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UP IN THE AIR: WILL CALIFORNIA'S METHANE GAS MITIGATION LAWS AND POLICIES LOWER GLOBAL GREENHOUSE EMISSIONS?

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INTRODUCTION

Anthropogenic climate change is wreaking havoc in California. In recent years, increases in the frequency and intensity of drought,[1] wildfires,[2] rising sea levels,[3] and flooding[4] have devastated California communities and

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1. *See generally* Noah S. Diffenbaugh et al., *Anthropogenic Warming Has Increased Drought Risk in California*, 112 PROC. NAT'L ACAD. SCI. U.S. 3931 (2015) (discussing the increased frequency of drought in California).

2. *See* A.L. Westerling et al., *Climate Change and Growth Scenarios for California Wildfire,* 109 CLIMATIC CHANGE 445, 445–46 (2011) (anticipating increases in wildlife burn area and variability in fire severity); A.L. Westerling & B.P. Bryant, *Climate Change and Wildfire in California*, 87 CLIMATIC CHANGE 231, 231 (2008) (stating wildfire activity in California "has greatly increased in recent years").

3. Kendra L. Garner et al., *Impacts of Sea Level Rise and Climate Change on Coastal Plant Species in the Central California Coas*t, PEERJ, May 12, 2015 at 1–2.

4. *See* Michael Dettinger, *Climate Change, Atmospheric Rivers, and Floods in California – A Multimodel Analysis of Storm Frequency and Magnitude Changes*, 47 J. AM. WATER RESOURCES ASS'N 514, 514 (2011) (anticipating increase in atmospheric river "episodes," leading to more frequent and severe floods).

delivered a cascade of financial consequences.[5] Arguably, the deleterious impacts of climate change in California and elsewhere have only just begun. Aggressive greenhouse gas (GHG) emission mitigation is critical to either reduce the effects of climate change or possibly even reverse its course.[6]

A series of laws enacted in California target 40% and 80% reductions in the state's GHG emissions from 1990 levels by 2030 and 2050, respectively.[7] The laws provide the California Air Resources Board (CARB) with teeth to regulate carbon intensity (CI) to effectuate these goals.[8] County, state, and federal financial incentives complement these Acts to develop renewable and alternative energy technology with lower GHG emissions and environmental impacts than fossil fuels.[9] Ostensibly, California's cadre of laws and policies place the state on a trajectory to accomplish its climate change mitigation goals. From 2004 to 2017 (the most recent year for which data are available), the state's total GHG emissions declined by 14%.[10] And, GHG emissions per capita were reduced by 24% from a 2001 peak.[11] United States net GHG emissions decreased 10% from 2005 to 2018,[12] while the world's carbon

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5. *Id.* at 514–15; *see* Katherine Blunt & Erin Ailworth, *PG&E Reaches $1 Billion Settlement with Paradise, California Governments,* WALL ST. J. (June 18, 2019), https://www.wsj.com/articles/pg-e-settles-with-some-california-communities-on-wildfire-claims-11560894354 (describing PG&E's liability for "deadly wildfires sparked by its equipment" in 2017–18); Faiz Siddiqui, *California's New Normal: Wildfires, Ash and Power Outages Could Last a Decade* (Oct. 26, 2019), https://www.washingtonpost.com/nation/2019/10/26/this-is-new-norm-fire-ravaged-wine-country-rolling-blackouts-become-way-life/ (showing how weather and fire conditions in California are worsening).

6. *See* James Hansen et al., *Target Atmospheric CO_2: Where Should Humanity Aim?*, OPEN ATMOSPHERIC SCI. J., May 2008, at 1–2, 16 (asserting prompt policy changes are necessary to avoid dangerous climate effects).

7. CAL. HEALTH & SAFETY CODE § 38566 (West 2019); Cal. Exec. Order No. S-3-05 (June 1, 2005).

8. *See*, *e.g.*, CAL. HEALTH & SAFETY CODE § 38510 (West 2019) (charging CARB with monitoring and regulating GHG emissions sources); *id*. § 38561 (directing CARB to create a scoping plan to achieve maximum feasible emissions reduction).

9. *See California Laws and Incentives*, U.S. DEP'T OF ENERGY, https://afdc.energy.gov/laws/state_summary?state=CA (last updated Oct. 2019) (listing available incentives in California).

10. CAL. AIR RES. BD., CALIFORNIA GREENHOUSE GAS EMISSIONS FOR 2000 TO 2017 3 (2019).

11. *Id*.; *see also* CAL. AIR RES. BD., CALIFORNIA GREENHOUSE GAS INVENTORY (MILLIONS OF METRIC TONNES OF CO_2 EQUIVALENT)—BY IPCC CATEGORY 22 (2007) (showing that California's total annual GHG emissions actually increased from 430.724 CO_2 equivalent in 1990 to 471.1 CO_2 equivalent in 2000, although GHG emission calculations and Global Warming Potential (GWP) are calculated slightly differently for these two datasets).

12 . Press Release, U.S. Envtl. Prot. Agency, Latest Inventory of U.S. Greenhouse Gas Emissions and Sinks Shows Long-Term Reductions, with Annual Variation (Apr. 13, 2020), https://www.epa.gov/newsreleases/latest-inventory-us-greenhouse-gas-emissions-and-sinks-shows-long-term-reductions-0; *see generally* U.S. ENVTL. PROT. AGENCY, DATA HIGHLIGHTS: INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2018 (2020) (summarizing GHG emissions and sinks nationwide).

dioxide (CO_2) emissions alone increased 46.37% from 2000 to 2014.[13] The contrasts between state, national, and international GHG emissions is potentially indicative of emissions leakages,[14] defined as "any change in emissions from sources not covered by the GHG policy or program that is caused by the GHG emissions policy or program."[15]

As the fifth largest economy in the world, California's market power clearly influences global commerce and the resulting environmental impacts.[16] The state has a large consumer-demand base and is a renowned hub for spinning off technological innovation: when California moves, others respond.[17] However, in order to effectively reduce GHG emissions on a global level that will aggressively curb climate change, transformative interventions with the largest sources of GHG emissions (the agricultural, transportation, and energy generation sectors)[18] cannot be limited to California. In order to truly address climate change, technological advancements must simultaneously mitigate GHG emissions while facilitating economic growth inside and outside of California, and across developed and developing nations.

This article posits that California's emerging dairy biogas supply chain infrastructure exemplifies technological advancement that may have a tractable impact on mitigating worldwide methane emissions that contribute

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13. *See* Tom Boden et al., *Global CO_2 Emissions from Fossil-Fuel Burning, Cement Manufacture, and Gas Flaring: 1751-2014*, CARBON DIOXIDE INFO. ANALYSIS CTR. (Mar. 3, 2017), https://cdiac.ess-dive.lbl.gov/ftp/ndp030/global.1751_2014.ems (listing raw data of CO_2 globally).

14. *See* MEREDITH FOWLIE & DANNY CULLENWARD, INDEP. EMISSIONS MKT. ADVISORY COMM., REPORT ON EMISSIONS LEAKAGE AND RESOURCE SHUFFLING 1 (2018) (discussing how heavily regulated GHG producers can become less competitive than producers in other jurisdictions that are not subject to emissions requirements).

15. *Id.* A rebound, or backfiring, effect may also cause net global GHG emissions to rise through increased consumer consumption attributable to perceived improvements in environmental quality ("My environmental footprint is lower for this product so I can consume more of it"), or increased production in locations where environmental impacts aren't transparent or valued (the invisible impacts of consumption). Kenneth Gillingham et al., *The Rebound Effect is Overplayed*, 493 NATURE 475, 476 (2013). The rebound effect occurs when a policy designed to reduce environmental impacts has the reverse effect, and environmental impacts actually worsen. *Id*. at 475. Energy efficiency and conservation policies present notable rebound effects, in that consumers increase their consumption with improved energy efficiency, although the magnitude of rebound effects is debated. *See id*. at 475–76 (discussing the rebound effect).

16. *California Now has the World's 5th Largest Economy* (May 4, 2018), https://www.cbsnews.com/news/california-now-has-the-worlds-5th-largest-economy/.

17. *See id.* (describing the reasons for California's large economy); Thomas Fuller, *The Pleasure and Pain of Being California, the World's 5th-Largest Economy* (May 7, 2018), https://www.nytimes.com/2018/05/07/us/california-economy-growth.html (explaining Silicon Valley and technology giants are a "big part of California's success").

18. *Global Greenhouse Gas Emissions Data*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data#main-content (last visited Apr. 29, 2020); *see* Hansen et al., *supra* note 6, at 1, 14, 16 (describing prompt policy changes that should be made regarding coal use, agriculture, and other practices to prevent dangerous climate effects).

to global climate change. Whether this will occur is highly dependent upon governmental and market forces. Small-scale anaerobic digesters have been successfully used for some time to transform methane by capturing it from organic waste and converting it into electricity.[19] Recently, the scale and scope of these practices have greatly expanded in California due to a cadre of innovative governmental policies.[20] The federal Renewable Fuel Standard (RFS) Program, promulgated by the Energy Policy Act of 2005[21] and revised as "RFS2"[22] under the Energy Independence and Security Act (EISA) of 2007,[23] and state initiatives turned biogas from dairy manure into a hot commodity for California's transportation sector.[24] California's rapidly expanding statutes, regulations, and financial incentives have provided grants to install new farm anaerobic digesters.[25] The biogas is reconditioned into Renewable Compressed Natural Gas (R-CNG) at regional fuel hubs and transported through newly expanded natural gas pipeline infrastructure to power natural gas vehicles.[26] In addition, fuel-cell technology is converting biogas into electricity without combustion; the electricity is being used to power plug-in electric vehicles (PEV), including state vehicle fleets.[27] Updated carbon offset and international GHG cap-and-trade programs also

19. *See* Catherine Keske, *Anaerobic Digestion Technology: How Agricultural Producers and the Environment Might Profit from Nuisance Lawsuits*, 52 NAT. RESOURCES J. 315, 315, 320 (2012) (explaining that anaerobic digestion systems are built so that microorganisms can break down organic materials in a closed space where there is no oxygen).

20. *See*, *e.g.*, CAL. DEP'T OF FOOD & AGRIC., DAIRY DIGESTER RESEARCH AND DEVELOPMENT PROGRAM: REPORT OF FUNDED PROJECTS (2015-18) 3, 9 (2019) (discussing results of significant legislative funding for 64 dairy digester projects).

21. Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594, 1068 (codified in relevant part at 42 U.S.C. § 7545 (2018)).

22. Clean Air Act, 42 U.S.C. § 7545(a) (2018).

23. Energy Independence and Security Act of 2007, 42 U.S.C. ch. 152 (2018).

24. *See*, *e.g.*, CAL. HEALTH & SAFETY CODE § 38566 (West 2019) (directing the Board to reduce GHG emissions by 40% below 1990 levels by 2030); *Advanced Clean Cars Program*, CAL. AIR RES. BD. (Feb. 8, 2019), https://ww2.arb.ca.gov/resources/fact-sheets/advanced-clean-cars (describing regulations to control emissions); *DDRDP Demonstration Projects*, CAL. DEPT. OF FOOD & AGRIC., https://www.cdfa.ca.gov/oefi/ddrdp/DemoProject.html (last visited Apr. 29, 2020) (describing grants for dairy digester projects); *California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA)*, CAL. STATE TREASURER, https://www.treasurer.ca.gov/caeatfa/ (last visited Apr. 29, 2020) (describing funding available to assist in reducing GHG emissions).

25. *See*, *e.g.*, CAL. HEALTH & SAFETY CODE § 38501 (West 2019) (directing CARB to design emissions reduction measures); *DDRDP Demonstration Projects*, *supra* note 24 (describing grants for dairy digester projects); *California Laws and Incentives*, *supra* note 9 (listing available incentives).

26. *Natural Gas Basics,* U.S. DEP'T OF ENERGY, https://afdc.energy.gov/fuels/natural_gas_basics.html (last visited Apr. 29, 2020).

27. *See generally* FUEL CELL TODAY, USING FUEL CELLS IN…CONVERTING WASTE TO ENERGY (2012) (describing the use of fuel cells to convert biogas to energy for use in electric vehicles).

support this developing supply chain and infrastructure by creating demand for methane conversion and GHG emission reduction.[28]

As the nation's largest dairy producer and the most populous state, California is highly motivated to cultivate a cost-effective energy supply chain for its transportation sector while striving to fulfill its heavily mandated and regulated GHG targets.[29] However, it is up in the air as to whether California's GHG mitigation programs will expand to a scale so that there are lasting impacts on climate change. It is also unclear whether its infrastructure will eventually buckle due to federal policy changes and GHG emission leakages if dairies and other industries relocate to avoid regulation.

The rest of the article is organized as follows: section I discusses the prevalence of methane GHG emissions from agriculture and the associated implications for global climate change. Section II summarizes the alignment of federal and state laws that facilitate renewable fuel generation. Section III elaborates upon the financial incentives created and explores whether California's expanding methane biogas capture supply chain will endure if the financial incentives taper from this confluence of policies. The conclusion is that the methane biogas supply chain could be scaled outside of California to mitigate climate change in the long term, if it is used in conjunction with other renewable energy sources to displace petroleum-based transportation fuels and methane leakages are effectively mitigated.

I. PREVALENCE OF METHANE GAS EMISSIONS AND IMPACTS ON CLIMATE CHANGE

In spite of relatively aggressive GHG emission reduction policies and an overall state decrease in GHG emissions since 2000, California's annual methane emissions have headed in the opposite direction.[30] The State's methane emissions increased approximately 16% from 2000 to 2017, though California's overall GHG emissions declined by 10% over that same

28. *See* CAL. HEALTH & SAFETY CODE § 38561 (West 2019) (directing CARB to implement emissions reduction measures); *id.* § 38562 (extending internationally recognized cap-and-trade system, effective 2031); INT'L CARBON ACTION P'SHIP, USA—CALIFORNIA CAP-AND-TRADE PROGRAM 1–6 (2020) (describing California's program, including its interaction with other programs internationally).

29. M. Shahbandeh, *Top U.S. States Based on Milk Production 2016 – 2018* (Apr. 3, 2019), https://www.statista.com/statistics/194968/top-10-us-states-by-milk-production/; Hans Johnson et al., *California's Population,* PUB. POLICY INST. CAL. (Mar. 2017), https://www.ppic.org/publication/californias-population/; *see also* Terence Chea, *California Targets Dairy Cows to Combat Global Warming* (Nov. 29, 2016), https://www.kqed.org/science/1201862/california-targets-dairy-cows-to-combat-global-warming (describing the dairy industry's role in combating GHG emissions).

30. CAL. AIR RES. BD., *supra* note 10, at 1, 3, 15.

period.[31] In contrast, U.S. methane levels decreased by 18.1% between 1990 and 2018.[32]

California's increasing methane emissions are attributed to its bourgeoning dairy industry, which is the state's largest source of anthropogenically created methane.[33] The California dairy industry doubled its milk production from 1970 to 1994,[34] and the state now accounts for approximately 20% of all U.S. milk production.[35] California agriculture contributes approximately 8% of all state-level GHGs, though emissions associated with crop production have generally declined since 2000.[36] In contrast, GHG emissions from dairy manure management and enteric fermentation increased between 2000 and 2007 as the industry expanded, and the levels have remained relatively constant from 2007 onward.[37] Due to the overall decline in GHG emissions, dairies now comprise a larger overall proportion of California's GHG emissions, accounting for roughly 60% of the state's total agricultural emissions.[38] Recognizing the significance of the consistently lingering levels of methane generated by livestock, the California Legislature enacted Senate Bill 1383, which set a goal of reducing methane from 2013 levels by 40% by 2030.[39]

Reducing anthropogenic methane is critical for climate change mitigation. Methane presents a relatively high radiative heating effect per molecule and per unit mass relative to CO_2 over a relatively short (20 to100 years) time horizon, earning it the description as a "short-lived climate pollutant."[40] Though estimates range upon the scientific study methodology and assumptions used, it's generally accepted that methane provides approximately 28–36 times the Global Warming Potential (GWP) of CO_2 during a 100-year time horizon and 84–87 times the GWP of CO_2 over a 20-

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31. *Id*. at 15.

32. *Greenhouse Gas Inventory Data Explorer*, U.S. ENVTL. PROT. AGENCY, https://cfpub.epa.gov/ghgdata/inventoryexplorer/#allsectors/allgas/gas/all (last visited Apr. 29, 2020).

33. CAL. AIR RES. BD., *supra* note 10, at 15.

34. L.J. BUTLER, MAINTAINING THE COMPETITIVE EDGE IN CALIFORNIA'S DAIRY INDUSTRY PART II—CHALLENGES AND OPPORTUNITIES iii (1994).

35. WILLIAM A. MATTHEWS & DANIEL A. SUMNER, UNIV. OF CAL., CONTRIBUTIONS OF THE CALIFORNIA DAIRY INDUSTRY TO THE CALIFORNIA ECONOMY IN 2018: A REPORT FOR THE CALIFORNIA MILK ADVISORY BOARD ES-1 (2019).

36. CAL. AIR RES. BD., *supra* note 10, at 15.

37. *Id*.

38. *Id*.

39. S.B. 1383, 2015-2016 Reg. Sess. (Cal. 2016) (enacted) (requiring adoption of regulations to reduce methane emissions from livestock manure); CAL HEALTH & SAFETY CODE §§ 39730.5, 39730.7 (West 2016).

40. S.B. 1383, 2015-2016 Reg. Sess. (Cal. 2016); *see generally* L.D. Danny Harvey, *A Guide to Global Warming Potentials (GWPs)*, 21 ENERGY POL'Y, 24 (1993) (describing methane as a GHG).

year time horizon.[41] Methane also interacts with other GHGs to create additive impacts depending upon how much is released, how long it remains, and how strongly the gas affects the atmosphere.[42] Methane is a precursor to ozone, another GHG.[43] Eventually, methane oxidizes into CO_2, in which case it may remain in the atmosphere for hundreds of years and its atmospheric concentrations may persist for thousands of years.[44]

Avoiding methane generation altogether is a preferred strategy to converting it into CO_2.[45] However, transforming methane into CO_2 is an opportunistic strategy to reduce GWP and climate change over a "short term" 100-year interval, when methane is clearly a potent GHG. Moreover, methane transformation may combat long-term climate change if the transformed methane displaces fossil-fuel sources for a net decrease in overall CO_2 emissions (essentially "foregone CO_2 emissions"). In sum, if biogas methane is transformed into energy in lieu of petroleum-based fuels without creating additional leakages, there may be a cumulative reduction in GHG emissions. Reductions may occur in both the agriculture and transportation sectors, where the conditioned biogas can fuel natural gas and electric vehicles. Section II summarizes how U.S. laws and policies align to effectuate this scenario.

II. THE ENERGY INDEPENDENCE AND SECURITY ACT OF 2007 (EISA)[46] AND CALIFORNIA LAWS FACILITATE THE USE OF DAIRY METHANE BIOGAS IN THE TRANSPORTATION SECTOR

Biogas generated from methane digesters may be counted as renewable fuel under the national RFS2 program promulgated by EISA, which has been in effect since 2007.[47] EISA requires that transportation fuel sold or

41. *Understanding Global Warming Potentials*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/ghgemissions/understanding-global-warming-potentials (last updated Feb. 14, 2017).

42. *See* Ivar S. A. Isaksen et al., *Atmospheric Ozone and Methane in a Changing Climate*, 5 ATMOSPHERE 518, 518, 520, 530 (2014) (showing "climate-chemistry interactions" between methane, ozone, and nitrous oxides).

43. *Understanding Global Warming Potentials*, *supra* note 41.

44. *Id.*; L.D. Danny Harvey, *supra* note 40, at 28.

45. *See* Annika Carlsson-Kanyama & Alejandro D. González, *Potential Contributions of Food Consumption Patterns to Climate Change,* 85 AM. J. CLINICAL NUTRITION 1704, 1706 (2009) (demonstrating that minimizing agriculture-based methane in food production has given rise to food movements calling for low to zero meat and dairy consumption).

46. Energy Independence and Security Act of 2007, 42 U.S.C. ch. 152 (2018).

47. 42 U.S.C. § 7545(o) (2018); *id.* § 17021; *see also* KELSI BRACMORT, CONG. RESEARCH SERV., R44045, THE RENEWABLE FUEL STANDARD (RFS): WAIVER AUTHORITY AND MODIFICATION OF VOLUMES 1 n.2 (2019) ("P.L. 109–58 (Title XV, Subtitle A, Section 1501) established the RFS under Clear Air Act Section 211(o); P.L. 110–140 expanded the RFS partly with the requirement of larger annual volumes and the addition of greenhouse gas accounting requirements, among other things.").

introduced into commerce in the United States on an annual average basis contains a specified amount of renewable fuel.[48] All replacement renewable fuels require reductions in "lifecycle GHG emissions" compared to gasoline or diesel fuel sold or distributed in 2005.[49] Assessing lifecycle GHG emissions involves a scientifically rigorous assessment of the aggregate direct and indirect emissions (e.g. land use changes) at all stages of fuel and feedstock production and distribution.[50] The GHG mass values are adjusted for comparative GWP.[51] Setting mandatory lifecycle GHG emission reduction thresholds compared to average petroleum fuels used in 2005 for four renewable fuel categories facilitates the transition to lower CI, non-petroleum based alternative fuels, and chiefly towards advanced and cellulosic (non-cornstarch ethanol) technology.[52] RFS2 ratchets up the federally required increases in renewable fuel volumes, from nine billion gallons in 2008 to 36 billion gallons in 2022, for the four renewable fuel categories, with D-3 Cellulosic Biofuel targets comprising the largest proportion of the four.[53] The RFS2 requires that volumes for D-3 Cellulosic Biofuels incrementally increase over time through 2022, at which point the EPA will revisit them.[54]

Methane biogas produced from organic matter qualifies as a D-3 Cellulosic Biofuel and reflects an 80% reduction in lifecycle GHG emissions compared to petroleum-based fuels.[55] However, calculating the supply and demand for renewable fuels for RFS2 compliance is highly nuanced and dynamic. Due in part to historically deficient supplies of D-3 Cellulosic

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48. 42 U.S.C. 7545(o)(2) (2018).

49. *See id*. § 17022 (requiring the Secretary to award grants "for advanced biofuels with the greatest reduction in lifecycle greenhouse gas emissions compared to the comparable motor vehicle fuel lifecycle emissions during calendar year 2005").

50. PANKAJ BHATLA ET AL., WORLD RES. INST., GREENHOUSE GAS PROTOCOL: PRODUCT LIFE CYCLE ACCOUNTING AND REPORTING STANDARD 72–73 (2011); *see generally* OFFICE OF TRANSP. & AIR QUALITY, ENVTL. PROT. AGENCY, EPA-420-F-09-024, EPA LIFECYCLE ANALYSIS OF GREENHOUSE GAS EMISSIONS FROM RENEWABLE FUELS (2009) (discussing EPA's lifecycle GHG emission calculation protocol).

51. *See* BHATLA ET AL., *supra* note 50, at 85 (discussing appropriate steps for companies to calculate lifecycle GHG emissions, including applying a GWP to emissions data).

52. *See* 42 U.S.C. § 7545(o)(1)(C) (2018) (defining baseline lifecycle GHG emissions as that of gasoline or diesel sold as fuel in 2005); *see generally* STEFAN UNNASCH, LIFE CYCLE ASSOCS., GHG EMISSIONS REDUCTIONS DUE TO THE RFS2: A 2018 UPDATE (2019) (describing the effect of RSF2's lifecycle GHG emissions reductions).

53. 42 U.S.C § 7545 (o)(2)(B)(i); 40 C.F.R. § 80.1425(g)(1) (2019) (designating cellulosic biofuel as D-3 for Renewable Identification Numbers).

54. *See* 42 U.S.C § 7545 (o)(2)(B)(i)(III) (mandating the incremental increase of cellulosic biofuels through 2022).

55. MATTHEN TOMICH & MARIANNE MINTZ, COW POWER: A CASE STUDY OF RENEWABLE COMPRESSED NATURAL GAS AS A TRANSPORTATION FUEL 1, 8 (2017).

Biofuel, the values are subject to annual supplemental notices of EPA rulemaking, as well as periodic exemptions, such as small refineries.[56]

Clearly, there is room to improve methane biogas collection practices to meet the D-3 Cellulosic Biofuel mandates and to reduce GWP. In California, the state's legal infrastructures mandating GHG[57] and methane reduction[58] combined with CARB's regulatory oversight over the transportation sector improve methane biogas collection. [59]

III. WILL CALIFORNIA REDUCE ITS METHANE EMISSIONS BY INNOVATION OR EVACUATION?

The fragile web of federal and California state laws surrounding the use of dairy biogas creates uncertainty about whether California will reduce methane emissions[60] through innovation or evacuation. Will California's rapidly evolving practices to convert methane from dairy biogas to displace petroleum-based vehicles remain financially viable if the EPA significantly reduces RFS2-mandated volumes after 2022?[61] What will happen if federal laws limit California's authority to enact more rigorous state air quality and emissions rules than federal standards?[62] Will dairies eventually relocate outside of California where there are less stringent state regulations leading to methane leakages and increased global methane emissions? Or, will anaerobic digesters generate enough revenue to encourage dairies to remain in the state and add more dairy cows? Understanding this conundrum requires additional discussion of the current federal and state financial incentives to produce dairy biogas.

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56. *See* 42 U.S.C. § 7545(o)(9) (providing small refiner exemption); BRACMORT, *supra* note 47, at 4–5 (describing cellulosic biofuel waivers); KELSEY BRACMORT, CONG. RES. SERV., R43325, THE RENEWABLE FUEL STANDARD (RFS): AN OVERVIEW 1 (2020) (noting a historic lack of cellulosic biofuel production causing difficulty in meeting total volume requirement); *Overview for Renewable Fuel Standard*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/renewable-fuel-standard-program/overview-renewable-fuel-standard (last updated June 7, 2017) (noting additional flexibility for cellulosic biofuel standard).

57. CAL. HEALTH & SAFETY CODE § 38566 (West 2019).

58. CAL. HEALTH & SAFETY CODE § 39730.5 (West 2019).

59. *See* CAL. HEALTH & SAFETY CODE § 38510 (West 2019) (charging CARB with monitoring and regulating GHG emissions sources); *see generally* CAL. AIR RES. BD, s*upra* note 10 (providing overview of CARB's management of the transportation sector).

60. *See*, *e.g.*, CAL. HEALTH & SAFETY CODE § 39730.5(a) (West 2019) (setting goal to reduce state methane emissions by 40% from 2013 levels by 2030).

61. BRACMORT, *supra* note 47, at 1.

62. *See* 49 C.F.R. §§ 531.7, 533.7 (2019) (demonstrating that this would repeal California's waiver to create more rigorous state air emissions standards than the federal standards for vehicles, including fuel efficiency). Though California and other states have filed lawsuits to challenge the ruling, this exemplifies the federal tensions with California, who exercises its discretion to enact state laws and regulations that address climate change and that are more rigorous than federal standards. Ostensibly, federal restrictions on California's autonomy may continue and erode CARB's regulatory authority.

Under RFS2, the EPA announces annual renewable fuel percentage standards that are used to calculate the number of gallons each Obligated Party (OP) must blend into their fuel every year.[63] Renewable Identification Numbers (RIN) demonstrate compliance.[64] One RIN is roughly equal to one gallon of ethanol.[65] Notably, the EPA requires OPs to demonstrate both feedstock (supply) and transportation (end-use demand) to generate a RIN.[66]

On the demand side, OPs have a Renewable Volume Obligation (RVO) to purchase renewable biofuels.[67] In 2020, D-3 Cellulosic RVO increased to 540 million RIN, 29% higher than the 2019 RVO.[68] Supplies, however, are expected to fall considerably short of meeting the demand, as has historically been the case.[69] Because meeting the D-3 Cellulosic Renewable Fuel volume demand has been consistently difficult due to inadequate supply, Congress gives the EPA Administrator waiver authority to adjust the renewable fuel volumes.[70] This is an option that the EPA Administrator has consistently exercised.[71] Waivers provide the OP with formulaically derived Cellulosic Waiver Credits (CWC)[72] that can be nested and combined with RINs from other biofuel categories,[73] creating a highly lucrative fuel portfolio for the OP.

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63. 42 U.S.C § 7545(o)(3)(B) (2018).

64. *See* 40 C.F.R. § 80.1127(a) (2019) (requiring obligated parties to demonstrate ownership of sufficient, time-limited RINs to meet the Renewable Volume Obligation for the compliance period).

65. *See id*. § 80.1106(b) (2019) (requiring obligated parties to demonstrate satisfaction of the Renewable Volume Obligation for the compliance period).

66. *Id.* §§ 80.1106(b), 80.1107.

67. *See id.* § 80.1106(b) (2019) (requiring obligated parties to demonstrate satisfaction of the Renewable Volume Obligation for the compliance period); COVINGTON & BURLING LLP, AN ANALYSIS OF THE RENEWABLE FUEL STANDARD'S RIN MARKET 5–6 (2019).

68. *Proposed Volume Standards for 2020, and the Biomass-Based Diesel Volume for 2021*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/renewable-fuel-standard-program/proposed-volume-standards-2020-and-biomass-based-diesel-volume-2021 (last updated Sept. 12, 2019).

69. *See Proposed Volumes for 2020 and Biomass-Based Diesel Volume for 2021: Supplemental Notice*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/renewable-fuel-standard-program/proposed-volumes-2020-and-biomass-based-diesel-volume-2021 (last updated Nov. 7, 2019) (reviewing how RVOs are being calculated).

70. *See* 42 U.S.C § 7545 (o)(7)(D) (2018) (establishing procedures for the Administrator to reduce the minimum volume requirements for cellulosic biofuel based on supply estimates).

71. U.S. ENVTL. PROT. AGENCY, CELLULOSIC WAIVER CREDIT PRICE CALCULATION FOR 2019 1 (2018) ("For any calendar year for which the projected volume of cellulosic biofuel production is less than the applicable volume of cellulosic biofuel set forth in Clean Air Act (CAA) section 211(o)(2)(B)(III), EPA must reduce the required volume of cellulosic biofuel for that year to the projected volume, and must provide obligated parties the opportunity to purchase cellulosic waiver credits (CWC). The price of these credits is determined using a formula specified in the CAA."); BRACMORT *supra* note 47, at 5–6.

72. *Id.* at 5.

73. 42 U.S.C. § 7545(o)(1)(B) (2018); BRACMORT, *supra* note 47, at 5.

Additional state financial incentives are available through California Low Carbon Fuel Standard (LCFS)[74] credits,[75] which count additional GHG emission reductions if both the supply source and the user are in California. For example, dairies may convert methane into electricity for on-farm use to cool and store milk.[76] This situation provides farmers with electricity cost savings and LCFS credits.[77] In another example, nitrous oxide emissions (NOx), which have approximately 265-298 times greater GWP compared to CO_2 over a 100-year period,[78] can be reduced 90% when dairy biogas is used to offset petroleum-based fuels in California's transportation sector.[79] Biogas converted into electricity to power vehicles does not qualify for federal RIN, but California LCFS incentives still apply.[80]

This nexus of federal and state incentives has created several emergent supply chain processes for supplying reconditioned dairy biogas to the transportation sector.[81] Biogas may be treated at regional facilities that serve multiple anerobic digesters and farms, collected, and injected into the natural gas grid for R-CNG transportation filling stations.[82] The reconditioned gas may also be exported outside the state as liquified natural gas (LNG).[83] Alternatively, the methane captured by the digesters may be converted into electricity by fuel cells connected to the electrical grid and purchased by electric vehicle (EV) charging stations to power EVs, for virtually GHG-free fuel.[84]

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74. As part of its Scoping Plan, CARB identified the Low Carbon Fuel Standard as an early action to reduce GHG emissions. *Low Carbon Fuel Standard*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about (last visited Apr. 28, 2020). The Low-Carbon Fuel Standard (LCFS) is a key AB 32 measure and part of a portfolio of evolving GHG policies in California over the past decade. *Id*.

75. *Id.*

76. Lydia Noyes, *Using Methane Power on a Dairy Farm* (Oct. 2018) https://www.motherearthnews.com/renewable-energy/other-renewables/using-methane-power-on-dairy-farm-zm0z18onzsphe.

77. PYE RUSSELL ET AL., RENEWABLE NATURAL GAS: THE RNG OPPORTUNITY FOR NATURAL GAS UTILITIES 1–3, 5 (2017).

78. *Understanding Global Warming Potentials*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/ghgemissions/understanding-global-warming-potentials (last updated Feb. 14, 2017).

79. RUSSELL ET AL., *supra* note 77, at 15.

80. Letter from Robert E. Cleaves IV, President & CEO, Biomass Power Ass'n, to Hon. Andrew R. Wheeler, Acting Adm'r, U.S. Envtl. Prot. Agency (Oct. 24, 2018).

81. *See* MARGARET SMITH & JOHN GONZALEZ, U.S. DEP'T OF ENERGY, COSTS ASSOCIATED WITH COMPRESSED NATURAL GAS VEHICLE FUELING INFRASTRUCTURE 2, 9 (2014) (highlighting different methods of supplying natural gas to the transportation sector).

82. *See Renewable Natural Gas Production*, U.S. DEP'T OF ENERGY, https://afdc.energy.gov/fuels/natural_gas_renewable.html (last visited May 2, 2020) (explaining how biogas can be refined for use as a source of fuel).

83. *Id.*

84. *See* Michael J. McAnulty et al., *Electricity from Methane by Reversing Methanogenesis*, NAT. COMM., May 2017, at 1, 2–4.

These complex and evolving initiatives are rapidly expanding California's infrastructure and demand for biogas-generated renewable fuels.[85] This has prompted many dairy farmers to rely on consultants to determine how they can maximize their financial benefits by facilitating GHG reduction while ensuring they remain compliant with legal and regulatory standards.[86] On one hand, this infrastructure creates an efficient mechanism for dairy methane gas capture in California. This is an issue with which the state has struggled[87] and has global implications for climate change mitigation.

However, this emergent dairy biogas supply infrastructure also creates perverse incentives for farmers to raise more dairy cows. This would allow farmers to generate more methane and thus more revenue. Will the dairy industry continue to grow in California? It may if: (1) the RFS2 volumes for D-3 Cellulosic Biofuels are not impinged upon following the 2022 Reset; (2) RFS2 federal financial incentives continue; and (3) California continues to provide policy and financial incentives to offset petroleum-based fuels in its transportation sector. The third will be predicated upon whether California's authority to implement more rigorous regulations of GHG emission reductions is upheld, though it will add an additional layer of complexity and uncertainty for the dairy industry.

In the face of considerable legal and regulatory uncertainty, there is concern that dairies, particularly small ones, may relocate outside of California where methane regulation is less stringent, and water is of greater abundance.[88] The "evacuation" of dairies outside of California would presumably generate methane leakages unless Congress extends the Clean Air Act to include GHG emissions such as methane. In this case, other states could replicate California's model.

In sum, California's emerging system of capturing dairy biogas to reduce transportation sector fossil fuels is critically important to lowering the state's level of methane and overall GHG emissions. However, it remains unknown whether California's innovative practices that have spurned technological

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85. *See* Christopher Yang et al., *Meeting an 80% Reduction in Greenhouse Gas Emissions from Transportation by 2050: A Case Study in California*, 14 TRANSP. RES. PART D 147, 151–52 (2009) (showing how improvements in efficiency and increased reliance on alternative fuels can reduce transportation emissions); CAL. DAIRY CAMPAIGN, ECONOMIC FEASIBILITY OF DAIRY DIGESTER CLUSTERS IN CALIFORNIA: A CASE STUDY 11–15, 25 (2013) (discussing state laws and regulations supporting the development of dairy digesters and biogas projects).

86. *See*, *e.g.*, *Dairies*, CAL. BIOENERGY, https://calbioenergy.com/dairies/ (describing how one company helps dairies develop and finance biogas projects) (last visited Mar. 28, 2020).

87. *See* CAL. AIR RES. BD., *supra* note 10 at 15 (describing the trends in dairy GHG emissions between 2000 and 2017).

88. Adam Ashton & Andrew Sheeler, *Turning Poop into Power: California Dairies Appeal for More State Climate Change Money* (May 29, 2019), https://www.fresnobee.com/news/business/agriculture/article230869984.html.

innovation can be replicated elsewhere in a cost-effective manner. This is critical in facilitating global climate change mitigation.

CONCLUSION

In conclusion, there is indeed potential for dairy methane biogas capture to have a tractable impact on GHG and climate change mitigation. For California's methane reduction policies to reduce GHG emissions that contribute to global climate change, the GHG emission reduction efficiencies between the state's agriculture and transportation sectors must expand in California and replicate elsewhere in a cost-effective manner. Otherwise, leakages will raise GHG levels nationally and internationally as industries relocate outside of California, seeking lighter regulations.[89]

Using dairy methane biogas as a D-3 Cellulosic Biofuel has shown to effectuate a net reduction in lifecycle GHGs emissions,[90] though the adoption of these practices on a larger scale relies upon the expanded use of EV and R-CNG vehicles.[91] Demand from states like California, with large governmental vehicle fleets, may drive the development of EV charging infrastructure, which has been significantly and positively correlated with EV adoption.[92] The expanded infrastructure necessary to support government fleets may propel private sector EV demand.[93] However, until the EV charging infrastructure matures, it will also be important for the State to continue providing financial incentives[94] both to grow EV infrastructure and demand and support R-CNG vehicles. Moreover, though reconditioned biogas provides one source of renewable biofuel, energy generation from non-fossil fuel technology (e.g. solar energy) is paramount for EVs to have larger scale GHG emission reductions that will affect global climate change.[95]

Though multiple, diverse sources of renewable energy are necessary to grow and support the emerging infrastructure for EVs, cultivating California's agriculture-based methane emissions is a significant step in

89. Thomas D. Peterson & Adam Z. Rose, *Reducing Conflicts Between Climate Policy and Energy Policy in the US: The Important Role of the States*, 34 ENERGY POL'Y 619, 620 (2006).

90. OFFICE OF TRANSP. & AIR QUALITY, *supra* note 50, at 2 (2009); TOMICH & MINTZ, *supra* note 55, at 1, 17.

91. AMY MYERS JAFFE, THE FEASIBILITY OF RENEWABLE NATURAL GAS AS A LARGE-SCALE, LOW CARBON SUBSTITUTE CONTRACT NO. 13-307 1, 4 (2016).

92. William Sierzchula et al., *The Influence of Financial Incentives and Other Socio-Economic Factors on Electric Vehicle Adoption*, 68 ENERGY POL'Y 183, 184 (2014).

93. *Id*. at 184, 192.

94. U.S. DEP'T OF ENERGY, *supra* note 9.

95. *Life Cycle Assessment Harmonization*, NAT'L RENEWABLE ENERGY LAB., https://www.nrel.gov/analysis/life-cycle-assessment.html (last visited May 2, 2020).

expanding renewable biofuel technologies that will reduce GHG emissions and mitigate global climate change. As California's supply chain model for R-CNG and EVs matures and becomes increasingly efficient, other states and countries may adopt a similar supply chain infrastructure for biogas capture and EVs. This may be true particularly if it becomes cost-effective to do so. California, an early adopter of EV infrastructure, shoulders the innovation costs and may leverage its market power to reduce costs so that technology may be replicated elsewhere.[96] For some time, small-scale anaerobic digesters have demonstrated to be economically feasible at the farm level.[97] Moreover, advancements in the use of biogas as a renewable fuel for transportation may enhance economic feasibility. It will be interesting to see whether this remains the case after the federal RFS2 volumes are reset in 2022.

The problem of anthropogenic climate change requires more resources and attention than strictly manure management. Methane biogas capture, however, is a good place to begin. Technological innovations that reduce environmental impacts and create efficiencies through a systems approach may simultaneously drive economic development and mitigate GHG emissions.[98] Small improvements in these innovations add up.

96. *See* NEXT 10, POWERING INNOVATION: CALIFORNIA IS LEADING THE SHIFT TO ELECTRIC VEHICLES FROM R&D TO EARLY ADOPTION 4-5, 26 (2011) (explaining California's role in the adoption of EV technologies). It is well established that California is known as being a hub for innovation, and that its market power facilitates adoption of these innovations elsewhere.

97. KESKE, *supra* note 19, at 315.

98. Another hypothetical example is capturing CO_2 emissions at the smokestack, transporting, and injecting the emissions into the ground. *See* José D., Figueroa et al., *Advances in CO_2 Capture Technology—the US Department of Energy's Carbon Sequestration Program*, 2 INT'L J. GREENHOUSE GAS CONTROL 9, 9-10 (2008) (identifying new technologies associated with injecting CO_2 into the ground).

HOW GREEN IS THE "GREEN RUSH"? RECOGNIZING THE ENVIRONMENTAL CONCERNS FACING THE CANNABIS INDUSTRY

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INTRODUCTION

Marijuana is a Schedule I controlled substance and remains illegal, for all purposes, under Federal law.[3] But, after 2018's ballot initiatives, and the State of Illinois' legislative enactments, 33 states plus the District of Columbia have legal, medical, and/or recreational cannabis regimes.[4] States where marijuana has been broadly legal for years have designated dispensaries as "essential businesses" during the COVID-19 crisis.[5] States that already have medical marijuana, such as New Jersey and Pennsylvania, are exploring full legalization.[6] Other states, such as Wisconsin and Kansas, are evaluating legislative proposals to decriminalize and regulate medical marijuana, and both have approved hemp-derived cannabidiol (CBD) oils with low tetrahydrocannabinol (THC) content.[7] Even Texas governor Greg Abbott indicated during a recent debate that he is "open to some form of decriminalization."[8]

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3. 21 U.S.C. § 841 (2018) (prohibiting the manufacture and distribution of marijuana); *id*. § 812(c)(a)–(d)(1) (identifying marijuana as a Schedule I substance). The information in this article is not intended to constitute legal advice. Possession, use, distribution, and sale of cannabis are illegal under federal law, and nothing in this article is intended to provide any guidance or assistance in violating federal law.

4. Robert McCoppin, *Legal Marijuana is Coming to Illinois as Gov. Pritzker Signs Bill He Calls 'Important and Overdue to Our State'* (June 25, 2019), https://www.chicagotribune.com/news/breaking/ct-governor-to-sign-recreational-marijuana-law-20190624-ee2bswlsq5eqvkcbuq6oz6id5i-story.html; Jeremy Berke & Skye Gould, *Legal Marijuana Just Went on Sale in Illinois. Here are All the States Where Cannabis is Legal* (Jan. 1, 2020), https://www.businessinsider.com/legal-marijuana-states-2018-1.

5. Caitlin O'Kane, *Marijuana Dispensaries in some States Deemed an "Essential Services" During Coronavirus Lockdowns* (Mar. 25, 2020), https://www.cbsnews.com/news/marijuana-dispensaries-in-some-states-deemed-an-essential-service-during-coronavirus-lockdowns/. California, New Jersey, Colorado, and Vermont are just some of the states that have so designated their dispensaries, with some states even permitting curbside pickup and even prescriptions via telehealth. *Id*.

6. Tom Angell, *These States are Most Likely to Legalize Marijuana in 2019* (Dec. 26, 2018), https://www.forbes.com/sites/tomangell/2018/12/26/these-states-are-most-likely-to-legalize-marijuana-in-2019/#41fb0a85adda.

7. *Id*.; *Kansas*, MARIJUANA POL'Y PROJECT, https://www.mpp.org/states/kansas/ (last updated Jan. 14, 2020); *Wisconsin*, MARIJUANA POL'Y PROJECT, https://www.mpp.org/states/wisconsin/ (last updated Apr. 20, 2020). Cannabis plants have over 113 different cannabinoids, with THC and CBD being the best known. Delta-9 THC is the primary psychoactive ingredient in cannabis. Adam Drury, *The Ultimate Guide to Cannabinoids in Cannabis* (Apr. 6, 2018), https://hightimes.com/health/science/cannabinoids/.

8. Angell, *supra* note 6.

Multiple bills are percolating through the U.S. Congress to address the federal/state conflict; some bills seek to legalize marijuana and end Category I scheduling of all cannabis. One such bill, H.R. 420, seeks to regulate marijuana like alcohol.[9] Although the current COVID-19 crisis may delay action, votes will eventually be taken.

The cannabis industry has already begun to contend with a dizzying patchwork of state laws and local ordinances governing the farmers, dispensaries, and ancillary businesses as they deal with licensing, distribution, and manufacturing of their products. However, some of the most significant—and underappreciated—challenges facing the emerging cannabis industry are in the environmental arena. Litigation is a significant risk: litigants have already filed toxic tort and product liability claims, civil lawsuits under the Racketeer Influenced and Corrupt Organizations Act (RICO),[10] citizen suit public nuisance claims,[11] and claims under California's Safe Drinking Water and Toxic Enforcement Act of 1986 ("Prop 65").[12] In addition, the industry faces state regulatory challenges in terms of resource use (water and land), sustainability and energy use, compliance with waste disposal, and pesticide laws. Recognizing these issues and risks is the first step towards solving them.

I. LITIGATION RISKS

Litigation poses an existential risk to any business. The National Center for State Courts' Court Statistics Project recently estimated that, of the approximately 84 million cases filed in 2016, 18%—

9. H.R. 420, 116th Cong. (2019).

10. Racketeer Influence and Corrupt Organization Act (RICO) of 1970, 18 U.S.C. §§ 1961–1968 (2018).

11. Nick Welsh, *Public Nuisance Lawsuit Filed Against Cannabis Growers* (Mar. 2, 2020), https://www.independent.com/2020/03/02/public-nuisance-lawsuit-filed-against-cannabis-growers/. The Santa Barbara Santa Barbara County Coalition for Responsible Cannabis named four greenhouse operations, with plaintiffs seeking relief "from the awful smells and noxious odors and chemicals that they are being assaulted with on a daily basis." *Id*.

12. CAL. HEALTH & SAFETY CODE §§ 25249.5–25249.13 (West 2020); *see also* Indictment at ¶¶ 1, 8, United States v. Wellgreensca, No. 19-CR-2439-WQH, (S.D. Cal. June 19, 2019), https://www.lion.com/getmedia/01c19fca-d466-4b61-9c1a-c00baaf03e8e/WellgreensCA-Indictment (highlighting the generation of hazardous waste by the cannabis industry and alleging multiple violations of RCRA including illegal transportation of hazardous waste under section 6928(d)(1) and transportation of hazardous waste without a manifest under section 6928(d)(5). Also alleging that the business owners and administrators participated in conspiracy to engage in these violations).

approximately 15,000,000—were civil cases, [13] —including approximately 56,000 tort claims filed in California alone.[14]

Despite being legal under specific state laws, cannabis-based businesses face Not in My Back Yard (NIMBY)[15] campaigns and others opposed to cannabis for a myriad of reasons.[16] Additionally, lawyers are focusing on suing the industry and encouraging others to do the same.[17] All of these factors lead to an environment ripe for litigation.

a. Products liability

Traditional products liability for toxic injury presents a potentially significant ongoing concern for cannabis growers, makers of cannabis products (including edibles), as well as dispensaries and retail locations. These claims, whether sounding in strict liability, negligence, or failure to warn, can be very costly.[18] Further, industry participants are potentially vulnerable in the areas of labeling (inadequate warnings), packaging (proper containers and childproof containers), and quality control (including the use of labs for testing of products to avoid contaminants).

One of the first toxic tort products liability cases the cannabis industry confronted was *Flores v. LivWell.*[19] In that case, the plaintiffs

13. NAT'L CTR. FOR STATE COURTS, *Composition of Incoming Cases, All Trial Courts, 2016* (Jan. 11, 2018), http://www.courtstatistics.org/~/media/Microsites/Files/CSP/National-Overview-2016/EWSC-2016-Overview-Page-4-Comp.ashx.

14. JUDICIAL COUNSEL OF CAL., 2017 COURT STATISTICS REPORT, STATEWIDE CASELOAD TRENDS, 2006 – 2007 THROUGH 2015–2016, 121–25 (2017).

15. *See* Denis J. Brion, *An Essay on LULU, NIMBY, and the Problem of Distributive Justice*, 15 BOS. C. ENVTL. AFF. L. REV. 437, 438 (1988) (explaining that "NIMBY" refers to the concept that there are some facilities most people desire so long as the facilities are not located near their homes).

16. *See* Jeremy Nemeth & Eric Ross, *Planning for Marijuana: The Cannabis Conundrum*, 80 J. AM. PLAN. ASS'N 6, 7–8 (2014) (describing reasons for campaigning against cannabis-based businesses); Peter Hecht, *How Liberal Marin County Turned NIMBY on Cannabis* (Feb. 27, 2018), https://www.leafly.com/news/politics/how-liberal-marin-county-turned-nimby-on-cannabis (describing community attempt to ban cannabis).

17. Alex Malyshev, *As Cannabis Industry Matures, Expect a Lot More Litigation* (Sept. 19, 2019), https://www.thinkadvisor.com/2019/09/19/as-cannabis-industry-matures-expect-a-lot-more-litigation/.

18. David Evans et al., *Litigating Against the Marijuana Industry* (July 29, 2018), https://vimeo.com/281275757.

19. *See generally* Plaintiffs' Class Action Complaint for Damages & Injunctive Relief, Flores v. LiveWell, Inc., No. 2015-CV-33528 (Dist. Ct. Cty. Denver Oct. 5, 2015), https://mjbizdaily.com/wp-content/uploads/2015/10/2015-10-05-04-49-31-Flores-v.-LiveWell-Complaint-FINAL.pdf (bringing a civil claim against a cannabis company); Mishan Wroe & Josue Aparicio, *Growing Concerns: Marijuana Industry Hit with Its First Ever Product Liability Lawsuit*, SCHIFF HARDIN (Oct. 31, 2015),

argued that the economic value of their cannabis was diminished because the grower and distributor, LivWell, used a fungicide that was not registered by the U.S. Environmental Protection Agency (EPA) for use on cannabis plants.[20] The chemical was allegedly hazardous when burned.[21] In issuing its order dismissing the case, the court engaged in a straightforward standing analysis under *Wimberly v. Ettenberg.*[22] Under *Wimberly,* a plaintiff is required to demonstrate both that "(1) he suffered an injury in fact, and (2) his injury was to a legally protected interest."[23] The court found that:

> Plaintiffs' sole stated injury is that they overpaid for defendant's product. There are no allegations that the product did not perform as it was supposed to, and indeed the Complaint alleges that Plaintiffs consumed the product. . . [n]or are there any allegations that Plaintiffs suffered physical or emotional injury.[24]

Citing various cases that a claim of diminished value does not state an injury in fact, including *Rule v. Fort Dodge Animal Health, Inc*. and *Rivera v. Wyeth-Ayerst Laboratories*, the court found the authorities cited by plaintiffs unavailing because no possibility of reselling the purchased marijuana existed.[25] As such, the court found that plaintiffs suffered no injury in fact and dismissed the cases.[26]

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https://www.productliabilityandmasstorts.com/2015/10/growing-concerns-marijuana-industry-hit-with-its-first-ever-product-liability-lawsuit/ (describing the lawsuit).

20. Plaintiffs' Class Action Complaint for Damages & Injunctive Relief, *supra* note 19, ¶ 1.

21. *Id.* ¶ 14.

22. Order on Defendant LivWell's Motion to Dismiss at 2, Flores v. LiveWell, Inc., No. 2015-CV-33528 (Dist. Ct. Cty. Denver Feb. 11, 2016), https://www.ettdefenseinsight.com/wp-content/uploads/2016/04/ORDER-ON-DEFENDANT-LIVWELLS-MOTION-TO-DISMISS.pdf.

23. *Id*.

24. *Id.* at 2–3.

25. *Id.* at 3–4.

26. *Id.* at 5. This concept is well ensconced in the established economic loss doctrine, which holds that a plaintiff in a product liability or negligence action may not recover for purely economic injury better suited to a non-tort cause of action. This includes "the loss of value or use of the product itself, and the cost to repair or replace the product." U.S. Gypsum v. Mayor & City Council of Balt., 336 Md. 145, 156 (1994); Tolan & Son, Inc. v. KLLM Architects, Inc., 719 N.E. 2d 288, 294 (Ill. App. Ct. 1999) ("[T]ort law is not intended to compensate parties for monetary los[s]es suffered as a result of duties which are owed to them simply as a result of a contract."); *see also* E. River S.S. Corp. v. Transamerica Delaval, Inc., 476 U.S. 858, 871 (1986) ("[A] manufacturer in a commercial relationship has no duty under either a negligence or strict products-liability theory to prevent a product from injuring itself.")

The court dismissed the *LivWell* suit because the plaintiffs lacked standing to proceed in the absence of a legally cognizable injury-in-fact.[27] However, in so ruling, the court supplied a roadmap for future lawsuits. The court's explicit statement that plaintiffs did not allege a physical injury suggests that such an allegation would have allowed plaintiffs to proceed with their lawsuit.[28]

"Actual injury" came quickly enough. In 2016, a wrongful death products liability case was filed in Denver, Colorado.[29] In *Andrew Kirk v. Richard Kirk*, the Richard Kirk's children sued the maker of cannabis containing candy, Gaia's Garden, and a dispensary, Nutritional Elements, Inc.[30] Plaintiffs alleged that Richard Kirk's consumption of "Karma Kandy Orange Ginger" caused "psychotic behavior, following ingestion of the marijuana infused edible candy," which led Richard Kirk to shoot and kill his wife, Kristine Kirk, at their family home.[31] The complaint advanced multiple causes of action, including strict liability and negligent failure to warn.[32] Ultimately, the dispensary settled the case for an undisclosed amount.[33]

These cases exemplify the vulnerabilities within the industry to products liability claims. Plaintiffs may try additional avenues as well. Accidental exposures to children are one such avenue. The Journal of the American Medical Association Pediatrics published a retrospective cohort study of hospital admissions at Children's Hospital Colorado (Aurora) to evaluate unintentional marijuana exposures in children.[34] The study evaluated approximately 240 instances of children's exposures.[35] The median age of the sample population was 2.4 years old.[36] The study found that edible products were involved in more than

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27. Order on Defendant LivWell's Motion to Dismiss, *supra* note 22, at 5.

28. *Id.* at 4–5.

29. Complaint for Damages & Jury Demand at paras. 22, 36, Kirk v. Kirk, No. 2016-CV-31310, (Dist. Ct. Cty. Denver Apr. 13, 2016), https://www.courthousenews.com/wp-content/uploads/2017/05/Kirk.v.Gaia_.pdf.

30. *Id.* ¶¶ 1–7.

31. *Id.* ¶¶ 12, 14, 36.

32. *See generally id.* (listing six claims for relief).

33. Cannabis Law Grp., *Marijuana Product Liability Lawsuits May Pick Up in 2019* (Jan. 15, 2019), https://www.marijuanalawyerblog.com/marijuana-product-liability-lawsuits-may-pick-up-in-2019/.

34. *See generally* George Sam Wang et al., *Unintentional Pediatric Exposures to Marijuana in Colorado, 2009-2015*, J. AM. MED. ASS'N PEDIATRICS, Sept. 6, 2016.

35. *See id.* at 3 (charting the number of state pediatric marijuana exposure cases).

36. *Id.*

48% of exposures.[37] For 9% of the exposure scenarios, the products were not in a child-resistant container.[38] In California, cannabis-infused gummies caused 19 people, mostly teens and children, to become ill at a birthday party.[39] While some states like Colorado have responded by advancing legislation to ban cannabis products in shapes likely to attract children, others have not.[40] Thus, inadequate packaging—combined with attractive shapes, flavors and colors likely to attract children—may create liability exposure.[41]

Another potential source of liability is contaminated cannabis. A lack of national standardization and quality control during harvesting, processing/extraction, and/or point of sale may result in unintended bacterial or chemical exposures to consumers.[42]

Finally, engineered cannabis strains or extracted cannabis concentrates with high THC may themselves be a source of liability.[43] Consumers unfamiliar with or unaware of the potential effects may suffer injury as a result.[44]

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37. *Id.*

38. *Id.* at 5.

39. *See* Lindzi Wessel, *Mass Marijuana Overdose in California is Latest in Worrisome Trend of Children Poisoned* (Aug. 9, 2016), https://www.statnews.com/2016/08/09/edible-marijuana-kids/ (reporting on a mass marijuana overdose that happened at a birthday party in California where 19 people were sickened after ingesting marijuana infused gummies).

40. Associated Press, *Colorado Bans Pot Gummy Bears, Other Edibles Appealing to Kids* (Oct. 2, 2017), https://www.cbsnews.com/news/colorado-bans-pot-gummy-bears-other-edibles-shapes/.

41. *See* CHLOE GROSSMAN ET AL., COUNCIL ON RESPONSIBLE CANNABIS REG. & NAT'L CANNABIS INDUSTRY ASS'N, CANNABIS PACKAGING & LABELING: REGULATORY RECOMMENDATIONS FOR STATES & NATIONS 34–35 (2014) (recommending prohibiting packaging that is attractive to minors).

42. *See* Nicholas Sullivan et al., *Determination of Pesticide Residues in Cannabis Smoke*, J. TOXICOLOGY, Apr. 2013, at 1–2 (describing lack of regulation of pesticide application); Penelope Overton, *Lack of Mandated Testing Could Expose Cannabis Users to Toxins*, PORTLAND PRESS HERALD, https://www.pressherald.com/2018/12/30/lack-of-mandated-testing-could-expose-cannabis-users-to-toxins (last updated Dec. 30, 2018) (describing lack of testing requirements).

43. *See* Chris Roberts, *What's Wrong with Genetically Modified Marijuana—And Are You Smoking Some Right Now?* (Sept. 6, 2019), https://observer.com/2019/09/gmo-marijuana-effects-identification/ (describing genetically modified cannabis).

44. *See* Raj Persaud, *Has Cannabis Been Secretly Genetically Modified to Render It More Dangerous?* (July 22, 2012), https://www.huffingtonpost.co.uk/dr-raj-persaud/has-cannabis-been-secretly-modified-_b_1688684.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAFOJWXJUP8cpq7SjhSKdE302H30p5Xukl88GXN8pFRWWQg_HPCJDOgeH3lJupvJRH8wWpF0LTvi8snaFUodBIPbqnvqSp62FjVeko2zoDmVovIBSGN_C45AdLT_o3wtt4E3H4nF9f40thMEK6JSFMKnyu6mUpYK7TaP6QGjYxgkt (describing the potential danger of unregulated, genetic modification).

b. Civil RICO Claims

In another example of NIMBY litigation, private plaintiffs, often backed by moneyed anti-cannabis interests, have brought suit against legal cannabis business owners in federal court under RICO in multiple states, including Oregon, Colorado, and California.[45] Originally intended to combat organized crime, RICO permits private civil claims and authorizes treble damages, attorney's fees, and potential injunctive relief.[46]

Initially, these suits prompted settlements, and even claimed some early legal victories.[47] In 2017, in *Safe Streets Alliance v. Hickenlooper*,[48] the Tenth Circuit held that landowners in Colorado could move forward with a civil suit under RICO against a licensed marijuana cultivation enterprise located on an adjacent property.[49] The landowners claimed that the existence of the marijuana cultivation enterprise, as well as the noise and smell coming from the enterprise, damaged their property.[50] The Tenth Circuit found "three plausibly alleged" injuries, including odor and property value diminution and remanded the case back to the district court for further proceedings.[51]

However, on October 31, 2018, a jury returned a decision in favor of the marijuana cultivation enterprise, finding that the plaintiffs had not suffered an injury.[52] Two decisions out of the Ninth Circuit quickly followed *Safe Streets—Ainsworth v. Overby* and *Bokaie v. Green Earth Coffee*.[53] Each held that the plaintiffs failed to properly allege

45. *See* Kara Thorvaldsen, *RICO Suites Against Cannabis Companies and Co-Conspirators Slow to Gain Traction* (Nov. 13, 2018), https://www.natlawreview.com/article/rico-suits-against-cannabis-companies-and-co-conspirators-slow-to-gain-traction (describing RICO lawsuits against cannabis companies).

46. 18 U.S.C. §§ 1961, 1964 (2018); *see also* Religious Tech. Ctr. v. Wollersheim, 796 F.2d 1076, 1077 (9th Cir. 1986) (holding that injunctive relief is not available to a private plaintiff in civil RICO suits). *But see* Nat'l Org. of Women v. Schiedler, 267 F.3d 687, 700 (7th Cir. 2001) (holding that RICO authorizes private plaintiffs to seek injunctive relief).

47. *See*, *e.g.*, Ricardo Baca, *Anit-pot Racketeering Suit Settles, Opens Door for Future RICO Claims* (Oct. 2. 2016), https://www.denverpost.com/2015/12/30/anti-pot-racketeering-suit-settles-opens-door-for-future-rico-claims/ (describing settlement); Safe Sts. All. v. Hickenlooper, 859 F.3d 865, 891 (10th Cir. 2017) (holding plaintiffs' RICO claims could proceed).

48. *Safe Sts. All.*, 859 F.3d 865.

49. *Id.* at 885.

50. *Id.* at 879, 887.

51. *Id.* at 890–91.

52. Thorvaldsen, *supra* note 45.

53. Ainsworth v. Overby, 326 F. Supp. 1111 (D. Or. 2018); Bokaie v. Green Earth Coffee, LLC, No. 18-cv-05244-JST, 2018 WL 6813212 (N.D. Ca. Dec. 27, 2018).

injury to person or property under RICO and dismissed the claims.[54] *Bokaie* was particularly favorable to the defendant, with the court expressly noting that RICO "was intended to combat organized crime, not to provide a federal cause of action and treble damages to every plaintiff."[55]

Despite the decisions in *Ainsworth* and *Bokaie*, the U.S. District Court for the District of Oregon in *Momtazi Family v. Mary E. Wagner*, issued an order on August 27, 2019 denying the defendant's motion to dismiss for failure to state a claim and lack of subject matter jurisdiction.[56] The defendant was an adjacent property owner who grew marijuana legally on his premises under Oregon law, and the plaintiff owned a vineyard.[57]

Unlike previous decisions in *Bokaie* and *Ainsworth*, the court found that the *Momtazi Family* plaintiff had alleged sufficient facts to establish constitutional standing to bring its claim under the Article III "case or controversy" requirement of the U.S. Constitution.[58] Citing the landmark *Lujan v. Defenders of Wildlife*, the Court noted that a plaintiff must show they suffered "an invasion of a legally protected interest" that is "concrete and particularized" and "actual or imminent, not conjectural or hypothetical."[59] However, the court found that the alleged injuries, including that "an order for grapes was cancelled as a result of the customer's concern that the grapes were contaminated by the marijuana smell" and concerns about "diminished marketability" of the grapes, were sufficiently "concrete and particularized" to permit the claim to go forward.[60]

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54. *Bokaie*, 2018 WL 6813212 at * 7; *Ainsworth*, 326 F. Supp. 3d at 1116.

55. *Bokaie,* 2018 WL 6813212 at *3.

56. Momtazi Family, LLC v. Mary E. Wagner, No. 3:19-CV-00476-BR, 2019 WL 4059178 at *1, *7 (D. Or. Aug. 27, 2019).

57. *Id.* at *1.

58. *Id.* at *3–4.

59. *Id*. at *3 *(*citing Lujan v. Def's of Wildlife, 504 U.S. 555, 560 (1992)).

60 . *Id.* at *4–5. The court identified the other bases for the existence of a "concrete injury" as follows:

> [T]he value of its property has been diminished, it has been unable to market its grapes, a reservoir on its property was damaged, a calf was killed, and another cow damaged as a direct and proximate result of Defendants' activities to grow marijuana on their property. . . .In addition, Plaintiff alleges the terracing on Defendants' property has caused dirt to flow downhill into the reservoir on Plaintiff's property and has been damaging fish and wildlife.

While civil RICO lawsuits have been largely unsuccessful against the industry, litigants continue to bring cases, and the risk remains that litigants may appeal the cases to the conservative-majority U.S. Supreme Court.

b. Nuisance Claims

If civil RICO claims fail, the industry is ripe for targeting with "garden variety" public and private nuisance claims. These claims frequently take the form of citizen suits, with organized groups of citizens acting as plaintiff.[61]

Bringing a nuisance claim is relatively straightforward, especially in a jurisdiction like California. While private nuisance claims typically require showing interference with some rights in land, public nuisance claims do not.[62] They merely require that the nuisance complained about be "indecent or offensive to the senses." Cannabis odors are very recognizable and foment sometimes strong reactions from neighbors. Nuisance claims may be the new frontier of NIMBY pushback from impacted neighbors, providing a civil cause of action against businesses which will survive broad legality of the industry for years to come.

> On this record the Court concludes Plaintiff has alleged injuries in fact that are concrete, particularized, and actual. These allegations are sufficient to establish Plaintiff's constitutional standing, and, therefore, the Court has subject-matter jurisdiction over this case.

Id. at *4.

61. There are multiple examples of these kinds of claims around the country. In California, Santa Clara Citizens for Responsive Cannabis recently brought suit for fumes impacting a local high school. Giana Magnoli, *3 Carpinteria Residents File Nuisance Lawsuit Against Cannabis Farms* (Mar. 2, 2020), https://www.noozhawk.com/article/carpinteria_residents_file_nuisance_lawsuit_against_cannabis_farms. In Michigan, Ypsilanti Township prevailed in a nuisance case against a private couple for emitting marijuana fumes into their neighborhood. Tom Perkins, *Ypsilanti Township Wins 'Seminal' Case Against Couple Pumping Intense Marijuana Fumes into Neighborhood* (updated Apr. 3, 2019), https://www.mlive.com/news/ann-arbor/2014/07/ypsilanti_township_wins_semina.html. And a first of its kind nuisance case in Oregon involved allegations of hemp and marijuana cross pollination, destroying the value of a hemp crop. Jack Hempicine LLC v. Leo Mulkey Inc., Case No. 18CV38712 (Ore. filed Aug. 31, 2018).

62. *See* Judicial Council of California Civil Jury Instructions (CACI) Nos. 2020 & 2021 (2017) ("Private nuisance concerns injury to a property interest. Public nuisance is not dependent on an interference with rights of land: '[A] private nuisance is a civil wrong based on disturbance of rights in land while a public nuisance is not dependent upon a disturbance of rights in land but upon an interference with the rights of the community at large.' (*Venuto v. Owens-Corning Fiberglas Corp.*, 22 Cal.App.3d 116, 124 (1971)).

c. Targeting of the Cannabis Industry in California with Environmental Laws

As is frequently the case, cannabis cultivators in California have unique issues, particularly in the environmental realm. Discussed below are environmental regulatory issues specific to California.

1. Safe Drinking Water and Toxic Enforcement Act of 1986 (Prop 65)

California's Prop 65[63] has provided California-based advocacy groups ample opportunity to target the cannabis industry. Prop 65 requires businesses to provide warnings to Californians about significant exposures to chemicals that cause cancer, birth defects, or other reproductive harm.[64] The California Attorney General's office, any district attorney, or any individual acting in the public interest can enforce Prop 65.[65] Penalties for violations may be as high as $2,500 per violation per day, and the lawsuits can be difficult to defend against.[66] "Marijuana smoke" was added to the Prop 65 list of chemicals on June 19, 2009.[67] In August 2009, the California Environmental Protection Agency published a report proffering evidence of its carcinogenicity.[68]

Over the last two years, hundreds of cannabis-related Prop 65 notices of violation have been served by at least two citizen enforcers—the Clean Cannabis Initiative, LLC[69] and the Center for Advanced Public Awareness, Inc.[70] Sonoma Patient Group, the longest-running dispensary in Santa Rosa, recently paid $40,000 to settle a claim.[71]

63. CAL. HEALTH & SAFETY CODE §§ 25249.5–25249.14 (West 2020).
64. *Id.* § 25249.6.
65. *Id.* § 25249.7(c), (d).
66. *Id.* § 25249.7(b).
67. CAL. CODE REGS. tit. 27, § 27001 (2020).
68. RAJPAL S. TOMAR ET AL., CAL. ENVTL. PROT. AGENCY, EVIDENCE ON THE CARCINOGENICITY OF MARIJUANA SMOKE, (2009).
69. Notice of Violation letter from Mark Morrison, Morrison Law Firm, to TKO, Care of Domain by Proxy LLC, and appropriate public enforcement agencies (Aug. 7, 2017).
70. Julie Johnson, *Santa Rosa Cannabis Dispensary Fined for Failing to Provide Cancer Warnings* (May 29, 2018), https://www.northbaybusinessjournal.com/northbay/sonomacounty/8376224-181/santa-rosa-cannabis-dispensary-fined.
71. *Id.*

2. California Environmental Quality Act (CEQA)

In California, CEQA generally requires that a proposed business evaluate its environmental impacts and means of mitigating substantial impacts.[72] Many cannabis businesses in California are facing CEQA compliance challenges because temporary CEQA exemptions granted to municipalities (such as the city of Los Angeles[73]) are expiring.[74] This may require the businesses themselves to directly participate in the compliance process.

These categories represent some, but certainly not all, of the litigation risks facing the industry.

II. ENVIRONMENTAL REGULATORY CONCERNS

In addition to other private claims, the industry must also address significant environmental regulatory issues.

a. Water

Water usage and water rights are significant issues for cannabis growers, particularly on the West Coast. California's water boards require that cannabis cultivators planning to divert surface water have a water right to do so.[75] Further, cultivators must document water supply sources in order to obtain a CalCannabis cultivation license.[76] Limited water resources in California have created tension between existing property owners and cannabis cultivators. For example, in Sonoma County, existing businesses and homeowners are seeking to

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72. *See generally* CAL. PUB. RES. CODE § 21156 (West 2020) (identifying the legislative intent of CEQA as requiring analysis of potential environmental impacts of proposed projects).

73. Notice of Exemption, ENV-2017-3361-SE, from Office of the County Clerk, City of Los Angeles to City of Los Angeles Department of City Planning (Sept. 5, 2017).

74. John Schroyer, *California Environmental Regulations and Marijuana: Q&A with Green Wise's Pamela Epstein*, MARIJUANA BUS. DAILY (Mar. 19, 2019) https://mjbizdaily.com/california-environmental-regulations-marijuana-green-wise-pamela-epstein/?utm_medium=email&utm_source=mjbiz_daily&utm_campaign=MJD_20190319_NEWS_Daily_03192019.

75. *Cannabis Water Rights*, CAL. WATER BDS. https://www.waterboards.ca.gov/water_issues/programs/cannabis/cannabis_water_rights.html (last updated July 7, 2019).

76. *Id.*

set up an exclusion zone for cannabis cultivation.[77] The State Water Board has also identified "Cannabis Priority Watersheds" throughout the state that are at increased risk as a result of cannabis cultivation activities, which could significantly impact native species or cause other environmental harm.[78]

Water rights, however, are not the only issue. Water quality issues are especially significant. For example, California's Regional State Water Resources Control Boards, which have struggled with illegal waste discharges, finalized a regulatory package which went into effect on October 17, 2017.[79] The regulations address waste discharge and other water issues, and 2018 was the first full year of the program.[80] The California Water Board has identified a number of activities that have resulted in negative impacts on water quality, including grading and site development, domestic waste discharges, timber conversions, and improper chemical storage and releases.[81] This could ultimately create liability for cannabis businesses under relevant environmental cleanup statutes, including the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA).[82]

77. Letter from Harriet Buckwalter, Co-Chair, and Linda Sartor, Cho-Chair, Friends of the Mark West Watershed, to Sonoma County Board of Supervisors (July 16, 2018), http://winewaterwatch.org/2018/07/mark-west-springs-area-dewatered-by-vineyards-and-cannabis-operations/.

78. *California Priority Watersheds*, CAL. WATER BDS., https://www.waterboards.ca.gov/water_issues/programs/cannabis/california_priority_watersheds.html (last updated Nov. 1, 2018).

79. *State Board – Cannabis Cultivation Water Quality*, CAL. WATER BDS., https://www.waterboards.ca.gov/water_issues/programs/cannabis/cannabis_water_quality.html (last updated Apr. 16, 2020).

80. *Id.*; *see also* CAL. WATER CODE § 13276(b) ("The state board or appropriate regional board shall address discharges of waste resulting from cannabis cultivation under the Medicinal and Adult-Use Cannabis Regulation and Safety Act and associated activities, including by adopting a general permit, establishing waste discharge requirements.").

81. Yvonne West, Director, Office of Enforcement Cal. State Water Res. Control Bd., Address at the Environmental Law Conference at Yosemite: Water Boards' Statewide Cannabis Cultivation Policy, Implementation, and Enforcement (Oct. 19, 2018).

82. Resource Conservation and Recovery Act, 42 U.S.C. § 6901 et seq. (2018); Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. § 9601 et seq. (2018).

b. Air

In the Pacific Northwest, Washington's air quality authorities have stepped up odor- and emissions-based enforcement actions. In 2017, there were two enforcement cases in Washington State that dealt with air quality permitting for cannabis cultivation operations: *Green Freedom, LLC v. Olympic Region Clean Air Agency*, and *Avitas Agric., Inc. v. Puget Sound Clean Air Agency*.[83] Both cases dealt with odors emanating from the facilities.[84] Notably, the *Green Freedom* case involved a complaint brought by a private landowner.[85]

c. Energy & Climate

The cannabis industry has also been singled out for its high energy consumption, exacerbated by 24-hour lighting requirements, heating, ventilation, and air conditioning at large-scale grow facilities.[86] Indoor cannabis cultivation taxes resources, and increases fossil fuel use, leaving a potentially significant carbon footprint.[87] While legalization may eliminate much of the need for indoor grow operations,[88] many within the industry feel that indoor growing—and the ability to strictly control growing conditions—results in a superior product.[89] As such, widespread legalization will not result in elimination of indoor grows.

d. Pesticides & Enforcement

The EPA regulates pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).[90] The EPA also regulates

83. Green Freedom, LLC v. Olympic Region Clean Air Agency, PCHB No. 16-048, 2016 WL 7233503 (Wash. Pol. Control Bd.); Avitas Agric., Inc. v. Puget Sound Clean Air Agency, PCHB No. 16-003, 2017 WL 478809 (Wash. Pol. Control Bd.).

84. *Green Freedom*, 2016 WL 7233503 at *1; *Avitas Agric.*, 2017 WL 478809 at *2–*3.

85. *Green Freedom*, 2016 WL 7233503 at *2.

86. Melanie Sevcenko, *Pot is Power Hungry: Why the Marijuana Industry's Energy Footprint Is Growing* (Feb. 27, 2016), https://www.theguardian.com/us-news/2016/feb/27/marijuana-industry-huge-energy-footprint.

87. Oliver Milman, *Not So Green: How the Weed Industry is a Glutton for Fossil Fuels* (June 20, 2017), https://www.theguardian.com/society/2017/jun/20/cannabis-climate-change-fossil-fuels.

88. *Id.*

89. Trevor Hennings, *Growing Cannabis Indoors v. Outdoors: 3 Key Differences* (May 29, 2016), https://www.leafly.com/news/growing/indoor-vs-outdoor-cannabis-growing-3-key-differences.

90. Federal Insecticide, Fungicide, and Rodenticide Act of 1947, 7 U.S.C. §§ 136–136y (2018); 40 C.F.R. § 152.1 (2018).

pesticides used for food or feed uses under the tolerance provisions of the Federal Food Drug and Cosmetic Act (FFDCA).[91] Under the FFDCA, the EPA establishes the maximum amount of pesticide residue allowed in or on food or feed (known as a tolerance) or exemptions from those tolerances.[92]

Any person or entity using a pesticide in a manner for which it is not registered is in violation of FIFRA.[93] In view of the illegal status of cannabis in the United States, the EPA has neither approved the registration of any pesticide products for use on cannabis, nor established any tolerances or tolerance exemptions for pesticide residues in or on cannabis food products.[94] However, the EPA has approved pesticides for use on industrial hemp with .3% or less THC by volume, given industrial hemp's new legal status under the Agricultural Improvement Act of 2018 (commonly known as the Farm Bill).[95] Notably, obtaining approval for a new pesticide use can involve a complex pre-approval process in which the applicants must generate and submit scientific data to allow the EPA to assess any risks to the environment or human health that may be associated with the new use.[96]

In the absence of any pesticides with federally registered cannabis uses at this time, a majority of states where some form of cannabis is legal have adopted rules or guidance addressing the limited circumstances in which pesticides may be lawfully used on cannabis within their jurisdictions.[97] In general, these states provide that a pesticide product may be applied to cannabis under state law as long as the active ingredient found in the product is exempt from residue tolerance requirements under the FFDCA and the product is: (i) exempt from federal FIFRA registration requirements; or (ii) otherwise registered for a use under FIFRA that is broad enough to cover cannabis (i.e., "for use on outdoor vegetables" or "can be used

91. Federal Food, Drug, and Cosmetic Act, 21 U.S.C. § 346 (2018).

92. *Id.* §§ 346–346a.

93. 7 U.S.C. § 136j (2018).

94. Nate Seltenrich, *Into the Weeds: Regulating Pesticides in Cannabis*, 127 ENVTL. HEALTH PERSP. 42001-2 (2019).

95. Agriculture Improvement Act of 2018, Pub. L. No. 115-334, § 297A, 132 Stat. 4490.

96. 7 U.S.C. § 136a(c)(1).

97. Jacob Holzman & Jacob Fischler, *As States Legalize Marijuana, Pesticides May be a Blind Spot* (Sept. 16, 2019), https://www.rollcall.com/2019/09/16/as-states-legalize-marijuana-pesticides-may-be-a-blind-spot/.

on greenhouse plants").[98] In some instances, states also require that the pesticide be registered for use on tobacco.[99] Several states have attempted to address this issue by invoking the "Special Local Needs" (SLN) provisions of FIFRA. Under § 24(c), FIFRA provides that each state may register an additional use of a federally registered pesticide product if certain conditions are met.[100] The EPA currently rejects this approach for cannabis uses.[101] In spring 2017, Vermont, Nevada, Washington, and California each sought to issue four SLN

98. Below is a partial listing of various states' guidance materials on cannabis pesticide use: **Alaska:** *Cannabis and Pesticides*, ALA. DEP'T. OF ENVTL. HEALTH, https://dec.alaska.gov/eh/pest/cannabis-and-pesticides/ (last visited Apr. 14, 2020) (detailing Alaska's guidance on pesticide use on cannabis); *List of Pesticides that Meet Alaska Criteria for Use on Marijuana*, ALA. DEP'T. OF ENVTL. HEALTH, http://dec.alaska.gov/media/14350/cannabis-pesticides-alaska.xlsx (last visited Apr. 14, 2020) (listing some pesticides that meet criteria to be used on cannabis crops); **California**: CAL. ENVTL. PROT. AGENCY DEP'T OF PESTICIDE REG., CANNABIS PESTICIDES THAT ARE LEGAL TO USE (2017) (listing examples of pesticides that are legal to use on cannabis in California, provided they meet certain criteria); **Colorado**: *Pesticide Use in Cannabis Production Information*, COLO. DEP'T OF AGRIC., https://www.colorado.gov/pacific/agplants/pesticide-use-cannabis-production-information (last visited May 2, 2020) (providing information on Colorado's regulations on pesticide use in cannabis cultivation); COLO. DEP'T OF ARGIC., PESTICIDES ALLOWED FOR USE IN CANNABIS PRODUCTION (Dec. 26, 2019), https://drive.google.com/file/d/1upPu4MArl5Wcdy0eOgP7fkgFDTTSmQo0/view (providing a list of permissible pesticides for cannabis cultivation in Colorado); **Maine**: , ME. DEP'T OF AGRIC., SELECTING EPA REGISTERED PESTICIDE PRODUCTS NOT PROHIBITED FOR USE ON CANNABIS IN MAINE (2020), (demonstrating whether a pesticide can be used on cannabis in Maine); **Maryland**: *Use of Pesticides on Medical Cannabis in Maryland*, NATALIE M. LAPRADE MD. MED. CANNABIS COMM'N, https://mmcc.maryland.gov/Pages/Pesticide-Application.aspx (last updated July 11, 2018) (explaining Maryland's regulations on the use of pesticides on medical cannabis); MD. DEP'T OF AGRIC., PESTICIDE LIST (providing a list of pesticides for use in cultivation of medical cannabis); **Massachusetts**: Letter from John Lebeaux, Massachusetts Commissioner of Agriculture, to Cultivators of Marijuana and Hemp (Sept. 26, 2018) (detailing the Massachusetts prohibition on applying any pesticide to cannabis products unless explicitly approved by the Department); **Nevada**: NEV. DEP'T OF AGRIC., MEDICAL MARIJUANA PESTICIDE LIST (2019) (establishing a list of pesticides that are not legally prohibited for use on medical/recreational marijuana pursuant to Nevada Revised Statute Chapter 586); **Oregon**: *Guide List for Pesticides and Cannabis*, OR. DEP'T OF ARGIC., https://www.oregon.gov/ODA/programs/Pesticides/Pages/CannabisPesticides.aspx (last visited May 2, 2020) (providing a guide for pesticide use and cannabis in Oregon); **Washington**: *Pesticide & Fertilizer Use on Marijuana*, WASH. DEP'T OF ARGIC., https://agr.wa.gov/departments/marijuana/pesticide-use (last visited May 2, 2020) (providing a guide on pesticides and cannabis in Washington, including the Pesticide Information Center OnLine (PICOL) Data Base and a list of pesticides allowed for use on marijuana).

99. *See* U.S. GENERAL ACCOUNTING OFFICE, GAO-03-485, PESTICIDES ON TOBACCO: FEDERAL ACTIVITIES TO ASSESS RISKS AND MONITOR RESIDUES (2003) (explaining that the EPA places regulations on pesticide use for tobacco, some specific to state geology, waterways, and susceptibility to ecological harm).

100. Telisport W. Putsavage, *Legal Pot Industry Bugged by Lack of Pesticide Guidance*, 37 N.Y. ENVTL. L. 75, 76 (2017); 40 C.F.R. § 162.152.

101. Joseph Misulonas, *The EPA Won't Regulate Harmful Pesticides in Marijuana Crops*, https://www.civilized.life/articles/epa-no-marijuana-pesticide-regulation/ (last visited Apr. 14, 2020).

registrations for uses of tolerance-exempt products on cannabis.[102] On June 22, 2017, the EPA sent letters notifying these states of the Agency's intent to disapprove the registrations.[103] Three of the states withdrew their SLN applications; the EPA disapproved Nevada's application on July 3, 2017.[104] This was a change of course from an EPA letter sent to Colorado in 2015, which had signaled that the EPA would consider SLN registrations for cannabis uses under some circumstances.[105] By contrast, in December 2019, the EPA approved adding industrial hemp to the use sites of 10 pesticides, consistent with the provisions of the Farm Bill.[106]

CONCLUSION

As cannabis businesses establish and expand their operations, it is critical that they understand and adapt to a broad range of issues. This includes the environmental compliance and enforcement issues with which all businesses must grapple, as well as the exposure to litigation risk that such enterprises face from the existing and evolving legal and regulatory landscape. The litigation risks are magnified by anti-marijuana interest groups and the conflict between Federal illegality and state legality under which the industry may still operate for some time. Awareness of the issues is the first step in the process; subsequent engagement of appropriate consultants, experts, and legal counsel needed to address these issues will result in a stronger, environmentally sustainable industry.

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102. *See* Cannabis Status Update from the U.S. Envtl. Prot. Agency Pesticide Program Dialogue Committee Meeting (Nov. 1, 2017) (listing the states seeking a SLN registration for tolerance exempt products to use on cannabis plants).

103. Disapproval of Pesticide Product Registrations for Special Local Needs, 82 Fed. Reg. 47,733 (Oct. 13, 2017); Cannabis Status Update, *supra* note 102.

104. Cannabis Status Update*, s*upra note 102.

105. Letter from Jack Housenger, Dir., Envt'l Prot. Agency, Office Pesticide Programs, to Mitchell Yergert, Dir., Colo. Dep't Ag. Div. Plant Indus. (May 19, 2015).

106. *Pesticide Products Registered for Use on Hemp*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/pesticide-registration/pesticide-products-registered-use-hemp (last visited May 2, 2020).

RECONCILING ENVIRONMENTAL JUSTICE WITH CLIMATE CHANGE MITIGATION: A CASE STUDY OF NC SWINE CAFOS

D. Lee Miller[1] and Ryke Longest[2]

INTRODUCTION: THE BIG PIG PROBLEM

For thirty years, the swine industry has externalized severe environmental and health harms onto poor communities of color in Eastern North Carolina.[3] This "Big Pig" problem is caused by the confinement, consolidation, and concentration of industrial hog operations within the low, flat, and economically marginalized Coastal Plain.[4]

Big Pig's rise was not inevitable. As recently as 1982, more than 11,000 small swine farms freckled nearly all of North Carolina's 100 counties.[5] Then came the "boom" of consolidation and industrialization that transformed hog

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3. Kate Jenkins, *Industrial Hog Farming and Environmental Racism* (Dec. 20, 2015), http://www.stirjournal.com/2015/12/20/industrial-hog-farming-and-environmental-racism/.
4. *See* Bob Edwards & Anthony E. Ladd, *Environmental Justice, Swine Production and Farm Loss in North Carolina*, 20 SOC. SPECTRUM 263, 264 (2000) (discussing concentration of swine production on coastal plain and growing environmental justice concerns).
5. *Id.* at 268 ("Of the nearly 11,400 farms in 1982 producing hogs and pigs . . . almost 60 percent had less than 25 hogs.")

production into a highly consolidated and vertically integrated industry.[6] Between 1989 and 1995, vertically integrated corporations and their contract growers built 700 Concentrated Animal Feeding Operations[7] (CAFOs) in Eastern North Carolina while 7,000 smaller hog farmers went out of business.[8] The emergent "megalopolis"[9] of confinement houses quartered 8.2 million pigs[10] that produced twice as much manure as the population of New York City without a sewage treatment plant in sight.[11]

The new mega-facilities are concentrated in a handful of socially and environmentally vulnerable communities in the Coastal Plain where the most prominent geological features are sandy soils, high water tables, and proximity to the coast.[12] Ten North Carolina counties in the Coastal Plain now account for ten percent of the entire swine inventory of the United States.[13] Nearly every hog is grown under contract to be slaughtered at the world's largest swine slaughter facility located in the small town of Tar Heel, North Carolina.[14]

The 2,300 North Carolina swine CAFOs operating today rely on the so-called lagoon and spray field system.[15] Hog waste is flushed from confinement barns into uncovered and unlined earthen pits, where it partially digests before industrial sprinklers spray the effluent onto nearby cropland.[16]

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6. *See id.* at 264, 267 (discussing "explosion" of the North Carolina swine industry).

7. CAFOs are Animal Feeding Operations (AFOs) distinguished by their size or their designation as significant polluters of surface waters. 40 C.F.R. § 122.23(b)-(c) (2020). AFOs are livestock farms that raise animals in confinement. *Id.* § 122.23(b)(1).

8. Edwards, *supra* note 4, at 267.

9. Joby Warrick & Pat Stith, THE NEWS & OBSERVER, *New Studies Show that Lagoons are Leaking*, THE PULITZER PRIZES (Feb. 19, 1995), https://www.pulitzer.org/winners/news-observer-raleigh-nc.

10. NAT'L AGRIC. STATISTICS SERV., U.S. DEP'T AGRIC., HOGS AND PIGS: FINAL ESTIMATES 1993-1997 6 (1998) (noting 8.2 million swine in North Carolina in 1995).

11. Hannah Connor, *Comprehensive Regulatory Review: Concentrated Animal Feeding Operations Under the Clean Water Act From 1972 to the Present*, 12 VT. J. ENVTL. L. 276, 276 (2011).

12. *Our State Geography in a Snap: The Coastal Plain Region* (Jan. 1, 2012), https://www.ncpedia.org/geography/region/coastal-plain.

13. *See* NAT'L AGRIC. STATISTICS SERV., U.S. DEP'T OF AGRIC., 2019 NORTH CAROLINA AGRICULTURAL STATISTICS: ONE HUNDRED YEARS AND COUNTING 42 (2019) (displaying swine data by county).

14. *See* Paul Blest, *A Stench in the Nostrils of God* (Feb. 20, 2020), https://theoutline.com/post/8633/smithfield-pork-tar-heel-north-carolina-industrial-farms-lawsuits?zd=1&zi=tmcimmnh (describing Tar Heel slaughter facility). Local citizens later sued the state for failing to conduct an environmental impact assessment of the facility, raising specific concerns about cumulative and indirect impacts caused by new hog operations built to satisfy this increased processing capacity. *See generally* Citizens for Clean Indus., Inc. v. Lofton, 427 S.E.2d 120 (1993).

15. *USGS Studies Influence of Animal Feeding Operations on Stream Water Quality*, STORMWATER REPORT (Aug. 5, 2015), https://stormwater.wef.org/2015/08/usgs-studies-influence-animal-feeding-operations-stream-water-quality/.

16. *See* Michelle Nowlin, *Sustainable Production of Swine: Putting Lipstick on a Pig?*, 37 VT. L. REV. 1079, 1084–85 (2013) (describing the mechanics of the lagoon and spray field system).

The lagoon and spray field system lies at the root of Big Pig's environmental harms, including water pollution, air pollution, antibiotic resistance, and nuisance conditions.[17]

This pollution harms human health, especially the health of people who live nearby. A comprehensive literature review found respiratory illness, MRSA, Q fever, and stress/mood disorders are all "consistently and positively associated" with living near a CAFO.[18] Local data confirm the trend. Duke University researchers found that North Carolinians living near a swine CAFO experienced a broad range of worse health outcomes compared with a control group.[19] Neighbors suffered higher rates of all-cause mortality, infant mortality, mortality from anemia, kidney disease, tuberculosis, septicemia, and low birth weight.[20] These negative outcomes robustly and inversely correlated with proximity to the nearest hog CAFO.[21]

North Carolinians do not bear these health costs equitably. The environmental and public health harms of this system are a black-and-white issue of environmental justice (EJ) because CAFOs were disproportionately built in politically disenfranchised communities of color.[22] Beginning in the mid-1990s, community-based participatory research by University of North Carolina epidemiologist Steve Wing investigated the locations and community health impacts of CAFOs in Eastern North Carolina.[23] He found "a case study of environmental racism."[24] Compared to the non-Hispanic white population, Black people and Native Americans are respectively 1.4 and 2.39 times more likely to suffer the consequences of living within three miles of a swine CAFO.[25]

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17. *See generally id.* at 1085–96 (describing negative impacts of CAFOs); CARRIER HRIBAR, NAT'L ASS'N OF LOCAL BDS. OF HEALTH, UNDERSTANDING CONCENTRATED ANIMAL FEEDING OPERATIONS AND THEIR IMPACT ON COMMUNITIES 5–11 (2010) (describing negative impacts of CAFOs).

18. Joan A. Casey et al., *Industrial Food Animal Production and Community Health*, 2 CURRENT ENVTL. HEALTH REP. 259, 259 (2015).

19. Julia Kravchenko et al., *Mortality and Health Outcomes in North Carolina Communities Located in Close Proximity to Hog Concentrated Animal Feeding Operation*, 79 N.C. MED. J. 278, 278 (2018).

20. *Id.* at 278, 281–84.

21. *Id.* at 278, 285.

22. *See, e.g.*, STEVE WING & JILL JOHNSTON, DEP'T OF EPIDEMIOLOGY, UNIV. OF N.C., INDUSTRIAL HOG OPERATIONS IN NORTH CAROLINA DISPROPORTIONATELY IMPACT AFRICAN-AMERICANS, HISPANICS AND AMERICAN INDIANS 1 (2015); Wendee Nicole, *CAFOs and Environmental Justice: The Case of North Carolina*, 121 ENVTL. HEALTH PERSP. A182, A183 (2013); Edwards, *supra* note 4, at 266.

23. *See generally* Steve Wing et al., *Community Based Collaboration for Environmental Justice: South-East Halifax Environmental Reawakening*, 8 ENV'T. & URBANIZATION 129 (1996) (describing environmental racism near hog production facilities).

24. *Id*. at 129. Wing uses "environmental racism" to describe how "[i]nstitutional racism connects with exposure to environmental hazards when inequalities of political and economic power result in a discriminatory pattern of location of polluting industries and wastes." *Id*. at 131.

25. WING & JOHNSTON, *supra* note 22, at 6.

Lagoons break down solid and liquid waste into gasses, creating air pollution.[26] Liquid waste sprayed onto fields runs off or seeps into groundwater.[27] CAFOs emit volatile organic compounds (VOCs) like dimethyl sulfide, ammonia, hydrogen sulfide, and particulate matter.[28] Antibiotic-resistant pathogens travel through both air and water vectors.[29]

Now, as global concern over climate change drives corporate demand to decarbonize supply chains, market forces exert pressure for converting existing lagoon and spray field CAFOs into biogas factories. Biogas mitigates GHG emissions by combusting methane into CO_2 while generating revenue from electricity sales and carbon offset credits.[30] Reconciling the interests of EJ, local natural resources, and the global climate requires agribusiness to reinvest some of this financial boon into the clean technologies they have promised—and shirked—for decades.

CHAPTER I: RISE OF THE RESISTANCE

North Carolina became the fastest-growing swine-producing state in the country during the early 1990s.[31] From the very beginning of that boom, a clutch of grassroots community groups formed to oppose the lagoon and spray field system.[32] They asked local government leaders to slow construction.[33] Residents rightly feared that large swine farms promising economic development would instead deliver air pollution, noxious odors, groundwater contamination, surface water pollution, the loss of independent family farms, farmland loss, and the loss of rural vitality and institutions.[34] One group, the Concerned Citizens of Tillery, successfully pushed county

26. Dan Charles, *Big Companies Bet On Cleaner Power From Pig Poop Ponds* (Nov. 22, 2019), https://www.npr.org/sections/thesalt/2019/11/22/781565978/big-companies-bet-on-cleaner-power-from-pig-poop-ponds ("On most farms, that gas just goes floating off into the air — and contributes to the overheating of the planet. Methane is a greenhouse gas with a warming impact at least 25 times greater, per pound, than carbon dioxide.").

27. *See generally* Casey et al., *supra* note 18 (discussing the impacts of swine CAFOs, including to ground- and surface water).

28. HRIBAR, *supra* note 17, at 5.

29. *See* Casey et al., *supra* note 18, at 260 (summarizing the transmission of antibiotic-resistant pathogens).

30. U.S. DEP'T OF AGRIC. ET AL., BIOGAS OPPORTUNITIES ROADMAP 12 (2014); NAT'L RENEWABLE ENERGY LAB., ENERGY ANALYSIS: BIOGAS POTENTIAL IN THE UNITED STATES 1 (2013).

31. Edwards, *supra* note 4, at 263.

32. Elisabeth Stoddard, *Neoliberal Governance and Environmental Risk*, *in* POLITICAL ECOLOGIES OF MEAT 137, 146 (Jody Emel & Harvey Neo, eds., 2015). These groups included the Concerned Citizens of Tillery, the Alliance for a Responsible Swine Industry, the Rural Empowerment Association for Community Help, and the North Carolina Environmental Justice Network. *Id*.

33. *See id.* (describing pressures the community groups put on the state).

34. Steve Wing, *Social Responsibility and Research Ethics in Community-Driven Studies of Industrialized Hog Production*, 110 ENVT. HEALTH PERSP. 437, 438 (2002).

officials to enact a local health ordinance requiring basic environmental protections missing from state laws.[35] Other groups ensured that anti-CAFO zoning ordinances proliferated at the county level.[36] But legal challenges and state preemption ultimately de-clawed local resistance.[37]

Then a series of catastrophic lagoon breeches and hurricanes in the mid-1990s transmuted a local environmental problem into a political problem for state government. Operational deficiencies caused a lagoon breach in 1995 that spilled 25 million gallons of hog waste into the New River.[38] In 1996, The (Raleigh) News and Observer published a Pulitzer-Prize-winning series, "Boss Hog," exposing how corporate swine interests had captured the legislature and wrought a toxic landscape in Eastern North Carolina.[39] During Hurricane Floyd in 1999, heavy rains caused at least five lagoons to burst; forty-seven other lagoons flooded, spilling their contents into the landscape.[40]

Responding to community groups, the widespread spills, and the "Boss Hog" press, Governor Hunt convened the Blue Ribbon Commission on Agricultural Waste to study swine CAFO pollution.[41] The Commission's report found egregious violations and urged legislative action.[42] In 1997, the legislature put a temporary moratorium on new lagoons that prohibited new lagoon and spray field waste management systems, absent strict environmental performance standards.[43] Since 1997, no new lagoons have been lawfully built, absent exceptions to the moratorium.[44] Thousands of existing lagoons were grandfathered in, and dozens of new lagoons were built under moratorium exceptions.[45]

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35. *Id.*

36. *Id.*

37. *See, e.g.*, Craig v. Cty. of Chatham, 565 S.E.2d 172 (2002) (finding a town ordinance to be preempted by state law).

38. *Huge Spill of Hog Waste Fuels an Old Debate in North Carolina*, N.Y. TIMES, June 25, 1995, § 1, at 21.

39. *See The News & Observer (Raleigh, NC)*, THE PULITZER PRIZES, https://www.pulitzer.org/winners/news-observer-raleigh-nc (last visited May 1, 2020) (naming the "Boss Hog" article series as the 1996 Pulitzer Prize Winner in Public Service); Pat Stith et al., THE NEWS & OBSERVER, *Boss Hog: The Power of Pork, North Carolina's Pork Revolution*, THE PULITZER PRIZES (Feb. 19, 1995), https://www.pulitzer.org/winners/news-observer-raleigh-nc (describing the relationship between the hog industry and North Carolina).

40. Nowlin, *supra* note 16, at 1088.

41. *See* DAVID KIRBY, ANIMAL FACTORY 144, 147 (2010) (describing the research of "the governor's Blue Ribbon Commission on Agricultural Waste").

42. *Id.*

43. *See generally* 1997 N.C. Sess. Laws 458 (codified as amended at N.C. GEN. STAT. § 143-215.10A (2013)) (enacting a moratorium on the construction or expansion of swine farms and lagoons).

44. *CAFO Wars Continue* (Mar. 12, 2019), https://www.yadkinriverkeeper.org/news/2019/3/12/cafo-wars-continue.

45. Talia Buford, *A Hog Waste Agreement Lacked Teeth, and Some North Carolinians Say They're Left to Suffer* (Nov. 23, 2018), https://www.propublica.org/article/a-hog-waste-agreement-lacked-teeth-

The 1997 law also added state permitting and inspection requirements—a landmark victory at the time.[46] North Carolina's Department of Environmental Quality (DEQ) requires facilities with more than 250 hogs to have either a state permit or a permit under the Clean Water Act's National Pollution Discharge Elimination System (NPDES).[47] Virtually all hog farms use the State's general permit rather than its more stringent federal counterpart.[48] Optimism over the inspection and permit system was short lived. Permitting fell far short of community hopes, in large part because DEQ has consistently issued permits without considering the additional burden placed on communities of color.[49] Inspections suffer from funding cuts and public records exemptions.[50]

Indeed, if the permit system had lived up to its facial promises, the disproportionate burden borne by communities of color would at least have been much lighter. But DEQ's swine permits are fundamentally flawed. They are predicated on the legal fiction that regulated facilities do not pollute public waters; they are classified as non-discharge facilities.[51] The fiction that these facilities do not discharge rests on magical thinking backed by models.[52] Permittees must spray waste at "agronomic rates," meaning that nitrogen applied through manure balances with the theoretical nitrogen uptake by crops.[53] Yet the permit does not require ground- or surface-water monitoring except when regulators observe permit violations, a catch-22.[54] Worse, the permit exempts from the definition of a discharge any waste that

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and-some-north-carolinians-say-left-to-suffer; *Despite Moratorium, More Hog Farms Built in North Carolina in Past 10 Years* (Mar. 23, 2007), https://thepigsite.com/news/2007/03/despite-moratorium-more-hog-farms-built-in-north-carolina-in-past-10-years-1.

46. *See generally* 1997 N.C. Sess. Law 458 (describing permitting requirements); N.C. GEN. STAT. § 143-215.10C (discussing applications and permits to construct or operate an animal waste management system); *id.* § 143-215.10F (discussing inspection program).

47. N.C. GEN. STAT. § 143-215.10C(a)(1); 15A N.C. ADMIN. CODE ch. 02T (2018).

48. *See List of Permitted Animal Facilities*, N.C. DEP'T ENVTL. QUALITY (Nov. 6, 2019), https://files.nc.gov/ncdeq/List_Of%20Permitted_Animal_Facilities2019-11-06.xls (listing data on permitted animal facilities in North Carolina).

49. *Infra*, Chapter III; Complaint at 34–41, Waterkeeper Alliance, Inc. v. N.C. Dep't of Envtl. Quality (Sept. 3, 2014), https://earthjustice.org/sites/default/files/files/North-Carolina-EJ-Network-et-al-Complaint-under-Title-VI.pdf.

50. Stoddard, *supra* note 32, at 148–49.

51. STEPHEN L. HARDEN, U.S. DEP'T. OF THE INTERIOR, SURFACE-WATER QUALITY IN AGRICULTURAL WATERSHEDS OF THE NORTH CAROLINA COASTAL PLAIN ASSOCIATED WITH CONCENTRATED ANIMAL FEEDING OPERATIONS 2 (2015).

52. *See*, *e.g.*, *id.* at 47 (discussing analysis to identify differences in watersheds associated with either having or not having CAFO manure effects).

53. N.C. GEN. STAT. § 143-215.10C(e)(6)–(7); *id.* § 413-215.10C(f); *see also* DEP'T OF ENVTL. QUALITY , N.C. ENVTL. MGMT. COMM'N, SWINE WASTE MANAGEMENT SYSTEM GENERAL PERMIT 1, 3 (2014) [hereinafter GENERAL PERMIT] (listing permit requirements).

54. *See generally* DEP'T ENVTL. QUALITY, *supra* note 53 (showing no ground or surface water monitoring requirement).

spills during a 25-year, 24-hour storm event—defined as the strongest storm with a probable recurrence interval of 25 years.[55] Eastern North Carolina has experienced two 1,000-year storms in the past four years.[56]

In 2000, North Carolina's then Attorney General Mike Easley reached an agreement with Smithfield and its subsidiaries to identify replacement technology for grandfathered lagoons.[57] Smithfield committed to fund research on new environmentally superior waste treatment technologies (ESTs).[58] The company agreed to install ESTs on all company-owned farms within three years from the date that the "designee" determined that they met environmental performance standards and proved "technically, operationally, and economically feasible."[59] Smithfield also agreed to provide assistance for their contract farmers to install ESTs.[60]

The environmental performance standards specified ESTs must 1) eliminate all animal waste discharges to surface and ground water; and substantially eliminate 2) atmospheric ammonia emissions; 3) odor detectable beyond the farm boundary; 4) disease-transmitting vectors and airborne pathogens; and 5) nutrient and heavy metal contamination of soil and groundwater.[61] Notably, the Smithfield Agreement left out methane as a pollutant subject to performance standards, as had the moratorium legislation before it.[62]

An engineering committee under the Smithfield Agreement labored to set standards based on different interpretations of "substantially eliminate." For example, the committee decided that, in the case of ammonia emissions, "substantially eliminate" meant a 60% reduction compared to a typical swine farm.[63] In the intervening years, multiple ESTs tested on North Carolina

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55. *Id.* at 2.

56. *See* James Bruggers, *After Back-to-Back Hurricanes, North Carolina Reconsiders Climate Change* (Dec. 27, 2018), https://insideclimatenews.org/news/27122018/hurricane-damage-north-carolina-climate-change-2018-year-review-florence-michael-matthew (describing major rain events in North Carolina); Jason Samenow, *Florence was Another 1,000-year Rain Event. Is This the New Normal as the Planet Warms?* (Sept. 18, 2018), https://www.washingtonpost.com/weather/2018/09/18/florence-was-another-year-rain-event-is-this-new-normal-planet-warms/ (explaining the increase in number of rare storms).

57. Agreement between the Attorney General of North Carolina et al., at 1–6 (July 25, 2000), https://projects.ncsu.edu/cals/waste_mgt/smithfield_projects/agreement.pdf [hereinafter Smithfield Agreement].

58. *Id.* at 2–3.

59. *Id.* at 3–5.

60. *Id.* at 13.

61. *Id.* at 4.

62. *See generally id.* (showing no methane provisions).

63. SMITHFIELD AGREEMENT ADVISORY PANEL ENGINEERING SUBCOMMITTEE, ENVIRONMENTALLY SUPERIOR PERFORMANCE CRITERIA DEFINITIONS: RECOMMENDATIONS DOCUMENT 2,

swine farms proved capable of meeting—and far exceeding—the environmental performance standards.[64] The third generation of a treatment technology called Super Soils "was documented to remove approximately 99% of total suspended solids, 98% of [chemical oxygen demand], 99% of TKN (Total Kjeldahl nitrogen), 100% ammonia, 92% phosphorus, 95% copper, and 97% zinc from the flushed manure. Fecal coliform reductions were measured to be 99.98%."[65]

A separate economic subcommittee set out to define "economically feasible."[66] A majority of the subcommittee agreed on a standard that would keep at least 88% of swine farms in business.[67] Four dissenting members, representing swine companies and an agricultural bank, wrote a dissenting report contending that the standard should be "no net increase in cost" compared to the lagoon and spray field system.[68] Industry's dissent contradicted the terms of the Smithfield Agreement: "The parties understand and agree that alternative technologies that cost more than the lagoon and spray field system may be determined to be economically feasible."[69] As early as 2006, designee Dr. C. Mike Williams concluded that Super Soils "comprise an unconditional Environmentally Superior Technology for new farms" meeting all EST requirements and economic feasibility.[70]

Seven years into the Smithfield Agreement, the lagoons and spray fields operated unabated.[71] In 2007, frustrated community groups championed a bill that would have banned all new lagoons and prohibited any swine facility from installing new waste treatment systems without adopting ESTs.[72] It would have given grants to any producers who installed any of the five waste

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http://projects.ncsu.edu/cals/waste_mgt/smithfield_projects/phase1report04/Appendix%20D(Engineering).pdf.

64. *See* C.M. WILLIAMS, ANIMAL & POULTRY WASTE MGMT. CTR., N.C. STATE UNIV., EVALUATION OF GENERATION 3 TREATMENT TECHNOLOGY FOR SWINE WASTE 2 (2013) (noting second and third generation technologies achieved efficient environmental performance at reduced costs).

65. *Id*. at 3.

66. *See* CHANTAL LINE CARPENTIER ET AL., MAJORITY REPORT FROM THE ECONOMICS SUBCOMMITTEE OF THE ADVISORY PANEL TO THE DESIGNEE UNDER THE AGREEMENTS BETWEEN ATTORNEY GENERAL OF NORTH CAROLINA AND SMITHFIELD FOODS, PREMIUM STANDARD FARMS AND FRONTLINE FARMERS REGARDING RECOMMENDATIONS ON ECONOMIC FEASIBILITY DETERMINATIONS 30–31 (2005), https://projects.ncsu.edu/cals/waste_mgt/smithfield_projects/phase3report06/pdfs/Appendix%20D.pdf (presenting letter within majority report seeking to define "economically feasible").

67. *See id.* at 6, 20 (agreeing with 12% reduction in swine operation to obtain better waste handling).

68. *Id.* at 3.

69. Smithfield Agreement, *supra* note 57, at 10.

70. MIKE WILLIAMS, DEVELOPMENT OF ENVIRONMENTALLY SUPERIOR TECHNOLOGIES: PHASE 3 REPORT 6 (2006).

71. *See* Stoddard, *supra* note 32, at 147 (noting that five ESTs had been developed, yet none were implemented); Buford, *supra* note 45 (noting that hog farmers continued to store hog waste in lagoons).

72. Stoddard, *supra* note 32, at 147.

management technologies approved as ESTs through the Smithfield Agreement.[73]

After passing the NC Senate with unanimous support, then-Governor Mike Easley pulled the bill before it could pass the House.[74] It was replaced with a bill developed with industry support.[75] The new bill retained the ban on construction of any new lagoons without ESTs, but dispensed with the regulations on expanding facilities.[76] Perhaps most significantly, the new bill substituted comprehensive financial support for ESTs with a pilot program for producers to capture lagoon methane and sell it at subsidized prices for electricity generation.[77] As one commentator noted, "the legislation rolled back the more restrictive regulations in the original bill and turned the industry's hog waste into a commodity that was to be subsidized by the state's citizens."[78]

Methane capture could be a revenue source because it was not regulated at all. Methane itself is odorless and thus not covered by North Carolina odor standards.[79] While state water quality permits for swine are weak, air permits for swine are nonexistent.[80] Like the Clean Air Act regulations before, and the Smithfield Agreement that would follow, the state swine permit contains no standards for methane emissions.[81] Omitting methane preserved Clean Air Act loopholes that allowed CAFOs to emit unlimited atmospheric methane, which in turn allows these emissions sources to meet "additionality" requirements of voluntary carbon markets.[82] Thusly were the seeds sown for the nascent biogas industry, now on the rise twenty years later.

Community groups rose in opposition to the lagoon and spray field system. Throughout the 1990s and 2000s, they erected zoning restrictions, filed nuisance suits, and catalyzed the state's legislature and executive

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73. *Id*.

74. *Id*.

75. 2007 N.C. Sess. Laws 523 (codified at N.C. GEN. STAT. § 143-215.10I); *see also North Carolina Finalizes Swine Lagoon Ban* (Sept. 20, 2007), https://www.nationalhogfarmer.com/news/newsflash/north-carolina-finalizes-lagoon-ban (discussing new bill).

76. *North Carolina Finalizes Swine Lagoon Ban, supra* note 75.

77. Stoddard, *supra* note 32, at 147–48.

78. *Id*. at 148.

79. Lan Luo, *Properties of Methane Gas* (Feb. 23, 2020), https://sciencing.com/properties-methane-gas-5090934.html; *see generally* 15A N.C. ADMIN. CODE 02D § .1800 (2000) (lacking methane in odor standards).

80. *See generally* GENERAL PERMIT, *supra* note 53 (listing permitting requirements). The general permit applies to any swine animal feeding operation in North Carolina, but it does not regulate air pollution. *Id*.

81. *See generally id*. (containing no standards for methane emissions).

82. *See* Steven Ferrey, *When 1+1 No Longer Equals 2: The New Math of Legal "Additionality" Controlling World and U.S. Global Warming Regulation*, 10 MINN. J. L. SCI. & TECH. 591, 591–94 (2009) (describing "additionalities").

powers to pass a lagoon moratorium, implement a permitting regime, and pressure industry into a landmark agreement.[83] Yet 25 years into the lagoon and spray field era, activism had failed to stop—let alone reverse—the environmental, social, or human health problems caused by concentrated swine.[84] By the early 2010's, the environmental and EJ communities began to look for new strategies.

CHAPTER II: NEW ACTORS CHANGE STRATEGIC LANDSCAPE

Around 2014, three new actors emerged to challenge the status quo: a mature and coordinated EJ community; well-resourced plaintiffs' attorneys; and corporate sustainability divisions of major firms.[85] Each opened a new legal assault against Big Pig's pollution. Each sought different remedies: compensatory and punitive monetary damages for past harms; change to the regulatory schema that account and correct for permitting inequities to prevent future hams; and emissions accounting and reductions in order to decarbonize the corporate supply chain.[86] Each remedy comes with a significant price tag, at least up front. But, while the infrastructure to capture methane for biogas will lower GHG emissions, it will not improve the daily lives of nearby residents.[87] The extent to which climate mitigation and EJ interests get reconciled will mold the legal and physical landscape for a generation to come.

Title VI Complaint

By 2014, the community organizations that first resisted the CAFO boom had blossomed into a coordinated network of environmental justice leaders. In 2014, Earthjustice, on behalf of the North Carolina Environmental Justice Network, the Rural Empowerment Association for Community Help, and the Waterkeepers Alliance, filed a complaint with the Environmental Protection

83. *See generally* Stoddard, *supra* note 32, at 137–49 (describing community groups' actions throughout the history of swine CAFOs).

84. *See* Lily Kuo, *The World Eats Cheap Bacon at the Expense of North Carolina's Rural Poor,* QUARTZ (Jul. 14, 2015), https://qz.com/433750/the-world-eats-cheap-bacon-at-the-expense-of-north-carolinas-rural-poor/ (outlining the struggles of activists and those affected by swine CAFOs).

85. *See* CHRISTINE BALL-BLAKELY, ANIMAL LEGAL DEF. FUND, CAFOS: PLAGUING NORTH CAROLINA COMMUNITIES OF COLOR 30–37 (2018) (discussing coordinated community movement against CAFOs).

86. *Id.*

87. *See* Nicole, *supra* note 22, at A188 (noting methane digester will not, on its own, reduce odors, pathogens, and heavy metals).

Agency's (EPA) Office of Civil Rights.[88] The complaint alleged that the lagoon and spray field system disproportionately impacted communities of color with many types of pollution and that the state, through its permitting system, failed to address these racial disparities in violation of Title VI of the federal Civil Rights Act.[89]

After preliminary investigation, the EPA issued a Letter of Concern to DEQ in 2017.[90] Its investigators found "adverse impacts from industrial swine operations on communities of color"[91] and "retaliation, threats, intimidation, and harassment by swine facility operators and pork industry representatives" against residents who filed complaints.[92] The letter seemingly rattled DEQ officials, who did not wait for the EPA to complete its full investigation before settling in 2018.[93] The settlement terms, negotiated with the same community organizations that DEQ had ignored for decades, put new arrows in the quivers of communities fighting for greater protections from CAFO pollution.[94] Among other terms, state officials agreed to propose specific updates to the state swine general permit;[95] develop and implement an Environmental Justice tool;[96] and take steps to broaden community participation in state permitting processes.[97]

Nuisance Suits

In 2014, plaintiffs' attorneys filed nuisance suits on behalf of 500+ neighbors of swine CAFOs claiming that the lagoon and spray field system harmed the use and enjoyment of their property.[98] This was not the first

88. *See generally* Complaint Under Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d, 40 C.F.R. Part 7, (2014) at 1, https://earthjustice.org/sites/default/files/files/North-Carolina-EJ-Network-et-al-Complaint-under-Title-VI.pdf (submitting administrative complaint to the EPA Office of Civil Rights).

89. *Id.* at 3, 12–13.

90. Letter from EPA External Civil Right Compliance Office, Office of General Counsel, to William G. Ross, Jr., Acting Secretary, North Carolina Department of Environmental Quality, (Jan. 12, 2017), http://waterkeeper.org/wp-content/uploads/2017/01/Letter-to-Complainants-in-Case-11R-14-R4-Forwarding-Letter-of-Concern-to-NC-DEQ-1-12-2017.pdf.

91. *Id.* at 3.

92. *Id.* at 4.

93. Settlement Agreement between N.C. Dep't. of Envtl. Quality et. al. (May 3, 2018), https://files.nc.gov/ncdeq/documents/files/Final%20Settlement%20Agreement_attachments%20and%20sig.pdf.

94. *See id.* at 1 (naming parties to the agreement).

95. *Id.* at 4–5.

96. *Id.* at 6.

97. *Id.* at 7–8.

98. *See*, *e.g.*, Complaint of Linda Atkinson, et al., In re NC Swine Farm Nuisance Litig., No. 5:15-cv-00013-BR, 2017 WL 5178038 (E.D.N.C. Nov. 8, 2017); Complaint of Bertha Lee Carter Battle et.al., In re NC Swine Farm Nuisance Litig., No. 5:15-cv-00013-BR, 2017 WL 5178038 (E.D.N.C. Nov. 8,

attempt to use nuisance law to rein in CAFO pollution, nor even the first to produce eye-catching verdicts.[99] Nuisance suits proliferated nationwide in the late 1990s.[100] In 2010, a Missouri court awarded neighbors $11 million in damages caused by a swine mega-farm owned by Premium Standard Foods, a Smithfield subsidiary.[101]

Earlier nuisance actions floundered in North Carolina. Former U.S. Senator Robert Morgan sued a swine CAFO in the mid-1990s claiming that fumes from the lagoons were "often so noxious that at times it burns their eyes and noses, making it difficult for [plaintiffs] to see and breathe."[102] Senator Morgan lost the case. In contrast, the civil actions brought in 2014 to abate nuisances caused by the lagoon and spray field system have been groundbreaking.[103]

Two strategic choices help explain the revival of common law remedies to hold Big Pig accountable. First, the cases name Smithfield, not the contract growers who grow most of Smithfield's hogs, even though some of the targeted farms were owned by contract growers.[104] The court found that the contract growers were not a necessary party to the litigation,[105] successfully opening up the $15 billion multi-national company[106] to damages without pinning them on the contract growers. In the process, plaintiffs reaped a

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2017); Complaint of Alex Bordeaux et. al., In re NC Swine Farm Nuisance Litig., No. 5:15-cv-00013-BR, 2017 WL 5178038 (E.D.N.C. Nov. 8, 2017).

99. Leah Douglas*, "Finally, Somebody Heard What the People Were Saying was Happening to Them*" (May 1, 2018), https://www.motherjones.com/food/2018/05/the-growing-grassroots-opposition-to-industrial-hog-farming-just-scored-a-major-victory/.

100. Lisa Sorg, *Neutering Nuisance Laws in North Carolina* (Nov. 15, 2017), http://www.ncpolicywatch.com/2017/11/15/neutering-nuisance-laws-north-carolina/.

101. *See* Owens v. ContiGroup Cos., 344 S.W.3d 717 (Mo. Ct. App. 2011) (affirming the lower court's decision to award plaintiffs over $11 million in damages); Allan Ripp, *Missouri Jury Awards Residents $11 Million in Damages From Living Under Cloud of Stench Caused by Industrial Hog Farms*, SPEER L. FIRM (Mar. 5, 2010), https://www.prnewswire.com/news-releases/missouri-jury-awards-residents-11-million-in-damages-from-living-under-cloud-of-stench-caused-by-industrial-hog-farms-86643287.html.

102. Parker v. Barefoot, 502 S.E.2d 42, 44 (1998), *overruled by* Parker v. Barefoot, 519 S.E.2d 315 (1999).

103. In re NC Swine Farm Nuisance Litig., No. 5:15-cv-00013-BR, 2017 WL 5178038 (E.D.N.C. Nov. 8, 2017); Barry Yeoman, *Here are the Rural Residents Who Sued the World's Largest Hog Producer Over Waste and Odors—and Won*, FOOD & ENVTL. REPORTING NETWORK (Dec. 20, 2019), https://thefern.org/2019/12/rural-north-carolinians-won-multimillion-dollar-judgments-against-the-worlds-largest-hog-producer-will-those-cases-now-be-overturned/.

104. Complaint of Linda Atkinson et al., *supra* note 98; Complaint of Bertha Lee Carter Battle et.al., *supra* note 98; Complaint of Alex Bordeaux et. al., *supra* note 98; Yeoman, *supra* note 103.

105. *In re NC Swine Farm Nuisance Litig.*, No. 15-cv-00013, 2017 BL 176858, at *6 (finding that the company was in full control of grower operations and awards, directed the type and amount of feed, directed waste disposal method and, in several cases, directed the siting of the contract grower's operation).

106. Buford, *supra* note 45.

tactical advantage by focusing on decisions made by corporate officers rather than overstretched family farmers.

Second, plaintiffs' attorneys filed in federal court.[107] They relied on the diversity jurisdiction created by Smithfield, a Virginia corporation, owning all of the hogs through Murphy-Brown, a corporation registered in Delaware and controlled by Smithfield through a wholly owned subsidiary also registered in Delaware.[108]

The cases presented temporary nuisance claims.[109] Complainants alleged that the hog facilities caused a range of problems—such as odors, ammonia emissions, pests, and truck noise—negatively affecting the use of plaintiffs' property.[110] Plaintiffs suffered health effects that included burning eyes, respiratory problems, headaches, anxiety, and spikes in blood pressure.[111] Plaintiffs' claims alleged harms that ESTs were designed to remedy or prevent. The complaints allege additional wrongdoing that merit punitive damages.[112] Specifically, the plaintiffs alleged that the defendant and their executives knew about the nuisance, had the EST technology and financial resources to take corrective action, and failed to do so negligently and improperly.[113]

Five jury pools have produced verdicts in these cases that ranged from the hundreds of thousands to hundreds of millions of dollars.[114] The largest reached $473.5 million,[115] later reduced to $94 million by mandatory state caps on punitive damages.[116] Smithfield appealed and key issues from the first five trials are now before the Fourth Circuit, which heard oral arguments on January 31, 2020.[117]

One of the big questions is whether the amended "Right to Farm" law, passed to deter nuisance suits, should apply retroactively. In the wake of the first large verdicts, the North Carolina legislature updated the State's Right

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107. Third Amended Complaint, McKiver v. Murphy-Brown, LLC, No. 7:14-cv-00180-BR, 2018 WL 4189408 (E.D.N.C. Feb. 12, 2018).

108. *Id.* ¶¶ 25–28.

109. *Id.* ¶¶ 220–35.

110. *Id.* ¶ 3.

111. *Id.* ¶ 31, 219; Yeoman, *supra* note 103.

112. Third Amended Complaint, *supra* note 107, ¶ 236–39.

113. *Id.* ¶ 230.

114. McKiver v. Murphy-Brown, LLC, No. 7:14-CV-180-BR, 2018 WL 10322917, at *1 (E.D.N.C. May 7, 2018).

115. *See* Verdict, James Jacobs, et al., v. Murphy-Brown LLC, No. 7:14-CV-237-BR (E.D.N.C. Aug. 13, 2018) (outlining the amount of recovery and punitive damages each plaintiff was entitled to, which adds up to $473.5 million).

116. N.C. GEN. STAT. §1D-25(b) (2019).

117. *See Oral Argument Calendar*, U.S. COURT OF APPEALS FOR THE FOURTH CIRCUIT, https://www.ca4.uscourts.gov/oral-argument/cal/january-2020-session (last visited May 2, 2020) (setting the oral argument date for *Joyce McKiver v. Murphy-Brown, LLC* for Friday, January 31, 2020).

to Farm law to make it virtually impossible for similarly situated neighbors to bring these kind of nuisance claims in the future.[118] Based on this claim, an appellate court could overturn a key lower court ruling or remand for procedural reasons.[119] On the other hand, if the Fourth Circuit upholds the damage awards, Smithfield may find that installing technology they have resisted for decades will no longer seem so "economically infeasible."[120]

Corporate Sustainability

Independent of the EJ communities' concerns, a major shift in the industry's handling of waste is on the horizon. Retailers have begun adopting GHG reduction targets throughout their supply chains to "green" their corporate image and demonstrate that private law can step in where governments have failed.[121] In 2012, Walmart began conditioning purchase orders on suppliers' use of a "Sustainability Index" that rates product sustainability across 100 metrics.[122] Then, in 2017, Walmart set a goal of avoiding one billion metric tons of GHGs by 2030.[123] Walmart flexed its monopsony power as the nation's largest grocery store over suppliers like Smithfield. [124] These "green" commitments are pushing suppliers like Smithfield to reduce emissions or risk the loss of critical retail outlets.

At the same time, energy companies and their corporate customers are demanding renewable and low-carbon feedstock for their power plants and

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118. N.C. GEN. STAT §§ 106-701, 106-702 (2019). In nuisance actions against agricultural and forestry operations, plaintiffs must be the legal possessor of the property; the property must lie within ½ mile of the nuisance source; and the action must be filed within 1 year of the operations establishment or major change causing the nuisance. *Id.* Section 106-702 limits compensatory damages to the reduction in fair market value of the affected property and limits punitive damages to cases where there has been a criminal conviction or civil enforcement action by an environmental regulatory agency. *Id.*

119. *See* Parker v. Barefoot, 502 S.E.2d 42 (N.C. Ct. App. 1998) (overruled by Parker v. Barefoot, 519 S.E.2d 315 (1999) on the grounds that the jury was given improper instructions regarding the nuisance statute).

120. Anne Blythe, *Jury Awards More than $25 Million to Duplin County Couple in Hog-Farm Case* (June 29, 2018), https://www.newsobserver.com/news/local/article214096384.html.

121. *See*, *e.g.*, *More Than 300 Companies Commit to Set Science-Based Emissions Reduction Targets*, WORLD RES. INST., https://www.wri.org/our-work/top-outcome/more-300-companies-commit-set-science-based-emissions-reduction-targets (last visited May 2, 2020) (showing that companies make their own rules they must follow to reduce GHG).

122. *Walmart Announcements New Commitments to Drive Sustainability Deeper into the Company's Global Supply Chain* (Oct. 25, 2012), https://corporate.walmart.com/newsroom/2012/10/25/walmart-announces-new-commitments-to-drive-sustainability-deeper-into-the-companys-global-supply-chain.

123. *Walmart on Track to Reduce 1 Billion Metric Tons of Emissions from Global Supply Chains by 2030* (May 8, 2019), https://corporate.walmart.com/newsroom/2019/05/08/walmart-on-track-to-reduce-1-billion-metric-tons-of-emissions-from-global-supply-chains-by-2030.

124. *Project Gigaton*, https://www.walmartsustainabilityhub.com/project-gigaton (last visited May 2, 2020).

pipelines. North Carolina's Renewable Energy Portfolio Standard provides a growing market for waste-to-energy projects.[125] North Carolina's Clean Energy Plan, a product of the governor's executive order[126] to meet Paris Accord targets, requires significant reductions in the State's energy-related GHG emissions.[127] Increasing demand further, there are growing opportunities to sell carbon credits from manure management practices into voluntary markets.[128]

Broadly, there are two kinds of market pressure at play. On the one hand, major corporate retailers of low-cost meat, like Walmart, are demanding a lower carbon footprint from their supply chain.[129] On the other hand, natural gas pipeline project investors are hoping to offer renewable gas.[130] Together, market signals point in the direction of "greening" the corporate sustainability chain for major corporations on the food side, but also "greening" the gas side.

The loophole that ignores methane creates the business opportunity. If either the EPA or the states regulated methane emissions from CAFOs, methane captured for electricity production could neither be credited toward Walmart's reduction targets nor used to generate carbon offset credits, which require mitigation beyond baseline levels (the "additionality" requirement).[131] In a counterfactual world with a methane mandate, there would be no new economic rents[132] to divvy up through private law arrangements between corporate sustainability offices, hog producers, and electricity companies.

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125. N.C. GEN. STAT. § 62-133.8 (2019) (promoting the development of renewable energy and energy efficiency in the state).

126. North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy, N.C. Exec. Order No. 80 (Oct. 29, 2018).

127. N.C. DEP'T ENVTL. QUALITY, NORTH CAROLINA CLEAN ENERGY PLAN: TRANSITIONING TO A 21ST CENTURY ELECTRICITY SYSTEM (2019).

128. CALIFORNIA AIR RES. BD., DRAFT SHORT-LIVED CLIMATE POLLUTANT REDUCTION STRATEGY 11 (2015).

129. Pippa Stevens, *Behind Walmart's Push to Eliminate 1 Gigaton of Greenhouse Gases by 2030* (Dec. 15, 2019), https://www.cnbc.com/2019/12/15/walmarts-project-gigaton-is-its-most-ambitious-climate-goal-yet.html.

130. *Renewable Natural Gas Production*, U.S. DEP'T OF ENERGY, https://afdc.energy.gov/fuels/natural_gas_renewable.html (last visited May 2, 2020).

131. *See generally* Umair Irfan, *Can You Really Negate Your Carbon Emissions? Carbon Offsets, Explained* (Feb. 27, 2020), https://www.vox.com/2020/2/27/20994118/carbon-offset-climate-change-net-zero-neutral-emissions (explaining that "additionality" is a key principle to consider when making a reliable offset). The article draws the example of an additionality as "a counterfactual: Does buying this specific offset lead to a reduction of greenhouse gas emissions that would not have happened otherwise?" *Id.*

132. NANCY CARTWRIGHT, COUNTERFACTUALS IN ECONOMICS: A COMMENTARY 1 (2007) (counterfactuals are "causal surrogates" that defines causal relationships in economics).

Instead, climate change has created market signals that are pushing integrators to reduce the carbon embedded in their supply chain and pulling them into new biogas revenue streams.[133] Smithfield inventoried all of its lagoons in response to Walmart's demands.[134] In 2016, Smithfield promised to reduce its GHG emissions 25% below 2010 levels by the year 2025.[135] Two years later, Smithfield explained that it would meet this goal by retrofitting existing lagoons with "manure-to-energy" capabilities, including across 90% of Smithfield-owned hog-finishing facilities in North Carolina.[136] All told, the company expects to capture 85,000 tons of methane each year to generate renewable natural gas.[137]

In fall 2018, Smithfield and the energy company Dominion committed to spend at least $250 million to build biogas infrastructure in North Carolina, Virginia, and Utah.[138] A year later, the companies announced they were doubling that commitment to $500 million dollars in an effort "to become the largest renewable natural gas supplier in the U.S."[139] The first North Carolina project, which will collect methane from 19 farms in the hog belt, will be constructed in 2020 and produce approximately 300,000 dekatherms.[140] Once refined, the gas will be injected into the ever-expanding Piedmont

133. *2018 Integrated Report, Case Study: Expanding Our Efforts to Generate Renewable Energy* SMITHFIELD FOODS SUSTAINABILITY, https://www.smithfieldfoods.com/integrated-report/2018/environment/case-study-expanding-our-efforts-to-generate-renewable-energy-2 (last visited May 2, 2020).

134. Maggie Monast, *What Food Companies Can Learn from Smithfield Foods Exceeding its Grain Sustainability Goal*, ENVTL. DEF. FUND (Feb. 25, 2019), http://blogs.edf.org/growingreturns/2019/02/25/smithfield-exceeds-grain-sustainability-goal/.

135. Press Release, Smithfield Foods, Smithfield Foods Leads Industry as First Major Protein Company to Adopt Greenhouse Gas Reduction Goal (Dec. 5, 2016), https://www.smithfieldfoods.com/press-room/company-news/smithfield-foods-leads-industry-as-first-major-protein-company-to-adopt-greenhouse-gas-reduction-goal.

136. Press Release, Smithfield Foods, Smithfield Foods Announces Landmark Investment to Reduce Greenhouse Gas Emissions (Oct. 25, 2018), https://www.smithfieldfoods.com/press-room/company-news/smithfield-foods-announces-landmark-investment-to-reduce-greenhouse-gas-emissions.

137. Steven Mufson, *Companies Launch Plan to Capture Methane from Hog Manure Lagoons* (Nov. 27, 2018), https://www.washingtonpost.com/energy-environment/2018/11/27/companies-launch-plan-capture-methane-hog-manure-lagoons/.

138. *2018 Integrated Report*, *supra* note 133.

139. Press Release, Smithfield Foods, Dominion Energy and Smithfield Foods Invest Half Billion Dollars to Become Largest Renewable Natural Gas Supplier in U.S. (Oct. 23, 2019), https://www.smithfieldfoods.com/press-room/company-news/dominion-energy-and-smithfield-foods-invest-half-billion-dollars-to-become-largest-renewable-natural-gas-supplier-in-us.

140. John Downey, *How Dominion Energy, Smithfield Foods Plan to Make NC a Leader in Renewable Natural Gas*, CHARLOTTE BUS. J. (Dec. 2, 2019) https://www.bizjournals.com/charlotte/news/2019/12/02/how-dominion-energy-smithfield-foods-plan-to-make.html.

Natural Gas pipeline system.[141] Once complete, the companies are planning an even larger project comprising at least 30 farms in Duplin County.[142]

Of the three new actors to arrive in the 2010s, at this moment it is only clear that the last—the private law of corporate interests—will make a lasting impact on the CAFO landscape. The CAFO and biogas revolution is already under construction; the EJ organizations and long-suffering neighbors of these facilities are still waiting on their remedies.

CHAPTER III: RECONCILING CLIMATE CHANGE MITIGATION WITH ENVIRONMENTAL JUSTICE

Actors will be required to take swift and dramatic action to reduce GHG emissions in order to avoid the worst impacts of climate change. But reducing GHGs does not correct for historical inequity rooted in racism and other systems of oppression. As Smithfield and others reap the profits of climate mitigation, representatives of the people must compel them to finally fix the continuing, immediate, and localized environmental harms of their production system.

Reducing GHG emissions from CAFOs is essential given their contribution to methane emissions. On the mitigation side, agriculture contributes 9.3% to U.S. GHG emissions.[143] Livestock manure management alone produces methane and nitrous oxide that account for 13% of agricultural emissions (CO_2 equivalent).[144] Waste-to-energy (WTE) projects capture methane for biogas generation, which mitigates GHG emissions.[145]

But WTE is not the same as ESTs, which correct the local environmental and public health harms associated with industrial hog farming.[146] The cheapest way to build an anaerobic digester that captures methane from a lagoon is to simply cover the lagoon with an impermeable layer of material.[147] An anaerobic digester requires no material improvement to the

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141. *Id.*

142. *Id.*

143. *See* U.S. ENVTL. PROT. AGENCY, EPA 430-R-20-002, INVENTORY OF GREENHOUSE GAS EMISSIONS AND SINKS 5-1 (2020) (providing 2018 GHG percentages in the U.S.).

144. *Id.* at 5-2 (showing that manure management contributed 9.9% and 3.1% of total estimated agricultural release of methane and nitrous oxide, respectively).

145. Richard L. Skaggs et al., *Waste-to-Energy Biofuel Production Potential for Selected Feedstocks in the Conterminous United States*, 82 RENEWABLE & SUSTAINABLE ENERGY REVS. 2640, 2640–41 (2017).

146. *See generally id.* at 2640 (concluding WTE is a way to divert wastes, such as those from hog farms, in a way that potentially eliminates or significantly reduces adverse effects of waste resources on public health, safety, welfare, and the environment).

147. PETER WRIGHT, OVERVIEW OF ANAEROBIC DIGESTION SYSTEMS FOR DAIRY FARMS 1-2 (2001).

existing lagoon and spray field system.[148] In contrast, Smithfield Foods' plans to install anaerobic digesters on existing lagoons do not mention any intent to implement the ESTs promised by—and developed through—the Smithfield Agreement.[149]

Alarmingly, WTE technology on its own may actually worsen the impacts of the lagoon and spray field system.[150] Three areas of concern are already apparent. First, covering and pressurizing lagoons will increase downward pressure on the cesspools, most of which remain unlined.[151] The few lagoons constructed after 1997 were required to have a clay or synthetic lining to limit hydraulic conductivity,[152] which nonetheless have been shown to seep and leach into the environment even under normal operating conditions. [153] Second, trapping gasses under lagoon covers further concentrates available nutrients within the lagoon effluent that gets sprayed onto fields.[154] Finally, the distribution of biogas will impose additional, disproportionate burdens on communities of color. For example, getting the gas to market increases truck traffic and requires many miles of in-ground piping to transport unrefined gas to processing facilities.[155] The Grady Road project alone requires 30 miles of pipeline to move methane from farms to the plant.[156]

Dr. C. Mike Williams understood that dismantling the lagoon and spray field system went hand-in-hand with generating new sources of revenue from a new waste management system.[157] His 2006 report under the Smithfield Agreement called for "expeditious" investment in further research to improve waste management technologies, as well as "institutional incentives, public policies, and markets related to the sale of byproducts (with priority on energy production) that will reward farmers for utilizing technologies

148. WILLIAM F. TOOLEY, NAT'L RES. CONSERVATION SERV., NRCS 69-3A75-0-123, AEROBIC TREATMENT OF MANURE LAGOONS SHOWING ENVIRONMENTAL AND ECONOMIC BENEFITS WITH ECO-SYSTEM SERVICE PAYBACKS 1, 5 (2013).

149. Greg Barnes, *Smithfield's Plans to Cover Hog Lagoons Could Spur N.C. Biogas Industry* (Jan. 4, 2019), https://www.northcarolinahealthnews.org/2019/01/04/smithfields-plans-to-cover-hog-lagoons-could-spur-n-c-biogas-industry/.

150. Steve Davies, *Smithfield Converting Manure to Energy at Hog Farms in Three States* (Oct. 30, 2018), https://www.agri-pulse.com/articles/11609-smithfield-converting-manure-to-energy-at-hog-farms-in-three-states.

151. Nowlin, *supra* note 16, at 1084.

152. 15A N.C. ADMIN. CODE. 2T.0505 (2013).

153. Nowlin, *supra* note 16, at 1087 n.59 (citing J.M. Ham, *Seepage Losses from Animal Waste Lagoons: A Summary of a 4-year Investigation in Kansas*, 45.4 TRANSACTIONS OF THE ASAE 983, 983 (2002)).

154. ROSE M. STENGLEIN ET AL., IMPERMEABLE COVERS FOR ODOR AND AIR POLLUTION MITIGATION IN ANIMAL AGRICULTURE: A TECHNICAL GUIDE 7 (2011).

155. Downey, *supra* note 140.

156. *Id.*

157. WILLIAMS, *supra* note 70, at 5.

[that] yield improvements and environmental benefits over the current lagoon spray field system."[158] Fourteen years later, industry has found an energy market for its byproducts, but shows no sign of implementing ESTs.

Market incentives for biogas production will only grow as urgency for climate action opens a firehose of private funding to de-carbonize agriculture. As one business-oriented environmental group notes, "When the world's largest pork producer set out to reduce greenhouse gas emissions from its full supply chain, it sent a powerful signal to the industry at large: By cutting emissions it's also creating new business opportunities."[159]

The public sector is ready to sweeten the pot. Cap-and-trade systems and renewable fuel standards commodify carbon offsets to provide additional revenue streams for companies that mitigate emissions.[160] Markets are already in place under both California and New England's carbon budgets.[161] Renewable fuel standards, both state and federal, create price premiums for sellers of biogas and biofuels.[162] Leading presidential candidates,[163] think tanks,[164] and academics[165] have outlined bold proposals to help farmers generate additional revenues from climate-friendly practices including manure management.

For nearly two decades Smithfield Foods has argued that economic infeasibility precludes taking the necessary steps to install ESTs.[166] Like a

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158. *Id.* at 47.

159. Maggie Monast, *How one Company's Plan to turn Pollution into a Commodity Could Change an Entire Industry*, ENVTL DEF. FUND (Dec. 12, 2018), https://www.edf.org/blog/2018/12/12/how-one-companys-plan-turn-pollution-commodity-could-change-entire-industry.

160. *How Cap and Trade Works*, ENVTL. DEF. FUND, https://www.edf.org/climate/how-cap-and-trade-works (last visited Mar. 27, 2020).

161. Jackson Morris & Bruce Ho, *California Leads Off: Now RGGI Must Grab the Climate Baton,* NAT. RES. DEF. COUNCIL (July 19, 2017), https://www.nrdc.org/experts/jackson-morris/california-leads-now-rggi-must-grab-climate-baton.

162. *Overview for Renewable Fuel Standard*, EPA (Jan. 19, 2017), https://www.epa.gov/renewable-fuel-standard-program/overview-renewable-fuel-standard.

163. *See*, *e.g.*, Liz Crampton, *Sen. Bernie Sanders' Plan to Expand Agriculture and Rural Policies* (May 5, 2019), https://www.politico.com/story/2019/05/05/bernie-sanders-agriculture-rural-policies-1302634.

164. *See*, *e.g.*, Bidisha Bhattacharyya, Ryan Richards, & Rita Cliffton, *Building a 100 Percent Clean Future Can Drive an Additional $8 Billion a Year to Rural Communities* (Jan. 8, 2020), https://www.americanprogress.org/issues/green/reports/2020/01/08/479168/building-100-percent-clean-future-can-drive-additional-8-billion-year-rural-communities/.

165. *See*, *e.g.*, Aashna Aggarwal et al., *Achieving the Mid-Century Strategy Goals for Deep Decarbonization in Agriculture and Forestry* (Duke Univ. Nicholas Inst. For Envtl. Pol'y Solutions, Working Paper No. NI WP 18-02, 2018) (proposing the adoption of a national carbon bank, among other policy changes, to reduce U.S. GHG emissions).

166. *See*, *e.g.*, MAJORITY REPORT FROM THE ECONOMICS SUBCOMMITTEE OF THE ADVISORY PANEL TO THE DESIGNEE UNDER THE AGREEMENTS BETWEEN ATTORNEY GENERAL OF NORTH CAROLINA AND SMITHFIELD FOODS, PREMIUM STANDARD FARMS AND FRONTLINE FARMERS REGARDING RECOMMENDATIONS ON ECONOMIC FEASIBILITY DETERMINATIONS 3–4 (2005) (asserting that the economic feasibility of installing ESTs could be supported, but only up to a cost of $400,000 for an "average" farm of 4320 head of cows).

leaking lagoon, that argument hardly holds water now that the poop—a headache to manage, even if poorly—is suddenly a revenue stream unto itself. It's an old adage that "you can't make a silk purse out of a sow's ear," but with a nod from regulators the swine industry will fill a silk purse from a sow's rear. With that windfall comes the opportunity to harmonize the EJ and corporate sustainability interests by investing the new revenue from low-CO_2 pork and biogas production into ESTs.

Now is the time for farmers, industry executives, lawmakers, and NC regulators to seize the opportunity to end the public health and EJ crisis caused by the lagoon and spray field system. Turning the moral imperative—fixing the lagoon and spray field system—into reality requires robust policy along the following lines:

1. Parties to the Smithfield Agreement should agree that converting a lagoon into a biogas plant is a major change to an existing waste management system that triggers mandatory EST implementation;
2. Farmers and state regulators should add new permit conditions to reflect the consequences of lagoon covers on existing waste management systems, including requirements for increased surface- and groundwater testing upstream and downstream of installed digesters; and
3. Lawmakers should repeal Right to Farm and enact a lagoon-and-spray-field conversion program to help farmers transition either to ESTs or to return to pastured pork production.

CONCLUSION

Any lessons from reconciling EJ with climate mitigation in North Carolina will be broadly applicable across the country. The Big Pig problem is a microcosm of the national movement toward decarbonizing agriculture. There is huge and growing investment in limiting GHGs and generating carbon credits in agricultural systems. With this focus comes a real threat of ignoring—or even worsening—other environmental, health, and justice problems.

Climate change threatens life on earth as we know it. Avoiding the worst effects of climate change requires emissions reductions from all sectors. As long as swine CAFOs exist, they must capture and destroy methane. Similarly, so long as corn and soy monocultures blanket the Midwest, they

must use conservation tillage, cover cropping, and other conservation practices to mitigate NOx.

However urgent and dire the climate crisis may be, paying for GHG mitigation should not prop up a system that is poisoning our water, air, and bodies. GHG sources do not exist in a policy vacuum; swine CAFOs in NC are embedded in a landscape of poor communities of color that have suffered their immediate consequences for a generation. In this context, the rise of biogas is both a risk and an opportunity. The risk in turning methane into a profit center is that industry will produce (and capture) more of it at the expense of non-commodified public goods like drinkable water or breathable air. The opportunity lies in how these revenues could be invested to finally implementing the ESTs that industry has resisted for decades. Seizing the opportunity will require a public mobilization on behalf of the communities that have combatted the lagoon and spray field system for the past 30 years.

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,

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

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

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

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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

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

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

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

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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

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

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

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,

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

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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

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

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.

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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

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

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.