CORN, CARBON, AND CONSERVATION: RETHINKING U.S. AGRICULTURAL POLICY IN A CHANGING GLOBAL ENVIRONMENT

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INTRODUCTION

> It must be recognized that the current food system—characterized by monocultures of corn and soy in the field and cheap calories of fat, sugar and feedlot meat on the table—is not simply the product of the free market. Rather, it is the product of a specific set of government policies that sponsored a shift from solar (and human) energy on the farm to fossil-fuel energy.[1]

Less than one month before the 2008 election of President Barack Obama, *The New York Times Magazine* published an open letter from Michael Pollan, author of the bestselling books *The Omnivore's Dilemma* and *In Defense of Food*, to the next "Farmer in Chief" (i.e., the soon-to-be president elect). In the letter, Pollan implores the new president to develop what he refers to as a new "sun-food" agenda. Pollan points out the connections between industrialized agricultural[2] practices, climate change, and energy independence and contends that "when we eat from the industrial-food system, we are eating oil and spewing greenhouse gases."[3] Describing at length the intertwining of the crises in food and energy, Pollan proposes a new approach to U.S. agricultural policy to encourage a new type of sustainable "solar-based" (rather than "fossil-fuel-based") agriculture.

Pollan's letter reflects the American public's recent renewed interest in ensuring that the food it eats is healthy and is grown in ways that are envi-

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1 Michael Pollan, *Farmer in Chief*, N.Y. TIMES MAG., Oct. 12, 2008, at 62, 65.

2 The Union of Concerned Scientists states that "[i]ndustrial agriculture views the farm as a factory with 'inputs' (such as pesticides, feed, fertilizer, and fuel) and 'outputs' (corn, chickens, and so forth). The goal is to increase yield (such as bushels per acre) and decrease costs of production, usually by exploiting economies of scale." Union of Concerned Scientists, Industrial Agriculture: Features and Policy, http://www.ucsusa.org/food_and_agriculture/science_and_impacts/impacts_industrial_agriculture/industrial-agriculture-features.html (last visited Mar. 8, 2010). Pollan provides a working definition of "industrial food" as "[a]ny food whose provenance is so complex or obscure that it requires expert help to ascertain." MICHAEL POLLAN, THE OMNIVORE'S DILEMMA: A NATURAL HISTORY OF FOUR MEALS 17 (2006).

3 Pollan, *supra* note 1, at 64.

ronmentally and economically sustainable. The immense popularity of books such as *The Omnivore's Dilemma*,[4] the widespread "locavore"[5] movement, First Lady Michelle Obama's White House lawn vegetable garden, concerns over genetically modified crops,[6] rising food prices, growing concerns over the government's misguided policy to promote corn ethanol, and the climate change crisis have refocused the public's attention on the nation's agricultural policies and their impact on human health, the environment, and a sustainable energy future.

This Article explores a range of issues related to both the regulatory and incentive-based federal programs that affect the crops we grow, the manner in which they are grown, and the human and environmental impacts of such programs. Part I presents concerns regarding our current agricultural system. Part II describes the myriad environmental problems resulting from current agricultural practices. Part III evaluates the federal regulatory and incentive-based programs that encourage unsustainable, fossil-fuel-intensive, and environmentally destructive agricultural practices. In particular, the Article evaluates the 2008 Farm Bill and describes how the policies contained in it influence virtually every aspect of agriculture, from the decision to grow certain crops, the amount of crops grown, the industrial manner in which the crops are grown, and the ingredients in processed foods. What emerges from this evaluation is a picture of a complex, outdated, and flawed agricultural policy that substantially interferes with the conservation of energy, water resources, and other natural resources, and substantially contributes to climate change. Part IV of the Article articulates the impor-

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4 POLLAN, *supra* note 2.

5 The term "locavore," coined by Jessica Prentice on the occasion of World Environment Day 2005, describes a person who eats food grown or produced locally or within a prescribed distance. *See* Marian Burros, *Preserving Fossil Fuels and Nearby Farmland by Eating Locally*, N.Y. TIMES, Apr. 25, 2007, at F10 (discussing locavore movement). The locavore movement promotes the practice of eating locally-produced food and purchasing food from farmers' markets because buying locally grown food is less energy intensive and more environmentally friendly than purchasing food from large centralized supermarkets. *Id.* In 2007, *The New Oxford American Dictionary* chose the word "locavore" as its word of the year. Oxford University Press Blog, Oxford Word of the Year: Locavore, http://blog.oup.com/2007/11/locavore (Nov. 12, 2007). The local foods movement is gaining popularity and has been explored in various books, for example: BARBARA KINGSOLVER, ANIMAL, VEGETABLE, MIRACLE: A YEAR OF FOOD LIFE (2008); ALISA SMITH & J.B. MACKINNON, THE 100-MILE DIET: A YEAR OF LOCAL EATING (2007). A detailed discussion of the locavore movement is beyond the scope of this Article. Over the past several years, a number of other popular books addressing concerns with modern agriculture have been published, addressing issues ranging from community-based agriculture to the role agriculture has played in shaping our entire political and social landscape. *See, e.g.*, THOMAS A. LYSON, CIVIC AGRICULTURE: RECONNECTING FARM, FOOD, AND COMMUNITY (2004); RICHARD MANNING, AGAINST THE GRAIN: HOW AGRICULTURE HAS HIJACKED CIVILIZATION (2004).

6 A detailed discussion of the issues surrounding genetically modified farm crops is beyond the scope of this Article. For discussion of regulating genetically modified organisms, see Mary Jane Angelo, *Regulating Evolution for Sale: An Evolutionary Biology Model for Regulating the Unnatural Selection of Genetically Modified Organisms*, 42 WAKE FOREST L. REV. 93 (2007).

tance of an agricultural policy that promotes sustainable practices that conserve energy, water resources, and other natural resources,[7] and proposes alternative approaches to agricultural policy that could dramatically reduce environmental impacts, be more protective of public health, result in a more nutritious food supply, and be more environmentally and economically sustainable, while helping to address the challenges of climate change and dependence on foreign fossil fuels. This Article focuses on one particular commodity, corn, which while ubiquitous and seemingly pedestrian, is perhaps one of the major environmental offenders, and for which the development of a modernized agriculture policy could transform U.S. agriculture.

I. PUBLIC CONCERNS OVER U.S. AGRICULTURE

A. *Why Corn?*

> It does take some imagination to recognize the ear of corn in the Coke bottle or the Big Mac. At the same time, the food industry has done a good job of persuading us that the forty-five thousand different items or SKUs (stock keeping units) in the supermarket—seventeen thousand new ones every year—represent genuine variety rather than so many clever rearrangements of molecules extracted from the same plant.[8]

In *The Omnivore's Dilemma*, Michael Pollan devotes over one hundred pages to a discussion of corn.[9] He describes his undertaking to follow the industrial food chain back to its source, fully expecting that it would lead back to a wide variety of crops and locations, but discovering that it invariably led back to one crop and one place—corn from the American Corn Belt.[10] It is truly staggering to discover the domination of corn in the American food system. As Pollan describes, corn is not only what feeds the steer, pigs, turkey, catfish, and salmon that we eat, but also what feeds the cows that produce our dairy products.[11] More startling, however, is that corn products can be found in virtually every processed food in our grocery stores. Using the example of chicken nuggets, Pollan demonstrates that the chicken not only eats the corn, but most of the ingredients in the nuggets

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7 Many of the agricultural policies described in this Article also have significant economic and social impacts, such as risk to farm workers and farm worker communities, economic impacts on small family farms, social and economic impacts on rural communities, and international trade impacts. Although all of these economic and social impacts are important, a detailed discussion of them is beyond the scope of this Article. For more information on these topics, see Linda Lobao & Curtis W. Stofferahn, *The Community Effects of Industrialized Farming: Social Science Research and Challenges to Corporate Farming Laws*, 25 AGRIC. & HUM. VALUES 219 (2008).

8 POLLAN, *supra* note 2, at 20.

9 *See id.* at 15-119.

10 *Id*. at 17-18.

11 *Id*. at 18.

are derived from corn—the modified corn starch, the corn flour in the batter, the corn oil, the leavening and lecithin, the mono-, di-, and triglycerides, the golden coloring and the citric acid preservative all are derived from corn.[12] According to Pollan, of the more than 45,000 items found in an average American supermarket, more than one quarter contain corn.[13] Pollan goes on to show the ubiquity of another corn product, corn syrup, in virtually every processed food[14]—a fact that has raised concerns about the American public's massive consumption of high fructose corn syrup being linked to the high rates of obesity and diabetes in children and adults in the United States.[15] Finally, Pollan outlines how corn is used in a vast array of non-food products ranging from coatings to wallboard to linoleum.[16] Other research has shown that the majority of carbon in the tissues of Americans is derived from corn.[17]

The corn story becomes even more bizarre when we learn that the vast majority of the corn grown in the American Midwest cannot be digested by humans without significant industrialized processing.[18] Thus, the corn we grow is no longer a food, but is instead a feedstock for an industrial process.[19] Pollan notes the irony that a farmer in Iowa with one thousand acres of corn can no longer feed himself.[20] After reading Pollan's account, one can't help but wonder "why corn?"

Why are we using some of our most productive farmlands to grow gargantuan quantities of a crop that humans cannot eat without industrial processing? The question becomes even more profound given the fact that corn is one of the most energy-intensive, water-intensive, and pesticide- and

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12 *Id*.

13 *Id*. at 19.

14 POLLAN, *supra* note 2, at 19.

15 *See* Nicholas Bakalar, *Fructose-Sweetened Beverages Linked to Heart Risks*, N.Y. TIMES, Apr. 23, 2009 ("Some research has suggested that consumption of high-fructose corn syrup . . . may increase the risk of obesity and heart disease.").

16 POLLAN, *supra* note 2, at 19.

17 Sanjay Gupta, *If We Are What We Eat, Americans Are Corn and Soy*, CNN.COM, Sept. 22, 2007, http://www.cnn.com/2007/HEALTH/diet.fitness/09/22/kd.gupta.column/index.html.

18 *See* POLLAN, *supra* note 2, at 34.

19 "Currently, less than 10 percent of the U.S. field corn crop is used for direct domestic human consumption . . . while the remainder is used for animal feed, exports, ethanol production, seed, and industrial uses." Ephraim Leibtag, *Corn Prices Near Record High, But What About Food Costs?*, AMBER WAVES, Feb. 2008, at 13, http://www.ers.usda.gov/AmberWaves/February08/PDF/AW_February08.pdf. For example, of the 4.95 billion bushels of corn produced in the U.S. from September 2008 to August 2009, 466 million bushels were used to produce high fructose corn syrup, 461 million bushels were used to produce other sugars and starch, and 134 million bushels were used for alcohol for fuel. United States Department of Agriculture Economic Research Service, Feed Grains Database: Yearbook Table 31, http://www.ers.usda.gov/Data/FeedGrains/Yearbook/FGYearbookTable31-Full.htm (last visited Mar. 8, 2010).

20 *See* POLLAN, *supra* note 2, at 34.

fertilizer-intensive crops we grow.[21] To confound further, corn growers receive billions of dollars in agricultural subsidies from the federal government every year. These subsidies in effect create a market for this industrial corn that would otherwise not exist—at least not on such a large scale. From 1995-2006, the United States government paid out nearly $177.6 billion in agricultural subsidies.[22] The total amount of the subsidies varies somewhat year to year. In 2000 alone, the federal government paid out more than $23 billion in agricultural subsidies.[23] Although there are a number of subsidy programs, by far the vast majority of the subsidies are paid through the commodity payment programs, which totaled more than $140 billion from 1995 to 2006, with the highest payments of more than $20 billion in the year 2000 alone.[24] By far the largest commodity subsidies were for corn, with 1,568,095 recipients receiving $56,170,875,257 from 1995 to 2006.[25] The next largest commodity subsidy payouts were for wheat,[26] cotton,[27] soybeans,[28] and rice,[29] respectively.

The federal subsidization of commodity crops such as corn is nothing new. Beginning with the Agricultural Adjustment Act of 1933, the United States has had a long history of subsidizing and regulating its agricultural sector.[30] A product of the New Deal era, the 1933 legislation aimed to control crop prices by decreasing supply, a feat achieved by paying farmers to produce less.[31] The fifteen pieces of legislation that have followed in the subsequent seven decades—a series of Farm Bills—have evolved into the country's comprehensive agricultural policy, tackling a variety of goals from price support to conservation.[32] The current Farm Bill—the recently

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21 *See* David Pimentel & Tad W. Patzek, *Ethanol Production Using Corn, Switchgrass, and Wood; Biodiesel Production Using Soybean and Sunflower*, 14 NAT. RESOURCES RES. 65, 66 (2005).

22 United States Department of Agriculture ("USDA") subsidies for farms in United States totaled $177.6 billion from 1995 through 2006. Environmental Working Group, Farm Subsidy Database, http://farm.ewg.org/farm/regionsummary.php?fips=00000 (last visited Mar. 8, 2010).

23 *Id.*

24 *Id.*

25 Environmental Working Group, Farm Subsidy Database, Top Programs in United States, 1995-2006, http://farm.ewg.org/farm/region.php?fips=00000 (last visited Mar. 8, 2010).

26 Wheat subsidies totaled $22,051,566,200, received by 1,308,268 recipients. *Id.*

27 Cotton subsidies totaled $21,329,862,262, received by 247,879 recipients. *Id.*

28 Soybean subsidies totaled $14,239,702,740, received by 985,712 recipients. *Id.*

29 Rice subsidies totaled $11,043,795,298, received by 65,533 recipients. *Id.* Other commodities ranking in the top twenty of the largest subsidies include sorghum, dairy, peanut, barley, tobacco, sunflower, apple, sugar beet, canola, oat, and wool, albeit at one to two orders of magnitude smaller that than the top five commodities. *Id.*

30 *See* The National Agricultural Law Center, United States Farm Bills, Farm Bill Legislation, http://www.nationalaglawcenter.org/farmbills (last visited Mar. 8, 2010) (providing complete versions of each farm bill passed from 1933 to 2008).

31 Agricultural Adjustment Act of 1933, Pub. L. No. 73-10, § 8(1), 48 Stat. 31, 34 (1933).

32 *See* RENÉE JOHNSON, CONG. RESEARCH SERV., WHAT IS THE "FARM BILL"?, (2008) (summarizing the Food, Conservation, and Energy Act of 2008), *available at* http://www.nationalaglawcenter.

passed Food, Conservation, and Energy Act of 2008[33]—contains a labyrinth of complex, piecemeal, and often contradictory agricultural, energy, and conservation subsidy programs with a total cost of about $307 billion.[34]

Although early farm policy targeted decreasing supply to support commodity prices, during the past thirty years U.S. policy has undergone a dramatic shift toward encouraging high-yield production, thereby becoming a major driver in today's input-intensive industrial agriculture. Starting in the 1970s, many of these commodity subsidies became tied to production levels, with a specified payment per bushel.[35] Under this "coupled" approach, the more the farmer grew the more government money she would receive. This led to a dramatic increase in the amounts of commodity crops like corn grown in the United States.[36] The United States is currently the largest corn producer in the world, accounting for approximately 42 percent of all corn produced globally.[37] The landscape of Corn Belt states, such as Iowa, is now covered in mountains of corn awaiting a home in the world market. It is only by virtue of America's market-distorting subsidy programs that farmers have a reason to grow corn in such a high-yield fashion, requiring large inputs of fossil fuels and water that contribute to the degradation of the environment.

B. *Why Carbon?*

> [T]he way we feed ourselves contributes more greenhouse gases to the atmosphere than anything else we do—as much as 37 percent, according to one study.[38]

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org/assets/crs/RS22131.pdf.

33 Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-246, 122 Stat. 923 (2008). The Act was initially passed and vetoed by the president in May 2008. David Stout, *Farm Bill, in Part and in Full, Wins Passage*, N.Y. TIMES, May 23, 2008, at A23. Congress then overrode the first veto. *Id.* After this process, lawmakers discovered that the bill was missing thirty-four pages, which required Congress to pass the entire bill again the next day. *Id.* The president vetoed the bill again, and Congress again overrode the veto. *Id.* Thus, Pub. L. No. 110-246 is the full and final version of the bill, while the initial version (less the thirty-four pages) is Pub. L. No. 110-234, 122 Stat. 923. The commodity programs are listed in Title I. Pub. L. No. 110-246, §§ 1001-1623, 122 Stat. 1651, 1664-1753.

34 David M. Herszenhorn & David Stout, *Defying President Bush, Senate Passes Farm Bill*, N.Y. TIMES, May 15, 2008.

35 *See, e.g.*, Food and Agricultural Act of 1977, Pub. L. No. 95-113, §§ 401(B), 501(B), 91 Stat. 913, 922, 929 (1977) (establishing the prices per bushel for wheat and corn).

36 Per acre yields of corn continue to increase. During the period from 1996-2005, corn yields in the U.S. averaged 138 bushels per acre, up from 115 bushels per acre during the previous decade. Allen Baker & Steven Zahniser, *Ethanol Reshapes the Corn Market*, AMBER WAVES, April 2006, at 30, 34, http://www.ers.usda.gov/AmberWaves/April06/pdf/FullIssueApril06.pdf.

37 Soyatech.com, Corn Facts, http://www.soyatech.com/corn_facts.htm (last visited Mar. 8, 2010).

38 Pollan, *supra* note 1, at 64.

Perhaps no environmental issue has captured the scientific community's interest, the media's eye, the public's concern, and even the policymakers' attention more than the climate change crisis. The scientific and legal literature, as well as the news media and popular press, is replete with discussions of the link between carbon emissions and climate change and the potential global harms that are likely to occur as a result.[39] There is no need for this Article to restate the plethora of discussions on this topic. However, it is worthwhile to briefly review some of the serious environmental harms that are likely to result as the globe warms. According to most scientists, no environmental problem in human history is as potentially harmful as the climate change crisis.[40] Scientists predict that without dramatic and timely reduction in releases of carbon into the atmosphere, a suite of global climatic changes will occur that will make all other environmental crises pale in comparison.[41] Likely consequences of climate change include: future warming,[42] increased frequency of heat waves,[43] increased heavy precipitation in some areas,[44] increased droughts,[45] more intense tropical storms,[46] and increased incidents of high sea level.[47]

The relationship between climate change and agriculture is a close one. Climate change, with its probable changes in temperature and rainfall patterns, has the potential to dramatically impact worldwide food produc-

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39 *See, e.g.*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS, SUMMARY FOR POLICYMAKERS 10 (2007) (stating that most of the increase in global temperatures is very likely attributable to greenhouse gas concentrations), http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf.

40 *See* Raymond B. Ludwiszewski & Charles H. Haake, *Climate Change: A Heat Wave of New Federal Regulation and Legislation*, FED. LAW., June 2009, at 32, 32 (explaining that global climate change is currently the top environmental concern).

41 *See* Linda R. Larson & Jessica K. Ferrell, *Precautionary Resource Management and Climate Change*, NAT. RESOURCES & ENV'T, Summer 2009, at 51, 52.

42 According to the Intergovernmental Panel on Climate Change ("IPCC") Report, it is "[v]irtually certain" (>99% probability of occurrence) that future warming will occur. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT 53 (2007), http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf. For explanation of the probability terminology, see *id.* at 27.

43 According to the IPCC Report, it is "[v]ery likely" (>90% probability of occurrence) that there will be an increased number of heat waves. *Id.*

44 According to the IPCC Report, it is "[v]ery likely" (>90% probability of occurrence) that there will be increased heavy precipitation in some areas of the globe. *Id.*

45 According to the IPCC Report, it is "[l]ikely" (>66% probability of occurrence) that there will be an increased number of droughts. *Id.*

46 According to the IPCC Report, it is "[l]ikely" (>66% probability of occurrence) that there will be more intense tropical storms. *Id.*

47 According to the IPCC Report, it is "[l]ikely" (>66% probability of occurrence) that there will be increased incidents of high sea level. *Id.*

tion.[48] Conversely, current agricultural practices are significant contributors to greenhouse gas emissions believed to be linked to climate change.[49] As described in more detail below, industrialized agricultural practices are fossil-fuel-intensive.[50] Many pesticides and fertilizers used in industrial agriculture are derived from fossil fuels.[51] Moreover, farm tilling and harvesting, food processing and transportation of food to processors, distributors, wholesalers, retailers, and eventually consumers rely heavily on fossil fuels.[52] In fact, agriculture accounts for approximately 20 percent of U.S. fossil fuel usage.[53] Moreover, certain industrial agricultural practices are major contributors to atmospheric methane, a greenhouse gas twenty times more powerful than carbon dioxide.[54]

The other significant link between agriculture and climate change results from the search for alternative renewable fuels, which has resulted in substantial increases in corn ethanol production. As described in more detail in Part III below, U.S. policy continues to promote corn ethanol as an alternative fuel source. Nevertheless, studies consistently demonstrate that reliance on corn ethanol will not help to solve the climate change crisis and poses additional environmental and social problems.[55]

C. *Why Conservation?*

> Right now, most of the conservation programs run by the U.S.D.A. are designed on the zero-sum principle: land is either locked up in "conservation" or it is farmed intensively. This either-or approach reflects an outdated belief that modern farming and ranching are inherently destructive, so that the best thing for the environment is to leave land untouched.[56]

Decades of scientific research demonstrate the importance of resources and services derived from nature. Virtually every survey conducted indi-

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48 *See* Christina Ross, Evan Mills & Sean B. Hecht, *Limiting Liability in the Greenhouse: Insurance Risk-Management Strategies in the Context of Global Climate Change*, 43A STAN. J. INT'L L. 251, 297-98 (2007).

49 William S. Eubanks II, *A Rotten System: Subsidizing Environmental Degradation and Poor Public Health with Our Nation's Tax Dollars*, 28 STAN. ENVTL. L.J. 213, 269-70 (2009).

50 *Id*. at 269.

51 *See id*.; *see also* Peter Warshall, *Tilth and Technology: The Industrial Redesign of Our Nation's Soils*, *in* FATAL HARVEST: THE TRAGEDY OF INDUSTRIAL AGRICULTURE 221, 225 (Andrew Kimbrell ed., 2002).

52 *Id*.

53 *Id*.

54 William S. Eubanks II, *The Sustainable Farm Bill: A Proposal for Permanent Environmental Change*, 39 ENVTL. L. REP. NEWS & ANALYSIS 10493, 10504 (2009).

55 Eubanks, *supra* note 49, at 271.

56 Pollan, *supra* note 1, at 66.

cates strong public support for the conservation of natural resources.[57] Moreover, in recent years, the American public has become increasingly concerned with conserving natural resources and ecological services for future generations.[58] The idea of intergenerational equity (i.e., ensuring that future generations have the resources they need) pervades modern environmental thought.[59] In the agricultural arena, perhaps more than in any other segment of U.S. industry, there is dramatic room for improvement in the conservation of natural resources and ecosystem services. Current policies assume for the most part that agriculture will inevitably destroy natural resources and services. Over the past twenty years, the United States has begun to incorporate certain conservation-promoting programs in its agricultural policy. However, most of these programs continue to operate on the outdated premises that conservation and farming are mutually exclusive and that cropland that is not explicitly identified for conservation will not protect natural resources or ecological services. Although there are a number of federal programs that provide economic incentives for farmers who engage in certain conservation practices, for the most part these programs are geared either toward setting land aside to keep it from being farmed or imposing modest conservation-related restrictions on current agricultural growing practices. While these programs have significant environmental benefits, neither type gets to the heart of the matter. The fundamental transformation that is needed to conserve energy, water, soils, and other natural resources is a shift to a less intensive, more diverse, solar-based agricultural system. As discussed in Part IV below, to achieve such a transformative shift, new approaches, including paying farmers to protect and enhance natural resources and ecosystem services, may be warranted.

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57 There are numerous surveys and studies that consistently demonstrate the existence of public commitment to environmental protection. For a general discussion of American environmental values and public opinion surveys regarding such values, see ROBERT V. PERCIVAL ET AL., ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY 8 (5th ed. 2006). One recent study conducted by the Yale Center for Environmental Law and Policy indicates that most Americans are seriously concerned about the country's environmental health and want more attention paid to environmental problems. *See* YALE CENTER FOR ENVIRONMENTAL LAW AND POLICY & YALE UNIVERSITY SCHOOL OF FORESTRY & ENVIRONMENTAL STUDIES, THE ENVIRONMENTAL DEFICIT: SURVEY ON AMERICAN ATTITUDES ON THE ENVIRONMENT 1, 2 (2004), http://environment.research.yale.edu/documents/downloads/v-z/yale_poll_globalwarming.pdf. This survey also suggests that most Americans, whether Democrat, Republican, or Independent, are as concerned with problems of air pollution and toxic contamination of soil and water as they are with issues of jobs and the cost of gas. *See id.* at 2, 3.

58 *See, e.g.*, EDITH BROWN WEISS, IN FAIRNESS TO FUTURE GENERATIONS: INTERNATIONAL LAW, COMMON PATRIMONY, AND INTERGENERATIONAL EQUITY 21-28 (1989) (explaining the theory of intergenerational equity).

59 *See id.* at 21.

II. INDUSTRIAL AGRICULTURE'S IMPACT ON THE ENVIRONMENT

Agriculture has undergone dramatic changes in the past fifty years. Much of the change is a direct result of the "Green Revolution." The Green Revolution refers to the transformation of agriculture that began in the 1940s and gained traction during the 1960s, leading to dramatic increases in per acre farm yields.[60] One of the primary changes that occurred during the Green Revolution was the replacement of human labor with technological innovations, inputs derived from fossil fuels, and mechanized farm equipment. These changes resulted from a combination of new government policies that for the first time encouraged high-yield farming of commodity crops by linking subsidy payments to production levels, provided more government money for research and development on high-yield farming, and created a vast network of education and training for farmers in high-yield commodity farming. The Green Revolution is credited with increasing farm production by more than 152 percent between 1948 and 2006.[61]

Although the changes brought about by the Green Revolution have served to significantly increase crop yields, they have also brought with them a variety of adverse social, economic, and environmental consequences. From an economic and social standpoint, non-labor intensive industrial agriculture has led to fewer farmers producing the vast majority of crops, the virtual disappearance of the traditional family farm, high-risk working and living conditions for farm laborers, increased production costs, and a decline of economic and social conditions in rural communities.[62] With regard to the natural environment, high-production industrialized agriculture has contributed to topsoil depletion, contamination of surface and groundwater, loss of biodiversity, and harm to protected species.[63] The fossil-fuel-intensive inputs required in industrialized agriculture exacerbate the daunting challenge of reducing carbon emissions to stem climate change. History is replete with examples of civilizations faltering due to

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60 *See* Eubanks, *supra* note 49, at 222.

61 *See* Economic Research Service, USDA Data Sets: Agricultural Productivity in the United States, http://www.ers.usda.gov/Data/agproductivity (last visited Mar. 8, 2010) ("The level of U.S. farm output in 2008 was 158 percent above its level in 1948 . . . .").

62 S*ee* Eubanks, *supra* note 49, at 221-33.

63 *Id*. at 255-59, 261-63. For additional discussion on the environmental harms caused by farming, see Mary Jane Angelo, *Embracing Uncertainty, Complexity, and Change: An Eco-pragmatic Reinvention of a First-Generation Environmental Law*, 33 ECOLOGY L.Q. 105 (2006) [hereinafter Angelo, *Embracing Uncertainty*]; Mary Jane Angelo, *The Killing Fields: Reducing the Casualties in the Battle Between U.S. Species Protection Law and U.S. Pesticide Law*, 32 HARV. ENVTL. L. REV. 95 (2008) [hereinafter Angelo, *The Killing Fields*]; Jan Lewandrowski, James Tobey & Zena Cook, *The Interface Between Agricultural Assistance and the Environment: Chemical Fertilizer Consumption and Area Expansion*, 73 LAND ECON. 404 (1997); J.B. Ruhl, *Farms, Their Environmental Harms, and Environmental Law*, 27 ECOLOGY L.Q. 263, 374-92 (2000).

overexploitation of resources and/or severe natural resource degradation due to unsustainable agricultural practices.[64]

A range of industrial agricultural practices contribute to environmental harms. The Union of Concerned Scientists identifies the key features of industrialized agriculture as: monocultures,[65] few crop varieties, reliance on chemical and other inputs, and the separation of animal and plant agriculture.[66] Each of these features both alone and in combination carries with it a panoply of potential environmental, human health, and socio-economic impacts. Industrialized agricultural practices such as conversion of undeveloped land into agricultural fields, intensive water use for irrigation, fertilizer use, pesticide use, growing crops in monocultures, and tilling soils impact natural resources, wildlife and biodiversity, ecosystem services, human health, and significantly contribute to climate change.

A. *Impacts on Water*

All agriculture has the potential to cause adverse impacts on water resources. Water impacts from agriculture include effects on water quantity as well as effects on water quality.[67] Intensive industrialized agriculture, with its concomitant large requirements of water and fossil-fuel-derived inputs such as energy, fertilizer, and pesticides, dramatically increases the potential for harm to water resources.[68] Agriculture, and especially highly intensive industrialized agriculture, is a significant user of water.[69] The high-yield goal of industrial agriculture requires water-intensive agricultural practices that depend on large-scale irrigation.[70] Water quantity impacts are a direct result of irrigation.[71] Commercialized commodity crop production is responsible for significant reductions in both water quality and water

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64 Historians believe that numerous ancient civilizations, including those in Mesopotamia, the Mediterranean, pre-Colombian Southwest United States, and Central America have declined in large part due to natural resources degradation resulting from unsustainable agricultural practices. *See* JARED DIAMOND, COLLAPSE: HOW SOCIETIES CHOOSE TO FAIL OR SUCCEED 47-48, 134-56 (2005); Wes Jackson, *Farming in Nature's Image: Natural Systems Agriculture*, *in* FATAL HARVEST: THE TRAGEDY OF INDUSTRIAL AGRICULTURE, *supra* note 51, at 41, 42.

65 For a discussion of the global reliance on monoculture farming, see Helena Norberg-Hodge, *Global Monoculture: The Worldwide Destruction of Diversity*, *in* FATAL HARVEST: THE TRAGEDY OF INDUSTRIAL AGRICULTURE, *supra* note 51, at 13, 13-14.

66 Union of Concerned Scientists, Industrial Agriculture: Features and Policy, *supra* note 2. *See also* Frederick Kirschenmann, *Scale—Does it Matter?*, *in* FATAL HARVEST: THE TRAGEDY OF INDUSTRIAL AGRICULTURE, *supra* note 51, at 91, 95.

67 Eubanks, *supra* note 46, at 252.

68 *Id.* at 252-61.

69 *Id.* at 252-54.

70 *Id.* at 253; *see also* Peter Rosset, Food First/Inst. for Food & Dev. Pol'y (IFDP), Lessons from the Green Revolution (Apr. 8, 2000), http://www.foodfirst.org/media/opeds/2000/4-greenrev.html.

71 *See* Ruhl, *supra* note 63, at 280.

quantity.[72] Irrigation for agriculture constitutes more than one-third of the freshwater use in the United States, making it the largest use in the nation.[73] An exacerbating problem is that many commodity crops, such as corn, are grown in parts of the country that do not have sufficient water resources for this type of intensive agriculture.[74] Accordingly, water must be diverted from waterbodies long distances from the fields.[75] In many western states, water consumed for crop irrigation accounts for approximately 75 percent of the total water consumed.[76] Many of the country's, as well as the world's, water disputes involve agriculture as a major factor.[77]

Corn production in particular has a very large "water footprint."[78] In some instances, certain crops may be planted in inappropriate geographic locations where there is not sufficient rainfall or other water sources, and thus intensive irrigation from groundwater or water pumped from long distances away must be employed.[79] Even where crops are grown in appropriate locales, much of the current irrigation used is inefficient. For example, a substantial portion of the agricultural industry relies on spray irrigation, from which large amounts of water are lost to evaporation, and which is considerably less efficient than other approaches such as drip irrigation.[80] By growing crops in appropriate places, using efficient irrigation systems, and having water management plans, water quantity impacts can be reduced.

Nevertheless, regardless of these reductions, industrial agriculture, which is rooted in high per acre yield, still demands large amounts of water to produce such large yields.[81] As urban and suburban centers grow, there is an ever-increasing tension between agricultural water users and urban water users. In addition, quantities of water are needed to maintain fish, wildlife, and other natural resources. Many areas of the country currently are facing

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72 Eubanks, *supra* note 49, at 252; *see also* Ruhl, *supra* note 63, at 274.

73 Eubanks, *supra* note 49, at 253.

74 *See id.* at 253-54.

75 *Id*. at 254.

76 B. Delworth Gardner, *Legal Impediments to Transferring Agricultural Water to Other Uses*, *in* AGRICULTURAL POLICY AND THE ENVIRONMENT 67, 67 (Rodger E. Meiners & Bruce Yandle eds., 2003).

77 *See* Eubanks, *supra* note 49, at 254.

78 Adell Amos, *Freshwater Conservation in the Context of Energy and Climate Policy: Assessing Progress and Identifying Challenges in Oregon and the Western United States*, 12 U. DENV. WATER L. REV. 1, 6 (2008) ("Corn, one source of ethanol, and the process used to convert corn to ethanol, are water intensive.").

79 *See* Eubanks, *supra* note 49, at 253-54. *See generally* Christine A. Klein, *Water Transfers: The Case Against Transbasin Diversions in the Eastern States*, 25 UCLA J. ENVTL. L. & POL'Y 249, 253 (2007) (discussing current practices of supplying water in the western states and defining "transbasin diversions").

80 *See* J.D. Oster & D. Wichelns, *Economic and Agronomic Strategies to Achieve Sustainable Irrigation*, 22 IRRIGATION SCI. 107, 112 (2003).

81 Eubanks, *supra* note 49, at 253.

severe water shortages and such shortages have often pitted agriculture against either the natural environment[82] or against public water supply needs for urban and suburban populations.[83]

In addition to water quantity impacts, agriculture can cause serious adverse impacts to the quality of both groundwater and surfacewater.[84] When rain or irrigation water comes into contact with farm fields, certain agricultural chemicals, including water soluble pesticides and nutrients, such as nitrites found in fertilizers, easily leach into groundwater.[85] This contamination can render groundwater sources of water unacceptable for drinking.[86] Where ground water naturally flows into surfacewater, such as is the case with artesian springs, surfacewaters become contaminated as well.[87] Rain and irrigation water that exceeds the amount capable of being absorbed into the soil flows off of agricultural fields as stormwater runoff carrying with it a variety of pollutants which ultimately end up in surfacewater.[88] Stormwater runoff from farm fields frequently contains high levels of sediments from soil erosion from tilled fields, pesticides, and fertilizers.[89]

Fertilizers used to maximize yields in industrial agriculture typically contain nutrients such as phosphorus and ammonium nitrate.[90] Scientific studies demonstrate that agricultural intensification via increased chemical fertilizer and other inputs is directly linked to increased environmental damage.[91] Large quantities of these compounds are carried in rain runoff into waterbodies where they exert their plant-growth-enhancing effect re-

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82 *See, e.g.*, Reed D. Benson, *Giving Suckers (and Salmon) an Even Break: Klamath Basin Water and the Endangered Species Act*, 15 TUL. ENVTL. L.J. 197, 227-28 (2002) (discussing the 2001 crisis between agricultural and environmental interests in the Klamath Basin); Holly Doremus & A. Dan Tarlock, *Fish, Farms, and the Clash of Cultures in the Klamath Basin*, 30 ECOLOGY L.Q. 279, 283-84 (2003) (same); Drew Melville, *"Whiskey is for Drinking": Recent Water Law Developments in Florida*, 20 J. LAND USE & ENVTL. L. 489, 289-93 (2005) (describing the outcry by environmental, agricultural, and other interest groups over a plan to transfer water from North to South Florida).

83 *See* Eubanks, *supra* note 49, at 254 (explaining that the water dispute in the Apalachicola-Chattahoochee-Flint River Basin was caused by increased demand for water by agricultural consumers and by Atlanta-area consumers). *See generally* Christine A. Klein, Mary Jane Angelo & Richard Hamann, *Modernizing Water Law: The Example of Florida*, 61 FLA. L. REV. 403, 409-10 (2009) (detailing the shift from common law to statutory law as a result of increased tension between urban/suburban and agricultural demands for limited water supplies); C. Grady Moore, *Water Wars: Interstate Water Allocation in the Southeast*, 14 NAT. RESOURCES & ENV'T 5, 6 (1999) (explaining the effect of metropolitan Atlanta growth on regional water supplies).

84 Eubanks, *supra* note 49, at 255-59.

85 *Id*. at 258.

86 Ruhl, *supra* note 63, at 291.

87 *See* Eubanks, *supra* note 49, at 255.

88 *Id*.

89 *Id.* at 255, 258-59. For a further discussion of industrial agriculture's contribution to soil erosion, see John Boardman, Jean Poesen & Robert Evans, *Socio-economic Factors in Soil Erosion and Conservation*, 6 ENVTL. SCI. & POL'Y 1, 2-3 (2003).

90 Eubanks, *supra* note 49, at 255; *see also* Ruhl, *supra* note 63, at 284.

91 Lewandrowski, Tobey & Cook, *supra* note 63, at 407.

sulting in overgrowth of algae.[92] When algae becomes overabundant, it depletes oxygen and reduces sunlight penetration resulting in a condition referred to as eutrophication.[93] Eutrophied lakes are characterized by algae dominance rather than submersed plant dominance, low oxygen, and reduced fish and other aquatic organisms.[94] When nutrient-laden water finds its way to estuarine areas, it can create "dead zones" in areas previously characterized by high fish and aquatic organism productivity.[95] For example, nutrient heavy water in the Mississippi River is believed to have caused a large dead zone in the Gulf of Mexico.[96] About 66 percent of the nitrogen entering the gulf can be traced back to agricultural activities in the Mississippi River basin.[97] Similarly, pesticides used on farm fields can be washed away by rainwater and end up in waterbodies, exerting their own harmful effects on fish and aquatic life.[98]

In addition to fertilizers and pesticides in waterbodies, sedimentation from soil erosion is a major concern. Soil erosion results from tilling practices which dislodge soil making it vulnerable to being carried off by runoff.[99] The Green Revolution's shift from perennial rotation of crops to large single crop monocultures, such as most corn fields, has led to erosion of topsoil.[100] Not only are large quantities of topsoil critical to future farm productivity lost by erosion, but it is estimated that more than two billion tons of sediment enter the nation's waterways each year.[101] This sedimentation can clog streams and fill in shallow areas in water bodies, thereby reducing habitat and light availability to submersed plants.[102]

Some of the greatest contributors to water quality impacts are animal feedlots. Until relatively recently, ranchers generally raised livestock on farms or on open grazing fields.[103] Historically, the livestock received the majority of their nutrition from field grass with very little supplementation from grains. However, grain, such as corn, became far less expensive to purchase with the advent of the policies of the Green Revolution, which heavily subsidized feed grains.[104] Thus, farmers no longer needed large areas of land for grazing and they were able to confine livestock onto highly concentrated feedlots where they could feed livestock the cheaply pur-

92 Eubanks, *supra* note 49, at 255-56.
93 *Id.*
94 *Id.*; Ruhl, *supra* note 63, at 288.
95 Eubanks, *supra* note 49, at 256.
96 *Id.*
97 *Id.*
98 Ruhl, *supra* note 63, at 283-84.
99 Eubanks, *supra* note 49, at 257.
100 *Id.* at 257-58.
101 *Id.* at 257.
102 *Id.*
103 *Id.* at 259.
104 *Id.* at 259-60.

chased grain because they no longer needed large areas of land for grazing.[105] Today, corn has replaced grass as the primary cow feed. Consequently, many cattle ranchers have replaced open-range grazing with corn production and feed their animals a mostly corn-based diet in confined feedlots.[106] Over the past one hundred years, the diet of cattle went from grass to grain such as corn.[107] Aside from ethical issues of raising animals in the horrific conditions of the modern concentrated animal feeding operation, these practices have resulted in significant water pollution problems.[108] Animal wastes, which once could be readily used as fertilizers for crops grown on the same farm as the animals that created the waste, now have no use. Moreover, the intense concentration of feedlot animals means that vast quantities of concentrated animal waste have become a serious source of water pollution.[109] Thus, what once was a win-win situation—animal wastes fertilized the crops that fed the animals in a relatively "closed loop" system with relatively insignificant pollution resulting—has now become a substantial environmental problem.[110] In his October 12, 2008, letter, Michael Pollan paraphrases Wendell Berry stating:

> [T]o take animals off farms and put them on feedlots is to take an elegant solution—animals replenishing the fertility that crops deplete—and neatly divide it into two problems: a fertility problem on the farm and a pollution problem on the feedlot. The former problem is remedied with fossil-fuel fertilizer; the latter is remedied not at all.[111]

B. *Implications for Biodiversity*

Harm to wildlife and biodiversity from agriculture occurs in a number of ways.[112] Conversion of natural areas into farmland reduces or eliminates

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105 Eubanks, *supra* note 49, at 259-60.

106 *Id.*

107 POLLAN, *supra* note 2, at 66. Currently corn is the primary feed grain in the United States, accounting for more than 90 percent of total feed grain produced and used. Economic Research Service, Briefing Rooms, Corn: Background, http://www.ers.usda.gov/Briefing/Corn/background.htm (last visited Mar. 8, 2010).

108 Bruce Yandle & Sean Blacklocke, *Regulating Concentrated Animal Feeding Operations: Internalization or Cartelization?*, *in* AGRICULTURAL POLICY AND THE ENVIRONMENT, *supra* note 76, at 45, 48-49.

109 *See* Eubanks, *supra* note 49, at 260.

110 *See id.* at 259-60.

111 Pollan, *supra* note 1, at 65.

112 *See generally* Catherine Badgley, *Can Agriculture and Biodiversity Coexist?*, *in* FATAL HARVEST: THE TRAGEDY OF INDUSTRIAL AGRICULTURE, *supra* note 51, at 279, 279 (assessing modern industrial agriculture as a contributor to the world being in "the early phases of a mass extinction"); Mrill Ingram, Stephen Buchmann & Gary Nabhan, *Our Forgotten Pollinators: Protecting the Birds and the Bees*, *in* FATAL HARVEST: THE TRAGEDY OF INDUSTRIAL AGRICULTURE, *supra* note 51, at 295 (discussing the effects of habitat loss, pesticides and disease on birds, bees, and animals that pollinate plants); Jackson, *supra* note 63, at 41; Kelley R. Tucker, *Wildlife Health*, *in* FATAL HARVEST: THE

habitat.[113] Sedimentation from erosion harms aquatic organisms.[114] Eutrophication from fertilizer runoff chokes out oxygen, thereby killing submersed plants and aquatic organisms.[115] Pesticides harm wildlife and aquatic organisms.[116] This occurs through direct contact to animals that are in farm fields when they are treated with pesticides, as well as from aerial drift and runoff from farm fields into non-farm areas where wildlife species are present.[117] Further, certain pesticides bio-accumulate in the food chain, exposing predatory species to highly concentrated pesticides in their food sources.[118]

The heavy use of pesticides, which by definition are intended to kill organisms or disrupt natural systems, poses significant risks to birds, aquatic life, and other wildlife. Although pesticides of one form or another have been used in agriculture for hundreds of years,[119] it was not until the latter half of the twentieth century that the development of synthetic chemical pesticides led to an explosion of global pesticide usage.[120] Because these new synthetic chemical pesticides were spectacularly effective at controlling a wide variety of pests, they quickly gained favor, and before long, were ubiquitous. Estimates of global pesticide usage are staggering. More than 1,600 types of pesticides are currently available.[121] More than five billion pounds of pesticides, with a value of over $30 billion, are used annually in the world.[122] Pesticide usage in the United States accounts for 27 per-

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TRAGEDY OF INDUSTRIAL AGRICULTURE, *supra* note 51, at 287, 292 (discussing the need to change farming practices to increase animal habitat); George Wuerthner, *The Destruction of Wildlife Habitat by Agriculture*, *in* FATAL HARVEST: THE TRAGEDY OF INDUSTRIAL AGRICULTURE, *supra* note 51, at 277, 277 (explaining that farming destroys wildlife habitat).

113 Alex Avery & Dennis Avery, *High-Yield Conservation: More Food and Environmental Quality Through Intensive Agriculture*, *in* AGRICULTURAL POLICY AND THE ENVIRONMENT, *supra* note 76, at 135, 135-36; Wuerthner, *supra* note 112, at 277.

114 Ruhl, *supra* note 63, at 278.

115 Eubanks, *supra* note 49, at 255-56.

116 *Id*. at 258-59.

117 *See* Ruhl, *supra* note 63, at 283. Aerial drift or pesticide drift is "any airborne movement of pesticides away from the target cite," and can result from aerial pesticide application or wind. BRIAN LITMANS & JEFF MILLER, SILENT SPRING REVISITED: PESTICIDE USE AND ENDANGERED SPECIES 4 (2004), http://www.biologicaldiversity.org/publications/papers/Silent_Spring_revisited.pdf.

118 *See* James M. Armitage & Frank A.P.C. Gobas, *A Terrestrial Food-Chain Bioaccumulation Model for POPs*, 41 ENVTL. SCI. & TECH. 4019, 4023 (2007).

119 *See* Angelo, *Embracing Uncertainty*, *supra* note 63, at 144.

120 Clive A. Edwards, *The Impact of Pesticides on the Environment*, *in* THE PESTICIDE QUESTION: ENVIRONMENT, ECONOMICS AND ETHICS 13, 13 (David Pimentel & Hugh Lehman eds., 1993). Portions of this section have been adapted from Angelo, *Embracing Uncertainty*, *supra* note 63, at 114-45.

121 Eubanks, *supra* note 49, at 258.

122 These figures are based on EPA pesticide market estimates for the years 2000-2001. *See* TIMOTHY KIELY, DAVID DONALDSON & ARTHUR GRUBE, ENVIRONMENTAL PROTECTION AGENCY PESTICIDES INDUSTRY SALES AND USAGE: 2000 AND 2001 MARKET ESTIMATES 4, 8 (2004), http://www.epa.gov/oppbead1/pestsales/01pestsales/market_estimates2001.pdf.

cent of global pesticide usage, with U.S. exports to other countries exceeding 450 million pounds of pesticides per year.[123]

The rapid adoption of synthetic chemical pesticides began during World War II as a result of the development of two primary categories of chemical insecticides—the organochlorines and the organophosphates.[124] The organochlorines, which include the notorious pesticide DDT,[125] were highly desirable at first because they are very toxic to a broad range of invertebrates but they are not highly acutely toxic to humans or other mammals.[126] These pesticides also persist for long periods of time in the environment, making them highly effective for long-term pest control. However, this persistence became their downfall when the long-term ecological consequences of these pesticides came to light. While organochlorine pesticides, such as DDT, helped save thousands of lives during World War II from insect-borne diseases,[127] it quickly became apparent that these pesticides accumulated in living tissues and bioconcentrated as they moved through the food chain.[128] This bioconcentration seriously affected predators at the top of the food chain, including the bald eagle.[129] This concern led the United States to ban some of the most risky pesticides, including the organochlorines. However, another category of pesticides, the organophosphates, continue to dominate U.S. agriculture and create substantial risks of their own. The organophosphate pesticides were first developed as wartime nerve gases.[130] While these pesticides are less persistent in the environment than organochlorine pesticides, the organophosphates tend to be highly acutely toxic to humans, other mammals, and birds.[131] Since the United States banned or restriced most organochlorine pesticides, the organophosphates quickly became the pesticides of choice.[132] Organophosphates remain the largest category of chemical insecticides used in the United States

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123 Edwards, *supra* note 120, at 13; *see also* KIELY, DONALDSON & GRUBE, *supra* note 122, at 8 (reporting that the United States accounted for 23 percent of the world market in 2000 and 24 percent in 2001).

124 *See* Edwards, *supra* note 120, at 13; *see also* Angelo, *Embracing Uncertainty*, *supra* note 63, at 145.

125 DDT is the abbreviation for synthetic insecticide, 1, 1, 1´-trichloro-2,2-bis(4-chlorophenyl) ethane ($C_{14}H_9Cl_5$). ROBERT E. PFADT, FUNDAMENTALS OF APPLIED ENTOMOLOGY 658 (2d ed. 1971); *see also* T.S.S. DIKSHITH & PRAKASH V. DIWAN, INDUSTRIAL GUIDE TO CHEMICAL AND DRUG SAFETY 107 (2003).

126 Edwards, *supra* note 120, at 14.

127 Andrew P. Morriss & Roger E. Meiners, *Property Rights, Pesticides, & Public Health: Explaining the Paradox of Modern Pesticide Policy*, 14 FORDHAM ENVTL. L.J. 1, 6-7 (2002).

128 *See id.* at 13-14.

129 James L. Noles, Jr., *Is "Recovered" Really Recovered?: "Recovered" Species Under the Endangered Species Act*, 39 CUMB. L. REV. 387, 388 (2009).

130 Edwards, *supra* note 109, at 15.

131 *Id.*

132 *See* LITMANS & MILLER, *supra* note 117, at 1.

today.[133] Not only have these pesticides been implicated implicated in a many avian and wildlife poisonings, they also pose serious risks of acute poisoning to farm workers.[134]

A number of recent studies and reports make clear that the threat of agricultural pesticide use to wildlife, and in particular threatened and endangered species, was not abated by the organochlorine bans of the 1970s and 1980s. In 2004, the Center for Biological Diversity ("CBD") issued a report that concluded that the Environmental Protection Agency ("EPA") has approved registrations for pesticides that put more than 375 threatened and endangered species at risk.[135] The CBD is not alone in its concerns over wildlife impacts due to pesticide use. For example, the American Bird Conservancy states that out of the 672 million birds that are directly exposed to pesticides each year, more than sixty-seven million will die from the pesticide exposure.[136] Moreover, fish, bird, and other wildlife poisonings from exposure to pesticides are fairly frequent and widespread.[137] In fact, one database that tracks bird mortality from pesticide use lists over 400,000 reported bird deaths caused by pesticides resulting from over 1,700 pesticide poisoning incidents.[138] Actual bird deaths from pesticide poisonings are most likely substantially greater due to the known underreporting of bird deaths.[139] Further, the U.S. Department of Agriculture has warned of an "impending pollinator crisis" due in part to pesticide use.[140] Pollinators at risk include both commercial bees and a number of wild pollinators, including wild bees and a variety of species of bird and bat pollinators.[141] A num-

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133 *See* KIELY, DONALDSON & GRUBE, *supra* note 122, at 16.

134 LITMANS & MILLER, *supra* note 117, at ii, 16-17.

135 *See* LITMANS & MILLER, *supra* note 117, at 18, 19-44.

136 American Bird Conservancy, Pesticides and Birds, http://www.abcbirds.org/abcprograms/policy/pesticides/index.html (last visited Mar. 8, 2010). This estimate is based on a study by Dr. David Pimentel, who has reported a conservative estimate of sixty-seven million bird deaths per year from agricultural pesticide use. David Pimentel, et al., *Assessment of Environmental and Economic Impacts of Pesticide Use*, *in* THE PESTICIDE QUESTION: ENVIRONMENT, ECONOMICS AND ETHICS, *supra* note 120, at 47, 68.

137 *See* American Bird Conservancy, The Avian Incident Monitoring System (AIMS), http://www.abcbirds.org/abcprograms/policy/pesticides/aims/aims/index.cfm (last visited Mar. 8, 2010). AIMS is a cooperative program between American Bird Conservancy and EPA. *Id.* The AIMS database tracks incidents of pesticide exposure impacting wild birds. *Id.*

138 *Id.*

139 American Bird Conservancy, AIMS Background, http://www.abcbirds.org/abcprograms/policy/pesticides/aims/aims/AIMS.cfm (last visited Mar. 8, 2010). Bird deaths are underreported for a number of reasons. First, sick or dying birds typically fly away from the area where they were poisoned and often seek shelter in a hidden location. Second, bird carcasses are quickly carried away by predators and scavengers. Finally, humans often fail to report deaths either because they are not aware that there is reason to do so, or to avoid potential legal liability for contributing to the bird death. *See* Pimentel et al., *supra* note 136, at 66.

140 LITMANS & MILLER, *supra* note 117, at 17.

141 Ingram, Buchman, & Nabhan, *supra* note 112, at 295.

ber of additional recent scientific studies reveal the substantial risks and lack of full understanding regarding the pesticide risks to wildlife.[142]

Another obvious impact to biodiversity stems from the clearing of land and growing of vast areas of monocultures or corn and other commodities. Agriculture is a significant contributor to the loss of biodiversity.[143] Obviously, clearing and planting of crops is an inherent part of agriculture; however, a shift away from monocultures to fields containing a diversity of crops, coupled with the use of borders, buffers, and refugia for other organisms could limit the impacts to wildlife and biodiversity resulting from the conversion of nature to farmland.

C. *Human Health Impacts*

In addition to the environmental impacts of industrial agriculture, many of which indirectly affect human health, certain agricultural practices can cause direct harm to humans. This is particularly true with regard to pesticide use. As discussed above, pesticides can leach into groundwater and run off into surfacewaters causing contamination to drinking water sources, contamination of fish that humans consume, and direct skin contact through bathing or swimming in contaminated waters. Humans are also directly exposed to pesticides through aerial drift and pesticide residues in

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142 *See, e.g.*, Lawrence J. Blus & Charles J. Henny, *Field Studies on Pesticides and Birds: Unexpected and Unique Relations*, 7 ECOLOGICAL APPLICATIONS 1125, 1130-31 (1997) (finding, among other things, shortcomings with existing field testing of pesticides on birds and unexpected toxic effects and routes of exposure of certain organophosphate pesticides); ANDREW OGRAM & YUN CHENG, FINAL REPORT: BIOLOGICAL BREAKDOWN OF PESTICIDES IN LAKE APOPKA NORTH SHORE RESTORATION AREA SOIL IN A MESOCOSM EXPERIMENT, ST. JOHNS RIVER WATER MANAGEMENT DISTRICT 9 (2007), http://www.sjrwmd.com/technicalreports/pdfs/SP/SJ2007-SP1.pdf (demonstrating the complexity of pesticide breakdown in soils and under a variety of conditions).

In his article, Professor J.B. Ruhl describes the negative impacts of agriculture and the lack of strong environmental regulation of agriculture. Ruhl describes how farms, despite their substantial and negative influence on the American environment, often are exempted from environmental laws and regulations. Ruhl, *supra* note 63, at 293-315. Farms account for 930 million acres of the American landscape, and in 1997 had sales of just under $200 billion. *Id.* at 272-73. However, the farming industry also provides numerous hazards to the U.S. environment, such as habitat loss and degradation, soil erosion, pesticide releases, and nonpoint source water pollution. *Id.* at 274-93. Farms use over 750 million pounds of pesticides annually, and account for roughly 80 percent of the U.S. pesticide use. *Id.* at 282. The author notes how a "significant fraction" of pesticides fail to interact with the target but rather are absorbed into the soil, posing short-term, and for some pesticides, long-term toxic risks. *Id.* at 283. Furthermore, pesticide runoff has serious and negative consequences for the water supply. *Id.* at 283-84.

143 *See generally* Badgley, *supra* note 112, at 279 ("Agriculture, more than any other human activity, has the greatest collective negative effect on Earth's biodiversity."); Thomas K. Gottschalk et al., *Impact of Agricultural Subsidies on Biodiversity at the Landscape Level*, 22 LANDSCAPE ECOLOGY 643, 643-44 (2007) (noting that agricultural practices negatively impact biodiversity).

food.[144] By far the largest group of people to be directly impacted by pesticides is farmworkers and their families, who are put at significant risk from high levels of pesticide exposure.[145] Finally, industrial agriculture can impact human health indirectly, by influencing the foods people eat. For example, the glut of corn resulting from U.S. agricultural policy has resulted in cheap high fructose corn syrup that has been incorporated into virtually all processed foods. High fructose corn syrup has been linked to obesity and diabetes.[146]

D. *Contribution to Climate Change*

High intensity agriculture such as corn production not only has a large "water footprint," but it also has a large "carbon footprint." Many of the inputs relied on in industrial agriculture are derived from fossil fuels. Nitrogen fertilizers are derived from natural gas made from fossil fuels.[147] Most synthetic pesticides are made from fossil fuels.[148] Fossil fuels, especially diesel and gasoline, are used for heavy machinery including tractors and combines as well as for transportation of agricultural products to processing facilities and ultimately to retail grocery stores.[149] Agriculture accounts for about 20 percent of U.S. fossil-fuel consumption as well as 15 percent of worldwide greenhouse gas emissions.[150] It is estimated that it takes "[ten] calories of petroleum to yield just one calorie of industrial food" and about two-thirds of a gallon of gasoline to produce one bushel of corn.[151]

Another significant agricultural contributor to climate change is methane production.[152] Animals, particularly cows that are kept in confined feeding operations and fed large quantities of corn and other grains, pro-

144 A detailed discussion of the risks to humans from pesticide exposure from food and water is beyond the scope of this Article. For a more detailed discussion, see EDWIN D. ONGLEY, FOOD & AGRIC. ORG. OF THE UNITED NATIONS, CONTROL OF WATER POLLUTION FROM AGRICULTURE (1996), http://www.fao.org/docrep/W2598e/w2598e07.htm.

145 A detailed discussion of the health effects of farm worker exposure to pesticides is beyond the scope of this Article. For a more detailed discussion, see Eubanks, *supra* note 49, at 276.

146 A detailed discussion of the health effects linked to high fructose corn syrup is beyond the scope of this Article. For a more detailed discussion, see George A. Bray, Samara Joy Nielsen & Barry M. Popkin, *Consumption of High-Fructose Corn Syrup in Beverages May Play a Role in the Epidemic of Obesity*, 79 AM. J. CLINICAL NUTRITION 537, 537 (2004).

147 Eubanks, *supra* note 54, at 10504; Warshall, *supra* note 51, at 225.

148 Warshall, *supra* note 51, at 225.

149 Eubanks, *supra* note 54, at 10504; Warshall, *supra* note 51, at 225.

150 Eubanks, *supra* note 54, at 10504.

151 *Id.* (citing DANIEL IMHOFF, FOOD FIGHT: THE CITIZEN'S GUIDE TO A FOOD AND FARM BILL 102 (2007)) (internal quotation marks omitted).

152 *See id.*; Joshua A. Utt, W. Walker Hunter & Robert E. McCormick, *Carbon Emissions, Carbon Sinks, and Global Warming*, *in* AGRICULTURAL POLICY AND THE ENVIRONMENT, *supra* note 76, at 151, 156.

duce substantial amounts of methane gas.[153] Methane gas is a greenhouse gas that has been demonstrated to be approximately twenty times more powerful than carbon dioxide in exerting a greenhouse effect.[154] While methane gas is obviously a natural waste product produced by animals, the enormous quantities of methane gas produced in modern agriculture are directly attributable to the sheer numbers of animals in confined feeding operations, which would not exist if not for cheap corn and soy production.[155]

III. U.S. POLICIES THAT ENCOURAGE ENVIRONMENTALLY UNSOUND AGRICULTURAL PRACTICES

A. *Regulatory*

Although there are a number of federal regulatory programs that address, to some extent, the environmental problems associated with agricultural activities, they are very limited and are not nearly adequate to address the serious pollution, water overuse, carbon emissions, and other environmental harms resulting from current industrial agricultural practices. In fact, many federal environmental statutes contain explicit exemptions for agricultural activities or hold these activities to significantly lower standards than other industrial practices. Professor J.B. Ruhl refers to these exemptions and lower standards as regulatory safe harbors for agriculture.[156] As discussed in more detail below, the primary federal statute designed to address water pollution, the Clean Water Act,[157] contains exemptions for many agricultural activities and more importantly completely excludes from its major regulatory program the majority of pollution-laden runoff (e.g., fertilizers, pesticides, and animal wastes) from farms into the nation's waters. The other major statute addressing environmental issues associated with agriculture, the Federal Insecticide, Fungicide and Rodenticide Act ("FIFRA"),[158] regulates the manufacture, distribution, sale, and use of pesticides. However, as described in more detail below, by employing the least stringent environmental standard used in federal environmental law—the cost-benefit balancing standard—and by not adequately regulating pesticide use, this statute does not provide adequate protection from the human health and ecological risks resulting from the use of these toxic substances.

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153 Eubanks, *supra* note 54, at 10504.

154 *Id.*

155 *See id.*

156 *See* Ruhl, *supra* note 63, at 293.

157 Federal Water Pollution Control Act ("Clean Water Act"), 33 U.S.C. §§ 1251-1387 (2006).

158 Federal Insecticide, Fungicide, and Rodenticide Act ("FIFRA"), 7 U.S.C. §§ 136-136y (2006).

1. The Clean Water Act

The 1972 Federal Water Pollution Control Act, commonly referred to as the Clean Water Act ("CWA"),[159] serves as the primary federal regulatory authority for addressing water pollution. One of the most significant features of the CWA is the National Pollutant Discharge Elimination System ("NPDES") program, which requires that permits be obtained for any discharge of a pollutant from a point source into waters of the United States.[160] The permitting agency, either EPA or states that have the authority to implement the program, must ensure that permitted discharges meet two different types of standards: technology-based standards and water quality-based standards.[161] Technology-based standards are established on an industry-wide basis to ensure that polluters are treating discharges to the extent feasible.[162]

Water quality standards are generally established by the states for each waterbody within their jurisdiction. Water quality standards are comprised of: (1) designated use; (2) water quality criteria; and (3) antidegradation standard.[163] Each state determines the designated use of each waterbody within the state.[164] For example, states may determine that a particular waterbody should be designated for drinking water, for shellfish harvesting, for fishing and swimming, for agricultural use, or for industrial use. Then, numerical, or in some cases narrative, criteria are established for particular pollutants to protect such uses.[165] In theory, all NPDES permits must ensure that these water quality criteria are met, and therefore by extension, the designated uses are protected. Water quality standards were intended to serve as a backstop to technology-based standards, to protect designated uses in situations where technology-based standards were not sufficient to protect a designated use of a particular waterbody.[166]

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159 33 U.S.C. §§ 1251-1387.

160 *Id.* § 1342.

161 *See* Ruhl, *supra* note 63, at 294; *see also* 33 U.S.C. § 1311-17, 1342.

162 Three different technology-based standards exist under the CWA. The applicable technology is determined based on the type of pollutant discharged and whether the discharging source is new or existing. JACKSON B. BATTLE & MAXINE I. LIPELES, WATER POLLUTION 167 (3d ed. 1998). "Best Available Technology" is the technology-based standard applied to existing sources of non-conventional and toxic pollutants. 33 U.S.C. § 1311(b)(2)(A). "Best Conventional Technology" is applied to existing sources of conventional pollutants. *Id.* "Best Available Demonstrated Control Technology" is the technology-based standard applied to new sources of water pollutants. *See id.* § 1316; *see also* BP Exploration & Oil, Inc. v. EPA, 66 F.3d 784, 789-90 (6th Cir. 1995) (explaining the different standards EPA uses to control pollutants under the CWA). For an excellent overview of water law, see BATTLE & LIPELES, *supra*.

163 BATTLE & LIPELES, *supra* note 162, at 182.

164 *See id.* at 182-83.

165 *See id.* at 183-84.

166 *See id.* at 181-82.

An important, but until fairly recently long-ignored, component of implementing water quality standards is Total Maximum Daily Loads ("TMDL"). The CWA defines a TMDL as the sum of allocated loads of pollutants set at a level necessary to implement the applicable water quality standards, including: waste load allocations from point sources, and load allocations from nonpoint sources and natural background conditions.[167] The CWA further provides that TMDL must contain a margin of safety and a consideration of "seasonal variations."[168] In other words, a TMDL can be described as the amount of a particular pollutant that a particular waterbody can assimilate without resulting in a violation of a water quality standard. Once TMDLs are established by states and approved by EPA, the next challenge is the allocation of TMDLs among all point and nonpoint source dischargers and the implementation of the TMDLs. For point source discharges, TMDLs will be allocated and implemented through the NPDES permitting program and may require pollution reductions beyond what would be required using only technology-based standards.[169] For nonpoint sources, which include agricultural runoff as well as urban and suburban runoff and which are not addressed by the NPDES permitting program, the allocation and implementation of TMDLs is much more challenging. In most places it is likely that a multi-faceted watershed-based approach will be needed. Components of such a multi-faceted approach will most likely have to include, among other things, some or all of the following pollution reduction approaches: state regulation of urban, suburban, and agricultural runoff; adoption of best management practices to reduce pollutant loadings in stormwater and agricultural discharges; retrofitting existing urban areas to treat stormwater; land acquisition programs to protect riparian areas that provide the function of filtering pollutants from runoff; wetland and waterbody restoration programs; and public education.[170]

The NPDES program has been relatively successful at reducing the amount of pollutants discharged from point sources. One of the greatest failures of the program, however, is that it does not apply to nonpoint source discharges including agricultural runoff. The NPDES program was designed to apply only to point source discharges and explicitly exempts most agricultural discharges, in particular agricultural stormwater and irrigation return flow, from the definition of "point sources."[171] In 1987, when

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167 *See* 33 U.S.C. § 1313(d)(1)(C) (2006); *see also* Ruhl, *supra* note 63, at 300-05 (discussing TMDLs).

168 33 U.S.C. § 1313(d)(1)(C).

169 *See* BATTLES & LIPELES, *supra* note 162, at 184.

170 *See* Oliver A. Houck, *TMDLs III: A New Framework for the Clean Water Act's Ambient Standards Program*, 28 ENVTL. L. REP. NEWS & ANALYSIS 10415, 10423 (1998).

171 The CWA defines the term "point source" as "any discernable, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from

Congress amended the CWA to include certain stormwater discharges in the NPDES permitting program, it once again chose to exempt agricultural stormwater runoff.[172] Consequently, most of the current significant water quality problems with the nation's waters are caused by these unregulated nonpoint source discharges.[173] The two greatest contributors to nonpoint sources water pollution are runoff from agriculture and runoff from urban and suburban land uses.[174] In many areas of the country, agricultural runoff is considered to be the greatest challenge of water pollution control efforts.

2. The Federal Insecticide, Fungicide and Rodenticide Act

The Environmental Protection Agency's authority for regulating pesticides is primarily under FIFRA.[175] EPA issues FIFRA registrations, which are required for any pesticide that is sold or distributed in the U.S. FIFRA authorizes EPA to issue registrations provided certain criteria are met. The primary substantive criterion is that a pesticide may be registered only if its use will not cause an "unreasonable adverse effect on the environment."[176] FIFRA defines the term "unreasonable adverse effects on the environment" as "any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide."[177] Accordingly, EPA considers the risks posed by the pesticide as well as the economic and social implications of its use when determining whether to register a certain pesticide.[178] Although not explicitly required by FIFRA, EPA has consistently interpreted and applied this standard as a type of cost-benefit balancing analysis.[179]

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which pollutants are or may be discharged. This term does not include agricultural stormwater discharges and return flows from irrigated agriculture." 33 U.S.C. § 1362(14).

172 *See id.* § 1342(p)(2).

173 *See* BATTLES & LIPELES, *supra* note 162, at 537.

174 *See id.* at 535-36.

175 7 U.S.C. §§ 136-136(y) (2006). Portions of this section are adapted from Angelo, *The Killing Fields*, *supra* note 63, at 104-10.

176 *See id.* § 136a(c)(5). Section 136(j) provides that "[t]he term 'environment' includes water, air, land, and all plants and man and other animals living therein, and the interrelationships which exist among these." *Id.* § 136(j).

177 *Id.* § 136(bb).

178 It should be noted that cost-benefit terminology is used differently under FIFRA than it is used in discussing most environmental regulations. Typically, in doing a cost-benefit analysis, the regulatory agency compares the costs of regulation (e.g., the cost of installing pollution controls) to the benefits of regulation (e.g., lives saved or cancers avoided). Under FIFRA, however, the "costs" are considered to be the costs of allowing the use of the pesticide (e.g., cancer deaths), whereas the benefits are considered to be the benefits of allowing the use of the pesticide (e.g., reduction in crop loss from pest insect damage). *See* WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW 452-53 (2d ed. 1994).

179 A number of scholars have pointed out that although Congress did direct EPA to take into account economic factors, it did not explicitly mandate that EPA conduct a strict cost-benefit analysis.

To register a pesticide under FIFRA, EPA must find that the pesticide "will perform its intended function without unreasonable adverse effects on the environment."[180] However, FIFRA expressly states that EPA "shall not make any lack of essentiality a criterion for denying registration of any pesticide," and that "[w]here two pesticides meet the requirements [for registration], one should not be registered in preference to the other."[181] Accordingly, there is no requirement to demonstrate that a pesticide is essential to obtain a registration and the availability of alternative pesticides for the same use does not preclude registration. Moreover, FIFRA expressly authorizes EPA to waive all data requirements pertaining to efficacy and EPA enacted a corresponding rule to do so.[182] Thus, as a practical matter, EPA does not require any showing of the economic or social benefits to be derived from the pesticide in making registration decisions, and instead assumes that such benefits will result.

One of the most significant aspects of FIFRA is that it requires an applicant for a pesticide registration to submit data to EPA.[183] The vast majority of EPA's data requirements under FIFRA relate to human health ef-

See SIDNEY A. SHAPIRO & ROBERT L. GLICKSMAN, RISK REGULATION AT RISK: RESTORING A PRAGMATIC APPROACH 32-33 (2003); Angelo, *Embracing Uncertainty*, *supra* note 63, at 176-77, 182. In fact, as Professor William Rodgers has described, the legislative history of FIFRA suggests that adverse affects were not intended to be tolerated unless there are "overriding benefits" from the use of the pesticide. *See* RODGERS, *supra* note 178, at 451-532. Despite the apparent intent of Congress in enacting FIFRA, for more than thirty years EPA has interpreted FIFRA to require a cost-benefit balancing, and this interpretation has been upheld by the court. *See* Envtl. Def. Fund, Inc. v. EPA, 548 F.2d 998, 1005 (D.C. Cir. 1976) ("To evaluate whether use of a pesticide poses an 'unreasonable risk to man or the environment,' [EPA] engages in a cost-benefit analysis . . . ."); Protexall Prods., Inc., FIFRA No. 625, 2 Envtl. Admin. Dec. 854, 854 (EPA July 26, 1989) ("[T]he risk-benefit assessment required under FIFRA involves a balancing of the risks . . . against the benefits . . . ."); Chapman Chem. Co., FIFRA No. 246, 1 Envtl. Admin. Dec. 199, 203 (EPA Feb. 17, 1976) ("[B]efore any pesticide can be cancelled under the FIFRA [EPA] must be persuaded that the risks to man or the environment from continued use of the pesticide outweigh the benefits of its continued use.").

180 7 U.S.C. § 136a(c)(5)(C) (2006).

181 *Id.* § 136a(c)(5).

182 *Id.*; 40 C.F.R. § 158.640(b)(1) (2007). The procedures for registering pesticides are set forth in the statute and regulations (primarily 40 C.F.R. Part 152). *See* 40 C.F.R. § 152 (2009).

183 *See* 7 U.S.C. § 136a(a), (c)(1). Data requirements are found at 40 C.F.R. Part 158, and provide for the submission of certain health and environmental effects data. 40 C.F.R. § 158 (2009).

fects.[184] EPA's data requirements for testing for wildlife and ecological effects are much more limited.[185]

Based on the submitted data, EPA determines whether use restrictions are necessary to meet the registration standard. However, EPA's ability to regulate pesticide "use" is very limited under FIFRA. FIFRA does not create a permitting system for pesticide use like many other environmental statutes, which means that no EPA approval is necessary before using a pesticide, even on a large scale. As a result, factors like the time and place of pesticide usage are not evaluated by EPA under FIFRA prior to the release of pesticides into the environment. FIFRA primarily addresses the "use" of pesticides through labeling restrictions.[186] The registration applicant is responsible for proposing all labeling with the registration application.[187] FIFRA defines the term "label" as "the written, printed, or graphic matter on, or attached to, the pesticide."[188] "Labeling," on the other hand is much broader and includes the label as well as "all other written, printed, or graphic matter" that accompanies the pesticide or to which reference is made on the label.[189] All registered pesticide products must be labeled with specified information such as warnings, directions for use, and a statement of ingredients.[190] The primary means by which EPA regulates pesticide "use" under FIFRA is by requiring users of pesticides to follow all label directions. All pesticide product labels are required to state that it shall be unlawful for any person to use any pesticide in a manner inconsistent with its labeling.[191] This is the sole obligation placed by FIFRA on users of pesticides. Accordingly, "directions for use" is the only mechanism to regulate user behavior to accomplish risk reduction goals. Unfortunately, pesticide users may not understand, or be willing to follow, the complex labeling instructions necessary to regulate use to prevent environmental harms. Moreover, it is virtually impossible for EPA to know who, where, when, and how persons are using pesticides, not to mention to monitor each and

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184 These data requirements include testing on residue chemistry to estimate human exposure to pesticides, acute human hazard, subchronic human hazard, chronic human hazard, mutagenicity, metabolism studies, reentry hazard, spray drift evaluation, as well as oncogenicity, teratogenicity, neurotoxicity, and reproductive effects in humans. *See* 40 C.F.R. §§ 158.202(a), 202(c), 202(e), 202(f), 202(g), 390, 440 (2007); *see also* 40 C.F.R. § 158.34 (2009) (providing that certain human health effects data submitted to EPA must be flagged as indicating potential adverse effects).

185 *See* Leslie W. Touart & Anthony F. Maciorowski, *Information Needs for Pesticide Registration in the United States*, 7 ECOLOGICAL APPLICATIONS 1086, 1087-90 (1997) (describing and evaluating EPA's ecological risk data requirements for pesticide registration).

186 *See* RODGERS, *supra* note 178, at 466-67.

187 7 U.S.C. § 136a(c)(1)(C).

188 *Id.* § 136(p)(1).

189 *Id.* § 136(p)(2).

190 A product whose label or labeling does not contain the information required by EPA or which sets forth false or misleading information is misbranded. *Id.* §§ 136(q), 136j(a)(1)(E).

191 *Id.* § 136j(a)(2)(G).

every pesticide user in the country to assure the labeling instructions are followed.

FIFRA does, however, authorize EPA to classify higher risk pesticides as restricted use pesticides. A restricted use pesticide may not be purchased by the general public.[192] Instead, these products may only be used by or under the supervision of a certified applicator.[193] However, the designation is designed primarily to protect users without much consideration for ecological or wildlife interests. States generally administer the certification of applicators according to state certification plans that must conform to certain standards enumerated in FIFRA.[194] Certified applicators are not required to receive any particular training in local ecological systems and their vulnerability to particular pesticides.[195] Finally, although FIFRA section 11 requires EPA and states to make available to certified applicators at their request instructional materials concerning Integrated Pest Management ("IPM"), the statute expressly states certified applicators are not required to receive instruction on IPM and are not required to be shown to be competent with respect to such techniques.[196] Thus, certified applicators are not required to know about less risky pest control techniques, let alone to consider them in making decisions regarding which options to choose to control a particular pest. In fact, a certified applicator's job is not to decide what approach to take to control a pest, but is merely to ensure that once a particular pesticide is chosen, it is applied properly in accordance with label instructions.

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192 *See* RODGERS, *supra* note 178, at 457.

193 *See* 7 U.S.C. § 136a(d)(1).

194 Regarding the use of restricted use pesticides, section 136i, entitled "Use of restricted use pesticides; applicators," provides:

> (a) Certification procedure
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> (1) Federal certification. In any State for which a State plan for applicator certification has not been approved by the Administrator, the Administrator, in consultation with the Governor of such State, shall conduct a program for the certification of applicators of pesticides. . . .
>
> (2) State certification. If any State, at any time, desires to certify applicators of pesticides, the Governor of such State shall submit a State plan for such purpose. The Administrator shall approve the plan submitted by any State [if such plan meets certain general conditions regarding the state's legal authority, funding mechanisms, etc.] . . . .

7 U.S.C. § 136i(a)(1)-(2).

195 For a description of certified applicator training programs, see RODGERS, *supra* note 178, at 459-63 (stating that in many instances, "filling out the form is the exclusive test of competence").

196 Section 136i(c) of Title 7, regarding instruction in integrated pest management, provides:

> Standards prescribed by the Administrator for the certification of applicators of pesticides under subsection (a) of this section, and State plans submitted to the Administrator under subsection (a) of this section, shall include provisions for making instructional materials concerning integrated pest management techniques available to individuals at their request in accordance with the provisions of section 136u(c) of this title, but such plans may not require that any individual receive instruction concerning such techniques or to be shown to be competent with respect to the use of such techniques. The Administrator and States implementing such plans shall provide that all interested individuals are notified on the availability of such instructional materials.

After the registration of a pesticide, EPA continues to have the authority to either cancel or suspend the existing registration based upon determinations of risks and benefits. FIFRA section 136d(b), which specifically addresses cancellation, provides that EPA may issue a notice of intent to cancel if a pesticide or its labeling does not comply with FIFRA or if, when used in accordance with widespread and commonly recognized practice, the pesticide generally causes unreasonable adverse effects on the environment.[197] Under subsection (b) there are two types of cancellation actions that EPA can take. EPA is authorized to issue a notice of intent to cancel or change classification under subsection (b)(1).[198] EPA is also authorized under subsection (b)(2) to issue a notice of intent to hold a hearing in order to determine whether or not the existing registration should be cancelled or classification changed.[199] Regardless of the type of cancellation action taken by EPA the risk-benefit balancing standard is the standard for cancellation.[200] Before taking final action under section 6(b), EPA must first consider whether any unreasonable risks posed by a pesticide's use can be sufficiently mitigated by regulatory measures short of cancellation, such as additional labeling restrictions or the classification of the pesticide for restricted use.[201] If EPA determines that sufficient risk reduction cannot be achieved by such measures, the registration of the pesticide for that use must be cancelled.[202]

B. *Incentive-Based*

1. History of Agricultural Economic Regulatory Programs

The face of farming in the United States has changed dramatically from the small family farmer of the early part of the twentieth century to the large corporate industrial producer of today. Between 1935 and 2002, the total number of U.S. farms declined by 70 percent while the total acreage of all farms remained the same.[203] This trend was a consequence of larger farms buying out smaller farms.[204] From 1900 to 1997, the number of farms

197 *Id.* § 136d(b).

198 *Id.* § 136d(b)(1).

199 *Id.* § 136d(b)(2).

200 *See, e.g.*, Envtl. Def. Fund, Inc. v. Ruckelshaus, 439 F.2d 584, 594 (D.C. Cir. 1971).

201 *See id.*; RODGERS, *supra* note 178, at 485.

202 This Article's discussion of environmental regulatory programs affecting agriculture is focused on the Clean Water Act and FIFRA. It should be noted that other regulatory programs, including the Clean Air Act and hazardous waste laws, are also relevant. *See* Eubanks, *supra* note 49, at 248-49, 267; Ruhl, *supra* note 63, at 337-38.

203 Eubanks, *supra* note 49, at 228-29.

204 *Id.* at 229.

over one thousand acres in Iowa grew from 340 to 5,887.[205] Some of the greatest contributing factors to the revolution in farming can be found in U.S. agricultural economic incentive programs, particularly those contained in the various versions of what is known as the "Farm Bill."[206]

The United States has a long history of government-supported agriculture that dates back to the late eighteenth and nineteenth centuries when the government opened vast areas of public land for agricultural settlement.[207] By the mid-nineteenth century, the federal government began to play a significant role in encouraging and funding agricultural research. The Morrill Act authorized grants of public lands to state to establish "land grant" colleges,[208] and the Hatch Act of 1887 authorized federal funding of agricultural research.[209] In the early twentieth century, the Cooperative Extensive Service was established to provide practical education to those in the agricultural industry.[210] It was not until the 1930s, as a reaction to the Great Depression and the devastating "Dust Bowl" era that the federal government began to enact the complex maze of agricultural law and policy that forms the backbone of our current agricultural system.[211]

The combination of the Great Depression and the Dust Bowl era of the 1930s led to the first significant economic intervention by the government into what previously had been a relatively free agricultural marketplace.[212] Initially, government intervention was aimed at stabilizing prices by limiting production to limit supply.[213] During the Depression, agricultural land values sunk, resulting in a staggering number of farm mortgage foreclosures and bankruptcies in the farm credit sector.[214] Moreover, commodity prices declined, and there were stockpiles of certain commodities well in excess of market needs.[215] As part of his 1932 presidential campaign, Franklin Delano Roosevelt vowed to solve the agricultural problems.[216] Against this backdrop was the devastating 1936 Dust Bowl. Consequently, the 1930s experienced a rash of "New Deal" agricultural legislation designed to

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205 *Id.*

206 *See id.* at 228.

207 *See, e.g.*, DONALD B. PEDERSEN & KEITH G. MEYER, AGRICULTURAL LAW IN A NUTSHELL 1-5 (1995) (describing the series of laws enacted in the eighteenth and nineteenth centuries to promote agricultural settlement).

208 Morrill Act of 1862, 7 U.S.C § 301-05, 307-08 (2006); Second Morrill Act, 7 U.S.C. § 321-26, 328-29 (2006).

209 Hatch Act of 1887, 7 U.S.C. §§ 361(a)-(i) (2006).

210 Smith-Lever Act, 7 USC §§ 341-45, 347a-349 (2006).

211 Eubanks, *supra* note 49, at 218-19; *see also* PEDERSEN & MEYER, *supra* note 207, at 5-6.

212 PEDERSEN & MEYER, *supra* note 207, at 5-6.

213 *See* Eubanks, *supra* note 49, at 219.

214 PEDERSEN & MEYER, *supra* note 207, at 6; *see* Eubanks, *supra* note 49, at 219.

215 Eubanks, *supra* note 49, at 218-19.

216 Gertrude Almy Slichter, *Franklin D. Roosevelt and the Farm Problem, 1929-1932*, 43 MISS. VALLEY HIST. REV. 238, 240 (1956); *see also* PEDERSEN & MEYER, *supra* note 207, at 6.

stabilize agricultural markets and support prices of certain basic commodities.[217]

The most significant of the Depression-era agricultural enactments was the Agricultural Adjustment Act of 1933 and its successor, the Agricultural Adjustment Act of 1938, which continue to serve as the foundation for the current commodity price and income support programs.[218] The 1938 Act was designed primarily to increase farm income and stabilize prices.[219] These goals were echoed in a succession of later legislative acts including the acts that are now commonly referred to as the "Farm Bills." During the 1930s the federal government also created the Commodity Credit Corporation ("CCC"), which is a federal corporation within the Department of Agriculture that is authorized to act to stabilize and support farm income and prices.[220]

After the problems of the 1930s, farm subsidies continued as a way to keep prices high and limit the amount produced by taking some land out of production and controlling the amount of crops making it to market. The goal of stabilizing markets by limiting production continued until 1973 when then Secretary of the Department of Agriculture Earl Butz dramatically changed policy direction by encouraging farmers to grow the maximum amount possible of commodity crops like corn.[221] Butz's policy shift, coupled with the technological advances of the Green Revolution, resulted in dramatic increases in per acre yields.[222] Rather than limiting production, the new policies tied payment amounts to production levels, thereby incentivizing the maximum production of certain commodity crops for which subsidies were available.[223] Growers could benefit by substituting the heavily subsidized commodity crops for their previous variety of vegetable crops and grazing lands. As more and more land became devoted to ever increasing densities of corn and other grains, farms grew larger and large farms squeezed out the smaller family farms that once grew a variety of types of food. Today, a majority of corn farmers have more than one thousand acres of corn and farm size continues to grow as larger farmers buy out smaller farmers.[224] Because more bushels of corn meant more money, techniques were developed to maximize the per acre yield of corn. Currently, it is not uncommon for corn growers to yield 200 bushels, or five tons, of corn from

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217 Eubanks, *supra* note 49, at 219.

218 *See* Howard B. Pickard, *Price and Income Adjustment Programs, in* 1 AGRICULTURAL LAW § 1.02, at 3-6 (John H. Davidson ed., 1981).

219 PEDERSEN & MEYER, *supra* note 207, at 9.

220 *Id.*; *see also* Pickard, *supra* note 218, § 1.02, at 4.

221 Eubanks, *supra* note 49, at 225.

222 *Id.* at 222, 225.

223 *Id.* at 225-26.

224 *See* NIGEL KEY & MICHAEL J. ROBERTS, U.S. DEP'T OF AGRIC., COMMODITY PAYMENTS, FARM BUSINESS SURVIVAL, AND FARM SIZE GROWTH 1 (2007), http://www.ers.usda.gov/Publications/ERR51/ERR51.pdf.

a single acre of land.[225] This represents an approximately four-fold increase in per acre corn yield since the early 1990s.[226] To achieve such high yields it is necessary to plant a staggering 30,000 kernels of corn per acre and to rely on high inputs of fertilizer,[227] pesticides, and irrigation water.

The dramatically increased yields led to huge surpluses, which in turn led to the rise of the corn syrup sweetener industry. Prior to 1970, virtually no Americans ate high fructose corn syrup because it was too expensive to make.[228] With the need to create a market for the huge corn surpluses, industrial techniques were developed to make the process much cheaper. As a result, by the late 1980s high fructose corn syrup was being used in a vast array of processed foods and took over more than half of the sweetener market.[229] Although beyond the scope of this Article, it is worth noting that research has shown a correlation between high levels of ingestion of high fructose corn syrup and obesity and Type II diabetes.[230]

2. Farm Bill Subsidy Programs

The major agricultural subsidy programs are found in what is commonly referred to as the "Farm Bill." The roots of the Farm Bill date back to the 1933 Agricultural Adjustment Act, which was considered to be emergency legislation designed to stabilize farm prices and prevent a collapse of the farming system during the Great Depression.[231] The focus of this early legislation was to stabilize crop prices by reducing the huge commodity surpluses that existed at that time, which depressed the prices farmers could get for their crops.[232] These programs, which provided financial incentives for farmers who took vast acreages of farmland out of agricultural production, coupled with the literal "dumping" of surplus crops,

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225 *Illinois Takes Top Yield Honors in Corn Belt with 175 Bushels of Corn Per Acre*, PRAIRIEFARMER.COM, May 14, 2008 ("Farms with corn yields averaging over 200 bushels [an acre] were common in 2007."), http://prairiefarmer.com/story.aspx?s=17305&c=14.

226 *See* JORGE FERNANDEZ-CORNEJO, U.S. DEP'T OF AGRIC., THE SEED INDUSTRY IN U.S. AGRICULTURE: AN EXPLORATION OF DATA AND INFORMATION ON CROP SEED MARKETS, REGULATION, INDUSTRY STRUCTURE, AND RESEARCH AND DEVELOPMENT 5 fig.5 (2004), http://www.ers.usda.gov/publications/aib786/aib786fm.pdf.

227 A typical Iowa corn farm uses 133 pounds of anhydrous ammonia per acre as fertilizer. IOWA STATE UNIV. DEP'T OF AGRONOMY, IOWA TOTAL CORN FERTILIZER USE 9 (2004), http://extension.agron.iastate.edu/soils/pdfs/Nuse/NBacktb3.PDF.

228 *See* Edward A. Evans & Carlton G. Davis, *Dynamics of the United States High Fructose Corn Sweetener Market*, *in* SUGAR AND RELATED SWEETENER MARKETS: INTERNATIONAL PERSPECTIVES 281, 283, 291 (A. Schmitz et al. eds., 2002).

229 *See id.*

230 *See* Bray, Nielsen & Popkin, *supra* note 146, at 542.

231 *See* Eubanks, *supra* note 49, at 228; *see also* PEDERSEN & MEYER, *supra* note 207, at 6-7.

232 *See* Eubanks, *supra* note 49, at 219.

resulted in a 50 percent increase in gross farm income within three years.[233] The legislation, thus, served its purpose of averting a crisis. Nevertheless, the policies in the original legislation continued to serve as the backbone of U.S. agricultural policy long after the farming crisis of the Great Depression was averted. Every five years or so Congress passes another "Farm Bill," which primarily consists of a set of amendments to the 1933 Agricultural Adjustment Act. Subsidies in the early Farm Bills were primarily designed to limit production to keep prices high, which was accomplished through land "set asides."[234] The result of these acreage set asides was that farmers found more intensive ways to get higher per acre yields. Beginning in the 1940s, the Green Revolution led to further yield increases through the development of new technologies to increase yields and a policy to grow as much as possible.

More recent commodity subsidy provisions under the Farm Bill have included a large number of complex programs including price support programs and income support programs. Price support programs are geared toward bolstering and stabilizing prices for certain specified commodities, including corn.[235] One of the major price support programs is the nonrecourse loan program. Income supports are direct payments to farmers. Direct payments and countercyclical payments comprise the largest categories of subsidies. From 1995 through 2006, $8,807,823,536 of direct payments and $5,381,622,107 in countercyclical payments went to corn producers.[236]

Over the past seventy-plus years, although the basic structure of the Farm Bill has remained intact, numerous programs have been added and several significant changes have been made. One significant change was the policy shift that took place in the early 1970s, which encouraged farmers to produce as much as possible, rather than limit production.[237] Another change was the addition of certain conservation programs in the 1985 Farm Bill.[238] These programs, while similar to the early Farm Bill acreage set aside programs, had a different purpose than the early set aside programs. The new conservation programs were not targeted at limiting production, but instead were aimed at conserving certain lands such as highly erodible

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233 *Id*. at 220.

234 DOUG O'BRIEN, NAT'L AGRIC. L. CTR., WORLD TRADE ORGANIZATION AND THE COMMODITY TITLE OF THE NEXT FARM BILL 4-5 (2006), http://www.nationalaglawcenter.org/assets/articles/obrien_wto.pdf.

235 PEDERSEN & MEYER, *supra* note 207, at 15-17.

236 Environmental Working Group, Farm Subsidy Database, Total Direct Payments in United States, http://farm.ewg.org/farm/progdetail.php?fips=00000&progcode=total_dp (last visited Mar. 8, 2010); Environmental Working Group, Farm Subsidy Database, Total Counter Cyclical Payments in United States, http://farm.ewg.org/farm/progdetail.php?fips=00000&progcode=total_cc (last visited Mar. 8, 2010).

237 Eubanks, *supra* note 49, at 225.

238 *Id*. at 241-42.

lands, wetlands, and other environmentally sensitive lands.[239] Ultimately these conservation programs resulted in farmers attempting to increase yields even further on the lands that were not identified for conservation. Another significant policy shift was adopted as part of the failed attempts in the 1996 Farm Bill to begin to wean commodity producers off of federal subsidies. This change "decoupled" certain commodity subsidy programs from production levels.[240] In other words, for certain specified subsidy programs, the amount of financial incentives received would no longer be tied to the amount of crop produced by the farmer. Although the primary goals of decoupling were to address inefficiency through market distortion, variability in federal budget exposure, and international trade distortion concerns, one of the benefits of decoupling was to no longer provide incentives for farmers to produce large surpluses of certain commodity crops.[241] However, as discussed in more detail below, not all commodity subsidy programs were decoupled, and history has shown that the decoupling that did occur does not appear to have resulted in surplus reductions.

The most recent Farm Bill is the Food, Conservation, and Energy Act of 2008.[242] This Act mostly reauthorizes and makes small changes to programs in previous Farm Bills. Some new programs were added, but the basic structure of previous Farm Bills is maintained. The primary types of subsidies in the latest Farm Bill include income supports, price supports, and acreage set asides.[243] The goal of income supports is to keep farmer income high regardless of prices they get for crops. The goal of price supports is to keep prices that farmers get for crops at a higher level and more stable. The goal of acreage set asides is to conserve certain lands for conservation purposes and to limit supply.

The largest category of commodity subsidy programs is the income support programs. Included in this category are direct payments, countercyclical payments, and the new Average Crop Revenue Election program. Direct payments are made to producers with eligible historical production of commodity crops.[244] The covered commodity crops are wheat, feed

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239 Erodible Land and Wetland Conservation and Reserve Program, 16 U.S.C. §§ 3811, 3821, 3831, 3837 (2006).

240 Mary E. Burfisher & Jeffrey Hopkins, *Farm Payments: Decoupled Payments Increase Households' Well-Being, Not Production*, AMBER WAVES, Feb. 2003, at 40, http://www.ers.usda.gov/AmberWaves/Feb03/pdf/Feature-Decoupled%20Farm%20Payments.pdf.

241 Economic Research Service, U.S. Dep't of Agric., Farm and Commodity Policy: What is Meant by Decoupling?, http://www.ers.usda.gov/Briefing/FarmPolicy/decoupling.htm (last visited Mar. 8, 2010) [hereinafter Decoupling].

242 Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-246, 122 Stat. 923 (2008).

243 For a detailed summary of the commodity programs in the 2008 Farm Bill, see JIM MONKE, CONG. RESEARCH SERV., FARM COMMODITY PROGRAMS IN THE 2008 FARM BILL 4-25 (2008), *available at* http://www.nationalaglawcenter.org/assets/crs/RL34594.pdf.

244 Economic Research Service, U.S. Dep't of Agric., 2008 Farm Bill Side-By-Side, Title I: Commodity Programs, http://www.ers.usda.gov/FarmBill/2008/Titles/TitleIcommodities.htm (last visited

grains (including corn), cotton, rice, and oilseeds.[245] The payment amount is the product of the statutory payment rate, the historical payment acres of the covered commodity,[246] and the historical payment yield for the commodity.[247] Direct payments are limited to $40,000 per person per crop year.[248] Payments must be linked to a person or legal entity, either directly or indirectly.[249] One of the most interesting aspects of the direct payment program is that the producer does not need to actually grow the crops to get the payments.[250] For example, if the producer historically grew a covered crop, such as corn, she can now grow soy and still get the subsidy. It is even possible to get the subsidy for leaving the farmland fallow (i.e., for growing nothing at all).

Under another income support program, the Countercyclical Payment Program, payments are made to producers with "eligible historical production of commodity crops."[251] The covered crops are wheat, feed grains (including corn), cotton, rice, legumes, and oilseeds.[252] Payments are made if the effective price for a commodity is less than the target price regardless of the market price of the commodity.[253] The limit of countercyclical payments is $65,000 per person per year.[254] The effective price for covered commodities, except rice, equals the sum of (1) the greater of either the national average market price received by producers or the national average loan rate for marketing assistance loan and (2) the payment rate for the covered commodity and the direct payment rate for the commodity.[255]

Under the Average Crop Revenue Election ("ACRE") Program, which appears for the first time in the 2008 Farm Bill and covers wheat, feed grains (including corn), cotton, rice, legumes, and oilseeds, producers may

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Mar. 8, 2010) [hereinafter Title I: Commodity Programs]. The 2008 Farm Bill allows the 2002 Farm Bill Direct Payment Program to remain intact with a few minor changes. In particular, the 2008 Bill provides that payment acres for crop years 2009-2011 are 83.3 percent and eliminates the three-entity rule (limited number of farms from which a person could receive program payments—full payment directly and up to half a payment for two additional entities) for payment limits. *Id.*; *see also* Center for Rural Affairs, Overview of the 2008 Farm Bill, http://www.cfra.org/newsletter/2008/05/overview-2008-farm-bill (last visited Mar. 8, 2010.) (discussing the three entity rule).

245 Title I: Commodity Programs, *supra* note 244.

246 That percentage is 83.3 percent in crop years 2009-2011 and 85 percent in crop years 2008 and 2012. *See id.*

247 *Id.*

248 *Id.* This limit excludes peanuts and is also reduced for participants in the Average Crop Revenue Election ("ACRE") Program. *Id.*

249 *Id.*

250 *Id.*

251 Title I: Commodity Programs, *supra* note 244.

252 *Id.*

253 *Id.*

254 *Id.* Again, this limit excludes peanuts, and, for ACRE participants, this limit includes both countercyclical payments and ACRE payments. *Id.*

255 *Id.*

make an irrevocable election to receive a state-based revenue guarantee equal to 90 percent of benchmark state yield multiplied by the ACRE program guarantee price for the crop year.[256] If the producer elects to receive ACRE payments, she is not eligible to receive countercyclical payments, direct payments are reduced by 20 percent, and marketing assistance loan rates are reduced by 30 percent.[257] This program provides a revenue guarantee each year based on state market prices and average state yields.[258] Payments are limited to $65,000 per farm in addition to the 20 percent reduction in direct payments and 30 percent reduction in marketing loan rates.[259]

The price support subsidy programs include a marketing loan assistance program, also known as "nonrecourse loans." Under this program, producers of wheat, corn, grain sorghum, barley, oats, upland cotton, extra long staple cotton, long and medium grain rice, soybeans, other oilseeds, peanuts, wool, mohair, honey, dry peas, lentils, and small and large chickpeas are allowed to receive a nonrecourse loan at a commodity-specific loan rate per unit of production.[260] Producers pledge their production as collateral for the loan. Producers may then store their crops and sell their production when market conditions may be more favorable. If market prices are higher than the loan rate, the producer will sell her crop, pay off the loan and keep the profits. If, on the other hand, market prices are lower than the amount of the loan, the producer may pay off the loan or forfeit the pledged crop to the Commodity Credit Corporation at loan maturity. In years when market prices are lower than the loan rate, this program in essence is the federal government purchasing crops at below market value.[261] Thus, growers have the security that they can either take advantage of market prices in good years or simply "sell" their crops to the government at below market value in bad years. Because of the glut of many commodity crops most years, the latter frequently occurs. Thus, the federal government

256 *Id.* Once enrolled, a farmer is enrolled in ACRE until the end of the 2012 crop year. *Id.*

257 Title I: Commodity Programs, *supra* note 244.

258 *Id.*

259 *Id.* The ACRE Program guarantee may not increase or decrease more than 10 percent from the previous year. *Id.* Two requirements that must be met before ACRE payments may be made are: (1) the actual State revenue for the crop year for the covered commodity is less than the ACRE program guarantee; and (2) the actual farm revenue for the crop year for the covered commodity or peanuts is less than the farm ACRE benchmark revenue for the crop year. *Id.* ACRE payment is equal to the product of (1) the lesser of (a) the ACRE program guarantee minus Actual State Revenue or (b) 25 percent of the ACRE program guarantee, (2) 83.3 percent of planted acres in 2009-2011 or 85 percent of planted acres in 2012, and (3) the farm's productivity ratio (that is, the ratio of the farmer's five-year Olympic average yield per planted acre divided by the state's five-year Olympic average yield per planted acre). *Id.* Under the ACRE program the total number of acres for which producers may receive payments may not exceed total base acreage for all covered commodities and peanuts on the farm. *Id.* In addition to the income support programs described above, the Farm Bill has specific subsidy programs that apply only to sugar and dairy. *Id.*

260 *Id.*

261 *See id.*

is left with vast quantities of surplus corn and other commodities, for which it must either find a market or find some method of disposal. These large surpluses are what have created the flood of cheap corn into the marketplace where it can serve as inexpensive industrial feedstock for processed foods.

Other commodity subsidy programs include crop insurance programs under which producers of specific crops, primarily commodity crops, are able to purchase insurance policies at a subsidized rate.[262] One of the most significant differences between the existing income support programs and the nonrecourse loan program is that while direct payments are limited to $40,000 per person per year and countercyclical and ACRE payments are limited to $65,000 per person per year, nonrecourse loan payment amounts are not capped under the 2008 Farm Bill.[263] The 2002 Farm Bill placed a $75,000 per person per year limit on these loans, limiting the maximum total amount of commodity payment that could be received to $360,000 per farm per year.[264] Under the 2008 Farm Bill, the limit for direct and countercyclical payments continues to be $210,000 per farm couple per year, however there is no longer a limit on nonrecourse marketing loans.[265] Thus, at least in theory, farming couples could receive considerably more than the previous maximum of $360,000 per farm per year.

Although not designed to be conservation programs, the Direct Payments, Countercyclical Payments, and ACRE Programs require producers to agree to carry out certain conservation-related practices to qualify for the payments. For example, the producers during the crop year in which they receive payments must agree to the following: not to produce an agricultural commodity on, designate for conservation uses, or set aside land where a majority of it is highly erodible;[266] not to produce an agricultural commodity on a wetland that has been drained, dredged, filled, leveled, or converted in any way for production of an agricultural commodity;[267] to plant any crop on base acres except fruits, vegetables (excluding mung beans and pulse crops), or wild rice;[268] to use the farmland for agricultural or conservation

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262 Economic Research Service, U.S. Dep't of Agric., 2008 Farm Bill Side-By-Side, Title XII: Crop Insurance, http://www.ers.usda.gov/FarmBill/2008/Titles/TitleXIICropInsurance.htm (last visited Mar. 8, 2010).

263 Title I: Commodity Programs, *supra* note 244.

264 RENÉE JOHNSON, ET AL., CONG. RESEARCH SERV., THE 2008 FARM BILL: MAJOR PROVISIONS AND LEGISLATIVE ACTION 13, 64 (2008), *available at* http://www.nationalaglawcenter.org/assets/crs/RL34696.pdf [hereinafter CRS, THE 2008 FARM BILL].

265 *Id.*

266 The conservation requirements are found in subtitle B of Title XII of the Food Security Act of 1985. 16 U.S.C. § 3811 (2006).

267 The wetland protection requirements are found in Title XII of the Food Security Act of 1985. 16 U.S.C. § 3821 (2006).

268 A limited number of exceptions allow the planting of the prohibited crops, however direct payments and countercyclical payments are reduced by an acre for each acre planted with a prohibited

uses; and to control noxious weeds and follow sound agricultural practices.[269]

The combination of the various subsidy programs for large-scale commodity production, in essence, incentivizes practices that cause some of the major crises facing society today—dependence on foreign oil, climate change, environmental degradation, water shortages, obesity, and diabetes.

3. Conservation Subsidy Programs

In addition to the commodity production related financial incentives provided in the 2008 Farm Bill, the Bill provides a number of incentive programs designed to conserve natural resources.[270] Some of these programs date back to the 1985 Farm Bill, and some are more recent developments. These programs include voluntary working lands programs**,** voluntary land retirement or set asides**,** voluntary farmland protection programs, and mandatory conservation requirements linked to accepting other subsidies.[271] In contrast to the early Farm Bills, acreage set aside programs in recent Farm Bills are designed primarily to achieve certain conservation objectives.

One of the largest conservation programs in the Farm Bill is the Conservation Reserve Program ("CRP"), which appeared for the first time in the 1985 Food Security Act.[272] The CRP is a voluntary land retirement program that offers annual payments and cost sharing assistance to participants that establish long-term resource-conserving plant cover on environmentally sensitive land.[273] Pursuant to the CRP, the federal government enters into contracts with farmers to retire lands from farming that are highly erodible or environmentally sensitive.[274] Participants must then establish long-term

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crop. *See* FARM SERVICE AGENCY, U.S. DEP'T OF AGRIC., FSA HANDBOOK: DIRECT AND COUNTER-CYCLICAL PROGRAM AND AVERAGE CROP REVENUE ELECTION FOR 2009 AND SUBSEQUENT CROP YEARS 7-28, 8-1 (2009), http://www.fsa.usda.gov/Internet/FSA_File/1-dcp_r03_a03.pdf.

269 *Id.* at 7-26.

270 For a detailed summary of the conservation provisions in the 2008 Farm Bill, see Economic Research Service, U.S. Dep't of Agriculture, 2008 Farm Bill Side-By-Side, Title II: Conservation, http://www.ers.usda.gov/FarmBill/2008/Titles/TitleIIConservation.htm (last visited Mar. 8, 2010).

271 16 U.S.C. §§ 3831-35a (2006 & Supp. 2009); *see also* Erin Morrow, *Agri-Environmentalism: A Farm Bill for 2007*, 38 TEX. TECH L. REV. 345, 392 (2006) (arguing that U.S. farm policy should strive to protect the environment and that such a policy is feasible).

272 ECONOMIC RESEARCH SERVICE, U.S. DEP'T OF AGRIC., THE CONSERVATION RESERVE PROGRAM: ECONOMIC IMPLICATIONS FOR RURAL AMERICA 1 (2004), http://www.ers.usda.gov/publications/aer834/aer834.pdf.

273 *Id.*

274 The environmental goals of the CRP include protection of topsoil from erosion, reduction of water runoff and sedimentation, protection of groundwater and improvement of water quality, and conservation of wildlife habitat. The CRP is the largest conservation incentive program ever in terms of acres enrolled. The 2002 Farm Bill expanded acreage to 39.2 million acres from 36.4 million acres.

resource-conserving plant cover on environmentally sensitive land. As of October 2007, 34.6 million acres of former farmland have been enrolled in the CRP.[275] The 2008 Farm Bill caps CRP enrollment at 32 million acres, approximately 7.2 million acres lower than the previous cap.[276] Over the past four years, the USDA has paid out an average of more than $1.5 billion annually for CRP contracts and other obligations.[277]

The other large conservation program is the Wetlands Reserve Program ("WRP"), which is a voluntary program to help owners of eligible lands restore and protect wetlands.[278] The program provides cost sharing and/or long-term or permanent easements for restoration of wetlands on agricultural land. Landowners have three enrollment options.[279] Under the first option, participants grant a perpetual conservation easement on enrolled acreage. In exchange, they may receive 100 percent of the easement value and up to 100 percent of restoration costs. Under the second option, participants grant a thirty-year easement on enrolled acres and may receive 75 percent of the easement value and up to 75 percent of restoration costs. The third option does not involve the granting of a conservation easement. Instead, a participant who agrees to restore or enhance wetland functions enters into a cost-share agreement with the federal government. More than two million acres of wetlands have been enrolled in the WRP[280] at a cost of more than $227 million.[281] The 2008 Farm Bill increases the WRP enrollment cap from the previous 2.275 million acres to 3.014 million acres.[282]

In addition to the CRP and WRP, a number of additional conservation programs have been added to various Farm Bills over the past twenty years. Unlike the CRP and WRP, some of these programs are "working land" programs, providing incentives for farmers who voluntarily choose to employ specified conservation practices in their farming operations. The Environmental Quality Incentives Program ("EQIP") is a voluntary program for

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Annual program expenditures average $1.3 billion per year. ECONOMIC RESEARCH SERVICE, U.S. DEP'T OF AGRIC., BALANCING THE MULTIPLE OBJECTIVES OF CONSERVATION PROGRAMS 41 (2006), http://www.ers.usda.gov/publications/ERR19/ERR19fm.pdf.

275 Nathaniel Kale, A Brief Economic Survey of the USDA Conservation Reserve Program 5 (April 2009) (unpublished professional paper, University of Minnesota), https://conservancy.umn.edu/bitstream/49111/1/Kale,Nathaniel.pdf.

276 CRS, THE 2008 FARM BILL, *supra* note 264, at 17.

277 Kale, *supra* note 275, at 7-8.

278 16 U.S.C. §§ 3837-3837f (2006 & Supp. 2009).

279 16 U.S.C. § 3837(b)(2).

280 Natural Resources Conservation Service, U.S. Dep't of Agric., 2008 WRP Cumulative Contract Information, http://www.nrcs.usda.gov/programs/wrp/2008_ContractInfo/CumulativeContractInfo2008.html (click "Cumulative Acres Enrolled as of 2008") (last visited Mar. 8, 2010).

281 Natural Resources Conservation Service, U.S. Dep't of Agric., Wetlands Reserve Program FY 2007 Financial and Technical Assistance Dollars to States, http://www.nrcs.usda.gov/programs//2007_allocations/07WRPAlloc.pdf (last visited Mar. 8, 2010).

282 CRS, THE 2008 FARM BILL, *supra* note 264, at 17.

agricultural producers and forestry managers that enter contracts from one to ten years in length.[283] The program provides technical and financial assistance and cost sharing for conservation and environmental improvements on land used for agricultural production.[284] The Agricultural Water Enhancement Program provides payments to producers that enter contracts to carry out agricultural water enhancement activities.[285] The purpose of the program is to promote ground and surfacewater conservation and improve water quality on agricultural lands.[286] The Conservation Stewardship Program provides payments to producers for adopting, installing, or maintaining conservation activities.[287] Payments are based on the income foregone by the producer or the expected environmental gain.[288] Participation is limited to producers who have addressed at least one resource concern at the time of application and who agree to address at least one more priority resource concern by the end of the contract.[289]

The Agricultural Management Assistance Program is a voluntary program that provides cost-share and incentive payments to agricultural producers that address water management, water quality, and erosion control issues by using conservation measures in farming operations.[290] Conservation measures agricultural producers may use include: construction of water management structures or irrigation structures, planting of trees for windbreaks or to improve water quality, production diversification, and conservation practices (e.g., soil erosion control, integrated pest management, or transition to organic farming).[291] This program is only available in Connecticut, Delaware, Hawaii, Maine, Maryland, Massachusetts, Nevada, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Utah, Vermont, West Virginia, and Wyoming.[292] The program is limited to those sixteen states because participation in the Federal Crop Insurance Program is low.[293] Finally, the Emergency Conservation Program provides assistance to farmers whose farmland is damaged by natural disasters.[294]

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283 Environmental Quality Incentives Program, 16 U.S.C. § 3839aa (2006). For the contract term, see 16 U.S.C. § 3839aa-2(b)(2).

284 16 U.S.C. § 3839aa.

285 16 U.S.C. § 3839aa-9.

286 *Id.*

287 16 U.S.C. §§ 3838d, 3838e. The Program was repealed in 1996, but the 2008 Farm Bill reenacted the Program. *See* Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-246, § 2301, 122 Stat. 923, 1768 (2008) (codified at 16 U.S.C. §§ 3838d-3838g).

288 16 U.S.C. § 3838f(d).

289 *Id.* § 3838f(a).

290 7 U.S.C. § 1524(b) (2006).

291 *Id.* § 1524(b)(2).

292 *Id.* § 1524(b)(1).

293 *Id.*

294 16 U.S.C. §§ 2201-05 (2006).

Additional conservation programs are geared toward conservation of specific types of lands or habitats. The Wildlife Habitat Incentives Program provides cost sharing and technical assistance to landowners and producers that develop and improve wildlife habitat.[295] The Conservation of Private Grazing Lands provides technical and educational assistance for conservation and enhancement of private grazing lands.[296] The Farmland Protection Program provides financial assistance for the purchase of easements by state, tribal or local governments, and nonprofit organizations in order to maintain the agricultural production and use of land.[297] The Grassland Reserve Program provides assistance for restoring grassland and conserving virgin grasslands with easements or long-term rental agreements.[298] Livestock grazing and hay production are still allowed.[299] Finally, the Cooperative Conservation Partnership Initiative directs the federal government to work with state and local governments, Indian tribes, producer associations, farmer cooperatives, institutions of higher education, and nongovernmental organizations with a history of addressing conservation issues to provide technical and financial assistance to producers in all the conservation programs except: (1) the Conservation Reserve Program; (2) the Wetlands Reserve Program; (3) the Farmland Protection Program; or (4) the Grassland Reserve Program.[300]

Although these programs encourage certain conservation practices, they do not address the overarching environmental concerns associated with industrial commodity production—the unsustainability due to high energy (i.e., fossil fuel) inputs, the widespread environmental harms caused by chemical outputs (i.e., fertilizer and pesticides), and the loss of biodiversity and ecological integrity due to large-scale monoculture production**.** The largest programs, the CRP and WRP, are land set aside programs and thus do not address in any way the manner in which farming is carried out. Moreover, all of the programs are voluntary with strict limits on the types and amounts of lands that can be enrolled and on the types of practices that qualify for the subsidies. Moreover, the amount of money devoted to these conservation programs pales in comparison to the money expended on commodity subsidy programs described above. For example, approximately $1.5 billion per year is spent on the CRP as compared to the $20 billion per year spent on the commodity subsidy programs.[301]

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295 16 U.S.C. § 3839bb-1 (2006).

296 16 U.S.C. § 3839bb (2006).

297 16 U.S.C. § 3838i (2006).

298 16 U.S.C. § 3838n (2006).

299 16 U.S.C. § 3838o(d)(1) (2006).

300 16 U.S.C. § 3843 (2006).

301 *See supra* notes 22-29, 277 and accompanying text. The Congressional Budget Office estimates new spending on the combined conservation programs in the 2008 Farm Bill to total $4 billion over the next ten years. JOHNSON, WHAT IS THE "FARM BILL"?, *supra* note 33, at 2. When this new spending is

4. Biofuel Programs

> Abusing our precious croplands to grow an energy-inefficient process that yields low-grade automobile fuel amounts to unsustainable, subsidized food burning.[302]

With the intense focus on both climate change and the desire for domestic energy independence in recent years, scientists and policymakers have searched for alternative energy sources that could be produced domestically and that would not contribute to climate change to the extent that fossil fuels do. One of the major alternative energy supplies that has been heavily subsidized by the federal government is corn ethanol.[303] Corn ethanol production has increased from approximately 175 million gallons in the early 1980s to almost 6.5 billion gallons in 2007.[304] In 2008-2009, 34 percent of all U.S. corn production was used for ethanol production, up from 20 percent just two years prior.[305] Often touted as a "renewable" or "alternative" energy,[306] the use of ethanol as a major source of fuel is not without controversy.[307] The rapid acceleration in corn ethanol production is at least in part attributable to the heavy subsidies that have been provided since the 1970s.[308] With the recent focus on finding alternative sources of energy, corn ethanol subsidy programs have proliferated. Both the Energy Policy

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added to existing conservation spending mandates, the estimated conservation-related spending is estimated at $54.7 billion over the next ten years, or approximately $5 billion per year. *Id.*

302 Gary D. Libecap, *Agricultural Programs with Dubious Environmental Benefits: The Political Economy of Ethanol*, *in* AGRICULTURAL POLICY AND THE ENVIRONMENT, *supra* note 76, at 89, 89 (quoting David Pimentel).

303 *See id.* (explaining that ethanol has received over $10 billion in subsidies).

304 James A. Duffield, Irene M. Xiarchos & Steve A. Halbrook, *Ethanol Policy: Past, Present, and Future*, 53 S.D. L. REV. 425, 425 (2008); *see also* Karl R. Rabago, *A Review of Barriers to Biofuel Market Development in the United States*, 2 ENVTL. & ENERGY L. & POL'Y J. 211, 212 (2008) (describing the remaining barriers to full commercial success for biofuels in the United States).

Corn is not the only plant, or even the only vegetable, that can be used to make ethanol. Jose C. Escobar et al., *Biofuels: Environment, Technology and Food Security*, 13 RENEWABLE & SUSTAINABLE ENERGY REVIEWS 1275, 1278 (2008). However, corn is the major ethanol raw material in the United States. *Id.* at 1280. Other countries, such as Brazil, produce large quantities of ethanol from other plants, such as sugar and palm. *See id.* at 1284.

305 Cattlenetwork.com, Percentage of Corn Crop Used for Ethanol, http://www.cattlenetwork.com/Percentage-Of-Corn-Crop-Used-For-Ethanol/2008-06-20/Article.aspx?oid=595584 (last visited Mar. 8, 2010).

306 *See, e.g.*, Growth Energy, About Growth Energy, http://www.growthenergy.org/2009/about/index.asp (last visited Mar. 8, 2010).

307 *See, e.g.*, Christopher Jensen, *Caution Flags Raised Over Ethanol Industry's 15% Solution*, N.Y. TIMES, May 10, 2009, at AU; *see also infra* Part III.C.

308 *See* Wallace E. Tyner, *The U.S. Ethanol and Biofuels Boom: Its Origins, Current Status, and Future Prospects*, 58 BIOSCIENCE 646, 646 (2008); *see also* Robert W. Hahn, *Ethanol: Law, Economics, and Politics*, 19 STAN. L. & POL'Y REV. 434, 437-45 (2008) (describing how federal subsidies have driven the development of the ethanol fuel industry in the United States); Libecap, *supra* note 302, at 89.

Act of 2005 and the Energy Independence and Security Act of 2007 created additional incentives for ethanol development.[309]

The Food, Conservation, and Energy Act of 2008 contains a number of provisions that provide support for and regulation of renewable energy development in the United States. Located mostly within Title IX of the 2008 Farm Bill, the provisions on renewable energy range from regulatory measures to subsidization.[310] In some instances, significant additions were made to the previous Farm Bill; in others, existing provisions are simply renewed.[311] Although some of the programs target more efficient and sustainable forms of renewable energies, such as cellulosic biofuels, most of the programs would provide financial and other incentives for the development of corn ethanol. Many of the programs apply generally to "biofuels" or "biobased products," and thus include corn-based biofuels.[312] The number and range of programs addressing biobased fuels is impressive. Unfortunately, most of these programs do not distinguish between alternative energy sources that provide a net energy benefit and those, such as corn ethanol, that take more fossil fuel to make than they provide.

A survey of the biofuel related programs in the 2008 Farm Bill includes the following programs that apply to corn-based biofuels.[313] The Biobased Markets Program, section 9002,[314] establishes a label—"USDA Certified Biobased Product"—available to producers of biobased products. A process for qualification of products is also established. The Program

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309 Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594 (2005); Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492 (2007). *See also* MARK HOLT & CAROL GLOVER, CONG. RESEARCH SERV., ENERGY POLICY ACT OF 2005: SUMMARY AND ANALYSIS OF ENACTED PROVISIONS 100 (2006), *available at* http://lugar.senate.gov/energy/links/pdf/Energy_Policy_Act.pdf; FRED SISSINE, CONG. RESEARCH SERV., ENERGY INDEPENDENCE AND SECURITY ACT OF 2007: A SUMMARY OF MAJOR PROVISIONS 6 (2007), *available at* http://energy.senate.gov/public/_files/RL342941.pdf.

310 U.S. Dep't of Agric., Factsheet: 2008 Farm Bill Renewable Energy Provisions, http://www.usda.gov/documents/FB08_Pub_Mtg_Renew_Energy_Factsheet.pdf (last visited Mar. 8, 2010).

311 Economic Research Service, U.S. Dep't of Agric., 2008 Farm Bill Side-by-Side, Title IX: Energy, http://www.ers.usda.gov/FarmBill/2008/Titles/TitleIXEnergy.htm (last visited Mar. 8, 2010) [hereinafter Title IX: Energy].

312 In addition to the 2008 Farm Bill provisions, substantial incentives for biofuels were included in the Energy Policy Act of 2005. S. Kent Hoekman, *Biofuels in the U.S.—Challenges and Opportunities*, 34 RENEWABLE ENERGY 14, 14 (2009).

313 For a comparison of the 2008 Farm Bill with the prior law, see Title IX: Energy, *supra* note 311. For a detailed summary of federal biofuel incentives, see BRENT D. YACOBUCCI, CONG. RESEARCH SERV., BIOFUELS INCENTIVES: A SUMMARY OF FEDERAL PROGRAMS (2006), *available at* http://lugar.senate.gov/energy/links/pdf/Biofuels_Incentives.pdf; BRENT D. YACOBUCCI & RANDY SCHNEPF, CONG. RESEARCH SERV., BIOFUELS IN THE 2007 ENERGY AND FARM BILLS: A SIDE-BY-SIDE COMPARISON (2007), *available at* http://sharp.sefora.org/wp-content/uploads/2007/11/rl34239.pdf; TOM CAPEHART, CONG. RESEARCH SERV., RENEWABLE ENERGY POLICY IN THE 2008 FARM BILL (2008), *available at* http://www.tcfa.org/RenewableEnergyPolicy-2008FarmBill.pdf.

314 7 U.S.C. § 8102 (Supp. II 2008).

also establishes a preference for biobased products in federal procurement and sets forth guidelines for intermediate ingredients and feedstocks for such procurement. The Biorefinery Assistance Program, section 9003,[315] provides grants on a competitive basis to eligible entities for development, construction, and retrofitting of demonstration-scale biorefineries. It also guarantees loans of up to 80 percent of the cost of development and construction of a biorefinery. The Repowering Assistance Program, section 9004,[316] provides payments to biorefineries in existence to replace fossil-fuels systems and install new systems that use renewable biomass. The Bioenergy Program for Advanced Biofuels, section 9005,[317] provides payments to eligible producers of advanced biofuels. Payment is based on quantity and duration of production and net nonrenewable energy content of the advanced biofuel. The Biodiesel Fuel Education Program, section 9006,[318] provides competitive grants to eligible entities to educate governmental and private entities that operate vehicle fleets and the public about the benefits of biodiesel fuel use. The Rural Energy for America Program, section 9007,[319] provides grants and financial assistance to agricultural producers and rural small businesses for energy audits, energy development assistance, energy efficiency improvements, and renewable energy systems. It also provides competitive grants to eligible entities that help agricultural producers and rural small businesses become more energy efficient and use renewable energy technologies and resources. The Program provides loan guarantees for up to 75 percent of the cost of purchasing renewable energy systems and making energy efficiency improvements. The Biomass Research and Development Initiative[320] requires the Secretaries of Agriculture and Energy to coordinate promotion and development policies and procedures for biofuels and biobased products. It provides competitive grants, contracts, and financial assistance to eligible entities to research, develop, and demonstrate biofuels and biobased products, and the methods, practices, and technologies used to produce the biofuels and biobased products.

For the first time, the 2008 Farm Bill has included a number of key provisions intended to accelerate the development of cellulosic biofuels.[321] In addition, the 2008 Farm Bill includes several renewable energy programs, which do not appear to apply to corn-based fuels. The Rural Energy Self-Sufficiency Initiative[322] provides financial assistance to eligible rural

315 7 U.S.C. § 8103 (Supp. II 2008).

316 7 U.S.C. § 8104 (Supp. II 2008).

317 7 U.S.C. § 8105 (Supp. II 2008).

318 7 U.S.C. § 8106 (Supp. II 2008).

319 7 U.S.C. § 8107 (Supp. II 2008).

320 7 U.S.C. § 8108 (Supp. II 2008).

321 *See Implications of the U.S. Farm Bill for Cellulosic Ethanol Development*, 4 INDUS. BIOTECHNOLOGY 131, 131-32 (2008) (discussing the cellulosic biofuel provisions of the 2008 Farm Bill).

322 7 U.S.C. § 8109 (Supp. II 2008).

communities to increase energy self-sufficiency. It provides grants to eligible rural communities to conduct energy assessments, and formulate and analyze ideas for reducing energy usage. The Feedstock Flexibility Program for Bioenergy Producers[323] requires the Secretary of Agriculture to purchase raw or refined sugar or in-process sugar that would otherwise be forfeited to the CCC from eligible entities and sell it to bioenergy producers to use in the production of bioenergy. The Biomass Crop Assistance Program ("BCAP")[324] provides financial assistance to producers of eligible crops in a designated BCAP project area to establish and produce eligible crops, and to collect, harvest, store, and transport eligible material for use in a biomass conversion facility. The term "eligible crop" includes renewable biomass, but excludes crops eligible to receive payments under Title I of the 2008 Farm Bill and invasive or noxious plants.[325] The Forest Biomass for Energy, section 12,[326] authorizes a competitive research and development program to encourage use of forest biomass for energy. The Community Wood Energy Program, section 13,[327] provides grants to state and local governments of up to $50,000 to assess available feedstocks necessary to supply a community wood energy system and the long-term feasibility of supplying and operating a community wood energy system. It provides competitive grants to state and local governments to acquire or upgrade community wood energy systems. The Sun Grant Program[328] provides grants to six sun grant centers (North-Central Center, Southeastern Center, South-Central Center, Western Center, Northeastern Center, and Western Insular Pacific Sub-center) to: enhance national energy security through development, distribution, and implementation of biobased energy technologies; promote diversification and environmental sustainability of agricultural production in the U.S. using biobased energy and product technologies; promote economic diversification in rural areas of the U.S. using biobased energy and product technologies; and improve coordination and collaboration of the Departments of Agriculture and Energy and colleges and universities to enhance efficiency of bioenergy and biomass research and development programs. The Cellulosic Biofuel Producer Credit[329] provides a tax credit of up to $1.01 to any taxpayer for each gallon of qualified cellulosic biofuel production. The Modification of Alcohol Credits Program[330] reduces tax credit after annual production or importation of ethanol reaches 7.5 billion gallons.

323 7 U.S.C. § 8110 (Supp. II 2008).
324 7 U.S.C. § 8111 (Supp. II 2008).
325 *Id.*
326 7 U.S.C. § 8112 (Supp. II 2008).
327 7 U.S.C. § 8113 (Supp. II 2008).
328 7 U.S.C. § 8114 (Supp. II 2008).
329 26 U.S.C. § 40(b)(6) (2006).
330 *Id*.

Cellulosic biofuels appear to be preferable to corn-based biofuels in that they do not require intense fossil-fuel and water inputs.[331] Thus, the shift to subsidy programs to encourage the development of cellulosic biofuels is a good one. Nevertheless, there are still many uncertainties over the potential impacts of cellulosic biofuels and thus, they should be pursued with caution and not perceived as a panacea. The concerns associated with planting large areas of plants for cellulosic biofuels depend in large part on what land uses or crop plants they are replacing. If cellulosic plants replace fields currently occupied by industrial commodity crops, the environmental and energy benefit will be significant. However, if the same acreage of industrialized commodity crops continue to be grown and additional natural lands are converted to grow cellulosic biofuel crops, there will be additional environmental harms that must be taken into consideration.

C. *Perverse Incentives and a Distorted Market*

Nowhere else does U.S. government policy create as perverse incentives as with our current system of agricultural subsidies.[332] Programs that

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331 Berk Akinci et al., *The Role of Bio-fuels in Satisfying US Transportation Fuel Demands*, 36 ENERGY POL'Y 3485, 3488 (2008). For further reading on the benefits of biomass and cellulosic biofuels, see generally Dennis R. Becker et al., *Assessing the Role of Federal Community Assistance Programs to Develop Biomass Utilization Capacity in the Western United States*, 11 FOREST POL'Y & ECON. 141 (2009); R.H.V. Corley, *How Much Palm Oil Do We Need*? 12 ENVTL. SCI. & POL'Y 134 (2009); L. Leon Geyer et al., *Ethanol, Biomass, Biofuels and Energy: A Profile and Overview*, 12 DRAKE J. AGRIC. L. 61 (2007); Jose Goldemberg & Patricia Guardabassi, *Are Biofuels a Feasible Option?*, 37 ENERGY POL'Y 10 (2009); Robert R. Harmon & Kelly R. Cowan, *A Multiple Perspectives View of the Market Case for Green Energy*, 76 TECH. FORECASTING & SOC. CHANGE 204 (2009); Mark Murphey Henry et al., *A Call to Farms: Diversify the Fuel Supply*, 53 S.D. L. REV. 515 (2008); Timo Kaphengst et al., *At a Tipping Point? How the Debate on Biofuel Standards Sparks Innovative Ideas for the General Future of Standardisation and Certification Schemes*, 17 J. CLEANER PRODUCTION S99 (2009); Lian Pin Koh & Jaboury Ghazoul, *Biofuels, Biodiversity, and People: Understanding the Conflicts and Finding Opportunities*, 141 BIOLOGICAL CONSERVATION 2450 (2008); Li Lu et al., *The Role of Marginal Agricultural Land-Based Mulberry Planting in Biomass Energy Production*, 34 RENEWABLE ENERGY 1789 (2009); David Nicholls et al., *International Bioenergy Synthesis—Lessons Learned and Opportunities for the Western United States*, 257 FOREST ECOLOGY & MGMT. 1647 (2009); Rudolf M. Smaling, *Environmental Barriers to Widespread Implementation of Biofuels*, 2 ENVTL. & ENERGY L. & POL'Y J. 287 (2008); Gail Taylor, *Biofuels and the Biorefinery Concept*, 36 ENERGY POL'Y 4406 (2008); Tobias Wiesenthal et al., *Biofuel Support Policies in Europe: Lessons Learnt for the Long Way Ahead*, 13 RENEWABLE & SUSTAINABLE ENERGY REVIEWS 789 (2009).

332 *See generally* Boardman, Poesen & Evans, *supra* note 89, at 3-5 (discussing the impacts and costs of policy on land use and erosion); Jodi Soyars Windham, *Putting Your Money Where Your Mouth Is: Perverse Food Subsidies, Social Responsibility & America's 2007 Farm Bill*, 31 ENVIRONS ENVTL. L. & POL'Y J. 1, 3-5 (2007) (discussing how the 2007 Farm Bill reduces incentives for corporations to be socially responsible); Christopher B. Connard, Comment, *Sustaining Agriculture: An Examination of Current Legislation Promoting Sustainable Agriculture as an Alternative to Conventional Farming Practices*, 13 PENN ST. ENVTL. L. REV. 125, 141-43 (2004) (noting the perverse incentives and arguing

began in the 1930s to address "emergencies" created by the Great Depression, and which were intended to be temporary, have not only persisted but have thrived and expanded. Much of current agricultural policy has not evolved to keep up with the dramatic global changes that have occurred since the 1930s and thus does not fulfill current societal goals. While the original commodity subsidy programs from the 1930s may have addressed the imminent need to stabilize farm prices and prevent a total collapse of the U.S. agricultural system, these programs have distorted the market by providing perverse incentives that are in many cases antithetical to today's concerns regarding climate change, energy independence, and environmental degradation. Moreover, changes to the policies in the Farm Bills enacted over the past seventy years have served to further distort the market to exacerbate current concerns.

Subsidies for corn ethanol production only exacerbate the problems associated with subsidizing corn production in the first place. Reliance on biofuels, including corn ethanol, is projected to grow dramatically in the twenty-first century.[333] Proponents point to economic stimulation and job creation, bolstering of domestic corn prices, energy security and independence, and reduction of harmful pollutants as proof that ethanol's role in the nation's energy portfolio should continue to grow.[334] Critics, however, note that the use of corn for ethanol drives up world food prices and agricultural land use.[335] Opponents also point to the inputs of ethanol—including fossil fuels, fertilizers, and pesticides—as being environmentally costly.[336] Others argue that the current focus on biofuels, especially corn ethanol, could inhibit the development of other alternative technologies that could better address the problems associated with dependence on fossil fuels.[337]

Proponents of ethanol argue that corn is a renewable source of energy that avoids the negative costs of nonrenewable sources, namely fossil fuels.[338] Opponents argue, however, that the amount of energy needed to pro-

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that a broader and clearer definition of sustainable agriculture would make the legislation more effective).

333 Ayhan Demirbas, *Biofuels Sources, Biofuel Policy, Biofuel Economy and Global Biofuel Projections*, 49 ENERGY CONVERSION & MGMT. 2106, 2114 (2008).

334 *See* American Coalition for Ethanol, Ethanol 101, http://www.ethanol.org/index.php?id=34&parentid=8 (last visited Mar. 8, 2010).

335 Duffield, Xiarchos & Halbrook, *supra* note 304, at 425.

336 Boardman, Poesen & Evans, *supra* note 89, at 4-5; Pål Börjesson, *Good or Bad Bioethanol from a Greenhouse Perspective—What Determines This?*, 86 APPLIED ENERGY 589, 589-91 (2009).

337 *See* Börjesson, *supra* note 336, at 593; Michael B. Charles et al., *Public Policy and Biofuels: The Way Forward?*, 35 ENERGY POL'Y 5737, 5737-38 (2007); Peter Z. Grossman, *If Ethanol is the Answer, What is the Question?*, 13 DRAKE J. AGRIC. L. 149, 176-77 (2008); Seungdo Kim & Bruce E. Dale, *Life Cycle Assessment of Various Cropping Systems Utilized for Producing Biofuels: Bioethanol and Biodiesel*, 29 BIOMASS & BIOENERGY 426, 438 (2005); Sunderasan Srinivasan, *The Food v. Fuel Debate: A Nuanced View of Incentive Structures*, 34 RENEWABLE ENERGY 950, 950 (2009).

338 *See* American Coalition for Ethanol, Ethanol 101, *supra* note 334.

duce ethanol requires great amounts of fossil fuels, ultimately resulting in a net loss of energy.[339] Specifically, their argument posits that the amount of "non-renewable energy required to grow and convert corn into ethanol is greater than the energy value present in the ethanol fuel."[340]

Research into the energy efficiency of ethanol production varies widely. A 2002 report by the USDA reviewed several studies which measured the net energy value ("NEV") of ethanol.[341] On one extreme, one report measured that for every gallon of ethanol produced, 30,589 Btu was gained, meaning that energy output exceeded input.[342] Similarly, the authors of the report conducted their own study and reported a net energy positive return of 34 percent.[343] On the other extreme, one study found that for every gallon of ethanol produced, 33,562 Btu was lost, meaning that energy input greatly exceeded energy output.[344] The USDA report attributed this discrepancy in findings to differences in "assumptions about corn yields, ethanol conversion technologies, fertilizer manufacturing efficiency, fertilizer application rates, coproduct evaluation, and the number of energy inputs included in the calculations."[345]

A more recent study by David Pimentel—the author of the study cited above that measured a net loss of energy—and Tad Patzek found that the production of a liter of ethanol requires 29 percent more energy in fossil fuels than that which is produced as ethanol.[346] Specifically, "fossil fuels expended for corn production and later in the ethanol plants amount to expenditures of 6,597 kcal of fossil energy per 1,000 [liters] of ethanol produced."[347] The authors argue that studies which find a net energy gain in ethanol production, such as those in the USDA report cited above, often are incomplete because they omit some of the energy inputs in the ethanol production system.[348] Those inputs include labor, machinery, diesel, gasoline, nitrogen, phosphorus, potassium, lime, seeds, irrigation, herbicides, insecti-

339 *Ethanol and Biodiesel from Crops Not Worth the Energy*, SCIENCE DAILY, July 6, 2005, http://www.sciencedaily.com/releases/2005/07/050705231841.htm (citing Pimentel & Patzek, *supra* note 21); *see also* Hahn, *supra* note 308, at 467-68.

340 HOSEIN SHAPOURI, JAMES A. DUFFIELD & MICHAEL WANG, U.S. DEP'T OF AGRIC., THE ENERGY BALANCE OF CORN ETHANOL: AN UPDATE 1 (2002), http://www.transportation.anl.gov/pdfs/AF/265.pdf.

341 *Id.* at 2.

342 *Id.* (based on the paper by David Lorenz & David Morris, Institute for Local Self-Reliance, *How Much Energy Does it Take to Make a Gallon of Ethanol?* (1995), http://www.carbohydrateeconomy.org/library/admin/uploadedfiles/How_Much_Energy_Does_it_Take_to_Make_a_Gallon_.html).

343 *Id.* at 12.

344 *Id.* at 2.

345 *Id.* at 3.

346 Pimentel & Patzek, *supra* note 21, at 66.

347 *Id.* at 69.

348 *Id.*

cides, electricity, and transport.[349] Of these, the largest energy inputs are for "the corn feedstock, the steam energy, and electricity used in the fermentation/distillation process."[350] Among the inputs omitted by the aforementioned studies which find a net energy gain in ethanol production is the energy required to produce and repair farm machinery and the fermentation-distillation equipment.[351] Another shortcoming of those studies is that they only use data from a few states (as few as nine), while the Pimentel and Patzek study used data from all fifty states.[352]

In addition to its unsustainable use of nonrenewable energy, ethanol production has other environmental costs. Specifically, U.S. corn production causes more total soil erosion, uses more herbicides and insecticides, and uses more nitrogen fertilizer than any other U.S. crop, thus causing more water pollution than any other crop.[353] Ethanol production also consumes large amounts of water. Currently, in Iowa, the nation's largest producer of corn ethanol, ethanol producers account for 7 percent of the state's total water consumption, an amount expected to double by 2012.[354]

Another environmental impact of ethanol concerns the amount of land needed to produce it. More corn production amounts to more agricultural land use. One potential impact of growing more corn for ethanol concerns the effect of vast monocultures of corn on naturally occurring plant species; specifically, less genetic diversity could result from genetic drift.[355] Also, increased use of corn for energy could displace natural land cover, leading to "a loss of ecosystem functions and reduced biodiversity."[356] A report by the Organisation for Economic Co-operation and Development ("OECD") in 2005 "suggested that replacing 10 percent of America's motor fuel with biofuels would require about a third of the total cropland devoted to cereals, oilseeds and sugar crops."[357]

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349 *Id*. at 66-69.

350 *Id*. at 67.

351 *Id*. at 69.

352 Pimentel & Patzek, *supra* note 21, at 69.

353 *Id*. at 68-69.

354 Girard P. Miller, *Developers See Green and Neighbors See Red: A Survey of Incentives and Mandates for the Development of Alternative Energy and the Unfolding Challenges*, 3 TEX. J. OIL GAS & ENERGY L. 117, 147 (2008).

355 Vincent Barbera, Comment, *Tomorrow Today? Cellulosic Ethanol: How It's Done, Who's Getting It Done, and Its Environmental Impact*, 20 VILL. ENVTL. L.J. 27, 40-41 (2009).

356 *Id*. at 41 (quoting JIM COOK & JAN BEYEA, NAT'L AUDUBON SOC'Y, AN ANALYSIS OF THE ENVIRONMENTAL IMPACTS OF ENERGY CROPS IN THE USA: METHODOLOGIES, CONCLUSIONS AND RECOMMENDATIONS (1998), http://www.panix.com/~jimcook/data/ec-workshop.html).

357 Editorial, *The High Costs of Ethanol*, N.Y. TIMES, Sept. 19, 2007, at A24 (citing a two year-old OECD report).

IV. NEW DIRECTIONS

Over the past few decades, scientists, policymakers, farmer organizations, environmentalists, and others have called for new sustainable agricultural approaches to replace industrialized agriculture. What is commonly referred to as "sustainable agriculture," generally is focused on obtaining and maintaining three main objectives: environmental health, economic profitability, and social and economic equity.[358] The Union of Concerned Scientists explains that

> sustainable agriculture views a farm as a kind of *ecosystem*—an "agroecosystem"—made up of elements like soil, plants, insects, and animals. These elements can be enriched and adjusted to solve problems and maximize yields. This integrated approach is both practical and scientific: it relies on modern knowledge about the interactions within natural systems, as well as cutting-edge technologies, to achieve its results. It is a powerful approach that can produce high yields and profits for farmers while protecting human health, animal health and the environment.[359]

Although defined and described in many ways, the underlying principle of sustainability is the desire to meet current needs of society while still preserving sufficient resources for future generations to meet their needs.[360]

The Union of Concerned Scientists identifies five key techniques of sustainable agriculture: crop rotation, cover crops, soil enrichment, natural pest predators, and biointensive integrated pest management.[361] Crop rotation describes the practice of growing different crops in the same field over a period of time.[362] The benefit of this practice is that it discourages the buildup of pests that can occur when one crop is continuously grown in the same location. Sustainable farming uses cover cropping (i.e., planting specific crops on fields between plantings of the primary crop so that fields do not remain bare), which has benefits including reducing soil erosion, reducing weed growth, and enhancing soil nutrients.[363] Rich healthy soil is critical to sustainable farming. Rather than allowing soils to be depleted and

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358 U.C. Sustainable Agriculture Research and Education Program, What is Sustainable Agriculture?, http://www.sarep.ucdavis.edu/concept.htm (last visited Mar. 8, 2010).

359 Union of Concerned Scientists, Sustainable Agriculture—A New Vision, http://www.ucsusa.org/food_and_agriculture/solutions/big_picture_solutions/sustainable-agriculture-a.html (last visited Mar. 8, 2010) [hereinafter Sustainable Agriculture]. For further descriptions of sustainable agriculture, see John H. Davidson, *Agriculture*, *in* STUMBLING TOWARD SUSTAINABILITY 347, 360-62 (John C. Dernbach ed., 2002).

360 Davidson, *supra* note 359, at 360; *see also* Union of Concerned Scientists, Sustainable Agriculture Techniques, http://www.ucsusa.org/food_and_agriculture/science_and_impacts/science/sustainable-agriculture.html (last visited Mar. 8, 2010) [hereinafter Sustainable Techniques].

361 Sustainable Techniques, *supra* note 360.

362 *Id.*; *see also* Boardman, Poesen & Evans, *supra* note 89, at 1-3 (discussing runoff and soil erosion associated with industrial agriculture).

363 Sustainable Techniques, *supra* note 360.

then relying on synthetic fertilizers, as is done in industrial agriculture, sustainable agriculture seeks to maintain and enhance soil richness by plowing under cover crops and using natural fertilizers, such as composted animal waste.[364] Soil richness is also maintained by abstaining from heavy use of pesticides, which kill the beneficial soil-inhabiting organisms necessary for healthy soils.[365] In lieu of synthetic pesticides, sustainable farming practices are geared toward maintaining a healthy ecosystem, which allows natural predators and parasites of crop pests to thrive and keep pest populations in check.[366] To the extent natural pest control is not adequate, integrated pest management practices, which employ a range of biological and cultural control practices, as well as limited targeted synthetic chemical pest control, is used.[367] To achieve a system of sustainable agriculture, it is necessary to develop regulatory and incentive-based tools that require or promote these practices. The challenge we face is how to revise current policies to meet the goal of ensuring and affording a healthful food supply while moving toward an agricultural system that is environmentally, economically, and socially sustainable.

A. *Proposals for Regulatory Changes*

As described above in Part III, U.S. environmental law affords agriculture regulatory exemptions that are not available for most industrial or commercial operations. Eliminating or modifying these exemptions could help to reduce the environmental impacts of agriculture. For example, the elimination of exemption from CWA section 404 wetlands permits for normal agricultural activities, at least for large-scale farming operations, could protect many jurisdictional wetlands that are currently allowed to be plowed with impunity. Moreover, without the exemption for those wetlands that are impacted, mitigation would be required to offset the functions impacted by the agricultural activities, as is required for other types of activities that impact jurisdictional wetlands.

Another major change that could go a long way to reduce water pollution impacts from agriculture would be to impose stormwater treatment requirements on agricultural discharges that are currently not subject to CWA regulation because they are not defined as point sources. As described above, significant groundwater and surfacewater impacts are directly linked to agricultural activities. Although it may not be possible to impose the same "end-of-pipe" technologies that are typically imposed on traditional point source dischargers, appropriate technology-based standards

364 *Id.*
365 *Id.*
366 *Id.*
367 *Id.*

could be imposed on agricultural stormwater discharges. Many states have voluntary programs incorporating "Best Management Practices" ("BMP") that provide assistance and incentives for farmers who agree to build stormwater treatment ponds or employ other practices to reduce pollutant discharges from their operations. These types of BMPs could be imposed through a federal agricultural permitting program as technology-based "best available" technology. Alternatively, additional funding and technical assistance could be provided to encourage more farmers to implement BMPs. Another major tool available to reduce water pollution from farming operations is through the implementation of TMDLs. As described above, although the federal NPDES permitting system does not apply to nonpoint source agricultural discharges, TMDLs include both point source and nonpoint source discharges.[368] TMDLs are allocated to agricultural operations as well as to traditional point sources. Unfortunately, under the existing CWA there is no federal "regulatory hook" to impose TMDLs on nonpoint sources. Aside from the NPDES permitting program, TMDLs are implemented primarily by the states. Some states have developed approaches in essence to require farmers to comply with BMPs in order to demonstrate compliance with TMDL allocations. In Florida, for example, the Florida Watershed Restoration Act of 1997 establishes a "safe harbor" for agricultural operations that comply with specified BMPs designed to reduce water pollution.[369] If a farmer complies with the BMP, she is considered to be in compliance with TMDLs and Water Quality Standards and has a safe harbor from enforcement action.[370] If the CWA were to be amended to impose regulatory requirements on agricultural discharges, the Florida approach could be used as a model for implementation.

To address the environmental impacts from pesticide use, FIFRA should be amended.[371] As described above, one of the shortcomings of FIFRA is that it relies on cost-benefit analysis rather than more protective feasibility or risk-based standards. A more environmentally sustainable approach that would still allow the use of pesticides needed for agriculture and public health protection would be to revise the standard for registering pesticides under FIFRA to make clear that high-risk pesticides may only be registered if there are overriding public health, social, or economic benefits that justify registration. Such a revision would in effect force EPA to apply the standard originally contemplated by the Congress in enacting the 1972 FIFRA. Another important revision to FIFRA would be to require EPA to

368 33 U.S.C. § 1313(d) (2006); *see also* Pronsolino v. Nastri, 291 F.3d 1123, 1125-26 (9th Cir. 2002); *see supra* text accompanying notes 167-70.

369 FLA. STAT. § 403.067(7)(c) (2008).

370 *Id.*

371 For detailed discussions of the author's previous proposals for FIFRA reform, see Angelo, *Embracing Uncertainty*, *supra* note 63, at 181-202; Angelo, *The Killing Fields*, *supra* note 63, at 137-48.

consider benefits in its registration decisionmaking. For example, registration applicants should be required to demonstrate that the pesticide they are seeking to register is efficacious and will provide overriding benefits. As discussed above, currently FIFRA allows EPA to waive efficacy data and allows pesticides to be registered without a showing of necessity or a consideration of whether lower risk alternatives are available.[372] Consideration of the availability of lower risk alternatives should be required not only when deciding whether to cancel a registration, but also at the time of registration and reregistration. Another change necessary to ensure species protection is a reevaluation of pesticide registration data requirements to address more wildlife and ecological effects. FIFRA should also be amended to promote IPM and less risky pesticides. For example, section 11 of FIFRA should be amended to require that certified applicators receive training on lower risk alternatives to chemical pesticides, IPM, and other sustainable pest management approaches.[373] FIFRA should also be amended to make clear that lower risk and nonchemical pest management alternatives be considered when evaluating the benefits of a pesticide in both the registration process and the cancellation process.

Finally, the most significant change to FIFRA necessary to be more ecologically protective would be to amend the statute to create a mechanism for localized decisionmaking. Such decisionmaking can take into account geographic factors to protect wildlife, natural resources, and ecosystem services.[374] This could be carried out by a permitting system for large-scale releases of pesticides into the environment wherein permit conditions could be imposed to maximize protection of natural resources and ecosystem services. For example, such permit conditions could include buffers around habitat; buffers around waterbodies; buffers around nests; restric-

372 *See supra* text accompanying note 180-84.

373 *See supra* text accompanying notes 192-98.

374 Professor J.B. Ruhl has also noted that one of the most significant shortcomings of farm regulation is the lack of an adequate mechanism for regulating agro-chemical releases such as pesticide use. *See* Ruhl, *supra* note 63, at 337-38. Ruhl describes the regulatory schemes for various environmental laws, and the variety of exemptions and exceptions built into these statutes for agriculture. *Id.* at 293-316. As a result, Ruhl notes how the core pesticide statute, FIFRA "does little to regulate farm applications of pesticides and leaves fertilizers untouched." *Id.* at 309. FIFRA does not regulate the farm applying the pesticide, but simply how the pesticide itself is made or sold. *Id.* at 310. Contrasting this regulatory system with those found under the Clean Water Act and Clean Air Act, Ruhl argues that the system, with its lack of permits, performance standards, public reporting requirements, or pesticide monitoring system, lacks any comprehensive framework for the regulation of agricultural pesticide use. *Id.* at 311. Ruhl proposes a new statutory scheme, tailored to the specific features of the agricultural industry. *Id.* at 333-46. Among the proposals would be a requirement that farms provide a use report for chemical releases, akin to the Toxic Release Inventory, so as to create a national database. *Id.* at 337-38. Tied into the release report, Ruhl advocates a taxation system that would be begin at certain pre-set levels pursuant to the eco-toxicity of the chemical. *Id.* at 338-89. Ruhl stresses that these reforms alone are not sufficient in the absence of state regulatory vigilance and a continued vigorous federal role in the fight against air and water degradation. *Id.* at 347-48.

tions on spraying certain pesticides during certain times of years to avoid migration, breeding, or nesting; restrictions on spraying under certain weather conditions (e.g., high winds or heavy rain); and any other condition that would reduce the risk of harm to listed species or migratory birds.

Other scholars have made similar suggestions for regulatory reform to provide additional environmental protections from agriculture. For example, David Adelman and John Barton have suggested a number of revisions to existing environmental regulatory programs to ensure that agricultural impacts to the environment are regulated "to the same extent and with the same standards as other industrial operations."[375] J.B. Ruhl has set forth a mix of regulatory, information reporting, tax-based, and incentive-based changes that could help to alleviate many of the environmental harms resulting from agriculture.[376] Ruhl's regulatory proposals, while not dramatic, could result in significant improvements. Specifically, Ruhl argues in favor of eliminating certain agricultural exemptions from the NPDES program and using a traditional industrial regulatory approach for large agricultural operations.[377] Another component of Ruhl's proposal would be to adopt a "Farm Release Inventory," an approach similar to the Toxics Release Inventory ("TRI"), which would require farms to publicly report releases of agro-chemicals.[378] Experience with the TRI has shown that simply requiring industrial operations to report to the public the types and amount of toxic releases from industrial facilities results in significant reductions of toxic releases, in part because industry will voluntarily reduce its emissions to avoid being seen as the "bad neighbor" and in part because citizens often use the information to put political pressure on industry to find ways to reduce releases or substitute less toxic materials.[379] Ruhl also contends that tax-based and incentive-based approaches should be employed to encourage farmers to engage in more environmentally-friendly practices.[380] Ruhl's suggestions for incentive-based approaches focus primarily on expanding the existing WRP and CRP "green payment" programs.[381]

Although the types of regulatory changes described above can help to minimize the harms caused from pollution from agricultural operations and wetlands impacts, they do not go far enough to address the fundamental systemic problem with modern industrial commodity production. To fully address the energy and environmental implications of modern agricultural

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375 David E. Adelman & John H. Barton, *Environmental Regulation for Agriculture: Towards a Framework to Promote Sustainable Intensive Agriculture*, 21 STAN. ENVTL. L.J. 3, 39-40 (2002). The authors argue in favor of technology neutral standards that consider the comparable risks and benefits of each technology. *Id.* at 40.

376 *See* Ruhl, *supra* note 63, at 334.

377 *Id.* at 334, 335-37.

378 *Id.* at 337-38.

379 *Id.*

380 *Id.* at 338-41.

381 *Id.* at 340-41.

practices, we must make a dramatic shift to a more sustainable system of agriculture. To accomplish such a transformative shift, mere tinkering with existing regulatory regimes will not be sufficient. A complete overhaul of existing agricultural policy is warranted, and a significant component of such an overhaul would be a complete rethinking of commodity subsidy programs.

B. *Proposals for Changes to Subsidy Programs*

The regulatory changes proposed above would result in some environmental benefits. However, simply bringing the current agricultural system more squarely into the realm of environmental regulation will not address the root of the problem—our entire system of industrial agriculture is fundamentally flawed and unsustainable. Current environmental statutes, even if they were to be amended to more comprehensively address the environmental impacts of agriculture, simply are not designed to promote the changes in agricultural practices that are needed. For example, FIFRA is not designed to eliminate or reduce pesticide usage or even to encourage the replacement of higher-risk pesticides with lower-risk pesticides. Instead, the statute merely provides a licensing program that ensures pesticides meet a cost-benefit standard prior to commercialization. Neither FIFRA nor CWA contains any mechanisms or authority to require or encourage more sustainable forms of agriculture. Even if CWA were to be amended to remove current agricultural exemptions, existing industrial agricultural practices could continue to be employed as long as sufficient engineering solutions to reduce pollutant discharges or provide wetlands mitigation are implemented. Although perhaps yielding environmental benefits, such an approach would do nothing to address the intensive use of fossil-fuel and water inputs of industrial agriculture or to encourage more sustainable practices such as crop rotation, diversification via intercropping, IPM, cultural pest control, biological pest control, efficient irrigation practices, water conservation practices, and nonsynthetic fertilizers. And none of the existing environmental regulatory programs provides any authority to offer incentives to influence the types of crops that are grown in particular geographic locales. Thus, in addition to improving environmental regulatory programs, we must look to ways to improve the vast agricultural subsidy system that serves as a major driver of agriculture. Just as existing regulatory programs could be modified to promote more environmentally friendly practices, current subsidy programs could be modified to do the same.

An evaluation of current agricultural subsidy programs requires that we ask ourselves the following questions: Are the goals of the legislation passed in the 1930s in response to the Great Depression and the Dust Bowl the goals that are most salient today? If not, what other goals must be considered? Even if our goals remain largely the same, is the current labyrinthine agricultural subsidy system really meeting the stated goals? If our

goal is to have a safe, secure, abundant, and reasonably-priced food supply, it is far from clear that our current system is helping to meet these goals. When the vast majority of our subsidies go to grow crops which are not "foods" without substantial processing and when there is not a market for these crops, it is very questionable how these subsidies are helping to meet our societal goals. Moreover, with the more recent crises in the areas of climate change, energy security, and energy scarcity, we must reevaluate whether subsidizing fossil-fuel-intensive industrialized agriculture is serving the best interests of our nation.

Through a variety of forces (including federal legislation such as Farm Bills), the agricultural system that has arisen in the United States since the 1930s is one composed primarily of "industrialized monocultures controlled by a handful of transnational corporations."[382] The consequences of this agricultural system include a broad range of economic, social, and ecological costs. Economically, for example, many rural communities have been destroyed, and the small farmers that do remain have been saddled with debt and dependence on government subsidies.[383] Socially, the concentration of agricultural ownership and intensification of production has led to agricultural jobs that are often dangerous, low paying, and demeaning.[384] Ecologically, the agricultural industry's reliance on intensive production methods and chemical inputs (in the form of pesticides, fertilizers, antibiotics, and hormones) has led to: threats to air, water, and soil quality; stresses on supplies of natural resources such as water, soil, fuel, and land; and decreases in the overall genetic diversity of plants and animals.[385] By supporting certain types of production and commodities over others, the 2008 Farm Bill contributes to this state of affairs. Ultimately, subsidies should be shifted away from industrialized agriculture and toward more sustainable agriculture. Just as subsidies are currently used to promote certain types of agricultural behavior, subsidies may be used as incentives to farmers who engage in sustainable farming practices that protect ecological resources and services. Compensation to those parts of the agricultural industry that engage in sustainable practices is justified by the same rationale that justified the New Deal policy of paying farmers to produce less—the welfare of the nation depends on it.

There are several justifications for a shift away from current subsidy programs to a subsidy program that affirmatively promotes sustainable

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382 Devon G. Peña, *Environmental Justice and Sustainable Agriculture: Linking Ecological and Social Sides of Sustainability* 3 (Second Nat'l People of Color Envtl. Leadership Summit Resource Paper Series, Oct. 23, 2002), *available at* http://www.ejrc.cau.edu/summit2/SustainableAg.pdf.

383 *See* NAT'L RESEARCH COUNCIL, ALTERNATIVE AGRICULTURE 90-93 (1989) [hereinafter ALTERNATIVE AGRICULTURE].

384 Eric Schlosser, *Hog Hell: Smithfield's Workers Face a Modern-Day Jungle*, THE NATION, Sept. 11, 2006, at 28, 29.

385 ALTERNATIVE AGRICULTURE, *supra* note 383, at 97-130.

agriculture. First, the societal goals that led to the creation of the Dust Bowl-era subsidies and the subsidies promoting high yields in the 1970s are not the same goals that we have today. The public has consistently favored environmentally sound practices and the public has become increasingly concerned with purchasing healthy "clean" food.[386] Moreover, the climate change crisis forces us to examine our use of fossil fuels. Industrialized agriculture that relies on large amounts of fossil-fuel inputs that contribute to the climate change crisis and further our dependence on foreign oil cannot be sustained. Finally, as Pollan says, we must stop viewing farming as a zero sum matter where either we completely preserve land from agriculture or we allow agriculture to seriously degrade the biodiversity and other ecological benefits provided by the land that is farmed.[387] For thousands of years humans have engaged in agriculture, much of which was carried out in ways that preserved a significant portion of the environmental resources and ecosystem services. Much has been written in recent years about compensating land owners for ecosystem services that they protect on their land but that benefit all of us. To pay farmers to protect ecosystem services while continuing to be able to farm seems to be a win-win situation. People need food, and thus we all have an interest in ensuring a robust agricultural system. However, people also need and want a healthy environment. Perhaps it makes more sense to pay farmers who engage in practices that meet both of these needs rather than forcing farmers to engage in environmentally harmful and unsustainable practices that merely provide industrial feedstocks because it is the only way they can stay afloat financially.

One of the most obvious subsidy changes that could help to facilitate a shift away from industrial agriculture would be to eliminate the subsidies for corn ethanol production. As described above, corn ethanol does not appear to have any net energy or environmental gain and the subsidy programs aimed at encouraging its development only serve to exacerbate the problems associated with the industrial production of corn. In contrast, the subsidies for certain other biofuel development, including cellulosic biofuels and other renewable alternative energy sources, may be warranted. Some of the money that is currently spent on corn ethanol subsidization could be shifted to some of these more promising alternative energy development programs.[388] More significantly, however, shifting a substantial portion of the money currently spent on corn ethanol to ecosystem payments for sustainable agriculture could provide more bang for the buck in terms of making progress toward energy independence, reducing greenhouse gas emissions, and reducing other environmental degradation and

386 Pollan, *supra* note 1, at 64-65.

387 *Id.* at 65.

388 For a discussion of alternative sustainable energy, see Lynn Price & Mark D. Levine, *Production and Consumption of Energy*, *in* STUMBLING TOWARD SUSTAINABILITY, *supra* note 359, at 79, 93-98.

public health problems. Industrial corn production relies on large quantities of fossil-fuel inputs. In an era where energy independence and climate change are two of the greatest problems facing our nation, it may be worth spending money to wean ourselves off of energy intensive farming rather than spending money to promote more energy intensive farming for a questionable fuel source.

The Farm Bill's large commodity subsidy programs should also be evaluated for potential overhaul. Historically, critics have pointed to the Farm Bills' primary purpose of price stabilization through subsidization as being outdated at best and, at worst, a handout to large corporations at the expense of most farmers, the environment, and the overall health of the nation.[389] Economic studies demonstrate that, at least in the developed world, the primary driver of farmers' choices in what crops to grow and what agricultural practices to employ are economic incentives, including price supports and other economic subsidies.[390] Agricultural producers react rapidly to changed economic incentives.[391] Other studies have demonstrated a positive correlation between farm sector assistance, including subsidies, and per hectare use of chemical fertilizers.[392]

To meet this challenge of moving away from an industrial agriculture dominated system to a more sustainable system, it will be necessary to rethink the entire Farm Bill subsidy framework. Just as U.S. agricultural subsidy programs have shaped agriculture in the past by rewarding growers for what are now seen as unsustainable practices, U.S. agricultural subsidy programs can be adapted to promote practices that society now finds more desirable because they conserve resources for future generations. It is certainly worth considering whether a major shift in subsidy programs away from supporting high-yield monoculture industrial commodity production toward promoting a less energy and water intensive, more environmentally friendly, and diverse form of agriculture is warranted.

Legal scholars have only recently begun to weigh in on ways to achieve a more sustainable agricultural system. For example, Professor Neil Hamilton has asserted that a new sustainable agriculture could, and perhaps should, play an important role in the new "green industry" movement.[393] As Hamilton puts it, agriculture was the "original green activit[y]" and "is in-

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389 For representative criticism of the Farm Bills, see Brian M. Riedl, Top 10 Reasons to Veto the Farm Bill, The Heritage Foundation, (Apr. 17, 2002), http://www.heritage.org/research/agriculture/bg1538.cfm; Defenders of Wildlife, Top Ten Major Problems with the House Farm Bill, http://www.familyfarmer.org/sections/tenproblems.pdf; Michael Pollan, *You Are What You Grow*, N.Y. TIMES MAG., Apr. 22, 2007, at 15.

390 Boardman, Poesen & Evans, *supra* note 89, at 1-2.

391 *Id.*

392 *See* Lewandrowski, Tobey & Cook, *supra* note 63, at 419.

393 Neil D. Hamilton, *Feeding Our Green Future: Legal Responsibilities and Sustainable Agricultural Land Tenure*, 13 DRAKE J. AGRIC. L. 377, 379-82 (2008).

herently part of any sustainable future."[394] Of course, for agriculture to play a role in the green industry movement, it must be transformed from its current incarnation. Hamilton argues that sustainable agriculture is tied to the recent interest in buying local or organic food, joining community supported agriculture, and the "clean food" movement.[395] The challenge is how to move away from current practices to promote and encourage a sustainable agricultural system.[396]

While the current Farm Bill contains several conservation programs (including the Wetlands Reserves Program ("WRP") and the Environmental Quality Incentives Program ("EQIP")),[397] and contains provisions which promote the accessibility of organic and local foods,[398] many critics argue that any reform that the 2008 Act contains is superficial. The status quo of major subsidies to large-scale, industrialized producers of a few commodities was preserved, to the detriment of most farmers, the environment, and the overall health of the nation.[399] While the conservation programs and supports for more sustainable foods that do exist should be commended, they should also be greatly expanded.

For example, the Union of Concerned Scientists recommends shifting EQIP livestock funds to sustainable livestock and poultry production rather than using the funding to subsidize large concentrated animal feeding operations.[400] It suggests using the funding for managed rotational grazing, pasture and range management, and other environmentally sound practices.[401] Likewise, they argue in favor of new funding and technical assistance to encourage a shift from grain-fed feedlot animal operations to grass-fed operations.[402] Other recommendations include providing more subsidies for small and medium farms on par with the funding currently provided primarily to the largest agricultural operations.[403] As with the regulatory modifications described above, these types of alterations to current subsidy programs could have significant environmental benefits. However, the ap-

394 *Id.* at 380.

395 *Id.*

396 *Id.* at 387.

397 For a complete list of conservation programs in the 2008 Farm Bill, see Natural Resources Conservation Service, U.S. Dep't of Agric., 2008 NCRS Farm Bill Conservation Programs, http://www.nrcs.usda.gov/PROGRAMS/farmbill/2008/ (last visited Mar. 8, 2010).

398 *See, e.g.*, SUSTAINABLE AGRICULTURE COALITION, GRASSROOTS GUIDE TO THE 2008 FARM BILL 60-87 (2008), http://sustainableagriculturecoalition.org/wp-content/uploads/2008/11/sac-farm-bill-guide.pdf.

399 *Id.* at 3.

400 Union of Concerned Scientists, Farm Bill Comments Submitted by UCS, http://www.ucsusa.org/food_and_agriculture/solutions/big_picture_solutions/farm-bill-comments-submitted.html (last visited Mar. 8, 2010).

401 *Id.*

402 *Id.*

403 *Id.*

proach of simply modifying existing subsidy programs to promote more environmentally and socially sound farming practices may not be sufficiently transformative to get to the core of the problem—that we are using vital environmental and energy resources to grow surpluses of industrial feedstocks that do not contribute to the need for nutritious foods. Merely providing subsidies for industrialized agriculture that makes some improvements in its practices is not enough. As Pollan has argued, we need to find a way to move our current fossil-fuel-based industrialized agriculture to a solar-based sustainable agriculture.[404] To achieve the agricultural transformation that is needed to have a truly sustainable food production system, a more dramatic shift in policy may be warranted.

Some commentators have argued in favor of dramatically reducing or even eliminating agricultural subsidies. However, it is important to recognize that such a move in itself may not significantly reduce the environmental degradation associated with agriculture. For example, some studies have shown that decreasing subsidies may not reduce the overall pollution associated with fertilizer use because although that would reduce the per hectare amount of fertilizer used, lower subsidy levels may actually increase the number of hectares farmed.[405]

One of the most significant market-distorting flaws with subsidy programs is that historically they were coupled with, and in some cases are still coupled with, production levels—the more a farmer grows, the more government money she receives. Consequently, growers have a financial incentive to produce the highest yields possible, which requires high water and fossil-fuel inputs and has significant environmental consequences. One option to shift growing practices away from this type of agriculture is to decouple subsidies from production levels. In 1996 the United States took a major step toward decoupling by instituting income support systems that are not based on production levels.[406] As described above, direct payments, countercyclical payments, and ACRE payments are made regardless of whether the producer actually grows the crop or how much of the crop is produced.[407] The European Union took a similar step in 2003 when it decoupled its subsidies from production.[408] In addition, as part of the EU's 2003 overhaul of agricultural policy, it imposed requirements that growers must comply with certain specified environmental practices in order to receive subsidies.[409] However, although these programs have decoupled payment from actual production, they are only partially decoupled. For exam-

404 Pollan, *supra* note 1, at 66.

405 Lewandrowski, Tobey & Cook, *supra* note 63, at 419.

406 Decoupling, *supra* note 241.

407 *See supra* Part III.B.2.

408 Daniel Bianchi, *Cross Compliance: The New Frontier in Granting Subsidies to the Agricultural Sector in the European Union*, 19 GEO. INT'L ENVTL. L. REV. 817, 818, 825 (2007).

409 *Id.* at 818, 820-22.

ple, "[c]ounter-cyclical payments are tied to historical base acres and fixed program yields."[410] Consequently, farms do not receive larger payments for larger yields. However, these payments are still linked to market conditions and payments increase in response to lower national average prices.[411] Thus, on a national basis, if a commodity is produced at such a high rate that there is a large surplus and consequently prices are low, farmers will receive a larger subsidy than they would in the absence of such surpluses. Unfortunately, these attempts to partially decouple subsidies from production levels do not appear to have significantly reduced high-yield production of commodity crops.[412] The reasons for the failure of decoupling to impact agricultural practices are unclear and most likely multi-faceted. For example, one study suggests that the United States' attempts at decoupling have not alleviated the problem of production distortion because decoupled lump payments increase farmers' household income, which enables increased investment in farming operations that in turn can lead to increased production levels.[413] One study found that farmers typically spend a large percentage of the decoupled subsidy payments they receive to invest in their farming operations.[414]

Another significant problem that remains after U.S. income supports were decoupled from production levels is that other programs such as price supports were not decoupled. Thus, although there may not be a financial incentive for a farmer who historically grew corn to switch to another crop under the income support programs, a strong incentive continues to exist for that farmer to grow as much corn as possible under the price support programs. As described above, the nonrecourse loan program in essence directs the federal government to buy commodities at higher prices than could be obtained on the open market.[415] Consequently, farmers continue to have a strong incentive to produce as much as possible. Income supports will not be affected one way or another by production levels, and price support levels will rise in direct proportion to the amount produced. Decoupling one program without decoupling the others does not achieve the goal of allowing market forces, rather than government subsidies, to dictate what crops to grow and at what production levels. Professors Adelman and Barton have noted that even with the United States' attempts at decoupling, "loan-deficiency subsidies continue to discriminate against farmers who employ environmentally sound crop rotations and, despite record surpluses, induce

410 Decoupling, *supra* note 241.
411 *Id.*
412 *See id.*
413 *Id.*
414 *Id.*
415 *See supra* Part III.B.2.

farmers to maximize their yields through overuse of agrichemicals and irrigation."[416]

The USDA has recognized that the United States' decoupling approach has not achieved its intended goal in part because when the 1996 decoupling occurred, the decoupled income subsidizes were intended to be the primary commodity subsidies.[417] However, declines in market prices for many years after the decoupling led to an increase in subsidy payments from price support programs that were not decoupled, such as the nonrecourse marketing loan program.[418]

Another potential explanation for the failure of decoupling is that, because income supports are only available to farmers who historically grew large commodity crops, even with decoupling these farmers may continue to grow those commodity crops because that is what they do. A farmer who has grown corn all of her life, who knows how to grow corn, who has invested large amounts of money into equipment to grow corn, and who lives in a community that has a strong corn-growing culture, may choose to continue to grow corn even though she could receive the same income supports if she were to grow other crops. Thus, decoupling of income support programs in itself is not enough.

Decoupling price supports as well as income supports could prove more effective at promoting a shift away from overproduction of large commodity crops. Of course, to encourage such a shift, price supports would have to be available for crops other than the major commodity crops. In an era of surpluses of commodity crops such as corn that are primarily used in large animal feedlot operations or as industrial feedstocks for processed foods, it simply makes no sense from a public policy standpoint to continue to subsidize only these commodities and to fail to afford the same subsidies to producers of noncommodity food crops. If public policy concerns argue in favor of any subsidies, they would argue for the subsidization of a broad array of healthy food crops grown in an environmentally sound manner without the heavy dependence on fossil-fuel inputs and the decoupling of all subsidies from high-yield unsustainable commodity production. To achieve this, subsidy programs must be modified not only to apply to a broad variety of crops rather than a few commodity crops, but also a mechanism must be in place to tie subsidies to environmental protection.

The uncertainty regarding the extent to which decoupling changes farmer behavior is only half of the equation. Perhaps the more important issue is even if a farmer plants less acreage in a decoupled system, will there be resultant environmental benefits? Planting fewer acres may result in more environmental benefits on the land that is left fallow, but if the

416 Adelman & Barton, *supra* note 375, at 32.

417 Burfisher & Hopkins, *supra* note 240, at 40.

418 *Id.*

farmer compensates for this by more intensely farming the planted acres, there may not be a net environmental benefit. For example, one study analyzing the effects of subsidies based on production levels and decoupled income payments on species richness supports the conclusion that both types of subsidies contribute to loss of species richness.[419] The two different subsidy programs, however, appear to influence different species in different ways, with decoupling appearing to have more influence on avian richness than insect richness.[420] This study suggests that production-dependent subsidies, such as price supports, tend to lead to increases in the area of arable land and consequent decreases in the area of fallow land.[421] Income supports that are decoupled from production levels, on the other hand, tend to induce a shift to more fallow land and less actively farmed land.[422] This trend supports the idea that decoupling can result in increased biodiversity due to less land being farmed.[423] However, the study shows that the impacts to particular species or groups of organisms from such changes are not well understood, and there may be substantial differences among different taxa.[424] Thus, decoupling alone may not be sufficient to achieve a more sustainable agricultural system.

Another option for encouraging such a shift to sustainable agriculture is to make a more dramatic change to subsidy programs. For example, a system could be created in which subsidy levels are tied to the adoption of varying levels of sustainable practices. Perhaps a tiered system could be created where growers who continue to grow in a monoculturistic industrial fashion, but reduce their use of fertilizers, pesticides, and water and employ certain best management practices to limit erosion, depletion of organic matter in soils, contamination of ground and surfacewater, and harm to surrounding biodiversity, receive a tier-one level of subsidy. Of course, this subsidy should be available for a variety of crops—not merely for commodity grain crops. Another tier could be a higher level of subsidy provided to growers who meet existing USDA organic certification growing standards. This subsidy would serve to reward organic growers, encourage more growers to go organic and lower consumer prices for organic products, thereby increasing consumer demand for such products. However, although USDA organic certification standards call for the use of certain sustainable practices, they are primarily targeted at prohibiting the use of certain substances such as synthetic pesticides and fertilizers, genetically modified organisms, and antibiotics rather than requiring widespread implementation of sustainable practices. Thus, perhaps a third tier is also warranted. The

419 Gottschalk et al., *supra* note 143, at 643.

420 *Id.* at 643, 648.

421 *Id.* at 647.

422 *Id.*

423 *See id.*

424 *Id.* at 650.

third tier could be comprised of growers who, while not going as far as to meet organic standards, engage in a set of identified sustainable practices, which would require a very different approach to farming than large-scale monoculture industrialized production.

Perhaps the most useful model for this proposed shift in the subsidization of agricultural production is paying for ecosystem services. In general, an ecosystem services approach recognizes, protects, and restores the multitude of services provided by ecosystems—services such as "purifying air and water, detoxifying and decomposing waste, renewing soil fertility, regulating climate, mitigating droughts and floods, controlling pests, and pollinating plants."[425] Ecosystem services payments are one of several instruments that can be used to protect ecosystem services and usually take "the form of a subsidy, either as a direct payment or tax break."[426] They are justified by a public goods argument: "[S]ociety at large benefits from these activities but because of market failures does not pay for them."[427] Moreover, converting to and implementing more sustainable agricultural practices will undoubtedly cost farmers money, at least in the short run.[428] Despite criticism from some policy analysts as wasteful or inefficient subsidies, or as paying people to do what they "should" be doing anyway, ecosystem services payments can be found in environmental laws and policies around the world.[429] Although the existing conservation programs, such as the CRP and WRP, could be considered a form of ecosystem services payments (i.e., paying farmers for the ecological values protected by taking certain lands out of production), to accomplish the goal of truly sustainable agriculture, farmers must be paid not just for the land they do not farm, but more importantly for the ecosystem services provided by the land that they do farm. By compensating farmers for preserving certain ecological functions such as habitat, carbon sequestration, and use of animal waste on the actively farmed lands themselves, farmers will have economic incentives to adopt more sustainable approaches to farming.

One commentator describes the rationale for providing ecosystem services payments to farmers as follows:

> [W]hy not treat farmers' provision of ecosystem services as no different from their provision of other marketable goods? Farmers are certainly well accustomed to contractual arrangements for their agricultural products. Dairy farmers sign contracts to sell their milk; potato

425 James Salzman, Barton H. Thompson, Jr. & Gretchen C. Daily, *Protecting Ecosystem Services: Science, Economics, and Law*, 20 STAN. ENVTL. L.J. 309, 310 (2001).

426 James Salzman, *Creating Markets for Ecosystem Services: Notes from the Field*, 80 N.Y.U. L. REV. 870, 886 (2005).

427 *Id.*

428 *See* Linda K. Lee, *Groundwater Quality and Farm Income: What Have We Learned?*, 20 REV. AGRIC. ECON. 168, 169, 177 (1998) (evaluating twenty-one studies which suggest farm income decreases as measures are taken to reduce water pollution from farms).

429 *See* Salzman, *supra* note 426, at 870, 873-74, 876.

> farmers do the same for their spuds. Why not treat the provision of water filtration services as a similar business transaction, where farmers manage their land through riparian buffers and grass swales to "grow the crop of water quality" much the same as dairy and potato farmers do for their cash crops?
>
> In many respects, provision of ecosystem services would be no different than supplying traditional farm produce, with the level of compensation dependent on the quality and level of services provided.[430]

Another commentator suggests the following measures that Congress should take in order to fully integrate ecosystem services payments into federal farm policy: (1) funding "research to determine how to calibrate farm practices with ecosystem service delivery at local scales" (similar to what is being done with the Florida Ranchland Environmental Services Project discussed below); (2) developing "national standards for quantifying ecosystem service values associated with agricultural lands, including the development of proxies that can inexpensively be measured to estimate service delivery potential"; (3) giving preferential treatment "in federal 'green subsidy' payments programs for farms that would actually deliver ecosystem service values to identifiable local and regional populations"; and (4) funding "pilot and permanent demand-based state and local farm multifunctionality programs" (such as the Florida Ranchlands Environmental Services Project).[431]

A compelling example of ecosystem services payments in practice, the Costa Rican Payments for Environmental Services Program, is a government-run plan that pays private landowners direct payments for the ecological services that their lands produce.[432] Implemented by the Sistema Nacional de Areas de Conservacion and the Fondo Nacional de Financiamiento Forestal, the Program encourages the adoption of land uses and forest management techniques that protect primary and secondary forests and encourages forest plantations to meet industrial demands for lumber and other wood products.[433] The Program enters into site-specific contracts with individual as well as small- and medium-sized farmers.[434] Three types of contracts exist: (1) forest conservation contracts, in which $210 per hectare is paid over a five-year period for forest conservation easements; (2) sustainable forest management contracts, in which $327 per hectare is paid over a five-year period for fifteen-year sustainable forest management

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430 *Id.* at 888.

431 J.B. Ruhl, *Agriculture and Ecosystem Services: Strategies for State and Local Governments*, 17 N.Y.U. ENVTL. L.J. 424, 458 (2008).

432 Edgar Ortiz Malavasi & John Kellenberg, Program of Payments for Ecological Services in Costa Rica 1, *available at* http://ecosystemmarketplace.com/documents/cms_documents/lr_ortiz_kellenberg_ext.pdf.

433 *Id.*

434 *Id.* at 4.

easements; and (3) reforestation contracts, in which $537 per hectare is paid over a five-year period for fifteen- to twenty-year reforestation easements.[435]

An example of environmental services payments closer to home, the Florida Ranchlands Environmental Services Project, is "a payment for ecosystem services pilot program designed to test whether cattle ranchers near Lake Okeechobee can provide ecosystem services more cost effectively than by building new public works projects."[436] A collaboration between South Florida cattle ranchers, Florida state agencies, Natural Resources Conservation Service, researchers, and environmental groups, the eventual aim of the Project is to "allow ranchers to compete to provide environmental services of water storage, phosphorus retention and wetland habitat enhancement in the Northern Everglades ecosystem."[437]

As described above, one of the important components of an ecosystem services payment program, or any other agricultural sustainability program, is to fund additional research, education, and training to support the development and widespread use of such a program. Leading agricultural law expert Professor John Davidson has opined that "[i]n American agricultural research, particularly in the research stations and the land-grant colleges, there is a notable absence of serious and continuing collaboration with ecologists."[438] Because an ecosystem services-based model of agriculture is such a new and different approach and because it relies heavily on an understanding of the functioning of ecosystems and how to integrate agricultural production and ecosystem services, additional research will be needed.

In addition to continued support for programs such as the Conservation Reserve Program and the Environmental Quality Incentives Program (which themselves contain components of environmental services payments), the 2008 Farm Bill, in section 2709, contains promising language for the prospect of environmental services payments being fully integrated into agricultural policy. That section

> requires the Department of Agriculture to "establish technical guidelines that outline science-based methods to measure the environmental services benefits from conservation and land management activities in order to facilitate the participation of farmers, ranchers, and forest landowners in emerging environmental services markets" and to establish guidelines to develop a procedure to measure environmental services benefits, a protocol to report environ-

435 *Id*. at. 4-5.

436 Jacob T. Cremer, *Tractors Versus Bulldozers: Integrating Growth Management and Ecosystem Services to Conserve Agriculture*, 39 ENVTL. L. REP. NEWS & ANALYSIS 10541, 10546 (2009).

437 University of Florida Water Institute, Valuing Ecosystem Services on Florida Ranchlands: Lessons Learned, http://www.waterinstitute.ufl.edu/symposium/downloads/92718559.pdf (last visited Mar. 8, 2010).

438 Davidson, *supra* note 359, at 366.

> mental services benefits, and a registry to collect, record and maintain the benefits measured.[439]

In order to implement these provisions, the USDA created two new entities in December 2008.[440] The Office of Ecosystem Services and Markets and the Conservation and Land Management Environmental Services Board were established in order to "assist the Secretary of Agriculture in the development of new technical guidelines and science-based methods to assess environmental service benefits which will in turn promote markets for ecosystem services including carbon trading to mitigate climate change."[441] It is not yet clear what type of ecosystem services payment programs will emerge from this new legislation. However, it is important to note that these new provisions do not alter existing large-scale commodity subsidy programs. Although the new provisions may reflect a potential evolution toward a new ecosystem services payment program, a large-scale shift to a sustainable agricultural system will require a more comprehensive overhaul of the current system, rather than the piecemeal addition of a few new programs.

Finally, any proposal to change the Farm Bill Subsidy programs must take into consideration how the various subsidy programs can work together. For example, although the CRP and other conservation provisions in the Farm Bill have been successful in conserving certain environmentally sensitive lands, they may unintentionally also adversely impact some ecosystem services and natural resources. When farmers are paid to set aside acreage for conservation, their natural inclination, as encouraged by price supports, may be to increase yield levels on the remaining lands that they are free to continue farming by farming more intensively. Such increased intensive farming may result in even more environmental degradation and the need for more fossil-fuel and water inputs than may have been previously used. Thus, the current conservation programs in the Farm Bill are double-edged swords, protecting certain environmental values while at the same time encouraging the degradation of others. To avoid this problem it may be necessary to integrate the conservation subsidy programs into the price and income support subsidy programs to establish one comprehensive subsidy program that maximizes the promotion of environmentally sound and sustainable practices both on and off of the actively farmed fields.

Development of a robust ecosystem services program for agriculture could go a long way to promote a more sustainable agriculture system. However, merely establishing yet another subsidy program will not be suf-

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439 Ruhl, *supra* note 431, at 459 (quoting 16 U.S.C. § 3845 (2006)).

440 Press Release, U.S. Dep't. Agric., USDA Announces New Office of Ecosystem Services and Markets (Dec. 18, 2008), http://www.usda.gov/wps/portal/!ut/p/_s.7_0_A/7_0_2KD?contentidonly=true&navid=farmbill2008&contentid=2008/12/0307.xml.

441 *Id.*

ficient. To achieve the level of change that is warranted to squarely address climate change, dependence on foreign energy, and environmental degradation from agriculture, the conservation subsidy programs should be integrated into a newly constructed version of the current commodity subsidies programs of Title I.[442] Such a "merged" subsidy system could induce the shift to sustainable, ecologically functioning cropland ecosystems, rather than dividing crop land into two categories: conserved fallow land and industrialized monocultures with little or no ecological value on actively farmed land.[443] Under this approach, Title I subsidies would be paid to producers of a large variety of crops rather than just the few large commodity crops, but only if they implement practices geared toward low fossil-fuel inputs and general environmental sustainability. Rather than tying subsidy levels merely to historic or current production levels, subsidies would be tied to the level of ecosystem services provided. Ecosystem services that could be included as compensable could include the following: carbon offsets, soil conservation, soil enhancement, water conservation, habitat protection, protection of important nutrient cycling microorganisms, pollinator protection, nutrient retention, flood protection, aquifer recharge, erosion protection, animal waste disposal (by employing it as fertilizer), and a variety of other important services that might be provided depending on the crop and the manner in which it is produced. Under a merged approach certain environmentally sensitive lands could continue to be set aside, as they are in the current CRP and WRP. Lands that are completely protected would most likely provide greater ecosystem services than lands that are actively farmed—albeit in an environmentally sustainable manner. Thus, lands chosen for conservation would receive higher subsidies than working lands, but working lands would still receive subsidies based on the type and level of ecosystem services provided.

CONCLUSION

Current agricultural practices in the United States are based on an outdated industrial model that relies on intensive fossil-fuel inputs and significantly contributes to both climate change and a number of other environmental and societal problems. U.S. environmental regulatory laws contain numerous exemptions and other provisions that limit its ability to address environmental problems associated with agriculture. Revisions to these environmental laws could help to alleviate or reduce some environmental

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442 Others have proposed similar, but less ambitious, merged "green payments" programs. *See, e.g.*, Katherine R. Smith, *Time to "Green" U.S. Farm Policy*, ISSUES SCI. & TECH., Spring 1995, at 71, 71.

443 For a discussion of how farms can be made to function like ecosystems, see Daniel Imhoff, *Farming with the Wild: A Conservation Approach to Agriculture*, *in* FATAL HARVEST: THE TRAGEDY OF INDUSTRIAL AGRICULTURE, *supra* note 51, at 367; Jackson, *supra* note 64, at 41.

degradation resulting from agriculture. However, to achieve the level of change necessary to fully address the problems associated with industrial agriculture, it will be necessary to find a way to accomplish a more fundamental transformation of the entire agricultural system. Current subsidies contained in the Farm Bill primarily reward large-scale industrial production of a few commodity crops, such as corn, which instead of serving as healthy food, serve as industrial feedstocks for processed food and large-scale concentrated animal feeding operations. Government subsidies for these commodities, which once served an important societal purpose of stabilizing crop prices and keeping farmers in business, are outdated and no longer serve the more important societal concerns of today—namely dependence on foreign fossil fuels, climate change, environmental degradation, and public health. Although some modifications of the current subsidy system could help to make some limited progress toward achieving these goals, to make substantial progress a more fundamental change is warranted.

Subsidy programs in the United States should be completely overhauled to encourage the development of a sustainable agricultural system. One of the most promising means of accomplishing this goal is to combine existing commodity subsidy programs with existing conservation subsidy programs into one subsidy program, which compensates farmers of a wide variety of crops for conserving a range of critical ecosystem services. Such an approach could result in a shift from an agricultural system in which croplands are in essence industrial wastelands with little or no ecological value and which are used primarily to produce industrial feedstocks, to a more sustainable system in which agricultural lands are healthy, sustainable systems providing a number of critical ecosystem services that benefit the public and serve as a source of healthful food.