AGRICULTURE'S FATE UNDER CLIMATE CHANGE: ECONOMIC AND ENVIRONMENTAL IMPERATIVES FOR ACTION

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INTRODUCTION

Farming, ranching, and other agricultural activities are dominant economic and environmental influences in the Midwest and Great Plains, and agribusiness in general is a potent political force in the United States. Worldwide, agriculture is responsible for nearly ten percent of all emissions of carbon dioxide and other pollutants that cause global warming.[1] At the same time, agriculture offers many potential ways to reduce greenhouse gas (GHG) emissions, including cleaner renewable fuels and power, conservation, and capture of GHGs in soils. For these reasons, regulatory or legislative proposals to regulate carbon dioxide and other GHGs cause farmers, ranchers, and agri-business to take notice.

In Washington, the federal government is slowly and haltingly beginning to respond to the global warming threat. The House of Representatives passed a comprehensive global warming "cap-and-trade" bill in 2009.[2] Although several senators drafted climate change bills[3], the Senate failed to pass legislation in the 111th Congress. Faced with Congressional inaction, the U.S. Environmental Protection Agency (EPA) is now starting to take the lead in regulating carbon dioxide and other GHG emissions, including to some extent those from agriculture.[4]

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1. *See infra* Part I.C.

2. American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. (as passed by House, June 26, 2009).

3. *See e.g.* American Power Act, Discussion Draft, 111th Cong., *available at* http://kerry.senate.gov/imo/media/doc/APAbill3.pdf [hereinafter American Power Act]. Senators John Kerry (D-MA) and Joseph Lieberman (I-CT) drafted this legislation.

4. In *Massachusetts v. Environmental Protection Agency*, the Supreme Court held that the EPA could regulate GHGs as "pollutants" under the Clean Air Act. 549 U.S. 497, 522–33 (2007) (stating that if the EPA makes a judgment that an air pollutant "cause[s], or contribute[s] to, air pollution which may reasonably be anticipated to endanger public health or welfare," that air pollutant must be regulated under the Clean Air Act) (citing 42 U.S.C. § 7521(a)(1) (2006)).

These proposals generally treat farming, ranching, and other agricultural operations in ways that recognize agriculture's relatively unique position in the global warming puzzle as both a contributor and a solution to global warming. When reacting to these proposals, however, most agribusiness interests tend to focus on their shorter-term and relatively minimal cost impacts—on fuel, fertilizer, feed, and other farming expenses—instead of the long-term economic and environmental benefits and the risks of inaction. Laws that price carbon and drive investments in low-carbon technologies will, virtually by definition, benefit agriculture through new revenue opportunities. For example, farmers will grow dedicated new energy crops, lease or otherwise host wind turbines and solar panel arrays on their property, generate electricity with cow manure, and "sequester" carbon emissions in the soil. Farmers also have a strong direct business need to minimize the negative environmental impacts of global warming on their crops and livelihood. Considering the intensely negative impacts of global warming on agriculture, especially in the Midwest and Great Plains, agriculture has little to lose and much to gain from engaging in the battle against global warming.

I. THE MIDWEST CONNECTION TO CLIMATE CHANGE

A. Defining Climate Change

Climate change is the result of both natural and human forces.[5] A dry forest that is struck by lightning and catches fire or an erupting volcano spewing ash into the sky are both natural forces that can affect climate. Human activities, such as burning fossil fuels to produce energy, also affect climate. Sometimes called anthropogenic activities, human-caused GHG emissions are unnatural because they increase the rate at which heat-trapping greenhouse gases are released into the atmosphere above the normal rate of natural activities.[6]

Recent climate change is the end result of an average increase in global temperatures caused mostly by human activities. Over the past 100 years, the earth's average surface temperature has increased approximately 1.4 degrees Fahrenheit.[7] Over the next 100 years, scientists believe that the

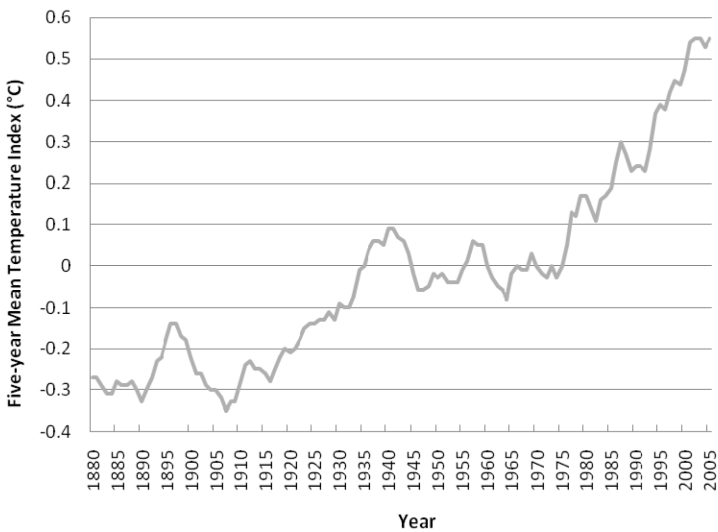
5. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 96–97 (S. Solomon et al. eds., Cambridge Univ. Press 2007).

6. NAT'L RESEARCH COUNCIL OF THE NAT'L ACADEMIES, ADVANCING THE SCIENCE OF CLIMATE CHANGE (forthcoming 2010) (manuscript at 15). Of course, much of the concern about climate change relates to how human-caused activities such as fossil fuel emissions can influence and exacerbate natural forces such as storms, droughts, and other occurrences. *See id.*

7. *Id.* (manuscript at 21).

world may experience an additional increase of 2 to 11.5 degrees Fahrenheit.[8]

GLOBAL LAND-OCEAN TEMPERATURE INDEX (C°)[9]



Increasing temperatures are already causing serious negative impacts. The polar caps are melting, leading to higher sea levels.[10] Heat waves and precipitation patterns are becoming more intense and frequent.[11] Some areas are experiencing more droughts, while other regions are experiencing more rain.[12] These temperature increases are creating more record highs and, more importantly, contributing to more serious weather disturbances.[13]

B. Global Warming's Impact on Agriculture

The Midwest's relationship with climate change is both strong and ironic. Agriculture, an important industry in the Midwest, is not only dependent on the region's climate, but is also responsible, both directly and indirectly, for emissions contributing to climate change. At the same time, global warming threatens the stability of agriculture by decreasing crop

8. *Id.* (manuscript at 3).

9. Goddard Institute for Space Studies, National Aeronautics and Space Administration, www.giss.nasa.gov.

10. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 5, at 110.

11. *Id.* at 105.

12. *Id*.

13. *See* Justin Gillis, *In Weather Chaos, a Case for Global Warming*, N.Y.TIMES, Aug. 15, 2010, at A1.

yield and livestock productivity and causing severe and unpredictable weather extremes. Rising temperatures change the rate at which crops grow and mature, expand the geographical ranges and populations of pests, and cause heat stress in livestock. Higher concentrations of carbon dioxide help some types of plants to grow better, but these benefits are greatly outweighed by the increased challenges of managing accompanying increases in weeds, pests, and diseases. Global warming also decreases the quality and quantity of water, a necessary resource for agriculture and a growing world population. By the end of the century, an Illinois summer is projected to feel like a summer currently experienced in Louisiana or eastern Texas.[14]

Plants are best suited to be grown in climatic regions that support their "optimum air temperature."[15] Cotton, for example, is more suitable for production in Southern states because its optimum temperature range for reproduction yield is seventy-seven to seventy-eight degrees Fahrenheit.[16] By contrast, wheat is more commonly grown in the Northern Great Plains region where conditions are more suitable to its optimum temperature range of fifty-nine degrees Fahrenheit for reproduction yield.[17] Air temperatures beyond a plant's optimal level speed up the crop's life cycle, shortening the reproductive phase[18] where the seed matures and is most sensitive to heat.[19] Warm soils earlier in the spring encourage premature seed germination, creating a greater risk for crop loss from late frosts.[20]

The Midwest/Great Plains region is experiencing even more rapid temperature increases than other areas in the world. According to the U.S. Global Research Program, the Great Plains has experienced approximately a 1.5-degree-Fahrenheit increase in average temperature since the 1960s.[21] Winter months in the northern states of the Great Plains have exhibited the largest increase in average temperature.[22] Milder winters in the Midwest and Great Plains are less effective as natural population controls for pests

14. *See* U.S. GLOBAL CHANGE RESEARCH PROGRAM, GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES 117 (Thomas R. Karl et al. eds., Cambridge University Press 2009), *available at* http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf.

15. PETER BACKLUND ET AL., U.S. CLIMATE CHANGE SCIENCE PROGRAM, THE EFFECTS OF CLIMATE CHANGE ON AGRICULTURE, LAND RESOURCES, WATER RESOURCES, AND BIODIVERSITY IN THE UNITED STATES 25 (Margaret Walsh et al. eds., U.S. Department of Agriculture 2008).

16. *See id*. at 26 tbl. 2.3.

17. *See id*.

18. *Id.* at 25–26.

19. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 14, at 72.

20. *Id.* at 74.

21. *Id.* at 123.

22. *Id.*

and diseases.[23] Invasive weed species and pests are generally more adaptable to climate change than native species and will migrate north as temperatures rise.[24] Ticks and mosquitoes thrive in the longer summers with more intense and frequent precipitation.[25] Populations of corn borer, aphids carrying soybean mosaic virus, and leaf hoppers will increase with milder winters.[26] Warmer temperatures are stressful to cattle and livestock, affecting their ability to produce milk, reach optimal weight, and reproduce.[27] Projected heat waves and increases in nighttime temperatures induce livestock stress and will require confined animal operations to invest in costly cooling equipment.[28]

Increasing carbon dioxide levels in the air creates more weed, pest, and disease management challenges for farmers and reduces the effectiveness of pesticides and herbicides.[29] For example, a study on glyphosphate, commonly known as Roundup, showed that the herbicide "loses its efficacy on weeds grown at carbon dioxide levels that are projected to occur in the coming decades."[30] Plant resistance to herbicides such as Roundup is becoming a serious problem for conservation practices, such as no-till farming, where farmers are dependent on herbicide rather than soil tillage to kill weeds.[31] Production costs will increase as the demand for herbicide increases to compensate for deficient effectiveness and higher weed growth. While increasing carbon dioxide concentrations in the air can catalyze plant growth in some crops,[32] this marginal benefit is outweighed by the negative impacts of climate change.

Climate change and changing weather patterns also will affect water availability for farmers and water quality for human use. Northern regions

23. *Id.* at 76.

24. *Id.* at 72, 83.

25. PETER C. FRUMHOFF ET AL., NE. CLIMATE IMPACTS ASSESSMENT, CONFRONTING CLIMATE CHANGE IN THE U.S. NORTHEAST: SCIENCE, IMPACTS, AND SOLUTIONS 100 (Union of Concerned Scientists 2007), *available at* http://www.northeastclimateimpacts.org/pdf/confronting-climate-change-in-the-u-s-northeast.pdf.

26. CYNTHIA ROSENZWEIG ET AL., CLIMATE CHANGE AND U.S. AGRICULTURE: THE IMPACTS OF WARMING AND EXTREME WEATHER EVENTS ON PRODUCTIVITY, PLANT DISEASES, AND PESTS 15 tbl.2 (Center for Health and the Global Environment 2000), *available at* http://chge.med.harvard.edu/publications/documents/agricultureclimate.pdf.

27. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 14, at 78.

28. *Id*. Stress from heat and the resulting decrease in milk production occurs in dairy cattle when ambient air temperatures exceed eighty degrees Fahrenheit. *See* J. Brouček et al., *Effects of High Air Temperatures on Milk Efficiency in Dairy Cows*, 51 CZECH J. ANIMAL SCI. 93, 93–94 (2006) (discussing the effects of humidity and warm air temperatures on milk and protein production in dairy herds).

29. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 14, at 76, 78.

30. *Id.* at 75.

31. *See* Editorial, *Resisting Roundup*, N.Y. TIMES, May 17, 2010, at A22.

32. *See* BACKLUND ET AL., *supra* note 15, at 34.

of the Great Plains will experience more rain, while western and southwestern regions will become even drier.[33] Intense rainfall decreases water quality by increasing sediment loading and agricultural pollutants, such as fertilizer and chemicals, in waterways and streams.[34] Flooded fields reduce productivity by depleting oxygen from the soil and delaying planting periods.[35] Already, climate disasters have led to dramatically higher crop and flood insurance losses, including over fifteen billion dollars in crop losses in 2008 alone due to Midwest flooding.[36] Pathogens thrive in the higher water temperatures, contaminating both livestock and human water supplies.[37] Higher evaporation rates will outpace projected increases in precipitation, exacerbating competition and conflict over water resources for an increasing population, irrigation, and livestock needs.[38]

C. Agriculture Is a Major Contributor to Greenhouse Gas Emissions

In contributing significantly to GHG pollution, agriculture is unintentionally undermining its ability to meet the food, feed, fiber, and energy demands of a growing world population.[39] Globally, agriculture is responsible for fourteen percent of the total world GHG emissions increase in the last thirty years.[40] In the United States, agriculture contributes over seven percent of all annual GHG emissions.[41] Nitrous oxide, methane, and carbon dioxide are the primary GHGs attributable to agricultural operations. Nitrous oxide and methane are more "carbon intense" than carbon dioxide. One unit of nitrous oxide has the equivalent global warming effect of 310 units

33. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 14, at 123.

34. U.S. ENVTL. PROT. AGENCY, NATIONAL WATER PROGRAM STRATEGY: RESPONSE TO CLIMATE CHANGE 38 (2008), *available at* http://water.epa.gov/scitech/climatechange/upload/20081016_nwpsresponse_to_climate_change_revised.pdf.

35. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 14, at 74.

36. NEAL LOTT ET AL., NAT'L CLIMATIC DATA CTR., BILLION DOLLAR U.S. WEATHER DISASTERS, 1980–2009 1 (2010), *available at* http://www.ncdc.noaa.gov/img/reports/billion/billionz-2009.pdf.

37. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 14, at 94–96, 119.

38. *See id*. at 123.

39. *See World Vital Events Per Time Unit: 2010*, U.S. CENSUS BUREAU, http://www.census.gov/cgi-bin/ipc/pcwe (last visited Dec. 6, 2010) (estimating that the world population is naturally increasing by 2.4 people every second).

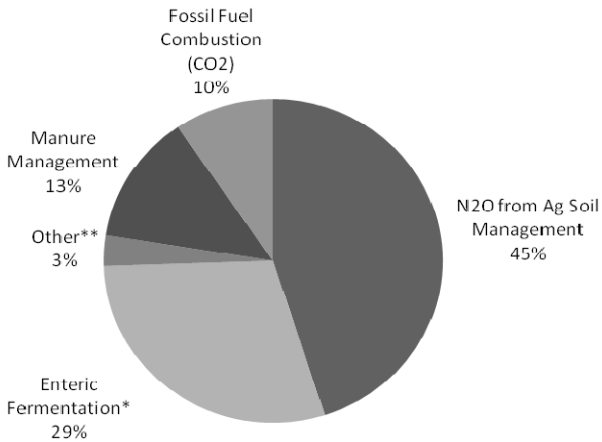
40. *See, e.g.,* BARILLA CTR. FOR FOOD & NUTRITION, CLIMATE CHANGE, AGRICULTURE & FOOD 13–14 (2009), *available at* http://www.barillacfn.com/uploads/file/62/1244800029_ClimateChangeEN_BarillaCFN_0609.pdf.

41. U.S. ENVTL. PROT. AGENCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2008, 2-17 tbl.2-12 (2010), *available at* http://www.epa.gov/climatechange/emissions/downloads10/US-GHG-Inventory-2010_Report.pdf (showing the agriculture sector produced 7.2% of the total U.S. greenhouse gas emissions in 2008).

of carbon dioxide, and methane has twenty-one times the equivalency of carbon dioxide.[42]

The largest sources of agriculture-based GHG emissions include soil management, enteric fermentation, and manure management. Soil management practices that release nitrous oxide into the atmosphere account for nearly half of all emissions.[43] Adding fertilizers to the soil, applying managed livestock manure or manure deposits from grazing, and cultivating nitrogen fixing crops (such as soybeans) increase nitrogen levels necessary for promoting vegetative growth and production yields.[44] However, the amount of nitrogen in soil is directly related to nitrous oxide emissions.[45]

U.S. Agricultural Sector, Major GHG Emission Sources



*Enteric fermentation refers to emissions resulting from livestock and other ruminant animal digestion processes.
**Includes rice cultivation, liming of agricultural soils, and urea fertilization.

Animal husbandry and manure management are also significant contributors to global warming, producing almost half of the world's and the

42. BARILLA CTR. FOR FOOD & NUTRITION, *supra* note 40, at 40.

43. *See* U.S. ENVTL. PROT. AGENCY, *supra* note 41, at 2-17 tbl.2-12 (attributing 3.1% of total U.S. greenhouse gas emissions in 2008 to nitrous oxide from agricultural soil management); *see also* BARILLA CTR. FOR FOOD & NUTRITION, *supra* note 40, at 39 (stating that forty-six percent of all annual agricultural greenhouse gas emissions worldwide are attributed to "nitrous oxide from working agricultural land and the use of energy").

44. U.S. ENVTL. PROT. AGENCY, *supra* note 41, at 6-16.

45. *Id.* at 6-16 to 6-17. Direct emissions are the result of nitrification and dentrification, the processes by which microorganisms in the soil convert ammonia into nitrogen, emitting nitrous oxide as an intermediate gaseous byproduct. *Id.* at 6-16 n.137. Indirect emissions result from evaporation and runoff of applied or mineralized nitrogen. *Id.* at 6-17.

United States' agricultural emissions in the form of methane.[46] The natural digestive processes of ruminant livestock, known as "enteric fermentation," produce a quarter of all anthropogenic methane emissions in the United States.[47] Beef cattle far outweigh other livestock in methane production, representing seventy-two percent of the total methane emissions from enteric fermentation.[48] Manure management practices produce eight percent of methane emissions.[49] Manure that is stored or treated in a liquid slurry lagoon, pond, or tank is decomposed by anaerobic bacteria that emit methane.[50] In contrast, manure solids used as fertilizers and natural manure deposits on pasture or rangeland are exposed to oxygen when decomposing and produce little to no methane emissions.[51]

Farm equipment that burns gasoline, diesel, and propane fuels also emits carbon dioxide into the atmosphere[52] and represents nearly ten percent of all annual greenhouse gas emissions from agriculture.[53]

II. FEDERAL GLOBAL WARMING POLICY INITIATIVES AFFECTING AGRICULTURE

Given agriculture's carbon footprint and, as explained in Part IV below, its ability to reduce carbon emissions, it is not surprising that federal farm, energy, and environmental policies affect agriculture in different ways. On the one hand, policies such as the federal Farm Bill include several incentives to encourage farm-based production of renewable energy. Recent Congressional proposals to reduce carbon emissions also include incentives for agriculture to help cut carbon emissions. On the flip side, the EPA is beginning to evaluate ways to regulate carbon emissions from different agricultural operations, beginning with large animal feedlot facilities.

A. Recent Federal Climate Proposals

To date, Congress has failed to pass comprehensive global warming legislation, largely because of Senate inaction. In June 2009, the House of

46. BARILLA CTR. FOR FOOD & NUTRITION, *supra* note 40, at 39 (stating that methane emissions come from "animal digestive fermentation processes (27%), rice cultivation (10%) and management of organic fertilizers (7%)"); *see also* U.S. ENVTL. PROT. AGENCY, *supra* note 41, at 2-17 tbl.2-12.

47. U.S. ENVTL. PROT. AGENCY, *supra* note 41, at 6-1.

48. *Id.* at 6-2.

49. *Id.* at 6-1.

50. *Id.* at 6-6.

51. *Id.*

52. *See* BARILLA CTR. FOR FOOD & NUTRITION, *supra* note 40, at 39.

53. *Id.*

Representatives passed the American Clean Energy and Security Act (ACES), also known as the Waxman-Markey bill.[54] The foundation of ACES is a national cap on carbon emissions that declines over time.[55] ACES would distribute carbon "allowances" to major carbon-emitting industries and authorize those industries to trade carbon allowances amongst each other and sell the allowances in carbon markets.[56] Agriculture is not directly regulated as an emission source in ACES.[57] Indeed, the legislation would provide income opportunities to agriculture through an "offsets" market in which agriculture and forestry practices, among others, could sell offset credits for carbon sequestration and other greenhouse gas reduction measures.[58] The value of the offset credit would be determined by multiplying the offset amount by the carbon price.[59] Farmers and others essentially would receive payments to reduce their carbon emissions or sequester carbon through changed farming practices. For example, dairy farmers could receive carbon credits for processing cow manure through anaerobic digesters to reduce methane emissions. Farmers could sell these credits to regulated industries, which could then emit one ton of carbon for each ton of purchased offset credit.

ACES also includes a national renewable electricity standard (RES) that would require electric utilities to provide at least twenty percent of their electricity from renewable energy sources such as wind, solar, and biomass power.[60] A national RES would provide new income opportunities for farmers and forest owners through investments and profits from the development of new wind, biomass, and other renewable energy resources required under an RES.

In contrast to the House, the Senate has not yet passed any global warming legislation. Several members of Congress introduced carbon legislation in the 111th Congress, but none garnered sufficient support to pass.

54. American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. (as passed by House, June 26, 2009).

55. *Id.* § 702.

56. *Id.* § 724.

57. *See In Brief: What the Waxman-Markey Bill Does for Agriculture*, PEW CTR. ON GLOBAL CLIMATE CHANGE, July 2009, at 1, *available at* http://www.pewclimate.org/docUploads/in-brief-waxman-markey-agriculture-oct2009.pdf.

58. H.R. 2454, *supra* note 54, § 503.

59. INFORMA ECON., POTENTIAL IMPACTS OF CAP-AND-TRADE POLICY ON U.S. AGRICULTURAL PRODUCERS 9, 10 fig. 2 (2010), *available at* http://www.farmland.org/documents/InformaPotentialImpactsofCapandTrade.pdf (showing, for example, "the offset credit for adopting no-till practice in 2025 would be $35 per acre" at a carbon price of $66 per metric ton and a set sequestration rate for no till of 0.53 metric tons of carbon dioxide equivalent per acre per year).

60. H.R. 2454, *supra* note 54, § 101.

The American Power Act,[61] for example, drafted by Senators John Kerry and Joseph Lieberman, seeks to cut carbon pollution emissions 4.75% below 2005 levels by 2013, 17% by 2020, 42% by 2030, and 83% by 2050.[62] Under this Act, greenhouse gases from specified activities are capped, and the EPA must distribute allowances to regulated sources.[63] Regulated sources that emit more than their combined allowance level and offset purchases are subject to monetary penalties.[64]

The Act proposes to start the carbon price at a floor of twenty-five dollars per ton, increasing five percent and accounting for inflation each year.[65] The Act would exempt U.S. agriculture and forestry sectors from capping emissions and would allow selling greenhouse gas emission reductions at a significant enough level to meet the Act's goals.[66] The Act directs the Secretary of Agriculture and the Administrator of the EPA to create an offset credit program from sources that are not subject to emission regulation under the Act, such as agriculture and forestry.[67]

B. Farm Bill Energy Title

Recognizing the increasingly critical role of farmers and agriculture in supplying renewable energy for the nation, Congress created the first ever Energy Title for the Farm Bill in the Farm Security and Rural Investment Act of 2002.[68] That legislation included $800 million in mandatory funding over five years for several programs, including a new initiative—Section 9006, Renewable Energy Systems and Energy Efficiency Improvements[69]—to help farmers and rural small businesses invest in renewable energy and energy efficiency projects. The Energy Title also included subsidies for ethanol and other biofuels,[70] more funding for biomass research and development,[71] and other programs.[72]

61. American Power Act, *supra* note 2.
62. *Id.* §§ 701–703.
63. *Id.* § 721.
64. *Id.* § 723.
65. *Id.* § 726(b)(3).
66. *Id.* § 733.
67. *Id.* §§ 722, 733.
68. *See* Farm Security and Rural Investment Act of 2002, Pub. L. No. 107-171, tit. 9, 116 Stat. 134, 475–85 (2002) (codified at 7 U.S.C. §§ 8101–8108 (2006)).
69. *Id.* § 9006, 116 Stat. at 482 (codified at 7 U.S.C. § 8106).
70. *Id.* § 9010, 116 Stat. at 485 (codified at 7 U.S.C. § 8108).
71. *Id.* § 9008, 116 Stat. at 483 (codified as amended at 7 U.S.C. § 7624).
72. *E.g., id.* § 9007, 116 Stat. 483 (hydrogen and fuel cell technologies).

More recently, Congress reauthorized the Farm Bill in the Food, Conservation, and Security Act of 2008.[73] It includes a larger and better-funded Energy Title with new programs and a stronger federal commitment to farm-based energy. Congress increased the total mandatory funding for the Energy Title to $1.12 billion over four years. Notably, Congress more than doubled funding for the Section 9006 program[74] and renamed it the Rural Energy for America Program (REAP).[75]

The 2008 Farm Bill also included new funding to help farmers establish and grow dedicated new "energy crops." Known as the Biomass Crop Assistance Program (BCAP),[76] it is intended to help break the "chicken and egg" problem of developing a new advanced biofuels industry in the United States. Biorefinery developers often cannot obtain capital financing without an assured energy crop feedstock, yet farmers are unlikely to grow the feedstock without an assured market. BCAP addresses this conundrum by providing significant financial incentives to farmers and private forest owners to grow energy crops.[77]

Among other funded programs, the 2008 Farm Bill provided significant financing incentives for(1) new cellulosic ethanol and other advanced biofuel refineries;[78] (2) "greening" ethanol plants by converting their fossil fuel power sources to renewable energy;[79] (3) production of soy biodiesel and other non-corn starch biofuels;[80] (4) biobased product development;[81] and (5) biomass research and development.[82]

Most of the Farm Bill's Energy Title programs reduce global warming emissions compared to the "business as usual" approach of continuing to rely on inefficient equipment and fossil fuels. According to a 2007 report, MITIGATING GLOBAL WARMING THROUGH THE FARM BILL, most of the Energy Title's major funded programs listed above could save, or displace, tens of millions of tons of carbon dioxide and other greenhouse gases an-

73. Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-246, tit. 9, 122 Stat. 1651, 2064–96 (2008) (to be codified at 7 U.S.C. §§ 8101–8113).

74. 122 Stat. 2079.

75. *Id.* § 9007, 122 Stat. at 2077 (to be codified at 7 U.S.C. § 8107).

76. *Id.* § 9011, 122 Stat. at 2089 (to be codified at 7 U.S.C. § 8111).

77. *Id.*

78. *See id.* § 9003, 122 Stat. at 2072 (to be codified at 7 U.S.C. § 8103) (Biorefinery Assistance).

79. *See id.* § 9004, 122 Stat. at 2075 (to be codified at 7 U.S.C. § 8104) (Repowering Assistance).

80. *See id.* § 9005, 122 Stat. at 2075–76 (to be codified at 7 U.S.C. § 8105) (Biorefinery Program for Advanced Biofuels).

81. *Id.* § 9002, 122 Stat. at 2067 (to be codified at 7 U.S.C. § 8102) (Biobased Markets Program).

82. *Id.* § 9008, 122 Stat. at 2079–80 (to be codified at 7 U.S.C. § 8108) (Biomass Research and Development).

nually, based on one billion dollars in annual program funding.[83] REAP, the Biorefinery Assistance Program, the Repowering Assistance Program, and an existing biofuels production incentive program were responsible for the bulk of the carbon savings.[84] The report points out that renewable biofuels can substitute for a significant portion of total petroleum use, while renewable power generation can displace coal and other fossil fuel energy.[85] Energy efficiency upgrades also reduce the overall consumption of fossil fuels on farms and by rural businesses.[86]

III. PRODUCTION COST IMPACTS FROM CARBON REGULATION

Opponents of federal climate change legislation often point to the cost side of the equation while downplaying the benefits to agriculture. In truth, legislation is likely to result in a net financial upside to farmers and other agriculture producers. Limiting global warming pollution will drive new opportunities and revenues for the farm community through valuable offsets, efficiency, farm-based renewable energy, and other options. While agri-business will face some cost impacts, they will be minimal in comparison to the benefits. Equally important, reducing global warming pollution will lead to less violent and more predictable weather, which is critical for agriculture to survive.

A. Studies Show Modest Cost Increases in the Short Term

Agriculture is an energy-intensive industry. Energy costs account for over half of the total operating costs in producing crops such as corn, wheat, sorghum, oats, and barley.[87] For example, farmers use fuel to cultivate and transport crops to market and use propane to dry grain in wet years.[88] Electricity and natural gas prices also impact agriculture indirectly through fertilizer production costs. Any legislation that affects energy prices will also therefore impact agriculture.

83. CHARLES KUBERT & JASON FRANKEN, ENVTL. LAW AND POLICY CTR., MITIGATING GLOBAL WARMING THROUGH THE FARM BILL: MEASURING THE POTENTIAL GREENHOUSE GAS SAVINGS OF THE FARM BILL'S ENERGY TITLE PROGRAMS 1 (2007).

84. *See id.* at 4.

85. *Id.* at 5.

86. *Id.*

87. OFFICE OF THE CHIEF ECONOMIST, U.S. DEP'T OF AGRIC., A PRELIMINARY ANALYSIS OF THE EFFECTS OF HR 2454 ON U.S. AGRICULTURE 3 fig.1 (2009), *available at* http://www.usda.gov/documents/PreliminaryAnalysis_HR2454.pdf.

88. *See* DOANE ADVISORY SERVICES, AN ANALYSIS OF THE RELATIONSHIP BETWEEN ENERGY PRICES AND CROP PRODUCTION COSTS 2 (2008).

Multiple studies have analyzed the effect of cap-and-trade legislation on agriculture.[89] The studies analyze the effect on agriculture production costs by assuming various prices on carbon and the resulting increase on overall energy costs. However, these energy costs will have a comparably small impact on farm income. The U.S. Department of Agriculture (USDA) predicts a decline in net farm income of only 0.9% from current levels,[90] mostly from increases in the cost of direct energy inputs such as gasoline, diesel fuel, liquid petroleum, natural gas, and electricity.[91] Another study estimates that legislation similar to ACES will increase production costs to 1% of total variable costs for corn and soybeans, and to 1.6% of total variable costs for wheat.[92]

Anhydrous ammonia, which is a nitrogen-rich fertilizer made from natural gas, is one of the biggest expenditures for U.S. farmers.[93] The USDA's study of the House ACES bill predicts that provisions in the ACES bill will limit fertilizer price increases through 2025 by providing special emissions allowances to industries that are energy-intensive and exposed to trade.[94]

Stabilizing the price of input costs such as anhydrous ammonia is especially important to livestock producers because it will prevent farmers from reducing overall acreage.[95] Acreage reduction can benefit farmers through higher prices but will drive up feed costs for livestock.[96] The USDA estimates that modest increases in crop production costs will not increase livestock prices at all in the short term.[97]

89. *See e.g.*, DANIEL DE LA TORRE UGARTE ET AL., BIO-BASED ENERGY ANALYSIS GROUP, ANALYSIS OF THE IMPLICATIONS OF CLIMATE CHANGE AND ENERGY LEGISLATION TO THE AGRICULTURAL SECTOR intro. at i (University of Tennessee 2009), *available at* http://www.25x25.org/storage/25x25/documents/ut_climate_energy_report_25x25_november11.pdf (assuming a carbon range of $27 to $160 per CO_2e); OFFICE OF THE CHIEF ECONOMIST, U.S. DEP'T OF AGRIC., *supra* note 87, at 4 tbl.1 (assuming a carbon price range of $12.64 to $70.40 per CO_2e).

90. OFFICE OF THE CHIEF ECONOMIST, U.S. DEP'T OF AGRIC., *supra* note 87, at 8 tbl.5.

91. *See id.* at 2.

92. INFORMA ECON., *supra* note 59, at 7–8.

93. *See Major Input Expenditures by Total, Percent of Total—United States: 2009*, NAT'L AGRIC. STATISTICS SERV., http://www.nass.usda.gov/Charts_and_Maps/graphics/arms3cht2_large.gif (last visited Dec. 6, 2010) (chemicals, fertilizers, and seeds made up 16.4% of all farm expenditures in 2009, equaling $47.1 billion).

94. OFFICE OF THE CHIEF ECONOMIST, U.S. DEP'T OF AGRIC., *supra* note 80, at 4 (citing Subtitle B of Title IV of H.R. 2454, which distributes specific quantities of emissions allowances to "energy-intensive, trade exposed entities" (EITE) and the EPA's list of presumed eligible sectors for the exemption, including fertilizer manufacturers (*supra* note 52)).

95. *See, e.g., id.* at 8.

96. *Id.*

97. *Id.* at 8 tbl.4.

B. Long-Term Outlook

Most studies estimate that higher energy prices will have only "modest" impacts on agriculture in the long run.[98] Higher production costs for farmers are especially worrisome to livestock producers because they depend on affordable feedstock sources for profitability. However, a 2009 University of Tennessee study concluded that "[c]ap-and-trade legislation would not create major disruptions in crop or bioenergy feedstock prices, and would enhance price returns to producers."[99] Most studies estimate long-term cost increases around seven percent and crop price increases within ten percent.[100]

The USDA estimates that cap-and-trade programs have the potential to raise fuel, oil, electricity, and fertilizer expenses by approximately twenty percent in the long term, but that does not necessarily translate into higher on-farm expenses.[101] Historically, farmers and the industry have reacted well to negative changes in market conditions, such as by increasing efficiency.[102] Several analyses of ACES show the impact of fertilizer on variable production costs. Under ACES, emission allowances for energy-intensive and trade-exposed industries would begin to expire by 2025.[103] Informa Economics estimates that a cap-and-trade program with an emission allowance for fertilizer manufacturers would increase production costs for soybeans and wheat in 2020 to only 1% and 1.6% of total variable costs, respectively.[104] By 2035, after the allowance has expired, the increase in wheat and soybean production costs would be closer to 7.3% and 3.3% of total variable costs, respectively.[105] Due to the large amount of fertilizer used to produce corn, the production costs for corn by 2035 will increase by approximately 7.8% to 9.6%.[106]

Higher energy prices will not affect all regions of the country equally. Regions that use less fertilizer, such as the Northern Great Plains, will be less affected in the long term when energy-intensive and trade-exposed

98. *See e.g.* INFORMA ECON., *supra* note 59, at 1.; OFFICE OF THE CHIEF ECONOMIST, U.S. DEP'T OF AGRIC., *supra* note 87, at 1; *see also* UGARTE ET AL., *supra* note 89, at 10.

99. UGARTE ET AL., *supra* note 89, at 13.

100. *See id.* (crop prices increase up to ten percent); INFORMA ECON., *supra* note 59, at 6 (production costs increase up to seven percent).

101. OFFICE OF THE CHIEF ECONOMIST, U.S. DEP'T OF AGRIC., *supra* note 87, at 10.

102. *See id.* at 11.

103. H.R. 2454, *supra* note 52, § 321.

104. INFORMA ECON., *supra* note 59, at 8.

105. *Id.* at 7–8 & fig. 1.

106. *Id.* at 7 (7.8%); OFFICE OF THE CHIEF ECONOMIST, U.S. DEP'T OF AGRIC., *supra* note 87, at 10 (9.6%).

emission allowances expire.[107] Similarly, parts of the country that rely heavily on irrigation will be impacted the most in the short term by increases in energy prices.[108]

Long-term production cost increases may reduce supply and increase crop prices,[109] but better efficiency should be a beneficial consequence of climate change legislation. Optimizing fertilizer management practices will become essential when long-term fertilizer costs peak.[110] Energy cost increases in the 1970s spurred increased energy efficiency in all sectors of the United States economy.[111] As noted in the prior section, higher energy prices do not mean corresponding income reductions, since more efficiency and some ability to pass on increases to consumers mitigate the impacts.

IV. AGRICULTURE'S "WIN-WIN" SCENARIO IN THE GLOBAL WARMING FIGHT

Agriculture's potential for reducing GHG emissions and helping to reverse global warming more than offsets its direct contributions to global warming. Properly constructed legislation can create new business opportunities for agriculture by incentivizing conservation and sequestration practices employed by producers. Biological sequestration practices reduce greenhouse gases by retaining organic matter, which absorbs carbon dioxide through photosynthesis, into the soil. Conservation practices and promotion of renewable fuel and electricity standards can reduce greenhouse gases by avoiding fossil fuel emissions. Effective manure and fertilizer management can reduce methane and nitrous oxide emissions, two greenhouse gases that are even more damaging to the environment than carbon dioxide. Legislation that employs these practices can create economic opportunities for agriculture and avoid the damaging long-term costs of climate change to agricultural production, thus creating a "win-win" future for farmers and the environment.

107. *See* INFORMA ECON., *supra* note 59, at 6.

108. *See id.*

109. *See e.g.* BRIAN C. MURRAY ET AL., NICHOLAS INST FOR ENVTL. POLICY SOLUTIONS, HOW MIGHT CARBON PRICES AND ENERGY COSTS AFFECT RETURNS TO AGRICULTURAL PRODUCERS 2 (Nicholas Institute for Environmental Policy Solutions 2009), *available at* http://nicholasinstitute.duke.edu/mitigationbeyondcap/how-might-carbon-prices-and-energy-costs-affect-returns-to-agricultural-producers.

110. *See* INFORMA ECON., *supra* note 59, at 14 (stating "several practices . . . can be included in the discussion of improved fertilizer . . . including [t]iming of fertilizer application, [t]he method of fertilizer application, [t]he type of fertilizer applied, including the use of advanced fertilizers, [o]ptimum placement of fertilizer applications, [and] [u]se of nitrogen-fixing cover crops").

111. *See* OFFICE OF THE CHIEF ECONOMIST, U.S. DEP'T OF AGRIC., *supra* note 87, at 5 (predicting that "[o]ver the long run, technological changes could help mitigate costs").

A. The Right Legislation Means New Business Opportunities

With appropriately-designed legislation, agriculture and forestry offset practices can be worth billions of dollars to farmers, agri-business, and rural economies. Opportunities will exist through carbon offsets, new markets for dedicated energy crops and other renewable energy, and efficiency improvements. Although a carbon-based cap-and-trade program is not the only solution, a well-designed and implemented program could offer the most benefits to agriculture. Under a cap-and-trade type program, similar to the ACES bill, legislation sets a ceiling, or "cap," on the amount of greenhouse gas emissions from certain sources. Regulated emitters can either reduce their emissions below this ceiling or purchase offset credits from other sources that are able to reduce emission levels below their cap.[112] Certain agricultural practices can either reduce emissions or sequester carbon from the air into the soil.[113] These reductions and sequestrations are converted into credits, which regulated sources may purchase to offset emission levels above their cap.[114] Thus the carbon market can become a source of more revenue for producers and reduce production costs for agriculture.[115]

Crop producers in the Midwest stand to gain financially from climate change legislation, in both the near term and long term. Legislation that caps carbon emissions and creates an offset market for environmentally sound agricultural practices could provide a new revenue source for Midwest farmers. For example, at a carbon price of twenty-seven dollars per metric ton,[116] cap-and-trade legislation can provide $4 billion annually to the agriculture sector.[117] Even considering higher energy costs, climate change legislation that promotes biofuels and sets a price on carbon can increase returns for corn producers around twelve percent.[118] The EPA estimates that annual returns to agriculture can rise to twenty billion dollars per year by 2050.[119] According to a 2008 analysis, Midwest/Great Plains farms have the highest carbon abatement potential of any region in the

112. *See* UGARTE ET AL., *supra* note 89, at 1.
113. *Id.*
114. *Id.*
115. *See e.g.* INFORMA ECON., *supra* note 59, at 1.
116. UGARTE ET AL., *supra* note 82, at 5 tbl.1.
117. UGARTE ET AL., *supra* note 89, at 11.
118. *See* MURRAY ET AL., *supra* note 109, at 4.
119. OFFICE OF THE CHIEF ECONOMIST, U.S. DEP'T OF AGRIC., *supra* note 87, at 11.

country, followed by the South, West, and Northeast.[120] The bottom line for all of these studies is that the economic and environmental benefits outweigh the costs.

Other policy approaches, such as renewable fuels and renewable electricity standards, and efficiency rules and incentives, also could reduce carbon emissions. By themselves, however, these laws will not create the right market conditions for a strong carbon credit market and likely will mean fewer business opportunities for agriculture.

B. Biological Sequestration

The Midwest and Great Plains were once covered in vast ranges of prairie and native grasses. Over the years, the grasses deposited carbon into the topsoil of the Midwest in the form of organic matter. This rich soil was attractive to pioneers moving west, who plowed through the prairie, oxidizing carbon in the soil and releasing it into the atmosphere. Over the years, carbon released from soils has outpaced the replacement of organic matter. But farmers in the Midwest and Great Plains regions can sequester carbon from the atmosphere back into the soil in multiple ways. Biological sequestration practices provide offset credits by using trees and crops to take carbon out of the atmosphere and place it into the soil. "No till" or "conservation" tillage is a common offsetting practice that sequesters carbon by limiting soil disturbance. This also improves soil health by increasing organic matter in the soil and preventing erosion from wind or water.[121] Sequestration rates depend on a variety of factors including geographic location and soil type,[122] and the overall price of carbon credits.

Besides "no-till" farming, other conservation practices also sequester carbon from the atmosphere and can be sold as an offset credit. Using cover crops and eliminating summer fallow practices can increase producer revenue by thirty-nine and twenty dollars per acre, respectively.[123] Offsets can also be achieved through managed shelterbelts and forested riparian zones, which can also improve soils and waterways by preventing runoff and erosion.

120. JOHN CREYTS ET AL., U.S. GREENHOUSE GAS ABATEMENT MAPPING INITIATIVE, REDUCING U.S. GREENHOUSE GAS EMISSIONS: HOW MUCH AT WHAT COST? 24 (McKinsey & Company 2007), *available at* http://www.mckinsey.com/clientservice/sustainability/pdf/US_ghg_final_report.pdf.

121. Bruce A. Babcock, *Costs and Benefits to Agriculture from Climate Change Policy*, IOWA AG REV., Summer 2009, at 1, 3, *available at* http://www.card.iastate.edu/iowa_ag_review/summer_09/IAR.pdf.

122. INFORMA ECON., *supra* note 59, at 10.

123. *Id.* at 13–14.

One concern raised by cap-and-trade opponents is that farmers will convert food-producing cropland into forests to capitalize on the high sequestration rates from trees compared to crop production sequestration, such as conservation tillage.[124] However, at a carbon price of around $27 per metric ton, "both crops and herbaceous perennial grasses outcompete afforestation" in revenue returns.[125] Shifts of cropland out of food production and into forests do not become viable until a carbon price of around $80 per metric ton, and remain insignificant until carbon prices reach $160, a price unlikely to occur.[126]

C. Avoided Fossil Fuel Emissions

Cap-and-trade legislation will drive up the cost of gasoline, diesel fuel, and natural gas on the petroleum markets. Carbon offsetting practices that reduce fossil fuel consumption will be an important cost-saving mechanism for agriculture. These market changes, including substituting gasoline, diesel fuel, and natural gas on the farm, will also make biofuels a more competitive and viable option for all industries.

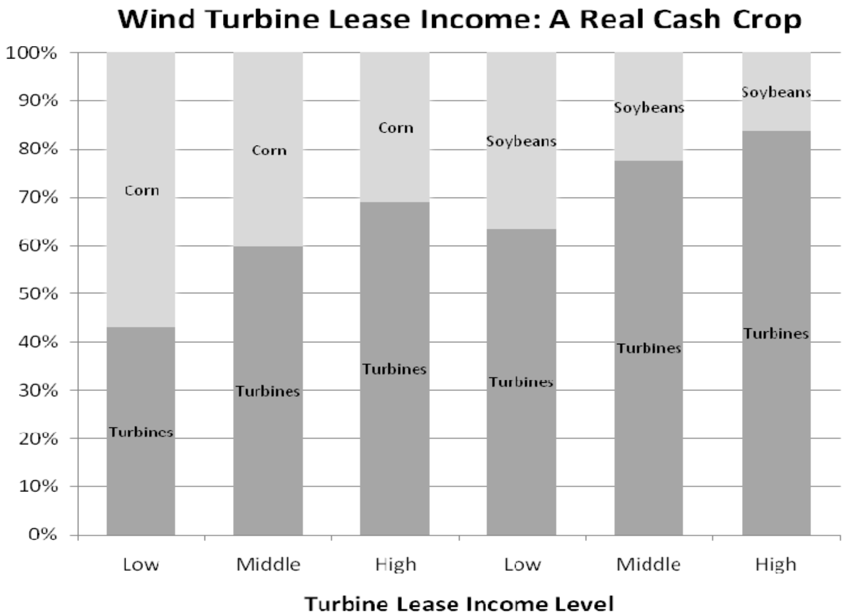
Legislation that includes future standards for renewable fuel and renewable electricity also can produce revenue options for farmers. The ACES bill included a renewable electricity standard that requires states to generate six percent of electricity from clean, renewable sources by 2012 and twenty percent by 2020.[127] Wind turbines, a source of clean energy that may be used by utilities to meet their renewable electricity standard, provide a supplemental income opportunity in the form of rental payments to farmers who provide land for construction, thus further mitigating any cost impacts.

124. *Id.* at 9 (stating that "the no-till credit reaches $35/ac (in nominal terms) by 2025 while the credit for afforestation reaches $100/ac by 2025").

125. UGARTE ET AL., *supra* note 89, at 13.

126. *Id.* at 15.

127. INFORMA ECON., *supra* note 59, at 18.



Source: Environmental Law and Policy Center (Chicago, Illinois) research and analysis

Demand for energy crops grown in the Great Plains and Midwest, such as corn grain, soybeans, and switchgrass, will increase as the nation implements the 2007 federal renewable fuel standard.[128] Properly constructed legislation will incentivize producers to cultivate new energy crops, especially in poor soil regions where production yields are below national averages. Studies estimate that wheat producers yielding up to twenty percent below regional averages could increase net revenues eighteen dollars per acre by transitioning to switchgrass.[129] Biomass cultivation provides opportunities for producers to receive carbon payments and governmental incentives, such as BCAP.[130] BCAP offers payments to eligible biomass crop producers, including payments for up to seventy-five percent of the cost of establishing biomass crops and matching payments of up to forty-five dollars per dry ton.[131]

128. *Id.* at 19 (estimating that fifty to seventy-five percent of the increase in demand will be met with energy crops).

129. *Id.* at 20.

130. *Id.* at 19.

131. *The Biomass Crop Assistance Program Fact Sheet*, U.S. DEP'T OF AGRIC. FARM SERV. AGENCY 1–2 (June 2010), http://www.fsa.usda.gov/Internet/FSA_File/bcap2010.pdf.

D. Cutting Methane and Nitrogen Emissions

Cap-and-trade legislation also should provide opportunities for livestock producers to benefit from offset practices. Reductions in methane emissions through effective manure management practices, such as capturing emissions in an anaerobic handling facility, create valuable carbon offset credits. Methane mitigation from livestock provides significant revenue opportunities because the reduction of one ton of methane is equal to reducing carbon dioxide emissions by twenty-one tons.[132] Studies show that dairy farms are capable of reducing annual equivalents of five tons of carbon dioxide per cow.[133] With projected carbon prices above twenty dollars per metric ton, methane mitigation can increase revenue opportunities for livestock producers through selling offset credits. Digesters equipped with electric generators powered by burning methane gas reduce on-farm electricity costs and create a revenue opportunity from selling electricity back to the power grid.

Reducing nitrous oxide emissions through efficiently-managed use of nitrogen fertilizer is another carbon credit offset source. Improvement of the timing, method, and type of fertilizer used, along with the use of optimizing placement technology to reduce over-application, can generate additional revenue.[134] Efficient fertilizer management is a smart policy for all farmers because it reduces expenses while generating revenue from the sale of offset credits.

E. A Cautionary Note About Offsets

While biological sequestration and other carbon-reduction offset practices offer much potential, legislation should be carefully designed to maximize their value and effectiveness. In addition to the fundamental requirement that sequestration and other offset projects be "additional" to existing actions, and would not have occurred without the offset's financial incentive,[135] offsets also must be permanent and minimize leakage. Permanence can mean forever, 100 years, the life of an offset contract, or some-

132. *High Global Warming Potential (GWP) Gases*, U.S. ENVTL. PROT. AGENCY, http://epa.gov/highgwp/ (last visited Aug. 26, 2010).

133. Babcock, *supra* note 121, at 11.

134. INFORMA ECON., *supra* note 59, at 14 (twenty dollars per acre by 2035). A Midwest wheat farmer who employs conservation tillage and optimizes his fertilizer management practices can sell those credits for ninety-two dollars per acre by 2035. *Id.* at 17.

135. *See* JONATHAN L. RAMSEUR, CONG. RESEARCH SERV., RL 34241, VOLUNTARY CARBON OFFSETS: OVERVIEW AND ASSESSMENT 2 (2009) ("The additionality criterion is at the crux of an offset's integrity, but additionality can be difficult to assess in practice.")

thing else.[136] For example, tilling previously no-tilled cropland releases GHGs into the atmosphere and negates the sequestration. Considering the impermanence of most land-use-based projects, using the law itself as the basis for defining permanence may make sense.[137] In any event, uncertain or potentially short-term sequestration practices, especially those that do not accomplish the purpose of the policy, should not receive compensation.

Second, "leakage" is a risk with most carbon offset policies. Leakage occurs when efforts or practices intended to reduce carbon emissions in one area simply shift the emissions to another area.[138] Leakage undermines the GHG benefits of offset policies. For example, leakage within the agricultural sector could occur within grassland conversion offset projects, where cropland is converted to grassland to sequester carbon. Market forces could encourage the conversion of forests to new cropland to make up for the lost cropland, releasing previously sequestered carbon into the atmosphere. Such economically-driven leakage can be minimized through adjusting the overall carbon cap, careful regional and national accounting, and other options.[139]

CONCLUSION

Most farmers will tell you that their livelihood is a "gamble." Their success is heavily dependent on comparatively predictable weather patterns appropriate for the crops and livestock they grow. Farmers cannot simply adapt to a changing climate by cultivating different crops appropriate to warmer temperatures, since global warming really means "global uncertainty." More droughts, floods, and other weather extremes are likely to reduce overall farm production levels. That, in turn, will undermine the security of our nation's food, feed, fiber and energy supply.

Bruce Babcock, a professor of economics and director of the Center for Agriculture and Rural Development at Iowa State University, has correctly explained the need for agriculture to have a clear vision for the future:

> Given the likelihood of modest costs and benefits from a cap-and-trade system, perhaps agriculture should look at whether a cap-and-trade poli-

136. LYDIA OLANDER ET AL., NICHOLAS INST. FOR ENVTL. POLICY SOLUTIONS, STICKING POINTS IN OFFSETS POLICY 3 (2010), *available at* http://nicholasinstitute.duke.edu/mitigationbeyondcap/sticking-points-in-offsets-policy/.

137. *See id.*

138. W. AARON JENKINS ET AL., NICHOLAS INST. FOR ENVTL. POLICY SOLUTIONS, ADDRESSING LEAKAGE IN A GREENHOUSE GAS MITIGATION OFFSETS PROGRAM FOR FORESTRY AND AGRICULTURE 2 (2009), *available at* http://nicholasinstitute.duke.edu/climate/policydesign/offsetseries4.

139. *Id.* at 6–8.

> cy will change growing conditions for the better or worse as a deciding factor in whether to support a change in policy. Given how much irrigated agriculture in the West relies on consistent mountain snowfall and Corn Belt agriculture relies on warm summers with abundant rainfall, any disruptive change in climate will have a far greater impact on livelihoods than will the price of carbon.[140]

Responding to climate change through meaningful legislative solutions will benefit agriculture both now and in the future. In the short term, carbon legislation is likely to shield producers from many production cost increases. In the long term, especially with a rise in carbon prices and other renewable energy opportunities, revenue opportunities will far outpace any cost increases. Agriculture also will profit from a return to a more stable climate, which in turn benefits all of us.

140. Babcock, *supra* note 121, at 11.