THE PUBLIC VALUE OF ECOLOGICAL AGRICULTURE

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INTRODUCTION

"The whole problem of health in soil, plant, animal and man is one great subject"[1]

Embedded in the modern American landscape are two fundamentally different approaches to farming. The dominant form is the industrial approach, which depends primarily on chemicals, biotechnology, and fossil fuels to maximize production.[2] Industrial agriculture is characterized by mechanization, intensive use of chemical fertilizers and pesticides, concentrated livestock production, and monocultural production of a few crops that overwhelmingly end up as animal feed, fuel, and processed products like high fructose corn syrup.[3] The other is an ecological approach, which learns from strengths of natural ecosystems, such as diversity, efficiency, and resiliency, and builds them into agricultural ecosystems to optimize long-term productivity.[4] Ecological farming takes advantage of these strengths, using minimal inputs along with habitat management and conservation, to create resilient farming systems.[5] Unlike industrial agriculture, inherently comprised of practices (monoculture, annual cropping, fertilizer use), an ecological approach selects and combines practices best suited to the local landscape and farm.[6]

While industrialized agriculture has achieved extraordinary levels of production, resulting in high volumes of cheap food products, America's dependence on chemicals, fossil fuels, and industry-wide monoculture has created a system that is wasteful, degrades resources, and is increasingly

1. ALBERT HOWARD, THE SOIL AND HEALTH: A STUDY OF ORGANIC AGRICULTURE xv (Norman Wirzba ed., The University Press of Kentucky 2006) (1947).

2. *See generally* David Tilman et al., *Agricultural Sustainability and Intensive Production Practices*, 418 NATURE 671 (2002) (describing characteristic approaches).

3. *See generally id.* (describing intensification in agriculture).

4. Fred Magdoff, *Ecological Agriculture: Principles, Practices, and Constraints*, 22 RENEWABLE AGRIC. & FOOD SYS. 109, 110–11 (2007).

5. *Id*.

6. Ilan Stavi et al., *Soil Functions and Ecosystem Services in Conventional, Conservation, and Integrated Agricultural Systems. A Review*, 36 AGRONOMIC SUSTAINABLE DEV. 32, 40 (2016) (finding that, comparatively, the agro-environmental score is highest for conservation systems); *see also* Leo Horrigan et al., *How Sustainable Agriculture Can Address the Environmental and Human Health Harms of Industrial Agriculture*, 110 ENVTL. HEALTH PERSP. 445, 452 (2002) (explaining that sustainable agriculture is "place specific," "dynamic," and "holistic").

precarious.[7] Relying on diversity, photosynthesis, and conservation, ecological agriculture produces nutritious food while maintaining the "functional integrity" of the land, ensuring the land retains a collective "state of vigorous self-renewal" of its component parts: soil, water, plants, and animals.[8] Thus, in addition to sustaining production, conservation enables agriculture to provide a stable supply of clean water and healthy soil, protection from droughts and floods, and climate regulation.[9] The most formidable obstacle to widespread ecological agriculture in the United States is the system of infrastructure and markets that facilitate industrial agriculture.[10] This system monopolizes channels for marketing and sales and supports particular commodities, production methods, and business structures.[11] Federal policies provide the foundation and sustenance for this model and are heavily weighted in its favor.[12] Consequently, small-scale producers of a diversity of fresh fruits and vegetables are challenged to find reliable markets.[13] Even for small-scale commodity producers, the subsidized competitive advantage of very large farms and the price and scarcity of land can present impenetrable barriers to entry. And for interested large-scale commodity producers, the risk is enormous, incentives are few, and the avenues restrictively limited for transitioning to an ecological system.[14]

Conservation, or maintaining the functional integrity of the land, is integral to ecological farming, while chemicals and fossil fuels are integral

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7. Horrigan et al., *supra* note 6, at 445; *see also* Claire E. LaCanne & Jonathan G. Lundgren, *Regenerative Agriculture: Merging Farming and Natural Resource Conservation Profitably*, PEERJ, Feb. 2018, at 1–2 ("This simplification of our food system contributes to climate change, rising pollution, biodiversity loss, and damaging land use changes that affect the sustainability, profitability, and resilience of farms." (internal citations omitted)).

8. ALDO LEOPOLD, *Conservation: In Whole or in Part?* (Nov. 1, 1944), *reprinted in* THE RIVER OF THE MOTHER GOD AND OTHER ESSAYS BY ALDO LEOPOLD 310 (Susan L Flader & J. Baird Callicott eds., 1991).

9. *See generally* Robert Costanza et al., *The Value of the World's Ecosystems Services and Natural Capital*, 387 NATURE 253 (1997) (estimating total economic value of 17 ecosystem services, including food production, water regulation, and erosion control, in 16 biomes).

10. *See generally* Mary Hendrickson, *Resilience in a Concentrated and Consolidated Food System* (Working Paper Nov. 2014) (discussing problems with consolidation in agriculture industry).

11. *See*, *e.g.*, *id.* at 4 (providing examples of monopolization of industrial agriculture).

12. *See*, *e.g.*, Magdoff, *supra* note 4, at 114 (discussing impact of subsidies on decision-making); *see also* William S. Eubanks, *A Rotten System: Subsidizing Environmental Degradation and Poor Public Health with Our Nation's Tax Dollars*, 28 STAN. ENVTL. J. 213, 257–58 (2009) (discussing historical development of agricultural system that favors large-scale monocultural production to maximize yields); Horrigan et al., *supra* note 6, at 453 (explaining that government also contributes to industrial agriculture by funding research for chemical fixes to agricultural problems to the exclusion of research on more sustainable options).

13. MARY HENDRICKSON ET AL., POWER, FOOD AND AGRICULTURE: IMPLICATIONS FOR FARMERS, CONSUMERS AND COMMUNITIES 5–6 (2017).

14. *See*, *e.g.*, *id.* at 3 (discussing limited choices for purchasing inputs and farm decision-making).

to industrial agriculture, which uses conservation not as a farming method, but as a retroactive tool to mitigate harm.[15] While federal policy once valued conservation as a farming approach, the subsequent widespread use of chemicals diminished the short-term need for conservation, as well as the perception of its value.[16] In time, conservation therefore became little more than a measure used to mitigate harms caused by overproduction and excessive chemical use.[17] At best, modern conservation programs serve merely as band-aids. At worst, they shore up an unsustainable extractive system by prioritizing and dispensing funds to the worst polluters.

I argue that to ensure a resilient future, the United States must transition away from farming methods that threaten environmental and public health. Originally designed to mass-produce cheap food for a growing population, industrial agriculture has morphed into an ecological and public health hazard.[18] In an era of global warming, desertification, and rapid biodiversity loss, the importance of a resilient and sustainable food system is paramount.[19] Industrial agriculture actively reduces the strengths of natural systems, while ecological farming offers a clear path to long-term resilience of our food system and natural resources.[20] To achieve long-term sustainability, the United States must retire its commitment to industrial farming, reintegrate conservation with federal policy, and reorganize farm programs to promote ecological food production. Current policies promote harmful practices, while failing to reward farmers who steward natural resources and provide

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15. ALDO LEOPOLD, *The Farmer as Conservationist* (1939), *reprinted in* THE RIVER OF THE MOTHER GOD AND OTHER ESSAYS BY ALDO LEOPOLD 255 (Susan L Flader & J. Baird Callicott eds., 1991); *see generally* Craig J. Pearson, *Regenerative, Semiclosed Systems: A Priority for Twenty-First-Century Agriculture*, 57 BIOSCIENCE 409 (2007) (encouraging a regenerative agriculture system).

16. Eubanks, *supra* note 12, at 251; *see also* Timothy D. Meehan et al., *Ecosystem-Service Tradeoffs Associated with Switching from Annual to Perennial Energy Crops in Riparian Zones of the US Midwest*, 8 PLOS ONE, Nov. 2013, at 1 (describing system design of agricultural landscapes only to maximize production, despite other potential benefits).

17. Tilman et al., *supra* note 2, at 676 (explaining that agricultural and environmental objectives often differ); LaCanne & Lundgren, *supra* note 7, at 1 (concluding that ecological farming "could be used to simultaneously produce food while conserving our natural resource base: two factors that are pitted against one another in simplified food production systems").

18. *See generally* Hendrickson, *supra* note 10 (describing the evolution of industrial agriculture and its downfalls).

19. U.S. GLOB. CHANGE RESEARCH PROGRAM, FOURTH NATIONAL CLIMATE ASSESSMENT: IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES 392 (2018) (concluding that "management practices to restore soil structure and the hydrologic function of landscapes are essential for improving resilience to these challenges"); *see also* Myles Allen et al., *Summary for Policymakers*, *in* GLOBAL WARMING OF 1.5 C 3, 9 (Valerie Masson-Delmotte et al. eds., 2018) (predicting that climate-related risks to food security will rise with global warming of 1.5 degrees C); Independent Group of Scientists appointed by the Secretary-General, *Global Sustainable Development Report 2019: The Future is Now, Science for Achieving Sustainable Development*, at 19 (United Nations, New York, 2019).

20. *See*, *e.g.*, Magdoff, *supra* note 4, at 111 (explaining that ecological agriculture harnesses strengths of natural ecosystems).

vital services like clean water, nutrition, and resilient landscapes.[21] Reforming federal law to account for ecological agriculture's economic and environmental benefits would promote agricultural systems that (1) reduce energy use, (2) minimize reliance on chemical inputs, and (3) secure against storms, diseases, and market volatility.

This article is organized as follows: Part I describes industrial agriculture, including its attributes and consequences. Part II describes ecological agriculture, reviewing its key benefits as well as its challenges. Part III explores the history of U.S. federal farm policy, including its early integration of conservation with farm programs, and co-evolution with industrial agriculture. Part IV provides examples of modern conservation and farm policies, and argues that despite conservation origins, federal policy today incentivizes industrial agriculture, rather than investing in ecological agriculture. Finally, Part V outlines reforms proposed to achieve the environmental and economic benefits of ecological agriculture.

I. MODERN AMERICAN AGRICULTURE

A. Industrial Agriculture Dominates American Farms

According to the most recent Census of Agriculture (issued in April 2019), there were 2,042,220 farms in the United States in the census year 2017.[22] These farms cover more than 900 million acres of land, of which 20% is dedicated to producing four major commodity crops: corn, wheat, rice, and soybeans.[23] Just 1% of this land is in vegetable production and 1.4% in fruit and tree farming.[24] The largest 3.8% of farms (making at least $1 million annually) cover 24% of farmland and account for 68% of the total market value of U.S. agricultural production.[25] The largest 12% of farms (making more than $250,000 per year) account for 53% of farmland and nearly 90% of the market.[26] While most agricultural products are sold to food processors,

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21. *See* Tilman et al., *supra* note 2, at 676 (describing policy changes necessary to encourage sustainable agriculture); *see generally* Peter H. Lehner & Nathan A. Rosenberg, *Promoting Climate-Friendly Agriculture for the Benefit of Farmers, Rural Communities, and the Environment*, 33 NAT. RESOURCES & ENVT. 7 (2018) (recommending sustainable agriculture policies).

22. NAT'L AGRIC. STATISTICS SERV., U.S. DEP'T OF AGRIC., 2017 CENSUS OF AGRICULTURE 7–9 (2019); 7 C.F.R. § 761.2 (2019). A "farm" is defined as "any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the census year." 7 C.F.R. § 761.2.

23. NAT'L AGRIC. STATISTICS SERV., *supra* note 22, at 7–9.

24. *Id.*

25. *Id.*

26. *Id.*; *see also* HENDRICKSON ET AL., *supra* note 13, at 4–5 (offering examples of market share control in specific food industries).

there are markets whereby farmers sell their products directly to consumers through farmers markets, community-supported agriculture (CSA) memberships, and roadside stands. About 12% of farms sell at least some products direct-to-consumer, but these sales account for just 1% of the total market value of agricultural goods.[27]

The vast majority of American farmland is characterized by the production phase of the agriculture industry, whereby farmers purchase inputs from agribusiness, produce agricultural commodities, and sell them at a low-cost to food processors, usually pursuant to a contract.[28] Food processors manufacture animal feed, biofuel products, and highly processed food items to sell to distributors, agribusinesses, retailers, and eventually consumers.[29] This commercial agricultural system has been constructed by federal policy and facilitated by the tools and incentives the government provides, which encourage above all else, the high volume production of cheap commodities.[30] Food production methods, business structures, and commercial transactions are all industrial, bearing more resemblance to manufacturing factories than to the traditional agrarian model of small independent farms speckling a country landscape.[31] Yet, it is often the agrarian ideal displayed on food labels for consumers to encounter in the grocery store.[32]

Industrial farms achieve high levels of production by using large inefficient amounts of fertilizers and pesticides, water, and fossil fuels.[33] Commodity crops are grown in monocultures, with genetically similar plants

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27. *See* NAT'L AGRIC. STATISTICS SERV, *supra* note 22, at 7, 92 (summarizing farm data).

28. JAMES M. MACDONALD ET AL., U.S. DEP'T OF AGRIC., FARM SIZE AND THE ORGANIZATION OF U.S. CROP FARMING 1 (2013); JAMES MACDONALD ET AL., U.S. DEP'T OF AGRIC., CONTRACTS, MARKETS, AND PRICES: ORGANIZING THE PRODUCTION AND USE OF AGRICULTURAL COMMODITIES 4 (Nov. 2004).

29. CONTRACTS, MARKETS, AND PRICES, *supra* note 28, at 3.

30. *See* LaCanne & Lundgren, *supra* note 7, at 1 (explaining that applying conservation within the current production model will have little impact without systemic shift); *see also* Peter Lehner & Nathan A. Rosenberg, *Legal Pathways to Carbon-Neutral Agriculture*, 47 ENVTL. L. REP. 10845, 10858 (describing the "parallel regulatory framework" of loopholes and permitting within which the agricultural system operates); Richard J. Jackson et al., *Agriculture Policy is Health Policy*, 4 J. HUNGER & ENVTL. NUTRITION 393, 394 (2009) (analyzing public health impacts of the Farm Bill).

31. *See generally* CONTRACTS, MARKETS, AND PRICES, *supra* note 28 (demonstrating supportive role of contracts and markets on industrial agriculture).

32. Twilight Greenaway, *Confined Dining: A Primer on Factory Farms and What They Mean for Your Meat* (Sept. 27, 2012), https://grist.org/food/confined-dining-a-primer-on-factory-farms-and-what-they-mean-for-your-meat/ (explaining the labeling requirements are the exception so that CAFO-produced meat is "normal" and only producers who want to raise animals on pasture, use organic feed, or raise animals in smaller numbers face labeling restrictions).

33. *See* STEVE GLIESSMAN, INT'L PANEL OF EXPERTS ON SUSTAINABLE FOOD SYS., BREAKING AWAY FROM INDUSTRIAL FOOD AND FARMING SYSTEMS 1, 8 (2018) (discussing concentration of political power in food systems); Horrigan et al., *supra* note 6, at 445; Lehner & Rosenberg, *supra* note 30, at 10849 ("[F]armers routinely apply fertilizer at higher rates than crops require. . . .").

extending across vast acres of land, and livestock produced in confined animal feeding operations (CAFOs).[34] Driven primarily by production, farms have grown in acreage and become increasingly concentrated, while the overall industry and market have globalized and become concentrated as well, with the top four producers controlling over 50% of the market share.[35] The concentration of market power has led to a lack of diversity throughout the agricultural sector, from agribusiness (producers of farm inputs like seed, fertilizer, and machinery) to agricultural production, processing, and retailing, as well as to finance and insurance carriers.[36] Consolidation has also contributed to the incredible political influence of the food industry in the United States today, compounding industrial advantages.[37]

B. Proponents Argue Necessity, Efficiency, and Affordability

At the heart of agribusiness and industrial production is the promise that technology and mechanization can efficiently produce food without limits for a growing population.[38] Proponents claim large and more intensive operations are necessary to provide cheap food for consumers.[39] Agrichemical company Banf, for example, claims that the invention of

34 Horrigan et al., *supra* note 6, at 445; *see also* 40 C.F.R. § 122.23(b)(1) (2018) (defining animal feeding operations as "a lot or facility (other than an aquatic animal production facility) where the following conditions are met: (i) animals (other than aquatic animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and (ii) crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility").

35. *See* Meehan et al., *supra* note 16, at 1–2 (discussing how consolidation and concentration encourages a shift to open systems where fertilizer and inputs used where cheap in dollar terms without consideration of their renewability or life cycle costs); Pearson, *supra* note 15, at 409 (discussing how consolidation and concentration encourages a shift to open systems where fertilizer and inputs used where cheap in dollar terms without consideration of their renewability or life cycle costs); CONTRACTS, MARKETS, AND PRICES, *supra* note 28, at 50–55 (discussing market power); *see also* DANIEL IMHOFF & CHRISTINA BADARACCO, THE FARM BILL: A CITIZEN'S GUIDE 37 (3rd ed. 2019) (providing graphic of top four producers' market share).

36. *Food Dollar Series*, ECON. RESEARCH SERV., https://www.ers.usda.gov/data-products/food-dollar-series/documentation.aspx (last visited Jan. 5, 2020) (defining agribusiness as "all establishments producing farm inputs (except those described in other industry groups) such as seed, fertilizers, farm machinery, and farm services, and all subcontracting establishments" and defining "farm production" as "all establishments classified within the agriculture, forestry, fishing, and hunting industry" and defining "food processing" as "all establishments classified within the food and beverage manufacturing industries, and all subcontracting establishments"); *see also* HENDRICKSON ET AL., *supra* note 13, at 2 (noting a small amount of actors make a majority of the decisions for the industry).

37. Lehner & Rosenberg, *supra* note 30, at 10858 (describing political power of agricultural industry).

38. *The Hidden Costs of Industrial Agriculture*, UNION OF CONCERNED SCIENTISTS (July 11, 2008), https://www.ucsusa.org/resources/hidden-costs-industrial-agriculture.

39. *See* Pearson, *supra* note 15, at 411 (acknowledging the beneficial impacts of conventional agriculture, including nutrient cycling, landscape and aesthetic value, and at times, water provision); *see generally* Tilman et al., *supra* note 2 (analyzing benefits and costs of intensive agriculture operations).

ammonia synthesis in 1913, which allowed production of nitrogenous fertilizers, "is still securing the nutrition of billions of people today."[40] Indeed, the synthesis of ammonia was a foundational catalyst for the industrialization of agriculture. The greatest benefits ascribed to modern agriculture are that is cheap, efficient, and necessary in order to feed Americans.[41] While there are some benefits that have come with industrial agriculture, these can be built into a less destructive model, and when the full costs are accounted, they are hardly advantages.[42] In the following section, I respond to these arguments by discussing the impacts of industrial farming.

C. Industrial Agriculture Threatens Public Health, Natural Resources, and Resiliency

First, while industrial agriculture is enormously productive, rather than adequately feed the population, most of its products are inedible goods such as biofuels and animal feed.[43] Moreover, industrial foods produced for human consumption have contributed to a public health crisis.[44] In the United States, one-third of adults and two-thirds of children are medically obese.[45] Globally, in 2019, 38 million children under age 5 were overweight or obese.[46] The increase in childhood obesity has been so dramatic that Type II diabetes, which has increased threefold in the last 40 years, is no longer called "adult-onset diabetes," as it now affects children as commonly as adults.[47] Sugar consumption, known to cause high blood pressure and diabetes, has increased by more than 20% since the 1970s.[48] All in all, Americans spend an estimated $147 billion per year on obesity-related illnesses.[49] Industrial agriculture's intensive use of pesticides and fertilizers is also problematic for

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40. *Fertilizer Out of Thin Air* (Mar. 21, 2013), https://www.basf.com/us/en/media/science-around-us/fertilizer-out-of-thin-air.html (resulting from a production of nitrogenous fertilizers).

41. *See also* GLIESSMAN, *supra* note 33, at 8 (noting focus on increasing crop production). *But see* LaCanne & Lundgren, *supra* note 7, at 5 (discussing how majority of corn grown is fed to animals).

42. Pearson, *supra* note 15, at 411 (concluding even the advantages of conventional agriculture could be built into less wasteful systems).

43. *The Hidden Costs of Industrial Agriculture*, *supra* note 38.

44. *See*, *e.g.*, Eubanks, *supra* note 12, at 275–95 (discussing public health impacts of industrial agriculture).

45. Jackson et al., *supra* note 30, at 394; *Obesity and Overweight*, WORLD HEALTH ORG. (April 1, 2020), https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight ("[W]orldwide obesity has nearly tripled since 1975.").

46. *Obesity and Overweight, supra* note 45.

47. Jackson et al*., supra* note 30, at 395.

48. *Id.* at 394, 397–98.

49. *Id.* at 399.

public health.[50] Toxic chemicals pollute air and waterbodies, threaten fish and wildlife, and create toxic algal blooms in rivers and lakes.[51] The standard use of antibiotics in livestock production–to prevent the spread of disease in tightly confined and crowded facilities–provides an additional example.[52] Consistent use of antibiotics in the food supply fosters human tolerance to antibiotics, interfering with the ability to combat bacteria and consequently, contributing to the spread of disease.[53]

While much of the food Americans consume is produced domestically, the majority of U.S. food production provides consumers with very little nutrition. Therefore, more than half of the fresh fruit Americans consume annually is imported.[54] Even with imported fruit, Americans do not consume recommended levels of fruits and vegetables, which would require increasing consumption by 173%.[55] To supply Americans with this amount would involve increasing domestic production of fruits and vegetables by 88%. Instead, American agriculture produces enormous monoculture harvests of commodity crops, much of which is exported.[56] Over 50% of rice and wheat, and roughly 20% of corn, are exported annually. Rather than providing nutrition to consumers, American agriculture contributes to the lack of diversity and nutrition in food consumption, contaminated air and water, and healthcare costs.[57]

Second, industrial agriculture is inefficient in several ways. Industrial farms mostly produce commodity crops like corn, wheat, soybeans, and rice, which cover 82% of U.S. cropland, many of which become animal feed or biofuels, not human food.[58] For example, only a small percentage of the 90

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50. *Id.* at 402; *see also* Horrigan et al., *supra* note 6, at 450–51 (assessing health impacts of pesticides).

51. *See*, *e.g.*, Tilman et al., *supra* note 2, at 675 (discussing hypoxia in Gulf of Mexico); *see also* Eubanks, *supra* note 12, at 255–56 (discussing eutrophication resulting in algal growth as a result of phosphorus and nitrogen discharges into waterbodies).

52. *See* Horrigan et al., *supra* note 6, at 451 (addressing impacts of antibiotic use in animals on public health).

53. *See* Jackson et al., *supra* note 30, at 401, 403; *see also* Tilman et al., *supra* note 2, at 675 (noting that agriculture uses a larger proportion of global antibiotic production than human medicine); Horrigan et al., *supra* note 6, at 451 (discussing impacts of antibiotic use in livestock production on public health).

54. *Agricultural Trade*, U.S. DEP'T OF AGRIC., https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/agricultural-trade/ (last visited Apr. 21, 2020).

55 Jackson et al., *supra* note 30, at 396, 401.

56. *Agricultural Trade*, *supra* note 54.

57. Lehner & Rosenberg, *supra* note 30, at 10853 (describing a "commodity-based" American diet).

58. Nathan Pelletier et al., *Energy Intensity of Agriculture and Food Systems*, 36 ANN. REV. ENV'T & RESOURCES 223, 235–36 (2011); *see also* Jackson et al., *supra* note 30, at 396 (noting that farmers growing fruits and vegetables are generally not eligible for direct subsidies, and because farmers rely on such subsidies for economic stability they tend to grow what government encourages).

million acres of corn grown is used for direct human consumption, much of it in the form of high fructose corn syrup.[59] Fifty percent of grain corn production is used for animal feed, which may feed humans indirectly, but wastes a significant amount of energy along the way.[60] This is because of the additional energy used in grain-fed livestock production and the inherently inefficient processes of converting feed calories to animal fat and protein.[61] Another nearly 50% of corn is used for ethanol production, which is not only an inefficient use of agricultural land that could be used to grow food, but is also very energy inefficient to produce.[62] Research shows that there is no identifiable net energy yield from corn ethanol or cellulosic ethanol.[63] This means that there is no net benefit derived from growing corn for ethanol, which instead unnecessarily wastes and depletes resources.[64]

In addition to using the majority of farmland for commodity crop production that does not provide human food, industrial farming uses far more fossil fuels, chemical fertilizers, and water than are necessary for production.[65] Along with India and China, the United States uses more nitrogen and phosphorus fertilizer than necessary to grow corn, rice, and wheat.[66] As a result, these three countries account for 66% of total global phosphorus and nitrogen pollution.[67] Nitrogen fertilizer, which is ten times more energy intensive to produce than phosphorus and potassium, is produced by synthesizing hydrogen from either natural gas or gasified coal with nitrogen from the air to produce ammonia.[68] Ammonia is then upgraded

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59. *Feedgrains Sector at a Glance*, U.S. DEP'T OF AGRIC., https://www.ers.usda.gov/topics/crops/corn-and-other-feedgrains/feedgrains-sector-at-a-glance/ (last updated Feb. 26, 2020).

60. *See id.* (classifying domestic corn uses); *see also* Horrigan et al., *supra* note 6, at 445 ("[A] significant amount of energy is lost as livestock convert the grain they eat into meat.").

61. *See* Pelletier et al., *supra* note 58, at 228 (discussing grain-fed livestock production).

62. *See Feedgrains Sector at a Glance*, *supra* note 59 (providing statistics for domestic corn production).

63. *See* Pelletier et al., *supra* note 58, at 236 (explaining that the energy return on investment, calculated by dividing energy produced by the sum of energy used for corn ethanol, is statistically inseparable from 1.0, meaning there is no identifiable net energy yield).

64. H. Shapouri et al., *The Energy Balance of Corn Ethanol Revisited,* 46 AM. SOC'Y AGRIC. ENGINEERS 959, 960 (2003) (comparing several corn ethanol studies, most finding corn-based ethanol production results in a net energy loss).

65. *See*, *e.g.*, Eubanks, *supra* note 12, at 251 (noting industrial agriculture relies on large inputs of fossil fuels, fertilizers, and water).

66. Fred Pearce, *Can the World Find Solutions to the Nitrogen Pollution Crisis?*, YALE ENV'T 360 (Feb. 6, 2018), https://e360.yale.edu/features/can-the-world-find-solutions-to-the-nitrogen-pollution-crisis; *see also* Horrigan et al., *supra* note 6, at 446 (citing David Pimentel et al., *Economic and Environmental Costs of Pesticide Use*, 42 BIOSCIENCE 750, 750 (1991) (addressing inefficiency of pesticide applications with only 0.1% reaching target pests).

67. Paul C. West et al., *Leveraging Points for Improving Global Food Security and the Environment*, 345 SCI. 325, 326 (2014).

68. David Pimentel et al., *Environmental, Energetic, and Economic Comparisons of Organic and Conventional Farming Systems*, 55 BIOSCIENCE 573, 573 (2005); *see also* MENGYAO YUAN, MANAGING

to other fertilizers such as ammonium nitrate, urea ammonium nitrate, nitric acid, and urea.[69] Nitrogen fertilizer production represents about half of agriculture's energy use, followed by machinery operation, and then livestock production.[70] Even agricultural commodities produced for human food are often outputs that require additional processing—and energy use—to become consumable products.[71] Finally, agriculture accounts for 80% of the United States' consumptive use of water, and roughly 38% of the nation's freshwater withdrawals.[72] Overall, industrial agriculture is enormously inefficient in its use of land, energy, and resources.[73]

Third, the claim that industrial agriculture provides cheap food for consumers overlooks important factors. Modern cheap foods, such as potato chips and frozen pizza, are highly processed and lack historical antecedents for comparison. Bread, on the other hand, at \$0.056 per pound in 1913, cost \$1.422 per pound in 2013, which is the same price when adjusted for inflation.[74] Despite industrial production of all of these foods, consumer prices have actually increased for many foods, including cereal and bakery products, meats and poultry, and by the largest margin—milk and dairy products. Though Americans today spend less disposable income on food than half a century ago, this decrease is mainly attributable to the rise of average income since that time.[75] Additionally, production costs comprise a relatively minor component of consumer prices.[76] In 2012, only 12 cents of every dollar spent on food went to farmers and the remaining 88 cents to processors, marketers, and distributors.[77] Lastly, consumers often pay for their food several times: as customers at the grocery store, as taxpayers

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ENERGY IN FERTILIZER PRODUCTION AND USE (Dec. 11, 2014) (describing nitrogen fertilizer production); Jeremy Cherfas, *Sustainable Food Systems*, *in* FOOD ETHICS 39 (Ben Mepham ed., 1st ed. 1996).

69. *See* Pelletier et al., *supra* note 58, at 227; *see also* Eubanks, *supra* note 12, at 225 (discussing ammonium nitrate).

70. Pelletier et al., *supra* note 58, at 227–28.

71. *See*, *e.g.*, Lehner & Rosenberg, *supra* note 30, at 10853 (arguing productivity should be analyzed with consideration of energy inputs cost); *see also* Horrigan et al., *supra* note 6, at 448 ("Processing accounts for about one-third of the energy use in the U.S. food system.").

72. *Irrigation & Water Use*, U.S. DEP'T OF AGRIC., https://www.ers.usda.gov/topics/farm-practices-management/irrigation-water-use/ (last updated Sept. 23, 2019) ("Withdrawals" refer to the quantity of water withdrawn from a water source and consumptive use refers to the amount of water taken up by crops); *see also* ALMUT ARNETH ET AL., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE AND LAND 2 (agriculture accounts for 70% of global freshwater use).

73. *See generally* Eubanks, *supra* note 12 (discussing the inefficiencies and negative impacts of industrial agriculture); *see also* Horrigan et al., *supra* note 6, at 446–49 (discussing damages from land degradation and noting that desertification costs an annual \$42.3 billion globally).

74. Jonathan Church & Ken Stewart, *Average Food Prices: A Snapshot of How Much Has Changed Over a Century*, BEYOND THE NUMBERS, Feb. 2013, at 2.

75. *Id.*

76. PATRICK CANNING, U.S. DEP'T OF AGRIC., A REVISED AND EXPANDED FOOD DOLLAR SERIES: A BETTER UNDERSTANDING OF OUR FOOD COSTS, 114 ECON. RESEARCH SERV., at 10 (2011).

77. *Food Dollar Series*, *supra* note 36.

financing agricultural subsidies, and as patients incurring medical bills associated with obesity, antibiotic resistance, poor nutrition, and loss of microbial diversity in their gut biomes.[78]

Externalities like these are troublesome because they are not accounted for in the price of an agricultural product and thus distort the market.[79] In addition to the external costs associated with buying and consuming food, there are negative externalities borne by everyone whether or not they consume the product.[80] These are the costs of harm to the environment and to public health that result from industrial production, namely from its use of toxic chemicals, fossil fuels, and practices that diminish integrated landscape function.[81] Environmental harms from industrial farming include air and water pollution, soil contamination and erosion, desertification, and loss of biodiversity.[82] According to one study, the most significant externalities of industrial agriculture are water contamination due to pesticides and fertilizers, damage to wildlife and natural habitats, emissions of greenhouse gases, soil erosion and organic carbon losses, and food poisoning.[83] One study estimated that $12 billion in annual U.S. environmental and health care costs are attributable to pesticide use and $45 billion to soil erosion.[84] CAFOs, for example, pollute the air and generate large amounts of waste beyond the land's capacity, resulting in nutrient runoff, water contamination, and ecosystem damage.[85]

The pursuit of economies of scale in industrial agriculture comes at a loss of diversity throughout the agricultural system.[86] Homogenization appears in

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78. Pearson, *supra* note 15, at 411 (noting real cost of food as compared with retail prices continues to receive little attention); *see also* Horrigan et al., *supra* note 6, at 450 ("[M]eat consumption costs the United States $30–60 billion a year in medical costs.").

79 *See generally* MARIA S. BOWMAN, ESSAYS ON EXTERNALITIES AND AGRICULTURE IN THE UNITED STATES AND BRAZIL (2013) (discussing externalities in agriculture); *see also* Horrigan et al., *supra* note 6, at 454 (arguing that without checks on pollution products from industrial farms will continue to be "artificially cheap").

80. Horrigan et al., *supra* note 6, at 453 (describing benefits of a full cost accounting of agricultural production systems); *see also Externality*, https://www.investopedia.com/terms/e/externality.asp (last visited May 9, 2020) (defining externality).

81 *See*, *e.g.*, Horrigan et al., *supra* note 6, at 448 (explaining that only a minority of species can live in a high-nitrogen environment).

82 *See*, *e.g.*, Pearson, *supra* note 15, at 411 (noting that while greenhouse gas emissions and climate change are part of environmental capital, it is not considered as such "in the public mind").

83. Jules N. Pretty, *The Real Costs of Modern Farming*, RESURGENCE & ECOLOGIST, Apr. 2001 (listing harms from most to least costly); *see generally* Rattan Lal, *Soil Degradation by Erosion*, 12 LAND DEGRADATION & DEV. 519 (2001) (discussing the extent of soil degradation with particular focus on agriculture's role).

84. Pimentel et al., *supra* note 68, at 573.

85. *See*, *e.g.*, Horrigan et al., *supra* note 6, at 449 (describing burden CAFOs place on land and water resources).

86. *Id.* at 453 ("Thus, the quest for greater yields has landed farmers on a technologic treadmill of increasing inputs and decreasing profit margins.").

business structures, the marketplace, and in food retail choices. Diversity of microbial life is lost in the soil, variety is missing in monoculture crop production, and there is a lack of microorganism diversity in consumers' gut biomes. [87] Monocultural production forces out diverse species in the environment, while biodiversity serves as a defense against disease and pests.[88] Without diversity, entire regions become susceptible to a total loss if there is an outbreak of disease or pests.[89] Examples of this have been seen in entire harvests of corn and separately in herds of livestock, which is made worse by confining animals in close quarters for long periods of time.[90] Globally, monocultures have resulted in a lack of diversity in human food consumption as well: 75% of what the world eats consists of just twelve plants and five animal species.[91] Plant and soil diversity have been found to be directly linked to human health.[92] This is because a diverse diet supports a strong immune system and provides defense mechanisms to fight disease.[93] Monoculture cropping also requires ever greater amounts of chemical inputs and machinery use to compensate for nutrient loss, inefficient water management, and eroded soil.[94]

A robust soil food web is crucial for long-term ecological resilience as well. Soil microorganism diversity and soil health support a variety of essential functions, and in particular are directly linked to plant health and resilience.[95] Thus, managing farms to encourage soil biodiversity supports the capacity of the land to hold water and nutrients, handle stressors like

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87. Gunnar Rundgren, *Food: From Commodity to Commons*, 29 J. AGRIC. ENVTL. ETHICS 118, 122 (2016) (highlighting lack of diversity on regional scale); *see also* David Tilman, *Global Environmental Impacts of Agricultural Expansion: The Need for Sustainable and Efficient Practices*, 96 PROC. NAT'L ACAD. SCI. 5995, 5995 (May 1999) (describing global biodiversity loss).

88. Horrigan et al., *supra* note 6, at 448 (explaining how monocultures drive out diverse habitats); *see* Tilman et al., *supra* note 87, at 5995, 5998 (noting that, because of vast monocultural expansion replacing natural ecosystems globally, "agriculture has caused a significant simplification and homogenization of the world's ecosystems").

89. *See*, *e.g.*, Horrigan et al., *supra* note 6, at 448 (modern plant breeding chips away at resistance to disease that develops in wild breeds over the long-term); *see also* Tilman et al., *supra* note 87, at 5998 (describing direct connection between monoculture crop production and biodiversity loss, which is valuable "to increase yields and to reduce impacts of agricultural pests and pathogens").

90. Tilman et al., *supra* note 2, at 674 (example in confined animal facilities).

91. Ben Panko, *Just a Few Species Make Up Most of Earth's Food Supply. And That's a Problem* (Oct. 2, 2017), https://www.smithsonianmag.com/smart-news/extinction-threatens-foods-we-eat-180965081/; *see also* Horrigan et al., *supra* note 6, at 448.

92. Craig Liddicoat et al., *Environmental Change and Human Health: Can Environmental Proxies Inform the Biodiversity Hypothesis for Protective Microbial–Human Contact?*, 66 BIOSCIENCE 1023, 1024 (2016).

93. *Id.*

94. Tilman et al., *supra* note 2, at 674–75 (providing example in confined animal facilities).

95. LaCanne & Lundgren, *supra* note 7, at 4–5; Magdalena Frac et al., *Fungal Biodiversity and Their Role in Soil Health,* FRONTIERS MICROBIOLOGY, Apr. 2018, at 1–2; *see also* Cameron Wagg et al., *Soil Biodiversity and Soil Community Composition Determine Ecosystem Multifunctionality*, 111 PROC. NAT'L ACAD. SCI. 5266, 5266 (2014).

temperature, and precipitation, and defend against pests and pathogens.[96] Soil microorganisms support the growth of deep root systems, which reduces erosion, provide critical soil structure, and protect crops by providing water during drought and stability during storms.[97]

In an additional externality, industrial farming emits greenhouse gases, upsetting the global carbon cycle and contributing to climate change.[98] Agricultural emissions result not only from direct energy use, but also from practices that release carbon from the soil.[99] Practices like annual cropping and tillage disturb the soil, which releases carbon into the atmosphere.[100] Such practices not only contribute to rising atmospheric carbon levels and climate change, but also destroy carbon sinks that balance carbon levels in the terrestrial biome and in the atmosphere.[101] Soil plays a particularly critical role in the global carbon cycle, as soil holds three times the amount of carbon that is in the atmosphere (although atmospheric carbon concentrations are increasing) and 3.8 times the amount of carbon that is in the biotic pool (which consists of plants and animals).[102]

The production of nitrogen fertilizers, which is fossil-fuel based and itself highly energy-intensive, also contributes to greenhouse gas emissions and other forms of environmental degradation. Globally, ammonia production accounts for 3–5% of global carbon emissions—not including

96. *See* Uffe N. Nielsen et al., *Soil Biodiversity and the Environment*, 40 ANN. REV. ENVT. & RESOURCES 63, 80 (2015) (describing and illustrating components of the soil food web and the importance of soil biodiversity).

97. Pearson, *supra* note 15, at 412; Tilman et al., *supra* note 2, at 674; *see also* Brenda Lin, *Resilience in Agriculture through Crop Diversification*, 61 BIOSCIENCE 183, 183 (2011) (explaining the value of biodiversity is in its redundancy, so that "when environmental change occurs, the redundancies of the system allow for continued ecosystem functioning and provisioning of services").

98. *Source of Greenhouse Gas Emissions*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions (last updated Apr. 11, 2020) (agriculture sector accounts for 10% of U.S. greenhouse gas emissions); *see also* Rattan Lal, *Carbon Emissions from Farm Operations*, 30 ENVT. INT'L 981 (2004) (analyzing energy use and carbon emissions by various farm operations); Rattan Lal, *Soil Carbon Dynamics in Cropland and Rangeland*, 116 ENVTL. POLLUTION 353, 353 (2001) (discussing important role soils play in global carbon cycle); Horrigan et al., *supra* note 6, at 448 (addressing global impact of agricultural greenhouse gas emissions); ARNETH ET AL., *supra* note 72, at 2 (finding with high confidence that land is both a source and a sink of greenhouse gases and that "sustainable land management can contribute to reducing negative impacts of multiple stressors, including climate change, on ecosystems and societies).

99. Lal, *supra* note 98, at 354.

100. *Id.*; *see also* Pearson, *supra* note 15, at 411 (noting agricultural emissions vary widely by type of agriculture and on complexity and efficiency of food chains, and that fertilizer and emissions from livestock represent particularly inefficient uses of nutrients and energy); *see also* K. Paustian et al., *Agricultural Soils as a Sink to Mitigate CO2 Emissions*, 13 SOIL USE & MGMT. 229, 231 (1997) (discussing cultivation's role in soil carbon loss).

101. M.J. Salinger et al., *Reducing Vulnerability of Agriculture and Forestry to Climate Variability and Change: Workshop Summary and Recommendations*, 70 CLIMATE CHANGE 341, 349 (2005).

102. Lal, *supra* note 98, at 353; Pearson, *supra* note 15, at 412 (discussing importance of healthy soil).

supply-chain emissions—while the fertilizer industry accounts for vast amounts of toxic waste and pollution that harm the environment and public health.[103] Agriculture is the largest emitter of nitrous oxide, a potent greenhouse gas with a global warming potential 300 times that of carbon dioxide.[104] Seventy-five percent of U.S. nitrous oxide emissions come from agricultural soil management, 6% from chemical production, and another 5% from manure management, meaning agriculture accounts for roughly 86% of U.S. nitrous oxide emissions.[105] This is largely attributable to the fact that, since the 1960s, fertilizer use in American agriculture has increased by 300%.[106] CAFOs are also responsible for a large amount of greenhouse gas emissions, not only from methane released by livestock, but also from their energy-intensive factory-style production.[107]

II. ECOLOGICAL FARMING

A. Ecological Approaches Develop Strengths of Natural Ecosystems

The opposite of an industrial system is an ecological one that maximizes the transformation of solar energy and other resources into useful products, ideally edible ones. Ecological agriculture captures the strengths of natural ecosystems to develop agricultural ecosystems that are productive and resilient.[108] Natural ecosystems are characterized by efficient capture and use of energy and water, biological diversity above ground and in soil, self-sufficiency (only needing sunlight and water), self-regulation (diversity promotes strong defense mechanisms to disease and pests), and resiliency.[109] Through habitat conservation management, ecological farming builds these strengths into managed agricultural ecosystems to optimize productivity. This means minimal disturbance, minimal use of fossil fuels and chemical

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103. Tom Philpott, *Our Other Addiction: The Tricky Geopolitics of Nitrogen Fertilizer* (Feb. 12, 2010), https://grist.org/article/2010-02-11-tracking-u-s-farmers-supply-nitrogen-fertilizer.

104. Sabrina Shankman, *What is Nitrous Oxide and Why is it a Climate Threat?* (Sept. 11, 2019), https://insideclimatenews.org/news/11092019/nitrous-oxide-climate-pollutant-explainer-greenhouse-gas-agriculture-livestock.

105. *Id.*

106. *Fertilizer Use and Price,* U.S. DEP'T OF AGRIC., https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx (last updated Oct. 30, 2019) (Table 1: U.S. consumption of plant nutrients).

107. *See generally* E. RESEARCH GRP., INC., ENVTL. PROT. AGENCY, NON-WATER QUALITY IMPACT ESTIMATES FOR ANIMAL FEEDING OPERATIONS (2002) (using modeling to estimate air emissions from AFOs).

108. *See* Magdoff, *supra* note 4, at 110–11 (describing strengths of natural ecosystems that ecological agriculture seeks to develop).

109. *Id.*

inputs, and minimal waste.[110] Ecological farming might include diversified production and methods like perennial cropping, crop rotation and rotational grazing, livestock integration, cover crops, and no-till or conservation tillage.[111] However, the focus is on performance and not practices, which vary by farm and location.[112] The ultimate goal of ecological farming is to facilitate conditions that enable beneficial organisms and healthy plants to thrive, while deterring pests.[113] This might also be called resource-conserving agriculture, or agricultural sustainability, which emphasize food production that makes the best use of nature's goods and services without damaging them.[114]

B. Critics Argue Impracticality, Expense, and Inefficiency

The greatest criticisms of ecological farming are that it reduces yields and profits, is more expensive, requires more land, is not scalable, and is inefficient.[115] It is true that financially and practically, ecological farming is a challenging approach to take because it does not receive the variety of federal supports that industrial agriculture does.[116] These include subsidies paid for commodity crops, insurance, and market access. Industrial agriculture also is facilitated by the many loopholes in agricultural and environmental laws.

On a level playing field, however, industrial farms would struggle to compete against the benefits offered by ecological ones, without disaster relief, crop insurance, and subsidies that provide relief that diversity and

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110. *Id*. at 111; *see also* Tilman et al., *supra* note 2, at 676 (arguing ecological farming presents no cost to productivity); *see generally* Stavi et al., *supra* note 6 (comparing conservation agriculture to other forms of agriculture).

111. *See* W.R. Teague, *Forages and Pastures Symposium: Cover Crops in Livestock Production: Whole-System Approach: Managing Grazing to Restore Soil Health and Farm Livelihoods*, 96 J. ANIMAL SCI. 1519, 1519–20 (2018) (describing importance of soil health to sustainability and value of implementing ruminant grazing animals into management).

112. *See* Horrigan et al., *supra* note 6, at 454 (arguing that sustainable agriculture "is not merely a package of prescribed methods," but a change in mindset). *But see* Tilman et al., *supra* note 2, at 675 (noting challenges in measuring—and rewarding—performance rather than practices).

113. Magdoff, *supra* note 4, at 111.

114. Jules N. Pretty et al., *Resource-Conserving Agriculture Increases Yields in Developing Countries*, 40 ENVT'L SCI. & TECH. 1114, 1114 (2006); *see also* Pearson, *supra* note 15, at 409 (defining sustainable agriculture and regenerative agriculture); Horrigan et al., *supra* note 6, at 445 (using term "resource-intensive" to describe unsustainable agriculture).

115. *See* Stavi et al., *supra* note 6, at 33 (articulating importance of defining environmental sound range of agronomic activities "of which a certain extent of intensity would be tolerable" recognizing there must be some compromise).

116. *See* Tilman et al., *supra* note 2, at 675–76 (explaining that sustainable agriculture requires addressing both agriculture and environment, which "often have different objectives"); *see also* G. Philip Robertson et al., *Farming for Ecosystem Services: An Ecological Approach to Production Agriculture*, 64 BIOSCIENCE 404, 404 (2014) (analyzing uncompensated costs of providing ecosystem services).

resiliency provide in less degraded landscapes.[117] Ecological resiliency reduces risk and results in many avoided costs that also make industrial agriculture less affordable, as discussed above.[118] Because it is resilient and reduces risk and harms from weather, disease and pests, and loss of natural resources, ecological farming is cheaper in the long-term, and, with reorganized federal priorities, it would be the cheaper option today as well.[119] Advantages and incentives for industrial farming constructed by federal policy as well as mechanisms to improve the feasibility of ecological farms are further discussed in Parts IV and V.

Contrary to criticism, research shows ecological systems often result in higher profits, nutritional quality, and comparable or greater yields per acre relative to industrial systems. This data makes sense considering that ecological farming has also been shown to be more efficient, diverse, and resilient, than its mechanized counterparts.[120] In the following section, I describe these and other advantages of ecological agriculture.

C. Ecological Farming is Diverse, Efficient, and Resilient

By prioritizing soil health and biodiversity in soil and above ground, ecological management promotes energy efficiency, nutrient cycling, water infiltration and retention, and carbon cycling.[121] Healthy soil is rich in organic content, which means it is energy-rich, and thus a valuable resource that provides nutrients and energy for productive and high-quality plant growth.[122] Healthy soil therefore reduces the need for energy and chemical inputs, and offers a host of other benefits, including reduced erosion, watershed management, and climate regulation.[123]

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117. *See*, *e.g.*, Liz Carlisle, *Factors Influencing Farmer Adoption of Soil Health Practices in the United States: A Narrative Review*, AGROECOLOGY & SUSTAINABLE FOOD SYS., Feb. 2016, at 6–7 (describing financial benefits of sustainable agriculture); *see also* Tilman et al., *supra* note 2, at 676 (considering costs of industrial farming); Joanna Becker, *Can Sustainable Agriculture/Habitat Management Pay Off?*, 17 J. SUSTAINABLE AGRIC. 113, 115 (2000) (describing finding of European study that paying for environmental benefits would cost the same or less than current agricultural subsidies).

118. Richard Tingem Munang et al., *Ecosystem Management: Tomorrow's Approach to Enhancing Food Security Under a Changing Climate*, 3 SUSTAINABILITY 937, 939–40 (2011).

119. *See generally* Cheryl Palm et al., *Conservation Agriculture and Ecosystem Services: An Overview*, 187 AGRIC. ECOSYSTEMS & ENVT. 87 (2014) (presenting benefits of conservation agriculture); *see also* Costanza et al., *supra* note 9 (discussing, generally, the economic values of ecosystem services).

120. *See generally*, *e.g.*, Robertson et al., *supra* note 116 (discussing resiliency benefits).

121. Wei Zhang, et al., *Ecosystem Services and Dis-Services to Agriculture*, 64 ECOLOGICAL ECON. 253, 255–56 (2007).

122. *See* Stavi et al., *supra* note 6, at 35 (compiliing factors used to evaluate soil health).

123. Tilman et al., *supra* note 2, at 674; LaCanne & Lundgren, *supra* note 7, at 5 (explaining that greater profitability is associated with fewer inputs).

Ecological farming involves selecting crops that are best suited to the landscape and season, require less inputs, and deliver more nutrition. Thus, management decisions are made that optimize whole landscape function, rather than simply reflect the demands of agribusiness and commodity markets.[124] Learning from the efficient energy and water conversion processes of natural ecosystems, ecological management uses practices that improve ecosystem function, such as cover cropping, crop rotations, covering the ground with plant residues, and no-till.[125] Studies show energy consumption for conventional tillage is significantly higher than for no-till crop production.[126] Reducing tillage also improves soil health and reduces soil erosion, which is detrimental to soil and farm productivity.[127] Pasture-based animal production is significantly less energy intensive than using feed for animal production, and improves the health of the animals, the quality of the products, and the health of the soil and landscape.[128] Grass-based livestock also minimize the energy intensity involved in feed production, processing, and transport.[129]

Rather than compromising yield size as critics argue, ecological farming can increase yields, profits, and nutrition.[130] Preserving natural resources like soil and water contributes to the long-term sustainability and productivity of agricultural ecosystems.[131] Crops, and perimeter plants *around* crops, are grown to provide protection from pests, and to enhance soil health.[132] Leguminous crops are introduced to biologically fix nitrogen, reducing reliance on chemical inputs and increasing soil organic matter.[133] This improves nutrient retention and supports water infiltration and reduces

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124. Thomas Allen & Paolo Prosperi, *Modeling Sustainable Food Systems*, 57 ENVTL. MGMT. 956, 957 (2016) (describing resilience as one of several "sustainability properties" of food systems).

125. *See generally* Ronald Vargas Rojas et al., *Healthy Soils: A Prerequisite for Sustainable Food Security*, 75 ENVTL. EARTH SCI. 179 (2016) (articulating critical role of healthy soils).

126. Pelletier et al., *supra* note 58, at 227.

127. Robertson et al., *supra* note 116, at 407.

128. Pelletier et al., *supra* note 58, at 229. In a survey of U.S. dairies, energy use varied from as low as 1670 MJ per year per animal for a pasture-based dairy to as high as 5893 MJ for a hybrid facility. *Id.*

129. *Id.* at 228; Horrigan et al., *supra* note 6, at 446 (discussing energy intensity of transportation in food system).

130. LaCanne & Lundgren, *supra* note 7, at 2 (concluding sustainability requires systemic shift to model that generates high yields and conserves natural resource base).

131. *See id*. (distilling sustainable farming principles).

132. *See id*. at 3–4 (describing finding that insect populations were ten times higher on insecticide-treated farms than on insecticide-free farms, explaining that pests result from lack of diversity); A.M. Shelton & F.R. Badenes-Perez, *Concepts and Applications of Trap Cropping in Pest Management*, 51 ANN. REV. ENTOMOLOGY 285, 288 (2006) (explaining the impact of using perimeter crops for pest management on overall agricultural system health).

133. *See* RAM SWAROOP MEENA & RATTAN LAL, LEGUMES AND SUSTAINABLE USE OF SOILS 2, 8–11, 13 (2018) (describing the benefit of using legumes for sustainable agriculture).

erosion.[134] Nitrogen cycling is also improved with manure and residues, which in turn reduce losses and costs of inputs and remediation.[135] Perennial cropping systems also reduce chemical use and can result in as much as 35 times more nitrogen efficiency than annual monoculture cropping.[136]

Research shows that ecological management can produce equal, and in many cases higher, yields than systems with intensive chemical and fossil fuel use.[137] One study showed that measures to improve environmental performance in crop production systems increased yields by 79–200%.[138] Data shows that ecological farms increase productivity by more efficient use of the biotic energy embedded in biomass and less energy inputs.[139] Another study demonstrated how, over the course of a decade, farmers in 286 projects in 57 countries improved crop productivity, reduced pesticide use, and increased water use efficiency and carbon sequestration.[140]

Ecological farming enhances plant growth by promoting microbial diversity in the soil.[141] In addition to considering productivity and taste, crops are selected that are resistant to local pests, contributing to the resiliency of the farm.[142] Improving soil health reduces erosion and nutrient runoff, improves watershed function and system resiliency, and reduces risk and damage.[143] Biodiversity provides defense mechanisms against pests and disease outbreaks.[144] Fungal-based soil food webs are common in ecological systems and are more adapted to drought than the bacteria-based food webs common in industrial systems.[145] By enhancing soil health and biodiversity, ecological farms also reduce air pollution, reduce soil and water contamination, and preserve carbon sinks.[146] This helps to mitigate climate

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134. *Id*.

135. Pelletier et al., *supra* note 58, at 235–36.

136. *Id.* at 238.

137. *See* LaCanne & Lundgren, *supra* note 7, at 5 (arguing that regenerative production can be twice as profitable as conventional corn production).

138. Pelletier et al., *supra* note 58, at 238.

139. *Id*. at 235–36.

140. Pretty et al., *supra* note 114, at 1114.

141. Ricardo Cavicchioli et al., *Scientists' Warning to Humanity: Microorganisms and Climate Change*, 17 NATURE REVIEWS MICROBIOLOGY 569, 578 (2019).

142. Pretty et al., *supra* note 114, at 1114.

143. LaCanne & Lundgren, *supra* note 7, at 6 (addressing value to watershed function and benefits for diversity in both soil and animals); *see also* U.S. DEPT. OF AGRICULTURE, HEALTHY SOIL = CLEAN WATER.

144. LaCanne & Lundgren, *supra* note 7, at 5; *see also* Lin, *supra* note 97 (describing how crop diversification enhances resiliency in agriculture).

145. Cavicchioli et al., *supra* note 141.

146. LaCanne & Lundgren, *supra* note 7, at 6–7 (noting that soil organic matter has been found to be a more important driver of proximate farm profitability than yields, and results in improved resiliency for several reasons, including because of more diverse income stream).

change and provides other immense benefits to public health and the long-term sustainability of our food system.

III. HISTORY OF AMERICAN FARM POLICY

In this section, I will briefly review the history of American farm policy, examining its coevolution with industrialized agriculture and divergence from conservation. At the dawn of the 19th century, small independent farms covered the landscape and farmers represented the nation's population.[147] Maintaining a farmer citizenry, according to Thomas Jefferson, was vital to the nation, "wedded to its liberty and interests by the most lasting bonds."[148] The 1800s were a time of settlement, land distribution, and expansion of the great American frontier, which remained open until 1890.[149] The Homestead Act of 1862 encouraged settlement, offering settlers 160-acre plots if they farmed the land for five years, a deal sweetened by the low mortgage rates and other incentives the railroad companies provided.[150] Settlers were motivated to improve the land they farmed whether they acquired acreage from the government or sold it at a profit to move further west.[151] Those who struggled to conserve resources exhausted the land quickly and bore the consequences, often deserting it to move further west.[152] By 1905, the two million farms of 1860 had tripled to six million, and the value of farms rose from eight billion to thirty billion dollars.[153]

By the second half of the nineteenth century, a conservation movement was on the rise, championed by leaders like George Perkins Marsh.[154] Amongst his goals in writing *Man and Nature* was to alert society to the

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147. IMHOFF & BADARACCO, *supra* note 35, at 37.

148. *Id.*

149. *See generally* LIBRARY OF CONGRESS, WESTWARD EXPANSION: ENCOUNTERS AT A CULTURAL CROSSROADS (describing westward settlement expansion in the 19th century).

150. Homestead Act of 1862, Pub. L. No. 37-64, 12 Stat. 392 (1862); *see also* Eric Alston & Steven Smith, Development Derailed: Uncertain Property Rights and Asset-Specific Investment (Mar. 5, 2020) (unpublished manuscript) (available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3201434) (exploring impacts of railroad land grants and western settlement on perceptions of property rights, public lands, and conservation).

151. 12 Stat. at 392.

152. *Westward Expansion: Economic Development,* https://www.khanacademy.org/humanities/us-history/the-gilded-age/american-west/a/westward-expansion-economic-development (last visited Mar. 28, 2020) (summarizing era of western settlement).

153. U.S. BUREAU OF THE CENSUS, HISTORICAL STATISTICS OF THE UNITED STATES, COLONIAL TIMES TO 1970 457 (1975).

154. *The Evolution of the Conservation Movement, 1850-1920*, LIBRARY OF CONGRESS, www.loc.gov/teachers/classroommaterials/connections/conservation/history.html (last visited Mar. 28, 2020).

dangers of agricultural expansion without conservation.[155] Meanwhile, political and social unrest grew amongst farmers, stirred by monopolistic behavior of railroads and grain companies, giving rise to the Populist Movement and formation of farmers' groups like the Grange and the Greenback party.[156] Farmer organizing of that era offers a rare example of successful collective action, despite inherent challenges like free-riding: incentives favor noncontribution to collectively producing public goods and services (those which are impossible to exclude others from enjoying).[157] Farmer groups influenced some of the major landmark legislative and judicial decisions of the progressive era. These included the Sherman Anti-Trust Act, which banned price-fixing agreements and other monopolistic behavior, and the Supreme Court decision in *Munn v. Illinois*, which affirmed state authority to regulate private industry actions like exploitative price-setting by grain companies.[158] Although these early grassroots organizations bear little resemblance to their descendants, their advocacy for cooperative marketing and fair competition inadvertently laid the groundwork for eventual agribusiness expansion and political dominance.

A. Early 20th Century Farm Policy

The years leading up to World War I brought prosperity to U.S. farmers, and they continued to thrive during the war, when food shortages in allied nations spiked demand abroad.[159] To address the domestic shortages and high prices that resulted, the government encouraged farmers to increase their production. Congress passed legislation in 1916 to provide credit options for farmers, encouraging them to take on debt in order to expand acreage and

155. GEORGE PERKINS MARSH, MAN AND NATURE iii (1864) (noting that one "object of the present volume" is "to point out the dangers of imprudence and the necessity of caution in all operations which, on a large scale, interfere with the spontaneous arrangements of the organic or the inorganic world").

156. *Farmers Revolt in the Populist Era*, https://courses.lumenlearning.com/suny-ushistory2os2xmaster/chapter/farmers-revolt-in-the-populist-era/ (last visited Apr. 6, 2020); James L. Stewart, *The Economics of American Farm Unrest, 1865-1900,* ECON. HISTORY ASS'N, https://eh.net/encyclopedia/the-economics-of-american-farm-unrest-1865-1900/ (last visited Apr. 17, 2020).

157. *See* MANCUR OLSON, JR., THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS 9–16 (1965) (noting that, even with agreement about methods to achieve common good, large groups will not organize to further common goals absent coercion or separate incentives); *see also* Stewart, *supra* note 156 (noting that, although "a rational and self-interested farmer would not join a lobbying group because he could enjoy the benefits of its work without incurring any of the costs," farmer organizations overcame free-riding by, for example, creating economic incentives for membership).

158. *See generally* Munn v. Illinois, 94 U.S. 113 (1887) (holding state regulations setting maximum rates grain storage and transport constitutional); Sherman Antitrust Act, 15 U.S.C. §§ 1–38 (1890) (banning monopolistic behavior of companies).

159. Todd Kosmerick, *World War I and Agriculture*, N.C. STATE UNIV. LIBRARY (Aug. 18. 2017), https://www.lib.ncsu.edu/news/special-collections/world-war-i-and-agriculture.

invest in equipment to intensify their production.[160] With the newly popular gasoline-powered tractor and the timely successful synthesis of ammonia in 1913, production increased significantly, and the seeds of industrial agriculture were planted.[161]

With the support of farmer organizations, the Cooperative Extension Service was formed in 1914.[162] This facilitated a wealth of agricultural research and resources for farmers to improve resiliency of their farms.[163] Examples of early agricultural research are full of information about the values of conservation to farming, the economy, and the public good. The Department of Agriculture even dedicated an entire edition of its annual yearbook to the value of soil and the importance of conservation for the entire nation.[164] Articles addressed good soil management techniques, such as legume-based nitrogen fixation, cover crops, efficient fertilizer use, and presented data on the importance of soil organic matter for crop productivity.[165] In one particular article describing the public benefits of conservation farming, Carl Taylor wrote, "the central public purpose of using soil for agriculture is to sustain on a relatively permanent basis the highest possible standard of living for the people of the United States."[166]

After World War I ended, however, and relief efforts dwindled, farmers faced mounting debt and a looming economic crisis.[167] While demand was low for agricultural products, prices also remained low because wartime investment in expansion, equipment, and intensive systems of production resulted in enormous surpluses. By the 1930s, farmers found themselves at the front lines of the economic crisis taking hold of the country. In 1932, farm prices had dropped by 50% in just three years, while the goods and services

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160. Federal Farm Loan Act, 7 U.S.C. §§ 1921–23 (2018).

161. *See generally* Warehouse Act, 7 U.S.C. §§ 241–256 (2018) (regulating the use of warehouses to store agricultural products); Federal Farm Loan Act, 39 Stat. 360 (1916) (providing long-term, low-interest loans to help small farmers and ranchers); *The Froelich Tractor*, www.froelichtractor.com/thetractor.html (last visited Apr. 17, 2020) (describing the success of the first gas-powered tractor); John Paull, *A Century of Synthetic Fertilizer: 1909-2009*, ELEMENTALS J. BIO-DYNAMICS TASMANIA, no. 94, 2009, at 17.

162. Smith-Lever Act, 7 U.S.C. §§ 341–343 (1914) (creating the Cooperative Extension Service).

163. *Id.*; *see generally Munn*, 94 U.S. at 134–35 (holding state regulations setting maximum rates grain storage and transport constitutional); Sherman Antitrust Act, 15 U.S.C. §§ 1–38 (1890); ECON. RESEARCH SERV., U.S. DEP'T OF AGRIC., STRATEGIC PLAN FOR 2007-2012, at iii–iv (2007).

164. *See generally* U.S. DEP'T OF AGRIC., H.R. DOC. NO. 398, SOILS & MEN: YEARBOOK OF AGRICULTURE 1938 (1938) (discussing public importance of soil).

165. *See generally id.* (compiling data on the importance of soil).

166. Carl Taylor et al., *The Public Purposes in Soil Use*, *in* U.S. DEP'T OF AGRIC., H.R. DOC. NO. 398, SOILS& MEN: YEARBOOK OF AGRICULTURE 47, 47 (1938).

167. *See*, *e.g.*, Larry Reichenberger, *History The Great War: Agriculture in the Aftermath of World War I*, THE FURROW, https://www.johndeerefurrow.com/2018/11/04/the-great-war/ (last visited Apr. 6, 2020) (recounting the encouragement of federal policies to increase production during the war and the resulting post-war fall-out).

farmers relied on to run their farms dropped by just 32%.[168] Some farmers made efforts to implement voluntary production control as the government recommended, although these ultimately failed. Government measures to stabilize the farm economy—such as collective marketing exemptions, tariffs, and financing options for farm cooperatives—were equally unsuccessful.[169] U.S. farm prices continued to drop as surpluses grew larger.[170] Consumed by debt, many farmers faced foreclosure, depressed land value, and severe drought. This compounded the impacts of the past 20 years of intensive production, resulting in extreme soil erosion across the country.[171] The Dust Bowl that ensued is said to have carried soil from the Great Plains all the way to Washington, D.C., where Hugh Hammond Bennett was testifying to Congress about the public value of soil conservation.[172] He advised lawmakers that soil erosion reduced the ability of the land to sustain agricultural productivity and to support rural communities who depended on it for their livelihoods.[173]

The New Deal response to the farm crisis presents perhaps the most striking example of conservation values embedded in farming policy in U.S. history. As dust blew across America and beyond its shores, and Americans joined farmers in the throes of an economy-wide depression, the connection between national security and the degradation of American soil became painfully clear.[174] A new era of farm policy emerged, grounded in the theory that the health of the soil, the farm economy, and the nation were inseparably linked. It was generally understood by that time that the government had an obligation to ensure economic stability for farmers who had answered production demands at the government's beckoning during World War I.[175] After postwar relief and subsequent legislative efforts failed, and dust swept the Great Plains, it became clear that farm policy required more direct financial support, in the form of supply management and price supports, embedded with rewards and resources to support conservation. New Deal

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168. ECON. RESEARCH SERV., U.S. DEP'T OF AGRIC., AIB-485, HISTORY OF AGRICULTURAL PRICE-SUPPORT AND ADJUSTMENT PROGRAMS 1933-84 1(1984).

169. *See* Capper-Volstead Act, Pub. L. No. 67-146 (1922) (exempting farmer cooperatives from antitrust laws); *see also* Agricultural Appropriation Act, Pub. L. No. 58-188 (1905) (creating US Bureau of Agricultural Economics); Fordney-McCumber Act, 42 Stat. 858 (1922) (imposing tariffs on imports); Smoot-Hawley Tarriff, Pub. L. No. 71-361 (1930) (imposing tariffs on imports); Agricultural Marketing Act, Pub. L. No. 71-10 (1929) (authorizing credit for cooperatives).

170. ECON. RESEARCH SERV., *supra* note 168, at 2.

171. *Id*. at 1.

172. *More Than 80 Years Helping People Help the Land*, U.S. DEP'T OF AGRIC., https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/about/history/?cid=nrcs143_021392 (last visited Apr. 21, 2020).

173. *Id*.

174. *Id*.

175. *Id*.

farm legislation implemented measures to achieve "balance between production and consumption of agricultural commodities,"[176] such as price supports, supply controls, and formation of the Soil Conservation Service (SCS). Now the Natural Resources Conservation Service (NRCS), the SCS was created because "wastage of soil and moisture resources on farms," was a "menace to the national welfare."[177] The voluntary domestic allotment plan was the first major price support program.[178] The program used voluntary contracts with producers to achieve acreage reduction with processors to regulate the market. Processing taxes were also implemented although the U.S. Supreme Court soon thereafter declared these to be unconstitutional.[179] Financial tools sought parity in the exchange relationship between agriculture and industry, and conservation efforts reflected lawmakers' realization that "by uprooting its topsoil, the United States had been living in a fool's paradise." [180] The success of the New Deal programs was immediately apparent, as farm income increased 50% from 1932 to 1935, with only 25% of the increase in cash income attributable to federal payments.[181]

Congress reaffirmed its intent to embed conservation into federal farm policy the following year when it passed the Soil Conservation and Domestic Allotment Act of 1936, which jointly pursued soil conservation, profitable use of natural resources, and a stable supply of food.[182] The law authorized payments for farmers who incorporated conservation into their farming systems, such as planting native grasses and legumes to support soil health and function.[183] Because surplus crops like wheat were "soil-depleting," farmers were paid to transition acreage to crops that conserved and enhanced the quality of the soil.[184] The first conservation compliance rules were created as well, although unlike modern rules, the early version applied more broadly than just to severely degraded land.[185]

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176. Agricultural Adjustment Act, Pub. L. No. 73-10, 48 Stat. 31 (1933) (codified as amended in scattered sections of 7 U.S.C.); Soil Conservation Act of 1935, Pub. L. No. 74-46, 49 Stat. 163 (1935) (codified as amended in scattered sections of 16 U.S.C.) (enacted "to provide for the protection of land resources against soil erosion").

177. 49 Stat. 163 (enacted "to provide for the protection of land resources against soil erosion").

178. *Id*.

179. *Id*.; U.S. v. Butler, 297 U.S. 1 (1936) (holding spending power broad but processing taxes unconstitutional).

180. *Soil Conservation in the New Deal Congress*, U.S. HOUSE OF REPRESENTATIVES HISTORY, ART & ARCHIVES, https://history.house.gov/Historical-Highlights/1901-1950/Soil-Conservation-in-the-New-Deal-Congress/ (last visited April 6, 2020) (quoting John Conover Nichols of Oklahoma).

181. ECON. RESEARCH SERV., *supra* note 168, at 5.

182. 49 Stat. 163.

183. *Id*.

184. *Id*.

185. *Id*.

Conservation programs of the 1930s were grounded in the philosophy adopted by Aldo Leopold. They were put in place not to reduce production, but to maintain the functional integrity of the soil, and to achieve "harmony between man and land."[186] Leopold explained to a group of Wisconsin farmers in 1939 that "when land does well for its owner, and the owner does well by his land, when both end up better by reason of their partnership, we have conservation. When one or the other grows poorer, we do not."[187] However, because production did begin to increase after conservation programs were implemented, they consequently drew criticism from some lawmakers and farmers.[188] This is interesting because today, critics often claim that conservation is at odds with production, yet history refutes this argument. Despite criticism, conservation survived in the next version of the Farm Bill, the Agricultural Adjustment Act of 1938.[189] The Act authorized price support in the form of nonrecourse loans and crop insurance for wheat, laying the groundwork for the continued expansion of subsidies, manifesting in modern examples like the Marketing Assistance Loan program and federal crop insurance.[190] Additionally, the 1938 Farm Bill contained the first version of the federal crop insurance program, which imposed acreage limits and required participants to implement soil conservation practices.[191]

Farm policy of the 1930s advanced the vision of an agricultural economy that maintained the function of natural resources. However, the notion that conservation provides the enrichment of land, farmers, and the public would soon be left in the dust, along with the diversity, resiliency, and self-sufficiency that once characterized American farming. While price supports and conservation programs would continue to stabilize the farming economy until mid-century, industrial use of chemicals, fossil fuels, and industrial equipment would quickly replace conservation as the sustenance of agriculture.

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186. Aldo Leopold, *The Farmer as Conservationist* (1939), *reprinted in* THE RIVER OF THE MOTHER GOD AND OTHER ESSAYS BY ALDO LEOPOLD 255 (Susan L Flader & J. Baird Callicott eds., 1991).

187. *Id.* Thirty years later, in the National Environmental Policy Act of 1969, Congress used the same language to declare a national policy to "encourage productive and enjoyable harmony between man and his environment." National Environmental Policy Act of 1969, Pub. L. No. 91-190, §2, 83 Stat. 852, 852 (1970) (prior to 1975 amendment).

188. *See*, *e.g.*, Zachary Cain & Stephen Lovejoy, *History and Outlook for Farm Bill Conservation Programs*, CHOICES, 2004, at 37–39 (comparing historical expenditures on conservation and describing how conservation resulted in *increased* output on farms).

189. Agricultural Adjustment Act, Pub. L. No. 75-430, 52 Stat. 31 (1938) (codified as amended as amended 7 U.S.C. §§ 1281–1393).

190. *Id.*

191. *Id.*

B. Farm Policy in the 1970s

The popularity of free-market agriculture grew under President Eisenhower and Secretary of Agriculture Ezra Taft Benson, who favored price supports that decreased as supplies increased.[192] The Agricultural Act of 1954 eliminated fixed price supports and marketing quotas entirely, resulting in drastic increases in production, chemical use, expansion, and CAFOs.[193] While conservation was present in the Agricultural Act of 1956, for the first time the government diverged from past conservation policy.[194] The 1956 Act reflected a different idea, that farming was inherently extractive, and that, to protect the land, the land must be taken out of production entirely.[195] An early version of the Conservation Reserve Program included an acreage reserve and a conservation reserve.[196] The acreage reserve was eliminated just two years in later in 1958 in response to criticism that it was ineffective and too costly.[197] The conservation reserve slowly dwindled in popularity until it was abandoned in 1972.[198] Production continued to increase through the 1960s despite efforts to implement stricter production controls and higher mandatory price supports, which met with limited success and political opposition from farm organizations.[199]

By the 1970s, conservation had been all but erased from federal farm policy.[200] Meanwhile, the American farm lobby was gaining political influence and taking on an industrial character.[201] While farm organizations of the past had advocated for high price supports and supply control to bring about parity, the food industry was increasingly specialized, and its politics began to reflect the interests of food manufacturers and not small independent farmers.[202] U.S. farm policy soon began to mirror the priorities of food manufacturers and agrichemical companies, which had little interest in

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192. Edward L. Schapsmeier & Frederick H. Schapsmeier, *Eisenhower and Agricultural Reform: Ike's Farm Policy Legacy Appraised*, 51 AM. J. ECON. & SOC. 147, 152-53 (1992).

193. ECON. RESEARCH SERV., *supra* note 168, at 21, 22.

194. Agricultural Act of 1956, Pub. L. No. 84-540, 70 Stat. 188 (1956) (codified as amended 7 U.S.C. §§ 1801-1838) (enacting the Soil Bank Program under Title I).

195. 70 Stat. 188.

196. ECON. RESEARCH SERV., *supra* note 168, at 22.

197. *Id*.

198. *Id*.

199. *Id*. at 23, 24.

200. *See id.* at 29 ("[I]ts emphasis on maintaining or increasing output was in marked contrast to earlier programs to curtail production of wheat, corn, upland cotton, and tobacco.").

201. *See*, *e.g.*, Ginette Aley, *American Agricultural Movement*, ENCYCLOPEDIA OF THE GREAT PLAINS, http://plainshumanities.unl.edu/encyclopedia/doc/egp.pd.004.xml (last visited Apr. 7, 2020) (describing effectiveness of the American Agricultural Movement political lobbying).

202. *See* ECON. RESEARCH SERV., *supra* note 168, at 23, 29 (explaining how food policy shifted from conservation to production and demand for fertilizers and pesticides raised).

conservation, not because it slowed production, but because it provided competition for the industrial products they marketed to farmers.[203] In 1964, Congress for the first time authorized farm subsidy payments to domestic handlers and manufacturers like textile mills, to lower the price of cotton below export prices.[204] Acreage controls had been eliminated for most crops in 1970, and payments to farmers were capped at a total of $55,000 per crop.[205] In 1971, federal farm policy came to reflect the priorities of Secretary Butz, an active agriculture industry board member and staunch champion of industrial agriculture.[206] Butz's personal and political interests were motivated by the singular desire for a high volume of cheap agricultural outputs, which benefitted grain companies and industrial processors and handlers.[207]

The Agriculture and Consumer Protection Act of 1973 incentivized production to lower prices for consumers and to expand export markets, providing perhaps the most comprehensive and coordinated federal support for industrial agriculture yet.[208] Target prices replaced previous price supports and were determined by productivity, measured relative to the most recent three-year national average price for a given crop.[209] Loans were authorized at below market value if market prices fell below target prices, encouraging farmers to take on debt in order to produce more.[210] Despite depressed farm prices and public outcry, Secretary Butz advised farmers to "adapt or die," "get big or get out," and "plant fence row to fence row" to maximize production.[211] Many farmers did get bigger instead of going out of business. Between 1970 and 1984, U.S. farm debt increased more than

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203. *See* Eubanks, *supra* note 12, at 226, 240 (describing historic transition from a family-based agricultural system to a corporate one).

204. ECON. RESEARCH SERV., *supra* note 168, at 25; Agricultural Act of 1964, Pub. L. No. 88-297, 78 Stat. 173 (1964); *see also* Food and Agricultural Act, Pub. L. No. 89-321, 79 Stat. 1187 (1965) (implemented conservation reserve programs to convert acreage for 40% value of diverted crop).

205. *Government Subsidies*, WESSELS LIVING HISTORY FARM https://livinghistoryfarm.org/farminginthe70s/making-money/government-subsidies/ (last visited Apr. 17, 2020).

206. Butz had previously served as Assistant Secretary of Agriculture under President Eisenhower from 1954-1957. IMHOFF & BADARACCO, *supra* note 35, at 36.

207. *Id.*

208. *See* ECON. RESEARCH SERV., *supra* note 168, at 29 (explaining how the Agricultural and Consumer Protection Act of 1973 focused on expanding production, lowered prices, and introduced new concepts such as target prices to replace price support payments).

209. *Id*. at 29, 30.

210. *See id*. at 30 (explaining how loans at below market prices "put greater reliance on the marketplace").

211. Tom Philpott, *A Reflection on the Lasting Legacy of 1970s USDA Secretary Earl Butz* (Feb. 8, 2008), https://grist.org/article/the-butz-stops-here/; James Risser & George Anthan, *Why They Love Earl Butz* (June 13, 1976), https://www.nytimes.com/1976/06/13/archives/why-they-love-earl-butz-prosperous-farmers-see-him-as-the-greatest.html.

tenfold, and when interest rates rose in the 1980s, one-third of family farms went bankrupt.[212] While America's farmers accrued debt and many lost their farms, food processors on a grand scale enjoyed huge benefits, profiting enormously from low commodity prices and large surpluses.[213] The federal government financed monumental industrialization of American farms, agribusiness, and politics into the 21st century.

C. 1980s Conservation Policy

Although conservation policy reemerged in 1985, when Congress once again declared a national policy "to improve and protect soil and water resources and promote conservation," it was a different interpretation of conservation than the kind integral to early farm policy.[214] However, for the first time, conservation programs were placed under a separate title of the Farm Bill.[215] While many scholars claim this marked a victory for conservation, describing this period as the dawn of conservation, it really marked a new and different dawn—a conservation policy premised on the belief that eventual exhaustion of resources is inevitable.[216] An earlier era of conservation would have rejected that premise entirely, having been informed rather by the notion that farming *relies* on conservation for the replenishment of its most necessary resources like soil, water, and land.[217] With 1980s programs like the Conservation Reserve Program, which offered ten-year easements to take land out of production, conservation became a restraint on farming, not a strategy for its improvement.[218] Modern farm policy continues to utilize conservation as a crisis management tool,

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212. Philpott, *supra* note 211.

213. *Id.*

214. S. 884, 97th Cong. (1981-1982); Agricultural and Food Act of 1981, Pub. L. No. 97-98, § 1501–38, 95 Stat. 1213, 1328 (1981) (codified as amended 7 U.S.C. §§ 1501-1538); *see also Farm Bill a Short History and Summary*, https://www.farmpolicyfacts.org/farm-policy-history/ (last visited Apr. 7, 2020) (discussing how original farm policy focused on conservation and how farm policy has evolved to focus on lands cost-share assistance programs).

215. *Farm Bill a Short History and Summary*, *supra* note 214.

216. *See generally* Robert H. Hilderbrand et al., *The Myths of Restoration Ecology*, 10 ECOLOGY & SOC'Y (2005) (describing the "pathology of natural resources management", derived from the assumption that "we have the knowledge, abilities, and foresight to actively control ecosystem structure and function to manage for a particular ecosystem state indefinitely into the future," which acted upon "invariably decreases system resilience by reducing the range of natural variation and adaptive capacity for the system to respond to disturbances").

217. *See Farm Bill a Short History and Summary*, *supra* note 214 (providing an example of how the original Farm Bill focused on conservation by putting "the most highly erodible ground back into grass or other conservation uses").

218. MEGAN STUBBS, CONG. RESEARCH SERV., R42783, CONSERVATION RESERVE PROGRAM (CRP): STATUS AND ISSUES 1 (2014); *see also* Food and Agricultural Act of 1965, Pub. L. No. 89-321, §402, 79 Stat. 1187, 1195 (1965) (implementing conservation reserve programs to convert acreage for 40% value of diverted crop).

confirming that the true value of conservation once integral to farming policy, has been left in the dust of the 1930s.[219]

IV. FARM POLICY AND CONSERVATION IN THE 21ST CENTURY

Farm policy of the early 20th century planted the seeds of an American agricultural system rooted in conservation, health, and long-term resilience. However, as is the way with unintended consequences, New Deal policies would come to betray the values they extolled, as they also provided the tools for government manipulation of agricultural markets and the unregulated expansion of agribusiness and food processing. Twenty-first century farm policy continues to confer enormous advantages on large-scale intensive agriculture, to the disadvantage of small diversified farms and devaluation of the potential ecological benefits agriculture can provide.[220] According to current Agriculture Secretary Sonny Perdue, "[i]n America, the big get bigger and the small go out."[221] Federal support for industrial agriculture enhances pollution, depletes resources, degrades the environment and public health, and increases risk to the domestic food supply, farmland, and national security.[222] It also increases dependency on foreign markets and vulnerability to pests, disease, and weather.[223] Although federal spending is authorized to promote the general welfare, the government encourages expansion, consolidation, intensive and wasteful production, monocultures, farmland conversion, and other irrational behavior in the agricultural sector.[224] Environmental law exemptions and permitting regulations further these patterns. The only justification for public spending would be to *correct* irrational behavior, not to cause it. Nevertheless, a variety of federal rules and programs support industrialized agriculture and deter ecological farming.[225] In this section, I discuss a few emblematic examples of this dynamic, including commodity programs, crop insurance, disaster relief, and

219. *See*, *e.g.*, Chad G. Marzen, *The 2018 Farm Bill: Legislative Compromise in the Trump Era*, 30 FORDHAM ENVTL. L. REV. 33, 49 (2019).

220. RANDY SCHNEPF, CONG. RESEARCH SERV., R45730, FARM COMMODITY PROVISIONS IN THE 2018 FARM BILL (P.L. 115-334) 4 (2019).

221. *See U.S. Agriculture Secretary: Family Farms Might Not Survive*, https://www.cbsnews.com/news/agriculture-secretary-sonny-perdue-says-family-farms-might-not-survive/ (last visited Apr. 7, 2020) (explaining how "In America, the big get bigger and the small go out" and how small farms are being lost).

222. SCHNEPF, *supra* note 220220, at 4.

223. *Id*.

224. U.S. CONST. art. I, §8, cl. 1 (authorizing spending "to pay the debts and provide for the common defense and general welfare of the United States").

225. *See* SCHNEPF, *supra* note 220 (referring to the programs supporting agriculture).

conservation programs under the current Farm Bill. In addition, I include a few environmental law provisions to demonstrate how modern federal policy perpetually promotes the degradation of American water, air, and soil.

A. Commodity Programs

Modern federal farm subsidies fundamentally differ from their ancestors, the supply control mechanisms of the 1930s and 1940s, which were designed to stabilize prices and farm income and based payments on farm production activities.[226] In contrast, subsidies today decouple payments from actual production and depend instead on historical program "base" acres and price averages.[227] While the theory justifying price supports may be sound, their current structure does not serve their purpose, and instead perpetuates a risky business model dependent on monoculture crops, which are vulnerable to market swings, disease and pests, and climate change.[228] The early rationale for subsidies—to achieve parity between the purchasing power of farmers and industry—has been distorted over the last few decades. Today's subsidies therefore achieve an opposite outcome, at enormous expense to taxpayers, the environment, and most of all, to farmers.[229] Industrial food processors are the main beneficiaries of these subsidies, which were designed to instead stabilize farmers' bottom lines and ensure a stable agricultural economy.[230] In their current form, subsidies support inefficient, nondiverse, and non-resilient production of a short list of commodity crops that can be sold cheaply to processors or the federal government, on the taxpayer's dollar.[231] Examples in the current Farm Bill include revenue support programs, disaster assistance, and conservation programs.[232]

The major subsidy programs, Marketing Assistance Loans, Price Loss Coverage, and Agriculture Risk Coverage, neither serve their original purpose, nor do they support resiliency and sustainability of American agriculture.[233] Marketing assistance loans (MAL) provide producers with the option each year at harvest to put up their harvested crop as collateral for a nine-month non-recourse loan at a statutorily set loan amount for that particular commodity, which they can choose to repay after the interim

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226. *Id*. at 7.
227. *Id.*
228. *Id*. at 3.
229. *Id*.
230. *Id*.
231. *See id.* at 4 (referring to the list of commodities and the impact they have).
232. *Id.* at Summary.
233. *See generally* Agriculture Improvement Act of 2018, 7 U.S.C. §§ 9011–9018, 9031–9040 (2018) (providing the major subsidy programs).

period or keep as payment for their forfeited harvest.[234] MAL effectively provides a price guarantee for eligible crops, and advance sign-up is not required.[235]

Producers can also select annually to enroll any base acres on the farm in either Average Revenue Coverage (ARC) or Price Loss Coverage (PLC) for covered commodities.[236] Eligible acres are determined using average acres historically planted in qualifying crops, and their status as base acres runs with the land.[237] PLC provides a payment when the national market-year average farm price falls below the statutorily set effective reference price for a particular commodity.[238] ARC provides payment when current-year county crop revenue falls to or below its guaranteed level (86%) of an average historical crop benchmark revenue for the county.[239] ARC can alternatively be selected at the individual level, which provides a single whole-farm revenue guarantee, but payments are made on a reduced 65% of base acres, rather than the 85% for PLC and ARC-county.[240] Proponents often refer to this option as a subsidy available to ecological farms, but besides the significantly lower rates, the rules for base acreage and the limitations on certain crops deter diversified farms, and only 1% of base acres are typically enrolled in this option.[241]

Federal subsidies promote monocultural commodity crop production and discourage diversification, resulting in non-resilient farms and a vulnerable nation. Twelve covered commodities qualify for the three revenue support programs discussed above, which account for the majority of farm payments, and just six crops—corn, wheat, soybeans, peanuts, cotton, and rice—account for over 92% of farm commodity program payments.[242] Corn, soybeans and wheat account for 82% (225 million acres) of eligible base

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234. SCHNEPF, *supra* note 220, at 10; 68 C.F.R. § 718.2 (2003).

235. SCHNEPF, *supra* note 220220, at 10.

236. 68 C.F.R. § 718.2 (defining farm as one or more tracts of land considered to be a separate operation).

237. Farm Security and Rural Investment Act, Pub. L. No. 107-171, §1101 (2002). Each base acre is associated with only one program crop, and acreage can be reduced if converted to conservation easements or nonfarm use. *Id.*

238. 7 U.S.C. § 9016; SCHNEPF, *supra* note 220220, at 17. Payment rate is calculated by subtracting the effective price (the higher of the national market-year average price or the MAL loan rate in statute) from the reference price (the higher of the price in statute or 85% of the 5-year Olympic average market-year average price). 7 U.S.C. § 9016. Payment then is equal to the payment rate ($/unit) multiplied by base acres, program yield (units/acre), and 85%. *Id.*

239. SCHNEPF, *supra* note 220, at 17. Payment rate ($/acre) is equal to the difference between the per-acre county revenue guarantee and the actual county revenue, but the rate cannot exceed ten percent of benchmark revenue. Payment is equal to payment rate multiplied by base acres, by 85%. *Id.*

240. *Id*. at 21.

241. *Id*. at 26.

242. *Id.* at 8.

acres.[243] None of these programs apply to livestock, poultry, and "specialty crops" like fruits and vegetables.[244] Rather than encouraging good farming practices, commodity programs encourage continued production of a select few commodities, regardless of suitability to the land and specific farm needs during any given year.[245] While proponents claim that these programs are an improvement from past decades because they "decouple" payment from production, they directly dictate management decisions, which respond to reference prices and loan rates, rather than on-farm factors or the marketplace.[246]

Revenue support programs actively discourage diversification and production of crops. In fact, producers cannot receive payments if they plant fruits, vegetables, and wild rice on enrolled base acres.[247] The rationale for this restriction was to protect the market share for growers of specialty crops who are not eligible for subsidy payments, but instead, the restriction only contributes to the existing disincentives for producers to grow fruits and vegetables.[248] The benefits of commodity production offered by the government overpower small handouts like this. Even if a commodity crop operation wished to diversify, not only would the farmer lose payment eligibility, base acreage designation, and the price guarantee provided by marketing assistance loans, but there is also is little infrastructure in single commodity agricultural counties to support production of anything else. Thus, while enrolled acres must be in conservation compliance, subsidy programs actually discourage conservation farming measures like diversification. For example, no ARC and PLC payments will be made if base acres were continuously in grass or pasture for 10 previous years.[249] To comply with conservation requirements, producers implement conservation measures such as cover cropping, but only on base acres that are on highly erodible land, and with many exemptions.[250] Only 101.1 million acres of U.S.

243. John Newton, *Modernizing Base Acres*, AM. FARM BUREAU FED'N (Sept. 13, 2017), https://www.fb.org/market-intel/modernizing-base-acres (considering influence of program design on farm decision-making).

244. SCHNEPF, *supra* note 220, at 5.

245. *Id*.

246. *See id.* at 3 (explaining the impact of decoupling).

247. *Id*. at 7. Although a pilot "planting flexibility project" would allow cucumbers, green peas, lima beans, pumpkins, snap beans, sweet corn, and tomatoes to be grown on a limited number of base acres in the Midwest, this expired in 2012 and has not been renewed since. 7 U.S.C. § 8717(d)(1) (2008).

248. *See generally Specialty Crops Overview*, NAT'L AGRIC. LAW CTR., https://nationalaglawcenter.org/research-by-topic/specialty-crops/ (last visited May 12, 2020) (providing an overview of legislation related to specialty crop production).

249. Agricultural Improvement Act, 7 U.S.C. § 9012 (2018).

250. MEGAN STUBBS, CONG. RESEARCH. SERV., R42459, CONSERVATION COMPLIANCE AND U.S. FARM POLICY 12–16 (2012) (referring to sodbuster and swampbuster provisions of 1985, and sodsaver provision of 2008).

cropland are classified as highly erodible, which is just 28% of total cropland in the country.[251] Thus, only land that is *already* significantly degraded, or "at risk," is required to be conserved, instead of requiring all farms with base acres to practice conservation in order to receive payment.

Additionally, revenue and price support programs encourage consolidation, expansion, and intensive production. Because of the focus on base acreage, PLC and ARC encourage expansion of acres in production and discourage the use of any base acres on a farm for pasture or grazing. This encourages crop production and using feed for livestock in order to maximize the number of acres on a farm eligible for payment. For example, despite environmental and health consequences of CAFOs, these programs distort the costs and benefits, rendering consolidated confinement and feed crop production the apparent best use of farmland for livestock production. Research confirms that payment follows production, rather than best use of the land from a resilience perspective. Thus, whether due to higher acreage or yield per acre, farms with greater output receive higher payment.[252]

Producer eligibility and payment limits further encourage consolidation and expansion and impose barriers to market participation in favor of very large operations, while discouraging ecological considerations in farm decision-making. Individuals, partnerships, and corporations that are "actively engaged in farming" are eligible for payments under the revenue support programs.[253] To qualify, individuals must make a "significant contribution" to the farm of capital, equipment, or land, as well as active personal labor or management. They must also share in profits or losses as well as risk.[254] However, spouses, landowners, and adult family members who receive income based on the farm operating results are also eligible for payments even if they do not meet the requirements to be considered "actively engaged in farming."[255] "Family member" was expanded in 2018 to include cousins, nephews, and nieces.[256]

Individuals and corporations who qualify can receive up to $125,000 annually under ARC and PLC. However, in a general partnership, each owner can receive this amount, providing an enormous incentive to consolidate and expand, to take advantage of this loophole. By creating rules

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251. NAT. RES. CONSERVATION SERV., U.S. DEP'T OF AGRIC., 2007 ANNUAL NATIONAL RESOURCES INVENTORY – SOIL EROSION 5 (2007).

252. ECON. RESEARCH SERV., U.S. DEP'T OF ARGIC., ERR-152, FARM SIZE AND THE ORGANIZATION OF U.S. CROP FARMING ii, 39–43 (2013).

253. RANDY SCHNEPF, CONG. RESEARCH SERV., R44656, USDA'S ACTIVELY ENGAGED IN FARMING (AEF) REQUIREMENT 1 (2019).

254. Farm Program Payments Integrity Act, Pub. L. No. 100-203 §§ 1301-1314 (1987).

255. *Id.* §§ 1330–15.

256. Agricultural Improvement Act, 7 U.S.C. § 1308(a)(1)(B) (2018).

like this and defining family farms broadly, federal policy has influenced the industrialization of America's family farms. The current definition of a "family farm" is "any farm organized as a sole proprietorship, partnership, or family corporation," which describes 97% of U.S. farms today.[257] Eighty-six percent of farms are sole proprietorships, 5% partnerships, and 5% family-held corporations.[258] A recent rule limited the number of nonfamily member farm managers who could qualify for payments, appearing to tighten oversight of subsidy disbursements, but because of the expansive definition of family farm, the change had little impact on the number of payments.[259]

Under these rules, not only are there hundreds of program beneficiaries hardly connected to farming at all, but many are also very wealthy, resulting in further widening of the parity gap and distorting the original objectives of farm price supports. In 2017, total net farm income was $88 million, while the total cost of producer expenses was $326 million.[260] Expansive definitions of "actively engaged in farming," "family farm," and "family member" encourage consolidation, expansion, and invite exploitative business relationships between agribusiness and producers. They also waste taxpayer money, deceive the American public, and destroy the credibility of these programs. They concentrate wealth and market power amongst the largest farms, reducing competition and diversity of the industry.

Agribusiness special interest groups are strong proponents of subsidies, arguing that subsidies increase competition in global markets and that income testing is at odds with policy goals.[261] To the contrary, while subsidies as structured today may increase competition in global markets by processors and distributors, production competition amongst U.S. farms—vital to a healthy economy and quality of goods and services—is diminished. Additionally, the only income-based rule is a $900,000 adjusted gross income cap for program eligibility initiated through the 2014 Farm Bill, providing little barrier to the benefits large farms receive from subsidies and the advantages of their concentrated market share. Instead of helping the most economically successful businesses and enhancing their huge competitive advantage, farm subsidies should promote competition and diversity throughout the agricultural sector.

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257. 7 C.F.R. § 1400.600 (2015); 7 C.F.R. 761.2 (2019); *Family Farms*, U.S. DEP'T OF AGRIC., https://nifa.usda.gov/family-farms (last visited Mar. 27, 2020).

258. NAT'L AGRIC. STATISTICS SERV., supra note 22, at 7.

259. 7 C.F.R. § 1400.600.

260. U.S. DEP'T OF AGRIC., AC-17-A-51, 2017 CENSUS OF AGRICULTURE: UNITED STATES SUMMARY AND STATE DATA 7, 96 (2019).

261. Marc F. Bellemare & Nicholas Carnes, *Why Do Members of Congress Support Agricultural Protection?*, 50 FOOD POL'Y 20, 32–33 (describing most influential factors in congressional voting on farm bill legislation).

B. Federal Crop Insurance

Federal crop insurance is the largest farm subsidy, consuming 77 billion dollars and 9% of the 2018 Farm Bill budget.[262] Like its early ancestor of the 1940s, crop insurance offers federally subsidized insured policies through private companies.[263] Policies cover roughly 238 million acres, an increase from just 26 million in the 1980s, and 86% of eligible acres.[264] While the program offers policies for over 100 crops, four major crops—corn, cotton, soybeans, and wheat—account for over 75% of enrolled acreage and 80% of claims paid.[265] Administered by the Risk Management Agency, approved private insurance companies sell and service the insurance policies.[266] Producers pay a portion of the premium and the government pays the rest, as well as the operating and administrative costs of the insurance companies. The federal government pays 65% of most premiums, and 100% for catastrophic coverage premiums.[267] The program's structure encourages consolidation, expansion, monoculture, and intensive production. The more acreage covered and lower the deductible, the better the rates, which are set by statute.[268] Large farmers get greater premium subsidy rates than smaller farmers, incentivizing consolidation and expansion like other programs. The top 10% of farms by crop sales receive 70% of payments. In fact, the top 2% of farms receive 30% percent of payments, and are payed $50/acre compared to the average of $12.50/acre.[269] There are no payment limitations or income restrictions to qualify for crop insurance payments.[270] Improved rates and larger payments further encourage consolidation and expansion. Expansion is increasingly necessary anyway, to remain competitive in a market where government subsidies distribute large payments to the already industry-dominant largest of the nation's farms.[271] Like commodity programs do, crop insurance serves to decrease diversity of production and participants. The USDA estimates that less than 0.5% of farms and less than 1% of premiums

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262. ISABEL ROSA, CONG. RESEARCH SERV., R45193, FEDERAL CROP INSURANCE: PROGRAM OVERVIEW FOR THE 115TH CONGRESS 13 (2018).

263. Federal Crop Insurance Act, 7 U.S.C. §§ 1501, 1502, 1506–08, 1521 (2018).

264. ROSA, *supra* note 262, at 5.

265. *See id.* at 13 (discussing federal crop insurance trends).

266. *About the Risk Management Agency,* U.S. DEP'T OF AGRIC. (Aug. 2016), https://www.rma.usda.gov/en/Fact-Sheets/National-Fact-Sheets/About-the-Risk-Management-Agency.

267. ROSA, *supra*, note 262, at 13.

268. *See* 7 U.S.C. § 1508 (outlining premium calculations).

269. ROSA, *supra* note 262, at 13.

270. *Id.* at 13.

271. IMHOFF & BADARACCO, *supra* note 35, at 39.

would be affected if the income cap were extended to crop insurance subsidies.[272]

Federal crop insurance is entirely structured around commodity crop production. The main revenue type of coverage—crop revenue coverage—is only available to commodity crops.[273] Individual revenue policies account for 84% of policy premiums and insure losses specific to a farm's insured acres against the combination of production losses from natural causes and commodity price declines.[274] Corn and soybeans accounted for 63% of the program's total liability in 2015.[275] Only 38 specialty crop categories are insurable, and many others are not eligible, including many that have ecological benefits to soil and nutrition, such as most leafy greens, root crops, and many fruits.[276] Other factors that reduce crop insurance opportunities for ecological producers include: little interest in insuring a small market, because of high costs relative to premiums for private insurance companies; small acreage, which results in limited use of contract production (contracts between producers and buyers); the use of niche markets, which increase variability of market prices because of price premiums; and the use of high-value fresh markets instead of crops sold for further processing.[277] Non-industrial modes of production are not favored by industry or federal guidelines for administering policies. Requirements and restrictions of the program discourage innovation, which could threaten coverage. Federal policy dictates what farmers grow and how they do it. With unlimited insurance payments and risk assessment methods that fail to account for positive and negative externalities, crop insurance costs taxpayers many billions of dollars annually to perpetuate a system that is unsustainable for farmers, consumers, and the environment.

Individual yield policies are the second most common policy.[278] While they do not offer payouts when commodity prices decline, they do guarantee payment if a producer's actual yield falls below a yield guarantee, which is determined based on their actual production history. Significantly, producers

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272. RANDY SCHNEPF & MEGAN STUBBS, CONG. RESEARCH SERV., R45659, U.S. FARM PROGRAM ELIGIBILITY AND PAYMENT LIMITS UNDER THE 2018 FARM BILL (P.L. 115-334) 23 (2019).

273. DENNIS A. SHIELDS, CONG. RESEARCH SERV., R40532, FEDERAL CROP INSURANCE: BACKGROUND 6 (2015).

274. ROSA, *supra* note 262, at 10.

275. *Id*. at 9.

276. ISABEL ROSA & RENÉE JOHNSON, CONG. RESEARCH SERV., R45459, FEDERAL CROP INSURANCE: SPECIALTY CROPS 1 (2019).

277. *Id*. at 19–20.

278. *See* ROSA, *supra* note 262, at 10 (identifying individual revenue and individual yield policies as the top two policies by premium).

have the option to exclude the worst production year from the average.[279] This option exposes farmers to enormous risk in order to continue producing a crop that will result in lucrative indemnity payouts. The producer ignores the past indicator of risk when making farm management decisions, and crop insurance administrators ignore the risk in calculating premium rates, incentivizing risky and irrational market behavior.

While eligibility does require conservation compliance, the requirements are minimal and the loopholes significant. Compliance is only required in areas severely at risk, and administrative processes discourage enforcement.[280] Policies continue to diminish the value of conservation.[281] Risk is largely assessed based on production capability of land, not on whether producers incorporate conservation measures to ensure resiliency.[282]

Federal policy distorts the value that ecological and diversified farms offer by burying the costs of industrial agriculture beneath a complex structure of risk protection subsidies, price guarantees, and environmental loopholes. Thus, farmers and the public are robbed of the benefits that ecological production methods can provide to farms, landscapes, and the agricultural industry.

C. Conservation Programs

The U.S. Department of Agriculture has taken the position that conservation ensures "thriving and sustainable agriculture for our future," by promoting "healthy soil, water, air, plants, animals, ecosystems, and productive and sustainable working lands."[283] NRCS, with its delegated authority to "conserve, improve, and sustain natural resources," strongly emphasizes the importance of agricultural soil health, defined as "the continued capacity of soil to function as a living ecosystem that sustains plants, animals, and humans."[284] Its message is the same as it was a century

279. ANNE WEIR SCHECHINGER & CRAIG COX, ENVTL. WORKING GRP., IS FEDERAL CROP INSURANCE POLICY LEADING TO ANOTHER DUST BOWL? 9 (2017).

280. *See* 7 U.S.C. § 1515 (2018) (describing requirements of program compliance); MARK A. MCMINIMY, CONG. RESEARCH SERV., R45525, THE 2018 FARM BILL (P.L. 115334): SUMMARY AND SIDE-BY-SIDE COMPARISON 126 (2019) (noting a limitation of the right of enforcement for USDA relating to agricultural land easement plans unless highly erodible).

281. MCMINIMY, *supra* note 280, at 89–117 (comparing conservation programs in the prior Farm Bill, House- and Senate-passed bills with the enacted Farm Bill).

282. *See*, *e.g.*, 7 U.S.C. § 1522(c)(7) (basing a diversified risk management insurance plan on the actual gross farm revenue rather than on conservation measures).

283. *Conservation*, U.S. DEP'T OF AGRIC., https://www.usda.gov/topics/conservation (last visited Apr. 21, 2020).

284. 7 C.F.R § 601.1 (2019); Maria Bowman et al., *An Economic Perspective on Soil Health*, U.S. DEP'T OF AGRIC. (Sept. 6, 2016), https://www.ers.usda.gov/amber-waves/2016/september/an-economic-perspective-on-soil-health/.

ago, that soil microbial diversity, organic matter, and good structure are of vital economic importance to farming.

While modern policy continues to state conservation goals, however, conservation programs tend to provide financial assistance to the largest polluters, enabling the perpetuation of harmful practices rather than fundamentally reforming management systems. Today, the major Farm Bill conservation programs are the Conservation Reserve Program (CRP); the Environmental Quality Incentive Program (EQIP), a cost-share program that provides incentive payments to install or implement structural or management methods; the Agricultural Conservation Easement Program, which helps to conserve agricultural land and wetlands through easements; and the Regional Conservation Partnership Program, which provides technical and financial assistance through stewardship partnerships.[285]

The U.S. Department of Agriculture acknowledges the public and private benefits of soil health and explains that programs like EQIP and CRP compensate farmers for improving soil health because the private benefits do not provide enough of an incentive.[286] However, in 2015, $100 million in EQIP payments went to large CAFOs, mostly for waste storage and handling.[287] In fact, the 2002, 2008, and 2014 Farm Bills even mandated that 60% of EQIP funds be allocated to animal agriculture because it had the "largest potential impact for remediation."[288] While federal conservation programs today do reward farmers for cover cropping and no-till, the programs are not designed to consider the larger framework within which farmers operate, including federal counterincentives which inflate the value of industrial agriculture by externalizing its hidden costs, and deflate the value of conservation. Decoupling conservation from the range of farm policies ignores its value to crops and livestock, in addition to soil and water.[289]

Another recent example of conservation as crisis management, decoupled from farm policy, is the soil health pilot program, which abides by the philosophy that production and stewardship are mutually exclusive.[290]

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285. *See* Agriculture Improvement Act of 2018, 7 U.S.C. § 2302 (2018).

286. Bowman et al., *supra* note 284.

287. IMHOFF & BADARACCO, *supra* note 35, at 163.

288. *Id*. at 54.

289. Jessica McKenzie, *Regenerative Agriculture Could Save Soil, Water, and the Climate. Here's How the U.S. Government Actively Discourages It* (Mar. 14, 2019), https://regenerationinternational.org/2019/03/14/regenerative-agriculture-could-save-soil-water-and-the-climate-heres-how-the-u-s-government-actively-discourages-it/.

290. MEGAN STUBBS, CONG. RESEARCH SERV., R45698, AGRICULTURAL CONSERVATION IN THE 2018 FARM BILL 20 (2019); *see generally* FARM SERV. AGENCY, U.S. DEP'T OF AGRIC., SOIL HEALTH AND INCOME PROTECTION PROGRAM (SHIPP) PILOT (2020) (reviewing provisions of the SHIPP pilot program).

The program allows removing less productive farm land from production in exchange for annual rental payments and planting low-cost perennial cover crops.[291] Eligible land is limited to the least productive area on the farm, no more than 15% of a farm, and no more than 50,000 acres of total national CRP acreage enrollment.[292] Such an approach to conservation resembles the decoupled approach of the 1980s, not the embedded version of the 1930s.

D. Federal Environmental Statutes

In addition to the Farm Bill incentives for monoculture, intensive production, and other harmful practices, environmental regulations turn a blind eye to air and water pollution, and worse, provide the permitting framework for industrialized farms. This is increasingly true in recent years. One example is the special treatment that CAFOs receive under environmental regulations. For example, the Fair Agricultural Reporting Method Act was passed in 2018, amending section 103(e) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), exempting farms from the requirement to report air emissions from animal waste.[293] CERCLA requires reporting of releases of hazardous substances that meet or exceed reportable quantities within a 24-hour period.[294] The purpose is for officials to evaluate the need for an emergency response to mitigate the effects of a release to the community.[295] In addition, government and the public lack useful data about emissions from agriculture, complicating lawmakers' ability to address them.[296] Further, CAFOs are not regulated as sources of air pollution either, despite their well-documented contributions to concentrated air and water pollution.[297] While Section 111 of the Clean Air Act requires new source performance standards for

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291. FARM SERV. AGENCY, *supra* note 290, at 1.

292. *Id*.

293. Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601–9675 (2018).

294. *Id*. § 9603(a); *see also CERCLA and EPCRA Reporting Requirements for Air Releases of Hazardous Substances from Animal Waste at Farms*, ENVTL. PROT. AGENCY, https://www.epa.gov/epcra/cercla-and-epcra-reporting-requirements-air-releases-hazardous-substances-animal-waste-farms (last visited May 9, 2020) (explaining that CERCLA and EPCRA require the reporting of releases that meet or exceed reportable quantities within a 24-hour period).

295. *CERCLA and EPCRA Reporting Requirements*, *supra* note 294294.

296. Jeff McMahon, *Why Agriculture's Greenhouse Gas Emissions Are Almost Always Underestimated* (Dec. 2, 2019), https://www.forbes.com/sites/jeffmcmahon/2019/12/02/5-reasons-agricultures-greenhouse-gas-emissions-are-usually-underestimated/#1b858d736ac8.

297. NAT'L RES. COUNCIL, AIR EMISSIONS FROM ANIMAL FEEDING OPERATIONS: CURRENT KNOWLEDGE, FUTURE NEEDS 130–1 (2003); Georgina Gustin, *EPA's Failure to Regulate Factory Farm Pollution Draws New Scrutiny* (Nov. 28, 2016), https://insideclimatenews.org/news/22112016/epa-regulate-factory-farm-emissions-pollution.

stationary sources of air pollutants, it does not apply to CAFOs, which are a major source of air pollution.[298] Efforts to revise this loophole have failed, and the EPA has justified its decision as a matter of practicality.[299] Though regulators claim there is no adequate accounting method available for farms that vary so widely in size and characteristics, the EPA has never attempted to develop such a method either.[300] Further, state and federal permitting of CAFOs is based on standardized determinations of size, scale, and characteristics.[301]

The Clean Water Act also supports industrial agriculture, through the permitting of CAFOs and the expressly carved-out exemptions for agricultural runoff and for irrigated agriculture from regulatory permitting requirements.[302] This regulatory loophole is likely the result of successful lobbying by the agricultural industry, as the amendment was proposed to add "does not include agricultural stormwater discharges" to the definition of "point source" between the time the Clean Water Act was first introduced and the time it reached the Senate.[303] Thus, environmental regulations facilitate water pollution by CAFOs through permitting, and by a wide portion of industrial agriculture by exempting irrigation agriculture across the board.[304]

Similarly, eligibility requirements for many farm loans administered through the Farm Service Agency facilitate pollution. While these loans typically require environmental review under the National Environmental Policy Act, a 2016 Farm Service Agency rule categorically exempted medium-sized CAFOs from review.[305] These operations may be "medium" when viewed in isolation, but many of these CAFOs are subcontractors to large agricultural companies, which obtain the financing on their behalf.[306]

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298. Air Pollution Control Act, 42 U.S.C. § 7411 (2018).

299. Gustin, *supra* note 297; *Petition to Regulate CAFOs Under CAA Denied* (Jan. 2, 2018), https://ehsdailyadvisor.blr.com/2018/01/petition-regulate-cafos-caa-denied/

300. *Petition to Regulate CAFOs Under CAA Denied*, *supra* note 299.

301. 40 C.F.R. §§ 70.3, 71.2–71.3 (2016).

302. Water Pollution Control Act, 33 U.S.C. §§ 1342, 1344(f)(1)(C) (2018); *see also id.* § 1362(14) (defining point source but exempting "agricultural stormwater discharges and return flows from irrigated agriculture"); Environmental Policies and Procedures; Compliance with the National Environmental Policy Act and Related Authorities, 81 Fed. Reg. 51,274, 51,281 (Aug. 3, 2016) (categorically exempting CAFOs from NEPA review).

303. *See* 133 CONG. REC. 243 (1987) (amendments submitted to Senate version of bill).

304. 68 Fed. Reg. 7176, 7179 (Feb. 12, 2003) (codified at 40 C.F.R. § 122.23(e)) (exempting CAFO stormwater discharges from NPDES permitting); *see also* Waterkeeper All. Inc. v. U.S. Envtl. Prot. Agency, 399 F.3d 486, 509 (2d Cir. 2005) (upholding EPA regulatory exemption for agricultural stormwater discharges as encompassing discharges from land areas under control of a CAFO). *But see* 33 U.S.C. § 1362(14) (2018) (defining "point source" to include "concentrated animal feeding operations").

305. Environmental Policies and Procedures; Compliance With the National Environmental Policy Act and Related Authorities, 81 Fed. Reg. at 51,281–91.

306. 40 C.F.R. § 122.23(b)(4), (b)(6) (defining large and medium CAFOs, respectively).

Effectively, so long as large corporations divide up operations into "medium" pieces, they can obtain financing for a limitless number of facilities without ever having to undergo environmental review.[307] Like rules that derive from the Farm Bill, these rules serve to perpetuate a system that harms not only the environment, but also those farmers who are working hard to provide ecological benefits to the public.

Lastly, the Renewable Fuel Standard provides an example of federal energy policy that both recognizes the value of environmental stewardship in the form of needing to reduce reliance on fossil fuels, and yet incentivizes agricultural practices that produce more emissions and further degrade natural resources. Congress created the program in 2005 to reduce greenhouse gas emissions and expand the nation's renewable fuels sector while reducing reliance on imported oil.[308] Industrial-scale commodity crop production plays an important role in achieving the program's goals as corn is the primary feedstock for conventional ethanol, and soybeans for biodiesel.[309] As a result of the mandate for cellulosic biofuel production from agricultural residues and dedicated energy crops, acreage of corn has increased by a third since the 1990s.[310] Biomass production uses energy, fertilizer and pesticides as inputs, which in addition to the already inefficient energy conversion rate of corn to ethanol, makes for a very inefficient process, not to mention extensive use of land.[311] Incentives for energy production on farmland also attract new participants in the agricultural economy who are motivated solely by short term profit and not by stewardship and land conservation, which contributes to exhaustion of natural resources and to increasing expansion of energy crop production onto environmentally fragile lands.[312] Biofuel incentives have also increased the removal of crop residues from farms, which can be used to produce ethanol.[313] Crop residues are the biological material that is left after a plant

307. Environmental Policies and Procedures; Compliance With the National Environmental Policy Act and Related Authorities, 81 Fed. Reg. at 51,280–51,281.

308. Energy Independence and Security Act of 2007, Pub. L. No. 110–140, 121 Stat. 1492 (codified in 42 U.S.C. §§ 17001–8008).

309. BRENT D. YACOBUCCI ET AL., CONG. RESEARCH SERV., RL33928, ETHANOL AND BIOFUELS: AGRICULTURE, INFRASTRUCTURE, AND MARKET CONSTRAINTS RELATED TO EXPANDED PRODUCTION 1, 4 (2007).

310. ECON. RESEARCH SERV., U.S. DEP'T OF AGRIC., EIB-112, AGRICULTURE'S SUPPLY AND DEMAND FOR ENERGY AND ENERGY PRODUCTS 5 (2003).

311. Roger Segelken, *70 Percent More Energy Required to Make Ethanol than Actually is in Ethanol*, CORNELL CHRONICLE (Mar. 6, 2009), https://www.organicconsumers.org/scientific/70-percent-more-energy-required-make-ethanol-actually-ethanol-cornell.

312. *See generally* Meehan et al., *supra* note 16 (discussing incentives and ecosystem tradeoffs associated with energy production); *see also* YACOBUCCI ET AL., *supra* note 309309, at 4 (finding corn-based ethanol production to increase the incentive to expand corn production by physical expansion).

313. Lal, *supra* note 98, at 357.

dies and parts of it fall to the ground, and they contribute to the health of soil and reduce the release of carbon from the soil into the atmosphere.[314] According to Rattan Lal, the effectiveness of no-till, for example, requires mulching with crop residues.[315] By creating the competing end use for crop residues of fuel production, federal policy discourages conservation practices like no-till, while encouraging farmers to remove critical soil-replenishing matter from their farms.[316]

CONCLUSION

> "Agricultural choices must be made by these inescapable standards: the ecological health of the farm and the economic health of the farmer"[317]

American agriculture has grown up within a framework of industrialism, contextualized by the federal programs that define modern farming. While subsidies and many government programs discussed here contribute to a precarious situation for agricultural producers and the nation as a whole, pulling out the rug from beneath the system would be devastating to the agricultural sector and would not bring about the reforms that advocates of less government involvement hope for in the end. However, programs do interfere with the growing interest in ecological food production from consumers, investors, and new farmers. Therefore, a balance must be struck that provides support for a transition away from a farming system that threatens the health and resilience of our nation, while returning the bulk of decision-making power and farming practice to farmers. In this paper, I have described the problem and its origin, arguing that the strength of this nation and the well-being of its citizens depend critically on diversification of our food supply, production methods, and opportunities for farmers. The path to achieving these goals is through a deeply reintegrated commitment to conservation and fierce championship for the ecological management of our most vital natural resources, and for those who steward them.

It is difficult to contemplate such profound reimagination of our agricultural system and the daunting work of transition. While there are billionaire recipients of federal farm payments and many more millionaire beneficiaries of subsidies, the reality is that the vast majority of American

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314. R. Lal, *World Crop Residues Production and Implications of Its Use as a Biofuel*, 31 ENV'T. INT'L. 575, 577 (2005) (defining crop residues as "the non-edible plant parts that are left in the field after harvest.")

315. *Id.* at 582.

316. *Id.*

317. Gracy Olmstead, Opinion, *Wendell Berry's Right Kind of Farming* (Oct. 1, 2018), https://www.nytimes.com/2018/10/01/opinion/wendell-berry-agriculture-farm-bill.html.

farmers depend in some fashion on the reliability of federal support, and tragically, in many cases face bankruptcy or land forfeiture anyway, through no fault of their own.[318] The loss of farmland, diminishing numbers of farmers, and the depletion of natural resources are amongst the greatest challenges of our time, exacerbated by global warming, rising sea levels, desertification, and biodiversity loss. Congressional exercise of the federal spending power to serve the general welfare must be redirected from harmful methods towards addressing these national threats and transitioning to an ecological food system. Although proponents of "free market agriculture" argue public money should not be spent on something like soil health that already provides private benefits, the Supreme Court rejected this argument in its landmark spending clause decision in *United States v. Butler*.[319] In *Butler*, the Court held that so long as private benefits are incidental to the object of achieving a benefit to the general public, such spending is constitutional.[320] In conclusion, the following comments are offered in recognition that our country collectively and urgently needs federal reform of our food system.

Federal programs should reflect both the public value of ecological agriculture, and the hidden costs of industrial farming. Subsidies should take into consideration the influence they have on market signals and pricing impacts and contemplate the harm caused by incentivizing both underproduction and overproduction, as well as monocultures and expansion. Conservation programs should incorporate conservation as a farming strategy to support the development of ecological systems, rather than serve as band-aids, or worse, perpetuate harmful operations. Crop insurance premium rates and eligibility should reflect the benefits of soil-building practices and ecological management that protect yields and whole landscapes from pests, pathogens, and severe weather. According to one Midwestern farmer, "unless crop insurance is restructured to benefit farmers doing things that are good for the farmland, good for the environment, and good for their yields, the federal government is going to continue subsidizing the degradation of American soil."[321] Farmers who integrate conservation into their systems of production should receive a "good farmer" discount, no matter what crops they grow, which markets they utilize, or how many acres they farm.

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318. P.J. Huffstutter, *U.S. Farm Bankruptcies Hit an Eight-Year High: Court Data* (Jan. 30, 2020), https://www.reuters.com/article/us-usa-farms-bankruptcy/us-farm-bankruptcies-hit-an-eight-year-high-court-data-idUSKBN1ZT2YE.

319. *See generally* United States v. Butler, 297 U.S. 1 (1936) (holding spending power broad but processing taxes unconstitutional).

320. *Id.*

321. *See* McKenzie, *supra* note 289.

Additionally, eligibility provisions and expansive definitions that enable unverified payment eligibility for wealthy and remote beneficiaries, to the disadvantage and insult to qualifying and at-risk farms and farmers, must be revised. Similarly, environmental statutes should be modified to reflect their stated goals, rather than the goals of agribusiness and industrial interest groups uninterested in the health of the nation. The promotion of ecological conservation should be applied consistently and rigorously across American landscapes whether developed, natural, or agricultural. Destructive farming practices should not be exempt from statutes and regulations, CAFOs should be required to report their emissions, and irrigation agriculture should be regulated as the point source of pollution that it is. Without honesty in legislation and integrity in administration, unnecessary conflicts will continue to grow—between agriculture and the environment, and between the public and America's farmers.

From a conservation perspective, the central objective of crop production is to maximize the transformation of solar energy and other resources into useful (ideally edible) products. Rather than promote, for example, the inefficient and wasteful production of corn ethanol, the government should advance regulation that encourages ecological farming. Ethanol production incentivizes overproduction, expansion, large-scale monocultures, and intensive chemical use, and ignores the fact that the inefficiency of biomass production for energy was one reason we switched to fossil fuels in the first place.[322] Given its energy inefficiency, it is remarkable that the United States has selected corn ethanol production to reduce national dependence on fossil fuels, especially considering that sugar cane and other crops offer a much higher energy return on investment. Instead of paying farmers to burn fuel to produce less-efficient fuel, on vast amounts of prime farmland, we need to start paying farmers to produce a diversity of nutrient-rich food and to protect our clean water, fresh air, and healthy soil.

American farms provide a striking exposé of the growing precarity of our agricultural, environmental, and political systems. The vast majority of the nation's farms are industrial, depending on chemicals and fossil fuels, rather than solar energy, to maximize production. Consideration of the industrial model's enormous waste and costs reflects its inefficient use of energy, land, and resources. According to Wendell Berry, the problem with an industrial approach to agriculture is that rather than imply a limit at all, industrialism "rests instead upon the premises of limitless economic growth and limitless consumption, which of course implies limitless waste, and final

322. James Conca, *It's Final -- Corn Ethanol is of No Use* (Apr. 20, 2014), https://www.forbes.com/sites/jamesconca/2014/04/20/its-final-corn-ethanol-is-of-no-use/#53ebd00667d3.

exhaustion."[323] Relentlessly taxing the capacity of the land pollutes and destroys natural ecosystems, inflicts devastating impacts on public health, and poses a grave ecological threat to the nation. Instead, valuing resiliency and diversity as much as productivity can produce a food system that is stable, fruitful, and lasting. Policies should reflect that farming is not inherently extractive nor is food production at odds with stewardship, and invest in ecological farming, which offers a stable climate, food security and nutrition, and a clean and reliable water supply. It is time to reconsider our self-destructive investment in industrial agriculture and revive our longstanding commitment to conservation, which is the key to well-managed farms and a well-governed nation.

323. Olmstead, *supra* note 317.