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The Carbon Tax Vacuum and the Debate about Climate Change Impacts: Emission Taxation of Commodity Crop Production in Food System Regulation

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"The vulnerability of agriculture to climatic change is strongly dependent on the responses taken by humans to moderate the effects of climate change."[1]

The scientific consensus on climate change is far ahead of U.S. policy on point. In fact, the U.S. has a legal vacuum of carbon taxation while climate change continues to impact the codependence of agriculture and the environment. As this Article shows, carbon taxes follow the polluter-pays model, levying taxes on the highest greenhouse gas ("GHG") emissions—and contributions to climate change. But this is not only unsustainable; it would also undermine agricultural production and, thus, food security. This Article describes how the law can regulate climate change contributions and promote adaptation and mitigation strategies. If climate change adaptation and mitigation are not

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1. U.S. DEP'T OF AGRIC., CLIMATE CHANGE AND AGRICULTURE IN THE UNITED STATES: EFFECTS AND ADAPTATIONS 1–2 (2013), https://perma.cc/5HWN-DU2B.

supported through carbon taxes in the agricultural sector, twenty percent of GHG contributions will be left untouched, jeopardizing the future of U.S. food production at the environment's expense. This Article reveals new avenues of climate change adaptation and mitigation through carbon taxation of genetically modified ("GMO") commodity crops to bring the carbon tax to a previously overlooked contributor to climate change: intensive agriculture. However, adapting to and mitigating the effects of climate change, such as extreme weather events, droughts, and floods, can only be accomplished through concerted efforts of various industries, governments, and the public like cap-and-trade or carbon tax schemes imposing blanket limits on GHG emissions.

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I. INTRODUCTION

Climate change has been a much-debated issue of our time. At the core of this debate lies the question of how the law can regulate climate change contributions and promote adaptation and mitigation strategies. The United Nations ("UN"), the European Union ("EU"), the United States, and intergovernmental organizations have been focusing on the policy aspects of climate change for decades while environmentalists, industrialists, and non-profit organizations have created precedent through litigation. The most important function of climate change law and policy, however, is to curb the global emissions of greenhouse gases ("GHGs") that trap heat in the Earth's atmosphere and warm climates. However, adapting to and mitigating the effects of climate change, such as extreme weather events, droughts, and floods, can only be accomplished through concerted efforts of various industries, governments, and the public like cap-and-trade or carbon tax schemes imposing blanket limits on GHG emissions. This Article reveals new avenues of climate change adaptation and mitigation through carbon taxation of genetically modified ("GMO") commodity crops to bring the carbon tax to a previously overlooked contributor to climate change: intensive agriculture.

At the onset, this Article describes the current state of agriculture and its effects on climate change. Part II summarizes the leading climate science and the Intergovernmental Panel on Climate Change's ("IPCC") evidence of climate change. Then, an introduction to Pacala and Socolow's "Wedges" model for climate change mitigation illustrates that the current business-as-usual food production system is unsustainable and harmful to its own continued existence. In the subsequent discussion about climate policy, the scientific rationales lay the groundwork for the following introduction to the carbon-tax idea within the law and policy setting. Thus, Part III first explains what a carbon tax is and provides an overview of carbon taxation under the EU's Emissions Trading Scheme ("ETS"). In the same section, the lacking carbon tax scheme in the U.S. is contextualized with the emissions reduction incentives that carbon taxation may bring. Part IV provides a background of the links between environmental law, climate change policy, and food and agriculture law to reveal points of action. The goal of this subsection is to lay out the jurisdictional hierarchy governing carbon taxes and the potential legal

challenges, unfavorable precedent, or policy obstacles to implementing a GMO-commodity-crop carbon tax ("GCCCT").[2] Finally, this Article concludes with an assessment of the chances for success of introducing a GCCCT in the EU and in the U.S.

II. CLIMATE CHANGE, CARBON TAXATION, AND AGRICULTURE

A. Current State of the Science: The IPCC's Assessment of Agriculture's Effect on Climate Change

On an international level, the IPCC has been studying and publishing strong evidence of climate change.[3] In periodic reports and environmental assessments, the IPCC provides guiding information on which the UN and governments around the globe rely. Recently, an IPCC Report highlights the impact climate change has had on agriculture,[4] pinpointing the most commonly traded crops—often GMOs.[5] Specifically, the report states that "[c]limate change has negatively affected wheat and maize yields for many regions and in the global aggregate (*medium confidence*). Effects on rice and soybean yield have been smaller in major production regions and globally . . . ."[6] The responses to these yield losses are increased uses of genetically engineered crops to withstand higher levels of pesticides and herbicides and to thrive

2. Carbon dioxide ("CO_2") is a particularly troublesome GHG, warranting special treatment. *See Climate Change Indicators: U.S. Greenhouse Gas Emissions*, EPA, https://perma.cc/NA7R-B9B7 (last updated Dec. 17, 2016). CO_2 is also a "GHG indicator"; it is often used as a representative of all GHGs. *Id.*

3. *See*, *e.g.*, *Fifth Assessment Report*, IPCC, https://perma.cc/6S4E-GX6H.

4. IPCC, CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY: SUMMARY FOR POLICYMAKERS, *in* WORKING GROUP II CONTRIBUTION TO THE FIFTH ASSESSMENT REPORT OF THE IPCC 4 (2014), https://perma.cc/X23U-M7J2 [hereinafter IPCC REPORT].

5. Gabriela Steier, *A Window of Opportunity for GMO Regulation: Achieving Food Integrity Through Cap-and-Trade Models from Climate Policy for GMO Regulation*, 34 PACE ENVTL. L. REV. 293, 294 (2017).

6. IPCC REPORT, *supra* note 4, at 5. The term "medium confidence" refers to the IPCC authors' judgment about the validity of that finding given the available evidence and the authors' degree of agreement with one another. *See* IPCC, GUIDANCE NOTE FOR LEAD AUTHORS OF THE IPCC FIFTH ASSESSMENT REPORT ON CONSISTENT TREATMENT OF UNCERTAINTIES 3 (2010), https://perma.cc/5BGP-H4WZ.

on synthetic fertilizers—all of which aggravate environmental degradation and contribute to climate change,[7] thereby fueling a vicious cycle. Breaking this cycle would mean discouraging the use of GMOs and switching to more environmentally friendly farming practices, even those which reduce the effects of, or help agriculture adapt to, climate change. As the Food and Agriculture Organization of the UN ("FAO") acknowledges, the global agricultural sector must "adopt more efficient and sustainable production methods and adapt to climate change."[8] The following section explores how such mitigation and adaption fits within legal frameworks.

The IPCC Report states that "[c]limate change is projected to progressively increase inter-annual variability of crop yields in many regions[, and] [t]hese projected impacts will occur in the context of rapidly rising crop demand."[9] This means that climate change will threaten food security worldwide and could aggravate global hunger. According to the IPCC:

> All aspects of food security are potentially affected by climate change, including food access, utilization, and price stability (*high confidence*). Redistribution of marine fisheries catch potential towards higher latitudes poses risk of reduced supplies, income, and employment in tropical countries, with potential implications for food security (*medium confidence*). Global temperature increases of ~4°C or more above late-20th-century levels, combined with increasing food demand, would pose large risks to food security globally and regionally (*high confidence*).[10]

Therefore, adaptation and mitigation strategies are urgently needed to avoid global food crises. Correspondingly, the IPCC defines adaption as "[t]he process of adjustment to actual or expected climate and its effects. In human systems, [such as agriculture,] adaptation seeks to moderate or avoid harm or exploit beneficial opportunities."[11] It follows that, "[i]n some natural systems," herein defined as the ecosystems that support local agri-

7. MARY J. ANGELO ET AL., FOOD, AGRICULTURE, AND ENVIRONMENTAL LAW 120 (2013).
8. FAO, GLOBAL AGRICULTURE TOWARDS 2050 1 (2009), https://perma.cc/6EWM-2E78.
9. IPCC REPORT, *supra* note 4, at 18.
10. *Id.* For a discussion of the definition of "high confidence," see *supra* note 6.
11. *Id.* at 5.

culture, "human intervention may facilitate adjustment to expected climate and its effects."[12] Notably, climate change impacts are defined as the "[e]ffects on natural and human systems."[13] In the IPCC Report, climate change impacts "generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system."[14] Thus, given the pervasiveness of agriculture's effects in all these areas of life, reducing agriculture's GHG emissions may have promising effects on climate change adaptation and mitigation.

Strategies to curb unsustainable farming practices—such as those that rely on heavy fossil fuel uses for transportation, tillage, or fertilizer production—present one of many avenues to reduce agriculture's effects on climate change. Although general examples of climate change adaptation and mitigation include soil health conservation in human systems and wildlife protection in natural systems, agroecologic approaches to food production may unite but decentralize systems,[15] thereby encouraging climate-friendly farming that suits the world's localities. Other examples of alleged adaptation and mitigation (but which are neither in reality)—often set forth by biased representatives and publications or advertisements of the industry producing GMO-based processed foods—include increased yield through genetic engineering, higher use of fertilizer and pesticides, and more aggressive farming practices, all of which are profit-oriented goals.[16] This is sometimes referred to as the "BigAg" scheme. In the agricultural sector, however, despite the wide acceptance of the BigAg scheme, the agroecologic strategy is more promising in the long run.[17] Specifically, reducing GHG sources may be accomplished by de-

12. *Id.*
13. *Id.*
14. *Id.*
15. USDA, CLIMATE CHANGE AND AGRICULTURE IN THE UNITED STATES: EFFECTS AND ADAPTATION 2 (2013), https://perma.cc/RJ5H-ZBEY.
16. ANGELO ET AL., *supra* note 7, at 128.
17. U.N. Conference on Environment and Development, *The Role of the International Economy: Our Common Future, From One Earth to One World*, 78, U.N. Doc. A/42/427, annex I (March 20, 1987), https://perma.cc/V6GE-28VX.

centralizing food systems, which would cut emissions from industrial production, processing, and distribution.[18] Simultaneously, carbon sinks may be enhanced through increased crop diversification, soil health management, and ocean conservation in the aquaculture subsector.[19] Thus, encouraging agroecologic farming practices inadvertently means that unsustainable farming practices following BigAg's scheme must be discouraged. Accomplishing these positive changes in the agricultural sector will take various strategies. This Article presents one approach: borrowing the carbon taxation method of addressing climate change to the agricultural sector to introduce the polluter-pays model to food production.

B. Business-As-Usual: Pacala and Socolow's Wedges

To adapt to—and mitigate—climate change, we must recognize that the business-as-usual, intensive agricultural model, which is still heavily reliant on BigAg-style centralization and industrialization, remains unsustainable. In fact, BigAg's model is undermining its own existence through resource exploitation and environmental degradation for short-term profit—and at the cost of long-term sustainability. This model is, however, the widely-established business-as-usual, which fails to mitigate climate change from the food and agriculture standpoint. Thus, clarifying the "current literature about stabilizing atmospheric [carbon dioxide] ("CO_2") at less than a doubling of the preindustrial concentration has led to needless confusion about current options for mitigation"[20] and can be explained differently than through the BigAg scheme and its biased publicity. In their seminal work, climate scientists Pacala and Socolow use wedges to idealize the fifty-year emissions reductions as a triangle, with a "flat" trajectory of fossil fuel emissions representing "stabilization" and a rising, straight "ramp" indicating business-as-usual ("BAU"). These

18. USDA, *supra* note 15, at 10.
19. Food & Agric. Org. [FAO], APFIC/FAO Reg'l Consultative Workshop, *Implications of Climate Change on Fisheries and Aquaculture: Challenges for Adaptation and Mitigation in the Asia-Pacific Region*, at 40, RAP Doc. 2011/17 (May 2011), https://perma.cc/B5KY-2PB9.
20. Stephen W. Pacala & Robert H. Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies*, 305 SCIENCE 968, 968 (2004).

lines form the "stabilization triangle," which removes exactly one-third of BAU emissions[21] (see Figure 1). The stabilization triangle is subdivided into seven equal wedges to "keep the focus on technologies that have the potential to produce a material difference by 2054."[22] As such, each "wedge represents an activity that reduces emissions to the atmosphere that starts at zero today and increases linearly. . . [and] thus represents a cumulative total of 25 GtC of reduced emissions over 50 years."[23] According to Pacala and Socolow's model, "[s]tabilization at any level requires that net emissions do not simply remain constant, but eventually drop to zero."[24] This drop represents the path toward sustainability.

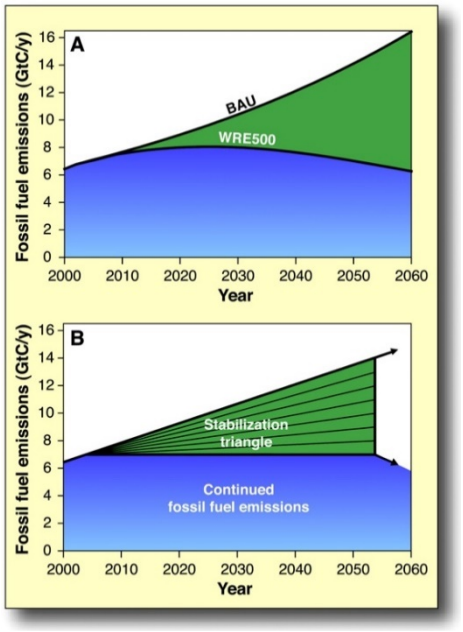
Applied to agriculture, the resource-intensive BAU would fail at stabilization "[w]hen forest or natural grassland is converted to cropland, up to one-half of the soil carbon is lost, primarily because annual tilling increases the rate of decomposition by aerating undecomposed organic matter."[25] Thus, "[a]bout . . . two wedges' worth . . . has been lost historically in this way."[26] Nonetheless, Pacala and Socolow provide an option that focuses on agricultural soils management,[27] which illustrates how stabilization in the agricultural sector could be accomplished through conservation tillage—when "seeds are drilled into the soil without plowing" or with "the use of cover crops, and erosion control."[28] Thus, "a good case could be made for the IPCC's estimate that an additional half to one wedge could be stored in this way."[29]

Notably, "this way" implies a set of sustainability- and environmental-conservation-oriented farming methods akin to agroecology—i.e., those in harmony with ecosystem conservation.[30] Conversely, stabilization, as illustrated through the wedges,

21. *Id.*
22. *Id.*
23. *Id.*
24. *Id.*
25. *Id.* at 971.
26. *Id.*
27. *Id.*
28. *Id.*
29. *Id.*
30. *See generally* Charles A. Francis et al., *Agroecology: The Ecology of Food Systems*, 22 J. SUSTAINABLE AGRIC. 99 (2003) (discussing the ecology of food systems and the framework around which education and research should be structured regarding the global food system).

would inevitably signify abandoning the farming methods that have destabilized at least two wedges' worth, as previously explained. Thus, following the BigAg scheme, i.e., the BAU model, is the exact opposite of what is needed to mitigate and adapt to climate change—which is necessary to ensure food safety[31] for the future; without steady agricultural yields in the face of changing climate, food security is, in fact, jeopardized.[32] In sum, a reduction in fossil-fuel-reliant farming is necessary to achieve the stabilization that food systems rely on to ensure continued food safety.

Figure 1 – Pacala and Socolow's Wedges[33]



(A) The top curve is a representative BAU emissions path for global carbon emissions as CO_2 from fossil fuel combustion and cement manufacture. . . . The area between the two curves represents the avoided carbon emissions required for stabilization.

(B) Idealization of (A): A stabilization triangle of avoided emissions (green) and allowed emissions (blue). The allowed emissions are fixed at 7 GtC/year beginning in 2004. The stabilization triangle is divided into seven wedges, each of which reaches 1 GtC/year in 2054. With linear growth, the total avoided emissions

31. *Food Safety*, *in* FAO, FOOD AND NUTRITION: A HANDBOOK FOR NAMIBIAN VOLUNTEER LEADERS, (2004) http://perma.cc/4YYH-EZ4Y (Food safety, for purposes of this Article, shall follow the UN FAO definition of focusing on "handling, storing and preparing food to prevent infection and help to make sure that . . . food keeps enough nutrients for . . . a healthy diet." *Id.*).
32. U.N. Conference on Environment and Development, *supra* note 17, at 82.
33. Pacala & Socolow, *supra* note 20, at 968–72.

per wedge is 25 GtC, and the total area of the stabilization triangle is 175 GtC. The arrow at the bottom right of the stabilization triangle points downward to emphasize that fossil fuel emissions must decline substantially below 7 GtC/year after 2054 to achieve stabilization at 500 ppm.

Pacala and Socolow are hopeful that "[h]umanity can solve the carbon and climate problem in the first half of this century simply by scaling up what we already know how to do."[34] While agroecology provides many of the answers, consumers are empowered to be climate-active citizens.[35] Thus, implementing agricultural policies to stabilize emissions "would inevitably be renegotiated periodically to take into account the results of research and development, experience with specific wedges, and revised estimates of the size of the stabilization triangle. But not filling the stabilization triangle will put 500-ppm stabilization out of reach."[36]

Consequently, governments are starting to respond with policy models that mandate certain GHG reductions to fill the stabilization triangle, even if these connections are not necessarily explicit. The following section focuses on carbon taxation as a policy response that may help to reach stabilization goals while further specifying climate change mitigation and adaptation strategies for the agricultural sector.

III. CARBON TAXING FOR CLIMATE CHANGE ADAPTATION AND MITIGATION

A. What is a Carbon Tax?

By definition, "[a] 'carbon tax' or a tax on GHG emissions imposes a direct fee (the carbon price) on emission sources based on the amount of GHG they emit, but does not set a limit on GHG

34. *Id.* at 968.
35. *See* Jan C. Semenza et al., *Public Perception of Climate Change: Voluntary Mitigation and Barriers to Behavior Change*, 35 AM. J. PREVENTATIVE MED. 479, 483 (2008) (discussing changes in individual behavior in response to knowledge of human-induced climate change).
36. Pacala & Socolow, *supra* note 20, at 968.

emissions."[37] As such, a carbon tax resembles cap-and-trade options in that "the tax could be imposed upstream or downstream"[38] and essentially follows a polluter-pays model. Notably, under such a model, those who emit the most GHG pay the most. While this shifts the responsibility for polluting to the actual culprits, seemingly removing the burden from the population at large, the carbon tax may be reflected in the prices of commodities and merely spreads the tax widely, rather than forces compliance with emissions caps. Nonetheless, such a carbon tax may "require importers, producers and distributors of fossil fuels to pay a fixed fee on the carbon dioxide contained in fuel sold and/or it could require emitters to pay based on their actual emissions," thereby enforcing improved transparency by virtue of disclosing measurable emissions.[39]

Carbon taxes offer a host of benefits that complement cap-and-trade alternatives.[40] In fact, "[a]nalyses have shown that an emission tax is more likely to allow for adoption of the cheapest mitigation strategies, as well as easier administration, than a cap-and-trade scheme.[41] Additionally, the revenue generation from carbon taxes may be reinvested in environmental cleanup programs, green-energy innovation, or for other societal benefits. However:

> Emitters may choose either to pay the tax or to reduce emissions [and,] [a]s a result, the level of the tax will likely have to be adjusted over time to meet a given emission target. This system does, however, provide price certainty, because the tax level is set before the policy is implemented.[42]

Although carbon taxation seems to be a straightforward approach to environmental regulation from a public-law perspective, it can actually take many forms through regional, national, and subnational carbon pricing initiatives.[43] Price rate changes,

37. HARI M. OSOFSKY & LESLEY K. MCALLISTER, CLIMATE CHANGE LAW AND POLICY 35 (2014).
38. *Id.*
39. *Id.*
40. *See generally* Steier, *supra* note 5.
41. OSOFSKY & MCALLISTER, *supra* note 37, at 35.
42. *Id.*
43. RICHARD ZECHTER ET AL., WORLD BANK GRP., STATE AND TRENDS OF CARBON PRICING 48, 52 (2016), https://perma.cc/AF53-UL8X.

for instance, target specific sectors, such as: heating fuel in Finland, which was increased by €10 from €44 per tCO_2e (US$11 per tCO_2e) to €54 per tCO_2e (US$60 per tCO_2e) from 2016; France's carbon tax rate, which increased from €14.5 per tCO_2e (US$16 per tCO_2e) to €22 per tCO_2e (US$24 per tCO_2e) in 2016; and Switzerland's carbon tax, which rose from CHF60 per tCO_2e (US$62 per tCO_2e) to CHF84 per tCO_2e (US$86 per tCO_2e) in 2016.[44] Similarly, governments may eliminate exemptions, as Slovenia did with the removal of the exemption for liquefied petroleum gas and natural gas, with a carbon tax rate of €17 per tCO2e (US$19 per tCO2e) now applying to all fossil fuels.[45] New Zealand, South Africa, China, and California proposed price stabilization mechanisms and carbon offsets for compliance with emission targets under Kyoto and Paris.[46] These public-law strategies have carbon tax underpinnings that strive to reduce GHG emissions, disincentivize pollution, and amass funds for environmental cleanup and green-energy development.

From a private-law perspective, corporate carbon price reporting encourages institutional investors to actively engage "with governments on the risks of weak climate policy and the need for a carbon price through the Global Investor Statement on Climate Change,"[47] according to the World Bank. For instance, the Global Investor Statement on Climate Change ("GISCC") was signed by 409 investors representing more than US$24 trillion in assets to transition to a low-carbon economy and adapt to the physical impacts of climate change.[48] Minimization of climate risk is at the forefront of the GISCC and illustrates the flip side to emissions taxation, where those taxed are seeking to exceed the bare minimum of government-imposed carbon taxation. Here, the proceeds may yield enormous benefits for adaptation and mitigation strategies.

44. *Id.* at 48.
45. *Id.* at 50.
46. *See* ZECHTER ET AL., *supra* note 43. *See generally* Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, 37 I.L.M. 22; United Nations Framework Convention on Climate Change, May 9, 1992, S. TREATY DOC. NO. 102-38, 1771 U.N.T.S. 107.
47. ZECHTER ET AL., *supra* note 43, at 55; *see* ASIA INV'R GRP. ON CLIMATE CHANGE ET AL., GLOBAL INVESTOR STATEMENT ON CLIMATE CHANGE (2014), https://perma.cc/4YQ8-3GQE.
48. ASIA INV'R GRP. ON CLIMATE CHANGE ET AL., *supra* note 47, at 1.

With these market realities and trends in globalization in mind, applied to the agricultural sector, a carbon tax would disincentivize the use of fossil-fuel-based fertilizers and pesticides, and may even shorten food chains that escalate food miles, i.e., the distances that food is transported from farm to fork. In theory, "higher prices generally result in lower consumption"[49] of those products with the highest emissions, such as GMOs with the greatest dependence on fossil fuels for production and processing. However, scholars warn that "fertilizer and input suppliers [may] bump up the prices they charge farmers to cover their carbon tax costs," while "[f]armers can't pass these direct and indirect costs on,"[50] thereby weakening the competitiveness of agricultural products. Simply put, commodity crop producers who may have to pay a carbon tax will likely be less competitive in the global market if their products are priced higher than those of competitors who do not pay a carbon tax. This likely consequence of carbon taxation in the agricultural sector begs the important question of how emissions taxation could be implemented to encourage more environmentally friendly farming practices. The following historical context and comparison of carbon taxation in the EU and the U.S. will be instructional in highlighting possible avenues to tax emissions for agroecological ideals.

B. Overview of Carbon Taxation in the European Union

Over the past quarter century, several European countries spearheaded carbon taxation models with a clear goal of addressing climate change.[51] Professor Mikael Skou Andersen from the Aarhus University in Denmark and Scientific Committee Vice-Chair of the European Environment Agency ("EEA") explains that

49. Kelvin Heppner, *Carbon Tax Misses the Mark in Agriculture*, REALAGRICULTURE (Apr. 4, 2017), https://perma.cc/V7JM-TMEC.

50. *Id.*

51. *See* Mikael Skou Andersen, An Introductory Note on Carbon Taxation in Europe: A Vermont Briefing (Dec. 1, 2016) (unpublished conference paper), https://perma.cc/Z642-S6G5.

> [c]arbon taxes are in place in 14 countries in Europe,[52] complementing emissions trading schemes for power plants and large industrial installations. . . . Carbon taxes have been leveraged by linking their introduction to other issues and often through a "roundtable" method of policy-making enabling agreement on exemptions and compensations.[53]

Professor Skou also notes that "[c]arbon taxes have proven effective in curbing emissions and, with excise taxes on fuels, provide a long-term signal capable of transforming energy and transport systems."[54] He emphasizes that "[c]arbon tax schemes have been designed to reinforce employment and economic activity and to avoid damaging economic growth."[55] Thus, as previously implied, the benefits of carbon taxation go beyond penalizing pollution by making funds available that stimulate green growth and redirect funds to adaptation and mitigation strategies.

1. A Little European Carbon Tax History

As a signatory to the Kyoto Protocol to the United Nations Framework Convention on Climate Change ("UNFCCC"), the EU partakes in the international community's striving towards the goals of mitigating and adapting to climate change.[56] For instance, in 2000, the EU launched the European Climate Change Program ("ECCP"), "including an emission trading program and various legislative initiatives to promote renewable energy, expand the use of biofuel, and improve the energy efficiency of buildings."[57] Later, in January 2005, the EU inaugurated the European Union Emission Trading Scheme ("ETS"). With these frameworks in place and by its own account, the EU considers the ETS "a cornerstone of the EU's policy to combat climate change and its key tool for reducing greenhouse gas emissions cost-effectively."[58] In fact, the ETS "is the world's first major carbon

52. *Id.* at 1.
53. *Id.*
54. *Id.*
55. *Id.*
56. *Kyoto Protocol*, EUR-LEX, https://perma.cc/WU7B-W3S2.
57. DAVID R. WOOLEY & ELIZABETH M. MORSS, CLEAN AIR ACT HANDBOOK: A PRACTICAL GUIDE TO COMPLIANCE § 10:7 (27th ed. 2017).
58. *Climate Action: The EU Emissions Trading System (EU ETS)*, EUROPEAN COMM'N, https://perma.cc/8AFX-KA7F (last updated Jan. 3, 2018).

market and remains the biggest one."[59] It "covers thousands of facilities across EU member countries in industries including power generation, petroleum refining, coke ovens, and iron and steel" whereby "member states set a national cap on CO_2 emissions from regulated facilities."[60] The authoritative *Clean Air Act Handbook* explains that "[w]ithin the limits of the national cap, governments issued allowances to each installation to emit a certain level of CO_2 annually."[61] Moreover, in 2009, the EU's fragmented national caps were harmonized in a single cap,[62] enabling facilities to cut cost and emissions and sell any surplus credits,[63] similar to the Kyoto carbon trading scheme.

Over the past three decades, carbon taxes were implemented on a national level in three waves.[64] First, around 1990, Nordic countries including Finland, Sweden, Norway, and Denmark entered into unilateral commitments under the 1988 Toronto Declaration that coincided with so-called "policies to lower payroll taxes to improve economic performance."[65] Specifically, Finland's fossil fuel carbon tax was followed by Sweden's carbon tax in 1991 and Denmark's introduction of a carbon and electricity tax in 1992.[66] Notably, Norway's policy model has "an almost carbon-free power sector relying on hydroelectricity,"[67] thereby vastly reducing the country's carbon footprint. The second wave started with the Eastern transition countries, Latvia, Slovenia, Estonia, Croatia, seeking EU membership since around 2000.[68] "A third wave of carbon taxes, enacted in Western European countries with budgetary challenges (Ireland, Portugal, France) around 2010, reflected . . . climate policy ambitions."[69]

59. *Id.*
60. WOOLEY & MORSS, *supra* note 57, § 10.7.
61. *Id.*
62. *Id.*
63. *Id.*
64. Andersen, *supra* note 51, at 2.
65. *Id.*
66. *Id.*
67. Stefan Speck, *Carbon Taxation: Two Decades of Experience and Future Prospects*, 4 J. CARBON MGMT. 171 (2013).
68. Andersen, *supra* note 51, at 2.
69. *Id.*

2. The European Union Emission Trading Scheme ("EU ETS")

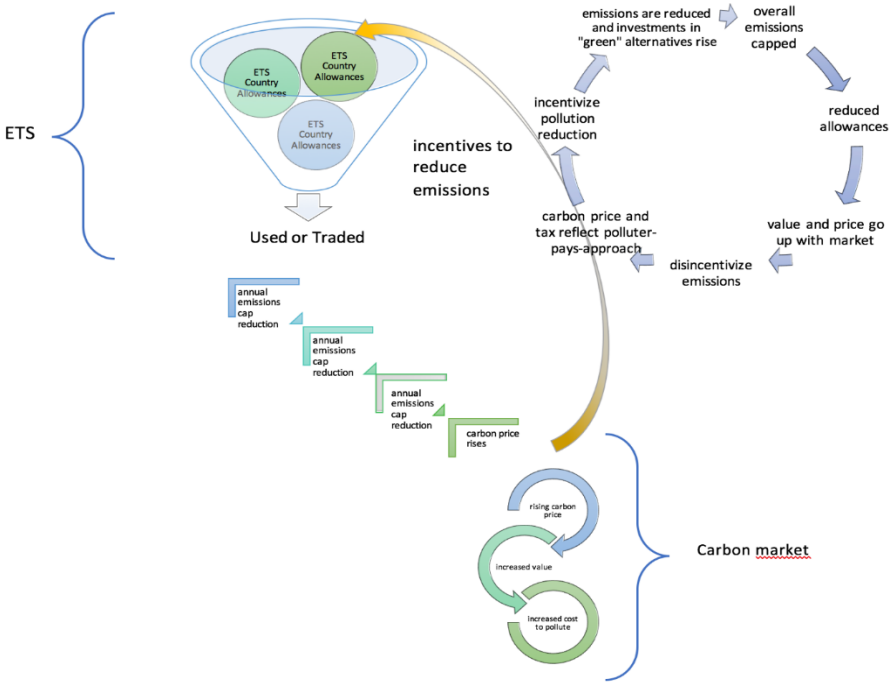
Of special interest for this Article is the EU ETS, especially the carbon stocks in the EU territory's agricultural lands, functioning as carbon sinks toward the overarching goal to reduce GHGs. In fact, the European Commission estimates that "the release of just 0.1% of the carbon currently stored in European soils would equal the annual emissions from as much as 100 million cars."[70] Emphasizing that the removal, emission, and storage of CO_2 is of particular importance,[71] the European Commission notes that agriculture in GHG accounts of industrialized nations are governed by Protocol rules for the so-called LULUCF sector—land-use, land-use change, and forestry.[72] Although the EU ETS works as a cap-and-trade scheme, it incorporates some carbon taxation by promoting robust carbon pricing for investment in clean, low-carbon technologies[73]—the so-called green energy sector. Operating in 31 countries—i.e., all 28 EU countries plus Iceland, Liechtenstein and Norway—the ETS "limits emissions from more than 11,000 heavy energy-using installations (power stations [and] industrial plants) and airlines operating between these countries," which "covers around 45% of the EU's greenhouse gas emissions."[74] As such, the ETS has the potential to live up the ideals of carbon taxes by following the polluter-pays model and bringing funds to local economies for clean-ups and greening.

Under the EU-wide ETS cap, companies receive or buy tradable emission allowances.[75] Between 2013 and 2020, the emissions cap is reduced by 1.74% every year,[76] forcing facilities to continually lower their emissions or pay a price. As such, the "[e]mission allowances are the 'currency' of the EU ETS, and the

70. EUROPEAN COMM'N, *supra* note 58.
71. *Id.* ("Removals take place when trees grow or organic material builds up in soils. Emissions take place for instance when plants die and decay or when soils are disturbed so that their capacity to store is decreased. This would be the case when trees or crops are harvested, if wetlands are drained or if grasslands are ploughed.").
72. *Id.*
73. *Id.*
74. *Id.*
75. European Comm'n, *Climate Action: The EU Emissions Trading System (EU ETS) Factsheet*, at 1 (2016), https://perma.cc/UW87-ATMP.
76. *Id.* at 2.

limit on the total number available gives them a value[,]"[77] whereby the price is subject to supply and demand of the carbon market. For example, "[i]n 2015, on average 26 million allowances or their derivatives were traded per trading day[, which] . . . added up to over 6.6 billion allowances or their derivatives, with a total value of around €49 billion."[78] This, in turn, explains how "capping overall greenhouse gas emissions from major sectors of the economy . . . creates an incentive for companies to invest in technologies that cut emissions."[79] Moreover, "[t]he market price of allowances—otherwise known as the 'carbon price'—creates a greater incentive as it increases."[80] Correspondingly, a carbon tax reflects the government's added disincentive to emit GHGs.[81]

Figure 2 – How Carbon Taxes Create Incentives to Reduce Emissions



77. *Id.* ("Each allowance gives the holder the right to emit one tonne of CO_2, the main greenhouse gas, or the equivalent amount of two other powerful greenhouse gases, nitrous oxide (N_2O) and perfluorocarbons (PFCs).").
78. *Id.* at 5.
79. *Id.*
80. *Id.*
81. *See infra* Figure 2.

This graph summarizes how the ETS and the workings of the carbon market create incentives to reduce emissions (or disincentivizes pollution). Under the ETS, countries set allowances (top left funnel) that create the basis for the usage or trade under Kyoto principles. Annual emissions cap reductions (middle steps), however, further shrink the mouth of the funnel, thereby affecting the carbon market (bottom inter-linking loops). Overall, the consequences for the carbon market create incentives to reduce emissions (large yellow arrow), which are nuanced in a positive feedback loop (top right).

C. Lacking Behind: US Carbon Taxation To-Date

"To date, the U.S. Congress has not passed any federal legislation on climate change."[82] Although a carbon tax following the EU ETS cap-and-trade model, where the government would allocate emission caps, might be better received than a blanket carbon tax, the U.S. has not ratified the Kyoto Protocol.[83] Commentators usually note that the U.S.'s reluctance in signing the Kyoto Protocol is for fear that the obligations to support developing countries could be economically harmful or that funding for federal agencies may be cut to reduce payments under the Protocol.[84] It is true that

> the United States has participated in international climate change discussions, submitting its sixth Climate Action Report in 2014 as required by the UNFCCC . . . describ[ing] the nation's current circumstances relating to global warming, future trends in greenhouse gas emissions, existing and planned policies and measures, expected impacts, and other information necessary to assess the country's status with respect to climate change.[85]

However, the U.S. did not formally participate in negotiations about emissions reduction targets because it is not a party. Nonetheless, it released its GHG emissions inventories from the ener-

82. Stephen Sewalk, *Carbon Tax with Reinvestment Trumps Cap-and-Trade*, 30 PACE ENVTL. L. REV. 580, 586 (2013). The author notes that more recent sources than 2013 are not available from the Congressional Research Service.

83. *Id.* at 602.

84. WOOLEY & MORSS, *supra* note 57, § 10:9.

85. *Id.*

gy, industrial processes, solvents, agriculture, land use change and forestry, and waste sectors[86]—thereby *acknowledging its agricultural carbon footprint*. In fact, the U.S. has less than five percent of the global population but consumes over one quarter of the world's oil and emits nearly half of global GHGs.[87] Food production accounts for 20 percent of fossil fuel consumption in the U.S.,[88] implying that a carbon tax in the agricultural sector could significantly raise climate change mitigation and adaptation.

Industrial farming and the BigAg scheme are particularly fertile grounds for effective climate change adaptation and mitigation through carbon taxes. American food processing releases major air pollutants including sulfur dioxide ("SO_2"), carbon monoxide ("CO"), ozone ("O_3"), CO_2, and nitrogen dioxide ("NO_2").[89] Environmental scholars explain that

> [e]missions from food processing can be classified into three categories: direct emissions, indirect emissions from purchased electricity, and other indirect emissions. Direct emissions are from sources owned by processors, including boilers, heaters, cookers, vehicle fleets, and wastewater treatment. Other key contributors to energy use and carbon emissions within the plant include processing equipment, like ovens, dehydrators, retorts and pasteurizers, coolers and freezers, compressed-air systems, air-handling systems, and lighting. Indirect emissions, the second category, come from the use of purchased electricity. And finally, the category of other indirect emissions includes "emissions that occur as a result of food processing activities but from sources not owned or controlled by the manufacturer" such as "ingredients, freight, equipment manufacture, solid waste disposal, contractor, [and] employee business travel."[90]

Thus, the pervasive nature of industrial agriculture is ripe for a carbon tax to address BigAg's impact on climate change where it is the most resource-intensive, highest-emitting form of food production. Nonetheless, the U.S. may continue to resist entering in-

86. *Id.*
87. Steven Hill, *Windmills, Tides, and Solar Besides: The European Way of Energy, Transportation, and Low-Carbon Emissions*, 43 ENVTL. L. REP. 10102, 10102–03 (2013).
88. ANGELO ET AL., *supra* note 7, at 115.
89. *Id.* at 123–24.
90. *Id.* at 124.

to treaties, such as the Kyoto Protocol, because of its culturally rooted tax aversion.[91]

Various challenges and obstacles to a carbon tax, such as the harmonized European ETS, make it difficult to envision successful implementation in the U.S. The following section outlines some of these limitations and proposes strategies to overcome them.

IV. IMPLEMENTING THE IDEA: CHALLENGES OF CARBON TAXATION AND OBSTACLES TO CARBON-TAXATION IN AGRICULTURE

A. The Hierarchy of Environmental Law and the Question of Power Over Carbon Taxes: A Juxtaposition of the EU and US-American Approaches

One major source of friction within food and agriculture law is the approval and cultivation of GMOs, as they pose a host of environmental risks which accelerate climate change—such as expanding fossil-fuel and intensive-type farming.[92] Noting agriculture's effects on climate change, this Article focuses on these connections.

In the EU, environmental protection and climate change are explicitly articulated goals set forth by the European Parliament. The polluter-pays principle is grounded in Art. 192(5) of the Treaty on the Functioning of the European Union ("TFEU") (formerly Art. 175 of the Treaty establishing the European Community ("TEC")).[93] Additionally, addressing climate change is a goal clearly listed in Article 191(1) of the TFEU (formerly Article 174 of the TEC).[94] As such, the European Parliament insists that the

91. Ingela Willfors et al., Comm. of Experts on Int'l Cooperation in Tax Matters, Rep. on Its Fourteenth Session, *Carbon Taxation – An Instrument for Developing Countries to Raise Revenues and Support National Climate Policies*, U.N. Doc. E/C.18/2017/CRP.6 (Mar. 30, 2017), https://perma.cc/A2TF-MZKE.

92. *See* ANGELO ET AL., *supra* note 7, at 326.

93. Consolidated Version of the Treaty on the Functioning of the European Union art. 192(5), Sept. 5, 2008, 2008 O.J. (C 115) 134, [hereinafter TFEU], https://perma.cc/27YR-9CVM.

94. *Id.* art. 191(1).

TFEU "be chosen as the legal basis for environmental legislation, thereby ensuring that Member States are free to adopt more stringent protective measures in accordance with Art. 193 TFEU (formerly Art. 176 TEC)"[95] This means that legal challenges can be brought based on these articles—specifically, climate change mitigation disputes may go before the European Court of Justice ("ECJ").

When challenges are brought, however, the question of jurisdiction arises, because few cases actually reach the ECJ. Germany's environmental protection and climate change challenges may, for instance, implicate various legal regimes, from the EU to the national and state levels.[96]

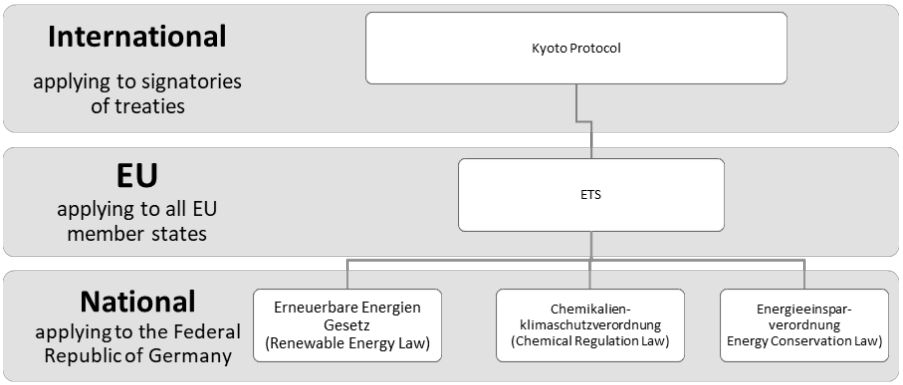


Figure 3 – Levels of Climate Change Laws Applicable in Germany. *International treaties, such as the Kyoto Protocol (top), influence how the EU sets forth its Emissions Trading Directives under the ETS. On the national level, the German set of laws, including but not limited to the examples listed above, implement EU-wide Directives, and may even be more restrictive and protective of climate and environmental considerations.*

In some of these challenges, tensions about the appropriate balance of power in climate change governance have given rise to heated disputes[97] and fascinating cases, where "[a]ttempts by the European Commission to centralize power in the hands of the EU

95. Joanne Scott, *The Multi-Level Governance of Climate Change*, 5 CARBON & CLIMATE L. REV. 25, 33 n.2 (2011).
96. *See infra* Figure 3.
97. Scott, *supra* note 95, at 25.

have been contested in the courts, by the European Parliament, and by [not-for-profit organizations]."[98] Section II.B (below) examines some of these cases and highlights points of comparison to similar suits brought in the U.S.

However, before the comparative analysis begins, the hierarchy of environmental and climate change legislation (or the lack thereof) must be introduced. As noted above, there is no single body of environmental law in the U.S., such as the German Umweltschutzgesetz. American environmental scholars maintain that, "for the foreseeable future, environmental law will be a law about the process of decision rather than a process of evolving decision rules."[99] Complementing these common law principles, several environmental statutes provide a regulatory framework for environmental litigation in the U.S.:[100]

- National Environmental Policy Act ("NEPA")[101]
- Clean Air Act[102]
- Federal Water Pollution Control Act ("Clean Water Act")[103]
- Federal Insecticide, Fungicide, and Rodenticide Act ("FIFRA")[104]
- Marine Protection, Research, and Sanctuaries Act of 1972 ("Ocean Dumping Act")[105]
- Endangered Species Act ("ESA")[106]
- Safe Drinking Water Act ("SDWA")[107]
- Toxic Substances Control Act of 1976 ("TSCA")[108]
- Resource Conservation and Recovery Act of 1976 ("RCRA")[109]

98. *Id.*
99. ROBERT V. PERCIVAL ET AL., ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY 63 (7th ed. 2013).
100. *Id.* at 92–94.
101. 42 U.S.C. §§ 4321–4370h (2018).
102. *Id.* §§ 7401–7671q.
103. 33 U.S.C. §§ 1251–1388 (2018).
104. 7 U.S.C. §§ 136–136y (2018).
105. 16 U.S.C. §§ 1431–1447f (2018); 33 U.S.C. §§ 1401–1445.
106. 16 U.S.C. §§ 1531–1544.
107. 42 U.S.C. §§ 300f–300j-26 (2018).
108. 15 U.S.C. §§ 2601–2697 (2018).
109. 42 U.S.C. §§ 6901–6992k.

- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA" or "Superfund")[110]
- Emergency Planning and Community Right-to-Know Act ("EPCRA")[111]

States may, of course, further regulate various aspects of pollution and environmental conservation, but most environmental disputes touch upon one or more of these statutes.[112] U.S. climate change policy is undergoing a change under the current administration, and this author limits the analysis to those aspects pertinent to this Article's argument regarding food and agriculture law.

Food and agriculture law is somewhat a sub-specialty of environmental law, albeit not exclusively. In the U.S., both food and agriculture law, on the one hand, and environmental law, on the other, involve the above federal environmental statutes in much of their litigation precedent. This overlap is evident in the roles of executive agencies, such as the Environmental Protection Agency ("EPA"), that oversee both environmental conservation and agriculture to some extent. The EPA, for instance, announced its "Strategy for Agriculture that outlined the agency's commitment to protect the country's food, water, land, and air for future generations."[113] This strategy, in other words, implies that sustainable food production works in conjunction with climate change mitigation and adaptation.

Although EU laws are clearer and more abundant than in the U.S., climate change litigation in the U.S. has far outpaced its

110. *Id.* §§ 9601–9675.

111. *Id.* §§ 11001–11050.

112. Conceding that the standing requirement, *see* Lujan v. Defs. of Wildlife, 504 U.S. 555, 560–61 (1992) (articulating three-pronged standing requirement for seeking judicial review of federal agency rules), and the Commerce Clause of the U.S. Constitution, *see* U.S. CONST. Art. I, § 8, cl. 3, also influence environmental litigation, the author notes that a discussion of this type is beyond the scope of this Article. Rather, the goal here is to focus on agriculture and the role of food production without the greater environmental and climate change context. Therefore, only a cursory overview of the relevant legal frameworks is possible.

113. MICHAEL T. ROBERTS, FOOD LAW IN THE UNITED STATES 398 (2016).

European counterparts.[114] "In fact, more lawsuits concerning climate change have been decided or settled in the U.S. than in the rest of the world combined."[115] Scholars note that "the . . . EU ETS has generated a substantial portion of non-U.S. litigation concerning its requirements and the efforts to comply with them."[116] Thus, while in the U.S., "[l]itigation has played a central role in driving the course of climate regulation . . . , primarily stemming from the landmark 2007 decision of the Supreme Court in *Massachusetts v. Environmental Protection Agency*[,]"[117] litigation is certainly a driver of US-American climate change policy.

Similar to the EPA and USDA in the U.S., the European Food Safety Authority ("EFSA") must also comply with the EU's environmental statutes in considering the approval of GMOs. Specifically, in a counterpart to EIS analysis, in the EU, "Environmental Risk Assessment ("ERA") considers the impact on the environment caused by, for example, the introduction of GM plants, the use of certain substances in food, feed and plant protection products, or the introduction and spread of plant pests."[118] Under a host of relevant legislation,[119] "EFSA carries out ERA for some products authori[z]ed under EU food law, such as pesticides, additives in animal feed, or GM food and feed which may involve risks to the environment."[120] However, climate change litigation in the EU is essentially limited to challenges under the ETS.

In Section II.B, this Article introduces the ETS, established by Directive 2003/87/EC, as the world's foremost carbon cap-and-

114. Since the Precautionary Principle governs the approval of GMOs in the EU, the proliferation and acceptance of GMOs in the EU is substantially lower than in the U.S.

115. MEREDITH WILENSKY, SABIN CTR. FOR CLIMATE CHANGE LAW, COLUMBIA LAW SCH., CLIMATE CHANGE IN THE COURTS: AN ASSESSMENT OF NON-U.S. CLIMATE LITIGATION i (2015), https://perma.cc/YB6Q-Z5LJ.

116. *Id.* at ii.

117. *Id.* (citing Massachusetts v. EPA, 549 U.S. 497 (2007)).

118. *Environmental Risk Assessment*, EUROPEAN FOOD SAFETY AUTH., https://perma.cc/UE2Z-WX2Q.

119. *Id.* ("Regulation No 1107/2009 on the placing of plant protection products on the market; Regulation No 1831/2003 on additives for use in animal nutrition; Directive 2001/18/EC on the deliberate release into the environment of genetically modified organisms; Regulation No 1829/2003 on genetically modified food and feed.")

120. *Id.*

trade scheme and the basis for carbon taxation in many European countries. Scholars note that "while much climate litigation in the U.S. is strategic, seeking either to force or to block GHG regulation, climate change litigation elsewhere is primarily tactical, aimed at specific projects or details of EU ETS implementation."[121] The following summarizes some of the pertinent lawsuits and the effects they may have on carbon taxation in the agricultural sector.

B. Legal Challenges of Climate Change Mitigation

Nowhere in the world has litigation played as big a part in climate regulation as in the U.S.[122] A common challenge in environmental litigation implicating GMOs is the issue of "whether the USDA's APHIS failed to comply with the National Environmental Policy Act ("NEPA"), under which agencies must prepare an environmental impact statement ("EIS") for 'major federal actions significantly affecting the quality of the human environment.'"[123] In a case where environmental advocacy groups challenged the USDA's compliance with NEPA and its EIS provisions, a U.S. federal district court held that "[t]he ESA mandates interagency collaboration, through a series of procedural requirements outlined in the statute, to effectuate Congress's goals of protecting endangered and threatened plant and animal species."[124] Other cases, such as *Monstanto v. Geertson Seed Farms*—where the U.S. Supreme Court reversed APHIS's nationwide injunction against partial deregulation of Roundup-ready alfalfa, a GMO[125]—further support the close links between environmental litigation, GMOs, and climate change actions. Professor Michael Roberts, a distinguished environmental scholar and Founding Executive Director of the Resnick Program for Food Law and Policy at UCLA School of Law, states, however, that *Geertson Seed Farms* "ultimately advances a number of values put forth by the sustainable food movement."[126] Correspond-

121. WILENSKY, *supra* note 115, at ii–iii.
122. *Id.* at iii.
123. ROBERTS, *supra* note 113, at 427 (citing 42 U.S.C. § 4332(2)(C) (2018)).
124. Ctr. For Food Safety v. Johanns, 451 F. Supp. 2d 1165, 1172 (D. Haw. 2006) (citing 16 U.S.C. §§ 1532, 1536 (2018)).
125. 561 U.S. 139, 158–59 (2010).
126. ROBERTS, *supra* note 113, at 427 (internal quotation marks omitted).

ingly, the sustainable food movement goes hand in hand with climate change adaptation and mitigation, thereby illustrating how environmental litigation implicating GMOs squarely fits within the climate change law framework.

Most cases challenge the European Commission's power to reject draft National Allocation Plans ("NAPs") under the substantially harmonized ETS. For example, in *Republic of Poland v. Commission of the European Communities*, Poland challenged the national GHG emissions allocation plan for the period from 2008 to 2012 in accordance with Directive 2003/87.[127] The dispute arose from a series of extensions that Poland requested from the Commission and the Commission's conclusion that Poland had infringed on several criteria in Annex III of the Directive.[128] Consequently, the Commission "reduced the total annual quantity of emission allowances in the NAP by 76.132937 million tonnes of CO_2 equivalent, fixing the ceiling at 208.515395 million tonnes of CO_2 equivalent,"[129] and Poland contested the decision. This case added to the understanding that "[t]he Commission may not intervene except in so far as it considers it necessary to raise objections to certain aspects of the NAP as notified and, if the Member State refuses to amend its NAP, to adopt a decision rejecting the plan."[130] At its core, this case illustrates that EU member states' climate actions are strategic but not climate policy trailblazers like their US-American counterparts.

Two notable climate change actions, one from Germany and one from the U.S., exemplify the importance of maintaining a hierarchy in power over carbon taxation in environmental law. Although these cases are not about food- and agriculture-related issues, they imply them and establish instructive precedent.

The discrepancies between EU and US-American climate change law and policy described above are ultimately linked through *Air Transport Ass'n of America v. Secretary of State for Energy & Climate Change* (the *Airline* case).[131] The ECJ affirmed Germany's sovereignty over its airspace in a landmark judgment

127. Case T-183/07, Republic of Poland v. Comm'n, 2009 E.C.R. II-03395.
128. *Id.*
129. *Id.*
130. *Id.*
131. Case C-366/10, Air Transp. Ass'n of Am. v. Sec'y of State for Energy & Climate Change, 2011 E.C.R. I-13833.

where US-American airline emissions affected German air quality.[132] The consideration of Kyoto emissions limitations (as well as a host of other treaties and statutes that are beyond the scope of this Article) forces even US-American airlines flying over Germany into ETS compliance.[133] As a result of this landmark case, U.S. airlines must purchase emissions allowances under the ETS for their airplane emissions over Europe. Even though the U.S. is not a Kyoto Protocol signatory, it must now comply with ETS rules to the extent that its airline businesses affect European airspace. Simply put, when American airlines pollute Europe's skies, they must now pay for it.

Similar principles can be used in food and agriculture policy, as much of the industrialized production originates in the U.S. and is traded globally. Here, a carbon tax on GMO-dependent commodity crops, which require fossil-fuel-intensive processing and transportation, might be priced higher, thereby discouraging proliferation. Drawing the consequences of the centralization of food chains, in light of the existence of multiple foci of industrial agriculture in the U.S., gives the EU a foundation to fight back and defend its own markets and environments from being overpowered by the U.S. Such sovereign protection against climate change, or the use of the proceeds from such carbon taxes for adaptation and mitigation strategies, gives hope that future generations can enjoy the environment without suffering the dangers that climate science predicts.

Such protection of future generations' interests is at issue in one of the most progressive climate actions in the U.S. to date. In *Juliana v. United States*, a group of twenty-one young plaintiffs (aged eight to nineteen), along with the environmental advocacy organization Earth Guardians, and Dr. James Hansen of Columbia University, acting as guardian for future generations, filed this action against defendants the United States, President Barack Obama, and numerous executive agencies, including the EPA, alleging that the defendants "deliberately allow[ed] atmospheric CO_2 concentrations to escalate to levels unprecedented in

132. *Id.*

133. *Europäischer Gerichtshof verdonnert US-Airlines zum Klimaschutz* [European Court of Justice Condemns U.S. Airlines for Climate Protection], SÜDDEUTSCHE ZEITUNG (Dec. 21, 2011), https://perma.cc/SH43-A82G.

human history."[134] The court agreed that "defendants are responsible for some of the harm caused by climate change and that the plaintiffs "may challenge defendants' climate change policy in court,"[135] thereby empowering private citizens to use public law and private law principles in suits to protect their health from climate change.

Applying these ideas to food and agriculture law, the protection of health and safety in light of climate change speaks for the promotion of agroecology, as noted above. Here, carbon taxation may disincentivize the BigAg scheme and make room for sustainable agroecologic farming practices that are locally based and collect fewer food miles. In terms of Pacala and Socolow's Wedges model, the shift toward agroecology could be within stabilization wedges which would, in turn, be financed with the proceeds from carbon taxes on heavy agricultural polluters along the entire food chain, from farm to fork.

Nonetheless, implementation of carbon taxes in the agricultural sector may be prone to industry critique and resistance. Beyond the theoretical benefits of expanding the carbon market to the agricultural sector are the real limitations of the market. In fact, some of the most recognized barriers to establishing an international carbon market are: (1) market uncertainty, (2) loss of regulatory control, and (3) comparability of effort and prices.[136] The market uncertainty may be attributed to the overall unpredictability of a new carbon taxation scheme, jointly complicating the competitiveness of products while relinquishing some regulatory control to treaty partners. However, these uncertainties and barriers may aid in the stabilization and work like a pendulum within the allotted emission allocations. As such, the expansion of carbon taxes to the agricultural sector may even have a variety of beneficial side effects.

134. Gabriela Steier, *No Ordinary Lawsuit: Juliana v. United States sets Landmark Precedent for Climate Change Litigation*, JURIST (Jan. 6, 2017 6:02 PM) (quoting Juliana v. United States, 217 F. Supp. 3d. 1224, 1233 (D. Or. 2016)), https://perma.cc/RZ59-SYQE (internal quotation marks omitted).

135. *Id.* (quoting *Juliana*, 217 F. Supp. at 1234).

136. ZECHTER, *supra* note 43, at 89–91.

V. CONCLUSION

The scientific consensus on climate change impacts the codependence of agriculture and the environment, and growing economic concerns related to climate change all counteract any supposed legal vacuum of a carbon tax. As this Article shows, carbon taxes follow the polluter-pays model, levying taxes on the highest GHG emissions—and contributions to climate change. Following the BAU approach, as Pacala and Socolow illustrate with their model of wedges, is not only unsustainable but would undermine agricultural production and, thus, food security. In fact, if climate change adaptation and mitigation are not supported through carbon taxes in the agricultural sector, *twenty percent* of GHG contributions will be left untouched, jeopardizing the future of U.S. food production at the environment's expense.

Litigation has established the causal links between GHG emissions and climate change. Considering the already-established connection between food and agriculture law on the one hand, and environmental litigation on the other, the loop is closed between food, agriculture, climate change, environmental protection, and GHG emissions.