to aid annual volumetric decisionmaking. In lieu of more comprehensive environmental assessments, this report summarizes recently documented impacts that may support waiver decisions concerning potential environmental harm.

2.2 Renewable Feedstocks, Eligible Land, and Aggregate Compliance

Under EISA, land eligible for growing crop-based renewable feedstocks must have been cleared or cultivated prior to the date of enactment, December 2007, and be "actively managed or fallow, and nonforested." In determining what biomass feedstocks would qualify under this definition, the EPA interpreted these guidelines to include all planted crops and crop residues harvested from existing agricultural land. Existing agricultural land was further defined to include cropland, pastureland, and Conservation Reserve Program (CRP) land, which suggests that each of these sources could be used or converted to grow biofuel feedstocks (Federal Registrar 2010) (p14692). Pastureland was described as property managed primarily for the "production of indigenous or introduced forage plants for livestock grazing or hay production, and to prevent succession to other plant types." Rangeland was excluded from qualifying for renewable biomass production on the basis that it is land where the vegetation is predominantly grasses, grass-like plants, forbs or shrubs and which — unlike cropland or pastureland — is predominantly managed as a natural ecosystem (Federal Registrar 2010) (p14693).

In its 2010 rulemaking, the EPA proposed three mechanisms to monitor the EISA land eligibility stipulation and enforce compliance. The first approach required establishment of a feedstock recordkeeping and reporting system, which would enable and require tracking of feedstock production locations to ensure they were existing cropland sites. The second, consortium-based proposal suggested development of a supply chain quality assurance program that would allow groups of fuel and feedstock producers to attain certification, subject to verification by an independent auditor. The final proposed mechanism for planted crops and crop residues from agricultural land provided an alternative means of compliance in which all feedstocks within the U.S. would be deemed eligible if certain nationwide cropland area thresholds were not exceeded.

Ultimately, the EPA chose the third, “aggregate compliance,” approach to determine feedstock eligibility (Federal Registrar 2010). The aggregate compliance approach was justified, in part, by assumptions that “in practice, new lands will not be cleared, at least in the near future, for purposes of growing renewable fuel feedstocks” (p14698). Under aggregated compliance, the EPA set a threshold of 402 million acres of existing cropland in 2007 from which eligible biomass could be sourced. If total cropland exceeded this threshold in subsequent years, the ruling stated that recordkeeping and reporting requirements would be enacted. If a lower, 397-million-acre threshold was reached, the EPA proposed to re-evaluate the aggregate approach. Despite reaching the lower threshold in some years, the EPA has not yet reformed the aggregate compliance approach (Wright et al. 2017).

Aggregate compliance was supported by several factors at the time of its proposal, but recent studies have found potential challenges to its efficacy (Wright et al. 2017). For example, the EPA relies on nationally aggregated measures of total cropland from the Department of Agriculture’s Farm Service Agency (FSA) and National Agricultural Statistics Service (NASS) to monitor the regulation. However, these aggregate indicators report only *net* changes in cropland area at the county level and fail to identify *gross* conversions to and from cropland. As such, any ineligible land that was converted to biofuel feedstock production could essentially be hidden or offset by abandonment of existing cropland in other areas. In addition, use of 2007 as the sole baseline year for comparison may be problematic, as 2007 planted area was already above previous year averages due to multiple factors, including favorable planting conditions, and some land may have already been converted in anticipation of the RFS update. Furthermore, a growing body of recent data suggests the foundational assumptions supporting aggregate compliance may no longer be valid. These issues are further described in sections 3 and 4 of this report.

2.3 SUMMARY OF EXISTING FEDERAL REPORTS

Several government studies that summarized the anticipated environmental impacts of biofuel production were published during or soon after EISA enactment and EPA's 2010 ruling on implementation. In February 2010, the EPA released its Regulatory Impact Analysis (RIA), which included reporting on the Life Cycle Analysis (LCA) of various biofuels' greenhouse gas (GHG) intensities and their relation to meeting GHG reduction thresholds of the RFS (U.S. EPA 2010). The assessment found that most renewable fuel pathways reduced emissions relative to gasoline. However, the review also concluded that land-use change was a significant determinant of a renewable fuel's net GHG balance, and thus represents a pivotal component to monitor and understand. The EPA has not yet updated the 2010 RIA, which could now incorporate observed data on land-use changes and associated GHG emissions to reasses renewable fuel pathway emissions estimates.

In 2011, the National Academies of Sciences (NAS) published their statutorily mandated study on the economic and environmental effects of biofuels (Committee on Economic and Environmental Impacts of Increasing Biofuels Production; National Research Council 2011). This report summarized many of the broad environmental impacts of biofuels known at the time. They concluded that the effects of increasing biofuel production are highly variable and depend on feedstock type, site-specific factors, and management, among other conditions.

Also in 2011, the EPA submitted its first triennial report to Congress on the environmental and conservation impacts of the RFS program. Of relevance, this report concluded that "the extent of negative impacts to date are limited in magnitude and are primarily associated with the intensification of corn production" and that "whether future impacts are positive or negative will be determined by the choice of feedstock, land use change, cultivation and conservation practices." These statements as well as the findings of the RIA and NAS study emphasize the importance of agricultural land use and spatial and crop specificity for understanding biofuel impacts. They also demonstrate the need for regularly updated environmental impact reviews to continue to inform the RFS program.

Under section 204 of EISA, the EPA is required to reassess the environmental and resource conservation impacts of the RFS program and report their findings to Congress every three years. The 2011 triennial report was the first and only such review (although an update was planned for delivery by the end of 2017, as of the date of this report, a new triennial report has not been released (U.S. EPA Office of Inspector General 2016)). At the time of the existing federal reports, many environmental impacts, particularly surrounding land use change, were uncertain and estimated using predictive models. Since then, substantial documentation of the role of biofuels and the RFS in modifying the landscape has emerged, which underscores the need for the updated review.

3 RECENT U.S. LAND USE CHANGE

Many of the environmental impacts of the RFS manifest through land use and land-use change (LULUC). Biofuel production requires large areas of land to grow feedstocks to use as input, and the effects of this production possibly constitute the largest potential environmental harm of the RFS. Although the environmental consequences of existing crop production are relatively well-known, the impacts of shifting crop patterns and further cropland expansion are less certain.

Agricultural land use changes induced by the RFS could occur through two key pathways: intensification and extensification. Both processes increase the overall production of a crop. Intensification refers to the process of getting more production from a fixed area of land, typically by increasing the yield of a crop or by increasing its acreage on existing cropland. Common examples of intensification for a specific crop include the initiation of irrigation, increased use of agronomic inputs like nitrogen fertilizer, or switching from other crops (e.g. continuous corn production rather than crop rotations). Extensification, or land conversion, increases crop production by bringing new land into cultivation, thus expanding the total area of production. This process converts uncropped land into cropland, and thus causes concomitant changes to the structure and function of the land, which in turn affects interactions within water, soils, and other natural resources.

Since the first triennial report to Congress from the EPA, a number of studies have documented extensificaiton and the domestic response of agricultural land to biofuel production. Several federal reports have also been released that detail the overall change in agricultural area across the U.S. following RFS enactment in 2007. These reports and data provide a snapshot of the response and dynamics of the agricultural industry during implementation of the RFS and help situate the policy within a broader context.

3.1 U.S. CULTIVATED CROPLAND AREA FOLLOWING PASSAGE OF THE RFS

The footprint of U.S. cropland has increased over the last decade. While there is some uncertainty concerning the total area of recent expansion, nearly all data sources suggest a net increase in total land under cultivation (Appendix 3-1)[1]. This expansion represents a reversal of the previous 30-year trend of crop area decline (Lark, Salmon, and Gibbs 2015). Data on cropland area are collected via a variety of methods, which include farmer-reported census, statistical surveying of crop fields by USDA field agents, and satellite-based observations of crop production and land use change.

The USDA's Census of Agriculture is often cited as the gold standard of agricultural land use data (Laingen 2015; Johnson 2013). For the period 2007 to 2012, the most recent years for which data are available, the Census of Agriculture shows an increase in harvested area of 5.3 million acres (Appendix 3-2). The area of failed cropland (planted but not harvested) also increased by 4.0 million acres to create a combined increase of 9.3 million acres of actively managed cropland. During the same period, fallow and idle cropland—two sources of land eligible for increasing feedstock production area under the RFS – decreased by 1.5 and 1.6 million acres, respectively. The remaining difference between the increase in actively managed cropland and the decrease in fallow and idle land suggests at least 6.2 million acres of cropland must have come from other sources, including pastureland, rangeland, or land enrolled in the Conservation Reserve Program. Note that if any fallow or idle land went into other non-crop uses such as development, the amount of increased cropland coming from pastureland, rangeland, or land enrolled in the CRP would be greater.

The National Resources Inventory (NRI), a long-term observational study of statistically representative sites across the country, also showed net cropland area expansion from 2007 to 2012. The NRI estimated 11.1 million acres of cropland gains from other uses, offset by only 7.2 million acres of

[1] Depending on the specific years, crops, and survey products selected, the annual NASS Survey products can suggest either an increase or decrease in planted or harvested area. As such, evaluating these individual metrics in isolation in not recommended.

cropland conversion to other uses, a net increase of about four million acres of cropland over the five-year period (appendices 3-4 and 3-5).

The satellite-based USDA Cropland Data Layer (CDL) is a landcover classification product that maps the distribution of cropland and specific crops each year and was used by Lark et al. (2015) to measure recent land use change. Their analysis accounted for errors, misclassifications, and mapping bias in the underlying CDL data. Their analysis found 7.3 million acres of cropland expansion from 2008 to 2012, offset by only 4.3 million acres of cropland loss, for a net increase of 3.0 million acres (Lark, Salmon, and Gibbs 2015).

The National Land Cover Database (NLCD) provides an alternative satellite-based assessment of land cover and land cover change that is independent of the USDA CDL and associated assessments. The NLCD is produced by a consortium of organizations that includes the USGS, USDA, EPA, and others. According to the NLCD, from 2006 to 2011 approximately 1.5 million acres were converted to cultivated crop production from other uses, offset by only 1.3 million acres of cropland loss, for a net increase of 172,000 acres of cropland(Appendix 3-6).

Although each of these datasets use different means of data collection and yield different estimates (see Appendix 3 summaries for each dataset), collectively they reveal a consensus that active cropland area increased in the U.S. during the period immediately following 2007. These nationwide assessments are further supported by a plethora of regional studies which have identified conversion of noncropland to active production during the RFS era (Wright and Wimberly 2013; Johnston 2014; Mladenoff et al. 2016; Reitsma et al. 2015; Wimberly et al. 2017).

There remains some debate regarding the magnitude of land cleared following 2007, how much of it was used for biofuel production, and how much of it should be ineligible for such use. However, there is irrefutable evidence that there was at least *some* cleared and converted land that should be ineligible for renewable feedstock production. In 2012 the USDA Farm Service Agency reported specifically on first-time conversions of noncropland to crops and identified over 400,000 acres of conversion (USDA 2013). Based on the definitions established by the EPA and the sources of data selected to determine the eligible area in the U.S., this land should be excluded from qualifying for renewable biomass production. Given that these data were tracked by the USDA and based directly on the data adopted by the EPA to define cropland, they provide the strongest evidence of ineligible land conversion and the inability of aggregate compliance to uphold the land protections established by EISA and the EPA.

3.2 LIMITATIONS OF NET AND AGGREGATED DATA

Use of net and aggregated data to monitor total cropland extent and compliance with the RFS can be problematic. Within the overall net increase in cropland area observed since 2007, there are concurrent annual increases and decreases as well as significant regional variations in the distribution of land use changes. However, land conversions and regional variations are often masked when cropland area is reported only by measures of net change or when the data are aggregated into larger administrative units.

When land use change data are reported only as net changes in total cropland area — as is the case in the Census of Agriculture and NASS Survey data — the amount of conversion to and from cropland is actually unknown. For example, areas of expansion in one location could be offset by abandonment in others, which would result in a net zero change in total cropland area, despite substantial landscape alteration. Instead, land use changes should more appropriately be reported based on both *net* change and the more detailed *gross* changes--into and out of cropland--which sum to equal the overall net change in cropland area. Unfortunately, the Census of Agricultural, NASS Surveys, and the FSA crop planting data used by the EPA to establish its baseline area for aggregate compliance all report only net changes in cropland.

Land use changes can be further obscured when data are spatially aggregated into larger administrative units. For example, several counties within a given state might show substantial cropland expansion while another group of counties exhibit countervailing losses. When county level results are aggregated to broader spatial extents, the magnitude of local changes are attenuated or can be completely offset. Aggregated measures of crop area are thus ineffective at quantifying the actual amount of land use change that occurs. Appendix Figure 3-7 from Lark et al. (2015) as well as figure 2 of Swinton et al. (2011) illustrate the heterogeneous nature of cropland use and change and exemplify the importance of measuring gross, dissaggregated changes on the landscape (Swinton et al. 2011; Lark, Salmon, and Gibbs 2015).

The obfuscation that results from net change measures and spatially aggregregated data is most pronounced at the national level. For example, even if cropland area had remained constant following passage of the RFS, some cropland is continuously lost to development and would need to be replaced with conversions elsewhere in order for the total area to remain the same (Coisnon, Oueslati, and Salanié 2014; Emili and Greene 2014). Thus cropland losses to development can mask increases elsewhere, including any increases for corn ethanol production. By the definitions of eligible land in EISA and EPA's 2010 rule on implementation, nonagricultural land converted after 2007 should not qualify for production of renewable fuel feedstocks. As it stands, however, the current "aggregate compliance" enforcement mechanism tracks only net changes at the nationally aggregated scale and therefore ineffectively monitors land conversion. As a result, all U.S. cropland is currently deemed compliant, even if it was recently converted from nonagricultural use.

3.3 CORN WAS FREQUENTLY PLANTED ON NEWLY CONVERTED LAND.

Several studies show that corn was frequently planted on land converted after 2007. Lark et al. (2015) found that corn was planted on 27% of new cropland between 2008 and 2012, followed by wheat (25%) and soybeans (20%) (Lark, Salmon, and Gibbs 2015). Mladenhoff et al. (2016) found that most previously open land converted to crop production between 2008 and 2013 in the Great Lakes region was planted to corn (Mladenoff et al. 2016), with large areas converted to soybeans and other crops as well. For newly re-cultivated cropland exiting the Conservation Reserve Program, researchers found that in the Midwest corn and soybeans were planted 34% and 40% of the time, respectively (Morefield et al. 2016). Collectively, the findings that cropland area has recently expanded and that corn was frequently planted on this land provide a clear mechanism for potential influence of the RFS on land use change, which is detailed in the following section.

4 RFS CONTRIBUTION TO CHANGE

The RFS affects land conversion through two key pathways. Broadly, the RFS can induce corn prices to rise nationally, thereby spurring increased planting of corn. Locally, the presence of an ethanol refinery can also influence planting decisions by guaranteeing a local market or increasing local demand and therefore providing an incentive to nearby farmers to plant more corn.

4.1 RFS IMPACTS ON NATIONWIDE COMMODITY PRICES AND ACREAGE

An economic analysis that isolated the role of the RFS from other crop price drivers like weather and global markets recently determined that corn prices were on average 30% higher each year, from 2006 to 2014, than they would have been without the RFS, with a 90% confidence interval of a price increase of 13-54% (Carter, Rausser, and Smith 2016). The study also identified a permanent increase in overall demand from the updated 2007 version of the RFS of roughly 5.5 billion gallons of ethanol, or 1.3 billion bushels of corn, which caused a 31% increase in its long-run (persistent) price. This estimate is scalable, such that future increases in corn demand are expected to increase prices proportionally (Carter, Rausser, and Smith 2016).

Earlier economic studies found similar price impacts. For example, a 2013 analysis that used calorie-weighted indices of prices estimated the effect of the RFS on food prices, quantities, and consumers. It found that their consumer food price index was 20-30% higher than it would have been without ethanol production, depending on the amount and quality of byproduct (i.e. distiller's grains) used for animal feed (Roberts and Schlenker 2013).

A review of 29 studies published between 2007 and 2014 found that corn prices rose on average three to eight percent per billion gallon increase in ethanol mandate (Condon, Klemick, and Wolverton 2015). Estimates from various scenarios suggested that the RFS could raise corn prices from less than one percent to over 80% in certain conditions. They further estimated that moving forward, each additional billion gallon expansion in corn ethanol mandate as of 2015 would cause an additional 3-4% increase in corn prices (Condon, Klemick, and Wolverton 2015). Overall, the available economic studies are in strong agreement that the RFS mandates have increased national corn prices.

Increased prices send signals to farmers to increase acreage planted to a given crop. Barr et al. (2011) estimated multiple acreage elasticities for the U.S. in attempt to quantify this short-term extensive response of cropland area to price. By taking the average of expected returns with respect to expected price for 2007 to 2009 for actual acreages and returns compared to baseline predictions, the authors found a cropland acreage response elasticity of 0.029. That is, for every one percent increase in crop price, there was an expected 0.029 percent increase in U.S. cultivated area. Other studies have found a similar response of noncropland acreage to price and have made estimates at the regional level. For example, Langpap and Wu (2011) suggest a 0.059 response elasticity within the corn belt region (Langpap and Wu 2011).

While these response values are relatively inelastic--meaning proportionally small changes in acreage in response to changes in price--the overall impact and change in area becomes substantial at the national scale. For example, using the reported 30% increase in price due to the RFS (Carter, Rausser, and Smith 2016), the 0.029 acreage response elasticity (Barr et al. 2011), and a base U.S. cropland area of 236 million acres in 2007 (Barr et al. 2011), it can be estimated that the RFS induced roughly 2 million acres of cropland expansion via its impact on national corn prices.

4.2 LOCAL IMPACTS OF ETHANOL REFINERIES ON CORN ACREAGE AND LAND CONVERSION

The construction and operation of ethanol refineries has also been observed to directly stimulate corn production at the local level. This interaction between ethanol refinery location and corn production is bidirectional. Availability and proximity to feedstock is the key determinant of refinery siting, since corn costs represent 50-70% of all ethanol production costs (Lambert et al. 2008). However, the placement of a refinery also increases local demand, which induces increases in local corn prices and planted acreage (Fatal and Thurman 2014). A study of new ethanol production facilities built between 2002 and 2008 found that every million gallons of new ethanol capacity in a county was estimated to trigger an additional 5.21 acres of corn in that county, and this effect was frequently compounded by many refineries and felt across hundreds of counties (Fatal and Thurman 2014). Thus, the typical refinery increased corn planting in its county by over 500 acres and increased planted acreage in surrounding counties up to nearly 300 miles away.

A separate study by authors at the USDA Economic Research Service (Motamed, McPhail, and Williams 2016) estimated corn and total agricultural acreage response to local refining capacity and found significant effects. From 2006 to 2010, local response elasticities for corn acreage and total agricultural area ranged from 1 to 1.7, that is, for every one percent increase in ethanol refining capacity within a 10 x 10 km neighborhood, there was an equal or larger percentage increase in both corn and total agricultural land cultivated in that neighborhood. Furthermore, in every year the response of total agricultural acreage was larger than that of corn acreage. This implies that ethanol refining influenced land use *extensification*, that is, it required conversion of new land to crop production, more than *intensification,* where other crops were switched to corn. The observed effects were greatest in locations that had low acreage of existing corn and total agriculture, which the authors suggest partially supports the hypothesis that ethanol production spurred cultivation in areas with previously unfarmed and low-quality land. Local responses were strongest within a 100 km radius of ethanol refineries, but remained positive and significant up to 200 km away (Motamed, McPhail, and Williams 2016).

Ethanol refinery location is also strongly correlated with rates of grassland conversion to corn and soy production. Analysis of conversion of all land in the U.S. from 2008 to 2012 has shown that the percentage of suitable land converted to crop production increases linearly with proximity to an ethanol refinery (Appendix Figure 4-1a). Within 100 miles, corn and soy are planted on well over half of newly converted croplands, and the fraction of new cropland planted to these crops increases with proximity

(Appendix Figure 4-2). Beyond 100 miles from a refinery, the fraction of new corn or soy crops drops below 20%. In addition, existing cropland is less likely to be abandoned or restored to grassland if it is located in close proximity to a refinery (Wright et al. 2017) (Appendix Figure 4-1).

These studies collectively provide evidence that the RFS has caused a change in both the use and conversion of land in the U.S. through their observations of nationwide price impacts and aggregate land conversion response, observed increases in local corn and cropland area, and the spatial concentration of land conversion surrounding ethanol refineries.

4.3 Indirect Land Use Change

The RFS may also influence land conversion outside the U.S. through indirect land use change (ILUC). ILUC occurs when existing crops diverted for use as biofuel feedstock in one location are replaced by expanded crop production elsewhere. This framework is commonly used to discuss connections that cross multiple regions or nations. For example, if corn for ethanol production replaces soybeans on existing cropland in the U.S., it may induce an increase in soybean prices on the global market and, in turn, lead to expansion of soybean cultivation in the Brazilian Amazon (Searchinger et al. 2008; Keeney and Hertel 2009). Most research on ILUC effects of the RFS focus on international land conversion and therefore are not reviewed here. However, the same market-mediated mechanisms of ILUC can occur within a single region or nation and thus may contribute to the observed domestic land use responses discussed earlier.

5 ENVIRONMENTAL IMPACTS BEYOND LAND USE CHANGE

The RFS's influence on land use has likely contributed to certain adverse environmental outcomes. Many of these outcomes stem from increased cultivation of corn but could also arise from the expansion of other feedstock crops, such as soybeans for biodiesel. Issues of concern include impairment of water quality and use, emission of greenhouse gases, loss of biodiversity and habitat, and potential risks to endangered species. There may also be air quality impacts and other effects associated with the refining process, transportation of feedstocks, or the combusion of end products, but these are not reviewed here. The following sections summarize potential environmental outcomes of the RFS as manifested specifically through land use change.

5.1 WATER QUALITY

Increased corn production can lead to water quality concerns about nutrient pollution and runoff, pesticide contamination and exposure, and contamination of groundwater and potable wells.

Agricultural nutrient pollution of waterways is driven primarily by the application of synthetic fertilizers and animal manure during crop production (U.S. EPA 2017a). These inputs contain high levels of nitrogen and phosphorus, which affect water quality when the nutrients are routed to waterways through surface erosion and runoff or are leached into groundwater. Excessive loading of these nutrients into waterways promotes the growth of plants and algae, a process referred to as eutrophication. As these organisms die their decomposition consumes oxygen and depletes the available dissolved oxygen in the body of water. If oxygen levels are sufficiently low (less than 2 mg/l dissolved oxygen), conditions are considered hypoxic (Smith et al. 2017). Eutrophication can also contribute to increases in algal toxin levels and the frequency of harmful algal bloom events (U.S. EPA 2017a; Carpenter et al. 1998).

Oxygen depletion and algal toxins can each lead to fish kills and thus decrease commercial and sport fishing, biodiversity, and recreational values of waterways (Dodds et al. 2009). Declines in water clarity, which arise from increased algal growth or sedimentation from eroded soils, also tend to negatively affect these aquatic uses and value. Algal toxins further pose risks to both human and livestock health (U.S. EPA 2017a).

The connection between corn and these impacts on water quality is clear. Corn has the highest fertilizer application rates of any feedstock crop (U.S. EPA 2011) and approximately one-fourth of all nutrients applied to corn are lost to the environment. In the Mississippi River Basin — the enormous watershed that encompasses the majority of U.S. corn and ethanol production — an estimated 16% of all nitrogen applied to corn and soybeans ends up in its waterways (Alexander et al. 2008). Several studies have also reported specifically on the link between increased biofuel crop production and water quality deterioration from nutrient pollution (Welch et al. 2010; Committee on Economic and Environmental Impacts of Increasing Biofuels Production; National Research Council 2011).

The state of U.S. waterways in regards to nutrient pollution is dire. A national assessment found that median concentrations of total nitrogen and phosphorus in agricultural streams are about six times greater than background levels (USGS Dubrovosky 2010). Findings also indicated that concentrations in streams frequently were two to 10 times greater than regional nutrient criteria recommended by the EPA to protect aquatic life. A 2009 study found that the highest levels of stream eutrophication occurred in the heavily cultivated Corn Belt and Great Plains regions, where 100% of the streams sampled contained nutrient levels above their reference state (Dodds et al. 2009).

In collaboration with states, territories and tribes, the EPA also identifies waters that are impaired or in danger of becoming impaired (threatened). These waterways are reported under Section 303(d) of the Clean Water Act and include areas that do not meet water quality standards established by their state. For each body of water on the list, the state identifies the pollutant causing the impairment. The data show that a number of 303(d) waterways are indeed impaired due to nutrient pollution and that many occur in heavily cultivated areas. Appendix Figures 5-1 to 5-6 provide mapped examples of select nutrient-impaired waterways specifically located in areas with high levels of recent conversion of land to corn and soy production and often in close proximity to ethanol refineries.

At the mouth of the Mississippi River Basin, a major regional hypoxic zone forms seasonally in the northern Gulf of Mexico. The Gulf Hypoxic zone, or 'dead zone,' is caused by the interaction of environmental conditions, water stratification, and excess nutrient pollution from the Mississippi River system (U.S. EPA 2017b). It is the largest dead zone in U.S. coastal waters and one of the largest globally (Diaz and Rosenberg 2008). Despite multi-organizational efforts to reduce the Gulf hypoxic zone, the 2017 dead zone was the largest ever recorded due to high delivery of nutrients from the Mississippi River (National Oceanic and Atmospheric Administration 2017).

Exposure to hypoxia can cause severe health problems for aquatic life including reduced growth and reproduction. Under hypoxic conditions, most fish and mammals are unable to survive and must leave the region. Less mobile animals like young fish, seafloor dwellers, and mussels or crabs frequently die (U.S. EPA 2017b). The loss of oxygen can also destroy fish habitat, decrease reproductive fitness, and reduce the size or value of commercially important species like shrimp and crab (U.S. EPA 2017b; National Oceanic and Atmospheric Administration 2017).

Corn and soybean cultivation is the source of the greatest contribution of nitrogen loading to the Gulf of Mexico, and provides approximately half the total loading (Alexander et al. 2008; Mississippi River/Gulf of Mexico Watershed Nutrient Task Force 2015). Donner and Kucharik (2008) estimated that the increase in corn ethanol production specifically related to RFS2 would increase the annual average flux of dissolved inorganic nitrogen exported by the Mississippi and Atchafalaya Rivers to the Gulf of Mexico by 10–34% (Donner and Kucharik 2008). Hendricks et al. (2014) used observed increases in crop prices (e.g. see section 4) to estimate the specific role of increased continuous corn (i.e. intensification) in Iowa, Illinois, and Indiana alone. They calculated that for each additional billion gallons of corn ethanol produced under the RFS, the size of the Gulf of Mexico hypoxic zone would grow by approximately 33 square miles.

Nutrient pollution and hypoxia from agricultural production and expansion also brings about economic consequences. Conservatively, the estimated costs of the economic impacts of U.S. freshwater eutrophication is approximately $2.2 billion per year (Dodds et al. 2009). These losses result from lakefront property value decline ($0.3 – 2.8 billion per year), recreational use loss ($0.37 – 1.16 billion per year), recovery of threatened and endangered species ($44 million), and drinking water treatment and purchase ($813 million). Recent research has also demonstrated a causal effect of hypoxia on shrimp markets, showing for the first time statistically significant economic consequences of nutrient pollution in the Gulf region (Smith et al. 2017).

Working to mitigate nutrient pollution once it has been generated can also be costly. A study published by the National Academy of Sciences indicates that agricultural conservation investments targeted at the most cost-effective locations of mitigation to reduce nutrients exported by fields would require a combined federal, state, local and private investment of $2.7 billion per year to reduce the size of the hypoxic zone (Rabotyagov et al. 2014). Modifying the RFS to reduce crop intensification and extensification could alleviate pollution generation and the associate impacts and costs of mitigation. Alternatively, increased corn production under the RFS is likely to lead to greater costs of pollution due to control and mitigation expenses as well as lost economic revenue (U.S. EPA 2011; Committee on Economic and Environmental Impacts of Increasing Biofuels Production; National Research Council 2011).

5.2 DRINKING WATER CONTAMINATION

Both the expansion of corn area and its intensification through increased fertilizer application or continuous monoculture practices can also affect drinking water quality, particularly through nitrate contamination. When nitrogen on crop fields is not taken up by plants or immobilized in the soil, the excess can leach out and contaminate groundwater. The EPA specifically reports that increased fertilizer application associated with expanded corn production may worsen nitrate contamination of drinking wells and water supplies (U.S. EPA 2011). Nitrate contamination can cause severe health problems in humans such as reproductive and developmental effects, increased risk of certain cancers, and infant methemoglobinemia or blue baby syndrome (Bouchard et al. 1992; Ward et al. 2005; Weyer et al. 2001). To protect public health, the EPA sets a maximum nitrate-nitrogen contaminant level of 10 parts per million (ppm). Other sources, such as the National Cancer Institute, recommend a lower threshold of 5 ppm nitrate-nitrogen.

To manage increases in water nitrate contamination, municipalities and utilities in agriculturally intensive regions have frequently had to augment their treatment. For example, in Minnesota between 2008 and 2014, the number of public water supply systems that required nitrate treatment increased from six to eight and the number of people directly served by systems actively treating for nitrate rose from 15,000 to 50,000 (Minnesota Department of Health 2015). More than 60 Iowa cities and towns have battled nitrate levels over 5 ppm in their drinking water over the past five years ("Database: High Nitrate Level Incidents in Iowa | DesMoinesRegister.Com" n.d.). In certain cases, municipal water treatment plants have sued over nitrate pollution, such as when Des Moines, Iowa, sought to recover damages from counties located upstream in their agricultural watershed after spending $1.5 million in 2015 to remove nitrates from drinking water (Cullen 2016).

Private water wells are also at risk of nitrate contamination from increased production of corn and other crops. A USGS study of nitrate in private wells across the northern U.S. found approximately 5% of them exceded 10 ppm of nitrates (Warner and Arnold 2010). A number of studies throughout Minnesota revealed similar levels of nitrate contamination, from 4.6% of wells in the Central Sand Plains to 14.6% in the southeast Karst region (Minnesota Pollution Control Agency 2016). A nationwide assessment by the USGS found that in agricultural areas the 10 ppm maximum contaminant level was exceeded in more than 20 percent of shallow domestic wells (those less than 100 feet below the water table).

Keeler and Polasky (2014) modeled the specific impact of grassland converted to corn production in southeastern Minnesota. They found that the land conversion from 2007 to 2012 was expected to increase the number of private wells exceeding the 10ppm threshold by 45% (from 888 to 1292 wells)(Keeler and Polasky 2014). Costs per contaminated private well were estimated to range from $1,790 to $16,725, with total costs estimated at $1.4 million to $4.8 million to treat all wells that exceeded 10 ppm due to land use change in the 11 county study region. Economic costs associated with groundwater nitrate contamination include remediation actions to replace contaminated wells, installation of filtration or treatment systems, or purchase of bottled water.

More broadly, a recent study by researchers at the EPA and elsewhere has shown that increased corn production between 2002 and 2022 is projected to cause the total nationwide area vulnerable to groundwater nitrate levels above 5ppm to increase by 56% to 79%, depending on the scenario of biofuel production and demand (Garcia et al. 2017). Looking at nationwide expenses, a study by the USDA Economic Research Service estimated that the cost to all public and private sources of removing nitrate from drinking water is over $4.8 billion per year, with the share specifically attributed to agriculture costing about $1.7 billion (Ribaudo et al. 2011). Given the role of the RFS in land use change and its impacts on groundwater quality, it is likely that the RFS has exacerbated existing nitrate contamination of drinking water, a conclusion supported by previous EPA reviews (U.S. EPA 2011).

Other chemicals, including pesticides, may also impair water quality. Studies of surface waters in agricultural regions have found complex mixtures of pesticides in wetlands and in the tissues of frogs living there (Smalling et al. 2015). While pesticides are widespread in surface waters across agriculturally intense regions, a 2017 study reported for the first time the presence of three neonicoinoid insecticides in finished drinking water and their persistence during conventional water treatment (Klarich et al. 2017). Given the prevelence of agriculturally generated contamination and new findings surrounding potential exposure risks, an updated review of the non-nutrient water quality impacts associated with expanded biofuel feedstock production may be warranted.

5.3 WATER USE

The RFS influences water use and availability via consumption during the biofuel production process at refineries as well as through the growth of corn and other feedstocks.

Corn ethanol production facilities use approximately 2.5 – 3 gallons of water per gallon of ethanol produced (Hoekman, Broch, and Liu 2017, 1). For a typical corn ethanol refinery with production capacity of 100 million gallons per year, this is estimated to consume as much water as a community of 5000 people (Hoekman, Broch, and Liu 2017; Service 2009). While these requirements are modest, they could strain water resources if located in a region of limited supply, such as the semi-arid Great Plains.

The water requirements of corn feedstock production are highly dependent upon location and whether the crop is irrigated or rainfed. On average, the current water use intensity of corn ethanol production is over 100 gallons of water per gallon of corn ethanol produced on a volume-weighted basis, which greatly exceeds the 5 gal/gal efficiency of gasoline (Hoekman, Broch, and Liu 2017). As of 2009, approximately 70% of the corn used to produce ethanol was estimated to be from regions with water requirements of 10-17 gal/gal. However, 19% of the corn was estimated to be grown in regions high in irrigation and water use, resulting in ethanol water intensities of over 300 gal/gal. Many studies confirm the substantial water footprint of corn production, leading ethanol to have a significantly higher per-volume (and per-mile) water intensity than other fuels (Committee on Economic and Environmental Impacts of Increasing Biofuels Production; National Research Council 2011; Hoekman, Broch, and Liu 2017). When paired with models of corn demand under the RFS, these studies predict substantial nationwide water consumption. For example, Cai et al (2013) estimate a 1.95 – 2.81 trillion gallon increase in national water consumption between 2005 and 2022 attributable to clean vehicle deployment, with 65% to 80% of this due to increased corn ethanol use.

Geographically, these water use impacts are expected to have greatest influence in locations of intensive corn production, especially where it is irrigated. Thus, water consumption for corn-based ethanol production is expected to be greatest in areas like Nebraska and Kansas, where upwards of half of all corn production is irrigated and ethanol refineries exert additional water stresses (Brown and Pervez 2014).

5.4 GREENHOUSE GAS EMISSIONS

Increased biofuel production, corn cultivation, and associated land use changes also affect greenhouse gas emissions. The study of the net GHG benefits of biofuel production and the RFS has been a key focus of many environmental assessments, including the EPA's Regulatory Impact Analysis (U.S. EPA 2010). These studies have investigated the full life cycle emissions of biofuels from "cradle to grave" or "well to wheels," and include evaluation of the impacts of feedstock cultivation, fuel production, distribution, and combustion. Some assessments have also included estimates of emissions from land use change, which are typically modeled using the economic effects of changes in biofuel and crop supply and demand.

Land use changes such as converting non-agricultural land to crop production typically involve clearing of standing vegetation and biomass as well as perturbation of the soil, which generates a net release of GHGs (Hoekman and Broch 2017). The carbon stored in vegetation is either released when above- and below-ground biomass is burned or decomposes, or released later if the vegetation is transformed into a product (e.g. fuel or furniture). Perturbation of the soil through plowing or cultivation generally increases microbial respiration and oxidation of stored carbon and results in a net release of GHGs to the atmosphere, except in rare cases where the previous land use caused soil organic matter to be substantially degraded, in which case conversion to cropland and its associated inputs can occasionally improve sequestration (Post and Kwon 2000; Lal and Bruce 1999). In general, conversion to crop production from grasslands — the most common source of new croplands — has been estimated to release between 68 and 134 Mg CO_2 per hectare (Fargione et al. 2008; Gelfand et al. 2011).

Given the emissions associated with conversion to crop production, total GHG emissions from domestic land use change following passage of the RFS are likely to be sizeable. For example, the emissions from the conversion of noncropland to corn and soy cultivation between 2008 and 2012 are estimated to range from 94 to 186 Tg CO_2e and may be closest to 131 Tg CO_2e, which is equivalent to a year's worth of CO_2 release from 34 coal-fired power plants or an additional 28 million cars on the road (Lark, Salmon, and Gibbs 2015). However, only part of this crop expansion may be directly attributable to the RFS, and substantial uncertainty exists in the magnitude of both land conversion and associated emissions. A rough estimate of the land-use associated emissions due to the RFS could be generated by applying the same emissions factors used above to the amount of estimated land conversion calculated in section 4.1. For example, the estimated two million acres of domestic land conversion attributable to the RFS would suggest 56 – 111 Tg CO_2e of associated emissions.

5.5 BIODIVERSITY AND HABITAT

The conversion of nonagricultural land to cropland to grow biofuel feedstocks often reduces biodiversity by simplifying the landscape and reducing the number of species it supports (Meehan, Hurlbert, and Gratton 2010; Fletcher et al. 2011). Grasslands were the most common land cover converted to crop production after implementation of the RFS, accounting for approximately 80% of the conversion across the U.S. from 2008 to 2012 (Lark, Salmon, and Gibbs 2015). Grasslands provide a number of benefits to society, including recreational use, forage for livestock, and water quality improvement services (Keeler et al. 2012; Blair, Nippert, and Briggs 2014; Glaser 2014). Their ability to mitigate floods and sequester carbon also make grasslands a key landscape element for combating climate change.

With respect to habitat quality, grasslands have higher carrying capacities for species and harbor significantly greater plant, microbial, and animal diversity than croplands (Werling et al. 2014). They also generate higher levels of nearly all vital agricultural ecosystem services, including pollination and pest suppression. Thus, people who farm close to those who are actively converting grassland to crop production could experience a reduction in agricultural productivity due to the loss of surrounding grasslands and their associated ecosystem services.

Types of grasslands recently converted to biofuel feedstock crops include areas that were actively managed and grazed, land enrolled in the Conservation Reserve Program, and unmanaged prairie and range. According to the USDA National Resources Conservation Service Inventory, approximately 50% of all land converted to cropland from 2007 to 2012 came from acreage enrolled in the Conservation Reserve Program (USDA 2015). Their analysis showed that the remaining land came primarily from areas previously used for pasture (41%, including both permanent and rotational pasture) and rangeland (4%). Other analyses, including one by the Renewable Fuels Association, also assert that a significant portion of the land converted for biofuel production after implementation of the RFS came from reductions in CRP land and pastureland (Cooper 2017).

While CRP land is eligible for renewable feedstock production under the EISA definitions, research has shown that the loss of CRP is directly tied to negative environmental outcomes. Impacts of CRP conversion include decreased pheasant population and recreational opportunities (Sullivan et al. 2004; Haroldson et al. 2006; ERRINGTON and GEWERTZ 2015), decreased bird diversity and prevalence (Fletcher et al. 2011; Ryan, Burger, and Kurzejeski 1998), and increased water pollution with risk of nitrogen contamination (Randall et al. 1997; Feather, Hellerstein, and Hansen 1999; Secchi et al. 2009).

Native grasslands and prairie, that is, locations that have never been cultivated, have also specifically been identified as having been converted to cropland in recent years (Wimberly et al. 2017; Lark 2017). Native grasslands are of especially high conservation value due to the rich mix of plant species and millenia of sequestered carbon stored in their soils. Furthermore, native grasslands provide habitat that is superior to restored or planted grasslands (Bakker and Higgins 2009) and supply critical food and nesting resources for grassland dependent wildlife like the Monarch butterfly and wild bees

(Moranz et al. 2012; Kwaiser and Hendrix 2008; Pleasants 2016). Given EISA and EPA's 2010 rulemaking on implementation, native grasslands should specifically qualify as nonagricultural lands and thus be ineligible for renewable feedstock production. However, the absence of a feedstock mapping and tracking system for enforcing EISA's land protections means that converted native locations can currently be used for renewable feedstock production without restriction, thus enabling the RFS to contribute to ongoing prairie loss.

Furthermore, the rate of grassland conversion to crop production has been shown to be significantly higher in close proximity to ethanol production refineries (Wright et al. 2017). This rate of conversion decreases linearly as the distance to refineries increases (Appendix Figure 5-7). In addition, the likelihood of cropland being restored or reverting into grassland decreases with proximity to ethanol refineries. Shrublands, forests, and wetland ecosystems have also been converted to crop production following passage of the RFS, and similar proximity effects are seen with these ecosystems — the closer they are to an ethanol refinery, the more likely they are to have been converted to cropland (Appendix Figure 5-8). All of these ecosystem types provide valuable habitat and typically improve biodiversity when located within agriculturally intense landscapes. Thus, their increased conversion to cropland is likely to lead to negative environmental outcomes for wildlife.

5.6 ENDANGERED SPECIES

The conversion of land for increased biofuel feedstock production may affect endangered and threatened species and the federally designated critical habitat upon which they rely. Section 7 of the Endangered Species Act (ESA) requires federal agencies to consult with the Fish and Wildlife Service or the National Marine Fisheries Service to ensure that the agency's actions are not likely to jeopardize the existence of any endangered or threatened species, or result in the destruction or adverse modification of critical habitat. Currently, there is no documentation of an endangered species consultation between the EPA and the relevant wildlife agencies nor evidence of other precautionary steps required under the ESA.

There is also a dearth of research in the scientific community to determine whether the RFS is likely to adversely affect listed species or their critical habitat. The land conversion and environmental impacts summarized in this report, however, imply a potential impact and thus advocate further review and consultation between EPA and the federal wildlife agencies.

To help species survive and recover, the ESA designates areas of critical habitat that are essential for reproduction, population stability, or distribution. Destruction or adverse modification of critical habitat could occur either through direct conversion of critical habitat or indirectly through conversion of nearby land. For example, conversion of land adjacent to critical habitat could decrease its functionality through landscape fragmentation, microclimate modification, encroachment, or other proximity effects, and thereby alter the physical or biological features that were the basis for critical habitat designation. Such alteration would qualify as adverse modification. Thus, any critical habitat located in agriculturally active areas may be affected by the RFS due to the expansion of corn production and the associated loss of grasslands and other ecosystems.

Critical habitat in locations of both substantial land conversion and close proximity to an ethanol refinery is likely at greatest risk, and should represent top priority areas for initial evaluation. Based on the location of recent land conversion, feedstock crop production, and ethanol refinery locations, possible species and locations of critical habitat at risk of impairment include the Piping Plover in North Dakota, the Whooping Crane in Kansas, and the Dakota Skipper in Minnesota and the Dakotas.

The RFS could also negatively affect a number of freshwater and marine species. Specifically, nutrient runoff, eutrophication, and hypoxia due to increased corn production and the associated decreases in water clarity and oxygen content could jeopardize the health of threatened and endangered aquatic species. As of 2007, according to the Fish and Wildlife Endangered Species database, 139 fish, 70 mussels, four crayfish, 23 amphibians, and one water dependent dragonfly had endangered or threatened status, and it is estimated that approximately 60 of these species are at least partially imperiled by eutrophication (Dodds et al. 2009). Species within the corn belt and other agriculturally intense regions and their watersheds may be at greatest risk of impairment from increased ethanol production and associated land use changes. Based on location of critical habitat in relation to recently expanded corn production and its estimated effects, potentially endangered and threatened aquatic species for further evaluation include a minnow, the Topeka Shiner, in southwest Minnesota and northwest Iowa, and the Purple Bankclimber, Fat Threeridge, and Oval Pigtoe mussels in southwest Georgia.

The link between the RFS, increased cropping intensification, and hypoxia in the Gulf of Mexico has also been well established (Hendricks et al. 2014; Donner and Kucharik 2008) (see section 5.1). The large seasonal dead zone in the Gulf may affect the critical habitat or migration and feeding ranges of current and pending listed species. Species that could potentially be at risk include the Gulf Sturgeon, Loggerhead Turtle, and Sperm Whale.

To date, little research has been performed regarding the potential impact of the Renewable Fuels Standard on threatened and endangered species. Given this lack of knowledge as well as the potential mechanisms of influence enumerated here, further review and evaluation of the possible impacts seems warranted.

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Appendix 3 to Declaration of Dr. Tyler Lark

Appendix 3: U.S. Land conversion following passage of RFS2.

Table 3-1: Summary of data on U.S. land conversion

Data Source	Time Period	Years	Net Cropland Expansion *(Mill. Ac.)*	Ave. Annual Net Expansion *(Mill. Ac./yr.)*
Census of Agriculture[1]	2007 – 2012	5	7.8	1.56
NASS Acreage Reports[2]	2008 – 2012	4	2.6	0.65
Cropland Data Layer-derived[3]	2008 – 2012	4	3.0	0.75
National Resources Inventory[4]	2007 – 2012	5	4.3	0.86
National Land Cover Database[5]	2006 – 2011	5	0.2	0.03

Notes:

1. Data from the sum of harvested + failed + fallow cropland between 2007 and 2012. See table 3-2.
2. Data from the official NASS June Acreage Reports, published and archived at http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1000
   Total area reported is "principle crops" (which includes 10 major crops' planted area plus harvested area of alfalfa and non-alfalfa hay) minus "non-alfalfa hay harvested area" in order to remove those areas which include mixed used grasslands and uncultivated land.
3. Data based on a time-series analysis of the USDA Cropland Data Layer by Lark et al. (2015). Crops include all row and closely planted crops, and horticultural/tree crops. Alfalfa was considered a crop. Non-alfalfa hay was considered non-crop, and thus not included in the reported area of change.
4. Data based change in cultivated cropland. The NRI cultivated cropland class comprises land in *row crops* or *close-grown crops* and also other cultivated cropland, for example, hayland or pastureland that is in a rotation with row or close-grown crops. Noncultivated cropland includes permanent *hayland* and *horticultural cropland*, and is not included in the reported area of cropland change.
5. Data based on changes to and from cultivated crops category (class 82). Alfalfa and non-alfalfa hay are not distinguished in the NLCD and are included in the pasture/hay category, and thus are not included in the reported area of cropland change.

Table 3-2: Data synthesized from the 2007 and 2012 USDA Census of Agriculture.

Category	**2007** *(acres)*	**2012** *(acres)*	**Δ 2007 to 2012**
Harvested	309,607,601	314,964,600	5,356,999
Failed	7,405,898	11,395,368	3,989,470
Fallow	15,671,507	14,145,567	-1,525,940
Idle	37,968,749	36,382,032	-1,586,717
Other Pasture*	35,771,154	12,802,847	-22,968,307

Combined Categories	**Δ 2007 to 2012**
Harvested + Failed	9,346,469
Harvested + Failed + Fallow	7,820,529
Harvested + Failed + Fallow + Idle	6,233,812
Harvested + Failed + Fallow + Idle + Other Pasture*	-2,680,154

Notes: The Census definition of "total cropland" includes that of other pastureland, which is defined as "other pasture and grazing land that could have been used for crops" but was not. Thus, combinations of Harvested, Failed, and Fallow land offer more specific and representative portrayals of total tilled or actively cultivated cropland area than the aggregate category of "total cropland".

Census of Agriculture Background:

The Census of Agriculture is USDA's flagship agricultural data product. Conducted by the National Agricultural Statistics Service (NASS) every 5 years, the Census provides a plethora of information about both crop and animal agriculture, the land it occupies, and overall trends in the industry ("USDA - NASS, Census of Agriculture," n.d.). It is particularly valuable for its comprehensiveness, as every farm and producer in the U.S. is included (or accounted for via correction estimates). All results are aggregated to and released at the county level, although certain county/state data points are withheld from the public record if there is a risk of respondent confidentiality being breached (for example, due to only one farmer operating in a given county). Measures from the Census that are of greatest relevance for land use and grassland conservation include total pasture and grazing land area, total cropland area and its subsets—harvested, idle, failed, and fallow cropland areas—and cropland-pasture area, which represents farmers' interpretations of locations used for grazing that could have been used for crops without additional improvement (USDA NASS, 2009). Additional information is also collected and released through supplemental census studies on special topics such as organic production and irrigation practices.

Regarding accuracy, the Census of Agriculture is often considered the “gold standard” for land use data (Johnson, 2013; Laingen, 2015). In addition to a rigorous outreach campaign in attempt to capture responses from all producers, NASS also accounts for biases from undercoverage, nonresponses, and misclassifications using a number of corrective statistics. Nonetheless, errors still exist, and these are reported at the county, state, and national level for each data point measured. Although these errors are all reported, it should be noted that some are quite large, and in many cases, the amount of change between 5-year censuses for a given metric—e.g. total cropland—in a given county is less than the standard error of that measure, meaning that the change is insignificant and thus should be considered unreliable. The margins of error are often overlooked, however, even though they can limit the utility of the Census for understanding changes to cropland and grassland area. This has led some to suggest that while the Census remains the most comprehensive and detailed set of information on US farming, it is not the end-all (“Just How Trustworthy Are Agricultural Statistics?,” 2014), and thus there may be substantial value in considering the Census in within the context of other sources.

Table 3-3: Data synthesized from USDA NASS Acreage Reports for 2008 and 2012 for principle crops, other hay, and their difference.

Year	Principal Crops *(acres)*	Other Hay* *(acres)*	Principle Crops - Other Hay *(acres)*
2008	324,029,000	39,661,000	284,368,000
2012	325,825,000	38,842,000	286,983,000
Δ 2008 to 2012	1,796,000	(819,000)	2,615,000

*Other hay excludes Alfalfa and Alfalfa mixes

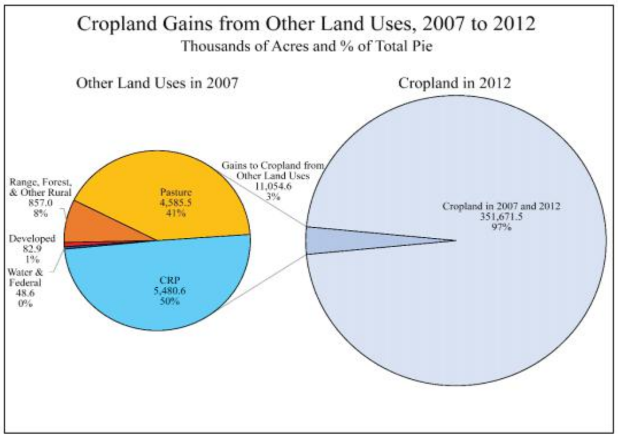
Notes: The NASS Survey and Acreage category of "Other Hay" closely corresponds to the CDL class of Non-alfalfa / Other Hay and includes harvested grasslands not typically tilled on an annual basis. The category of Principle crops includes changes in other hay. To facilitate comparison with other estimates such as those based on the CDL, the area of Other Hay can be subtracted from the total principals crops to align with the definition of cultivated cropland used by Lark et al (2015), the National Resources Inventory, and others.

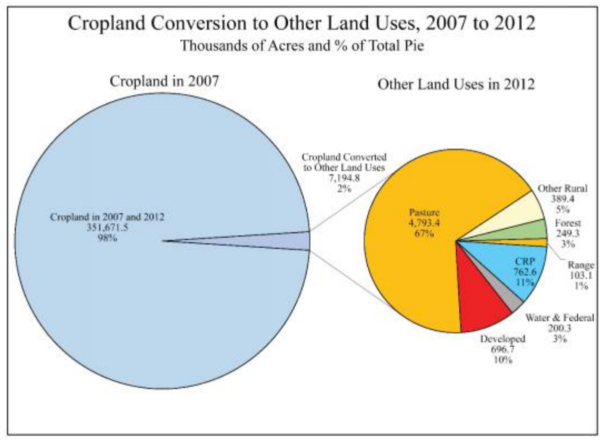
<u>NASS Survey Background:</u>

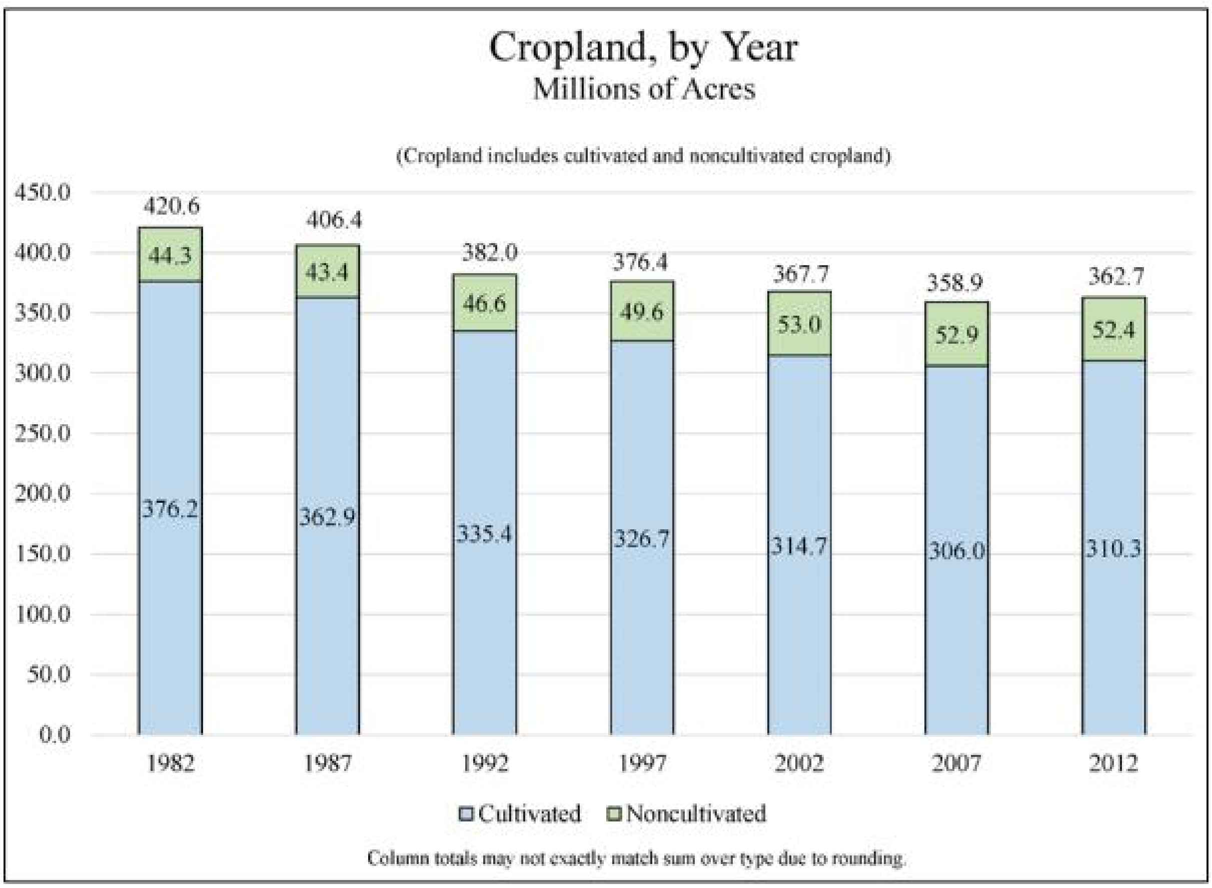
The other primary source of traditional agricultural statistics comes from annual NASS surveys. NASS's Agricultural Survey data, while often referenced as a collective dataset, represent not a single source but rather a series of surveys administered to agricultural producers throughout the year as well as data collected through direct observation and measurement by NASS field agents. NASS surveys include the June Area, the Objective Yield, and Crops/Stocks (sometimes referred to as the "agricultural survey") as well as around 100 others for specific industries and products, and together provide detailed estimates of crop acreage, yields and production ("USDA - National Agricultural Statistics Service," n.d.). The results of these surveys are summarized and released individually through reports such as Prospective Plantings, June Acreage, monthly Crop Production, and January Crop Production Summary. Collected data of most relevance to cropland expansion and grassland conversion are planted area and harvested area for principle field crops. While these totals do not fully capture cropland area--missing are actively tilled fallow land and less prominent crops--they can be highly valuable due to their annual frequency of reporting.

The accuracy of survey data is subject to two main types of error--sampling and non-sampling. Sampling errors are a result of NASS enumerators talking to or collecting data from a sampling of farmers, rather than the entire population (USDA NASS, n.d.). Because most of the NASS surveys use probability sampling, however, it is possible to estimate this error, and these figures are typically published in NASS survey-derived reports as a standard error or coefficient of variation. Non-sampling errors, on the other hand, represent all of the other issues that can affect an estimate, including respondent biases, misworded questions and inaccurate responses, and missed or inaccurately transcribed data. These types of error are difficult to quantify, and as a result are often just discussed during reporting of the NASS Survey data.

Figure 3-4: Data directly from the USDA National Resources Inventory for 2007-2012 (USDA 2015).







Source: 2012 National Resources Inventory Summary Report (USDA 2015). The NRI shows an increase in both cultivated and total cropland area between 2007 and 2012.

Table 3-5: Data directly from the USDA National Resources Inventory for 2007-2012 (USDA 2015).

Table 8 - Changes in land cover/use between 2007 and 2012
In thousands of acres, with margins of error

Land cover/use in 2007	Land cover/use in 2012								2007 total
	Cropland	CRP land	Pastureland	Rangeland	Forest land	Other rural land	Developed land	Water areas & Federal land	
Cropland	351,671.5 ±1,920.5	762.6 ±110.0	4,793.4 ±326.0	103.1 ±37.0	249.3 ±83.4	389.4 ±72.2	696.7 ±47.2	200.3 --	358,866.3 ±2,009.3
CRP land	5,480.6 ±289.8	23,277.1 ±344.1	3,097.8 ±330.9	249.7 ±55.8	319.2 ±58.9	26.5 ±18.8	11.8 ±15.0	1.3 --	32,464.0 --
Pastureland	4,585.5 ±330.3	180.6 ±77.4	112,059.9 ±1,390.8	142.6 ±50.0	1,858.8 ±221.6	272.0 ±61.6	561.5 ±56.8	83.2 --	119,744.1 ±1,468.5
Rangeland	485.8 ±180.5	1.7 ±2.6	199.5 ±142.7	404,854.9 ±3,427.9	390.7 ±147.1	452.6 ±182.6	554.5 ±63.3	291.2 --	407,230.9 ±3,447.5
Forest land	257.9 ±123.7	0.0 --	562.5 ±100.1	122.5 ±55.8	410,027.8 ±2,551.9	333.7 ±80.2	1,406.7 ±69.3	412.3 --	413,123.4 ±2,541.0
Other rural land	113.3 ±52.1	0.0 --	344.5 ±63.8	168.0 ±89.9	215.4 ±89.7	43,950.0 ±1,340.2	137.3 ±18.6	6.1 --	44,934.6 ±1,377.5
Developed land	82.9 ±12.5	0.0 --	48.0 ±10.1	22.0 ±12.5	161.7 ±11.4	22.6 ±8.6	110,738.6 ±1,240.0	5.0 --	111,080.8 ±1,238.1
Water areas & Federal land	48.6 --	0.0 --	32.4 --	114.1 --	114.3 --	1.7 --	5.4 --	456,382.0 --	456,698.5 --
2012 total	362,726.1 ±1,933.0	24,222.0 --	121,138.0 ±1,334.2	405,776.9 ±3,419.6	413,337.2 ±2,593.2	45,448.5 ±1,343.0	114,112.5 ±1,271.6	457,381.4 --	1,944,142.6 ±195.1
Net Change	3,859.8 ±670.3	-8,242.0 ±359.1	1,393.9 ±587.4	-1,454.0 ±394.1	213.8 ±403.6	513.9 ±304.0	3,031.7 ±133.4	682.9 ±31.7	0.0 --

Notes:
- Acreages for total Conservation Reserve Program (CRP) Land and Water areas and Federal land are established through geospatial processes and administrative records; therefore, statistical margins of error are not applicable and shown as a dashed line (--). CRP was not implemented until 1985.
- Cropland includes cultivated and non-cultivated cropland.
- When the estimate is 0.0, margins of error are not applicable and shown as a dashed line (--).
- Estimates in red = STOP, these estimates are not reliable. The margin of error is equal to or greater than the estimate so the confidence interval includes zero.

- 2007 land cover/use totals are listed in the right hand vertical column, titled 2007 total. 2012 land cover/use totals are listed in the bottom horizontal row, titled 2012 total. The number at the intersection of rows and columns with the same land cover/use designation represents acres that did not change from 2007 to 2012. Reading to the right or left of this number are the acres that were lost to another cover/use by 2012. Reading up or down from this number are the acres that were gained from another cover/use by 2012.

<u>NRCS National Resources Inventory Background:</u>

The Natural Resources Conservation Service's (NRCS) National Resources Inventory (NRI) is a statistically sampled land use dataset that surveys the country's non-federal lands, soils, and water-related resources (U.S. Department of Agriculture, 2013). The NRI currently provides a nationally consistent dataset spanning 30 years, with the latest 5-year update having been completed in 2012 and release last year (USDA, 2015), although the collection's history dates back to the original Soil Conservation Service's inventories of the 1930s and 40s. Rather than a comprehensive census of land, the NRI estimates state- and national-level trends based on statistical estimation from point observations. By tracking the same points on the landscape over time, however, it provides a valuable longitudinal view of the changing U.S. landscape.

The dataset was originally produced using field observation collected by staff, however more recent implementations mostly utilize aerial photo interpretation with some local verification via NRCS county field office records (USDA, 2015). Being based on a statistical sampling, the NRI has calculable margins of error, which are published with each rendition of the report. For relevant metrics such as stable cropland (351.7 M acres total), the margin of error is +-1.9 M Acres. As with other datasets, the margin of error for dynamic (change) classes are much wider. For example, cropland expansion 2007-2012 was measured to be 11 M Acres +-1.9 M Acres (~17% margin of error).

With respect to cropland expansion and grassland conservation, the dataset provides valuable independent data on the transformation of land between cultivated cropland, pastureland, and land enrolled in the Conservation Reserve Program (CRP). Because of this, it can be a useful dataset to calibrate land change models (Radeloff et al., 2011) or confirm changes identified through other means, such as analysis of the CDL. The drawbacks of the NRI include its lack of comprehensive spatial coverage (due to it being a point sampling) and lack of publicly available estimates at resolutions finer than the state level.

Table 3-6: Conversion data synthesized from the National Land Cover Database

Time period	Converted to Cropland *(acres)*	Converted away from cropland *(acres)*	Net cropland change *(acres)*
2006 – 2011	1,548,000	1,376,000	172,000

National Land Cover Database (NLCD) Background:

The National Land Cover Database is a U.S. nationwide land cover product produced by the Multi-Resolution Land Consortium, under the leadership of the US Geological Survery (USGS). Other partnering agencies include the EPA, NOAA, USFS, BLM, NASS, NPS, NASA, USFWS, and US Army Corps—mostly through the contribution of supplementary data or advisement on potential uses of the end product. The NLCD is produced consistently at 30-meter resolution, and maps land cover using 16 Anderson level II classifications (Homer et al., 2012). The NLCD is now produced on a 5-year cycle, with the most recent product available for the year 2011 (Homer et al., 2015). Previous years available include 2006, 2001, and 1992.

A unique aspect of the NLCD (particularly compared to the CDL) is its focus on land cover change (Jin et al., 2013). Thus, with recent product releases, the USGS has also included data layers of land cover change (e.g. 2006-2011). To achieve this, the NLCD implements a "linked" approach to mapping landcover, where each new product is dependent on the previous products' classification. The spectral changes from baseline are then measured and interpreted to generate the more recent year's classification. A benefit of this approach is that it is more suited to detecting changes and avoids many of the false positives and issues that annually-independent classifications often run into (Kline et al., 2013; Laingen, 2015; Reitsma et al., 2015; Wright and Wimberly, 2013). A drawback of the linked approach, however, is that errors can propagate throughout the time series, and even if these are identified by the producers or users, correction of problematic areas on the landscape require reclassification and reproduction of the entire time series (Danielson et al., 2016; Jin et al., 2013; Wickham et al., 2013).

The primary input of the NLCD is Landsat 5 Thematic Mapper satellite imagery, with ancillary data coming from the National Elevation Dataset (NED), USDA Natural Resources Conservation Service Soil Survey Geographic (SSURGO) database, National Wetlands Inventory (NWI), the CDL, and nighttime stable-light satellite imagery (NSLS) from the NOAA Defense Meteorological Satellite Program (DMSP) (Homer et al., 2015). Of particular note for dataset interdependence, the 2011 CDL was also used during post-classification to help in refinement of agricultural areas.

Accuracies for the static classes of the NLCD are generally high, with accuracies of the change product much lower (as is normal for landcover change products). Agricultural loss and gain between 2001 and 2006, for example, had users accuracies of just 39% and 27%, respectively, while the static agriculture class performed at a much higher 91% (Wickham et al., 2013). Compared to the CDL, the NLCD is generally considered less accurate in agricultural areas, but more accurate for non-agricultural classes (Johnson, 2013). Thus, the NLCD is used as a training input for CDL's non-ag locations, while the CDL is used as input to refine the NLCD's agricultural regions.

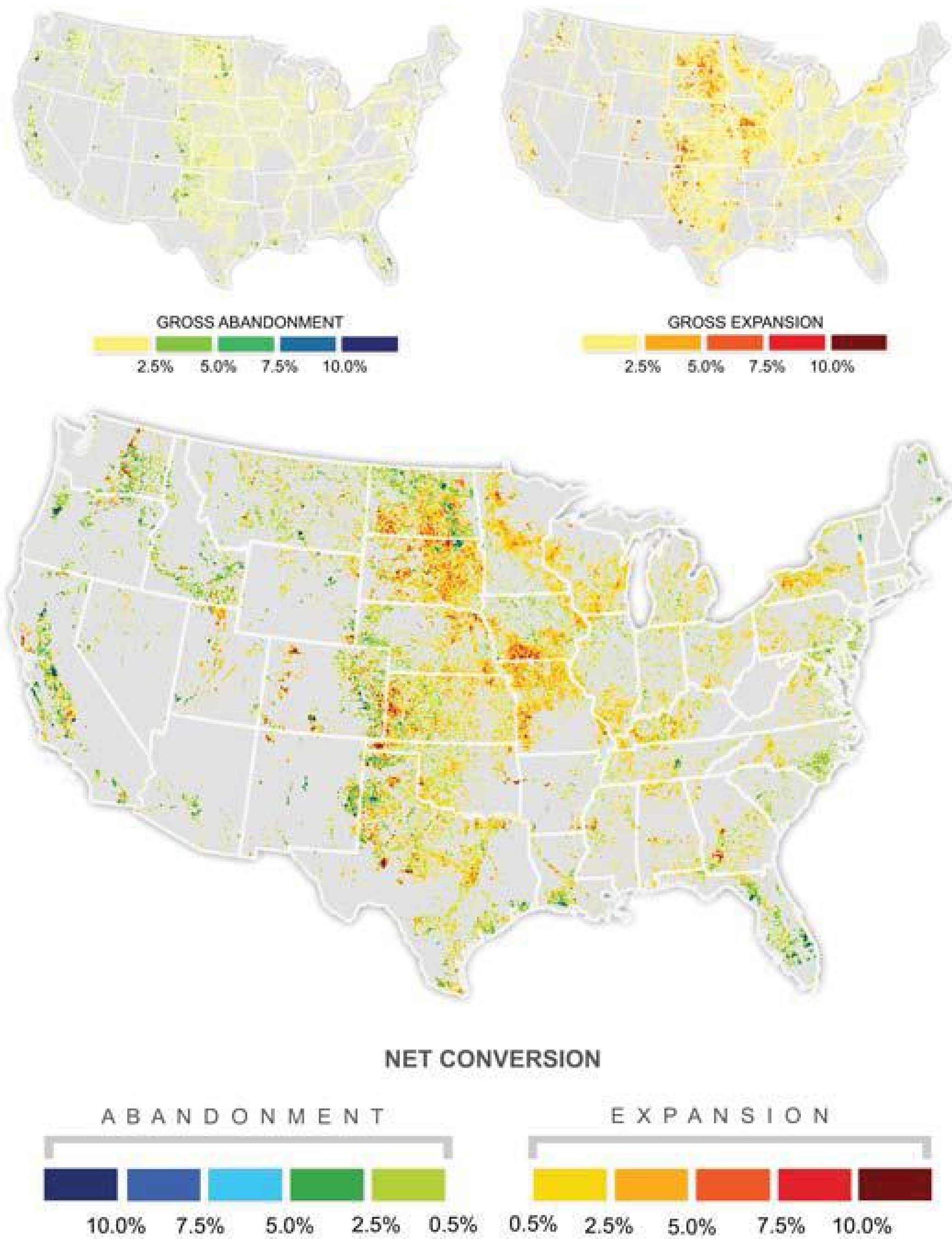


Figure 3-7: Maps of net and gross cropland conversion across the U.S. 2008-2012. The heterogeneous nature of cropland use and change can be masked by net and/or aggregate measures of total cropland area. Source: Lark et al (2015)

Appendix 4 to Declaration of Dr. Tyler Lark

Appendix 4: RFS contribution to change

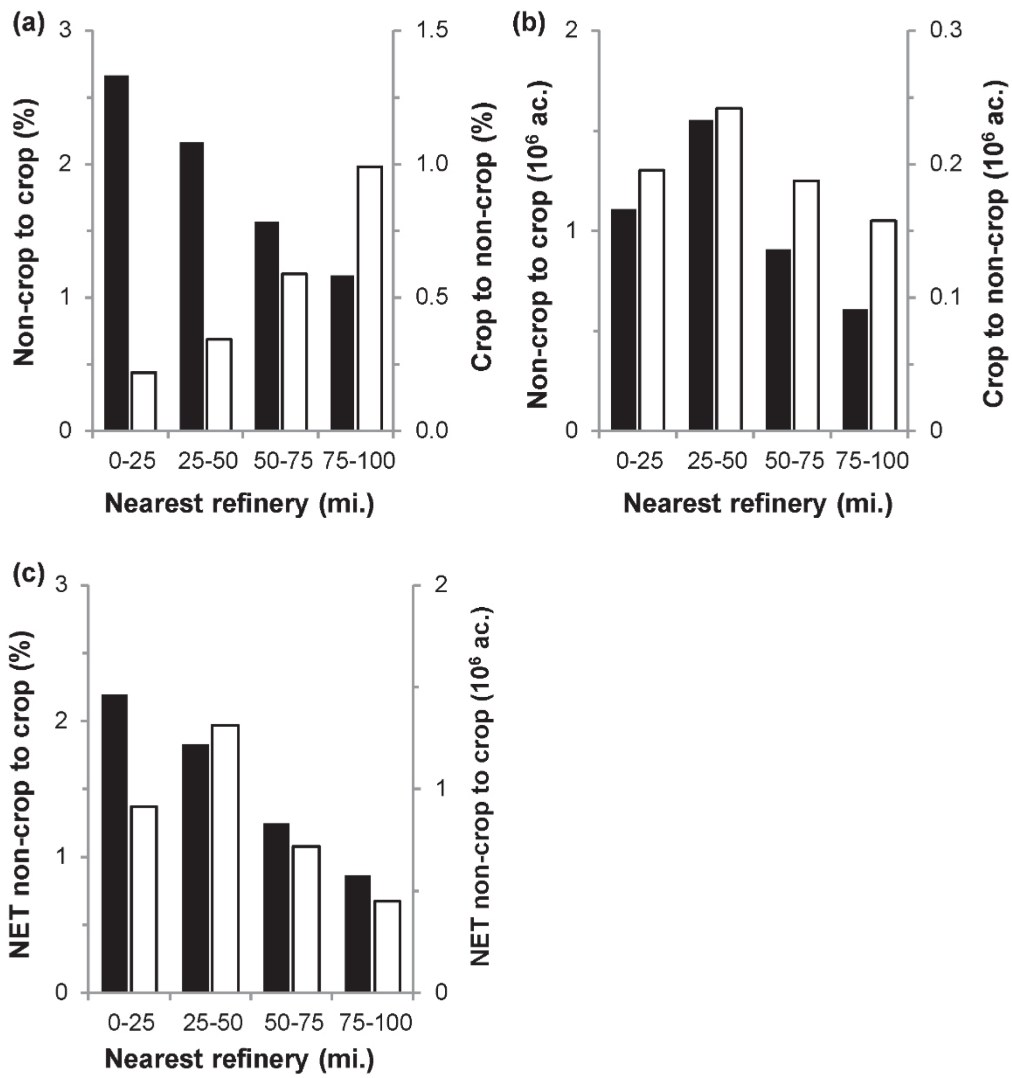


Figure 4-1: Data on location of land conversion in proximity to ethanol refineries, from Wright et al (2017). "Aggregate rates of change between arable non-cropland and cropland (2008–2012) plotted as a function of proximity to ethanol refineries. Distance intervals as in figure 1(c). (a) On the primary axis (black bars), relative conversion rates normalized by 2008 non-cropland area. On the secondary axis (white bars), relative rates of cropland reversion to non-cropland normalized by 2008 cropland area. (b) Gross conversion (primary axis, black bars) and reversion (secondary axis, white bars), both in 106 acres. (d) On the primary axis (black bars), net conversion (conversion minus reversion), normalized by 2008 non-cropland area. On secondary axis (white bars), net conversion in 106 acres." Figure and description from Wright et al. (2017).

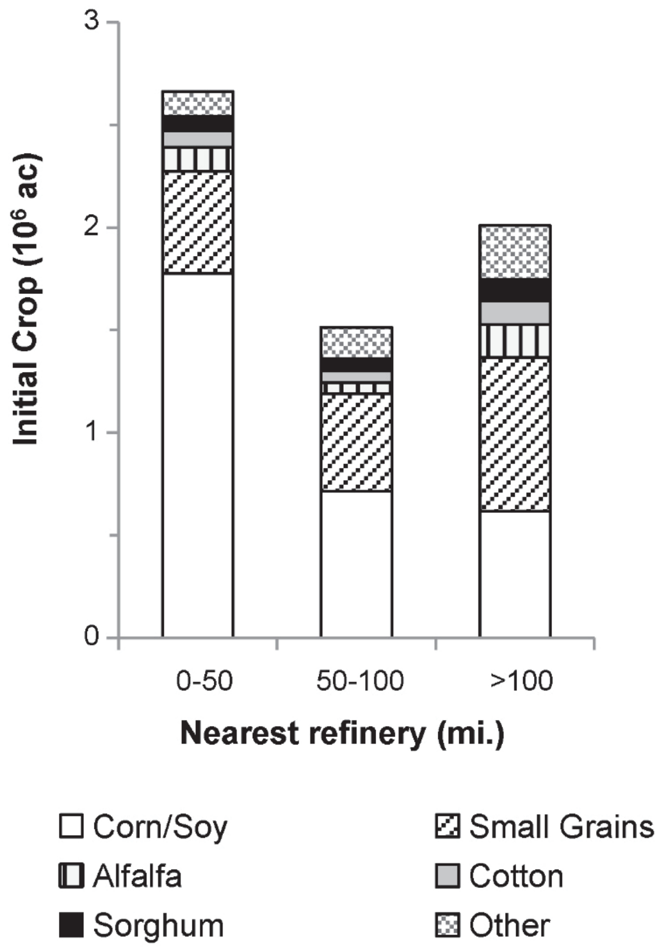


Figure 4-2: Initial crops following conversion of arable non-cropland to cropland as a function of proximity to ethanol refineries (in 10^6 acres). As the distance to the nearest ethanol refinery decreases, the frequency of corn and soy being planted on converted land increased. Figure and description from Wright et al. (2017).

Appendix 5 to Declaration of Dr. Tyler Lark

Appendix 5: Environmental Impacts

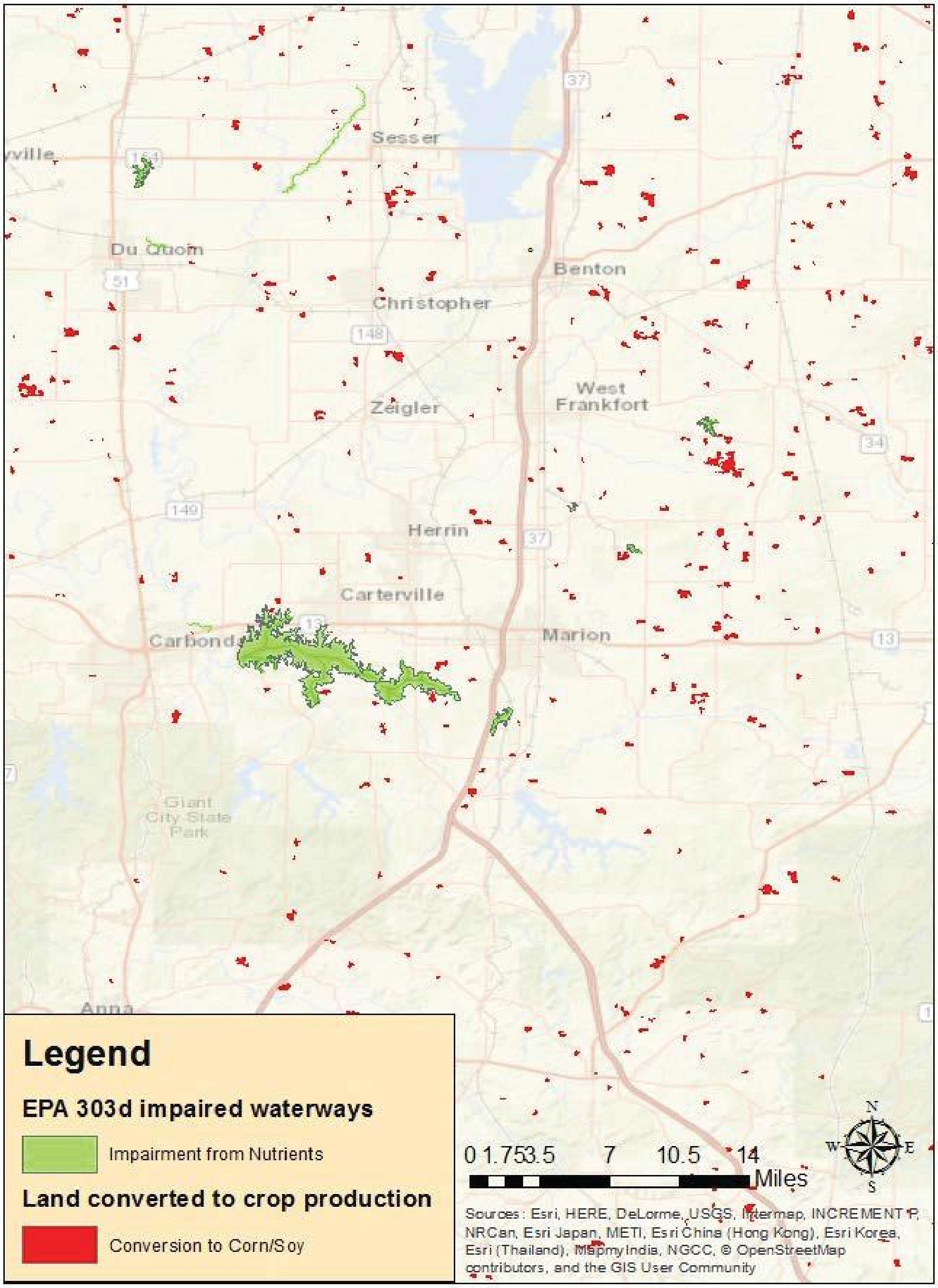
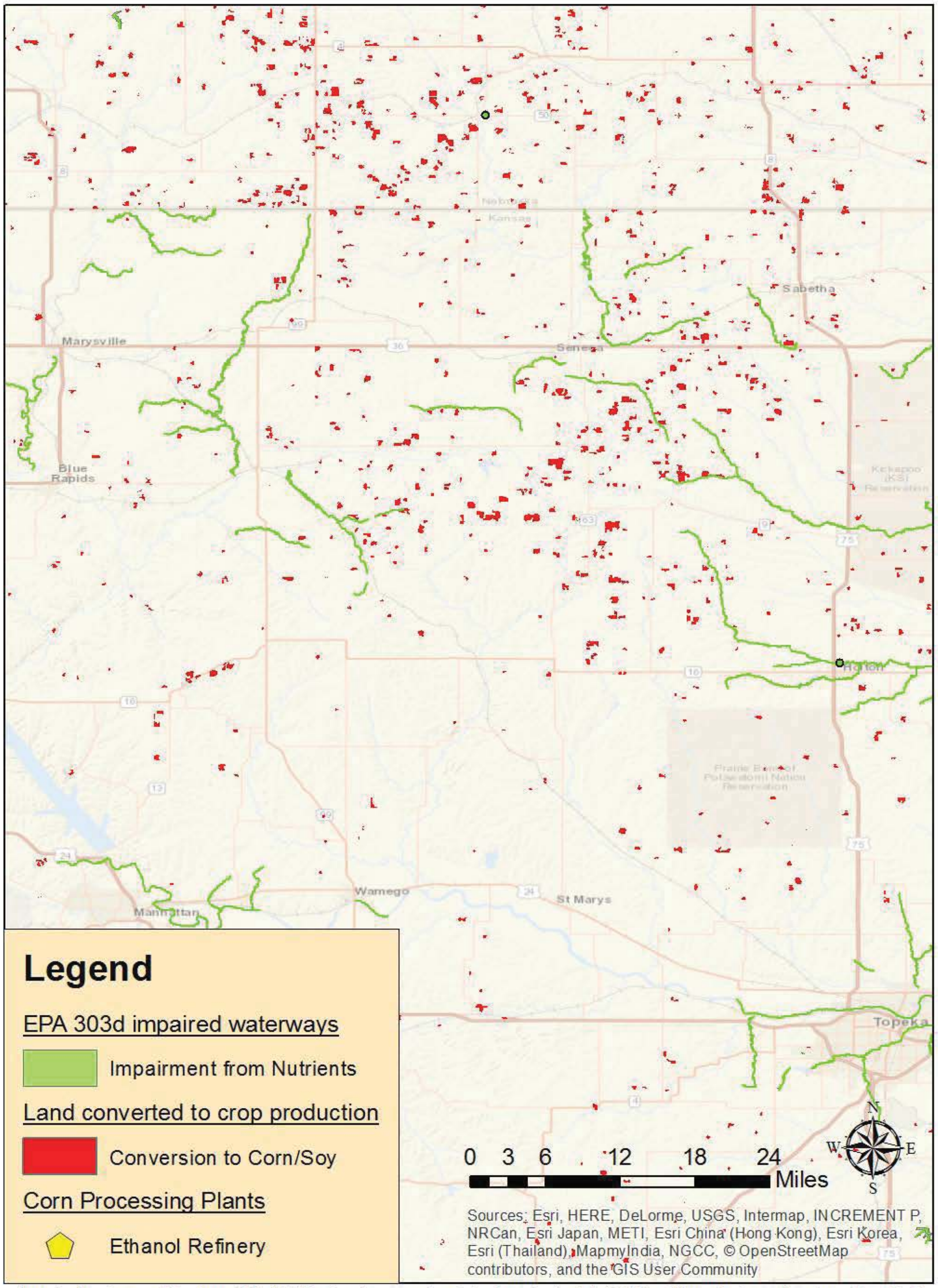
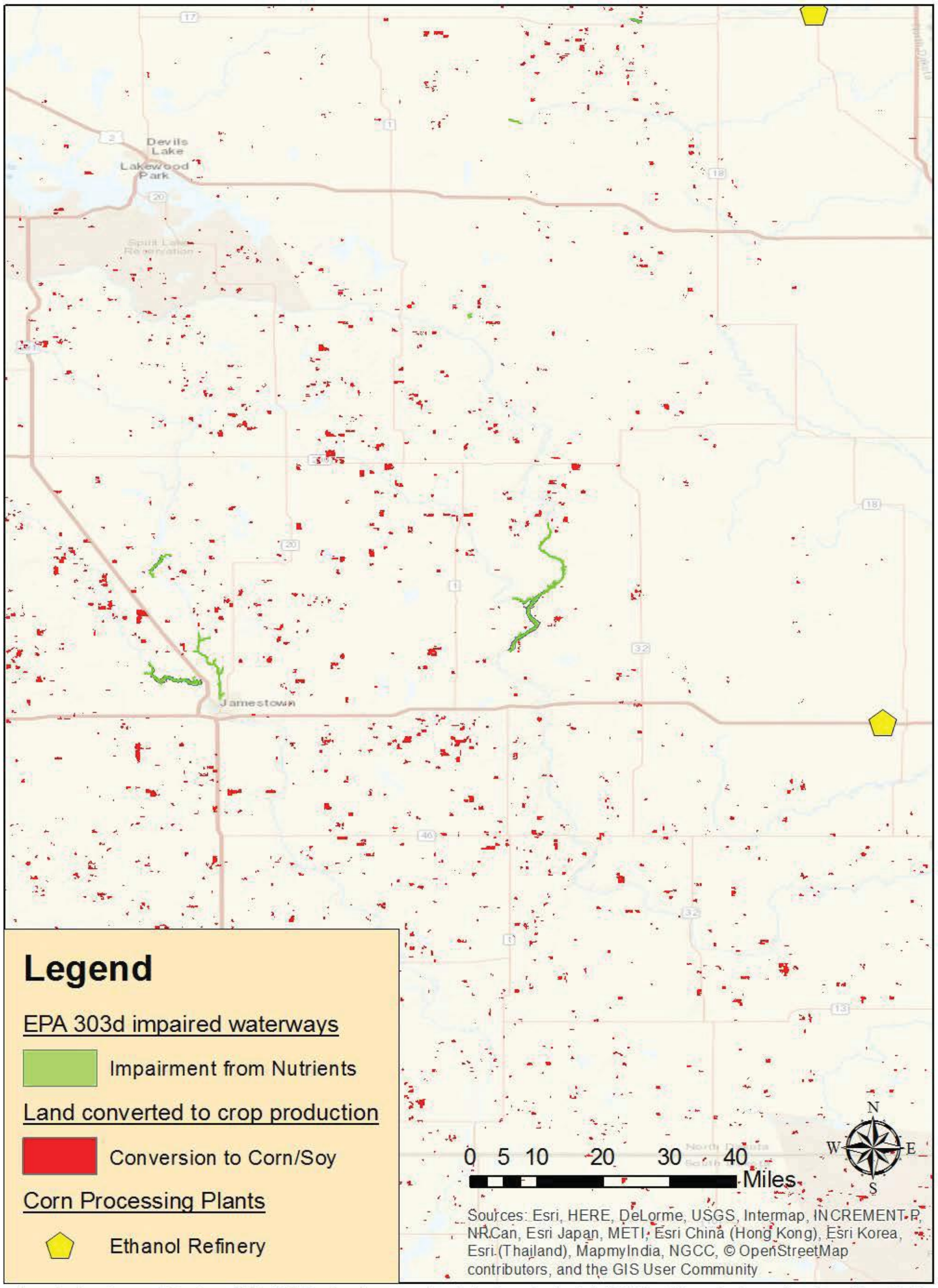


Figure 5-1: Map of 303(d) listed waterways that are impaired due to nutrient (nitrogen and phosphorus) pollution in Southern Illinois. Streams and waterbodies are highlighted in bright green; probable locations of recent conversion of non-cropland to corn or soybeans production are highlighted in red. Data from U.S. EPA and Lark et al (2015).



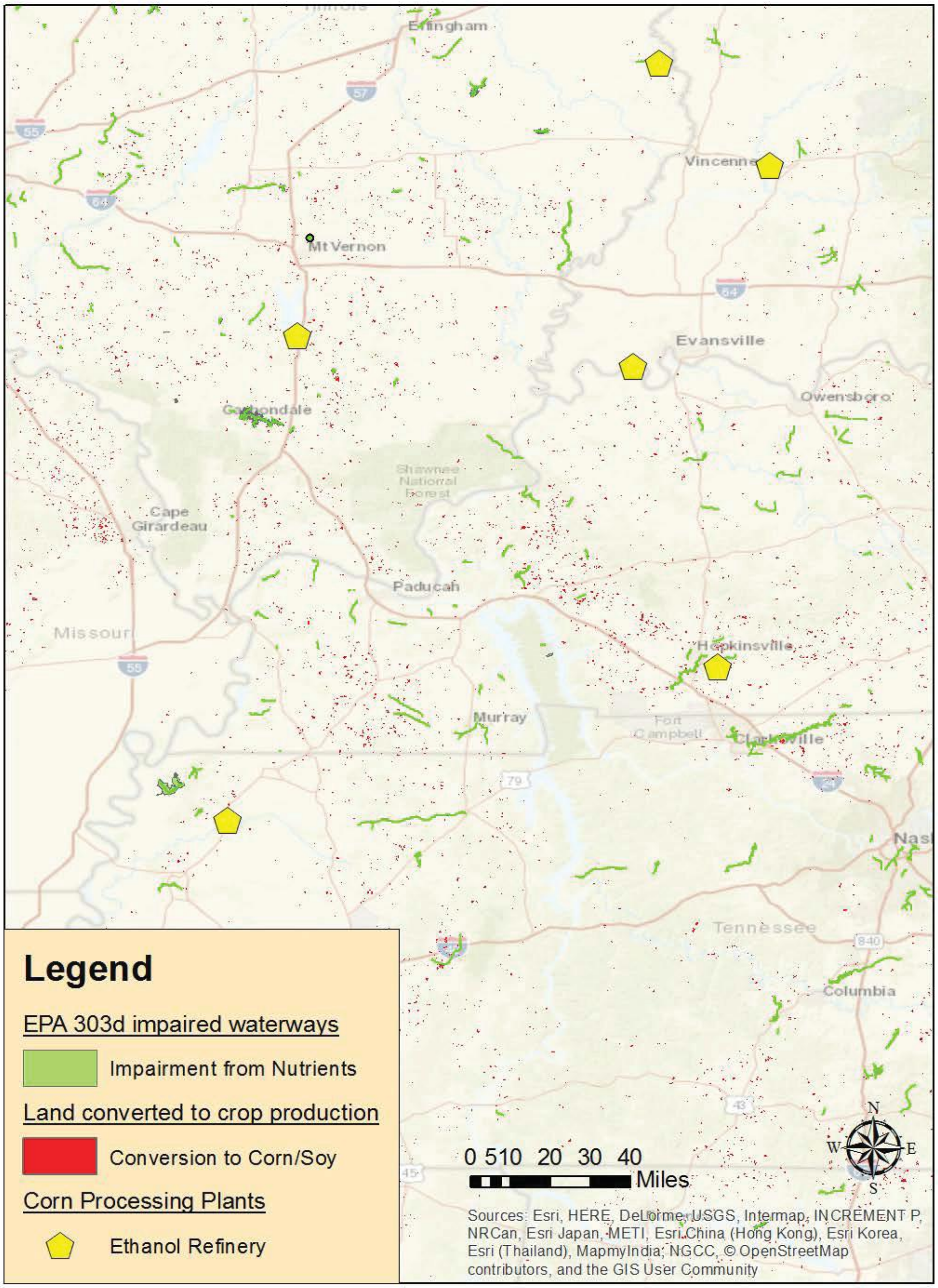
Impaired waterway data from EPA (2015). Land conversion data from Lark et al (2015). Ethanol refinery locations from Esri.

Figure 5-2: Map of 303(d) listed waterways that are impaired due to nutrient (nitrogen and phosphorus) pollution in northern Kansas. Streams and waterbodies are highlighted in bright green; probable locations of recent conversion of non-cropland to corn or soybeans production are highlighted in red. Data from U.S. EPA and Lark et al (2015).



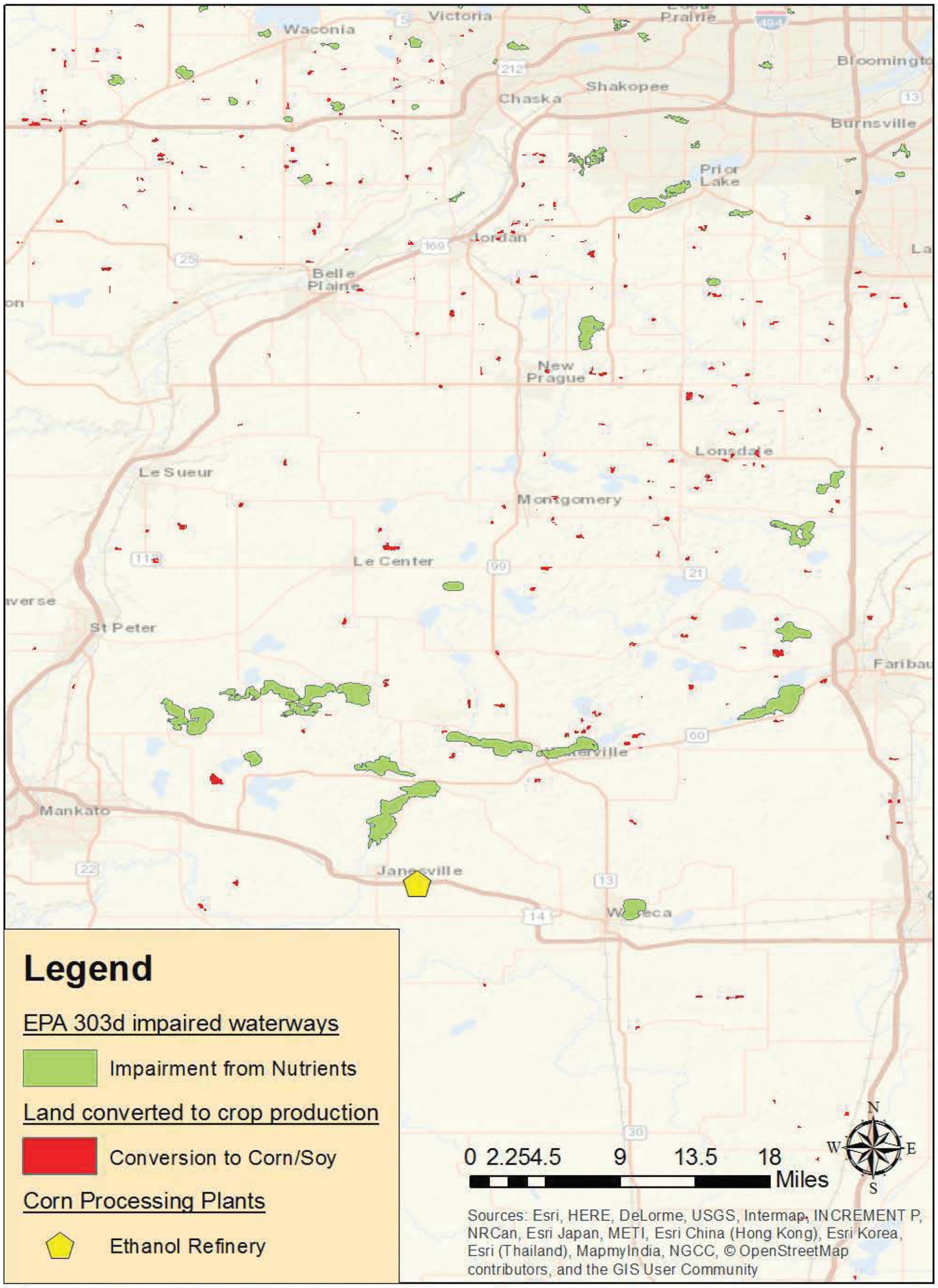
Impaired waterway data from EPA (2015). Land conversion data from Lark et al (2015). Ethanol refinery locations from Esri.

Figure 5-3: Map of 303(d) listed waterways that are impaired due to nutrient (nitrogen and phosphorus) pollution in central North Dakota. Streams and waterbodies are highlighted in bright green; probable locations of recent conversion of non-cropland to corn or soybeans production are highlighted in red. Data from U.S. EPA and Lark et al (2015).



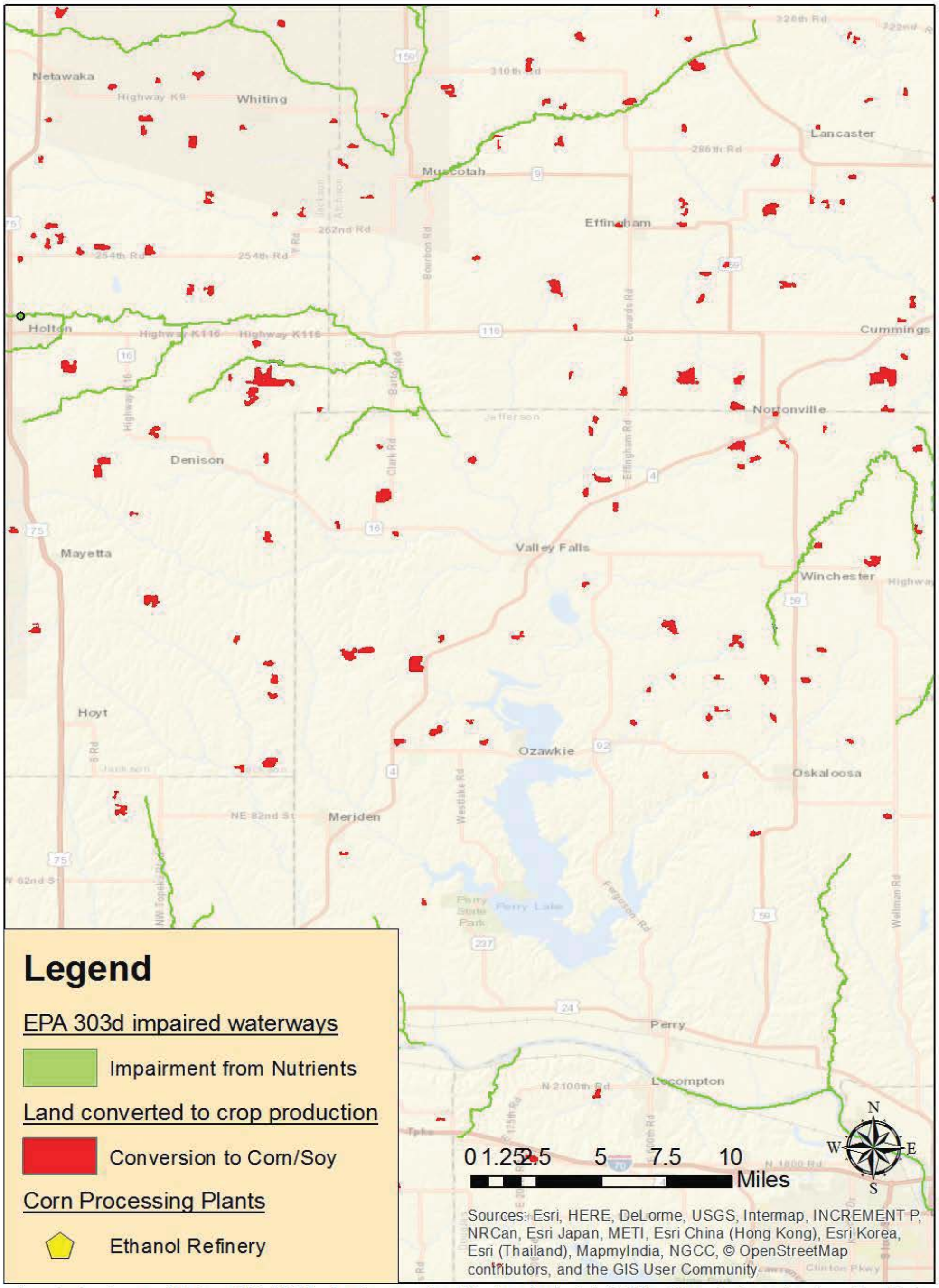
Impaired waterway data from EPA (2015). Land conversion data from Lark et al (2015). Ethanol refinery locations from Esri.

Figure 5-4: Map of 303(d) listed waterways that are impaired due to nutrient (nitrogen and phosphorus) pollution along the Illinois, Kentucky, and Tennessee borders. Streams and waterbodies are highlighted in bright green; probable locations of recent conversion of non-cropland to corn or soybeans production are highlighted in red. Data from U.S. EPA (2015) and Lark et al (2015).



Impaired waterway data from EPA (2015). Land conversion data from Lark et al (2015). Ethanol refinery locations from Esri.

Figure 5-5: Map of 303(d) listed waterways that are impaired due to nutrient (nitrogen and phosphorus) pollution in southcentral Minnesota. Streams and waterbodies are highlighted in bright green; probable locations of recent conversion of non-cropland to corn or soybeans production are highlighted in red. Data from U.S. EPA and Lark et al (2015).



Impaired waterway data from EPA (2015). Land conversion data from Lark et al (2015). Ethanol refinery locations from Esri.

Figure 5-6: Map of 303(d) listed waterways that are impaired due to nutrient (nitrogen and phosphorus) pollution in northeastern Kansas. Streams and waterbodies are highlighted in bright green; probable locations of recent conversion of non-cropland to corn or soybeans production are highlighted in red. Data from U.S. EPA and Lark et al (2015).

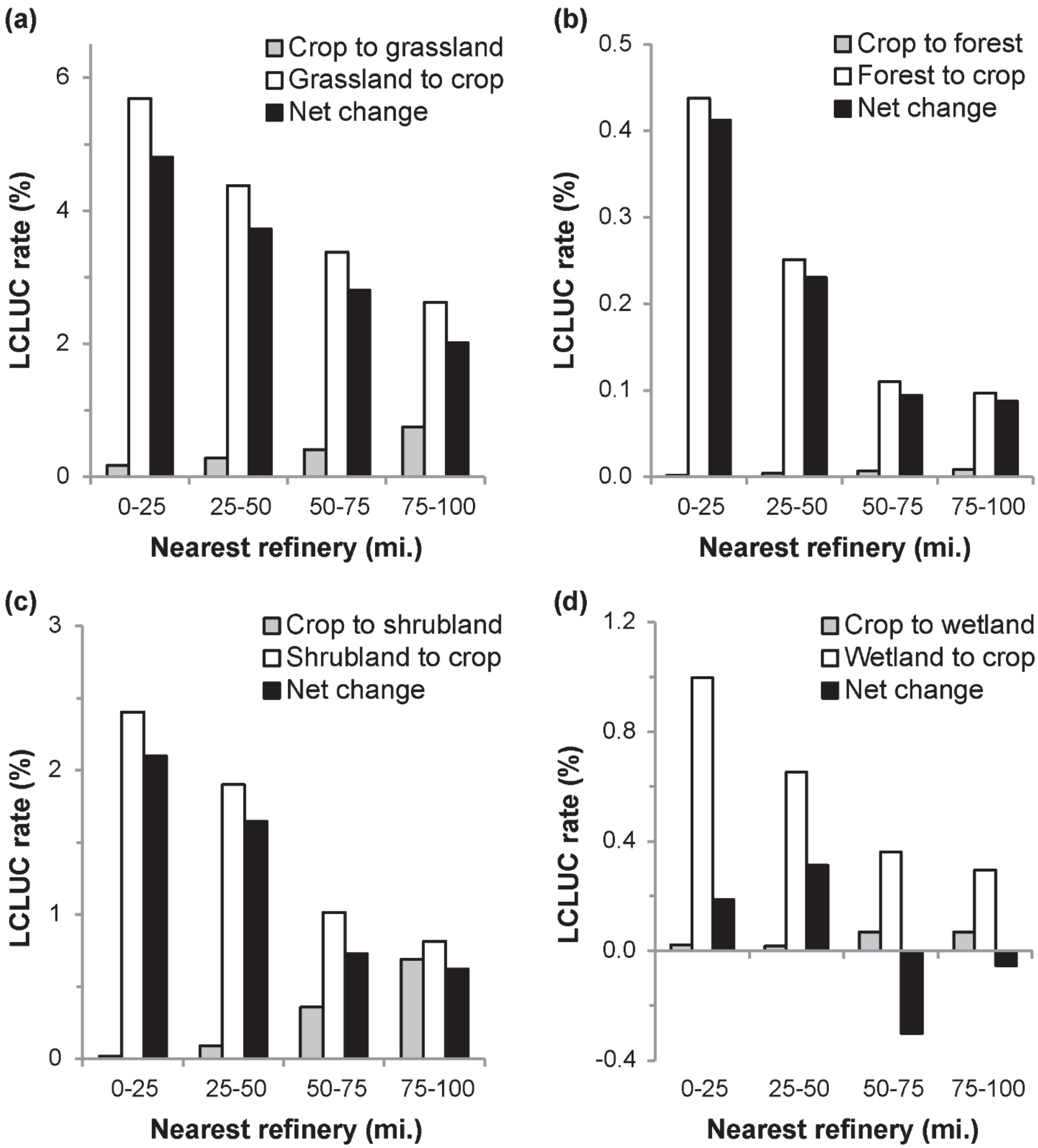


Figure 5-7: "Relative LCLUC rates (2008–2012) as a function of generalized land cover class and proximity to ethanol refineries. Conversion and net change rates normalized by arable land in the applicable non-cropland class in 2008. Reversion rates normalized by cropland area in 2008." Figure and description from Wright et al. (2017).

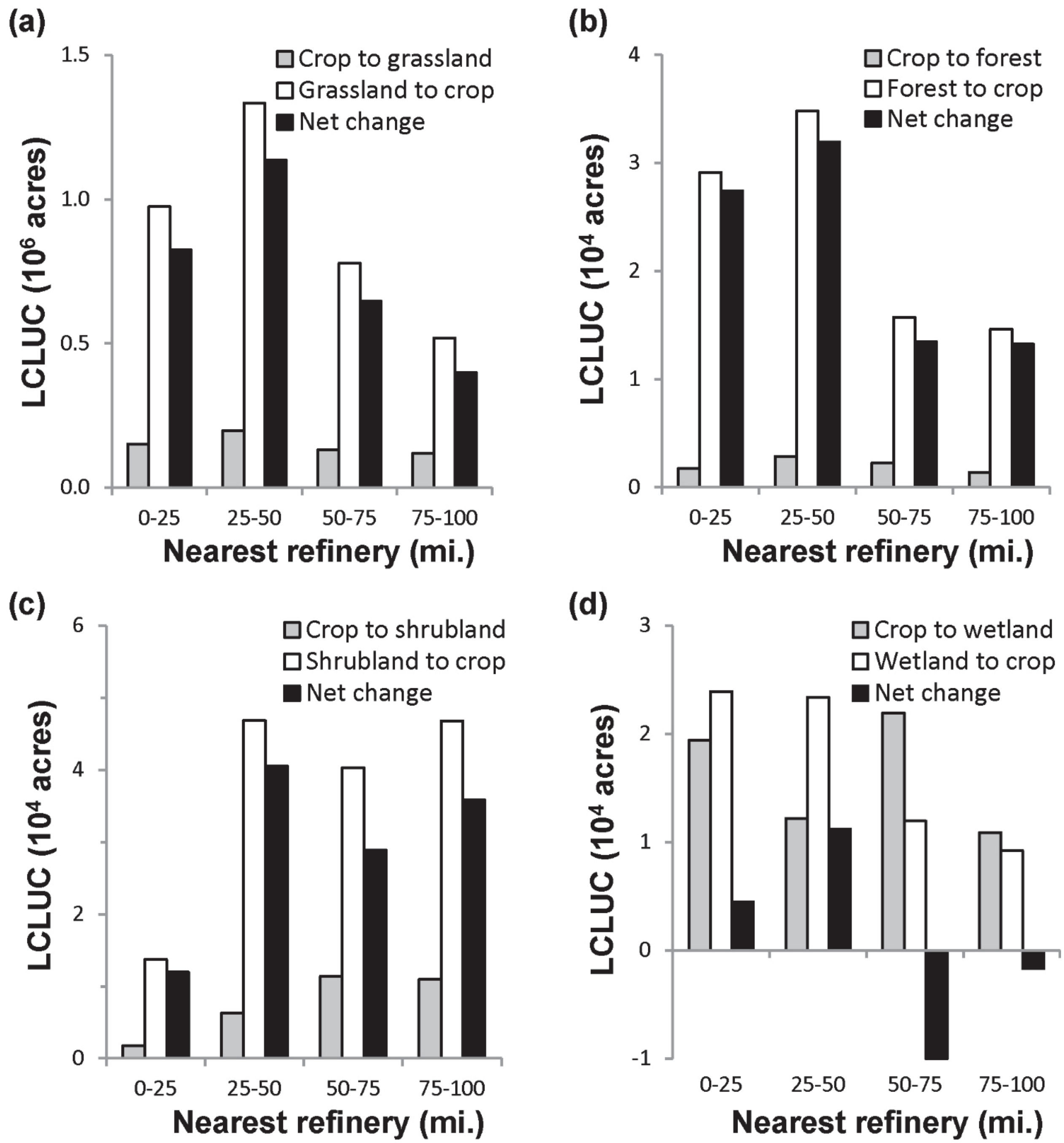
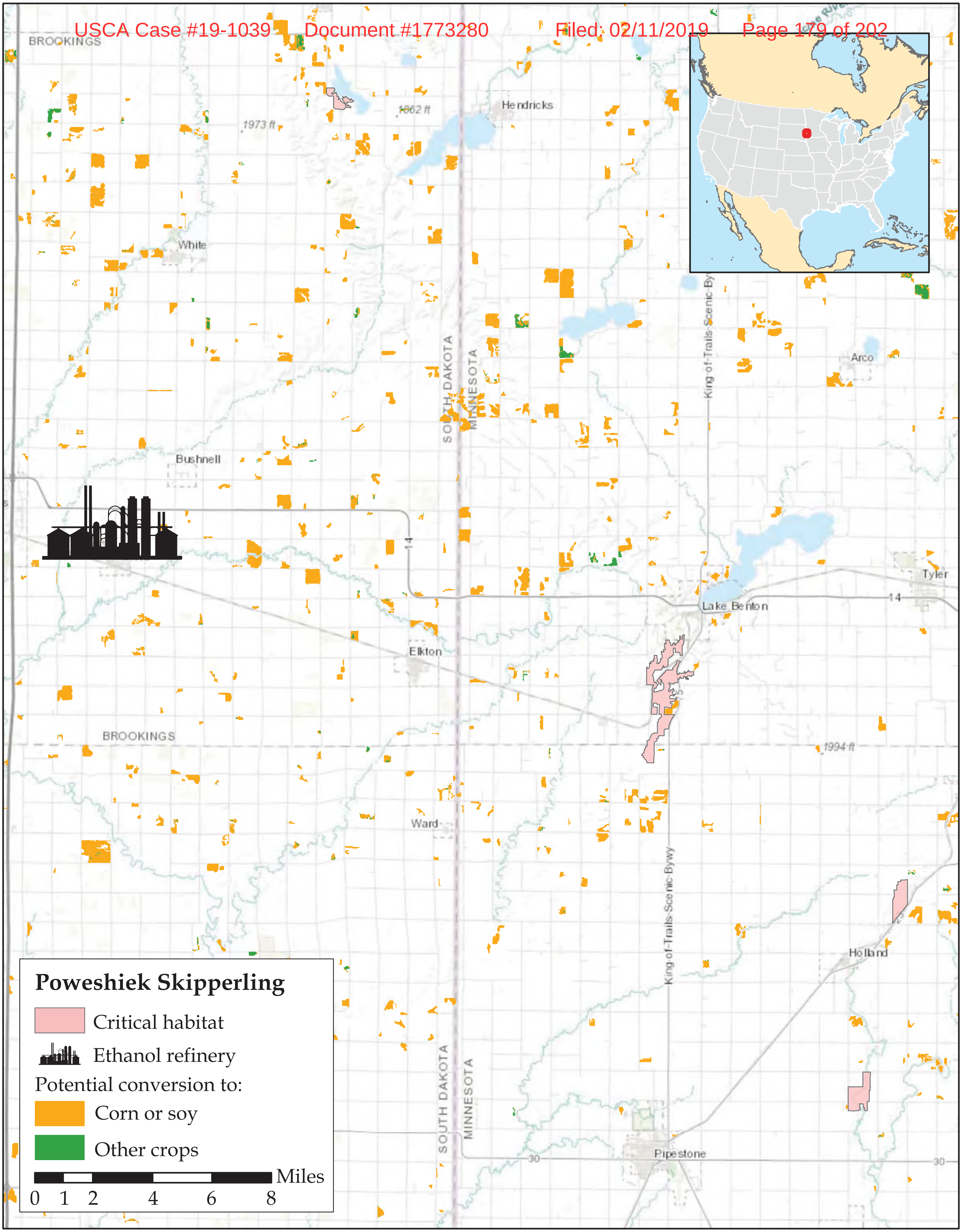
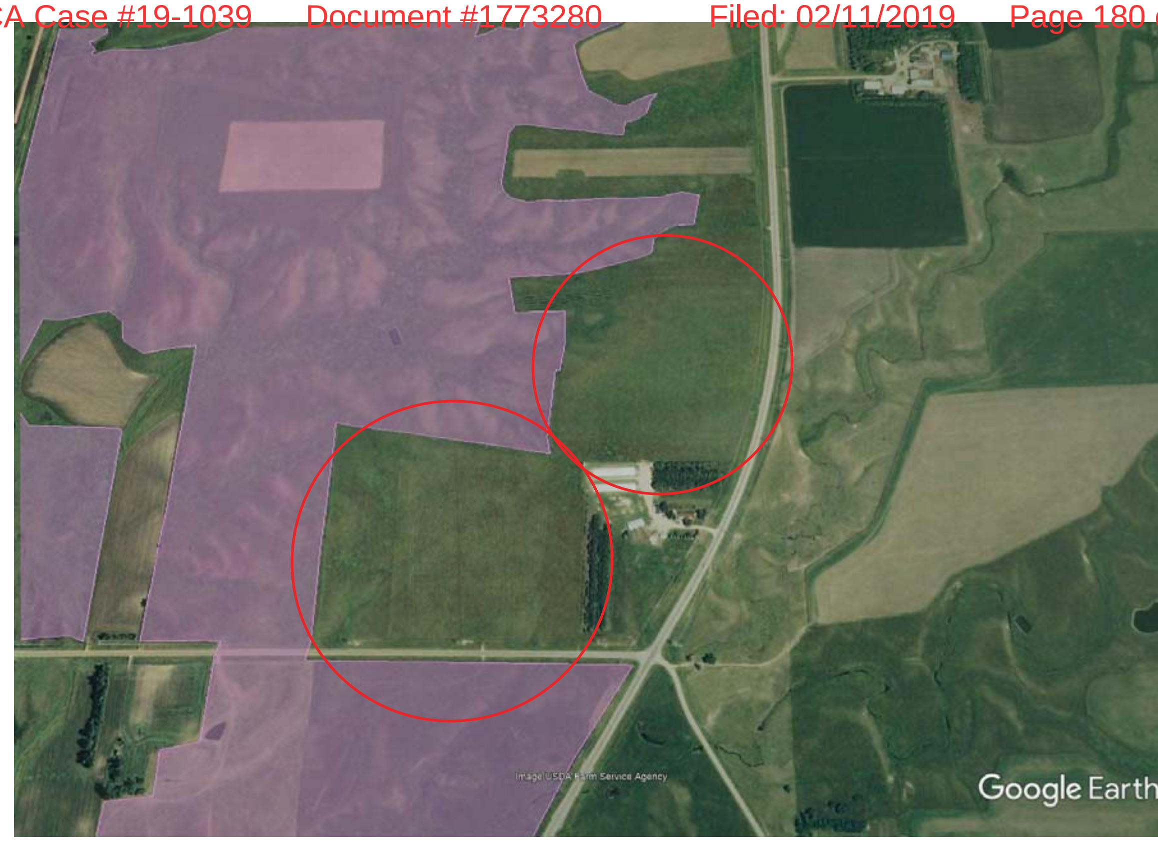


Figure 5-8: "Gross LCLUC (2008–2012) as a function of generalized land cover class and proximity to ethanol refineries. Note that grassland values are in 10^6 acres; forest, shrubland, and wetland in 10^4 acres. A positive net change (conversion minus reversion) represents a net loss in a given category; negative values indicate net gains (wetland only)." Figure and description from Wright et al. (2017).

Appendix 6 to Declaration of Dr. Tyler Lark



Critical habitat data from US Fish and Wildlife services
Land conversion data 2008-2016 based on approach of Lark et al. 2015
Ethonal refinery locations from Open Energy Info, basemap from Esri

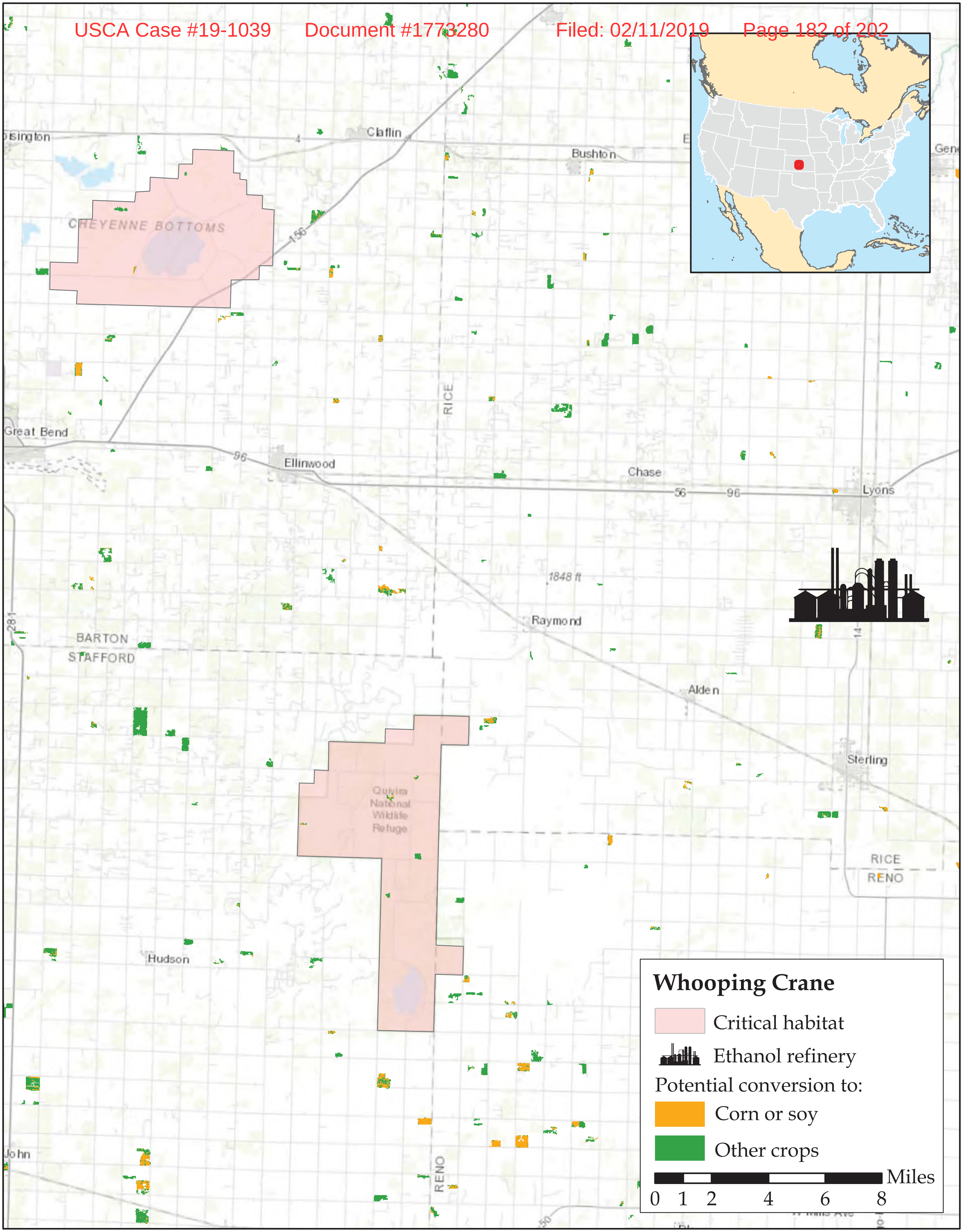


Above Image Date: 5/21/2008 44°12'49.48"N 96°18'29.90"W

Above Image Date: 6/23/2010 44°12'49.48"N 96°18'29.90"W

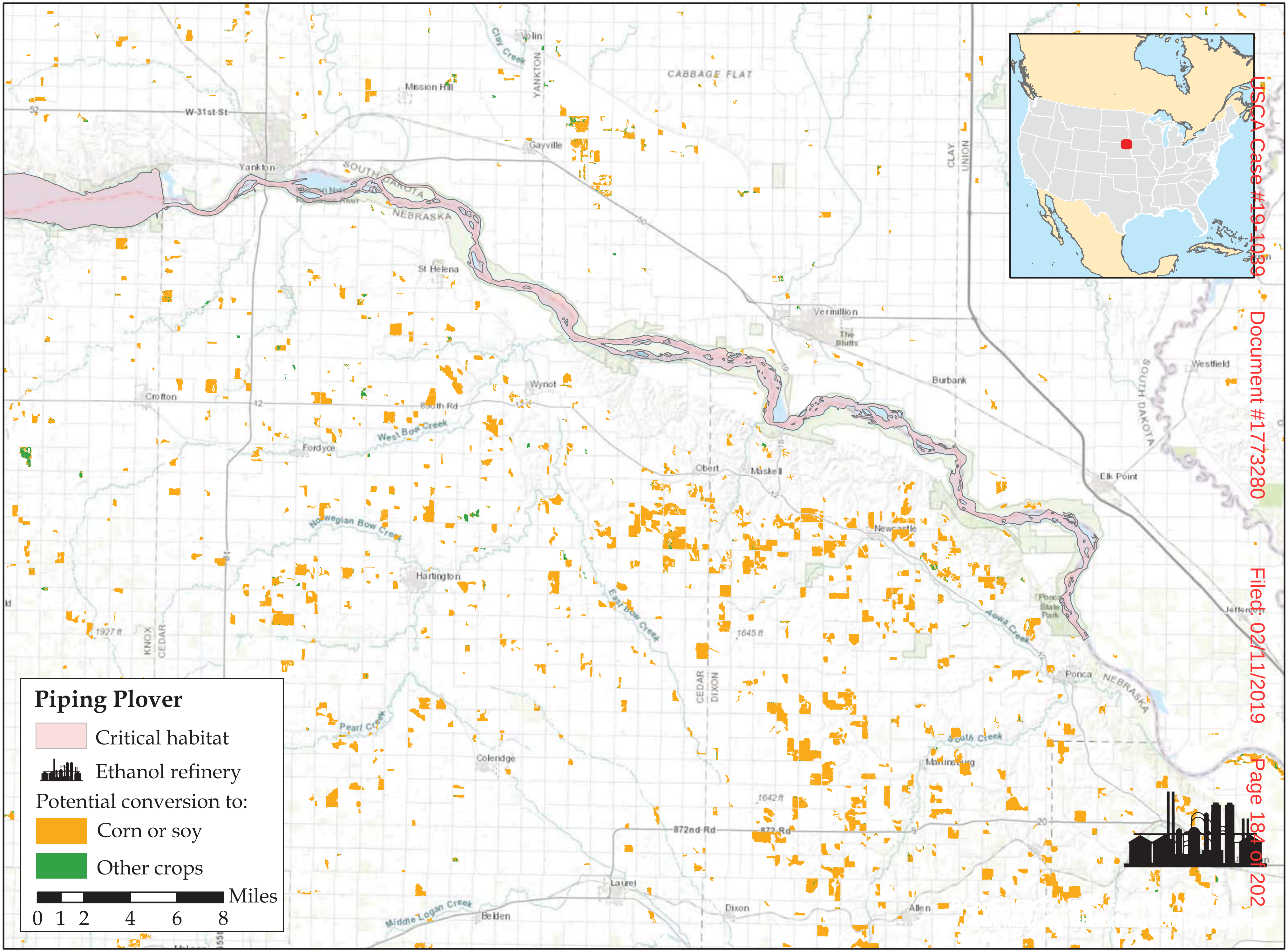
Aerial photographs of conversion from grassland to cropland located adjacent to designated critical habitat for the Poweshiek skipperling butterfly. Example is located south of Lake Benton in Lincoln County, Minnesota. Critical habitat area is highlighted pink, example of conversion is circled in red.

Appendix 7 to Declaration of Dr. Tyler Lark



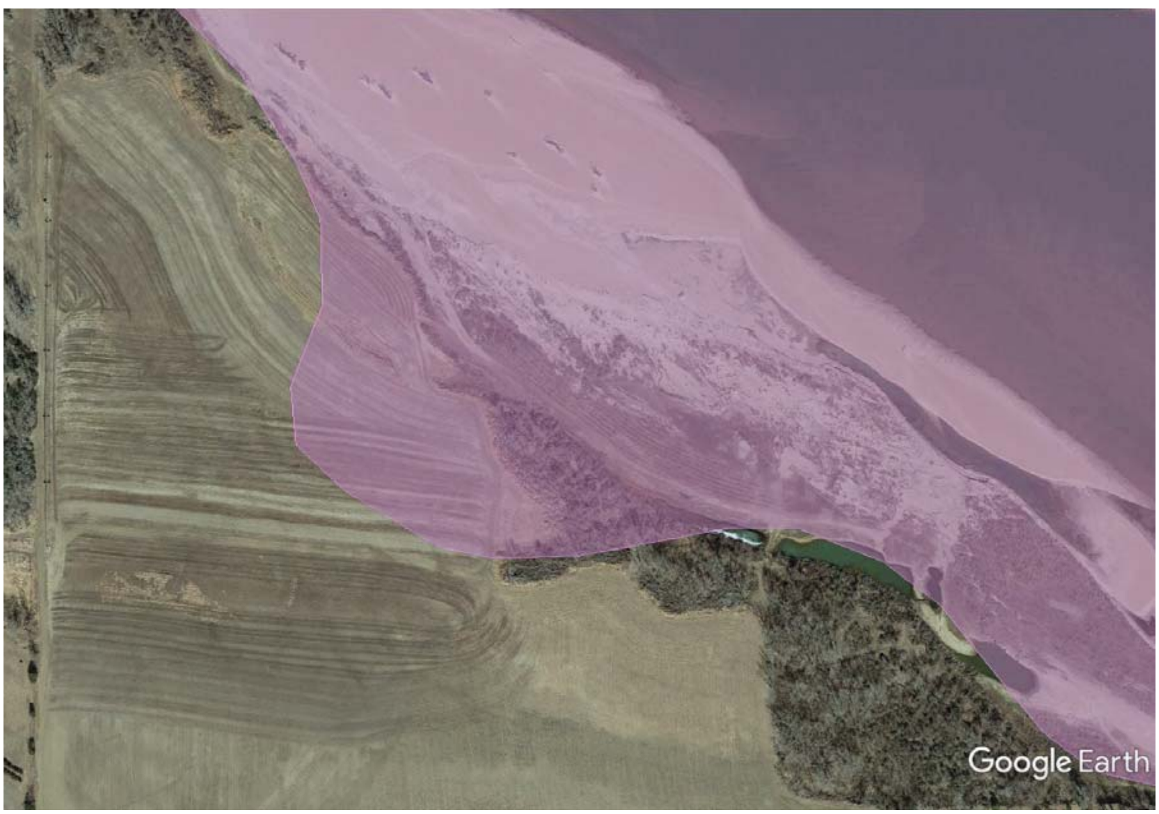
Critical habitat data from US Fish and Wildlife services
Land conversion data 2008-2016 based on approach of Lark et al. 2015
Ethonal refinery locations from Open Energy Info, basemap from Esri

Appendix 8 to Declaration of Dr. Tyler Lark



Critical habitat data from US Fish and Wildlife services
Land conversion data 2008-2016 based on approach of Lark et al. 2015
Ethonal refinery locations from Open Energy Info, basemap from Esri

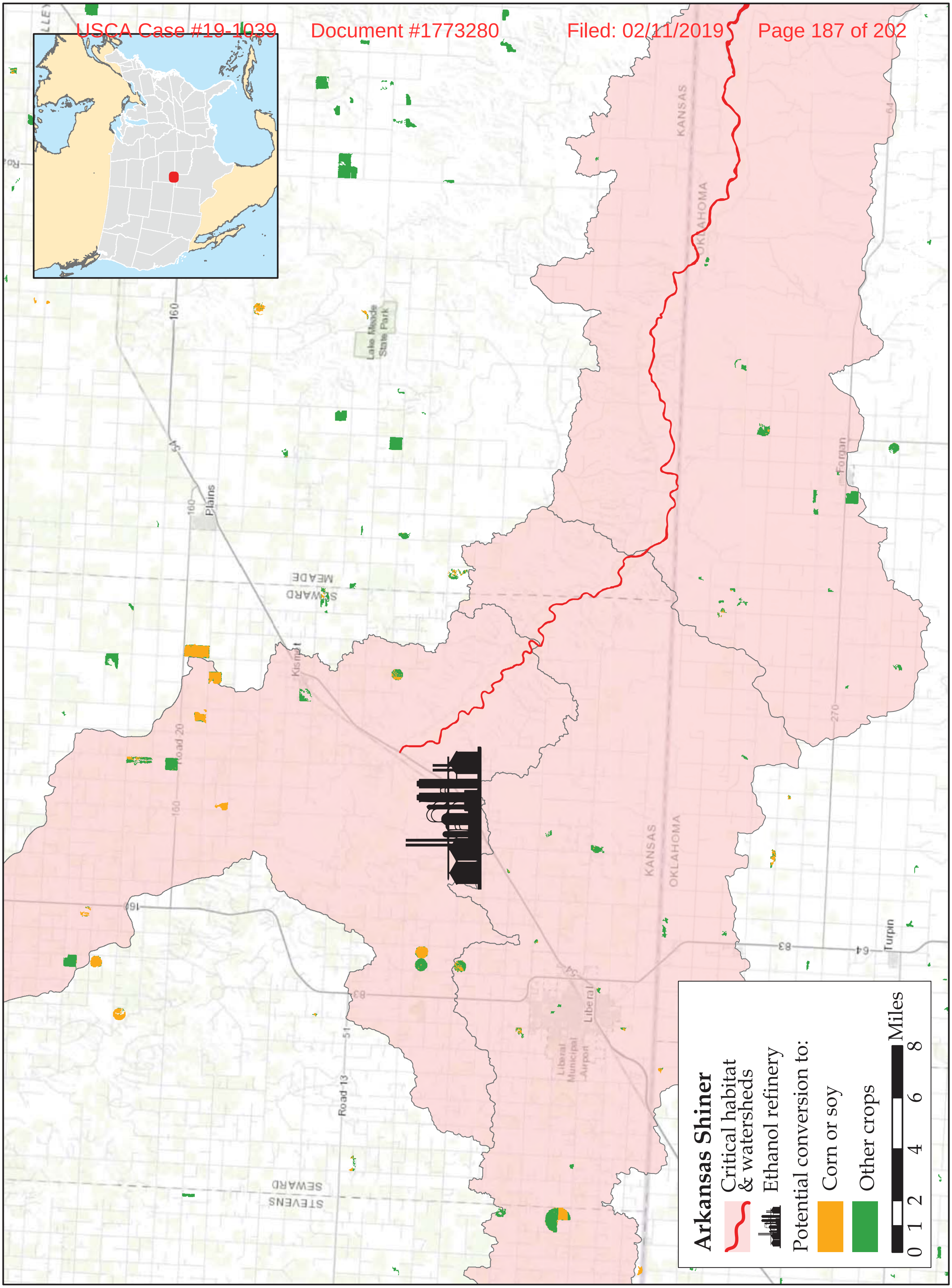
Above Image Date: 5/9/2012 42°51'11 N 97°17'26 W



Above Image Date: 3/13/2015 42°51'11 N 97°17'26 W

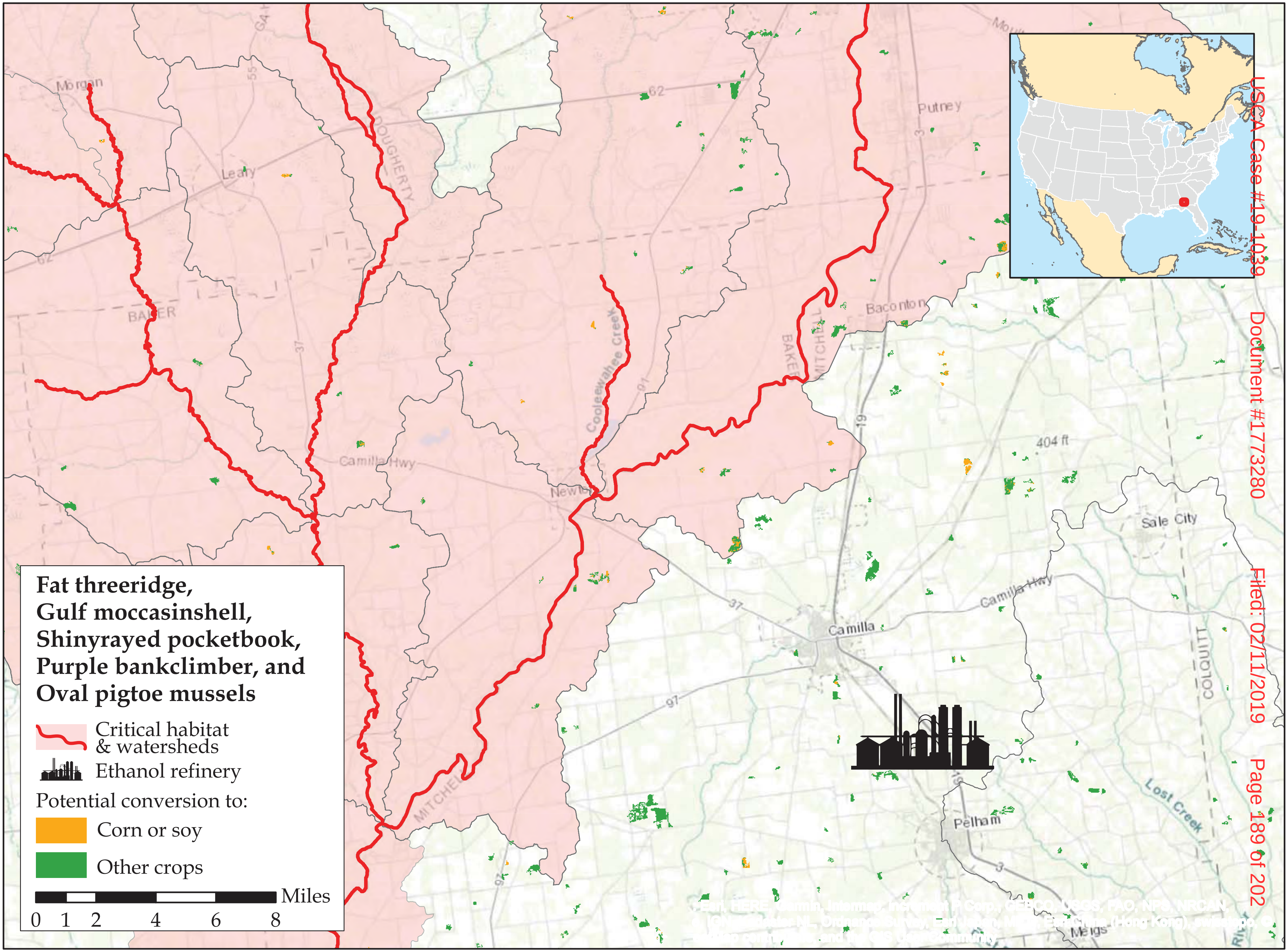
Aerial photographs of conversion of natural riparian habitat to cropland along the shoreline of the Missouri River, which is designated as critical habitat for the Piping plover. Example is located just east of Yankton, South Dakota, in Cedar County, Nebraska. Critical habitat area is highlighted pink.

Appendix 9 to Declaration of Dr. Tyler Lark



Critical habitat data from US Fish and Wildlife services
Land conversion data 2008-2016 based on approach of Lark et al. 2015
Ethonal refinery locations from Open Energy Info, basemap from Esri

Appendix 10 to Declaration of Dr. Tyler Lark



Critical habitat data from US Fish and Wildlife services
Land conversion data 2008-2016 based on approach of Lark et al. 2015
Ethonal refinery locations from Open Energy Info, basemap from Esri

Appendix 11 to Declaration of Dr. Tyler Lark

Additional references supporting the declaration of Dr. Tyler Lark

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Exhibit B

August 17, 2018

Mr. Andrew Wheeler
Acting Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, D.C. 20460

Submitted via regulations.gov

RE: Comments from Action for Ecology and People's Emancipation (AEER) Indonesia, ActionAid USA, ARA Germany, Biofuelwatch, Clean Air Task Force, Dogwood Alliance, Earthjustice, EcoNexus, Estonian Forest Aid, Fern, Global Forest Coalition, Mighty Earth, National Wildlife Federation, Partnership for Policy Integrity, Rainforest Action Network, Rainforest Rescue, Sawit Watch, and Sierra Club on the U.S. Environmental Protection Agency's Proposed Rule - "Renewable Fuel Standard Program: Standards for 2019 and Biomass-Based Diesel Volume for 2020" 83 Federal Register 32024 (July 10, 2018); EPA–HQ–OAR–2018–0167

Dear Acting Administrator Wheeler:

As national and international environmental, conservation, and development organizations, we respectfully submit these joint comments on the Environmental Protection Agency's (EPA) proposed rule "Renewable Fuel Standard Program: Standards for 2019 and Biomass-Based Diesel Volume for 2020" published in the Federal Register on July 10, 2018. Our groups represent millions of members who are concerned with fighting global warming, protecting human health, promoting human rights, preserving natural habitats, halting deforestation, and advocating for clean energy. We believe that setting appropriate volumes for the Renewable Fuel Standard (RFS) and effectively implementing both the Endangered Species Act (ESA) and habitat-conversion protections in the RFS are critical to achieving these goals.

Our comments are centered around five primary aspects of the proposed rule, which are listed below. More details on many of these issues can be found in joint comments that several of the undersigned groups submitted to EPA on previous proposed rules, which can be found here: http://www.catf.us/resources/filings/biofuels/.

We urge EPA to consider the following issues when finalizing its 2019 Renewable Volume Obligations rule:

- **Reducing the mandated volume of corn ethanol:** Over the last decade, the expansion of food-based biofuel production, particularly corn ethanol and soy biodiesel, has resulted in negative environmental outcomes. As EPA's Second Triennial Report to Congress acknowledges, these impacts include declines in water quality and quantity, soil and air quality, ecosystem health, and biodiversity, not to mention land use changes and increased greenhouse gas (GHG) emissions.[1] EPA should finalize volume amounts

[1] Lester Lave, et al. 2011. *Renewable Fuel Standard: Potential Economic and Environmental Effects of U.S. Biofuel Policy* (Report by the National Research Council Committee on Economic and Environmental Impacts of Increasing Biofuels Production) (internal citations omitted) (http://www.nap.edu/openbook.php?record_id=13105); Clean Air Task Force (CATF), Corn Ethanol GHG Emissions Under Various RFS Implementation Scenarios (April 2013) (http://www.catf.us/resources/whitepapers/files/20130405-CATF%20White%20Paper-Corn%20GHG%20Emissions%20Under%20Various%20RFS%20Scenarios.pdf); Congressional Budget Office. 2014. *The*

that limit the consumption of corn ethanol, a biofuel that has not only resulted in numerous environmental problems but also constrained commodity markets. Increased demand for corn ethanol and substitute crops has been linked to food security risks due to volatile commodity prices.[2]

- **Limiting the growth of vegetable oil-based biofuels:** Under the RFS, hundreds of millions of gallons of soy and palm biodiesel have been imported to the United States from Argentina and Indonesia, even as these countries face ongoing and severe deforestation due to agricultural expansion for soy and palm crops, respectively. The continued and increasing diversion of domestically grown soy oil away from food and consumer products and into biofuel production also creates market space for additional palm and soy production in Southeast Asia and Latin America. Soy and palm biodiesel may lead to GHG emissions that are two to three times higher than those from fossil diesel, according to a 2015 report produced by Hugo Valin *et al.* for the European Commission.[3] For these reasons, EPA should reduce the 2020 volume of biomass-based diesel.

- **Implementing the severe environmental harm waiver:** The RFS includes an important safety valve: if the law is found to cause "severe environmental harm," EPA is explicitly authorized to waive biofuel volumes below the minimum levels of the statute. The Second Triennial Report on the environmental impacts of the RFS found increased production of first-generation biofuels such as soy biodiesel and corn ethanol has caused a wide range of environmental problems for soil, water, air, and wildlife habitat, many of which have worsened since the last report was released in 2011.[4] EPA's proposal to significantly increase the biodiesel volumes for 2020 will create additional demand for vegetable oil feedstocks, exacerbating these impacts and leading to increased GHG emissions that contribute to climate change, a severe environmental harm. EPA should thus use its waiver authority to reduce the total renewable fuel and advanced biofuel standards below the statutory minimum in 2019.

- **Ending unlawful RFS-induced land conversion and the destruction of native habitats:** EPA should stringently implement the statutory requirement that RFS biofuel feedstocks (both domestic and international) be derived from "renewable biomass," as defined by the Energy Independence and Security Act of 2007 (EISA),[5] rather than feedstocks grown on recently cleared land. EPA's Second Triennial Report found direct and indirect domestic and international land use impacts have been tied to the expansion of RFS biofuels consumption, resulting in "cropland expansion and natural habitat loss (including forests)."[6] EPA should end the practice of unchecked land conversion by effectively implementing the renewable biomass definitions.

- **Assessing impacts under the Endangered Species Act:** EPA should also evaluate the impacts to water and air quality and biodiversity that would result from the Agency's proposed biofuel volumes.

Renewable Fuel Standard: Issues for 2014 and Beyond (internal citations omitted) (https://www.cbo.gov/publication/45477).

[2] International Food Policy Research Institute, Biofuels and Food Security: Balancing Needs for Food, Feed, and Fuel (2008) (http://www.ifpri.org/publication/biofuels-and-food-security).

[3] Hugo Valin, *et al*. 2015. The Land Use Change Impact of Biofuels Consumed in the EU: Quantification of Area and Greenhouse Gas Impacts, at 39 (Fig. 15). (https://ec.europa.eu/energy/sites/ener/files/documents/Final%20Report_GLOBIOM_publication.pdf).

[4] US Environmental Protection Agency (EPA), Biofuels and the Environment: The Second Triennial Report to Congress (2018 Final Report) (hereinafter "Second Triennial"), at 97 (https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=341491).

[5] CAA §211(o)(1)(J).

[6] Second Triennial at 48.

Specifically, the Agency also must fulfill its ESA Section 7 duties by consulting with wildlife agencies (U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration Fisheries) to ensure that any loss of habitat, including modification or pollution resulting from land use changes associated with the increased production of biofuels, does not jeopardize the continued existence of any federally-listed endangered and threatened species or cause the destruction or adverse modification of designated critical habitat.

In summary, the undersigned groups urge EPA to ensure that the 2019 Renewable Volume Obligations and those for biomass-based diesel for 2020 do not allow for the expansion of food-based biofuels, which have had numerous unintended consequences on our environment, not to mention impacts on food and feed prices. In addition to limiting volumes of corn ethanol, we urge EPA to alleviate demand for soy and palm biodiesel (and other market effects leading to greater demand for these vegetable oils), which have been linked to destructive land use changes, deforestation in countries such as Indonesia and Argentina, and other social and environmental problems. EPA can limit these impacts by finalizing a 2020 volume requirement for biomass-based diesel and 2019 volume requirements for advanced and total renewable fuels that do not incentivize increased production of food-based biodiesel and various vegetable oils. We also urge EPA to exercise its authority to reduce RFS volumes based on severe environmental harm, fulfill its ESA Section 7 duties, and give full effect to the "renewable biomass" definition in the RFS that was enacted to limit land use change from increased biofuel production both domestically and internationally as well.

Thank you for the opportunity to provide comments. We hope that our remarks provide useful guidance for EPA's final decision. We appreciate your consideration.

Respectfully submitted,

Pius Ginting
Action for Ecology and People's Emancipation (AEER) Indonesia

Kelly Stone
ActionAid USA

Monika Nolle
ARA, Germany

Rachel Smolker
Biofuelwatch

Jonathan Lewis
Clean Air Task Force

Adam Colette
Dogwood Alliance

Peter Lehner
Earthjustice

Helena Paul
EcoNexus

Martin Luiga
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Saskia Ozinga
Fern

Mary Louise Malig
Global Forest Coalition

Rose Garr
Mighty Earth

David DeGennaro
National Wildlife Federation

Mary Booth
Partnership for Policy Integrity

Robin Overbeck
Rainforest Action Network

Reinhard Behrend
Rainforest Rescue

Agustinus Karlo Lumban Raja
Sawit Watch

Andrew Linhardt
Sierra Club

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

NATIONAL WILDLIFE FEDERATION, HEALTHY GULF, AND SIERRA CLUB,	)	No. 19-
Petitioners,	)	
v.	)	
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, and ANDREW R. WHEELER, Acting Administrator, United States Environmental Protection Agency,	)	Petition for Review
Respondent.	)	

CERTIFICATE OF SERVICE

Pursuant to Fed. R. App. P. 15(c), Circuit Rule 15(a), Fed. R. App. P. 25, and 40 C.F.R. § 23.12(a), I hereby certify that on this date, a copy of the foregoing Petition for Review and Rule 26.1 Corporate Disclosure Statement is being served via First Class Mail to each of the following addresses:

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