Notes & Comments

Fire, Flood, Famine, and Pestilence: Climate Change and Federal Crop Insurance

Paul Janda*

Table of Contents

I. INTRODUCTION

It takes over one gallon of water to grow a single almond in California.[1] California farmers raise $5 billion of the nuts annually,[2] but because of the 2014 drought farmers let almond orchards die and bulldozed productive trees for firewood.[3] According to the United States Drought Monitor, nearly seventy-five percent of the state was blanketed by "extreme" or "exceptional" drought[4] that affected products from melons to cattle.[5] President Obama pledged nearly $200 million of relief.[6] Democratic legislators proposed hundreds of millions more in aid,[7] while California Republicans suggested legislation to erode the water use restrictions imposed by the Endangered Species Act.[8] Scholars suggest that even before the recent drought, water use in the Western United States put the entire region, including the enormous economy of California, at a historical "crossroads."[9] Unfortunately, weather and climate related disasters are not limited to the West; the National Oceanic and Atmospheric Association lists over thirty "Billion-Dollar Weather/Climate Disasters" in the last five years.[10]

---

* University of Colorado Law School, Class of 2015.

1. A single walnut takes five gallons. Max Ehrenfreund, *California's Drought is Extreme, but the Government is Making It Worse*, WASH. POST, Feb. 27, 2014, http://knowmore.washingtonpost.com/2014/02/27/californias-drought-is-extreme-but-the-government-is-making-it-worse.

2. Scott Smith, *California Almond Farmers Face Tough Choices,* ASSOCIATED PRESS, Feb. 24, 2014, *available at* http://bigstory.ap.org/article/california-almond-farmers-face-tough-choices-0.

3. *Id*.

4. *California Tabular Data Archive*, U.S. DROUGHT MONITOR, (Mar. 18, 2014, 8:39 P.M..), http://droughtmonitor.unl.edu/data/pngs/20140318/20140318_CA_date.png.

5. Norimitsu Onishi & Coral Davenport, *Obama Announces Aid for Drought-Stricken California*, N.Y. TIMES, Feb. 14, 2014, http://www.nytimes.com/2014/02/15/us/politics/obama-to-announce-aid-for-drought-racked-california.html.

6. *Id.*

7. *Id.*

8. Pete Kasperowicz, *House Looks to Help Calif. Drought Victims by Easing Obama's Water Restrictions*, THE HILL (Jan. 31, 2014, 1:30 P.M.), http://thehill.com/blogs/floor-action/energy-environment/197119-house-looks-to-end-california-drought-that-gop-blames.

9. B. LYNN INGRAM & FRANCES MALMUD-ROAM, THE WEST WITHOUT WATER: WHAT PAST FLOODS, DROUGHTS, AND OTHER CLIMATIC CLUES TELL US ABOUT TOMORROW 176 (2013).

10. *Billion-Dollar Weather/Climate Disaster,* NAT'L CLIMATE DATA CENTER, http://www.ncdc.noaa.gov/billions/events (last visited Oct. 29, 2014).

Since prehistory, human success has depended upon the weather and its effect on agriculture.[11] Inclement weather, like hail, can negatively impact single producers in obvious ways. Though agriculture has allowed humans to thrive by greatly increasing available food, dependence on that food supply has not come without perilous risk.[12] Recent decades have brought publicly financed tools to manage that risk: United States federal crop insurance and disaster assistance. These programs were designed to protect producers and the food supply in general from the age-old threat of weather. Few question the broad success of these programs,[13] and, partially as a result of the food supply stability they bring, U.S. residents continue to enjoy some of the lowest food prices in the world.[14]

More recently, anthropogenic climate change has emerged as a threat to our civilization's well-being. To mitigate the predicted effects of climate change, agricultural producers must adapt their agricultural practices. However, federal crop insurance and disaster assistance expose producers, consumers, and tax-payers to increased long-term risk, because they insulate producers from the price signals that would otherwise lead them to implement changes. While the current structure has ensured market stability thus far in the face of unpredictable weather, it may lead to increased volatility as we realize the predicted large-scale climatic trends.

This Note argues that federal agriculture risk management policy needs to create an incentive structure that protects producers and consumers by encouraging agriculture to adapt to the effects of climate change. The first section of this Note provides an overview of the U.S. federal crop insurance and disaster assistance programs. The second section examines climate change, its predicted effects on agricultural

---

11. WILLIAM F. RUDDIMAN, PLOWS, PLAGUES, AND PETROLEUM: HOW HUMANS TOOK CONTROL OF THE CLIMATE 128–38 (2005); *see also* Tia Ghose, *300-Year Drought Was the Downfall of Ancient Greece*, LIVESCIENCE, (Aug 14, 2013) http://www.livescience.com/38893-drought-caused-ancient-mediterranean-collapse.html (explaining that a drought may have caused the fall of ancient Greece); *Amos* 4:7 (King James) (". . . and I caused it to rain upon one city, and caused it not to rain upon another city: one piece was rained upon, and the piece whereupon it rained not withered.").

12. RUDDIMAN, *supra* note 11, at 128–38.

13. Though, some proponents of the Austrian School of Economics predictably find these programs violate their principles. *See* E.C. PASOUR, JR. & RANDAL R. RUCKER, PLOWSHARES AND PORK BARRELS: THE POLITICAL ECONOMY OF AGRICULTURE 227–41 (2005).

14. Derek Thompson, *Cheap Eats: How America Spends Money on Food*, THE ATLANTIC MONTHLY (Mar. 8 2013), http://www.theatlantic.com/business/archive/2013/03/cheap-eats-how-america-spends-money-on-food/273811/.

production, and describes mechanisms for how agriculture could adapt. The third section of this Note argues for specific changes in agriculture risk management policy and presents some alternative arguments.

II. AGRICULTURE RISK MANAGEMENT PROGRAMS

> I know of no pursuit in which more real and important services can be rendered to any country than by improving its agriculture, its breed of useful animals, and other branches of a husbandman's cares.[15]

A. Agriculture in the United States

Agriculture is a substantial sector of the U.S. Economy. The most recently published United States Department of Agriculture ("USDA") Census of Agriculture found that in 2007, the value of farm products sold neared $300 billion.[16] Nearly a half-million farms cover almost 1 billion acres[17] and employ approximately 2.5 million people.[18] The agriculture industry has a net positive trade balance of around $50 billion, with soybeans, corn, wheat, and cotton as primary exports.[19] The U.S. supplies nearly fifty percent of the world's corn (maize) and forty percent of the world's soybeans, while exporting seventy-eight percent of its domestic cotton, and thus is substantially integrated with world markets.[20]

---

15. Letter from George Washington to John Sinclair (July 20, 1794), *in* 5 THE FARMER'S REGISTER, at 385 (Edmund Ruffin ed., 1837).

16. U. S. DEP'T OF AGRIC. [USDA] NAT'L AGRIC. STATISTICS SERV. [NASS], 2007 CENSUS OF AGRICULTURE: ECONOMICS, *available at* http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Fact_Sheets/Economics/economics.pdf [hereinafter 2007 CENSUS OF AGRICULTURE: ECONOMICS].

17. C. L. Walthall et al., Climate Change and Agriculture in the United States: Effects and Adaptation, USDA-ARS Technical Bulletin No. 1935, at 11 (2013), *available at* http://www.usda.gov/oce/climate_change/effects.htm [hereinafter USDA Climate Change and Agric.].

18. USDA NASS, 2007 CENSUS OF AGRICULTURE: FARM LABOR, *available at* http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Fact_Sheets/Economics/farm_labor.pdf [hereinafter 2007 CENSUS OF AGRICULTURE: FARM LABOR].

19. *See* USDA Climate Change and Agric., *supra* note 17, at 11, 15.

20. *See id.* at 16.

The industry has changed dramatically over the years. In the past century, the percentage of agricultural workers has plummeted,[21] but U.S. producers have tripled the number of people they feed, from approximately 100 million to over 300 million, while still utilizing the same cultivated land area.[22] Between 2002 and 2007 alone, the market value of U.S. agricultural products rose nearly fifty percent and farm incomes rose nearly eighty percent.[23] Part of this production increase is due to increased specialization, evidenced by the drop in number of commodities produced by farms.[24] But this specialization also increases producers' risk of catastrophic loss.[25]

B. Federal Crop Insurance

The Great Depression provided the impetus for the first iterations of the federal crop insurance program. In the half-century before The Great Depression, a handful of private companies offered crop insurance policies in the United States, and most failed after accruing substantial losses.[26] But during the 1930s, farmers experienced widespread, catastrophic crop losses.[27] Nearly a half million farm families lost everything as a result of drought, insect damage, and market collapses.[28] By the mid-1930s, public demand for a federal response had grown, and both Franklin D. Roosevelt and his presidential opponent endorsed the idea.[29] The Federal Crop Insurance program was born in Title V of the Agricultural Adjustment Act of 1938.[30] The 1938 Act established the Federal Crop Insurance Corporation ("FCIC") within the Department of Agriculture.[31] Initially the program was limited to wheat, but it was

21. *See* U. S. DEP'T OF AGRIC., NAT'L AGRIC. STATISTICS SERV., *Trends in U.S. Agriculture*, http://www.nass.usda.gov/Publications/Trends_in_U.S._Agriculture/Farm_Population/ (last modified Aug. 11, 2009).

22. *See* USDA Climate Change and Agric., *supra* note 17, at 11.

23. *See* 2007 CENSUS OF AGRICULTURE: ECONOMICS, *supra* note 16.

24. *See* USDA Climate Change and Agric., *supra* note 17, at 11–12.

25. *Id.* at 12.

26. Bruce L. Gardner & Randall A. Kramer, *Experience with Crop Insurance Programs in the United States*, *in* CROP INSURANCE FOR AGRICULTURAL DEVELOPMENT: ISSUES AND EXPERIENCE 195 (Peter Hazell, et al. eds., 1986).

27. *See* GERALD D. NASH, THE FEDERAL LANDSCAPE: AN ECONOMIC HISTORY OF THE TWENTIETH-CENTURY WEST 27 (1999).

28. *Id.*

29. JAMES S. OLSON, HISTORICAL DICTIONARY OF THE GREAT DEPRESSION, 1929-1940, at 103 (2001).

30. *Id.*

31. *Id.*

quickly expanded to include a few other crops.[32] Within its first year, the program paid indemnities to one-third of the insured farmers.[33]

The program evolved slowly. Crop insurance remained limited in scope and experimental for the next 40 years.[34] Congress significantly expanded it with the Federal Crop Insurance Act of 1980 ("the 1980 Act").[35] The 1980 Act was intended, in part, to encourage producers to migrate from a reliance on the free disaster coverage of the previous decades by including a subsidy equal to thirty percent of the premium.[36] However, the 1980 Act failed to accomplish Congress's goal of fifty percent participation,[37] and producers continued to rely on ad hoc disaster assistance for relief from droughts through the late 1980s and early 1990s.[38] Thus, Congress responded with the Federal Crop Insurance Reform Act of 1994 ("the 1994 Act").

The 1994 Act and Congress's subsequent modifications created the modern regime.[39] The 1994 Act mandated participation in the crop insurance program by making it a precondition for deficiency payments, loans, and other benefits.[40] It also created fully subsidized catastrophic coverage.[41] In the 1996 Farm Bill (the common name for the annual act dealing with agriculture),[42] Congress eased the mandatory participation

---

32. *See id.*

33. Gardner & Kramer, *supra* note 26, at 196.

34. *See* RONALD D. KNUTSON, J. B. PENN & WILLIAM T. BOEHM, AGRICULTURAL AND FOOD POLICY 235–236 (1st ed. 1983) (explaining that only 10–20% of producers participated).

35. USDA RISK MGMT. AGENCY [RMA], *History of the Crop Insurance Program*, http://www.rma.usda.gov/aboutrma/what/history.html (last visited April 2, 2014) [hereinafter *Crop Insurance History*].

36. Joseph W. Glauber, *The Growth of the Federal Crop Insurance Program, 1990-2011*, 95(2) AM. J. AGRIC. ECON. 482, 483 (2012).

37. *Id.*

38. *Crop Insurance History*, *supra* note 35.

39. The statutory authority for the program is at 7 U.S.C. § 1506 (2012) and the accompanying regulations at 7 C.F.R. § 457 (2014). This Note largely precedes the 2014 Farm Bill, Agricultural Act of 2014, though some text and comments address changes that have since been enacted in rules and regulations.

40. *Crop Insurance History*, *supra* note 35.

41. *Id.*

42. The agriculture appropriations bill was historically titled "The Agricultural Adjustment Act of 19xx" and has more recently had a variety of names, but is always colloquially referred to as the "Farm Bill." *See* e.g. Food and Agricultural Act of 1965, Pub. L. No. 89-321, 79 Stat. 1187; Agricultural and Consumer Protection Act of 1973, Pub. L. No. 93-86, 87 Stat. 221; Farm Security and Rural Investment Act of 2002, Pub. L. No. 107-71, 116 Stat. 134; Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-234, 122 Stat. 923.

requirement and created the Risk Management Agency ("RMA"), a blanket organization under which the Federal Crop Insurance Corporation now falls. By 1998, approximately two-thirds of field crops in the United States were insured by federal programs.[43]

Federal crop insurance is a public-private partnership between the FCIC, a wholly-owned government corporation controlled by the RMA, and private insurance companies.[44] Each insurance contract is sold to producers through licensed private agents and brokers.[45] Eligibility is restricted to particular crops and geographic areas.[46] Non-commodity crops, such as fruits and vegetables, are excluded from participation,[47] which is an artifact of the program's Dust Bowl-era origins.[48] The annual contract insures the producer against unavoidable losses due to perils beyond the farmer's control.[49] The RMA sets all premiums for products it creates, and it must approve all premiums for products created by private insurers.[50]

The program is a significant and growing federal expenditure. While producer premiums and other income to the RMA totaled around $3 billion in 2003, they rose to over $13 billion in 2012.[51] The government cost rose from around $3.5 billion in 2003 to at least $14 billion in 2012.[52] By 2013, the program covered 280 million acres, with a total liability of $117 billion.[53] The 2014 Farm Bill further expanded

43. *Crop Insurance History*, *supra* note 35.

44. *Id.*

45. *Id.*

46. *Id.*

47. SUSAN A. SCHNEIDER, FOOD, FARMING, AND SUSTAINABILITY: READINGS IN AGRICULTURAL LAW 94 (2011).

48. Tamar Haspel, *Farm Bill: Why Don't Taxpayers Subsidize the Foods That Are Better for Us?*, WASH. POST. Feb. 18, 2014, http://www.washingtonpost.com/lifestyle/food/farm-bill-why-dont-taxpayers-subsidize-the-foods-that-are-better-for-us/2014/02/14/d7642a3c-9434-11e3-84e1-27626c5ef5fb_story.html.

49. *Crop Insurance History*, *supra* note 35.

50. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-07-819T, CROP INSURANCE: CONTINUING EFFORTS ARE NEEDED TO IMPROVE PROGRAM INTEGRITY AND ENSURE PROGRAM COSTS ARE REASONABLE, TESTIMONY BEFORE THE HOUSE COMMITTEE ON OVERSIGHT AND GOVERNMENT REFORM 5-7 (2007).

51. USDA RMA, FISCAL YEAR GOVERNMENT COST OF FEDERAL CROP INSURANCE, *available at* http://www.rma.usda.gov/aboutrma/budget/2013fygovcost.pdf [hereinafter COST OF FEDERAL CROP INSURANCE].

52. *Id.*; Funds come from both the annual agriculture appropriations bill and the FCIC fund. DENNIS A. SHIELDS, CONG. RESEARCH SERV., R40532, FEDERAL CROP INSURANCE: BACKGROUND AND ISSUES 11 (2013).

53. USDA RMA, ABOUT THE RISK MANAGEMENT AGENCY (rev. 2013), www.rma.usda.gov/pubs/rme/aboutrma.pdf.

crop insurance by covering even the premiums that producers pay as part of the deal to eliminate direct payments.[54] However, it will be years before the full costs of the programs are known.[55] Skyrocketing costs have caused political voices on both the left and the right to criticize the program.[56]

While the federal crop insurance system contains many discrete products including some that combine different types of insurance, there are two broad types of crop insurance: crop yield insurance and crop revenue insurance.[57] Producers choose the two types in roughly equal proportion.[58] Both types allow producers to choose the percentage of their crop they would like to insure.[59] Yield-based insurance indemnifies the producer if the crop yield falls below that producer's historical levels.[60] Yield-based insurance includes catastrophic coverage, which insures losses above fifty percent of normal yield and is fully subsidized by the federal government.[61] Coverage levels above catastrophic coverage are partially subsidized and capped below the maximum historical yield and predicted price.[62] In contrast, revenue-based

54. Direct payments were cash subsidies to farmers that did not depend on crop prices. Brad Plumer, *The $956 Billion Farm Bill, In One Graph*, WASH. POST (Jan. 28, 2014), http://www.washingtonpost.com/blogs/wonkblog/wp/2014/01/28/the-950-billion-farm-bill-in-one-chart/; *see also* Kristina Peterson, *Direct Payments to End, but Farm-Bill Policy Questioned*, WALL ST. J., Jan. 2, 2014, http://online.wsj.com/news/articles/SB10001424052702304361604579288802238911742.

55. Haspel, *supra* note 48.

56. Ron Nixon, *Record Taxpayer Cost is Seen for Crop Insurance*, N.Y. TIMES, Jan. 16, 2013, http://www.nytimes.com/2013/01/16/us/politics/record-taxpayer-cost-is-seen-for-crop-insurance.html (describing criticism from groups as diverse as the Environmental Working Group and the Heritage Foundation); Editorial, *In Congress's Farm Bill, the Rich Get Richer*, WASH. POST, Feb. 4, 2014, http://www.washingtonpost.com/opinions/in-congresss-farm-bill-the-rich-get-richer/2014/02/04/331443a8-8dd7-11e3-833c-33098f9e5267_story.html.

57. SCHNEIDER, *supra* note 47, at 97. This Note was written before the regulations implementing the 2014 Farm Bill For a detailed description of recent changes, *see* Agricultural Risk Coverage and Price Loss Coverage Programs, 79 Fed. Reg. 57,703 (proposed Sept. 26 2014) (to be codified at 7 C.F.R. pt. 718).

58. SHIELDS, *supra* note 52.

59. USDA RMA, *Policies Overview*, http://www.rma.usda.gov/policies/ (last visited Oct. 31, 2014).

60. SHIELDS, *supra* note 52. Modern yield-based insurance is "multi-peril," meaning it covers losses resulting from all natural causes, including drought, frost, disease, and excessive moisture. SCHNEIDER, *supra* note 47, at 97.

61. SHIELDS, *supra* note 52 (though the subsidy does not cover a small administrative fee).

62. *Id.*

insurance provides indemnity when a producer's actual farm revenue falls short of a target level by a pre-determined percentage.[63]

Statutes limit federal crop insurance to cover only expected losses and provide for a reasonable reserve.[64] Traditionally, rates have been based on historical losses.[65] But more recently the RMA has started considering weather data in its rate setting methodology, largely because of changes in agricultural practices.[66] Historical weather data is used to *moderate* the influence of current weather on premium rates, rather than to predict change based on recent trends. The current twenty-year period is compared to the 116-year average to lessen the effect of either good or bad weather on the premium.[67] The rate also factors in data from catastrophic events dating back to 1975.[68] Though the newest methodology gives more weight to recent years than the old methodology did, it still not only tempers the effect of "streaks" of weather, but reduces the influence of "infrequent weather events" in determining the premium paid by producers.[69] Notably, this will result in lower premiums for commodity crops in much of the country.[70]

C. Federal Disaster Assistance

Before the expansion of federal crop insurance, producers relied upon no-cost disaster coverage provided under Farm Bills.[71] The federal government issued "disaster payments" through both formal and informal mechanisms.[72] Generally these programs aimed to reimburse producers' sunk costs and were focused in especially high-risk areas.[73] As noted above, before the 1994 Act mandated participation in the federal crop insurance program, these programs were producers' primary

63. Though revenue insurance was created in 1997 as a pilot program, after only six years, it covered more acreage than the much more senior yield-based insurance. SHIELDS, *supra* note 52.

64. Federal Crop Insurance Act, 7 U.S.C. § 1508(c)(5)(B) (2006).

65. USDA RMA, PREMIUM RATE ADJUSTMENT 1 (2012), *available at* http://www.rma.usda.gov/news/2012/11/2013premiumrateadjustment.pdf [hereinafter PREMIUM RATE ADJUSTMENT].

66. *Id*. at 2.

67. *Id*.

68. *Id*.

69. *Id*.

70. PREMIUM RATE ADJUSTMENT, *supra* note 65, at 2.

71. *Crop Insurance History*, *supra* note 35.

72. KNUTSON et. al., *supra* note 34, at 285.

73. *Id*.

means of relief from crop loss.[74] Though producers and policy makers now view disaster assistance as a supplement to only crop insurance rather than the primary mechanism of relief,[75] these programs still represent substantial and relevant mechanisms that influence producers' behavior. The USDA now administers three types of disaster assistance: the Non-Insured Disaster Assistance Program, the Supplemental Revenue Assistance Program, and ad hoc disaster assistance as legislated by Congress.[76]

The Non-Insured Disaster Assistance Program ("NAP") provides risk management to agricultural producers who are not eligible for federal crop insurance.[77] Eligibility is quite broad, with coverage extended to any food crop; crop for livestock consumption; fiber crop; crop grown for seed; and even specialty crops like Christmas trees, turf, and aquaculture.[78] The program includes an income restriction and requires a small service fee.[79] Indemnity is based upon yield and offered at the same level of protection as catastrophic risk coverage, the basic level of crop-yield insurance.[80] In addition to yield loss, NAP offers payments if a natural disaster prevents a producer from planting more than thirty-five percent of their crop.[81] Payments are capped at $100,000 annually, per crop.[82] Producers are required to have NAP coverage in order to be eligible for the Supplemental Revenue Assistance Program.[83]

The Supplemental Revenue Assistance Program ("SURE")[84] was one of five disaster programs passed as part of the 2008 Farm Bill[85] and fills gaps left by the crop insurance program.[86] SURE differs substantially from earlier disaster assistance and crop yield insurance

74. *See supra* Part II.B.

75. GLAUBER, *supra* note 36, at 487.

76. SCHNEIDER, *supra* note 47, at 104.

77. *Id*.; NonInsured Crop Disaster Assistance Program, 7 C.F.R. § 1437 (2014).

78. USDA FARM SERVICE AGENCY, FACT SHEET: NONINSURED CROP DISASTER ASSISTANCE PROGRAM (NAP) FOR 2011 AND SUBSEQUENT YEARS (August 2011), *available at* http://www.fsa.usda.gov/Internet/FSA_File/nap_august_2011.pdf [hereinafter NAP FACT SHEET].

79. *Id.*

80. SCHNEIDER, *supra* note 47, at 104.

81. NAP FACT SHEET, *supra* note 78, at 3.

82. *Id.*

83. *Id.*

84. 7 C.F.R. § 760 (G).

85. Food, Conservation, and Energy Act, H.R. 2419, 110th Cong. §531(b) (2008).

86. DENNIS SHIELDS, CONG. RESEARCH SERV., R40452, A WHOLE-FARM CROP DISASTER PROGRAM: SUPPLEMENTAL REVENUE ASSISTANCE PAYMENTS (SURE) 11 (2010).

because it bases its indemnity on revenue loss.[87] Total indemnity is determined by multi-variable formulas,[88] and USDA officials have stated that SURE is the most complex program in the history of the agency.[89] In fact, this complexity has led to substantial criticism,[90] especially when compared to generous and simple subsidized programs such as the now discontinued direct payment program.[91]

In contrast to the relatively recent NAP and SURE programs, ad hoc disaster assistance, which is individually legislated assistance to discrete events,[92] has a long and tumultuous history. For more than three decades Congress has been working to displace ad hoc assistance with the federal crop insurance program.[93] Yet indemnifying producers following natural disasters remains politically popular.[94] A 2010 Congressional Research Service Report noted that despite the motivations of the 1980, 1994, and 1996 crop insurance legislation, Congress provided ad hoc disaster assistance nearly every year between 1988 and 2007.[95] 2005–2007 assistance alone totaled more than $2 billion.[96] Despite sometimes limited success, significant ad hoc spending, including nearly a half billion dollars in flood relief, followed the creation of new disaster programs in the 2008 Farm Bill, which was designed to eliminate the need for such efforts.[97] As the 2014 Farm Bill passed,[98] which again

87. *See id.*

88. *See id.*

89. *See id.*

90. *See* BRUCE A. BABCOCK, CENTER FOR AGRIC. AND RURAL DEV., CARD POLICY BRIEF 10-PB-2, COSTS AND BENEFITS OF MOVING TO A COUNTY ACRE PROGRAM, (May 2010), *available at* http://www.card.iastate.edu/policy_briefs/display.aspx?id=1128.

91. Press Release, U.S. Sen. Comm. on Agric., Nutrition & Forestry, Farm Bill Ends Direct Payment Subsidies (Jan. 28, 2014), *available at* http://www.ag.senate.gov/newsroom/press/release/farm-bill-ends-direct-payment-subsidies.

92. USDA, AGRICULTURE DISASTER ASSISTANCE, *available at* http://www.usda.gov/documents/AGRICULTURAL_DISASTER_ASSISTANCE.pdf.

93. *See supra* Part II.B.

94. SCHNEIDER, *supra* note 47, at 108.

95. DENNIS A. SHIELDS & RALPH M. CHITE, CONG. RESEARCH SERV., RS 21212, AGRICULTURAL DISASTER ASSISTANCE 5 (2010).

96. *Id.* at 6.

97. *Id.* at 7.

98. Rulemaking for the 2014 Farm Bill occurred after this Note was written, but for recent changes to disaster assistance, *see* Supplemental Agricultural Disaster Assistance Programs, Payment Limitations, and Payment Eligibility, 79 Fed. Reg. 21,086 (Apr. 14, 2014).

purported to shift U.S. policy from assistance to insurance, the Administration pledged relief for the California drought.[99]

III. CLIMATE CHANGE AND U.S. AGRICULTURE

> Sometimes we stare so long at a door that is closing that we see too late the one that is open.[100]

A. Threats from Climate Change

Climate models, incredibly complex and sophisticated computer programs, indicate that over the next century global temperatures will rise three to seven degrees Fahrenheit, or roughly two to four degrees Celsius.[101] Climate change threats are distinct from weather, because while weather is specific to a time and place,[102] climate change refers to deviations in our global temperature that affect weather over the course of centuries.[103] Any weather event, like the California drought, may or may not be a result of climate change as it is merely one data point over that grander scale.

But the United Nations Intergovernmental Panel on Climate Change ("UNIPCC")wrote in 2013 that, "[h]uman influence on the climate system is clear. This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system."[104] As President Obama's Climate Change Action Plan recognizes, "increasing floods,

---

99. Onishi & Davenport, *supra* note 5.

100. Alexander Graham Bell.

101. KERRY EMANUEL, WHAT WE KNOW ABOUT CLIMATE CHANGE 53 (2012).

102. Ruddiman, *supra* note 11, at 128–33.

103. *Weather & Climate Basics: What Is the Difference Between Weather and Climate?*, THE NAT'L. CENTER. FOR ATMOSPHERIC RESEARCH & THE UCAR OFFICE OF PROGRAMS, http://www.eo.ucar.edu/basics/ (last visited Oct. 31, 2014),. This distinction is very important, but often confused. *See* Chris Mooney, *Dear Donald Trump: Winter Does Not Disprove Global Warming*, MOTHER JONES (Jan. 2, 2014), http://www.motherjones.com/blue-marble/2014/01/blizzards-dont-refute-global-warming (listing tweets and AM radio comments from U.S. based climate change deniers during the wet and cool early winter weather of 2014).

104. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [IPCC], CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS, SUMMARY FOR POLICYMAKERS 15 (2013), *available at* http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_SPM_FINAL.pdf [hereinafter IPCC 2013 CLIMATE CHANGE SUMMARY].

heat waves, and droughts have put farmers out of business, which is already raising food prices dramatically."[105]

In the words of the UNIPCC, "[i]t is *very likely* that hot extremes, heat waves and heavy precipitation events will continue to become more frequent."[106] Snow cover will melt, [107] and as a result, the oceans will rise.[108] Those expanded oceans will be increasingly acidic[109] and their prevailing currents will change.[110] Tropical storms will move to higher latitudes,[111] hurricanes will continue to strengthen,[112] precipitation patterns will change,[113] and floods and droughts will increase in frequency, intensity, duration, and geographic extent.[114] In the context of these general predictions, however, there are significant findings regarding climate change's probable effects on agricultural production.

Though the true relationship between climate change and crop yields is complex,[115] climate change will have significant negative impacts on agricultural production.[116] Due to plant physiology, crops are more susceptible to temperature damage when water-stressed.[117] But yield loss will also result from increased insect damage and plant disease outbreaks.[118] Not only could sea level rise flood farmlands, especially in low lying areas such as coastal Bangladesh and the Mekong and Nile

---

105. EXECUTIVE OFFICE OF THE PRESIDENT, THE PRESIDENT'S CLIMATE ACTION PLAN 4 (2013).

106. IPCC, 2007: WORKING GROUP I: THE PHYSICAL SCIENCE BASIS, SUMMARY FOR POLICYMAKERS 15 (2007), *available at* https://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf.

107. IPCC 2013 CLIMATE CHANGE SUMMARY, *supra* note 104, at 17.

108. *Id*. at 13.

109. *Id.* at 14. For a discussion about the effects of ocean acidification, *see What Is Ocean Acidification?*, PAC. MARINE ENVTL. LABORATORY, http://www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%3F (last visited Oct. 31, 2014).

110. IPCC 2013 CLIMATE CHANGE SUMMARY, *supra* note 104, at 15.

111. *Id.* at 16.

112. EMANUEL, *supra* note 101, at 57.

113. IPCC 2013 CLIMATE CHANGE SUMMARY, *supra* note 104, at 16.

114. EMANUEL, *supra* note 101, at 58.

115. *See generally* DAVID B. LOBELL & CHRISTOPHER B. FIELD, LAWRENCE LIVERMORE NATIONAL LABORATORY, UCRL-JRNL-221905, GLOBAL CROP YIELD LOSSES FROM RECENT WARMING (2006).

116. "Extreme temperatures have a powerful and robust negative association with yields of commodity crops, particularly in rain-fed environments." Michael J. Roberts et. al., *Agronomic Weather Measures in Econometric Models of Crop Yield With Implications for Climate Change*, 95(2) Am. J. Agric. Econ. 236, 241 (2013).

117. *Id.*

118. Mirwais M. Quaderi & David M. Reid, *Crop Responses to Elevated Carbon Dioxide and Temperature*, *in* CLIMATE CHANGE AND CROPS 1, 11 (S.N. Singh ed., 2009).

Deltas,[119] but the salt water intrusions could also harm soil and food production.[120] In a study of twenty-five year global trends for the six most widely grown commodity crops—wheat, rice, corn, soybeans, barley and sorghum—regression modeling techniques predicted reduced yield in all crops but soybeans.[121] Even the U.S. Department of Defense recognizes the potential for food supply disruption, as it could have profound consequences for national security.[122]

The effects of climate change on world agricultural production are already visible. The Lawrence Livermore National Laboratory observed that between 1991 and 2006, climate change resulted in $1 to $2 billion dollars of global production losses of wheat and corn alone—an amount roughly equal to the annual production of Argentina.[123] This is especially problematic because worldwide population growth and economic improvement create demand for food production, and grain production is expected to double by the year 2050.[124] Not only do more people with more resources consume more food, but the diets of wealthier citizens become more grain intensive through their consumption of animal proteins.[125]

Complex regression modeling under eighteen climate scenarios predicts "strongly negative outcomes" specifically for U.S. agriculture, with yield losses ranging from ten to sixty percent in the years 2040 through 2069.[126] But it is difficult to predict what will happen in a single country like the United States because global models are scale dependent and do not have the resolution to predict models on a national level.[127] In

119. Colin D. Butler, *Climate Change, Crop Yields, and the Future*, U. N. Standing Committee on Nutrition, 38 SCN News 18, 20 (2010) *available at* http://www.unscn.org/files/Publications/SCN_News/SCN_NEWS_38_03_06_10.pdf.

120. Kristie L. Ebi et. al., *Climate Change Impacts on Food Security and Nutrition*, U. N. Standing Committee on Nutrition, 38 SCN News 11, 13 (2010), *available at* http://www.unscn.org/files/Publications/SCN_News/SCN_NEWS_38_03_06_10.pdf.

121. LOBELL & FIELD, *supra* note 115, at 5.

122. "[C]limate change could have significant geopolitical impacts around the world, contributing to poverty, environmental degradation, and further weakening of fragile governments. Climate change will contribute to water and food scarcity, will increase the spread of disease, and may spur or exacerbate mass migration. While climate change alone does not cause conflict, it may act as an accelerant of instability or conflict." US DEP'T OF DEF., QUADRENNIAL DEFENSE REVIEW, at 85 (Feb. 2010), *available at* http://www.defense.gov/qdr/qdr%20as%20of%2029jan10%201600.pdf.

123. LOBELL & FIELD, *supra* note 115, at 5.

124. Ebi et. al., *supra* note 120, at 11.

125. *Id.*

126. Roberts et. al., *supra* note 116, at 242.

127. LOBELL & FIELD, *supra* note 115, at 6.

the past six decades, weather improvements in the United States are actually responsible for a small percentage of commodity crop yield growth.[128] However, this is because the U.S. has not yet experienced much warming.[129] Because the agriculture system is so complex, it is important to tease out climate change's potential effects on the constituent parts of the system, including soil erosion, the water supply, and plants themselves.[130] This will help describe the probable effects on U.S. crop production.

Climate change could increase soil erosion through many mechanisms.[131] This is significant because greater-than-normal erosion damages agricultural production by decreasing available nutrients and reducing crop fertility.[132] The most substantial erosion will result from rainfall simply washing soil away.[133] Climate change is expected to alter storm frequency and increase storm intensity, and erosion is predicted to increase 1.7 percent for every one percent increase in total rainfall.[134] Altered precipitation may also force changes in irrigation, which could increase erosion.[135] Temperature changes could cause erosion by affecting plant growth and crop management decisions.[136] As images of the "Dirty 30s" and "Dustbowl" of the Great Depression call to mind, increased wind can also cause soil erosion.[137]

Though the consequences of erosion are dire, water resources are at least as important for crop production in much of the United States. Climate change could have broad negative consequences for the water resources necessary to agriculture production. Dryland production (production that does not or cannot benefit from irrigation) may be the

128. Roberts et. al., *supra* note 116, at 242.

129. *Id.* Climate change can even have some short-term economic benefits to local agriculture.

130. For example, weather-driven yield shortages in China and Russia were partially responsible for increased wheat prices in 2010–2011. USDA Climate Change and Agric., *supra* note 17, at 12.

131. *Id.* at 54.

132. T. A. Quine & Y. Zhang, *An Investigation of Spatial Variation in Soil Erosion, Soil Properties, and Crop Production Within an Agricultural Field in Devon, United Kingdom*, 57 J. of Soil and Water Conservation, 55–56 (2002).

133. USDA Climate Change and Agric., *supra* note 17, at 54.

134. F.F. Pruski & M.A. Nearing, *Runoff and Soil-loss Responses to Changes in Precipitation: A Computer Simulation Study*, 57 J. of Soil and Water Conservation, 7–16 (2002).

135. USDA Climate Change and Agric., *supra* note 17, at 54.

136. *Id.*

137. *Id.* at 55.

most significantly affected.[138] Not only will climate change cause changes to the water supply by increasing precipitation, but it may also alter both crops and soil by increasing the crops' water demands.[139] Irrigated regions, which exist in different circumstances across the U.S., will suffer from not only those effects but also from changes to water availability and price.[140] Surface water comprises fifty-eight percent of the irrigation supply, which is heavily dependent on stream flow and snow melt.[141] Furthermore, surface water is subject to increased evaporation at higher temperatures,[142] and the Department of Interior predicts that stored water reserves will decline in many basins.[143] Even if the effects on crop yield are less pronounced in irrigated areas than in dryland, the effects on production costs will be substantial.[144]

These climate changes and the resulting effects on soil and water will have different effects on different crops. Generally, climate change will speed up crop development, increase water use, and alter crop productivity.[145] Some researchers predict that America's number one crop, corn, will decrease in yield by 8.3 percent for every one degree Celsius (approximately 2 degrees Fahrenheit) increase in growing season temperature.[146] Increased temperature can disrupt the formation of wheat seeds.[147] While predictions are not available for rice yields, the crop is extremely dependent upon water availability and subject to flooding.[148] Cotton, one of the U.S.'s largest crops, might have some additional flexibility due to its extended flowering cycle, but could certainly suffer yield declines similar to the grain crops listed above.[149] Specialty crops

138. *Id.* at 56.

139. *Id.*

140. USDA Climate Change and Agric., *supra* note 17, at 58–59.

141. *Id.* at 57.

142. *Id.* at 58.

143. *See generally* BUREAU OF RECLAMATION, U.S. DEP'T OF INTERIOR, TECHNICAL MEM. 86-68210-2010-03, LITERATURE SYNTHESIS ON CLIMATE CHANGE IMPLICATIONS FOR WATER AND ENVIRONMENTAL RESOURCES (2d ed. 2011).

144. USDA Climate Change and Agric., *supra* note 17, at 58.

145. *Id*. at 61.

146. LOBELL & FIELD, *supra* note 115. Modern scholarship suggests the possibility of a 2.4% decrease in yields, though some disagreement exists. J. L. Hatfield et al., *Climate Impacts on Agriculture: Implications for Crop Production*, 103(2) Agronomy J. 351 (2011).

147. K.E. Zinn et. al., *Temperature Stress and Plant Sexual Reproduction: Uncovering the Weakest Links*, J. of Experimental Botany, 1959, 1961 (2010).

148. Rice is irrigated and primarily grown in the Mississippi delta, a low lying area subject to flooding. USDA Climate Change and Agric., *supra* note 17, at 64.

149. *Id*. at 70.

from fruits and vegetables to maple syrup are also susceptible to negative yield effects from climate change.[150] In short, the ramifications of climate change on U.S. agricultural production are bleak.

B. Agriculture Can Adapt to the Threat Posed by Climate Change

Luckily, there are many mechanisms producers could use to adapt their farms to the effects of climate change, including switching to different varieties or species of crops and changing planting times.[151] Switching crops is a viable option because different crops have different physiologies and therefore they respond differently to changes in temperature, CO_2, and water availability.[152] Since the dangers of climate change were first studied, researchers have discussed geographic adaptation by moving production areas.[153] The simplest example of this approach is moving to higher latitudes. In addition, changes to sowing dates or irrigation practices can offset climate change's effects.[154] Of course substantial complexities exist in finding not only ideal temperatures and solar radiation, but maintaining access to water through precipitation or irrigation.[155]

Adaptation through technology is possible too. The U.S. has historically solved its agricultural problems by exploiting technological solutions.[156] Genetic engineering has already greatly increased crop yields, even under changing circumstances.[157] Some researchers suggest that innovative non-GMO techniques that are highly developed versions of traditional crop breeding could be used to combat climate change.[158]

---

150. *See id*. at 75–88.

151. Roberts et. al., *supra* note 116, at 242.

152. In some climates, substituting sorghum or soybeans in areas currently producing corn is a viable alternative to deal with climate change. Maria Travasso et. al., *Maize and Soybean Cultivation in Southeastern South America: Adapting to Climate Change*, *in* CLIMATE CHANGE AND ADAPTATION 332, 348 (Neil Leary et. al. eds., 2008).

153. USDA Climate Change and Agric., *supra* note 17, at 107.

154. Raoudha Mougou et. al., *Adapting Dryland and Irrigated Cereal Farming to Climate Change in Tunisia and Egypt*, *in* CLIMATE CHANGE AND ADAPTATION, 181, 192 (Neil Leary et. al. eds., 2008).

155. *Id*.

156. USDA Climate Change and Agric., *supra* note 17, at 17.

157. NAT'L RESEARCH COUNCIL, THE IMPACT OF GENETICALLY ENGINEERED CROPS ON FARM SUSTAINABILITY IN THE UNITED STATES 1 (2010).

158. *See Reinventing Farming for a Changing Climate*, NAT'L PUBLIC RADIO (May 24, 2013), http://www.npr.org/2013/05/24/186450905/reinventing-farming-for-a-

But plants are still limited by their physiological requirements, so even crops designed to be more tolerant of high temperatures and less water will still be limited by the length of the growing season and pollination problems.[159]

IV. RISK MANAGEMENT POLICY AND CLIMATE CHANGE ADAPTATION

> It is only through labor and painful effort, by grim energy and resolute courage, that we move on to better things.[160]

A. Agriculture Risk Management Policy Must Change

Insurance, especially when subsidized, can substantially affect behavior through its design. "[T]he provision of poorly-designed government insurance may have the potential to disincentivize the adoption of otherwise optimal technologies, to the detriment of both the government and the adopters."[161] In one study, for example, suboptimal insurance policy design, when compared to either improved design or no insurance at all, was found to discourage the beneficial practice of skip-row planting in non-irrigated Midwestern corn despite two-fold potential yield differences in dry conditions.[162] Crop insurance and disaster assistance policies must change because the program design, including how rates are calculated, and even the signals sent by recent congressional action discourage adaptation to climate change and thus threaten both producers and consumers of agricultural products.

In the broadest sense, federal agriculture programs fail to properly encourage adaptation by shielding producers from some price signals.

---

changing-climate (discussion with Dr. Sally Mackenzie about a study at the University of Nebraska has developed climate resilience in plants by inducing genetic changes in the crops by applying artificial stress, and then selectively breeding the resulting organism).

159. Roberts et. al., *supra* note 116, at 242.

160. Governor Theodore Roosevelt, Speech at the Lincoln Club Dinner, New York City (Feb. 13, 1899).

161. Joshua D. Woodard et al., *Government Insurance Program Design, Incentive Effects, and Technology Adoption: The Case of Skip-Row Crop Insurance*, 94(4) Amer. J. Agric. Econ 823 (2012) Skip-row planting is an example of an adaptation technique particular to a crop and geography, specifically, non-irrigated corn in the Midwestern United States, where a producer plants only every other row. Under low-moisture conditions, skip-row dryland corn can outperform conventional practices, despite performing worse under more optimal precipitation.

162. *Id*. at 836.

Like any business owner, agricultural producers respond to market conditions. In Kansas, where the water table is dropping, some farmers are switching from corn, the preferred cash grain for many years, back to grain sorghum, which requires considerably less moisture.[163] Federal crop insurance discourages adaptation like this because it does not pass the full cost of insurance on to the producer and thus fails to send the full price signal that would properly allocate the risk. Instead, taxpayers shoulder over half of the cost of protection.[164] Of course, some risk is signaled through the reduced prices of subsidized crop insurance, but producers are still aware of the possibility of disaster assistance. Though there may be positive attributes to sharing the burden of food production with all citizens, the risk of deferred or non-existent adaptation by producers must be balanced against those attributes because it is also borne by all consumers of agricultural products.[165]

More narrowly, crop insurance rate design fails to encourage adaptation. Producers have considerable ability to adapt agricultural practices to meet changing conditions, and premium rates can encourage producers to adapt their practices to deal with climate change.[166] In the current calculation method, the risk from the droughts and floods that are occurring with greater frequency is underrepresented because the rates are adjusted according to the 116-year historical average.[167] Instead of accepting changes in precipitation as a sign of more to come and using the price of insurance to signal the future risk to producers, the scheme creates overly optimistic adaptation-discouraging rates by basing them on the comparatively tame weather of the past.

Although rate calculation methodology lies in the background, producers need not look beyond the overt actions of the federal government to feel secure staying the course rather than beginning to adapt to the threat. When framing the need for change, the USDA discusses altering crop insurance parameters only in the context of protecting government assets and responding to changes producers

163. Dan Charles, *Heat, Drought Draw Farmers Back to Sorghum, the 'Camel of Crops'*, NAT'L PUBLIC RADIO (Oct. 31, 2013, 4:56 P.M.), http://www.npr.org/blogs/thesalt/2013/10/31/231509864/heat-drought-draw-farmers-back-to-sorghum-the-camel-of-crops.

164. COST OF FEDERAL CROP INSURANCE, *supra* note 51.

165. *See supra* Part III.

166. *See* Marca Weinberg, *Agricultural Response to a Changing Climate: The Role of Economics and Policy in the United States of America*, *in* BUILDING RESILIENCE FOR ADAPTATION TO CLIMATE CHANGE IN THE AGRICULTURE SECTOR: PROCEEDINGS OF A JOINT FAO/OECD WORKSHOP 23–24 APRIL 2012 345, 345–56 (2012) (discussing that crop insurance costs can influence producer's decisions).

167. *See supra* notes 65–70 and accompanying text.

initiate independently.[168] More significantly, the 2014 Farm Bill substantially expanded the resources of the crop insurance program in counterproductive ways.[169] For example, this new legislation further insulates producers from that risk by not only continuing to support premiums, but by also covering the deductible in some instances.[170] These actions are far removed from the potential for risk management costs to drive, rather than respond to, change.[171] The moral hazard and excessive risk taking that can result from industry perceptions of a government safety net have been discussed extensively in banking regulation with the recognizable phrase "Too Big to Fail."[172] While many of the policies underlying the banking debate date from the past ten to fifteen years, agricultural disaster assistance has been a part of our public policy for over a half-century.[173]

Recent flood insurance reform also illustrates why, for both producers and taxpayers, crop insurance policy needs to anticipate the effects of climate change rather than respond in the wake of significant losses. Like federal crop insurance, Congress created a subsidized flood insurance program to fill a gap left by the private market.[174] The Biggert-Waters Flood Insurance Reform Act recognized that subsidized flood insurance premiums had not reflected the risk posed by flooding and that the premiums were unsustainable.[175] So, it will raise some homeowners' already costly annual premiums by up to *twenty-five percent per year*

168. *See* U. N. Development Programme, *A Climate Risk Management Approach to Disaster Reduction and Adaptation to Climate Change*, *in* THE EARTHSCAN READER ON ADAPTATION TO CLIMATE CHANGE 229 (2009) [hereinafter *Risk Management Approach*].

169. Letter from Douglas W. Elmendorf, Dir., Cong. Budget Office, to the Honorable Frank D. Lucas, Chairman of Comm. on Agriculture (Jan. 28, 2014), *available at* http://www.cbo.gov/sites/default/files/cbofiles/attachments/hr2642LucasLtr.pdf.

170. Plumer, *supra* note 54.

171. *See* Weinberg, *supra* note 166.

172. *See* Huberto M. Ennis & H.S. Sack, *Bank Risk of Failure and the Too-Big-Too-Fail Policy*, 91/2 FED. RES. BANK OF RICHMOND ECON. Q., 21 (2005). *See also* Paul Krugman, *Too Big to Fail FAIL*, N.Y. TIMES (June 18, 2009, 9:10 P.M.), http://krugman.blogs.nytimes.com/2009/06/18/too-big-to-fail-fail/; Adair Turner, *Too Much "Too Big to Fail"?*, PROJECT SYNDICATE, Sept. 2, 2010, http://www.project-syndicate.org/print/too-much—too-big-to-fail—.

173. *Crop Insurance History*, *supra* note 35.

174. FED. EMERGENCY MANAGEMENT AGENCY [FEMA], BIGGERT WATERS FLOOD INSURANCE REFORM ACT OF 2012: IMPACT OF NATIONAL FLOOD INSURANCE PROGRAM (NFIP) CHANGES 2 (2013), *available at* http://www.fema.gov/media-library-data/20130726-1909-25045-0554/bw12_sec_205_207_factsheet4_13_2013.pdf [hereinafter FEMA IMPACT OF NFIP CHANGES].

175. *Id.* at 1.

until the resulting rate reflects the full risk.[176] Coastal homeowners who will be unable to afford the new premiums are panicking, some property values are plummeting, and there is substantial public outcry.[177] While those concerns are serious, and significant for those directly affected, localized disruptions to the real estate market pale in comparison to the potential effects of a destabilized world food supply that could result from incorrect risk management assessments by crop producers.

B. How Crop Insurance Policy Must Change

> The oak fought the wind and was broken, the willow bent when it must and survived.[178]

The scale and severity of the threat posed by climate change demands "prospective risk reduction and control."[179] The federal government should turn crop insurance and disaster assistance into forward-looking risk-reduction tools that minimize the impending risks of climate change to agricultural production, federal funds, and consumers. The federal government can do this by passing more risk through to producers by requiring producers to pay crop insurance deductibles, by creating crop insurance rates that signal the real risk of agriculture production, and by creating a long-term structure to place incentives for adaptation in disaster assistance legislation. Of those, crop insurance is the most likely candidate for change. As an international study of various market-based tools for dealing with climate change summarized:

> The key mechanism by which insurance products can encourage behavioral change is by charging premiums based on the extant risk. And to the extent that this reduces exposure to natural disasters, it will bring about a contemporaneous reduction in community vulnerability to any future climate change enhancement of extreme weather.[180]

---

176. *Id.*

177. Lizette Alvarez & Campbell Robertson, *Cost of Flood Insurance Rises, Along With Worries*, N.Y. TIMES, Oct. 12, 2013, http://www.nytimes.com/2013/10/13/us/cost-of-flood-insurance-rises-along-with-worries.html.

178. ROBERT JORDAN, THE FIRES OF HEAVEN 516 (1994).

179. *Risk Management Approach*, *supra* note 168, at 231.

180. JOHN MCANENEY ET AL., NAT'L CLIMATE CHANGE ADAPTATION AND RESEARCH FACILITY, MARKET-BASED MECHANISMS FOR CLIMATE CHANGE ADAPTATION: ASSESSING THE POTENTIAL FOR AND LIMITS TO INSURANCE AND MARKET BASED MECHANISMS FOR ENCOURAGING CLIMATE CHANGE ADAPTATION 4 (2013).

While subsidization may be necessary for some of the same reasons the programs were first created, at the very least producers should be asked to pay the deductible on crop insurance premiums.[181] Congress should avoid action and rhetoric that signals that producers will be excessively insulated from risk.

More narrowly, the RMA should change the premium setting methodology. Rather than face the potentially sudden and drastic changes stemming from more fully realized climate change, similar to the flood insurance example above,[182] crop insurance rates could be altered now based on the predicted effects of climate change. Rates should fully embrace both recent events like droughts and floods and scale toward their predicted increased frequency and severity. In concrete terms, rather than adjusting rates by looking backward upon the last century's historical data, the rates should both consider recent data and look forward at the predicted trends. This would result in rates that reflect the prospective risk, or in other words, are more expensive than the current rates that assume the conditions of a world in which we no longer live. Then producers would be properly incentivized to consider adaptation strategies.

As both agricultural production and climate change are themselves highly complex systems, incorporating climate change information into the premium setting methodology would itself be a complex task and, as such, any rate methodology alteration should consider all the available data and tools. In an article for an international workshop titled "Building Resilience for Adaptation to Climate Change in the Agriculture Sector" one presenter argued that such integration should utilize the following approach: 1) inclusion of modern methods/tools for climate data sourcing and analysis; 2) analysis of climate risks and assessment of climate impacts using crop-weather interactions; 3) integration of economic models, linear and non-linear optimization methods and risk perception by farmers; and 4) preparation of advice to farmers and access to modern information and communication technologies.[183] Notably, the author's analysis is directed at an international audience, so the ideal balance of those objectives may be different for the United States than for other

181. *See* Plumer, *supra* note 54 (explaining that the 2014 Farm Bill covers some deductibles for producers).

182. *See supra* notes 174–177 and accompanying text.

183. Ramasamy Selvaraju, *Climate Risk Assessment and Management in Agriculture*, *in* BUILDING RESILIENCE FOR ADAPTATION TO CLIMATE CHANGE IN THE AGRICULTURE SECTOR: PROCEEDINGS OF A JOINT FAO/OECD WORKSHOP 23-24 APRIL 2012, 71, 75 (2012).

nations because of the size, diversity, and technological advancement of our agriculture sector.

Determining what changes might be made to disaster assistance is considerably more challenging than charting a course for insurance rate modification. First, as described above, disaster assistance is not a coherent policy stemming from the same legislation.[184] Second, it is less clear that disaster assistance figures into producers' production decisions.[185] However, if such a link were established, it would be possible to apply the framework listed above. For example, similar to the way Biggert-Waters is scaling up flood insurance premiums,[186] disaster assistance could be ratcheted down for a given crop in a given area, i.e. a specified crop in a particular area could be subjected to total assistance amounts that only cover fifty percent of the total loss in five years, then decline to forty percent in ten years, and so on. At the very least, climate change adaptation should be a part of disaster assistance policy decisions, as disaster assistance could help soften the application of new crop insurance rate methodology.

In addition, the solution should not be developed solely as a top-down policy discussion that is divorced from those it will impact most directly.[187] Rather, any modification to current federal policy must not only consider the science behind anthropogenic climate change and economically sound approaches to dealing with the effects, but should also integrate the concerns of the producer communities and their local governments.[188] Not only are integrated approaches ideal from a scientific and technical standpoint, but climate change responses that integrate mitigation and adaptation with local political realities are also the most feasible[189] because there are such strong connections between adaptation, risk management, government policy, and public support.[190]

---

184. *See supra* Part II.C.

185. *See* discussion *supra* Part IV.B., including studies regarding crop insurance, but less research regarding the effects of disaster assistance on producer behavior.

186. *See* FEMA IMPACT OF NFIP CHANGES, *supra* note 174.

187. *See Risk Management Approach*, *supra* note 168, at 239.

188. *Id*.

189. *Id*. at 244. *See also* Monica Wehbe et. al., *Local Perspectives on Adaptation to Climate Change: Lessons from Mexico and Argentina*, *in* CLIMATE CHANGE AND ADAPTATION 315, 329 (Neil Leary et. al. eds., 2008).

190. Jesus Anton et al., *A Comparative Study of Risk Management in Agriculture Under Climate Change*, *in* BUILDING RESILIENCE FOR ADAPTATION TO CLIMATE CHANGE IN THE AGRICULTURE SECTOR: PROCEEDINGS OF A JOINT FAO/OECD WORKSHOP 23-24 APRIL 2012 129 (2012).

C. Difficulties and Alternatives

While an extensive change to crop insurance and disaster assistance policy could be the most effective, there are several less-expansive potential options. Some have argued for strengthening the Conservation Stewardship Program and the Environmental Qualities Incentives Program.[191] However, the 2014 Farm Bill reduced funding for both programs as part of its limitations on direct payments to producers.[192] The Obama Administration has already pledged to create structures to better inform producers about climate change.[193] A next step could be to require producers who apply for crop insurance or receive other subsidies to submit a climate change adaptation plan that comports with that new information. The softest version of such a scheme could require contingency planning akin to that required by many environmental statutes.[194] Climate change is distinguishable from an oil spill or a toxic substance release because it is certain to happen. Thus, a more aggressive approach would require producers to submit plans that describe actions that would adapt to the predicted effects of climate change and demonstrate their compliance with those plans. However, this could be prohibitively complex. After all, the State Implementation Plan process for the Clean Air Act takes years to approve,[195] and there are ten thousand times as many farms as there are states.[196]

As discussed above, some uncertainties remain regarding the probable impacts of climate change, and these uncertainties could cause some to question the need for government action on any climate change-related matter. For example, increased CO_2 could offset some losses from climate warming because higher levels of atmospheric CO_2 increase photosynthesis.[197] However, with crops like corn and sorghum, any benefit will be modest in relation to the potential yield declines from

191. JULIA OLMSTEAD & JIM KLEINSCHMIT, INST. FOR AGRIC. AND TRADE POLICY, A RISKY PROPOSITION: CROP INSURANCE IN THE FACE OF CLIMATE CHANGE 5 (2011), *available at* http://www.iatp.org/files/2011_11_11_ARiskyProposition_JO_JK.pdf

192. NAT'L SUSTAINABLE AGRIC. COALITION, *What Is in the 2014 Farm Bill for Sustainable Food Systems* (Jan. 31, 2014), http://sustainableagriculture.net/blog/2014-farm-bill-outcomes/.

193. PRESIDENT'S CLIMATE ACTION PLAN, *supra* note 105, at 15.

194. *See* Oil Pollution Act, H.R. 1465, 101st Cong. (1990) (enacted); Emergency Planning and Community Right-to-Know Act, H.R. 2005, 99th Cong. § 301 (1985) (enacted); Resource Conservation and Recovery Act, S. 2150, 94th Cong. § 3004(a) (1976) (enacted).

195. *See* Virginia v. EPA, 108 F.3d 1397, 1401–02 (D.C. Cir. 1997).

196. *See* 2007 CENSUS OF AGRICULTURE: FARM LABOR, *supra* note 18.

197. Quaderi & Reid, *supra* note 118, at 1.

climate change itself.[198] In fact, the year-to-year impact of increased CO_2 on crop yield may be too small to measure.[199] Notably, any positive effects depend on the magnitude of warming, as the potential for increased productivity disappears at increased temperatures above three degrees Celsius.[200] Crops that experience the largest potential gains from increased CO_2, like rice,[201] are not possible to grow in many U.S. climates. In addition, some researchers are troubled by the quality of the models used to predict the effects of climate change on agriculture.[202] Yet, climate models are improving,[203] and agreement regarding climate change's probable negative effects is growing.[204] Since the political climate has made formerly bi-partisan legislation like the Farm Bill so difficult to discuss that it takes two years to pass an annual bill,[205] it is surely not too soon to begin substantial action to confront such a pressing, contentious issue.

Another issue is that many who advocate for significant global-scale solutions to climate change view adaptation as a policy that competes against mitigation.[206] Without mitigation, global temperatures could rise for decades, if not millennia.[207] So, for nearly two decades, the global

198. Roberts et. al., *supra* note 116, at 242.

199. LOBELL & FIELD, *supra* note 115, at 6.

200. Quaderi & Reid, *supra* note 118, at 2.

201. Ebi et. al., *supra* note 120, at 16.

202. Butler, *supra* note 119, at 21. *See generally* David B. Lobell & Marshall B Burke, *Why Are Agricultural Impacts of Climate Change So Uncertain? The Importance of Temperature Relative to Precipitation*, 3 ENVTL. RES. LETTERS 1 (2008).

203. Roberts, et. al., *supra* note 116, at 236, 242.

204. *See* IPCC 2013 CLIMATE CHANGE SUMMARY, *supra* note 104.

205. As noted above, crop insurance depends on annual appropriations. *See supra* Part II.B. Historically, the Farm Bill has passed relatively easily, as it represented both rural interests, in the form of agriculture policy, and urban interests, in the form of nutrition programs. Yet, Congress was unable to pass a Farm Bill in 2013, thus many have stooped to calling any bill at all a triumph. Bill Tomson, *Farm Bill Signed; USDA on the Clock*; POLITICO (Feb. 7 2014), http://www.politico.com/story/2014/02/farm-bill-usda-103270.html.

206. IPCC, CLIMATE CHANGE 2001: IMPACTS, ADAPTATION, AND VULNERABILITY, CONTRIBUTION OF WORKING GROUP II TO THE THIRD ASSESSMENT REPORT OF THE IPCC 93, 94 (James McCarthy et al. eds., 2001). Providing evidence that this position is warranted, one author from the American Enterprise Institute even argues that the potential for adaptation (in the private sector, of course) is reason enough to preclude any policy of mitigation. Kenneth P. Green, *Climate Change: The Resilience Option*, AM. ENTER. INST. ¶ 3–4 (Oct. 13, 2009), http://www.aei.org/article/energy-and-the-environment/climate-change-the-resilience-option (though this argument does offer encouragement regarding the political feasibility of adaptation measures).

207. IPCC 2013 CLIMATE CHANGE SUMMARY, *supra* note 104, at 17, 26.

community has discussed broad mitigation measures, namely, reducing the production of greenhouse gases for the purpose of slowing and reversing climate change, through treaties under the United Nations process, like the Kyoto Protocol.[208] In fact, mitigation and adaptation are not mutually exclusive, especially in the realm of agriculture. The U.N. Development Programme argues that an appropriate response to climate change "must be achieved guaranteeing a close, synergic and interactive relationship between existing risk management, climate adaptation, and sustainable development practitioners."[209] For example, "[s]ustainable grazing systems in drylands offer high potential for climate change mitigation, both through sequestration in vegetation and soil and through avoidance of emissions."[210] While an approach combining adaptation and mitigation seems ideal, considerable research remains to determine how best to take advantage of the synergies between them.[211]

Though the approach suggested is admittedly stick-based as it aims to incentivize action by creating the potential for economic loss if producers do not adapt, others might advocate for giving farmers a carrot in the form of financial incentives. Some studies identify a lack of capital as producers' biggest obstacle to adapting to climate change.[212] With that in mind, catastrophic loss or greatly increased costs could simply put a farm out of business rather than compelling adaptation. After all, sunk costs make adaptation difficult, as producers have considerable investments not only in land, but also in equipment necessary to produce a specific crop in a particular place. There is great potential for an agriculture risk management policy that, in addition to resolving the problems discussed above, contains financial incentives for adaptation rather than deeper penalties for not adapting.

Political feasibility is a concern for any course of action that requires federal legislation and the agricultural lobby is particularly powerful.[213] In addition, the makeup of the Senate, with each state

208. *See* Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, 37 I.L.M. 32.

209. *Risk Management Approach*, *supra* note 168, at 231.

210. Constance L. Neely & Jan De Leeuw, *Home on the Range: The Contribution of Rangeland Management to Climate Change Mitigation*, *in* CLIMATE CHANGE MITIGATION AND AGRICULTURE 333, 342 (Eva Wollenberg et. al eds., 2012).

211. Pete Smith & Eva Wollenberg, *Achieving Mitigation Through Synergies with Adaptation*, *in* CLIMATE CHANGE MITIGATION AND AGRICULTURE 50, 54–55 (Eva Wollenberg et al. eds., 2012).

212. *See, e.g.*, USDA Climate Change and Agric., *supra* note 17, at 106.

213. David Ryan Quintanilla, Comment, *A Bitter Policy Shoved Down Our Throats: How a Once Admirable and Necessary Agricultural Program Has Resulted in Major*

getting two votes, favors rural interests. Yet the concerns addressed here—the stability of the food supply, the long term viability of agricultural production, and even protecting the federal budget—should play across a variety of political dispositions. If Congress is able to act on any legislation, modifying the Farm Bill to protect these interests should be no less probable than action in many other subject areas.

Finally, there are many complexities this Note cannot explore. Climate change models lack the resolution to apply predictions specifically on the national level that crop insurance operates.[214] Crop insurance is a complex subject, and this paper has approached only the broadest descriptions of available products and the rate setting methodology behind them. While the FCIC acts as a reinsurer for the private companies that sell the actual policies,[215] crop insurance itself is reinsured at the global level, which in turn affects the federal entities' capacity to absorb and respond to risk.[216] Furthermore, this country's half-million farms are themselves complex and diverse, thus complicating efforts to achieve any aggregate change. However, the threat of climate change to the agriculture system is undeniable, thus these are all areas for deeper analysis in the context of seeking practical solutions.

V. CONCLUSION

"I have never seen anything like this."[217] In the midst of the 2012 drought, Midwestern commodity crop producers were despondent.[218] Some gave up on caring for their crops.[219] Others considered destroying what remained of their fields.[220] By harvest, drought covered the

Profits for Big Business and Major Frustration for Others, 15 ST. MARY'S L. REV. & SOC. JUST. 341, 358 (2013).

214. *See* LOBELL & FIELD, *supra* note 115, at 6.

215. Oscar Vergara et al., *Modeling the Potential Impact of Catastrophic Weather on Crop Insurance Industry Portfolio Losses*, 90 AMER. J. AGRIC. ECON. 1256, 1261 (2008).

216. *Id.*

217. Carey Gillam, *In Iowa, Hope Fades as Relentless Drought Decimates Crops*, REUTERS (July 13, 2012), http://www.reuters.com/article/2012/07/13/us-usa-drought-iowa-idUSBRE86C0WX20120713.

218. *Id.*

219. *Id.*

220. *Id.*

majority of the United States.[221] According to the USDA, the drought of 2012 was the most severe and extensive drought in at least a quarter-century.[222] It affected eighty percent of U.S. cropland, and the resulting loss of production caused increases in food and commodity prices.[223] Two years later, at the time of publication, the full effects of this drought on retail food prices may not yet be fully realized.[224]

Sadly, incidents like the recent droughts are projected to become more frequent. Yet there are things our agricultural producers can do to lessen the effects. Unfortunately, the current crop insurance and disaster assistance policy not only fails to encourage adaptation, but creates incentives to stay the course. For the sake of producers and ourselves, crop insurance premium setting methodology, disaster assistance policy, and agriculture policy in general need to anticipate this risk and encourage producers to adapt to the coming climatic change.

221. *Tabular Data Archive*, U.S. DROUGHT MONITOR, http://droughtmonitor.unl.edu/MapsAndData/DataTables.aspx? (access 2012 by scrolling through Percent Area in U.S. Drought Monitor Categories statistics).

222. USDA Economic Research Service, *U.S. Drought 2012: Farm and Food Impacts* (last updated July 26, 2013), http://www.ers.usda.gov/topics/in-the-news/us-drought-2012-farm-and-food-impacts.aspx.

223. *Id.*

224. *Id.*