COMMENT

FRANKENFUEL: GENETICALLY MODIFIED CORN, ETHANOL, AND CROP DIVERSITY

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I. INTRODUCTION

In his 2007 State of the Union Address, President George W. Bush called for a twenty percent decrease in gasoline usage over the next ten years.[1] Central to this proposal was a mandatory fuel standard requiring thirty-five billion gallons of renewable and alternative fuel by 2017.[2] Increased, corn-based, ethanol production was likely to be the primary medium used to meet this goal, as evidenced by its prominence in the creation of the Renewable Fuel Standard

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1. President George W. Bush, State of the Union Address (Jan. 23, 2007) *available at* http://www.whitehouse.gov/news/releases/2007/01/20070123-2.html.

2. *Id.*

Program (RFS)[3] and introduction of two bills addressing energy independence and support of farmers who grow crops necessary for ethanol production.[4]

Much has changed since the 2007 State of the Union. The RFS has now been in effect for over a year, the two bills have become law, fossil fuel prices have gone on dramatic rollercoaster ride,[5] world economies have crumbled,[6] and the United States has a new president. What has remained is corn-based ethanol.[7]

Support for ethanol produced through traditional, corn-based methods, has not waned since the 2007 State of the Union,[8] but neither has development of ethanol produced from cellulosic biomass and feedstock slowed. However, widespread production of ethanol from cellulosic sources is in its infancy.[9] Corn remains the primary crop used to produce ethanol in the United States;[10] subsidies for farmers who choose to plant corn for the production of ethanol have been increased.[11] These increased subsidies encouraging farmers to plant more corn have potential long term consequences that have not been fully addressed.

This comment focuses on the impact of planting greater amounts of genetically modified corn for ethanol production, and its potentially serious, and

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3. Regulation of Fuels and Fuel Additives: Renewable Fuels Standard Program; Final Rule, 72 Fed. Reg. 23,900 (May 1, 2007) (to be codified at 40 C.F.R. pt. 80) [hereinafter RFS] (This program was promulgated by the Environmental Protection Agency (EPA), and became effective on September 1, 2007).

4. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492 (2007) [hereinafter Energy Independence Act of 2007]; Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-234, 122 Stat. 923 (2008) [hereinafter 2008 Farm Bill].

5. Ana Campoy, *Gasoline Pump Prices Drift Upward: Consumers See Rise for the First Week in Months, but Further Drops Are Expected*, WALL ST. J., Dec. 19, 2008, at B2.

6. Neil Shah, *Year-End Review of Markets & Finance 2008: Global Markets Are in for Another Tough Slog: European Economy Promises More Pain; 'Going to See New Lows,'* WALL ST. J., Jan. 1, 2009, at R4.

7. While on the campaign trial, both Senator John McCain and then-Senator Barack Obama expressed that ethanol production was a primary means of extricating the US from the contemporary energy crisis, albeit Senator McCain to a lesser extent. John M. Broder, *Energy*, N.Y. TIMES, Oct. 26, 2008, at WK6. Now President Obama has vocalized, through words during the presidential campaign, and his actions following his election, support for ethanol as a primary means of combating the myriad problems of fossil fuels. Larry Rohter, *Obama Camp Closely Linked with Ethanol*, N.Y. TIMES, June 23, 2008, http://www.nytimes.com/2008/06/23/us/politics/23ethanol.html. During the Iowa caucuses President Obama stated that domestic ethanol production, amongst other things "'helps our national security.'" *Id.* The appointment of former Iowa Governor Tom Vilsack as Secretary of Agriculture and Senator Ken Salazar as Secretary of the Interior, both strong proponents of corn-based ethanol, evidence President Obama's continued support for domestically produced ethanol. Ian Swanson, *Obama's Ethanol Dream Team*, THEHILL.COM, Dec. 17, 2008, http://thehill.com/leading-the-news/obamas-ethanol-dream-team-2008-12-17.html. Furthermore, with the appointment of Steven Chu, a Nobel Prize winning scientist now focused on the advancement of cellulosic ethanol, to the position of Energy Secretary, President Obama signaled that ethanol's future role will remain prominent. *Id.*; *see also* Kenneth Chang & Andrew C. Revkin, *At A Sleek Bioenergy Lab, A Lens on a Cabinet Pick*, N.Y.TIMES, Dec. 23, 2008, at D1.

8. Swanson, *supra* note 7.

9. David Pimentel & Tad W. Patzek, *Ethanol Production Using Corn, Switchgrass, and Wood; Biodiesel Production Using Soybean and Sunflower*, 14 NO. 1 NATURAL RESOURCES RESEARCH 65 (2005).

10. PAUL C. WESCOTT, ECON. RESEARCH SERV., US DEP'T OF AGRIC., ETHANOL EXPANSION IN THE UNITED STATES: HOW WILL THE AGRICULTURAL SECTOR ADJUST? 6 (2007).

11. Jim Lane, *US Corn Exports 6 Percent in 2007; $3 Billion Ethanol Subsidy Reduced Crop Support Payments $6 Billion, Reduced US Trade Deficit More Than $20 Billion*, BIOFUELS DIGEST, March 27, 2008, http://www.biofuelsdigest.com/blog2/2008/03/27/us-corn-exports-rose-6-percent-in-2007-3-billion-ethanol-subsidy-reduced-crop-support-payments-6-billion-reduced-us-trade-deficit-more-than-20-billion/

environmentally dangerous, long-term consequences on crop diversity. First, the state of corn and crop diversity will be addressed, with particular heed to the potential negative consequences of increased genetically modified corn cultivation. Second, government subsidies, intended to promote ethanol production, which steer farmers towards planting more corn, and their effects on genetically modified corn production will be discussed. Lastly, the ramifications of cellulosic ethanol technology and release of land set aside for conservation and overproduction prevention by the Conservation Reserve Program[12] will be examined with particular focus on crop diversity maintenance.

II. CORN AND CROP DIVERSITY

A. Potential Long-Term Negative Consequences of Genetically Modified Corn Use on Crop Diversity

U.S. corn production has significant environmental costs. Corn cultivation requires a significantly greater amount of energy, water, and fertilizers as opposed to other crops.[13] For example, corn requires more nitrogen fertilizer than any other crop.[14] The high volume of chemicals required to sustain the nation's corn crop erode the topsoil, in turn requiring more chemicals to make up for the nutrients lost through erosion.[15] The United States has lost half of its topsoil since 1960,[16] and seventy-five percent of the genetic diversity in agriculture has been eliminated over the twentieth century, in large part by loss of topsoil.[17] In the face of these statistics, we have modified our crops' genetic structure in order to maintain a high volume of agricultural production.

Much of U.S. corn has been grown from hybridized or genetically modified seeds in order to make the plant more viable in colder climates, increase yields, resistant to drought, and resistant to insects.[18] Corn production has been made more lucrative through these advances.[19] However, the use of genetically modified corn within the current U.S. corn crop, and projected increases due to ethanol production, present serious obstacles to maintaining crop diversity.

1. Crop Diversity

Genetic diversity enables crops to adapt to varied growing conditions, develop different varieties offering resistance to environmental factors like pests

12. Jared Wiesner, Comment, *A Grassroots Vehicle for Sustainable Energy: The Conservation Reserve Program & Renewable Energy*, 31 WM. & MARY ENVTL. L. & POL'Y REV. 571 (2006-2007); *see also* Alexei Barrionuevo, *The Energy Challenge: A Modern Gold Rush; For Good or Ill, Boom in Ethanol Reshapes Economy of Heartland*, N.Y. TIMES, June 25, 2006 at 11.

13. Pimentel & Patzek, *supra* note 9, at 65.

14. Andrew Martin, *Farmers Head to Fields to Plant Corn, Lots of It*, N.Y. TIMES, March 31, 2007, at C1.

15. Andrew Kimbrell, *Seven Deadly Myths of Industrial Agriculture*, *in* FATAL HARVEST: THE TRAGEDY OF INDUSTRIAL AGRICULTURE, 16 (Andrew Kimbrell ed., 2002).

16. *Id.*

17. *Id*.

18. Alexei Barrionuevo, *Crop Rotation in the Grain Belt*, N.Y. TIMES, September 16, 2006, at C1.

19. *Id*.

or drought, and alter their nutritional profile.[20] The Food and Agriculture Organization (FAO) of the United Nations (UN) identified that preserving crop diversity is a key in ensuring agricultural productivity because of its influence on food, fuel, and clothing manufacture.[21] In their report, the FAO stated that Earth's population will increase by fifty percent in the next fifty years, and that in order to provide for that dramatic increase, crop diversity must be managed in a manner that promotes productivity without reducing diversity.[22]

Crop diversity, or agricultural biodiversity, can be defined by four elements: genetic resources,[23] ecosystem services,[24] abiotic (physical) elements,[25] and human activities.[26] Human activities stand out among this group because crop diversity is, in large part, shaped by our manipulations.[27] Socio-economic and cultural dimensions are significant factors, as well as traditional and local knowledge of crops, cultural influences on crop sustainability, and the effect of tourism associated with agricultural landscapes and processes.[28] Our

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20. GLOBAL CROP DIVERSITY TRUST, WHY CONSERVE DIVERSITY, http://www.croptrust.org/main/why.php?itemid=80 (last visited Jan. 7, 2009).

21. U.N. Food & Agric. Org. [FAO], Comm. on Agric., 20th Sess., at 3 (April 25-28, 2007) *available at* ftp://ftp.fao.org/docrep/fao/meeting/011/j9289e.pdf.

22. *Id.* at 4.

23. Genetic resources for food and agriculture include. the following:

a. Plant genetic resources such as pasture and rangeland species and forest genetic resources that are an integral part of farming systems

b. Animal genetic resources, including fishery genetic resources in cases where fish production is part of the farming system

c. Microbial and fungal genetic resources.

CONVENTION ON BIOLOGICAL DIVERSITY, WHAT IS AGRICULTURAL BIODIVERSITY, http://www.cbd.int/agro/whatis.shtml (last visited Jan. 7, 2009). Domestic crops have close genetic relatives in the wild, which are important for sustaining the development of future crops. *Id.* Agricultural products worldwide have been developed, almost exclusively, through the cultivation and domestication of wild varieties. *Id*.

24. *Id.*

> [T]hese [components] include a diverse range of organisms that contribute, at various scales to:
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> a. Nutrient cycling, for example, decomposition of organic matter and the maintenance of soil fertility
> b. Pest and disease regulation
> c. Pollination
> d. Maintenance and enhancement of local wildlife and habitats in their landscape
> e. Maintenance of the hydrological cycle, including the recycling of water suitable for agricultural use and the recycling of nutrient inputs into water from agriculture
> f. Erosion control
> g. Climate regulation and carbon sequestration

Id.

25. *Id.* Light, temperature, water, atmospheric gases, wind, soil, and the nature of land surface all have determining effects on how plants develop their own unique genetic traits. *Id.*; UNIV. OF THE W. CAPE, DEP'T OF BIODIVERSITY AND CONSERVATION BIOLOGY, ABIOTIC COMPONENTS *available at* http://www.botany.uwc.ac.za/sci_ed/grade10/ecology/abiotic/abiot.htm.

26. Convention on Biological Diversity, *supra* note 23.

27. *Id*.

28. *Id*.

daily activities also have a substantial effect on how crop diversity is cultivated.[29]

2. Particular Long-Term Consequences of Increased Cultivation of Genetically Modified Corn on Crop Diversity

Gene flow from genetically modified crops into wild, native, and organic varieties, potentially eliminating those varieties,[30] is the primary long-term consequence of increased genetically modified corn cultivation for ethanol production. This issue became visible when it was reported in 2001 that corn genetically modified in the United States was discovered among native maize varieties around Oaxaca, Mexico–hundreds of miles from the U.S. border.[31] The speculation as to how the modified corn arrived in the area centered on legally imported animal feed planted illegally in the region.[32] But, this is just one method by which genetically modified crops can commingle with native varieties; others are much more mundane.

Wind moving seeds and pollen from different areas, and mills grinding crops originating from various farms are two common, wide spread methods in which genetically modified corn can infiltrate wild, or organic, varieties.[33] The biotechnology industry's internal standard dictates that coexistence between native and wild varieties is achieved if mixing is below 0.9 percent.[34] However, many environmental groups argue that the mixing percentage limit is likely to be quickly surpassed with increased genetically modified corn cultivation.[35]

According to the United States Department of Agriculture (USDA), U.S. farmers, since 1996, have steadily increased the amount of genetically modified crops that they plant.[36] The USDA has divided up the variety of genetically modified crops planted into three categories: 1) herbicide tolerant (HT,) 2) insect resistant (Bt,) and 3) stacked (a combination of HT and Bt.)[37] For corn, the

29. *Id*. Currently, there are only about 150 varieties of crops cultivated on a wide scale around the world. GLOBAL CROP DIVERSITY TRUST, WHAT IS CROP DIVERSITY, http://www.croptrust.org/main/whatis.php (last visited Jan. 7, 2009). Fifteen of those 150 (along with eight animal species) provide ninety percent of the Earth's food. Convention on Biological Diversity, *supra* note 23. The major crops are: "wheat, rice, corn [(maize)], rye barley, soybeans, common bean, white potato, sweet potato, cassava, banana, coconuts, peanuts, sorghum, and millet." BIOLOGICAL INVASIONS: ECONOMIC AND ENVIRONMENTAL COSTS OF ALIEN PLANT, ANIMAL, AND MICROBE SPECIES 3 (David Pimentel ed., CRC Press 2002) (2002). The "leading livestock species are cattle, buffalo, sheep, goats, horses, camels, chickens, and ducks." *Id.*

30. Elizabeth Malkin, *Science vs. Culture in Mexico's Corn Staple*, N.Y. TIMES, March 27, 2005, at 110.

31. COMMITTEE FOR ENVTL. COOPERATION OF N. AM., MAIZE AND BIODIVERSITY: THE EFFECTS OF TRANSGENIC MAIZE IN MEXICO (2004), http://www.cec.org/files/pdf//Maize-and-Biodiversity_en.pdf.

32. Elisabeth Rosenthal, *Questions on Biotech Crops With No Clear Answers*, N.Y. TIMES, June 6, 2006 at C4.

33. *Id*.

34. *Id*.

35. *Id*.

36. UNITED STATES DEPARTMENT OF AGRICULTURE (USDA) ECONOMIC RESEARCH SERVICE, DATA SETS, ADOPTION OF GENETICALLY ENGINEERED CROPS IN THE US: OVERVIEW, http://www.ers.usda.gov/Data/biotechcrops/ (last visited Jan. 7, 2009) (hereinafter USDA Overview).

37. *Id*.; USDA ECONOMIC RESEARCH SERVICE, DATA SETS, ADOPTION OF GENETICALLY ENGINEERED CROPS IN THE US: DATA GLOSSARY, http://www.ers.usda.gov/Data/BiotechCrops/glossary.htm (last visited Jan. 7, 2009). In 2007, the USDA began to collect data on the amount of genetically modified, or engineered,

percentage of acres in 1996 dedicated to HT or Bt corn was less than ten percent.[38] In 2008 eighty percent of the corn planted in the United States was genetically engineered.[39]

The USDA's statistics, when viewed state-by-state, illuminate an interesting trend. Over the past seven years, in the majority of the major corn producing states, the total amount of genetically engineered corn has gone from around thirty percent or less, to well over sixty percent.[40] As a whole, the percentage of genetically modified corn planted in the United States has risen forty-eight percentage points over the last seven years, currently accounting for seventy-three percent of our national corn production.[41]

Current levels of U.S. corn production, specifically the percentage stemming from genetically modified sources, have already presented national and international legal issues. With the United States being the world's largest exporter of corn, maintaining a seventy percent share of the world market,[42] it is surprising more incidents have not occurred. Examples of future issues, stemming from gene flow, or other methods, revolve around the mixing of genetic traits. Corn engineered to resist a certain kind of pest in corn, which is only approved for use in animal feed, mixing with corn that is to be consumed by humans could have potential health and safety implications.[43] The presence of genes known to be allergens, such as those in varieties of nuts, in plants where the gene is not normally expected could prove to be harmful to the person who has those food allergies.[44]

Farmers could be harmed in multiple ways by the increased cultivation of genetically modified corn. The organic farmer may have a cause of action when his corn crop is rendered valueless through the infiltration of genetically modified corn from a neighboring farm.[45] Another cause of action could arise when a farmer's corn crop is only approved only for human consumption is pollinated by corn only approved for feedstock.[46]

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crops being planted in the US through the National Agricultural Statistics Service/Economic Research Service Agricultural Resource Management Survey.

38. USDA Overview, *supra* note 36.

39. USDA ECONOMIC RESEARCH SERVICE, DATA SETS, ADOPTION OF GENETICALLY ENGINEERED CROPS IN THE US: CORN VARIETIES, http://www.ers.usda.gov/Data/biotechcrops/ExtentofAdoptionTable1.htm (last visited Jan. 7, 2009).

40. USDA Overview, *supra* note 36. The USDA lists thirteen of the largest corn producing states with the outliers being Ohio (with forty-one percent of corn planted in 2007 being genetically modified) and South Dakota (with ninety-three percent). The average amount of genetically modified corn planted among these thirteen states is seventy-three percent.

41. *Id*.

42. USDA ECONOMIC RESEARCH SERVICE, BRIEFING ROOMS, CORN: TRADE, http://www.ers.usda.gov/Briefing/Corn/trade.htm (last visited Jan. 7, 2009) (hereinafter USDA Corn Trade). Interestingly, the United States maintains the majority share of the world market with twenty percent of domestic corn yields. *Id*.

43. Thomas Conner, Comment, *Genetically Modified Torts: Enlisting the Tort System to Regulate Agricultural Contamination by Biotech Crops*, 75 U. CIN. L. REV. 1187, 1189 (2007).

44. *Id.*

45. *Id*.

46. *Id*.

3. Corn and Ethanol

Currently, corn[47] is the central crop used in the production of ethanol in the United States, with twenty percent of the 2006 corn crop (2.1 billion bushels) being used for ethanol production.[48] In 2007, farmers were projected to plant over ninety million acres of corn, a twelve million acre increase from 2006.[49] They exceeded this projection by three million acres.[50] The USDA expected the 2007 yield to be twenty-six percent larger than that of 2006,[51] this percentage was not met, but the amount of corn produced increased by three billion bushels.[52] Twenty-three percent of the 2007 U.S. corn crop was used strictly for ethanol production.[53]

According to the National Agricultural Statistics Service (NASS) corn acreage increases have not substantially reduced the total amount of land dedicated to plant wheat and soybeans over the past five years.[54] However, farmers in some states have begun to shift away from planting these crops in favor of corn.[55] For example, Kansas farmers, who have been historically prominent producers of wheat, placed a higher priority on corn production in favor of wheat.[56] As a result, Kansas' corn production in 2000 exceeded wheat production by twenty-three percent.[57]

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47. Corn, or maize, is considered a priority crop under the International Treaty on Plant Genetic Resources for Food and Agriculture. International Treaty on Plant Genetic Resources for Food and Agriculture annex 1, Jan. 11, 2002. Corn is grown in 164 countries around the world with the total world production exceeding 690 million metric tons. GLOBAL CROP DIVERSITY TRUST, PRIORITY CROPS, MAIZE, http://www.croptrust.org/main/priority.php?itemid=30 (last visited Jan. 7, 2007). In Latin America, the Caribbean, and Sub-Saharan Africa, corn makes up a third of the caloric intake in the average persons diet. *Id.*

48. NATIONAL CORN GROWERS ASS'N, UNDERSTANDING THE IMPACT OF HIGHER CORN PRICES ON CONSUMER FOOD PRICES 2 (2007), http://www.micorn.org/downloads/NCGA_Food_Prices.pdf. Although it is the central ethanol producing crop, corn is primarily used to provide livestock food with corn accounting for over ninety percent of feed grains. USDA Corn Trade, *supra* note 42. As of 2005, the cost to produce one hectare (ten thousand square meters or two-point-five acres) of corn, considering energy inputs, is $916.93 US on average. Pimentel & Patzek, *supra* note 9, tbl. 1, at 66.

49. *The Consequences of Corn*, N.Y. TIMES, April 5, 2007, at A18. The statistics for 2008 have not been totally compiled by the NASS at the publication of this article; therefore, information from the 2007 yields will be used unless otherwise noted.

50. FIELD CORN NATIONAL STATISTICS, http://www.nass.usda.gov/QuickStats/index2.jsp (last visited Jan. 6, 2009).

51. *Id*.

52. *Id*.

53. RENEWABLE FUELS ASSOCIATION, ETHANOL AND THE US CORN CROP (2008), http://www.ethanolrfa.org/objects/documents/1898/corn_use_facts.pdf.

54. NATIONAL AGRICULTURAL STATISTICS SERVICE (NASS), SOYBEANS NAT'L STATISTICS, http://www.nass.usda.gov/QuickStats/index2.jsp; NASS, WHEAT NAT'L STATISTICS, http://www.nass.usda.gov/QuickStats/index2.jsp (last visited Jan. 7, 2009).

55. Barrionuevo, *supra* note 18.

56. *Id*.

57. *Id*.

4. Example of Legal Issues Presented by the Increased Cultivation of Genetically Modified Corn for Ethanol Production: *In re* Starlink Corn Products Liability Litigation

In 2002, a group of farmers brought a class action lawsuit against Aventis, a biotech company that engineered a variety of corn called StarLink.[58] Starlink was created to make the plant toxic to certain insects.[59] The gene that Aventis had engineered into the StarLink variety of corn found its way into other varieties of corn and significantly reduced their value.[60] The gene transfer, the court speculated, most likely came from the natural processes of plant reproduction, pollination.[61] The farmers whose corn crops had been infiltrated brought claims revolving around negligence, strict liability, private and public nuisance, and conversion.[62]

The Environmental Protection Agency (EPA) noted that the genetic modification in this particular variety of corn had attributes similar to known human allergens and limited its use.[63] StarLink was, however, approved to be used for ethanol production.[64] Because of the nature of corn, and standard corn industry practices making it difficult to segregate corn crops, the EPA required the farmers who grew the StarLink variety of corn to construct a 660-foot zone around StarLink crops (among other procedures) to prevent cross-pollination, or gene flow.[65]

StarLink seed was distributed through a limited registration across the United States from May 1998 to October 2000 with a cultivation limit of 120,000 acres, which was increased to 2.5 million acres in January 1999.[66] Despite this limitation, in October of 2000 numerous food products tested positive for the StarLink genetic modification and a many food manufacturers issued recalls on their corn products.[67] On October 12, 2000 Aventis canceled the limited registration of StarLink effective February 20, 2001.[68] The court

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58. *In re* StarLink Corn Products Liability Litigation, 212 F. Supp. 2d 828, 833-834 (N.D. Ill.).

59. *Id*.

60. *Id* at 833.

61. *Id*.

62. *Id*.; *see also* Sample v. Monsanto Co., 283 F. Supp. 2d 1088 (E.D. Mo. 2003) (allowing farmers antitrust claims against producers of genetically modified corn and soybeans).

63. StarLink, *supra* note 58, at 834.

64. *Id*. StarLink was also approved for feedstock and seed increase usage.

65. *Id*. The court recognized that:

> Corn replicates by the transfer of pollen from one corn plant to another, including cross-pollination from one breed to another. Once airborne, corn pollen can drift over considerable distances, meaning that different corn varieties within a farm, and from neighboring farms, regularly cross-breed. With few exceptions, there are not procedures in place to segregate types of corn. Different corn breeds within an individual farm are commingled at the harvesting stage. Corn from hundreds of thousands of farms is then further commingled as it is gathered, stored and shipped through a system of local, regional and terminal grain elevators. Elevators, storage and transportation facilities are generally not equipped to test and segregate corn varieties. The commingled corn is then marketed and traded as a fungible commodity.

Id.

66. *Id.*

67. *Id*. at 835.

68. *Id*.

recognized that the fear of StarLink contamination forced food producers to discontinue the use of U.S. grown corn in favor of imported corn.[69] Additionally, foreign countries either terminated, or substantially limited, their importation of U.S. corn.[70]

Farmers' claims of economic loss and negligence were held to be valid.[71] The court determined there were three points in the supply chain where StarLink corn could contaminate non-StarLink crops, allowing for a viable claim of economic loss.[72] First, contamination could occur if the plaintiffs had unknowingly bought seed from suppliers selling contaminated inventory.[73] Second, contamination could occur if plaintiffs' crops had been contaminated by pollen from StarLink corn planted on a neighboring farm.[74] Third, and finally, if the plaintiff's harvest was commingled with StarLink corn during transport or in a storage facility the plaintiff could make a claim based on economic loss.[75] The court held that the plaintiffs would be entitled to recover their economic losses if they are able to establish that their crop had been contaminated by any one or a combination of the above points.[76]

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69. *Id*.

70. *Id*.

71. *Id*. After deciding the claims were not preempted by federal law, the first claim that the StarLink court tackled was farmers' claims of economic loss. *Id*. The court held that the farmers had a legitimate claim against Aventis for harm to property and were entitled to be compensated for certain economic losses. *Id*. at 838. The court gave two definitions of economic loss based on Illinois and Wisconsin law. Illinois defines economic loss as:

> damages for inadequate value, costs of repair and replacement of the defective product, or consequent loss of profits-without any claim of personal injury or damage to other property ... as well as the diminution in the value of the product because it is inferior in quality and does not work for the general purposes for which it was manufactured and sold.

Id.

Wisconsin defines economic loss as:

> Economic loss is generally defined as damages resulting from inadequate value because the product "is inferior and does not work for the general purposes for which it was manufactured and sold." It includes both direct economic loss and consequential economic loss. The former is loss in value of the product itself; the latter is all other economic losses attributable to the product defect.

Id. The *StarLink* court defined two areas of law where economic loss claims generally arise: 1) products liability and 2) access cases. *Id*. With the products liability variety of tort, claims arise when the product harms a person, or property other than the product itself. *Id.* In access cases, a plaintiff is seeking to be compensated for profits lost because plaintiff's customers cannot reach plaintiff's place of business. *Id*. at 840.

72. *Id*. at 840. The court noted that non-StarLink corn is damaged when:

> [p]ollinated by StarLink corn. The pollen causes these corn plants to develop the Cry9C protein and renders what would otherwise be a valuable food crop unfit for human consumption. Non-StarLink corn is also damaged when it is commingled with StarLink corn. Once mixed, there is no way to resegregate the corn into its edible and inedible parts. The entire batch is considered tainted and can only be used for the domestic and industrial purposes for which StarLink is approved. None of that supply can ever be used for human food.

Id.

73. *Id*.

74. *Id*. at 841.

75. *Id*. at 842.

76. *Id*.

The court sustained the farmers' negligence claim, finding that Aventis had a duty to take the necessary steps to ensure that StarLink corn did not enter human food supply chains.[77] But, in allowing StarLink to contaminate the plaintiffs' crops, Aventis failed to uphold their duty to prevent contamination from happening and were thus liable.[78]

The *StarLink* events occurred while U.S. farmers were gradually beginning to plant corn in favor of other crops, before corn-based ethanol received substantial political backing, and prior to increased subsidies promoting greater corn cultivation. In this case, segregation of genetically modified corn not intended for human consumption from other varieties of corn could not be achieved.[79] It is important to reiterate that one of the primary reasons the StarLink variety of corn was approved was for ethanol production.[80] With the thirty-five million gallon renewable fuel mandate set out by Former-President Bush,[81] vocal support in the current administration for corn-based ethanol and ethanol subsidies,[82] and vast increases in national corn production,[83] the courts are likely to hear similar disputes in the future.

II. LAW AND SUBSIDIES PROMOTING INCREASED CORN CULTIVATION

Federal subsidies have been identified by some commentators as directing farmers to grow more genetically modified corn.[84] From 1995 to 2005 corn subsidies totaled over fifty-one billion dollars, outstripping wheat by thirty billion and soybeans by thirty-eight billion.[85] Increasing the amount of subsidies for corn widen this margin further. Considering the already high level of genetically modified corn cultivation, increased subsidies effectively encourage farmers to cultivate genetically modified corn, which could result in a dramatic loss of crop diversity.

Over the past year, Congress discussed and modified bills directly related to renewable and alternative fuels.[86] Two of these bills contained titles and

77. *Id*. at 843

78. *Id*. at 842.

79. Food Safety Dep't, World Health Org., Modern Food Biotechnology, Human Health and Development: An Evidence Based Study, 19 (2005) *available at* http://www.who.int/foodsafety/publications/biotech/biotech_en.pdf.

80. StarLink, *supra* note 58, at 834.

81. Bush, *supra* note 1.

82. Kent Garber, Obama Under Pressure Over Role of Ethanol in Energy Policy: Environmental Groups are Unhappy with His Support of Corn-Based Ethanol During the Campaign, U.S. NEWS & WORLD REP., Nov. 21, 2008, http://www.usnews.com/articles/news/national/2008/11/21/obama-under-pressure-over-role-of-ethanol-in-energy-policy.html.

83. FIELD CORN NAT'L STATISTICS, http://www.nass.usda.gov/QuickStats/index2.jsp (last visited Jan. 6, 2009).

84. *Id*.

85. ENVIRONMENTAL WORKING GROUP, FARM SUBSIDY DATABASE, http://farm.ewg.org/farm/region.php?fips=00000 (last visited Jan.7, 2009).

86. Energy Independence Act of 2007, *supra* note 4; 2008 Farm Bill, *supra* note 4. Many terms used in these laws have been defined by the Farm Security and Rural Investment Act of 2002. The terms that pertain to this comment, and defined by the Farm Security and Rural Investment Act of 2002, are as follows:

> (1) Administrator
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> The term "Administrator" means the Administrator of the Environmental Protection agency.

subsections relating directly to ethanol production of all types, the USDA's 2008 Farm Bill and the Energy Independence Act of 2007.[87] Both of these bills operate conjunctively in certain areas and create varied subsidies for the benefit of ethanol production. These subsidies are likely to negatively impact current levels of crop diversity by encouraging farmers to plant increasing amounts of genetically modified corn.[88]

A. The 2008 Farm Bill and Energy Independence Act of 2007

1. Overview

The USDA's 2008 Farm Bill expands programs that advance and provide for renewable energy production and commercialization.[89] Three relate directly to farm subsidies.[90] The first is the reauthorization of Federal Procurement of Biobased Products Program.[91] The second is the reauthorization of the Renewable Energy Systems and Energy Efficiency Improvements loan guarantee

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> (2) Biobased product
> The term "biobased product" means a product determined by the Secretary to be a commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials.
> (3) Biomass
> (A) In general
> The term "biomass" means any organic material that is available on a renewable or recurring basis.
> (B) Inclusions
> The term "biomass" includes--
> agricultural crops;
> trees grown for energy production;
> wood waste and wood residues;
> plants (including aquatic plants and grasses);
> …
> (C) Exclusions
> The term "biomass" does not include—
> paper that is commonly recycled; or
> unsegregated solid waste….
> (5) Renewable Energy
> The term "renewable energy" means energy derived from—
> a wind, solar, biomass, or geothermal source; or
> hydrogen derived from biomass or water using an energy source described in subparagraph (A)….
> (7) Secretary
> The term "Secretary" means the Secretary of Agriculture.

Farm Security and Rural Investment Act of 2002, 7 U.S.C. § 7901 (2002) [hereinafter 2002 Farm Bill]. These definitions have not been altered by either the 2008 Farm Bill, or the Energy Independence Act of 2007.

87. 2008 Farm Bill, *supra* note 4.

88. Environmental Working Group, Farm Subsidy Database, *supra* note 90; *see also* Adoption of Genetically Engineered Crops in the US: Corn Varieties, *supra* note 39.

89. USDA, 2007 FARM BILL PROPOSALS 143 (2007), *available at* http://www.usda.gov/documents/07finalfbp.pdf. The 2008 Farm Bill was initially proposed in 2007 and through the normal machinations of Congress did not get passed until 2008. The 2007 Farm Bill Proposals hold substantively true to what is contained in the 2008 Farm Bill as it was passed.

90. *Id*. at 144.

91. 2008 Farm Bill, *supra* note 4, at title 9, § 9002.

and grant program, re-christened as the Rural Energy for America Program.[92] The third is the expansion of the Specialty Crop Research Initiative.[93]

Many of the provisions of the 2008 Farm Bill are tied up with the Energy Independence Act of 2007, with both amending various laws while focusing heavily on three areas of the Farm Security and Rural Investment Act of 2002 (2002 Farm Bill.)[94] The first two areas increase loan guarantees for "biorefineries," and for farmers who choose to set up their own renewable energy systems.[95] Third, the Energy Independence Act of 2007 focuses on providing for increases in research related to renewable and alternative fuel production.[96]

2. Reauthorization of the Federal Procurement of Biobased Products Program

The Federal Procurement of Biobased Products Program encourages the federal government to purchase biobased products.[97] The reauthorization of the Federal Procurement of Biobased Products Program by the 2008 Farm Bill ties together with the Energy Independence Act of 2007.[98] Both of these acts amend the 2002 Farm Bill's section 9002 in order to "improve its effectiveness."[99]

Under this program, the Secretary, through the Commodity Credit Corporation, is to provide one million dollars for testing biobased products through the end of the 2008 fiscal year.[100] Beginning with the 2009 fiscal year, until 2012, the Secretary is to allocate two million dollars per fiscal year for the testing of biobased products.[101] This testing is authorized in order to carry out the intentions stated in this section of the Federal Procurement of Biobased Products Program.[102]

Ethanol fits the definition of a "biobased product". Ethanol is an industrial product, other than food or feed, which is composed almost wholly of biological products or renewable domestic agricultural materials.[103] Those companies or individuals performing tests on ethanol, therefore, benefit of from increased funding allocated by the 2008 Farm Bill and Energy Independence Act of 2007. The USDA states that by supporting:

> [f]ederal government purchases, the commercial viability of these products could be established and government demand for biobased products increased, thus leading to wider public acceptance, increased demand, and increased production of a greater variety of biobased products.[104]

92. *Id*. at title 9, § 9007
93. *Id*. at title 7, §. 7311.
94. Energy Independence Act of 2007, *supra* note 4; 2002 Farm Bill, *supra* note 108.
95. 2008 Farm Bill, *supra* note 4, at title 9.
96. Energy Independence Act of 2007, *supra* note 4.
97. 2002 Farm Bill, *supra* note 108.
98. 2007 FARM BILL PROPOSALS, *supra* note 94 at 147; Energy Independence Act of 2007, *supra* note 4.
99. 2007 FARM BILL PROPOSALS, *supra* note 94 at 147.
100. *Id*.
101. Energy Independence Act of 2007, *supra* note 4 at title 9, § 5002.
102. 2002 Farm Bill, *supra* note 115.
103. *Id*.
104. 2007 FARM BILL PROPOSALS, *supra* note 94 at 147.

This view, however, is slightly myopic in that it ignores the effects of promoting widespread use of biobased products across the various agencies and administrations of the federal government.[105]

3. Rural Energy for America Program

Streamlining rural development is a primary goal of this amendment.[106] The USDA maintains that consolidating legislative authorities under the umbrella of this program adds flexibility to the loan and grant programs, making them easier to use by USDA customers.[107] Substantively, this consolidation makes significant additions to the 2002 Farm Bill.

The first major category of additions are loan guarantees to farmers, ranchers, small rural businesses, and other agricultural producers who have decided to prioritize renewable and alternative energy sources.[108] These loan guarantees are capped at twenty-five million dollars and cannot exceed seventy-five percent of the cost of the funded activity.[109] These loans are to be prioritized by the Secretary who will rank the farmer, rancher, small rural business, or other agricultural producer from those requesting the least amount of assistance to the greatest.[110]

Under this modification, the Secretary is given greater access to Commodity Credit Corporation funds in order to carry out the intentions of the Rural Energy for America Program.[111] Originally, in the 2002 Farm Bill, the Secretary was granted access to twenty-three million dollars for 2003 through 2006 and three million in 2007.[112] With this provision of the program having run its course, the new proposal opens up the Commodity Credit Corporation's funds to the Secretary in the following amounts: fifty-five million for 2009 and 2010, eighty-five million for 2011, and 105 million for 2012.[113]

Although these loan numbers are not increases, because technically the original provisions have already ended, it is clear that the federal government is placing a high priority on renewable and alternative fuels. Again, the most used fuel that falls into the category of renewable and alternative is corn-based ethanol.[114] Farmers and rural communities that produce a great deal of corn have significant government incentives to use that crop to create more biorefineries.[115]

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105. LESTER R. BROWN, DISTILLERY DEMAND FOR GRAIN TO FUEL CARS VASTLY UNDERRATED: WORLD MAY BE FACING HIGHEST GRAIN PRICES IN HISTORY, available at http://www.earth-policy.org/Updates/2007/Update63_notes.htm; Sara Hughes et al., The Development of Biofuels Within the Context of the Global Water Crisis, 7 SUSTAINABLE DEV. L. & POL'Y 58 (2006-2007).

106. 2008 Farm Bill *supra* note 4 at title 9, § 9005; 2007 FARM BILL PROPOSALS, *supra* note 94 at 122-123. Specifically, the class of individuals listed are able to receive loans in relation to "1) puchas[ing] renewable energy systems, 2) mak[ing] energy efficiency improvements, and 3) produc[ing] and sell[ing] electricity generated by new renewable energy systems." *Id.*

107. 2007 Farm Bill Proposals, *supra* note 94 at 122-123.

108. 2008 Farm Bill, *supra* note 4 at title 9, § 9005.

109. *Id*.

110. *Id*.

111. *Id*.

112. 2002 Farm Bill, *supra* note 108 at § 8106.

113. 2008 Farm Bill, *supra* note 4 at title 9, § 9005.

114. NATIONAL CORN GROWERS ASS'N, *supra* note 48.

115. BROWN, *supra* note 110.

However, these biorefineries require more corn to operate, which results in the planting of more corn–further compounding the problems that current crop diversity levels face.[116]

4. Specialty Crop Research Initiative

The 2008 Farm Bill and the Energy Independence Act of 2007 states that the United States's growing energy demands and desire to be independent from foreign energy requires the improvement of biomass production capacity and efficiency.[117] In order to meet these goals, both bills amend the Biomass Research and Development Act of 2000 and incorporate the Specialty Crops Competitiveness Act of 2004.[118] This research initiative includes a broad-based funding structure that splits up five hundred million dollars over the course of ten years.[119]

A key part of the Biomass Research and Development Act of 2000 is the Biomass Research and Development Initiative.[120] One of the two objectives of the Biomass Research and Development Initiative is to improve biomass production and sustainability.[121] This initiative allows the Secretary of Agriculture and Secretary of Energy in conjunction with the Biomass Research and Development Board (set up by the Act) to award grant, contracts, and financial assistance to particular entities.[122] These entities can be any of the following:

> (A) an institution of higher education;
> (B) a National Laboratory;
> (C) a Federal research agency;
> (D) a State research agency;
> (E) a private sector entity;
> (F) a nonprofit organization; or
> (G) a consortium of two or more entities described in subparagraphs (A) through(F).[123]

These entities are granted funding as long as the research in which they are employed fits within one of four categories.[124] Particularly, these entities receive funding if they are working towards enhancing feedstock in order to increase productivity, reducing the level of chemicals required to produce the feedstock, or any other desired features.[125]

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116. *Id*.

117. 2007 FARM BILL PROPOSALS, *supra* note 94 at 129-130.

118. Energy Independence Act of 2007, *supra* note 4, title 2, subtitle B, § 232; 2008 Farm Bill, *supra* note 4 at title 9, § 9008; Biomass Research and Development Act, 7 U.S.C. §§ 8601-8609 (2006); Specialty Crops Competitiveness Act of 2004, 7 U.S.C. §§ 3101-3103 (2006).

119. 2007 Farm Bill Proposals, *supra*, note 94.

120. Energy Independence Act of 2007, *supra* note 4, title 2, subtitle B, § 232; 2008 Farm Bill, *supra* note 4 at title 9, § 9008.

121. 2007 Farm Bill Proposals, *supra*, note 94.

122. *Id.*

123. 2008 Farm Bill, *supra* note 4 at title 9, § 9008; *see also* Energy Independence Act of 2007, *supra* note 4, title 2, subtitle B, § 232.

124. *Id*.

125. *Id*.

Feedstock productivity is enhanced through genetic modification.[126] Farmers are able to reduce the level of chemicals required to produce feedstock by planting crops that have been genetically modified to resist the infiltration of certain weeds, diseases, and insects.[127] The USDA, in its explanation of the 2008 Farm Bill, states that it will "leverage the Department's existing broad scientific capabilities in plant genetics and breeding; crop production; soil and water science;. . .carbohydrate, lipid, protein, and lignin chemistry and biochemistry; enzyme development; fermentation; and microbiology."[128] Biotech companies have already begun to genetically engineer corn in order to facilitate the process of turning it into ethanol.[129] For example, biotech companies such as Pioneer, Monsanto, and Syngenta have recently developed seeds that will increase yields of corn with highly fermentable qualities.[130]

As explained earlier, corn occupies the largest proportion of feedstock in the United States, and the majority of it is already heavily genetically modified.[131] The Biomass Research and Development Initiative could increase the already high level of genetically modified corn, which could result in reducing crop diversity, by providing research entities twenty percent of the funds allocated by the Biomass Research and Development Act of 2000 and distributed through the 2009 to 2012 fiscal years.[132] Furthermore, as the *StarLink* case illustrates, promoting greater amounts of genetically modified corn could have serious negative implications within our legal system with more and more farmers' crops being damaged by infiltration.[133]

III. CELLULOSIC BIOMASS, CONSERVATION INITIATIVES, AND TECHNOLOGY

Subsidized incentives surrounding renewable and alternative fuels in the 2008 Farm Bill and Energy Independence Act of 2007 are prime actors which, could potentially have direct negative effects crop diversity levels through their promotion of increased genetically modified corn production. These bills also contain programs that could potentially compound the problems surrounding corn and crop diversity; specifically, suggested modifications to the Conservation Reserve Program.[134] Advantages forwarded by proponents of

126. Barrionuevo, *supra* note 18.

127. *Id*.

128. 2007 Farm Bill Proposals, *supra* note 94 at 129.

129. C. Matthew Rendleman & Hosein Shapouri, USDA, New Tech. in Ethanol Prod., 8 (2007).

130. *Id*.

131. USDA Corn Trade, *supra* note 42; USDA Overview, *supra* note 36.

132. Energy Independence Act of 2007, *supra* note 4, title 2, subtitle B, § 232; 2008 Farm Bill, *supra* note 4 at title 9, § 9008. The Commodity Credit Corporation will grant the Secretary two hundred twenty-five million dollars for 2008, two hundred fifty million dollars for 2009, two hundred seventy-five million dollars for 2010, three hundred million dollars for 2011, and three hundred fifty million dollars for 2012.

133. *StarLink*, 212 F. Supp. 2d 828; *Sample*, 283 F. Supp. 2d 1088.

134. 2008 Farm Bill, *supra* note 4 at title 2, § 2101. The Conservation Reserve Program was originally enacted by the Food Security Act of 1985 and allows the owner or operator of a farm or ranch to enter into a contractual agreement with the USDA:

> (1) to implement a plan approved by the local conservation district…for converting eligible land normally devoted to the production of an agricultural commodity on the farm or ranch to a less intensive use…, such as pasture, permanent grass, legumes, forbs, shrubs, or trees, substantially in accordance with a schedule outlined in the plan;

these modifications point to the low economic and environmental costs of employing lands within the program to fuel cellulosic biomass projects.[135] These advantages are real but optimism surrounding them should be tempered by the current state of technology regarding ethanol production from cellulosic biomass.[136]

A. Cellulosic Biomass and Ethanol Production

Cellulosic biomass is "biomass composed primarily of plant fibers that are inedible by humans and have cellulose as a prominent component."[137] These fibers are broken down, through hydrolysis and saccharifiaction, into sugars which are then fermented by microorganisms.[138] Cellulosic biomass can be made available as either:

> Residues – biomass resulting from activities or processes undertaken for some purpose other than ethanol production. Examples of such residues include corn stalks and other non-edible parts of plants used to produce food, municipal solid waste, and pulp and paper industry wastes, or
> Dedicated crops – crops grown for the primary purpose of energy production. Examples of potential dedicated crops for producing cellulosic biomass include grass and short rotation trees.[139]

> (2) to place highly erodible cropland subject to the contract in the conservation reserve established under this subpart;
> (3) not to use the land for agricultural purposes, except as permitted by the Secretary;
> (4) to establish approved vegetative cover (which may include emerging vegetation in water), water cover for the enhancement of wildlife, or, where practicable, maintain existing cover on the land.

Food Security Act of 1985, 16 U.S.C. § 3832 (2003). By entering into this relationship with the owner or operator of a farm or ranch the USDA will:

> (1) share the cost of carrying out the conservation measures and practices set forth in the contract for which the Secretary determines that cost sharing is appropriate and in the public interest; and
> (2) for a period of years not in excess of the term of the contract, pay an annual rental payment in an amount necessary to compensate for--
> (A) the conversion of highly erodible cropland normally devoted to the production of an agricultural commodity on a farm or ranch to a less intensive use; and
> (B) the retirement of any cropland base and allotment history that the owner or operator agrees to retire permanently.

Id. at § 3833. The USDA, by entering into this agreement, is able to keep a set amount of acres of highly erodible land out of use for the benefit of native plant and wildlife conservation purposes. *Id*. at § 3831

135. Wiesner, *supra* note 12.

136. RENDLEMAN & SHAPOURI, *supra* note 134, at 23-25.

137. LEE R. LYND, NAT'L COMM'N ON ENERGY POL'Y FORUM, CELLULOSIC ETHANOL FACT SHEET, 1 (2003), http://www.energycommission.org/files/finalReport/IV.4.c%20-%20Cellulosic%20Ethanol%20Fact%20Sheet.pdf.

138. *Id.*; RENDLEMAN & SHAPOURI, *supra* note 134, at 22.

139. LYND, *supra* note 142. The RFS amended the EPAct of 2005 to define cellulosic biomass ethanol as:

> (1) Ethanol derived from any lignocellulosic or hemicellulosic matter that is available on a renewable or recurring basis and includes any of the following:
> (i) Dedicated energy crops and trees.
> (ii) Wood and wood residues.
> (iii) Plants.
> (iv) Grasses.
> (v) Agricultural residues.

> Cellulosic biomass derived from either residues or dedicated crops can be used in ethanol production.[140]

In 1999, the USDA and the Department of Energy (DOE) estimated in a joint study that the cost of a twenty-five million gallon per year plant producing ethanol from cellulosic biomass would be $1.50 a gallon, equating to $37.5 million a year.[141] It is important to note that this figure has been disputed by others researching in the field. Dissenters estimate costs to produce cellulosic ethanol could range from as low as $1.16 a gallon to as high as six dollars a gallon.[142]

1. Expectations and Realities of Ethanol Produced From Cellulosic Sources

The Energy Policy Act of 2005 (EPAct) set a goal of two hundred fifty million gallons of ethanol produced from cellulosic biomass in 2013.[143] At the price per gallon estimated by the USDA and DOE, the cost to produce that amount of cellulosic biomass ethanol would be $375 million. However, converting cellulosic biomass into ethanol has not been made commercially viable, and many of the prices that have been estimated are based on not much more than speculation.[144]

The RFS reflects the federal government's expectations for technological developments in creating economically viable cellulosic biomass ethanol.[145] The EPA summarizes the assumed renewable fuel volume in 2012, five years ahead of the 2017 goal, and uses 2004 statistics for a base for their determinations.[146] They created two scenarios for 2012, one representing the volume levels

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> (vi) Animal wastes and other waste materials, the latter of which may include waste materials that are residues (e.g., residual tops, branches, and limbs from a tree farm).
>
> (vii) Municipal solid waste.
>
> (2) Ethanol made at facilities at which animal wastes or other waste materials are digested or otherwise used onsite to displace 90 percent or more of the fossil fuel that is combusted to produce thermal energy integral to the process of making ethanol, by:
>
> (i) The direct combustion of the waste materials or a byproduct resulting from digestion of such waste materials (e.g., methane from animal wastes) to make thermal energy; and/or
>
> (ii) The use of waste heat captured from an off-site combustion process as a source of thermal energy.

RFS, *supra* note 3, at 23,992.

140. LYND, *supra* note 142.

141. Rendleman & Shapouri, *supra* note 134, at 22.

142. *Id*.; LYND, *supra* note 142. In comparison, on the wholesale market, fuel ethanol sells for about one dollar and twenty cents a gallon and gasoline sells for seventy-five cents a gallon.

143. RFS, *supra* note 3, at 23,905.

144. Pimentel & Patzek, *supra* note 9, at 70-71; *see also* RENDLEMAN & SHAPOURI, *supra* note 134, at 22. As of 2005 producing switchgrass requires a total of two hundred thirty dollars per hectare to produce. Converting one liter into ethanol costs fifty-four cents, nine cents higher than the cost of converting corn to ethanol. Switchgrass also has a fifty percent negative energy return., meaning it takes fifty percent more fossil energy than ethanol fuel produced Converting wood cellulose into ethanol costs fifty-eight cents a liter and has a fifty-seven percent negative energy return.

145. RFS, *supra* note 3, at 23,905.

146. *Id*.

required to meet the RFS, and volume levels based on the Energy Information Administration's (EIA) projected volume levels.[147]

In 2004, corn based ethanol accounted for the majority of renewable fuel produced in the United States.[148] Out of a 3.573 billion gallons of renewable fuel, corn based ethanol made up 3.548 billion gallons of the total volume.[149] Biodiesel accounted for twenty-five million gallons of the total volume of renewable fuel in 2004.[150] Projecting to 2012, with volume levels required to meet the RFS, the total amount of renewable fuel is expected to be slightly less than seven billion gallons.[151] Corn based ethanol is expected to account for 6.4 billion gallons of the total volume of renewable fuel, biodiesel is expected to account for three hundred million gallons, and cellulosic ethanol is expected to round out the total with 250 million gallons.[152]

Using the EIA projections, the 2012 total volume of renewable fuel is expected to be slightly less than ten billion gallons.[153] Cellulosic ethanol is expected to reach the same level of volume as projected in the RFS, at two hundred fifty million gallons.[154] Biodiesel is also identical to the RFS, at three hundred million gallons.[155] Corn based ethanol's expected volume under the Energy Information Administration's projections is approximately 9.4 billion gallons.[156]

Clearly, under both of these projections, corn based ethanol will be the main source of renewable and alternative fuel produced in the United States.[157] Behind these statistics lies a fact that the federal government has recognized: the technology to produce ethanol from cellulosic biomass is not fully developed for large-scale commercial operation.[158] In October of 2006, there was only one plant in North America producing ethanol from cellulosic biomass, and that plant only produces approximately one million gallons a year.[159] Although several companies have announced that they intend on building plants capable of producing ethanol from cellulosic biomass none have moved out of research and pre-construction planning phases.[160]

On the other hand, plants producing ethanol from other sources are well under way. There are 112 ethanol plants that are expected to be completed prior to 2012.[161] Forty-seven of these plants are currently under construction and sixty-five have been planned.[162] Of these plants eighty-nine will produce ethanol

147. *Id.*
148. *Id.*
149. *Id.*
150. *Id.*
151. *Id.*
152. *Id.*
153. *Id.*
154. *Id.*
155. *Id.*
156. *Id.*
157. *Id.*
158. *Id.* at 23,952.
159. *Id.*
160. *Id.* at 23,905.
161. *Id.* at 23,956.
162. *Id.*

solely from corn; thirteen will produce ethanol from a corn blend, and the remaining from a mixture of molasses and milo.[163] Only four of these plants would produce ethanol from cellulosic biomass.[164]

These statistics demonstrate that the United States will continue to rely primarily on corn based ethanol to provide the majority of its renewable and alternative fuels. However, in anticipation of this inevitability, and due to the need to find other sources of alternative and renewable fuels, the 2008 Farm Bill and Energy Independence Act of 2007 have various provisions providing monetary support to researchers working towards creating viable means of producing ethanol from cellulosic biomass.[165] To assure that those researchers have resources to work with, and to provide for the potential plants producing ethanol from cellulosic biomass, modifications to the Conservation Reserve Program are also proposed.[166]

B. Modifications to the Conservation Reserve Program

The Conservation Reserve Program has been modified to allow the harvesting of land currently in the program.[167] Native grass harvest only occurs subsequent to the nesting season of the wildlife inhabiting the area.[168] The owner or operator of a farm or ranch whose land contained crops used for the production of ethanol from cellulosic biomass would have priority in enrolling their land in the Conservation Reserve Program.[169] The USDA estimates that over twenty-seven million acres currently enrolled would fit this classification.[170]

What is not clear from this modification is if farmers are to plant native grasses on the land that is enrolled in the Conservation Reserve Program or to allow grasses to grow on their own.[171] If it is determined that farmers are to plant native grasses, even without the use of any chemicals, that act itself could potentially continue to damage the already highly erodeable soil the program is intended to protect.

Erosion is a key factor in the reduction of crop diversity.[172] Some commentators have also expressed concern that changes in the Conservation Reserve Program could lead to more sweeping changes.[173] Agricultural interest groups already pressed the USDA into releasing a portion of land tied up in the Conservation Reserve Program so that farmers can plant more corn without any

163. *Id*.

164. *Id*.

165. Energy Independence Act of 2007, *supra* note 4, at title 2, subtitle B; 2008 Farm Bill, *supra* note 4, at title 9, § 9006.

166. 2007 Farm Bill Proposals, *supra* note 94 at 51-52.

167. *Id*. at 51 *see also* 2008 Farm Bill, *supra* note 4 at title 9, § 9006. This provision is contained within the Biomass Research and Development Act of 2000.

168. 2008 FARM BILL PROPOSALS *supra* note 94, at 51.

169. *Id*.

170. *Id*.

171. *Id*.

172. Kimbrell, *supra* note 15.

173. *The Consequences of Corn*, *supra* note 49.

interest in cellulosic biomass.[174] As a result of such pressure, the USDA has put a temporary moratorium on enrolling lands in the program.[175]

IV. CONCLUSION

The United States has made it a priority to find alternative methods of fueling. This desire was most clearly expressed by Former President Bush in 2007 and is a primary goal of President Obama. It is clear from the statistics gathered by the federal government and various interest groups that ethanol, particularly derived from corn, is the alternative fuel of choice. However, promoting corn-based ethanol has a serious potential negative consequence: a reduction in crop diversity due to the increased cultivation of genetically modified corn. Combating the problem of reduced crop diversity requires the federal government to look to a wider variety of methods to meet the 2017 renewable fuel goals. Corn ethanol alone is not the answer. Issues surrounding this problem are ones that have been barely encountered, but with the massive increases in the cultivation of genetically modified corn it is inevitable that will have to be dealt with soon.

174. *Id*.

175. *Id*.