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A Spoonful of Sugarcane Ethanol: A Green Tax Medicine for the Cellulosic Ethanol Industry

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Note

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On July 31, 2013, INEOS Bio, a bioenergy company,[1] announced that its Florida facility became the world pioneer in producing commercial-scale cellulosic ethanol.[2] Ethanol, or ethyl alcohol,[3] is a renewable fuel resulting from fermenting plant-based materials.[4] INEOS Bio produces cellulosic ethanol using vegetative and yard waste.[5]

Despite the flurry that accompanied last July's event, Brazil is still regarded as the country that implemented the most successful ethanol industry in the world[6]—the sugarcane ethanol industry.

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1. *Profile*, INEOS BIO, http://www.ineos.com/en/businesses/INEOS-Bio/Company/ (last visited Mar. 2, 2014).

2. *INEOS Bio Produces Cellulosic Ethanol at Commercial Scale*, INEOS BIO (July 31, 2013), http://www.ineos.com/en/businesses/INEOS-Bio/News/INEOS-Bio-Produces-Cellulosic-Ethanol/ [hereinafter *INEOS Bio*].

3. L. Leon Geyer et al., *Ethanol, Biomass, Biofuels and Energy: A Profile and Overview*, 12 DRAKE J. AGRIC. L. 61, 63 (2007).

4. David N. Cassuto & Carolina Gueiros, *The Evolution of the Brazilian Regulation of Ethanol and Possible Lessons for the United States*, 30 WIS. INT'L L.J. 477, 480 (2012).

5. *INEOS Bio*, *supra* note 2.

6. Rocky Mountain Farmers Union v. Corey, 730 F.3d 1070, 1082–83 (9th Cir. 2013) (low carbon intensity); Roberta F. Mann & Mona L. Hymel, *Moonshine to Motorfuel: Tax Incentives for Fuel Ethanol*, 19 DUKE ENVTL. L.

In the United States, the ethanol industry touches on two critical areas. First, ethanol can be used as motor fuel,[7] and it is no secret that the United States relies on motor fuel.[8] Second, the nation's reliance on motor fuel, especially gasoline, raises significant environmental concerns, notably, greenhouse gas (GHG) emissions.[9]

Thus, given the recent advancements in ethanol production, and the critical areas that ethanol touches on, an issue emerges as to whether Brazil's ethanol policy model can be instructive to the United States' fledgling cellulosic ethanol industry.

This Note seeks to suggest changes to the tax benefits of the U.S. cellulosic ethanol industry. Part I will present, primarily by focusing on federal tax policies and environmental effects linked with ethanol, (1) the trajectory of the United States' corn and cellulosic ethanol industries; and (2) the trajectory of Brazil's sugarcane ethanol industry. Part II (1) reviews the relevant existing literature addressing ethanol; (2) compares and contrasts the federal ethanol tax benefits of the United States' and Brazil's ethanol industries; (3) compares and contrasts these industries' impact on the respective country's environment; and (4) explains why Brazil's tax benefits should encourage the United States to implement similar benefits. This Note concludes that revising some of the U.S. cellulosic ethanol tax benefits, following Brazil's ethanol industry tax benefits, will likely spur the U.S. cellulosic ethanol industry, which would ultimately result in significant environmental benefits.

& POL'Y F. 43, 54 (2008) (cheaper to produce); Nancy I. Potter, Note, *How Brazil Achieved Energy Independence and the Lessons the United States Should Learn from Brazil's Experience*, 7 WASH. U. GLOBAL STUD. L. REV. 331, 347–48 (2008) (efficient to produce).

7. *See Rocky Mountain Farmers Union*, 730 F.3d at 1088 ("Indeed, the [fuel] market relies on th[e] undifferentiated structure [of ethanol] because ethanol from different regions . . . is regularly mixed together in the fuel supply.").

8. Lincoln L. Davies, *Alternative Energy and the Energy-Environment Disconnect*, 46 IDAHO L. REV. 473, 473–74, 507 (2010) (noting that Presidents Bush and Obama stated that the United States is figuratively addicted to oil).

9. *Cf.* Alexandra B. Klass, *Climate Change and the Convergence of Environmental and Energy Law*, 24 FORDHAM ENVTL. L. REV. 180, 196 (2013) [hereinafter Klass, *Climate Change*] (describing a methodology of analyzing motor fuel carbon emissions and their impact on the environment).

I. ETHANOL TAX BENEFITS[10]: IS THE SUGARCANE ALWAYS GREENER ON THE OTHER SIDE?[11]

Policymakers draw ethanol along several lines. Foremost, ethanol is a class of biofuel—a fuel produced from biomass.[12] Ethanol can also have a generation designation. First-generation ethanol is fermented from biomass containing simple sugars, such as cornstarch[13] and sugarcane juice.[14] Second-generation ethanol, or cellulosic ethanol,[15] is fermented from lignocellulosic biomass.[16] Finally, ethanol, when used as a motor fuel blend, is designated by a percentage figure. While pure ethanol can serve as motor fuel in certain kinds of

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10. "Ethanol tax benefits" encompass a wide range of terms ranging from direct subsidies to fiscal regulations that indirectly favor the ethanol industry, and all of the tax incentives that fall in between. For example, Brazil's Contribuição de Intervenção no Domínio Econômico is a federal tax that implicitly benefits Brazil's sugarcane ethanol industry by taxing gasoline importers at much higher rates than its ethanol counterparts. Cassuto & Gueiros, *supra* note 4, at 490. *See generally* Alexandra B. Klass, *Tax Benefits, Property Rights, and Mandates: Considering the Future of Government Support for Renewable Energy* 5–6 (Univ. of Minn. Law Sch. Legal Studies Research Paper Series, Research Paper No. 13-11, 2013) [hereinafter Klass, *Tax Benefits*], *available at* http://ssrn.com/abstract=2222987 (describing U.S. tax benefits for various kinds of renewable energy).

11. For U.S. state ethanol policies, see, for example, *Rocky Mountain Farmers Union*, 730 F.3d at 1104 n.14. For Brazilian state ethanol policies, see, for example, Paulina Calfucoy, *The Brazilian Experience in Building a Sustainable and Competitive Biofuel Industry*, 30 WIS. INT'L L.J. 558, 591–93 (2012).

12. "Biomass" (which some commentators call "feedstock") is organic material used to produce biofuels. *E.g.*, Vincent Barbera, Comment, *Tomorrow Today? Cellulosic Ethanol: How It's Done, Who's Getting It Done, and Its Environmental Impact*, 20 VILL. ENVTL. L.J. 27, 30 (2009) (describing cellulosic biomass). Other than ethanol, biofuels include biodiesel "and other renewable liquid fuels." U.S. ENERGY INFO. ADMIN., BIOFUELS ISSUES AND TRENDS 1 (2012), *available at* http://www.eia.gov/biofuels/issuestrends/pdf/bit.pdf.

13. Melissa Powers, *King Corn: Will the Renewable Fuel Standard Eventually End Corn Ethanol's Reign*, 11 VT. J. ENVTL. L. 667, 675 (2010).

14. CONSTANZA VALDES, USDA, BRAZIL'S ETHANOL INDUSTRY: LOOKING FORWARD 7 (2011).

15. Powers, *supra* note 13, at 675.

16. "Lignocellulosic" biomass encompasses "crops, trees, forest residues, and agricultural residues not specifically grown for food." Energy Policy Act of 2005, Pub. L. No. 109-58, § 932, 119 Stat. 594, 870; *cf.* Am. Petroleum Inst. v. EPA, 706 F.3d 474, 476 (D.C. Cir. 2013) ("[C]ellulosic biofuel [is] an advanced fuel derived from sources of lignocellulose, such as switchgrass and agricultural wastes . . . ."). For an explanation of third-generation ethanol, see Powers, *supra* note 13, at 676.

vehicles,[17] legislation addressing ethanol mostly concerns gasoline and ethanol blends.[18] These blends are abbreviated as "E," followed by a figure that denotes the percentage of ethanol blended in the motor fuel.[19]

A. THE UNITED STATES

In the United States, the corn and cellulosic ethanol industries are in many ways distinct in terms of federal policy programs and environmental effects.

1. Corn Ethanol

Though the corn ethanol industry is distinct from the cellulosic ethanol industry, a discussion of cellulosic ethanol would be incomplete without mentioning corn ethanol.[20] First, corn ethanol dominates the U.S. ethanol industry.[21] Not only is the United States the world's largest consumer[22] and exporter[23] of ethanol, but almost all the ethanol produced in the United States uses corn as biomass.[24] In addition, ethanol consumers generally cannot distinguish between different varieties of ethanol, because the varieties are often blended in the same gallon of motor fuel.[25]

In 2011, the U.S. corn ethanol production totaled about 13.9 billion gallons,[26] most of it produced in the Midwest.[27]

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17. VALDES, *supra* note 14, at 2–3.

18. *See, e.g.*, Grocery Mfrs. Ass'n v. EPA, 693 F.3d 169, 172 (D.C. Cir. 2012) (describing the U.S. Renewable Fuel Standard, which has the effect of increasing the U.S. national gasoline and ethanol blends); Cassuto & Gueiros, *supra* note 4, at 489 (describing a 2003 Brazilian law that mandated that twenty-two percent of the motor fuel in Brazil be blended with ethanol).

19. For example, E10 means a motor fuel blended with ten percent ethanol. *Grocery Mfrs. Ass'n*, 693 F.3d at 172.

20. *See* Matthew L. Wald, *Fuel from Waste, Poised at a Milestone*, N.Y. TIMES, Nov. 14, 2012, at B1 [hereinafter Wald, *Fuel from Waste*] (quoting a spokesperson of a biotechnology trade organization stating that it is impossible to "de-link" ethanol and advanced biofuels); *About BIO*, BIOTECHNOLOGY INDUS. ORG., http://www.bio.org/articles/about-bio (last visited Mar. 2, 2014).

21. *Grocery Mfrs. Ass'n*, 693 F.3d at 172 ("[R]efiners and importers primarily blend corn-based ethanol into the fuel supply.").

22. VALDES, *supra* note 14, at 16.

23. *Id.* at 18.

24. U.S. ENERGY INFO. ADMIN., *supra* note 12, at 6.

25. Rocky Mountain Farmers Union v. Corey, 730 F.3d 1070, 1088 (9th Cir. 2013).

26. U.S. ENERGY INFO. ADMIN., *supra* note 12, at 6.

Critics of corn ethanol identify concerns with ethanol production in at least two areas—the democratic process and the environment.[28]

a. Federal Tax Benefits and Related Policies

The impetus of Congress's implementation of the most recent federal corn-ethanol tax benefits and related policies was the 1970s oil crises that resulted from political turmoil in certain Middle Eastern countries.[29] In the first oil crisis in the early 1970s, the U.S. gasoline consumers experienced shortages and retail price hikes of about 40%.[30] In the second crisis, in the late 1970s, retail prices increased about 30%.[31] In response, Congress sought to spur corn ethanol—along with natural gas and other biofuels—to encourage energy independence.[32] While later federal corn ethanol policies also addressed other goals, notably environmental goals such as reduction of air pollutants[33] and GHG emissions,[34] energy independence goals have remained in the foreground of many policies.[35]

Other than corn ethanol tax benefits, major related federal policies include the Oxygenated Fuels, Reformulated Gasoline (RFG), and Renewable Fuel Standard (RFS) programs.[36] Until

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27. *See Ethanol Facilities' Capacity by State*, NEB. ENERGY OFF., http://www.neo.ne.gov/statshtml/121.htm (last visited Mar. 2, 2014) (listing the seven highest ranked states, all located in the Midwest, which operated at a production of about 10.4 billion gallons).

28. *See infra* Part I.A.1.a–.b.

29. James A. Duffield et al., *Ethanol Policy: Past, Present, and Future*, 53 S.D. L. REV. 425, 427–28 (2008).

30. *Id.* at 427.

31. *Id.* at 428.

32. *Id.*; Mann & Hymel, *supra* note 6, at 44 ("In 1978, Congress enacted the first tax incentives for ethanol production to reduce dependence on foreign oil.").

33. Duffield et al., *supra* note 29, at 430.

34. *Id.* at 439. "Greenhouse gas emissions" have been well recognized as the main contributor to global warming. Massachusetts v. EPA, 549 U.S. 497, 504–05 (2007). GHGs include carbon dioxide, methane, nitrous oxide, and hydrofluorocarbons. *Id.* at 510, 529. While the U.S. Supreme Court held in *Massachusetts v. EPA* that a statutory definition of "air pollutant" could encompass GHGs, *id.* at 528–29, for the sake of clarity, this Note provides an independent analysis of air pollutants—such as traditional pollutants from tailpipe emissions—and GHG emissions. *Accord* Duffield et al., *supra* note 29, at 449–50.

35. *E.g.*, *Energy Independence* and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492 (emphasis added).

36. Mann & Hymel, *supra* note 6, at 52–53.

January 2012, the main ethanol tax benefit was the Volumetric Ethanol Excise Tax Credit, which offered a $0.45 per gallon credit[37] to blenders that mix corn ethanol in motor fuel.[38] Additionally, small producers[39] could be eligible for an additional $0.10 per gallon.[40]

The Oxygenated Fuels Program, designed to control carbon monoxide (CO) during winter months, requires motor fuel to contain at least 2.7% oxygen content.[41] This goal was often achieved by mixing motor fuel with at least 7.5% of ethanol.[42] In December 2010, all targeted areas achieved federal ambient air standards for CO.[43]

The RFG Program, eliminated in 2005, required motor fuel to contain at least 2% of oxygen[44] as to reduce harmful tailpipe emissions.[45] As with the Oxygenated Fuels Program, in practice, the RFG Program mainly used ethanol.[46]

Finally, the RFS, the dominant corn ethanol policy in effect,[47] mandates, in broad terms, for the EPA to promulgate[48] a renewable fuel phase-in.[49] The RFS, introduced in the Energy Policy Act of 2005 and incorporated in the Clean Air Act,[50] was amended in the Energy Independence and Security Act of 2007

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37. A "tax credit" is a kind of tax benefit that reduces a taxpayer's tax liability dollar-for-dollar. JAMES J. FREELAND ET AL., FUNDAMENTALS OF FEDERAL INCOME TAXATION 873 (17th ed. 2013).

38. Klass, *Tax Benefits*, *supra* note 10, at 8.

39. The Internal Revenue Code defined "small producer" as having a capacity not exceeding sixty million gallons per year. Mann & Hymel, *supra* note 6, at 48–49.

40. *Id.* at 48.

41. Duffield et al., *supra* note 29, at 447.

42. *Id.*

43. YANN LING-BARNES, WASHOE COUNTY HEALTH DEP'T, 2011–2012 OXYGENATED FUELS PROGRAM FOR WASHOE COUNTY 1 (2012), *available at* http://www.washoecounty.us/repository/files/4/2011-2012-Oxy-Fuel-Report-April-2012.pdf.

44. Duffield et al., *supra* note 29, at 448.

45. *Id.* at 447. These harmful tailpipe emissions include CO, ground-level ozone, and other pollutants. *Id.* at 448.

46. Mann & Hymel, *supra* note 6, at 52.

47. *See* Klass, *Tax Benefits*, *supra* note 10, at 8 ("While Congress allowed the bulk of the tax credits for biofuels to expire at the end of 2011, this action did not meet with significant resistance from the biofuels industry primarily because of the [RFS].").

48. Am. Petroleum Inst. v. EPA, 706 F.3d 474, 475 (D.C. Cir. 2013).

49. Duffield et al., *supra* note 29, at 435.

50. Grocery Mfrs. Ass'n v. EPA, 693 F.3d 169, 172 (D.C. Cir. 2012).

(EISA)[51] partly to address the environmental concerns resulting from corn ethanol.[52] The RFS allows qualifying motor fuel suppliers to blend up to fifteen billion gallons of corn ethanol per year.[53]

Several scholars argue that, especially with the phasing out of corn-ethanol tax benefits, the RFS has been the main federal policy in spurring corn ethanol production.[54] When the RFS was first introduced, corn ethanol made up less than 4% of the amount of motor fuel volume; in 2011, the amount rose to about 10.6%.[55]

Scholars also posit that corn ethanol implicates interests that undermine representative democracy. Iowa, the leading ethanol-producing state and the first state to hold a presidential primary, is often the platform where presidential candidates vouch support for ethanol.[56] Some commentators assert that ethanol production only benefits a few big agribusinesses.[57]

b. Environmental Effects

Experts in scientific and policy-making fields have assessed the environmental effect of corn ethanol production in terms of GHG emissions, air pollutant emissions, and land use.

Although corn ethanol was important to the air pollutant reduction legislative goals in the Clean Air Act Amendments of 1990,[58] ever since 2007, the efficacy of corn ethanol with regard to its GHG-emission reduction has been under attack. When employing the lifecycle analysis to find carbon intensity of different varieties of ethanol,[59] corn ethanol is found to be more

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51. *Am. Petroleum Inst.*, 706 F.3d at 475.

52. Klass, *Tax Benefits*, *supra* note 10, at 24.

53. Powers, *supra* note 13, at 695.

54. *E.g.*, Klass, *Tax Benefits*, *supra* note 10, at 24–25; Powers, *supra* note 13, at 705–07.

55. *Bioenergy: Background*, USDA ECON. RES. SERVICE, http://www.ers.usda.gov/topics/farm-economy/bioenergy/background.aspx#.Um17nJR-RN0 (last updated May 27, 2012).

56. Mann & Hymel, *supra* note 6, at 73.

57. *E.g.*, *id.* at 72; Powers, *supra* note 13, at 685–86.

58. Duffield et al., *supra* note 29, at 431; *see supra* notes 44–46 and accompanying text.

59. "Lifecycle analysis" can address a kind of ethanol's "carbon intensity," i.e., the GHG emissions resulting from production and transportation of a kind of ethanol. Rocky Mountain Farmers Union v. Corey, 730 F.3d 1070, 1080 (9th Cir. 2013); *see also* Klass, *Climate Change*, *supra* note 9, at 196–97.

carbon-intensive than, for example, sugarcane ethanol.[60] In addition, some researchers point to the relationship between higher GHG emissions and indirect land use changes.[61] According to these researchers, because increases in corn prices encourage developing countries to convert rainforests and peatlands for agricultural production (or even for biofuel production), and these previously nonagricultural lands can no longer be as effective in sequestering GHGs, this course of events leads to higher GHG emissions.[62]

While Congress passed legislation favorable to corn ethanol to abate automobile air pollutant emissions,[63] empirical data have not fully confirmed corn ethanol's effectiveness in abating these emissions. Growing corn could threaten public health, because the practice increases the amount of airborne chemicals.[64] In addition, regarding the Oxygenated Fuel Program, corn ethanol may not have been the contributing factor in declining CO.[65] Finally, regarding the RFG Program, while commentators concede that RFG is one of the factors for the long-term downward trend in smog, commentators are uncertain of how much RFG contributed to that trend.[66] Also, because the EPA measures gasoline volatility differently between blended motor fuel and RFG, it is possible that increased use of ethanol could result in higher emissions of volatile organic compounds (VOCs).[67] This increase in emissions could ultimately result in higher emissions of ground-level ozone.[68]

Corn ethanol production potentially raises several environmental concerns related to land use. Increased corn

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60. *See Rocky Mountain Farmers Union*, 730 F.3d at 1082, 1110 (listing that "Ethanol from Sugarcane" has a lower carbon intensity value than "Ethanol from Corn").

61. Powers, *supra* note 13, at 687.

62. *Id.* at 684–88.

63. *See supra* notes 41–46 and accompanying text (explaining the Oxygenated Fuels Program and the RFG Program).

64. Powers, *supra* note 13, at 684.

65. Commentators point to other factors that could be the root of decline, such as the changes in the automobile industry. Duffield et al., *supra* note 29, at 447–48 (summarizing the findings and detailing two pieces of research scholarship).

66. *Id.* at 449.

67. *Id.*

68. *See id.* at 448 ("Ozone is not usually emitted directly into the air, but at ground level by a chemical reaction between oxides of nitrogen . . . and volatile organic compounds . . . in the presence of sunlight.").

ethanol production could raise geographically related land use issues, because the production is concentrated in the Midwest.[69] These land use issues are related to higher soil erosion and soil nutrient loss.[70] Additionally, some scholars underscore concerns related to biodiversity that result from continued corn production, such as the reduction of biome[71] and displacement of land that would otherwise qualify for conservation.[72] Finally, land use incurred during corn ethanol production raises environmental issues related to water supply in several ways. Not only is corn ethanol production water-intensive,[73] but production results in potentially hazardous water runoffs. Since corn production requires fertilizers, herbicides, and pesticides; and ethanol plants emit VOCs; the net result from these chemicals is the production of runoffs that pollute water bodies in the Midwest and create eutrophication in and around the Gulf of Mexico.[74]

2. Cellulosic Ethanol

Even if INEOS Bio won the race for producing cellulosic ethanol on a commercial scale, the race has more participants not far behind. The companies POET and Abengoa, located in Iowa and Kansas respectively, claim they are close to producing cellulosic ethanol.[75] POET intends to use biomass made out of corncobs and Abengoa, biomass of agricultural waste, wood waste, and nonfood crops.[76]

Commentators and researchers predict that the U.S. cellulosic ethanol industry will have other features. Some commentators posit that corn stover—the in-field residue after

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69. *See supra* text accompanying note 27; *cf*. Duffield et al., *supra* note 29, at 452 ("[T]he production of [cellulosic] feedstocks would not be concentrated in one region of the United States, as is the case with corn."); Mann & Hymel, *supra* note 6, at 76 ("The most significant environmental effects of ethanol production result from increased acreage in corn.").

70. Geyer et al., *supra* note 3, at 75 ("[T]he removal of biomass for energy production intensifies soil erosion, water runoff, and soil nutrient loss.").

71. *E.g.*, Powers, *supra* note 13, at 684.

72. *Id.* at 684–85.

73. *Id.* at 683–84 ("Corn is an extremely input-intensive crop, which requires massive amounts of water."); *see* Mann & Hymel, *supra* note 6, at 76–77 ("A biorefinery that produces [100,000,000] gallons of ethanol per year would use as much water as a town of about [500,000] people.").

74. Geyer et al., *supra* note 3, at 75–76; Mann & Hymel, *supra* note 6, at 76; Powers, *supra* note 13, at 683–84.

75. Wald, *Fuel from Waste*, *supra* note 20.

76. *Id.*

corn harvest[77]—will become the main biomass for cellulosic ethanol, because Midwestern corn-ethanol plants could economically adapt their current production into employing corn stover.[78] Other commentators cite switchgrass as a suitable cellulosic biomass option.[79] Finally, researchers from the influential Argonne National Laboratory (ANL)[80] list other biomass, such as willow and poplar, as potential candidates for cellulosic ethanol.[81]

a. Federal Tax Benefits and Related Policies

Federal policies favoring cellulosic ethanol had their origin in the Biomass Research and Development Act of 2000 (BRDA), which funded competitive research programs with the purpose of encouraging breakthroughs in various sources of renewable energy.[82] Yet, it was not until the Energy Policy Act of 2005 that Congress directly addressed cellulosic ethanol.

The Energy Policy Act of 2005 addressed cellulosic ethanol in three ways: the Cellulosic Biomass Program, amendments to the BRDA, and a reverse auction program.[83] Under the

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77. ZHICHAO WANG ET AL., ARGONNE NAT'L LAB., MATERIAL AND ENERGY FLOWS IN THE PRODUCTION OF CELLULOSIC FEEDSTOCKS FOR BIOFUELS FOR THE GREET MODEL 3 (2013), *available at* http://greet.es.anl.gov/files/feedstocks-13.

78. *Id.*

79. Geyer et al., *supra* note 3, at 73; *cf.* WANG ET AL., *supra* note 77, at 21 ("Currently there are public and private [switchgrass] breeding programs throughout the United States.").

80. *See* Brief for Professors of Environmental Law as Amici Curiae Supporting Appellants at 21, Rocky Mountain Farmers Union v. Goldstene, 730 F.3d. 1070 (9th Cir. 2013) (Nos. 12-15131, 12-15135) (explaining that the lifecycle analysis model maintained by the Argonne National Laboratory influences regulatory agencies in five U.S. states).

81. *See* WANG ET AL., *supra* note 77, at i (listing the varieties of biomass discussed in the report).

82. Duffield et al., *supra* note 29, at 436.

83. The amendments to BRDA refined the BRDA's goals and redirected research emphasis. *Id.* The amendments aimed at facilitating the production of cellulosic ethanol. Arnold W. Reitze, Jr., *Biofuels—Snake Oil for the Twenty-First Century*, 87 OR. L. REV. 1183, 1244 (2008). Since then, the Farm Bill of 2014 further amended the BRDA to continue to award research and development programs. H.R. Res. 2642, 113th Cong. (2014) (enacted); *Advancing Bioenergy Technologies*, BIOMASS RES. & DEV., http://www.biomassboard.gov/ (last updated Dec. 27, 2012); SI Staff, *President Obama Signs Farm Bill into Law*, SOLAR INDUSTRY (Feb. 10, 2014), http://www.solarindustrymag.com/e107_plugins/content/content.php?content.13788.

Cellulosic Biomass Program, Congress introduced RFS requirements[84] for cellulosic ethanol and introduced other programs.[85]

After the RFS for cellulosic ethanol was introduced, the RFS was amended by the EISA.[86] Under the current RFS, cellulosic ethanol falls under the definition of "cellulosic biofuels," what the RFS defined as a kind of "advanced biofuel."[87] The RFS sets targets that are subject to the EPA's adjustments.[88] For example, by 2012, half a billion gallons of ethanol sold in the United States must be cellulosic biofuel, and by 2022, the cellulosic biofuel must be more than three quarters of the amount of advanced biofuel.[89] Yet, in its implementation, the cellulosic biofuel part of the RFS has been more complex. In 2011, the EPA projected that cellulosic biofuel production could reach 6.6 million gallons, when the figure was really zero.[90] Under the RFS Program, the EPA projections are key because, if the projections are lower than the RFS mandated amount, the EPA Administrator may lower the mandated amount accordingly.[91]

Other than the RFS, the programs nested in the Cellulosic Biomass Program included programs for (1) cellulosic ethanol production loans; (2) research on cellulosic ethanol production;

Last, under the Energy Policy Act of 2005, the reverse auction program allows the Secretary of Energy to buy the first billion gallons of cellulosic ethanol. 42 U.S.C. § 16251(c) (2006); Geyer et al., *supra* note 3, at 65. An observer suggested that the reverse auction program could lower the transaction costs of cellulosic ethanol. Geyer et al., *supra* note 3, at 65 ("[R]everse actions . . . can lower the cost of procuring products and services." (internal quotations omitted)).

84. See *supra* notes 47–55 and accompanying text for discussion on the role of the RFS in spurring corn ethanol production.

85. Duffield et al., *supra* note 29, at 435.

86. Am. Petroleum Inst. v. EPA, 706 F.3d 474, 475 (D.C. Cir. 2013).

87. *Id.* at 476. "Advanced biofuels" achieve a lifecycle GHG emission displacement of fifty percent compared to gasoline. Powers, *supra* note 13, at 699–700; *Am. Petroleum Inst.*, 706 F.3d at 480–81.

88. *Am. Petroleum Inst.*, 706 F.3d at 475.

89. *Id.*

90. *Id.* at 477.

91. *Id.* at 476. Indeed, in 2013, the EPA projections and the Administrator's mandated determinations were subject to litigation in *American Petroleum Institute v. EPA*. The American Petroleum Institute (API) is a fossil fuel energy trade association. *About API*, AM. PETROLEUM INST., http://www.api.org/globalitems/globalheaderpages/about-api (last visited Mar. 2, 2014). The API petitioned the D.C. Circuit to review the EPA's 2012 RFS rule and the EPA's refusal to lower the 2012 mandates. *Am. Petroleum Inst.*, 706 F.3d at 476. The D.C. Circuit vacated the 2012 RFS rule. *Id.* at 481.

and (3) the Department of Energy to create an Advanced Biofuels Technologies Program.[92]

Unlike other cellulosic ethanol federal policies, the tax incentives directed at cellulosic ethanol were introduced in 2006. Two of the tax incentives are still in effect. The Tax Relief and Health Act of 2006 provided that cellulosic biomass ethanol plants in service before January 1, 2013 may receive a fifty percent bonus depreciation.[93] Since then, the American Taxpayer Relief Act of 2012 extended the bonus depreciation to January 1, 2014 and broadened "cellulosic biomass ethanol" to apply to any "cellulosic biofuel."[94] The Senate Finance Committee Majority cited reasons for the 2012 change, three of which relate to cellulosic ethanol: fostering technological development, encouraging energy independence, and creating manufacturing jobs in the United States.[95]

The Farm Bill of 2008 provided the second tax incentive—a credit to motor fuel producers that blend ethanol in motor fuel.[96] The credit includes cellulosic ethanol, which may receive $1.01 per gallon credit.[97] Like the bonus depreciation, the American Taxpayer Relief Act of 2012 extended the credit to December 31, 2013 and broadened "cellulosic biofuel" to apply to "second generation biofuel."[98] The Senate Finance Committee Majority cited two reasons related to cellulosic ethanol for the 2012 change—(1) spurring further commercial biofuel development; and (2) ensuring energy independence through fostering a diversity of fuel sources.[99]

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92. Duffield et al., *supra* note 29, at 435.

93. I.R.C. § 168(*l*)(1) (2012); Mann & Hymel, *supra* note 6, at 52 n.69. A "bonus depreciation" is a kind of tax benefit that enables a taxpayer to depreciate a property the first year the property enters into operation. *A Brief Overview of Depreciation*, IRS, http://www.irs.gov/Businesses/Small-Businesses-&-Self-Employed/A-Brief-Overview-of-Depreciation (last updated Sept. 16, 2013).

94. American Taxpayer Relief Act of 2012, Pub. L. No. 112-240, § 410, 126 Stat. 2313, 2342–43 (2013).

95. S. REP. NO. 112-208, at 96 (2012). *But see id.* at 112 ("[The Committee Minority is] concerned that the relentless dedication to subsidizing so-called 'green energy' will prevent the most efficient development of energy sources and cause a loss of jobs in the broader economy.").

96. Mann & Hymel, *supra* note 6, at 49.

97. Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-234, § 15321, 122 Stat. 923, 1512.

98. § 404, 126 Stat. at 2338–39.

99. S. REP. NO. 112-208, at 85 (2012). But see *supra* note 95 for the quote from the Committee Minority.

b. Environmental Effects

Since cellulosic ethanol has only recently become commercially viable, the studies addressing environmental effects of cellulosic ethanol are inchoate, if not speculative.[100] The available results based on cellulosic ethanol produced in the experimental stage[101] address areas such as GHG emissions, impact on biodiversity, and the land use implications.

There are mixed views on the issue of GHG emissions resulting from the production of cellulosic ethanol. An INEOS Bio chief executive argued that the company's ethanol production process is "carbon-negative." This executive reasoned that the electricity produced from the INEOS Bio plant precludes GHG emissions that would have come from more GHG-intensive sources.[102] Yet, according to a 2013 ANL report, production of cellulosic ethanol is not completely free from GHG emissions. On the one hand, the report listed the relative environmental advantages of native North American plants such as switchgrass.[103] On the other hand, the report pointed to the way that production of ethanol from certain cellulosic biomass could emit more GHGs. Biomass such as corn stover may require increased use of fertilizers.[104] To achieve optimal yield, even switchgrass requires use of fertilizers.[105] Finally, the report communicated the GHG-emission concerns of growing nonnative plants, since growing these plants in greenhouses is energy intensive.[106]

Regarding the environmental impact of cellulosic ethanol on biodiversity, observers' views depend on the kind of biomass

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100. *See* WANG ET AL., *supra* note 77, at 54–55 (listing outstanding issues in production and conversion technologies for cellulosic biomass feedstocks).

101. *See, e.g.*, Calfucoy, *supra* note 11, at 565 (noting the cellulosic ethanol from Sweden and Switzerland).

102. Wald, *Fuel from Waste*, *supra* note 20. *But cf.* Am. Petroleum Inst. v. EPA, 706 F.3d 474, 478 (D.C. Cir. 2013) (citing the petitioner arguing that cellulosic biofuel facility owners tend toward overstatement).

103. WANG ET AL., *supra* note 77, at 21.

104. *Id.* at 10–11. For ANL's lifecycle analysis, fertilizer use is an important factor. *Id.* at 10; *cf.* Robert Sanders, *Fertilizer Use Responsible for Increase in Nitrous Oxide in Atmosphere*, UC BERKELEY NEWS CENTER (Apr. 2, 2012), http://newscenter.berkeley.edu/2012/04/02/fertilizer-use-responsible-for-increase-in-nitrous-oxide-in-atmosphere/ ("[I]ncreased fertilizer use . . . is responsible for a dramatic rise in atmospheric nitrous oxide, which is a major [GHG] contributing to global climate change.").

105. WANG ET AL., *supra* note 77, at 23.

106. *Id.* at 14.

producers use, and where their production takes place. By supposing that cellulosic ethanol is produced from woody fibers, some observers speculate that the impact of cellulosic ethanol production on the ecosystem is negligible.[107] Yet, by supposing that the cellulosic ethanol is produced from switchgrass, observers speculate that this grass could become invasive, or lead to displacement of species from their habitat.[108] Moreover, because the EPA allows cellulosic biomass to grow in Conservation Reserve Program land,[109] this EPA practice could threaten biodiversity among plant species, a threat that would be more serious if the plants were genetically modified.[110]

The land use effects of growing cellulosic biomass, especially compared to growing corn, seem more positive. Unlike corn ethanol production's concentration in the Midwest, cellulosic ethanol production may be more dispersed.[111] Also, growing cellulosic biomass, such as switchgrass, requires less fertilizers, pesticides, and herbicides.[112] Further, a scholar found that cellulosic biomass, when compared to corn, is more beneficial to soil fertility and more conducive to reducing erosion.[113] Finally, the 2013 ANL report noted the characteristics of certain plants that could result in positive land use effects. For example, *miscanthus* x *giganteus* is efficient in terms of water use,[114] and short-rotation woody crops, such as willow and poplar, grow quickly.[115]

Despite these potential environmental benefits, even the INEOS Bio Chief Operating Officer admits that his Florida plant has yet to achieve optimal yield: "Now we want to produce more ethanol from a ton of wood, rather than just making ethanol from a ton of wood."[116]

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107. *See* Cassuto & Gueiros, *supra* note 4, at 498 ("[The sources for cellulosic ethanol] require less energy, fertilizer, [and] water . . . .").

108. Barbera, *supra* note 12, at 40–41.

109. "Conservation Reserve Program" is a scheme where the Department of Agriculture pays farmers to set aside and restore or protect environmentally sensitive lands. Powers, *supra* note 13, at 701.

110. *Id.*

111. Duffield et al., *supra* note 29, at 452.

112. Barbera, *supra* note 12, at 38; *cf.* WANG ET AL., *supra* note 77, at 21 ("[Switchgrass] has consistently high yields with minimal inputs and is well-suited to marginal land.").

113. Barbera, *supra* note 12, at 39 & n.92.

114. WANG ET AL., *supra* note 77, at 13.

115. *Id.* at 28.

116. Matthew L. Wald, *Milestone Claimed in Creating Fuel from Waste*, N.Y. TIMES, July 31, 2013, http://www.nytimes.com/2013/08/01/business/

B. BRAZIL

While Brazil has experimented with biofuels such as palm oil,[117] sugarcane ethanol is still Brazil's dominant biofuel.[118] In 2009, Brazil produced about 6.9 billion gallons of sugarcane ethanol,[119] most of it in the Southeast.[120] Brazil's sugarcane is likewise grown mostly in the Southeast.[121] Still, Brazil's ethanol use is more widespread. About 16% of the nation's vehicles may run on ethanol (these vehicles are called flex-fuel vehicles (FFVs)).[122] In 2009, about 90% of new vehicles in Brazil were FFVs.[123]

1. Federal Tax Benefits and Related Policies

In the 1970s, Brazil—then ruled under a military dictatorship[124]—first enacted tax benefits aimed at encouraging energy independence.[125] The 1970s oil crises had a sobering effect on Brazil because it imported eighty percent of its oil.[126]

Indeed, from the 1970s to the mid-1980s dictatorship era, the government developed and sustained a host of policies favoring sugarcane ethanol. These policies became more aggressive over time. At first, the policies—such as blending mandates[127] were aimed at developing ethanol to supplement gasoline,[128] but, starting in 1979, the government turned its

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energy-environment/company-says-its-the-first-to-make-ethanol-from-waste.html?_r=0 [hereinafter Wald, *Milestone Claimed*].

117. Sandra Dos Santos, Comment, *The Tainted Grail of Brazilian Ethanol: Achieving Oil Independence but Who Has Borne the Cost and Paid the Price?*, 11 N.Y. CITY L. REV. 61, 87 (2007).

118. Cassuto & Gueiros, *supra* note 4, at 496.

119. VALDES, *supra* note 14, at 10 (26.1 billion liters); *Liters to US Gallons (Liquid)*, METRIC CONVERSIONS, http://www.metric-conversions.org/volume/liters-to-us-liquid-gallons.htm (last updated Feb. 8, 2013).

120. VALDES, *supra* note 14, at 10.

121. *Id.* at 5.

122. *Ethanol Fuel in Brazil*, UN-ENERGY KNOWLEDGE NETWORK (Jan. 8, 2011), http://www.un-energy.org/stories/38-ethanol-fuel-in-brazil.

123. Roberto Samora, *Gabrielli: Etanol Reduzirá Mercado de Gasolina a 17% até 2020*, G1 (June 2, 2009), http://g1.globo.com/Noticias/Mundo/0,,MUL1180455-5602,00-GABRIELLI+ETANOL+REDUZIRA+MERCADO+DE+GASOLINA+A+ATE.html.

124. Cassuto & Gueiros, *supra* note 4, at 482 & n.29.

125. EDNALDO MICHELLON ET AL., BREVE DESCRIÇÃO DO PROÁLCOOL E PERSPECTIVAS FUTURAS PARA O ETANOL PRODUZIDO NO BRASIL 11 (2008), *available at* http://www.sober.org.br/palestra/9/574.pdf.

126. Cassuto & Gueiros, *supra* note 4, at 482.

127. *Id.* at 481.

128. *Id.* at 482.

attention to pure ethanol[129] through production mandates for the ethanol industry, agreements with FFV manufacturers, and tax benefits to FFV buyers.[130] Through all those years, the government implemented several financial measures, which included loans and subsidies to energy producers, investment in genetically modified sugarcane, and setting up ethanol.[131]

After the military dictatorship regime ended in Brazil, for less than a decade, Brazil's ethanol market stagnated;[132] yet, starting in the 1990s, Brazil's sugarcane ethanol industry thrived anew. In 1985, Brazil's military dictatorship ended and the nation started to transition to democracy.[133] The previous ethanol policy incentives were no longer viable in a nation that faced inflation and trade imbalance, and thus most of the policies were dismantled.[134] But starting in the early 1990s, Brazil's sugarcane ethanol industry began to convalesce.

Two major factors contributed to the industry's recovery—market forces and environmental awareness. In the area of market forces, the sugarcane ethanol industry modernized itself to remain competitive,[135] oil prices spiked due to instability in some regions in the Middle East,[136] and, in 2003, commercially viable FFVs were introduced in the automobile market.[137] In the area of environmental awareness, in 1993, Brazil enacted E22 mandates to reduce air pollutant emissions,[138] and, in 1997, the Kyoto Protocol created greater awareness of the need to enlist renewable fuels as to reduce GHG emissions.[139]

Currently, Brazil has in place three major federal policies that regulate its sugarcane industry: mandated blending rates,

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129. *Id.* at 484.

130. *Id.*

131. *Id.* at 483, 485.

132. *Id.* at 486.

133. *Id.* at 485.

134. *Id.*

135. *Id.* at 486–87. "Agriculture was mechanized, scientists experimented with new variations of sugar cane, strategic mergers and acquisitions were carried out, and mills and distilleries were modernized. Many private institutions arose as well." *Id.* at 487.

136. *Id.* at 487.

137. *Id.* at 487–88. "The Brazilian flex-fuel engine runs on any combination of anhydrous ethanol and gasoline blend, as well as [pure ethanol]. By contrast, [FFVs] produced in other countries operate on a blend of a maximum of [E85]." *Id.* at 488.

138. *Id.* at 486.

139. *Id.* at 487.

credits for the ethanol industry, and various tax benefits.[140] Historically, Brazil has had mandates for ethanol blends in motor fuel.[141] The government adjusts the mandate according to market conditions.[142] In April 2013, the Brazilian federal government announced that to spur ethanol investment and supply, it would increase the mandate from E20 to E25.[143]

Like the mandated blending rates, financial assistance to the ethanol industry in Brazil is not historically unseen.[144] In fact, credit programs have proliferated since the mid-2000s.[145] In 2010, the Central Bank of Brazil established a credit line of about $1.37 billion to assist ethanol plants, distilleries, production cooperatives, trading companies, etc.[146]

Formally, Brazil has three federal tax benefits in place. First, the Contribuição de Intervenção no Domínio Econômico (CIDE, translated as "intervening contribution on the economic domain") is collected to fund various transportation fuels and resources. The CIDE mainly funds: (1) ethanol, natural gas, and petroleum; (2) transportation facility programs; and (3) environmental projects addressing petroleum and gasoline issues.[147] The CIDE itself affects both the gasoline and the ethanol industries, because gasoline import tariffs are about twenty-three times higher than ethanol.[148]

Second, the Programas de Integração Social e de Formação do Patrimônio do Servidor Público (PIS/PASEP, translated as "programs of social integration and of establishment of public

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140. *See id.* at 488–89.

141. *See id.* at 484 (discussing the initial policy of mandatory minimum blends).

142. VALDES, *supra* note 14, at 24.

143. Fábio Amato, *Governo Corta Tributos e Aumenta Percentual de Álcool na Gasolina*, G1 ECONOMIA (Apr. 23, 2013, 12:26 PM), http://g1.globo.com/economia/noticia/2013/04/governo-anuncia-medidas-para-o-setor-sucroalcooleiro.html.

144. *See supra* note 131 and accompanying text.

145. VALDES, *supra* note 14, at 24 ("Financing for the ethanol sector has risen since the mid-2000s, with the amount of credit granted increasing rapidly and new credit programs being implemented.").

146. Ricardo Silva et al., *International Energy and Natural Resources Law*, 45 INT'L LAW. 297, 298 (2011).

147. Contribuição de Intervenção no Domínio Econômico (Cide), CÂMARA DOS DEPUTADOS (May 22, 2006, 10:20 AM), http://www2.camara.gov.br/camaranoticias/noticias/88696.html.

148. *See* Lei No. 10.336, de 19 de Dezembro de 2001, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 20.12.2001 (Braz.) (listing under article 5 that the gasoline tariff shall be R$860,00 per m^3 (860,00 Brazilian Real per cubic meter), while ethanol is R$37,20 per m^3).

servant endowment") is collected to be spent on pensions for business and government employees.[149] Until December 23, 2013, the PIS/PASEP had a blender's credit component for a producer, which is about $0.005 per gallon.[150] Another relevant component of the PIS/PASEP is that, while a gasoline producer must pay 5.08% of its aggregate revenue,[151] an ethanol producer only pays 1.5% of its aggregate revenue.[152]

Finally, the Contribuição para o Financiamento da Seguridade Social (COFINS, translated as "contribution for the funding of social security") is a tax collected for social security purposes.[153] Until December 23, 2013, the COFINS credit for blenders was about $0.024 per gallon.[154] For a gasoline producer, COFINS requires 23.44% of the producer's aggregate revenue,[155] while for an ethanol producer the figure is 6.9%.[156]

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149. *PIS-Programa de Integração Social*, CAIXA, http://www.caixa.gov.br/voce/social/beneficios/pis/ (last visited Feb. 20, 2014).

150. Decreto No. 6.573, de 19 de Setembro de 2008, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 22.9.2008 (Braz.) (listing under the stricken article 3(I) the amount of R$3,21 per m^3); *Cubic Meters to Gallons*, METRIC CONVERSIONS, http://www.metric-conversions.org/volume/cubic-meters-to-gallons.htm (last updated Feb. 8, 2013); *Convert United States Dollar to Brazilian Real*, THEMONEYCONVERTER.COM, http://themoneyconverter.com/USD/BRL.aspx (last visited Feb. 28, 2014) (reset "From USD to BRL" to "From BRL to USD" in the middle box).

A motor fuel trade association executive explained that the government decided that the blender's credit would not have an effect after May 2013. *Decreto Zera Crédito de PIS/Cofins na Aquisição de Álcool à Gasolina*, RURALBR AGRICULTURA (Dec. 24, 2013, 12:50 PM), http://agricultura.ruralbr.com.br/noticia/2013/12/decreto-zera-credito-de-pis-cofins-na-aquisicao-de-alcool-a-gasolina-4373642.html [hereinafter *Decreto Zera*].

151. Lei No. 9.718, de 27 de Novembro de 1998, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 28.11.1998 (Braz.) (listing under article 4(I) that the amount is 5.08%).

152. *Id.* (listing under article 5(I) that the amount is 1.5%).

153. Under Brazil's Federal Constitution, "social security" includes health and social welfare. *COFINS*, MASTERCLASS BRAZIL, http://masterclassbrazil.com/managing-a-business-in-brazil/taxes/cofins/ (last visited Feb. 28, 2014).

154. *See supra* note 150 (citing to the decree article that lists the stricken COFINS credit as R$14,79 and relevant Internet sources to convert the listed figures). Similar to the PIS/PASEP blender's credit, the COFINS blender's credit had not been in effect since May 2013. *Decreto Zera*, *supra* note 150.

155. Lei No. 9.718, de 27 de Novembro de 1998, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 28.11.1998 (Braz.) (listing under article 4(I) that the amount is 23.44%).

156. *Id.* (listing under article 5(I) that amount is 6.9%).

2. Environmental Effects

The environmental effects of the sugarcane ethanol industry touch on at least four areas—GHG emissions, air pollutant emissions, land use, and biodiversity.[157]

When compared to corn ethanol and gasoline, sugarcane ethanol emits the lowest amount of GHGs. Unlike corn ethanol plants, which are usually powered by nonrenewable sources, such as coal or natural gas, Brazil's sugarcane ethanol plants are mainly powered by renewable sources, such as hydroelectricity.[158] Both the U.S. federal and state policies recognize sugarcane ethanol as raising fewer GHG-emission concerns than corn ethanol. According to EISA, sugarcane ethanol—not corn ethanol—is defined as an "advanced biofuel."[159] EISA recognizes that sugarcane ethanol achieves a lifecycle GHG-emission displacement half that of gasoline.[160] California—the state "in the vanguard of efforts to protect the environment"[161]—determined that the average Brazilian sugarcane ethanol production process emitted a lesser amount of GHGs than the U.S. corn ethanol process.[162]

Yet, observers note that sugarcane ethanol production in Brazil is imperfect. Brazil is still in the process of abating a decades-old practice of clearing land by fire.[163] In Brazil, farmers burn sugarcane fields twice a year before manual harvesting,[164] but the burning would be unnecessary if the farmers mechanized the harvesting process.[165] Unsurprisingly, the manual harvesting practice emits large amounts of carbon dioxide,[166] the main GHG linked to climate change.[167] While the Brazilian federal and state governments have taken measures to increase mechanization, the mandated

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157. Yet, the sugarcane ethanol industry is criticized for human rights violations. *E.g.*, Dos Santos, *supra* note 117, at 88–91.

158. Rocky Mountain Farmers Union v. Corey, 730 F.3d 1070, 1096 (9th Cir. 2013).

159. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, § 201, 121 Stat. 1492, 1519.

160. *Id.*

161. *Rocky Mountain Farmers Union*, 730 F.3d at 1078.

162. *Id.* at 1110.

163. VALDES, *supra* note 14, at 28–29.

164. Dos Santos, *supra* note 117, at 82.

165. VALDES, *supra* note 14, at 28.

166. *Id.*

167. Massachusetts v. EPA, 549 U.S. 497, 504–05 (2007).

mechanization adoption rate by 2014 is 40%, and only by 2017 will the rate become 100%.[168]

The effect of sugarcane ethanol on air quality has been mixed. On the one hand, ethanol use contributed to lower air pollutant emissions in many Brazilian cities.[169] On the other hand, some commentators argue that ethanol production increased air pollutant emissions in rural areas. Not only does the burning of sugarcane raise GHG emission issues, but studies showed a relationship between the aerosol particles from burning sugarcane and respiratory ailments among rural residents.[170] These ailments have a higher impact on younger and elderly residents.[171]

The environmental threats to biodiversity in Brazil relate to Brazil's Amazon and Cerrado regions. Some commentators downplay the concern that the Amazon could be cleared for sugarcane fields because the land's climate is not favorable to sugarcane cultivation,[172] and the Brazilian Forest Code (BFC) requires eighty percent of the region to be unaltered.[173] Still, the literature posits that the risks of deforestation in the region are not unfounded. First, even if sugarcane production in the region were unlikely to occur, industries and population displaced by the sugarcane ethanol industry could migrate to the Amazon.[174] Second, enforcement of the BFC is likely to be imperfect.[175]

Indeed, in the Cerrado region, many of the concerns associated with the Amazon have already occurred. The Cerrado is located in the Center-West[176] and contains a wooded savanna with an endangered ecosystem.[177] From the 1960s to the early 1990s, the Brazilian government fostered several agricultural development programs in the Cerrado, which

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168. VALDES, *supra* note 14, at 28–29.

169. Dos Santos, *supra* note 117, at 80.

170. *Id.* at 83.

171. *Id.* at 83–85.

172. Cassuto & Gueiros, *supra* note 4, at 493.

173. Calfucoy, *supra* note 11, at 589.

174. Cassuto & Gueiros, *supra* note 4, at 493.

175. *Id.* at 494 ("[E]nforcement of [the BFC] presents significant challenges . . . where the vastness of the [Amazon] and the difficulties of assessing remote areas pose significant obstacles . . . .").

176. *Id.*

177. Mann & Hymel, *supra* note 6, at 55 n.84 ("[The Cerrado] host[s] an estimated 160,000 species of animals and plants, many threatened with extinction.").

benefitted soybean and oilseed production and, in turn, freed land for sugarcane ethanol production in the Southeast and South.[178] Under the BFC, thirty-five percent of the Cerrado is reserved.[179] Yet, like the enforcement of the BFC in the Amazon, the enforcement of the BFC in the Cerrado may be imperfect.[180]

In addition to endangerment of biome by indirect expansion into the Amazon and the Cerrado, growing sugarcane raises land use concerns of soil erosion and water depletion. While some commentators conclude that the effect of soil erosion in sugarcane fields is widespread, others claim there are "conflicting reports" as to the actual risk of soil erosion.[181] Regarding water depletion, the main concern of environmental advocates is that sugarcane ethanol plants produce wastewater that could threaten rural communities and Brazil's interior.[182]

These environmental findings suggest that many of Brazil's legal and environmental characteristics are unique to the sugarcane ethanol industry, but a question remains whether these characteristics can be assimilated elsewhere.

II. THE BRAZILIANIZATION OF CELLULOSIC ETHANOL: THE ENVIRONMENTAL BENEFITS OF EMULATING THE BRAZILIAN ETHANOL TAX BENEFITS

A. THE LESSONS FROM BRAZIL

An extensive literature has examined Brazil's sugarcane ethanol policies with the purpose of improving the United States' ethanol policies; however, while some authors come away with prescriptive recommendations, others conclude that there is little the United States can learn.[183]

1. Lessons of Hope

The recommendations in most articles focus on policies affecting the corn ethanol industry, either directly or indirectly. The recurring recommendations argue for increased

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178. VALDES, *supra* note 14, at 22.
179. Calfucoy, *supra* note 11, at 589.
180. Cassuto & Gueiros, *supra* note 4, at 494.
181. Dos Santos, *supra* note 117, at 85.
182. *Id.*
183. *But see* Powers, *supra* note 13, at 707 (suggesting that the U.S. biofuels policy could "serve as a model for biofuels laws in other countries").

government financial support and for general policies favoring biofuels.[184] Other recommendations support spurring the overall corn ethanol market.[185] One commentator suggests that any one policy recommendation does not necessarily preclude others; she advises that many policies be implemented in concert.[186]

Several commentators underscore the Brazilian government's investment-heavy policies, primarily when the sugarcane ethanol industry was nascent, to infer that the U.S. government should also offer munificent aid to corn ethanol producers and distributors.[187] For the producers, government financial support could take the form of direct loans to companies[188] or support through securing ethanol prices.[189] For distributors, support could help develop ethanol supply infrastructure.[190] One such kind of infrastructure is to encourage gas station operators to build E85 pumps[191] because all Brazilian gas stations must offer, at minimum, E85.[192]

Some commentators find that Brazil's sugarcane ethanol success story does not necessarily translate in the United States into identical policies for corn ethanol. Rather, the lessons from Brazil showed that the U.S. government should spur biofuels generally.[193] These commentators suggest that other biofuels, such as biodiesel,[194] could be conscripted to supplement corn ethanol.[195] A related approach is to enact legislation to encourage more efficient biofuel production.[196] The adherents of this approach suggest that efficient biofuel

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184. *See infra* text accompanying notes 187–92.

185. *See infra* text accompanying notes 193–97.

186. Potter, *supra* note 6, at 350.

187. *E.g.*, Barbera, *supra* note 12, at 47.

188. *Id.* at 45, 47 & n.156.

189. *Id.* at 45–46, 47 & n.156.

190. Mann & Hymel, *supra* note 6, at 55.

191. Potter, *supra* note 6, at 346.

192. Mann & Hymel, *supra* note 6, at 55 ("[A]ll Brazilian gas stations are required to offer at least E85 ethanol [sic].").

193. *See id.* ("Brazil's experience offers some insight on how the United States might produce biofuels more efficiently and support biofuel use more effectively.").

194. Potter, *supra* note 6, at 348 & n.129.

195. *Cf.* Mann & Hymel, *supra* note 6, at 78 ("[T]he attention on ethanol may distract researchers from developing new energy possibilities.").

196. *Id.* at 55.

production could be measured in terms of energy production per unit of fossil fuel input or ethanol production per acre.[197]

Finally, a third kind of policy outlook addresses ethanol market forces other than ethanol production or distribution. One commentator prescribes that the government mandate automobile manufacturers to increase the efficiency of automobiles that are partly fueled by ethanol.[198] Another commentator argues that effective ethanol policies require collaboration between the government and private industries in advancing common energy goals.[199] Other commentators, in light of Brazil's high gasoline taxes,[200] suggest that the United States also increase its taxes on ethanol's competitor—gasoline.[201]

2. Lessons of Despair[202]

Scholars who examined Brazil's federal ethanol policies and concluded that the United States would be unable to replicate Brazil's success rest this conclusion on three grounds. First, the United States cannot overcome the various advantages of producing ethanol with sugarcane over those with corn.[203] Second, the United States cannot replicate the Brazilian political regime when the major sugarcane ethanol policies were implemented.[204] Third, reforming the U.S. ethanol distribution system poses an insurmountable barrier.[205]

Scholars observe that, in comparison to the United States, Brazil possesses several comparative advantages for producing ethanol. In making this observation, scholars presume that the

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197. *Id.* at 53.

198. Potter, *supra* note 6, at 350. Potter acknowledged that the federally-mandated Corporate Average Fuel Economy (CAFE) standards are a step in the right direction, but she supported even higher CAFE standards. *Id.* at 340 n.75, 350.

199. Barbera, *supra* note 12, at 46; *cf.* Calfucoy, *supra* note 11, at 589. Calfucoy examined Brazil's sugarcane ethanol experience to propose a renewable motor fuel development model for developing countries. *Id.* at 563. She argued that the primary reason for Brazil's ethanol advances is due to private and public sectors working together for environmental sustainability goals. *Id.* at 593.

200. *See, e.g.*, *supra* text accompanying notes 150–52.

201. Mann & Hymel, *supra* note 6, at 55.

202. Cassuto & Gueiros, *supra* note 4, at 496 ("[R]eproducing Brazil's ethanol success in the United States would be virtually impossible.").

203. *See infra* text accompanying notes 206–08.

204. *See infra* text accompanying notes 209–12.

205. *See infra* text accompanying notes 213–14.

United States will produce corn ethanol[206] and not cellulosic ethanol. The advantages listed by these scholars include features related to growing sugarcane and producing sugarcane ethanol. Because of Brazil's favorable climate for sugarcane, ample fertile land, and cheap labor supply, growing sugarcane to fuel Brazil's ethanol production is not taxing.[207] In producing ethanol, Brazil can accomplish its task at a lower cost by using less energy and by placing less strain on farming.[208]

Scholars then argue that the United States could not implement successful ethanol policies unless it was ruled under a dictatorship. These scholars mean that the democratic process frustrates centralized government action to spur ethanol, such as fixing prices, and compelling gas stations to carry ethanol.[209] Since Brazil established a democratic government, these scholars surmise that even Brazil would currently be unsuccessful at incubating a new biofuel.[210] Another commentator seems to tacitly concede this argument.[211] She argues that the United States' governing arrangement is unfavorable to incubating a new biofuel: "In a constitutional republic, the decision-making process . . . is slow and cumbersome."[212]

Finally, scholars describe the U.S. ethanol distribution case as a classic catch-22 scenario. This view takes the position that widespread ethanol distribution through installation of pure ethanol pumps is crucial to developing the ethanol market.[213] Yet, U.S. stations are less likely to offer pure ethanol if fewer drivers own FFVs, and drivers are less likely to purchase FFVs if few stations offer pure ethanol.[214]

3. The Whole Curriculum

On the specific issue of whether Brazil's sugarcane ethanol industry tax benefits should, for environmental reasons, encourage the United States to enact similar tax benefits for

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206. Cassuto & Gueiros, *supra* note 4, at 497–98.
207. Potter, *supra* note 6, at 347.
208. Cassuto & Gueiros, *supra* note 4, at 497.
209. *Id.* at 496–97.
210. *Id.* at 497.
211. *See* Potter, *supra* note 6, at 345–47 (highlighting a relationship between political systems and effectiveness of ethanol policies).
212. *Id.* at 345.
213. Cassuto & Gueiros, *supra* note 4, at 497.
214. *Id.*

cellulosic ethanol, the academic literature provides some helpful, but also less helpful insight.

The more helpful literature addresses the topic of cellulosic ethanol tax benefits directly and indirectly. More directly, the commentators favor the development of biofuels other than corn ethanol,[215] and cellulosic ethanol fits the bill. Granted, the cellulosic ethanol industry is still inchoate,[216] but cellulosic ethanol does not need to necessarily supplant corn ethanol. Cellulosic ethanol still could help supplement the ethanol market. Furthermore, especially in terms of environmental impact, cellulosic ethanol has the potential to be greener.[217]

More indirectly, commentators suggest that Brazilian ethanol policies cannot be implemented wholesale in the United States, because these commentators underscore major differences between the United States and Brazil. For example, a few commentators observe that the success of sugarcane ethanol policies was due to the dictatorship regime that initiated these policies.[218] In contrast, democratic leadership can only accomplish certain policies after more deliberation.[219] Thus, these differences suggest that replicating Brazilian ethanol policies does not necessary produce identical results. The United States may lack some dispositive features—such as a dictatorship—which make some Brazilian policies ineffective when applied to the United States.

Another insight less directly related to cellulosic ethanol tax benefits that can be gleaned from the scholarship is that Congress has the option of formulating a variety of cellulosic ethanol policies. Alternatives to tax benefits include incentives to build E85 gas pumps[220] and policies aimed at increasing the efficiency of biofuel production.[221]

The less helpful literature recommends policies that tend to underestimate the complexities of the U.S. ethanol market in three ways. First, recommendations for higher investment in the ethanol market seem to reinvent a wobbly wheel. Historically, higher investment has not necessarily translated

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215. *See supra* notes 193–95 and accompanying text.

216. *See supra* text accompanying note 100.

217. *See, e.g.*, *supra* text accompanying notes 111–13 (listing that growing cellulosic biomass can have land use benefits when compared to growing corn).

218. *See* text accompanying notes 209–12.

219. *See* text accompanying note 212.

220. *See* text accompanying notes 190–92.

221. *See* text accompanying notes 196–97.

into intended results. Since 2000, the U.S. federal government has funded research for biofuels.[222] The recommendation also fails to take into account that the costs to the government could be wasted. Especially for corn ethanol incentives,[223] studies suggest that the United States has not been successful in reaping the benefits in the areas of energy independence and GHG emissions.[224]

Second, recommendations for establishing public-private collaborations to spur ethanol are unlikely to materialize in practice because the U.S. political system is likely to defeat the establishment of such collaborations. Scholars already have argued that there is government favoritism toward a few agribusinesses.[225] Even when the American Taxpayer Relief Act of 2012 passed tax incentives for cellulosic ethanol, the minority of the Senate Finance Committee Report censured the majority for "extend[ing] too many [provisions] that have little to do with sound tax policy and are actually harmful, market-distorting subsidies."[226] Out of the majority's nearly 100-page report,[227] the minority only singled out the "subsidizing of so-called 'green energy'" as an example.[228] As such, if a legislator were indeed to submit a bill of public-private ethanol projects, the other legislators could find the bill to be a sweetheart deal and these legislators could vote against the bill. Indeed, even if the fear of favoritism were unfounded, the mere perception that the collaboration signals preferential treatment could be a kiss of death for a bill.[229]

Third, the recommendations that advanced biofuels can come to substitute for corn ethanol if only the government were to take actions to bring them into fruition, are more

222. *See supra* text accompanying note 82 (noting the existence of the Biomass Research and Development Act of 2000).

223. *See supra* text accompanying notes 35–40 (listing the tax incentives for corn ethanol production).

224. *See, e.g.*, Mann & Hymel, *supra* note 6, at 77 & n.245 ("Since first enacted, U.S. tax incentives for ethanol production have . . . encouraged increased ethanol fuel production. However, increasing production of corn-based ethanol will not be effective in achieving the broader goals of energy security or reductions in GHG emissions."); *supra* text accompanying notes 38–40 (listing the tax incentives for corn ethanol production).

225. *See supra* text accompanying note 57.

226. S. REP. NO. 112-208, at 112 (2012).

227. *See id.* at 1–3 (listing the contents section of the committee report).

228. *Id.* at 112.

229. *Cf. supra* note 212 and accompanying text (describing the U.S. government decision making as "slow and cumbersome").

misconceived than visionary. Cellulosic ethanol policies illustrate this misconceived understanding in two notable ways. As early as 2006, Congress enacted tax benefits for cellulosic ethanol.[230] Yet the first commercial-scale cellulosic ethanol production only came about seven years later.[231] Indeed, Congress's 2012 adjustment of the tax benefits pertaining to cellulosic ethanol implies that Congress's 2006 expectations of biofuels were misguided. The Senate Finance Committee majority reported that these adjustments to the Internal Revenue Code (IRC) would foster technological development.[232] If these senators knew what kind of tax provisions could successfully foster the development of various biofuels, they would likely have enacted them years ago.

The course of the RFS for cellulosic ethanol is nearly parallel to that of the tax benefits. Since 2005, Congress created the RFS for cellulosic ethanol, which aspired that, by 2012, there would be half a billion gallons of commercial cellulosic ethanol.[233] In addition, Congress created in the RFS a safety valve where the EPA could lower the congressional mandates.[234] Since cellulosic ethanol only became commercially viable in 2013,[235] the RFS shows that congressional mandates were overoptimistic, and Congress was aware of its overoptimism.[236]

B. DIFFERENCES AND SIMILARITIES BETWEEN THE U.S. AND BRAZILIAN ETHANOL TAX BENEFITS

Though scholars and commentators have produced extensive literature on the broader issue of the relevance of Brazil's ethanol policies to U.S. ethanol policies, none of that literature is limited to the scope of sugarcane and cellulosic ethanol industries' tax benefits. This Section compares and contrasts the tax benefits in order to tease out the topic.

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230. *See supra* text accompanying note 93.
231. *See supra* text accompanying note 100.
232. *See supra* text accompanying note 95.
233. *See supra* text accompanying notes 86–88.
234. *See supra* text accompanying note 91.
235. *See supra* text accompanying notes 1–2.
236. *Cf.* Am. Petroleum Inst. v. EPA, 706 F.3d 474, 476 (D.C. Cir. 2013) ("Recognizing the technological challenges, Congress provided for the possibility that actual production would fall short of the stated requirements.").

1. How the U.S. Cellulosic Ethanol Tax Benefits Differ from the Brazilian Sugarcane Tax Benefits

The U.S. and Brazilian ethanol tax benefits differ in their (1) scope; (2) expiration date; (3) tax benefits' relationship to gasoline taxes; (4) the information the benefits offer about tax revenue; and (5) the blender's credit. Unlike the U.S. tax benefits, which apply to biofuels other than cellulosic ethanol,[237] the Brazilian tax benefits provisions are limited to ethanol.[238]

The U.S. and Brazilian ethanol tax benefits also differ in that only the U.S. tax benefits have an end date. In the United States, the bonus depreciation provisions expired on January 1, 2014, and the blender's credit expired on December 31, 2013.[239]

Further, unlike the United States, the Brazilian tax codes provide, facially, a discrete tax treatment for gasoline and ethanol. And this discrete treatment is not de minimis. In Brazil, the gasoline producers are taxed at least three times more than the ethanol producers.[240]

Fourth, Brazilian ethanol tax benefits offer more information than the U.S. ethanol tax benefits, especially about the tax revenue expenditures. In the United States, the IRC provisions that benefit cellulosic ethanol only give information about the kind of taxpayer or source to which the provision applies. For example, the cellulosic biofuel blender's credit, now the second-generation biofuel blender's credit, only informs the taxpayer who or what kind of source the code addresses.[241] In contrast, the Brazilian ethanol blender's credit mentions the kind of taxpayer—whether producer, importer, or distributor—and the use of the collected revenue—whether for pensions,

237. *See, e.g.*, *supra* note 98 (explaining that the American Taxpayer Relief Act nested cellulosic ethanol under "second generation biofuel").

238. In fact, the Brazilian revenue codes use the terms "álcool estílico combustível" (ethyl alcohol fuel), Lei No. 10.636, de 30 de Dezembro de 2002, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 31.12.2002 (Braz.), and "álcool" (alcohol), Lei No. 9.718, de 27 de Novembro de 1998, DIÁRIO OFICIAL DA UNIÃO [D.O.U.] de 28.11.1998 (Braz.), but, in effect, the codes apply only to ethanol. *See* Cassuto & Gueiros, *supra* note 4, at 490 (stating that there are "significant tax incentives for ethanol production in Brazil").

239. *See supra* notes 94, 98 and accompanying text.

240. *See supra* text accompanying notes 153, 155–56 (explaining that the COFINS for a gasoline producer is 22.44%, while for an ethanol producer it is 6.9%).

241. *See supra* text accompanying note 96.

social security, etc.[242] In the United States, while reports from congressional committees may offer some insight into the main aims for the tax legislation, these reports are silent as to how the federal government will spend the tax revenue.[243]

Finally, though only the United States provides tax credits for producers that blend ethanol with gasoline,[244] the difference between Brazil and the United States is a bit more complex. Brazil only repealed its blender's credit late in 2013.[245]

2. What the Tax Benefits Have in Common

The U.S. and Brazilian tax benefits have two features in common: (1) potential benefits for each country's own workforce; and (2) the context of a larger umbrella of policies favoring ethanol production. Both the United States and Brazil enacted their respective tax benefits taking into consideration their national workforces. In the United States, the Senate Committee Majority explained that one of the reasons for the majority's changes to the ethanol plant bonus depreciation provisions was to "creat[e] manufacturing jobs in the United States."[246] In Brazil, the tax revenue collected under the PIS/PASEP is spent on pensions of business and government employees.[247] The PIS/PASEP's relationship to funding of pensions is further complicated because, in effect, gasoline producers subsidize the ethanol producers' contributions to the pensions. Compared to the gasoline producers, ethanol producers have a lighter PIS/PASEP tax burden because a PIS/PASEP of a gasoline producer is three times higher than that of an ethanol producer.[248]

Additionally, in both countries, tax benefits are only a carrot in a larger basket of policies affecting ethanol production. For example, in addition to tax benefits, both the

242. See *supra* notes 149, 153, and accompanying text for information about the uses of PIS/PASEP and COFINS, respectively.

243. *E.g.*, S. REP. NO. 112-208, at 96 (2012) ("The Committee acknowledges that encouraging manufacturing of biofuels in the United States is important for fostering innovative new technology, encouraging energy independence, and creating manufacturing jobs in the United States.").

244. *See supra* text accompanying notes 96–98.

245. *See supra* text accompanying notes 150, 154.

246. S. REP. NO. 112-208, at 96.

247. *See supra* text accompanying note 149.

248. *See supra* text accompanying notes 150–52.

United States and Brazil mandate that ethanol be blended with gasoline.[249]

C. Environmental Effects

Tax benefits that spur ethanol production in the United States and Brazil have the likelihood of impacting these countries' environment, and these environmental impacts can be considered in the areas of GHG emissions, biodiversity, land use, and possibly air pollutant emissions.

1. Greenhouse Gas Emissions

When sugarcane ethanol production is placed next to cellulosic ethanol production, it is unclear which kind of ethanol emits less GHGs because many questions about the future of cellulosic ethanol production remain unanswered. Sugarcane ethanol production is recognized as emitting a low amount of GHGs,[250] and the production is in the process of emitting less.[251] On the one hand, cellulosic ethanol industry executives claim that cellulosic ethanol plants use few GHG-intensive sources,[252] and, assuming that cellulosic biomass would be made up of native grasses, one could surmise that growing native grasses will raise fewer GHG emission concerns than sugarcane ethanol production.[253]

On the other hand, if cellulosic ethanol biomass were to mainly be made up of corn stover and nonnative plants,[254] cellulosic ethanol may not trump sugarcane ethanol. If cellulosic ethanol plants were to primarily use corn stover, cellulosic ethanol production's emission of GHGs could be significantly higher than the sugarcane ethanol production emissions. First, corn stover may require increased use of

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249. *Compare supra* text accompanying notes 86–89 (explaining the RFS program in the United States), *with supra* text accompanying notes 141–43 (explaining the mandated blending rates in Brazil). Yet, despite these mandates, the scheme of the U.S. and Brazilian mandates and the countries' other ethanol production incentives are not identical. Further scholarship could examine the effect of the differences on the countries' ethanol industries.

250. *See supra* text accompanying notes 158–62.

251. *See supra* text accompanying notes 163–68 (summarizing the harms of the harvest-burning practice and the Brazilian government initiatives to address those harms).

252. *See supra* text accompanying note 102.

253. *See supra* text accompanying note 103.

254. *See supra* text accompanying notes 104, 106.

fertilizers.[255] In addition, corn stover could implicate some of the same GHG emission concerns as corn ethanol,[256] such as global indirect land use changes.[257] Finally, growing nonnative plants is energy intensive.[258]

2. Biodiversity

The differences between the environmental effects of cellulosic and sugarcane ethanol on biodiversity are inconclusive for at least two reasons. The effects depend on the kind of cellulosic biomass the ethanol plants will use, and the real facts of sugarcane ethanol's threat to Brazil's Amazon and Cerrado regions.

While current cellulosic biomass may not threaten plant and animal species,[259] prospective cellulosic biomass may not be so forgiving. Not only could some cellulosic biomass cultivars become evasive, but the current regulatory scheme allows biomass to grow in Conservation Reserve Program land.[260]

To further complicate the matter, in the Brazilian regions where biome protection is most needed—the Amazon and Cerrado—the protection may be lacking. That lack of protection could come about if people and industries displaced by sugarcane ethanol production[261] were to settle in the Amazon and Cerrado and authorities were to fail to enforce the relevant conservation codes.[262]

3. Land Use

While the scholarship addressing cellulosic ethanol production's effects on land use mainly considers that cellulosic raises fewer land use issues than corn ethanol,[263] these

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255. *See supra* text accompanying note 104.

256. *Cf. supra* text accompanying notes 77–78 (explaining that Midwestern corn ethanol industry actors could be spurred to adapt their plants to producing corn stover cellulosic ethanol).

257. *See supra* text accompanying notes 61–62 (detailing the course of events where (1) corn market fluctuations cause (2) decreases in the amount of land that is highly effective in sequestering GHGs).

258. *See supra* text accompanying note 106.

259. INEOS Bio and Abengoa use waste as biomass; POET uses corn cobs. Wald, *Fuel from Waste*, *supra* note 20.

260. *See supra* notes 108–10 and accompanying text.

261. *See supra* notes 174, 178.

262. *See supra* notes 175, 180 and accompanying text (discussing and citing sources that suggest that the BFC may not be properly enforced).

263. *See supra* text accompanying notes 111–13.

considerations may still help to compare cellulosic ethanol production with sugarcane ethanol production.

First, cellulosic ethanol production could be less geographically concentrated than sugarcane ethanol production. In Brazil, sugarcane fields and sugarcane ethanol plants are concentrated in the Southeast.[264] Commentators predicted in 2008 that cellulosic ethanol plants can be more dispersed.[265] The current locations of the larger U.S. cellulosic ethanol plants support the prediction because these cellulosic ethanol plants are found in several states spread out across the continental United States.[266]

Still, other observers suggest that cellulosic ethanol production could be as geographically concentrated as its sugarcane ethanol counterpart. This view predicts that Midwestern corn ethanol producers could become leading cellulosic ethanol producers by transitioning from cornstarch biomass to corn stover.[267]

Yet, even if cellulosic ethanol production were to be as geographically concentrated as sugarcane ethanol production, cellulosic ethanol production could use water more efficiently than sugarcane ethanol production. Specifically, producing cellulosic ethanol using the cellulosic biomass *miscanthus* x *giganteus* could raise fewer water use concerns than producing sugarcane ethanol.[268]

4. Possible Environmental Effects

Finally, when compared to sugarcane ethanol production, cellulosic ethanol production could emit fewer air pollutants than sugarcane ethanol. While the literature addressing the environmental effects of cellulosic ethanol production are silent as to whether the production could emit an alarming amount of air pollutants, the literature addressing sugarcane ethanol production does mention the air pollutant emission issue. Specifically, sugarcane ethanol production is related to a higher

264. *See supra* text accompanying notes 119–21.

265. *See supra* text accompanying note 111.

266. Wald, *Milestone Claimed*, *supra* note 116 (Florida); *see supra* text accompanying note 75 (Iowa and Kansas).

267. *See supra* text accompanying note 78 (citing a commentator positing that cellulosic ethanol may be mainly produced by current Midwestern corn ethanol industry actors).

268. *Compare supra* text accompanying note 114 (efficient water use), *with supra* text accompanying note 182 (water depletion).

rate of respiratory ailments among younger and older populations.[269]

D. Inspirations for the U.S. Cellulosic Ethanol Industry

To review, some of the literature addressing U.S. and Brazilian ethanol could be relevant to the U.S. cellulosic ethanol industry, the tax benefits of the United States and Brazil are somewhat different, and the United States could experience some environmental gains if it were to spur cellulosic ethanol production. A question remains: what are the tax benefits to best spur cellulosic ethanol production?

1. Proposed Changes for the Internal Revenue Code

For the United States to adopt tax benefits more like those in place in Brazil, the IRC could be changed in at least some of four ways.[270] First, the benefits could address cellulosic ethanol more explicitly, rather than addressing cellulosic ethanol by lumping it along with other advanced fuels.

Second, Congress could eliminate the present tax benefits' sunset provisions, rather than just extending the provisions' dates through subsequent amendments.

Third, Congress could draft provisions where cellulosic ethanol producers receive indirect tax benefits through provisions that treat gasoline and cellulosic ethanol producers differently. For example, the IRC could have a tax benefit where gasoline producers' aggregate revenue was to be taxed at a higher rate than the aggregate revenue of cellulosic ethanol producers.[271]

Fourth, the tax benefits could offer more information about the use of the revenue collected, rather than only referring to the kind of taxpayer involved. For instance, the IRC provisions that designate cellulosic ethanol plants' depreciation bonus could indicate whether the provisions affect any specific federal funds.[272]

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269. *See supra* text accompanying notes 170–71.

270. The option for the United States to repeal its blender's credit is not completely on point because Brazil repealed its blender's credit only last December. *See supra* text accompanying notes 150, 154.

271. *See supra* text accompanying notes 151–52 (describing the Brazilian PIS/PASEP tax where gasoline producers have a higher tax rate than ethanol producers).

272. The Brazilian ethanol tax benefits relate to funds addressing government projects regarding transportation fuels and resources, employee

2. The Merits of the Proposed Changes

Adopting any one of the changes may not cause a boom in the cellulosic ethanol industry,[273] but some changes are more likely to spur cellulosic ethanol production than others.

a. Elimination of Sunset Provisions

The elimination of sunset provisions could be the most effective at spurring cellulosic ethanol production for at least two reasons. This change in tax benefits could encourage greater commitment from cellulosic ethanol producers and could attract more industry investors.[274] As the development of Brazil's sugarcane ethanol industry shows, even with some indirect government support, the ethanol industry may be driven to modernize itself.[275]

Additionally, the elimination of sunset provisions could be more effective than other cellulosic ethanol industry incentives. Unlike formal public-private collaborations, the elimination of sunset provisions is less likely to be shunned by political opponents. Opponents would be unlikely to decry that this elimination is an act of favoritism, because the government would only provide the benefits if cellulosic ethanol production occurred.[276]

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pensions, and social security. *See supra* text accompanying notes 147, 149, 153.

273. *See* Potter, *supra* note 6, at 345–51 (analyzing the developments of U.S. corn ethanol and Brazil's sugarcane ethanol to conclude that "[t]he United States is not without hope, but neither is it in an enviable position"). *But see* Cassuto & Gueiros, *supra* note 4, at 496–98 (listing reasons and expounding on why "reproducing Brazil's ethanol success in the United States would be virtually impossible").

274. *Cf.* Robert F. Service, *Is There a Road Ahead for Cellulosic Ethanol?*, 329 SCIENCE 784, 785 (2010) ("'Until the government makes it absolutely clear that [cellulosic tax benefits are] a long-term policy, investors will be reluctant to support the [cellulosic ethanol] industry.'" (quoting Sean O'Hanlon, executive director of the American Biofuels Council in Miami, Florida)).

275. *See supra* text accompanying notes 135–39 (explaining that industry drive, along with E22 mandates, and other factors, helped Brazil's ethanol industry to recover); *see also* Potter, *supra* note 6, at 336 ("[D]espite that . . . sugar and ethanol industries experienced difficult times [in the 1990s], instead of folding, both industries chose to cut costs and improve production efficiency.").

276. *See supra* text accompanying notes 225–29 (arguing that policies that require public-private collaborations will likely be killed by the political process).

b. More Information About Revenue Expenditure

The change that requires tax benefits provisions to provide more information about the use of the revenue being collected could be effective because the change could facilitate the political deliberative process. This measure would make the resulting provision more transparent, and thus, the legislators debating the provision are less likely to dispute that the expressed end result is really a pretense. In the American Taxpayer Relief Act of 2012's Senate Finance Committee, a sticking point between the majority and the minority in enacting the 2012 cellulosic ethanol tax benefits was whether the benefits would really benefit the U.S. economy and not only a few private interests.[277] Thus, if the IRC were to clarify how part of its revenue could affect a specific federal fund, such as a fund allotted for employee pensions, a group of congresspersons would be less likely to allege that the others really intend to curry favor with private interests.[278]

c. Differential Treatment of Gasoline and Cellulosic Ethanol Producers

The taxing of gasoline producers at relatively higher rates could, in theory, also spur cellulosic ethanol production because that tax measure could provide cellulosic ethanol a comparative advantage.[279] Moreover, insofar as eliminating the cellulosic tax benefits' sunset provisions could result in a shortage in tax revenue, the revenue collected from the gasoline industry could make the difference. That said, it is possible that the U.S. political deliberative process could vote off the measure of taxing one industry at a higher rate than the other because

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277. S. REP. NO. 112-208, at 112 (2012) ("The tax code should not be used as a tool for picking winners and losers, nor should it reward politically favored industries or penalize disfavored ones."); *see supra* text accompanying note 228.

278. *Cf.* Donald B. Susswein, *Managing Our Energy Addiction: A Road Map*, 115 TAX NOTES 659, 663 (2007) (proposing a tax framework to discourage gasoline use, and explaining that the framework would be acceptable to Democrats because, for example, the framework addresses climate change; and also acceptable to Republicans because, for example, the framework reduces payroll taxes).

279. *See* Service, *supra* note 274, at 784–85 (citing an economist who argued for tax benefits favoring cellulosic ethanol over gasoline because the economist viewed such benefits as an opportunity for the cellulosic ethanol industry to "become competitive and established").

legislators could perceive the measure as a blatant preferential treatment.[280]

d. Explicitly Addressing Cellulosic Ethanol

A measure that amends the tax benefits to make them more explicit so that they aim at cellulosic ethanol may not be effective in spurring cellulosic ethanol production. If the IRC bills were to benefit cellulosic ethanol expressly and not other advanced biofuels, such provisions would draw attention to the view that the sponsors or supporters only intend to favor private interests and not the American population as a whole.[281] Unfortunately, these views need not have a strong foundation in order to frustrate the enactment of the tax benefits.[282]

3. Application of the Proposed Changes to the U.S. Cellulosic Ethanol Industry

An increase in cellulosic ethanol production facilitated by adopting tax benefits akin to those ethanol benefits in place in Brazil could have meaningful environmental benefits in the United States for two reasons. First, in some ways cellulosic ethanol is environmentally on a par with the world's reigning ethanol,[283] Brazil's sugarcane ethanol. Second, increasing the production of cellulosic ethanol in the United States would have more comparative environmental benefits than the dominant ethanol in the United States,[284] corn ethanol.

Overall, the environmental effects of cellulosic ethanol production are unlikely to be more detrimental than those of sugarcane ethanol production. Cellulosic ethanol production most likely raises fewer land use concerns than sugarcane

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280. *See* Klass, *Tax Benefits*, *supra* note 10, at 14 (discussing the prevalence among economists of taxing "fossil fuel productions," noting the merits of the tax approach, but concluding that "there does not appear to be any appetite in Congress for a fossil fuel" tax); *cf. supra* text accompanying notes 225–29 (discussing the legislature's rejection of a bill favoring one industry over other industries, but in the agribusiness context).

281. *Cf. supra* text accompanying notes 56–57 (describing commentary that implicated corn ethanol production in special interests in policymaking).

282. *Cf. supra* note 212 and accompanying text (describing the U.S. government decision making as "cumbersome").

283. *See supra* note 6 and accompanying text (listing reasons why sugarcane ethanol is perceived as successful).

284. *See supra* text accompanying notes 21–24.

ethanol production.[285] Additionally, even if cellulosic ethanol production does not fare better than sugarcane ethanol production in terms of lower GHG emissions, fewer threats to biodiversity, and air pollution emissions, the literature does not conclude that cellulosic ethanol production is worse.[286]

Even if the overall environmental benefits of cellulosic ethanol production could not surpass those of sugarcane ethanol, cellulosic ethanol would still fare better than corn ethanol.[287] The comparative environmental gains of cellulosic ethanol production over that of corn ethanol apply to GHG emissions,[288] land use concerns,[289] and potentially air pollutant emissions.[290]

CONCLUSION

A society reliant on motor fuel should not expect to fill up its gas tank at the expense of the environment. The United States' reliance on motor fuel raises the concern of whether motor fuel could be produced while placing a lesser strain on the environment. While the United States already has an established corn ethanol industry that is a player in the motor fuel mix, corn ethanol is not regarded, especially in terms of environmental impact, as being on the same level playing field as Brazilian sugarcane ethanol. Recently, the cellulosic ethanol industry emerged as a potential fuel in the U.S. motor fuel market. Therefore, the cellulosic ethanol's emergence raises an

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285. *See supra* text accompanying notes 263–68.

286. *See supra* text accompanying notes 250–60, 269.

287. This proposition assumes that cellulosic ethanol's environmental impact is not being compared against imported sugarcane ethanol. *See generally* Rocky Mountain Farmers Union v. Corey, 730 F.3d 1070, 1080–85 (9th Cir. 2013) (explaining California's Fuel Standard, which seeks to measure the total carbon intensity of different varieties of domestic and foreign ethanol).

288. *Compare supra* text accompanying notes 58–62 (describing several studies that note that corn ethanol is ineffective in reducing GHG emissions), *with supra* text accompanying notes 102–06 (describing studies that show a mixed view on the effectiveness of cellulosic ethanol in reducing GHG emissions).

289. *See supra* text accompanying notes 111–13 (pointing to ways cellulosic biomass raises fewer land use concerns than corn).

290. *Compare* text accompanying notes 63–68 (suggesting that corn ethanol may not be effective in combating air pollution), *with* text accompanying note 269 (stating that literature on cellulosic ethanol production is silent as to whether the production could emit alarming amounts of air pollutants).

issue of whether the cellulosic ethanol industry could learn some lessons from the Brazilian sugarcane ethanol industry model.

An inquiry into Brazil's sugarcane ethanol industry tax benefits sheds light on several ways Congress could change the cellulosic ethanol industry tax benefits, which could ultimately result in significant environmental gains. The past scholarship has not specifically examined Brazil's sugarcane ethanol industry tax benefits, or recognized the United States' cellulosic ethanol industry as a potential market player. Yet, after probing into the relevant Brazilian tax benefits, there emerge several ways that U.S. tax benefits could be changed when addressing the cellulosic ethanol industry, such as the elimination of sunset provisions and providing more information about revenue expenditures. These tax-benefits changes would result in an increase in the production of cellulosic ethanol, which, especially when compared to the more established corn ethanol, would result in significant environmental benefits.