

## (CARBON) FARMING OUR WAY OUT OF CLIMATE CHANGE

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### ABSTRACT

Numerous climate-related emergencies highlight the challenges and urgency posed by climate change: the 2018 Intergovernmental Panel on Climate Change (IPCC) Report, the Global Climate Action Summit in California, and international student walkouts, to name a few. While the IPCC Report sent an urgent cry to reduce total emissions and to achieve specific results—45% reduction by 2030 and net-zero emissions by 2050—reductions need to be combined with capturing and storing atmospheric carbon dioxide. Scientific studies have shown that an annual increase of 0.4% of carbon stored in soils would make it possible to stop the present increase in atmospheric CO<sub>2</sub>.

This Article focuses on carbon farming, a Climate Smart Agriculture strategy that uses plants to capture and store atmospheric carbon dioxide in soil to achieve the IPCC Report goal. This Article makes two contributions. First, recognizing the potential of private certifications to drive sales and investment (Organic-Certified food sales soared to \$100 billion in 2018), this Article designs a new Carbon Farming Certification with an Organic or Regenerative Agriculture certification as a base, and an add-on module to measure carbon sequestration. Second, a carbon farming certification becomes a linchpin to accessing a greater network of resources to scale-up carbon farming: farmers leverage the Certification to gain access to immediate and long-term financing; to unlock lucrative opportunities to sell carbon credits to those who purchase carbon offsets in California's cap-and-trade market; and to engage in forward contracting with major supply chains. State and local governments should leverage sequestered carbon metrics from Carbon Farming Certified-farms to demonstrate compliance with international law and treaty targets, as well as national and local climate policies.

Filling gaps in food law and environmental governance literature, this Article presents a multidisciplinary approach to solving a critical global problem. It identifies barriers which hinder the scale-up of promising carbon farming strategies, including: insufficient information, lack of funding

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for innovation to drive down solution costs, inconsistent regulations that hinder project development and private sector commercialization, and a patchwork of quantification standards for ensuring carbon sequestration is measured consistently and fairly. The Article’s proposed solution draws from new developments in computer modeling simulation and metrics, carbon credits, and global best practices. Further, this Article shares case studies highlighting novel collaborations between nations, private parties, NGOs, and international institutions.

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#### INTRODUCTION

The present and future challenges facing agriculture are daunting. Recent research suggests that the impacts of climate change on agriculture and food systems may be wider ranging than previously understood.<sup>1</sup>

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1. See John R. Porter & Liyong Xie et al., *Food Security and Food Production Systems, in CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY* 485–533 (Christopher B. Field et al. eds., 2014) (reporting negative wheat and maize production effects across regions, and overall effects, such as: heat stress via temperature increases; more frequent extreme weather events; changing rainfall amounts and patterns; shifts in timing and length of growing seasons; and changing prevalence and severity of pests, weeds and crop, and livestock diseases).

Scientists now realize agriculture plays a pivotal role in the climate change discussion—agriculture contributes to climate change but can also be used to *mitigate* climate change.<sup>2</sup>

While climate change—including its causes and consequences and feedback loops and triggers—is a politically divisive topic, replete with disagreement, some facts are clear. Climate scientists assert the main cause of the current global warming trend is human expansion of the greenhouse effect, or warming that results when the atmosphere and certain greenhouse gas (GHG) emissions—carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and fluorinated gasses—trap heat radiating from Earth into the atmosphere.<sup>3</sup>

Climate change will alter our food system; climate change will impact crop performance because it will negatively impact the availability and quality of land, soil, and water resources. The impact on crop performance will ultimately lead to negative public health outcomes in varying degrees: reduced food security and crop variety, price volatility,<sup>4</sup> political instability,<sup>5</sup> and world hunger.<sup>6</sup> Climate change already contributes to increased world hunger, and human population remains on the rise.<sup>7</sup> For the first time in fifteen years, about 815 million people worldwide—11% of the world's population—went hungry in 2016.<sup>8</sup> Recent studies show carbon-rich environments lead to vitamin deficiencies in rice crops—a

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2. Wilfrid Legg & Hsin Huang, *Climate Change and Agriculture*, OECD OBSERVER, [https://oecdobserver.org/news/archivestory.php/aid/3213/Climate\\_change\\_and\\_agriculture.html](https://oecdobserver.org/news/archivestory.php/aid/3213/Climate_change_and_agriculture.html) (last visited Mar. 10, 2020).

3. See *The Causes of Climate Change*, NASA, <https://climate.nasa.gov/causes/> (last visited Feb. 7, 2020). For a description of greenhouse gasses, see *Overview of Greenhouse Gases*, EPA <http://www3.epa.gov/climatechange/ghgemissions/gases.html> (last visited Mar. 10, 2020); see also Zeke Hausfather, *Understanding Carbon Dioxide Misconceptions*, YALE CLIMATE CONNECTIONS 4 (Jan. 20, 2009), <http://www.yaleclimateconnections.org/2009/01/common-climate-misconceptions-co-equivalence/> (last visited Mar. 10, 2020) (because different gases exhibit different global warming potential, scientists refer to greenhouse gases emissions according to their carbon dioxide equivalent (CO<sub>2</sub>e)). For example, one ton of CH<sub>4</sub> is twenty-five tons of CO<sub>2</sub>e because it has the global warming potential of twenty-five tons of CO<sub>2</sub>).

4. See Zvi Hochman et al., *Climate Change has Stalled Australian Wheat Yields: Study*, THE CONVERSATION (Jan. 24, 2017, 2:17 PM) <https://theconversation.com/changing-climate-has-stalled-australian-wheat-yields-study-71411> (last visited Feb. 7, 2020); see also Neal Hughes, *Australian Farmers are Adapting to Climate Change*, CONVERSATION (May 22, 2017, 3:58 PM) <https://theconversation.com/australian-farmers-are-adapting-to-climate-change-76939> (showing that “recent CSIRO modelling suggests that changes in climate have reduced potential Australian wheat yields by around 27% since 1990.”).

5. Andrea J. Nightingale, *Power and Politics in Climate Change Adaptation Efforts*, 84 GEOFORUM 11–20 (Aug. 2017), <https://www.sciencedirect.com/science/article/pii/S001671851730129X>.

6. Philip Thornton et al., *Agriculture in a Changing Climate: Keeping Our Cool in the Face of the Hothouse*, 47 OUTLOOK ON AGRICULTURE 283–90 (Dec. 6, 2018) (noting that GHG emissions, largely due to human activity, are warming the atmosphere and oceans, raising sea levels, and diminishing levels of snow and ice).

7. Leah Samberg, *World Hunger is Increasing Thanks to Wars and Climate Change*, CONVERSATION (Oct. 17, 2017, 7:51 PM) <https://theconversation.com/world-hunger-is-increasing-thanks-to-wars-and-climate-change-84506>.

8. *Id.* (noting that, undernutrition was cut in half between 1990 and 2015, due to initiatives at a global level, a recent report on food security and nutrition shows that world hunger is increasing again).

serious threat to food security for “600 million people world-wide whose diet consists mostly of rice.”<sup>9</sup> Climate change “exacerbate[s] allergy season,” and the decline of quality of grasses, which is important for raising cattle for human consumption.<sup>10</sup> These climate changes will continue and intensify.<sup>11</sup> If global emissions are not reduced by 70% by 2050, and to near 0% by the end of the century, catastrophic consequences will occur.<sup>12</sup>

Meanwhile, global efforts to meet GHG emission targets have stalled. The U.N. Sustainable Development Goals<sup>13</sup> (SDGs) provide guidance; the Paris Accord—whereby 196 countries pledged to reduce emissions and maintain warming below 2°C—set targets to meaningfully reduce GHG emissions from multiple sectors.<sup>14</sup> And yet, despite the initial successes of climate change mitigation treaties and mitigation pledges, success has stalled. The United States acknowledges climate change as among a number of threats to “our capacity to feed a growing population and need[s] to be taken into serious consideration,” but withdrew from the Paris Accord.<sup>15</sup> Pledges by other national governments under the Paris Accord—Nationally Determined Contributions (NDCs)—have fallen “significantly short [of action] needed to avoid the worst impacts of climate change.”<sup>16</sup> These dual strategies naturally fall under the goals of climate-smart agriculture (CSA); CSA is a unified governance framework—developed by the U.N. Food and Agricultural Organization (FAO) and adopted by the World Bank—to sustainably increase the productivity of a given crop (intensification), build resilience to climate change (adaptation), and reduce

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9. Helena Bottemiller Evich, *Agriculture Department Buries Studies Showing Dangers of Climate Change*, POLITICO (June 23, 2019, 5:04 PM), <https://www.politico.com/story/2019/06/23/agriculture-department-climate-change-1376413>.

10. *Id.*

11. See Press Release, Intergovernmental Panel on Climate Change, IPCC: Greenhouse Gas Emissions Accelerate Despite Reduction Efforts (Apr. 13, 2014), [https://www.ipcc.ch/site/assets/uploads/2018/06/20140413\\_pr\\_pc\\_wg3\\_en.pdf](https://www.ipcc.ch/site/assets/uploads/2018/06/20140413_pr_pc_wg3_en.pdf).

12. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: SYNTHESIS REPORT SUMMARY FOR POLICYMAKERS 10 (2014).

13. See *Sustainable Development Goals*, UNITED NATIONS, <https://www.un.org/sustainabledevelopment/sustainable-development-goals/> (last visited Mar. 10, 2020) (SDGs are a collection of seventeen global goals set by the U.N. in 2015. Climate-change related goals include: ensuring healthy lives (SDG #3), ending hunger (SDG #2), and combating climate change (SDG #13)).

14. See *The Paris Agreement*, UNITED NATIONS CLIMATE CHANGE, <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement> (last visited Mar. 10, 2020).

15. Karl Mathiesen, *US Signs G7 Statement Recognising Climate Threat to Food Security*, CLIMATE HOME NEWS (Oct. 16, 2017, 3:45 PM), <https://www.climatechange-news.com/2017/10/16/us-signs-g7-statement-recognising-climate-threat-food-security/> (last visited Feb. 9, 2020) (noting the U.S. acknowledgement at the G7 Summit); see generally INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2013: SYNTHESIS REPORT SUMMARY FOR POLICYMAKERS 10 (2013) (noting that the “[w]arming of the climate system is unequivocal,” according to the vast majority of climate scientists worldwide and happening faster than scientists predicted even a few years ago).

16. See *Global Climate Action Summit Delivers Raft of Pledges, Calls for Leaders to Step Up Efforts*, INT’L CENTRE FOR TRADE & SUSTAINABLE DEV. (Sept. 20, 2018) <https://www.ictsd.org/bridges-news/bridges/news/global-climate-action-summit-delivers-raft-of-pledges-calls-for-leaders-to>.

GHG emissions (mitigation).<sup>17</sup> Importantly, CSA approaches are the vehicle to carbon-neutral agriculture and climate change mitigation.

The agriculture industry is a leading sector for GHG emissions in the United States, accounting for up to 9% of total GHG emissions.<sup>18</sup> Agriculture and land use are responsible for 25% of global GHG emissions. These emissions are from: (1) deforestation; (2) agricultural management practices, leading to soil and nutrient management degradation; (3) emissions from managing livestock operations of anthropogenic methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and CO<sub>2</sub>.<sup>19</sup> Nonmanagement operations, which contribute CO<sub>2</sub> emissions from energy use, include fertilizer manufacturing.<sup>20</sup>

Deforestation is a source of emissions when forested land that normally absorbs CO<sub>2</sub> is cleared, often for conversion to settlement or for agricultural purposes that do not absorb as much CO<sub>2</sub>. Agricultural land comprises around 40% of the planet's surface, and an average of six million hectares of forest and grassland have been converted annually to help feed increasing populations.<sup>21</sup> While in the United States, since 1990, land use, land-use change, and forestry activities have resulted in more removal of CO<sub>2</sub> from the atmosphere than emissions, in many areas of the world, the opposite is true—particularly in countries where large areas of forest land are cleared. In these situations, this sector can be a net source of GHG emissions.

Agricultural management practices are either practices directly affecting the land—e.g., plowing, which emits N<sub>2</sub>O from nitrogen in the soil—or practices affecting land through livestock—e.g., cattle farming, which emits CH<sub>4</sub> from enteric fermentation. Soil erosion caused by agriculture management practices continue to threaten the Earth; the Earth loses 0.3% of global food production capacity to soil erosion.<sup>22</sup>

Though the threat posed by emissions from agricultural management practices is not to be understated, emissions from enteric fermentation processes, inherent in livestock operations, are the largest contributor to GHG

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17. *Climate-Smart Agriculture*, FOOD & AGRIC. ORG. UNITED NATIONS, <http://www.fao.org/climate-smart-agriculture/en/> (last visited Mar. 10, 2020); *but see* Marcus Taylor, *Climate-Smart Agriculture: What is it Good For?*, 45 J. PEASANT STUD. 89, 90, 96 (2018) (criticizing the conceptual foundations and underlying metrics of climate-smart agriculture).

18. *Sources of Greenhouse Gas Emissions—Overview*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions> (last visited Mar. 10, 2020).

19. *Driving Carbon Drawdown through Climate Action at the Landscape Level*, FOOD & AGRIC. ORG. UNITED NATIONS., <http://www.fao.org/north-america/news/detail/en/c/1197167/> (last visited Mar. 10, 2020); *see* *FAO Key Facts and Findings*, FOOD & AGRIC. ORG. UNITED NATIONS, <http://www.fao.org/news/story/en/item/197623/icode/> (last visited Mar. 10, 2020) (indicating the breakdown of livestock emissions into methane (44%), nitrous oxide (29%), and carbon dioxide (27%).)

20. *Agriculture Sector Emissions*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#agriculture> (last visited Mar. 10, 2020).

21. EUR. UNION, SCIENCE FOR ENVIRONMENT POLICY IN-DEPTH REPORT: SUSTAINABLE FOOD: A RECIPE FOR FOOD SECURITY AND ENVIRONMENTAL PROTECTION?, at 1, 3, 6 (2013).

22. INTERGOVERNMENTAL TECH. PANEL ON SOILS, STATUS OF THE WORLD'S SOIL RESOURCES 176 (Freddy Nachtergaele et al. eds. 2015).

emissions.<sup>23</sup> Over 14% of human-caused emissions are from livestock production; methane from ruminant livestock (cattle) is the largest contributor.<sup>24</sup> The quantity of methane emissions from cattle is equivalent to the combined emissions from all the cars, trucks, airplanes, and ships in the world today.<sup>25</sup> Methane emissions are driven primarily by population growth and demand for meat consumption.<sup>26</sup> Since the Industrial Revolution, agricultural practices and animal husbandry have released about 135 gigatons—135 billion metric tons—of carbon into the atmosphere.<sup>27</sup> U.S. methane emissions from enteric fermentation is projected to be 108 million metric tons of CO<sub>2</sub> equivalent by 2020—behind only Brazil, China, and India.<sup>28</sup> Nitrous oxide emissions from agricultural soils are projected to be 327 million metric tons of CO<sub>2</sub> equivalent by 2020—behind only China and India.<sup>29</sup> N<sub>2</sub>O and CH<sub>4</sub> emissions from livestock are projected to double by 2055.<sup>30</sup> Americans eat approximately 200 pounds of meat per capita, compared to 143 in the European Union (EU) and 79 pounds per capita in Japan.<sup>31</sup>

Reducing emissions will not sufficiently limit global warming.<sup>32</sup> Therefore, it is critical to examine drawdown approaches to store existing carbon dioxide from the atmosphere.<sup>33</sup> Renewable energy and electric vehicles are undoubtedly successful in mitigating the rate of new GHG emissions;<sup>34</sup> however, there is a growing need to remove existing carbon in the atmosphere.<sup>35</sup> Proposed carbon-drawdown methods

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23. Eric Toensmeier, *How We Can Make Beef Less Terrible for the Environment*, WASH. POST (May 30, 2018, 12:43 PM), <https://www.washingtonpost.com/news/theworldpost/wp/2018/05/30-carbon-farming/>.

24. *Id.*; Julia Moskin et al., *Your Questions About Food and Climate Change, Answered*, N.Y. TIMES (April 30, 2019), <https://www.nytimes.com/interactive/2019/04/30/dining/climate-change-food-eating-habits.html>; see also RICHARD K. LATTANZIO ET AL., CONG. RESEARCH SERV., R43860, METHANE: AN INTRODUCTION TO EMISSION SOURCES AND REDUCTION STRATEGIES 14 (2016) (describing how livestock contribute to greenhouse gases as microbes in ruminant animals ferment digested food and release gas through belching or flatulence).

25. Moskin et al., *supra* note 24.

26. U.S. ENVTL. PROTECTION AGENCY, U.S. METHANE EMISSIONS 1990-2020: INVENTORIES, PROJECTIONS, AND OPPORTUNITIES FOR REDUCTIONS INTRODUCTION 1-4 (1999).

27. Moises Velasquez-Manoff, *Can Dirt Save the Earth?* N.Y. TIMES MAG. (April 18, 2018), <https://www.nytimes.com/2018/04/18/magazine/dirt-save-earth-carbon-farming-climate-change.html> (noting remarks by Rattan Lal, a soil scientist at The Ohio State University).

28. U.S. ENVTL. PROTECTION AGENCY, *supra* note 26.

29. *Id.*

30. Alexander Popp, Hermann Lotze-Campen & Benjamin Bodirsky, *Food Consumption, Diet Shifts and Associated non-CO<sub>2</sub> Greenhouse Gases From Agricultural Production*, 20 GLOBAL ENVTL. CHANGE 451, 455-56 (2010).

31. See Skye Gould & Lauren F. Friedman, *The Countries Where People Eat the Most Meat*, BUS. INSIDER (Sept. 26, 2015, 7:30 AM), <https://www.businessinsider.com/where-do-people-eat-the-most-meat-2015-9>.

32. Velasquez-Manoff, *supra* note 27.

33. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 15, at para. 4.

34. See Michela Longo, Federica Foidelli & Wahiba Yaïci, *Electric Vehicles Integrated with Renewable Energy Sources for Sustainable Mobility*, in NEW TRENDS IN ELECTRICAL VEHICLE POWERTRAINS 203 (2018).

35. Velasquez-Manoff, *supra* note 27 (noting remarks by Keith Paustian, a soil scientist at Colorado State University).

include scrubbing the air with great air conditioner-like machines; fertilizing the oceans with iron dust [to prompt processes that carry captured carbon to the bottom of the sea]; capturing and storing the carbon dioxide that results when energy is produced by burning trees and other plants; and crushing and spreading certain types of rock [e.g., Basalt] that naturally absorb atmospheric carbon.<sup>36</sup>

However, these approaches are not yet proven or feasible at the scale necessary.<sup>37</sup> The most obvious obstacle to adequately scale is the amount of energy required because of the added cost.

A cost-feasible, carbon-drawdown approach to pursue is carbon farming.<sup>38</sup> Carbon farming—the explicit use of agriculture to sequester and store carbon in soil<sup>39</sup>—is a holistic model to implement an array of carbon-beneficial practices and create agroecosystems that optimize economic, ecological, and carbon abundance.<sup>40</sup> Carbon farming uses regenerative agricultural practices to sequester more carbon from the atmosphere than it produces (a carbon negative practice).<sup>41</sup> Research shows that carbon farming has the potential to remove substantial quantities of CO<sub>2</sub> from the atmosphere and is more feasible to scale, in part, because the practice itself does not require additional energy.<sup>42</sup> “Soils are the second largest reservoir of carbon” after the world’s oceans; the global recognition of soils as important natural carbon sinks—as well as the release of carbon to the atmosphere through unsustainable agriculture and grazing practices and land degradation—is growing.<sup>43</sup> If farmers are to be our frontline offensive to drawdown, and absorb carbon from the atmosphere, it is important that they begin to adopt carbon farming practices, such as those accepted by the U.S. Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS).<sup>44</sup>

How much carbon needs to be absorbed from the atmosphere? Scientific studies show that an annual 0.4% increase of carbon stored in soils would make it possible to stop the present increase in atmospheric CO<sub>2</sub>.<sup>45</sup>

36. *Id.*

37. *Id.*

38. *Id.* (noting that alternative solutions to carbon farming include planting trees, adding a charcoal made from organic material to soil, and restoring wetlands).

39. See Curt Ries, *A Green New Deal Must Prioritize Regenerative Agriculture*, TRUTHOUT (May 9, 2019), <https://truthout.org/articles/a-green-new-deal-must-prioritize-regenerative-agriculture>.

40. *Id.*; see *Carbon Farming in Colorado*, COLO. CARBON FUND, <https://www.coloradocarbonfund.org/carbonfarming/> (last visited Mar. 10, 2020).

41. *Carbon Farming in Colorado*, *supra* note 40.

42. See Cornelia Rumpel et al., *Put More Carbon in Soils to Meet Paris Climate Pledges*, NATURE (Dec. 3, 2018), <https://www.nature.com/articles/d41586-018-07587-4>; Velasquez-Manoff, *supra* note 27.

43. Charlotte Streck & Austina Gay, *The Role of Soils in International Climate Change Policy*, in INTERNATIONAL YEARBOOK OF SOIL LAW AND POLICY 2016, at 105, 105–07 (Harald Ginzky et al. eds., 2016).

44. See generally *Carbon Farming*, CARBON CYCLE INST., <https://www.carboncycle.org/carbon-farming/> (last visited Mar. 10, 2020) (providing a list of carbon farming practices).

45. Ronnie Cummins, ‘Four for 1000’: A Global Initiative to Reverse Global Warming Through Regenerative Agriculture and Land Use, REGENERATION INT’L: BLOG (Oct. 17, 2017), <https://regenerationinternational.org/tag/4p1000/page/2/>.

With this in mind, “[t]he USDA-NRCS and Colorado State University (CSU) have identified thirty-four regenerative practices that are carbon negative”<sup>46</sup>—practices that help draw carbon down from the atmosphere and are used and tracked by farmers and others—discussed further in Part IV.

Innovative projects, directives, and actions are needed. While “farming, forestry, and land use interventions account for twelve of the twenty most practical, cost-effective” solutions for addressing climate change,<sup>47</sup> carbon farming still has a long way to go. The European Commission states, in a 2017 directive, that “[u]nsustainable land use is consuming fertile soils, and soil degradation continues, resulting in impacts on global food security and the achievement of biodiversity targets.”<sup>48</sup> Within Europe, France launched the 4 per 1000 Initiative (4p1000)—setting its intention to “increase soil organic matter and carbon sequestration through the implementation of agricultural practices.”<sup>49</sup> Specifically, France intends to increase the amount of organic matter in soil by four-per-thousand (or 0.4%) each year—enough to compensate for all global GHG emitted due to human behavior.<sup>50</sup> This initiative merges willing partners (e.g., national governments, local and regional governments, companies, trade organizations, NGOs, research facilities) to voluntarily commit to an action plan: to implement farming practices that maintain or enhance soil carbon stock on as many agricultural soils as possible and preserve carbon-rich soils.<sup>51</sup>

Carbon farming is garnering multilevel support in the United States, from varying levels of government, nonprofits, private sector investors, and others.<sup>52</sup> Policy experimentation is most active at the state and local levels.<sup>53</sup>

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46. *Carbon Farming in Colorado*, *supra* note 40.

47. *Driving Carbon Drawdown through Climate Action at the Landscape Level*, *supra* note 19.

48. Council Directive 1386/2013, 2013 O.J. (L 354).

49. *The “4 Per 1000” Initiative*, 4 POUR 1000, <https://www.4p1000.org/> (last visited Mar. 10, 2020).

50. See Jean-Francois Soussana et al., *Matching Policy and Science: Rationale for the ‘4 per 1000–Soils for Food Security and Climate’ Initiative*, 188 SOIL & TILLAGE RES. 3, 4 (2017).

51. See Streck & Gay, *supra* note 43, at 107, 109, 112, 124.

52. See Velasquez-Manoff, *supra* note 27 (noting that the Trump Administration has reversed various Obama-era regulations meant to combat or adapt to climate change, including the Clean Power Plan, which required power plants to reduce their carbon emissions, and a rule instructing the federal government to consider sea-level rise and other effects of a changing climate when building new roads, bridges, and other infrastructure).

53. See Karen Atnonacci, *New Colorado Carbon Fund License Plates to Boost Boulder County Farms*, TIMES-CALL, (Aug. 11, 2018, 2:56 PM), <https://www.timescall.com/2018/08/11/new-colorado-carbon-fund-license-plates-to-boost-boulder-county-farms/> (noting that in 2008, the Colorado Carbon Fund released a red license plate design that Colorado vehicle owners could choose to pay extra for to fund carbon offset projects); see also Velasquez-Manoff, *supra* note 27 (In 2018, “Hawaii passed legislation meant to keep [the state] aligned with the Paris agreement,” and it has also “created a task force to research carbon farming. The New York state assemblywoman Didi Barrett introduced legislation that would make tax credits available to farmers who increase soil carbon, presumably through methods like those employed by Darin Williams and Gabe Brown. [I]n Maryland, legislation



This Article proceeds to detail the role of carbon farming in drawing-down atmospheric CO<sub>2</sub>.<sup>54</sup>

This Article makes two key contributions. First, this Article proposes and provides the design of a Carbon Farming Certification—the *only* certification to measure and track carbon sequestration. The goal of the Article, and proposed Carbon Farming Certification design, is to generate additional interest among stakeholders to further develop and commercialize the Carbon Farming Certification and overall to accelerate the adoption and implementation of carbon farming. In design, the Carbon Farming Certification combines two existing certifications: (1) the Organic or Regenerative Agriculture Certification and (2) the Carbon Management Evaluation Tool (COMET)-Planner—a globally recognized carbon sequestration calculator that harmonizes U.S. national efforts and U.N. bodies to assess climate change mitigation. Second, this Article explains how a Carbon Farming Certification is a linchpin to accessing a greater network of resources to scale-up carbon farming. Farmers can leverage the Carbon Farming Certification by: gaining access to immediate and long-term financing, unlocking lucrative opportunities to sell carbon credits to those who purchase carbon offsets in California’s cap-and-trade market, and engaging in forward contracting with major supply chains.<sup>55</sup> If Carbon-Certified farms are willing to share their carbon sequestration metrics, state and local governments can leverage this information to measure progress against and demonstrate compliance with international and domestic emission targets and policies.

This Article’s proposed solution to existing carbon emissions—the Carbon Farming Certification—capitalizes proven methods to track and measure the benefits of carbon farming and global experience to bring new tools to the fore. This Article adds to the environmental law and food law

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focused on soil health passed in 2017,” and in Colorado, Arizona, and Montana, carbon farming projects are ongoing.); Stanley Young, *CDFA and CARB Launch Public-Private Partnership to Advance Carbon Farming*, CA.GOV (Apr. 24, 2019), <https://ww2.arb.ca.gov/news/cdfa-and-carb-launch-public-private-partnership-advance-carbon-farming> (noting that the “California Department of Food and Agriculture and the California Air Resources Board announc[ed] the launch of a public-private initiative to advance climate-smart agriculture and reduce GHG emissions on agricultural lands.”).

54. The solution presented does not solve climate change but presents a path to reducing atmospheric carbon dioxide. See Gosia Wozniacka, *Big Food Is Betting on Regenerative Agriculture to Thwart Climate Change*, CIVILEATS (Oct. 29, 2019) <https://civileats.com/2019/10/29/big-food-is-betting-on-regenerative-agriculture-to-thwart-climate-change/> (citing David Montgomery, Ph.D., as noting that (1) regenerative agriculture can sequester carbon, but the amount is finite, so it is more like “a good down payment on reducing atmospheric carbon dioxide”; and (2) that regenerative efforts can easily be undone so policies need to ensure that regenerative work done today is beneficial in the future).

55. See Louisa Burwood-Taylor, *Indigo Agriculture*, AGFUNDERNEWS (June 12, 2019), <https://agfundernews.com/indigo-ag-to-incentivize-regenerative-agriculture-with-carbon-sequestration-market.html> (for example, Indigo Agriculture launched (1) the Terraton Initiative, which aims to sequester “one trillion tons of carbon dioxide from the atmosphere [through] farmers adopt[ing] regenerative agriculture practices,” (2) Indigo Carbon, a marketplace to “facilitate an incentive payment per ton of captured carbon”—\$15 per ton of carbon for starters or \$30 to \$60 per acre per year—“by food companies wanting to sell carbon-negative products.”); see also VAN R. HADEN ET AL., AM. CARBON REGISTRY, METHODOLOGY FOR COMPOST ADDITIONS TO GRAZED GRASSLANDS 11 (2014).

literatures, answering a call for an interdisciplinary and global perspective on incentives and strategies to guide farmers as they embrace Climate Smart Agriculture.<sup>56</sup>

The Article presents itself in four parts. Part I is a primer on carbon farming, detailing the costs, benefits, and the important role that carbon farming plays in Climate Smart Agriculture. Part II presents the network of resources to scale-up carbon farming, including existing international treaties, national, and state legislation. Part III introduces the solution, a new carbon farming certification, outlining the major features as well as the way in which the certification is a linchpin to scaling-up carbon farming, unlocking opportunities for farmers and government entities. Part IV concludes with recommendations for future work.

### I. CARBON FARMING

An increasing number of farmers are adopting carbon farming practices, embracing the potential to use agriculture to store large amounts of carbon from the atmosphere.<sup>57</sup> For individual farmers, carbon farming builds and sustains soil, ultimately resulting in higher yields for their farm; for the Earth, carbon farming sequesters carbon and mitigates the impact of climate change.

Carbon farming relies upon photosynthesis as a mechanism to store carbon in the Earth such that the carbon leaving a given ecosystem is less than the carbon entering it.<sup>58</sup> Carbon farming operates under the philosophy that plants have the potential to increase soil organic matter by trapping larger levels of CO<sub>2</sub> using photosynthesis.<sup>59</sup> A series of regenerative agriculture practices, described below, can be used to increase a crop's photosynthetic intake to trap and encourage the trapped carbon to move into and remain in the soil.<sup>60</sup> While previous studies on carbon formation emphasize how dead organic material must physically work its way into the soil, newer studies emphasize the active role of living plants in drawing down carbon.<sup>61</sup> Living plants increase soil carbon by directly nourishing

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56. *Climate-Smart Agriculture*, *supra* note 17.

57. See Kelly Connelly Garry, *Managing Carbon in a World Economy: The Role of American Agriculture*, 9 GREAT PLAINS NAT. RES. J. 18, 24 (2005).

58. See *id.* at 19.

59. Bionutrient Food Assoc., *John Kempf: Developing Regenerative Agriculture Ecosystems, Part 2 | SNC 2018 Pre-Conference*, YOUTUBE (Jan. 18, 2019), <https://www.youtube.com/watch?v=iKJh2caz0lk> (noting this example: plants are only photosynthesizing at a 20% photosynthetic efficiency (sugar production) versus 60% rate. If at 20%, then, for example, 35% goes to plant biomass, 35% into grain, and 15% each into the root and the root exudates. If the plant produces 10,000 pounds of carbohydrates per acre, it produces 7,000 pounds above the soil surface and 3,000 below surface. Reaching 60% efficiency, then 25% plant biomass, 25% grain fill, 25% each into the root and the root exudates); see Susan V. Fisk, *Root Exudates Affect Soil Stability, Water Repellency*, AM. SOC'Y AGRONOMY (Apr. 18, 2018), <https://www.agronomy.org/science-news/root-exudates-affect-soil-stability-water-repellency>.

60. See generally REGENERATIVE AGRIC. INITIATIVE & CARBON UNDERGROUND, WHAT IS REGENERATIVE AGRICULTURE? (Feb. 16, 2017).

61. See *supra* note 19 and accompanying text.

soil ecosystems.<sup>62</sup> As plant rootlets die, they deposit carbon underground; perhaps more importantly, as plants pull carbon from the air, plants' roots inject carbon into the soil, enriching the soil by feeding microorganisms and fungi.<sup>63</sup>

Farmers who practice carbon farming rely upon five principal regenerative agriculture techniques that emphasize soil health to improve the land:<sup>64</sup> (1) minimize soil disturbance such as tillage, synthetic pesticides, and fertilizers; (2) energize soil with above and belowground crop diversity; (3) cover soil to increase carbon sequestration; (4) ensure plant roots remain in the ground or plant longer rooted crops and incorporate organic materials into the soil; (5) integrate animals (e.g., goats, cattle, buffalo, sheep) on crops during the dormant period of the year.<sup>65</sup>

To minimize soil disturbance, farmers practice no-till, minimum-till, or conservation tillage, which means usually involves some or all of a previous crop's residue in a field when planting the new crop. Keyline plowing—a practice which “aerates the subsoil but limits disturbing the soil on top”—also minimizes soil disturbance.<sup>66</sup> By minimizing soil disturbance, no-till farming prevents soil erosion, increases retainment of moisture, and leaves the soil ecosystem (worms, fungi, roots, and more) mostly intact. These practices build resilience to water and nutrient loss and manage erosion risk, with the added benefit of maintaining high levels of carbon in the soil.<sup>67</sup>

Energizing soil via crop diversity can be achieved by planting a variety of crops and, specifically, crop varieties native to the soil.<sup>68</sup> Farmers and politicians are increasingly recognizing the climate change benefits to planting native crops and the drawbacks to monocropping.<sup>69</sup> With climate variation, planting one crop increases farm solvency risk if, for example, farmers cannot plant seed on time or obtain fertilizers, if rainfall does not

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62. See generally REGENERATIVE AGRIC. INITIATIVE & CARBON UNDERGROUND *supra* note 60.

63. *Id.*; see also Velasquez-Manoff, *supra* note 27 (noting that an “estimated 12,000 miles of hyphae, or fungal filaments, are found beneath every square meter of healthy soil.”).

64. REGENERATIVE AGRIC. INITIATIVE & CARBON UNDERGROUND, *supra* note 60.

65. *Id.*

66. See Karen Antonacci, *New Colorado Carbon Fund License Plates to Boost Boulder County Farms*, COLO. HOMETOWN WKLY. (Aug. 15, 2018), <https://www.coloradohometown-weekly.com/2018/08/15/new-colorado-carbon-fund-license-plates-to-boost-boulder-county-farms/> (“Keyline plowing follows the topography of a landscape to move water naturally from wet to dry areas” and in so doing, “builds topsoil and keeps carbon in the ground,” noting that keyline plowing had “its origins in Australia in efforts to stop drought and erosion that were similar to the effects of the Dustbowl of the 1930s in the United States.”).

67. See Burwood-Taylor, *supra* note 55.

68. JACK KITTREDGE, NORTHEAST ORGANIC FARMING ASSOC., SOIL CARBON RESTORATION: CAN BIOLOGY DO THE JOB? 11 (Aug. 14, 2015).

69. See Samberg, *supra* note 7; see also MERRITT PADGITT, 4.2 CROP ROTATIONS 143–44 (2017) (describing mono-cropping or monoculture as a “crop sequence where the same crop is planted for three consecutive years.”).

arrive as anticipated.<sup>70</sup> Agricultural research and development agencies, NGOs, and aid programs are increasingly helping farmers maintain traditionally diverse farms by providing financial, agronomic, and policy support for production and marketing of native crop and livestock species.<sup>71</sup> The added benefit of growing many different, locally adapted crops, provides for a range of nutritional needs and reduces solvency risk that can occur if crops fail due to variability in weather, obtaining inputs, or timing of input application.

To increase carbon sequestration, farmers plant cover crops, “a plant that is used primarily to slow erosion, improve soil health, enhance water availability, smother weeds, help control pests and diseases, [and] increase biodiversity.”<sup>72</sup> Types of cover crops include legume cover crops (red clover, crimson clover, vetch, peas, beans), which are useful for planting nitrogen into the soil, and nonlegume cover crops like cereals (rye, wheat, barley, oats, triticale), forage grasses (annual ryegrass), and broadleaf species (buckwheat, mustards and brassicas, including the forage radish), which are useful for removing excess nitrogen from the soil.<sup>73</sup> Aside from managing nutrients such as nitrogen, cover crops have numerous on-farm benefits—such as controlling erosion, improving water infiltration, and serving as a food for grazing animals.<sup>74</sup> In addition, by stimulating biological activity in the soil, cover crops planted on a large scale can sequester a large amount of atmospheric carbon. Along with planting cover crops, farmers also practice agroforestry (planting trees or shrubs into crop systems) to increase carbon sequestration.<sup>75</sup>

To increase carbon sequestration, farmers also plant longer rooted crops and incorporate organic materials into the soil.<sup>76</sup> Compost works both preventively, by reducing methane emissions that would normally occur when food and organic waste decomposes, and correctively, by improving contaminated, compacted, and marginal soils.<sup>77</sup> Among the other

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70. See PADGITT, *supra* note 69 (noting that “[m]any large-scale food security initiatives supply farmers with improved crop and livestock varieties, plus fertilizer and other necessary inputs. This approach is crucial, but can lead farmers to focus most or all of their resources on growing more productive maize, wheat or rice.”).

71. See BIOVERSITY INT’L, THE IMPACT OF BIOVERSITY INTERNATIONAL’S AFRICAN LEAFY VEGETABLES PROGRAMME IN KENYA (Apr. 2010).

72. Andy Clark, *Cover Crops for Sustainable Crop Rotations*, SUSTAINABLE AGRIC. RES. & EDUC. (2015), <https://www.sare.org/Learning-Center/Topic-Rooms/Cover-Crops/>.

73. *Id.*

74. *Id.*

75. See *USDA Agroforestry Strategic Framework: Fiscal Year 2019–2024*, U.S. DEP’T AGRIC., <https://www.usda.gov/topics/forestry/agroforestry> (last visited Mar. 10, 2020); see also *Agroforestry Frequently Asked Questions*, U.S. DEP’T AGRIC., <https://www.usda.gov/topics/forestry/agroforestry/agroforestry-frequently-asked-questions> (last visited Mar. 10, 2020).

76. KITTREDGE, *supra* note 68.

77. See *Reducing the Impact of Wasted Food by Feeding the Soil and Composting*, U.S. ENVTL. PROTECTION AGENCY, <https://www.epa.gov/sustainable-management-food/reducing-impact-wasted-food-feeding-soil-and-composting> (last visited Mar. 10, 2020).

benefits of composting, by enhancing plant growth, composting also aids in removing carbon from the atmosphere, another corrective process.<sup>78</sup>

Carbon sequestration can be improved with the inclusion of livestock.<sup>79</sup> When ranchers implement rotational grazing, “[a]nimals are frequently moved between paddocks with time between grazings built in for plant recovery.”<sup>80</sup> Allowing plants to recover means that plants have more time to absorb and process sunlight through photosynthesis; allowing herds to graze means that “manure and plant matter are trampled into the ground where they break down and enrich the soil’s network of microbial life.”<sup>81</sup> In this way, increasing the carbon content of soil can aid plant growth, increase organic matter in soil, and increase water retention capability—ultimately leading to less fertilizer input use.<sup>82</sup>

An example helps illustrate these practices. Imagine a hundred-acre farm that consisted of only soybeans. With regenerative practices, the farmer decides to continue to grow soybeans, and also plants corn, oats, and hay. The farmer also plants cover crops—or plants grown not to be harvested but to enrich the soil<sup>83</sup>—during the season when the field is not planted with soybeans, and livestock grazes on the cover crops, adding nutrients through manure back to the soil.<sup>84</sup> Potential cover crops are: “[S]orghum, a cane-like grass with red-tinted tassels spilling from the tops, mung beans and green-topped daikon radishes”; each plant benefits the soil in a different way.<sup>85</sup> “The long radishes break up the soil and draw nutrients toward the surface; tall grasses like sorghum produce numerous fine rootlets, adding organic material to the land; legumes like mung beans harbor bacteria that put nitrogen into the soil.”<sup>86</sup> Planting with a focus on the biological soil activity increases organic matter and stores carbon; it’s an exponential feedback loop.<sup>87</sup>

Other land use practices—silvopasture and biochar—though not widely supported or implemented in the United States, have been used successfully elsewhere to advance carbon capture.<sup>88</sup> Silvopasture is an

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78. *Id.*

79. See Burwood-Taylor, *supra* note 55; see also Brianna J. Schroeder, *Regenerative Agriculture and Livestock*, JAZEN AG L. (July 26, 2019), <https://www.aglaw.us/schroeder-ag-law-blog/2019/7/26/regenerative-agriculture-and-livestock>.

80. Schroeder, *supra* note 79; see also *Rotational Grazing*, RODALE INST., <https://rodaleinstitute.org/why-organic/organic-farming-practices/rotational-grazing/> (last visited Mar. 10, 2020).

81. *Rotational Grazing*, *supra* note 80; Schroeder, *supra* note 79.

82. *Rotational Grazing*, *supra* note 80; Schroeder, *supra* note 79.

83. See KITTREDGE, *supra* note 68.

84. See Robert Leonard & Matt Russell, *Our Small Towns Are Toppling Like Dominoes: Why We Should Cut Some Farmers a Check*, N.Y. TIMES (June 24, 2019), [https://www.ny-times.com/2019/06/24/opinion/farmers-climate-change-government-global-warming.html?mc\\_cid=5f0e069969&mc\\_eid=6c4ffa9f46](https://www.ny-times.com/2019/06/24/opinion/farmers-climate-change-government-global-warming.html?mc_cid=5f0e069969&mc_eid=6c4ffa9f46).

85. See Velasquez-Manoff, *supra* note 27.

86. *Id.*

87. See KITTREDGE, *supra* note 68, at 14.

88. *Id.* at 13; see Tom Driscoll, *What Can Farmers Do About Climate Change? Silvopasture*, NAT’L FARMERS UNION (Feb. 6, 2017), <https://nfu.org/2017/02/06/what-can-farmers-do-about-climate-change-silvopasture/>.

efficient land management and carbon sequestration practice of grazing animals in forests (rather than fields).<sup>89</sup> The amount of carbon is up to five times greater in silvopasture soil than soil under managed grazing.<sup>90</sup> “Recent decades have seen an explosion of silvopasture in Latin America,” backed by government financial assistance.<sup>91</sup> The governments of Costa Rica, Colombia, and Nicaragua all offer payments to ranchers to convert to silvopasture.<sup>92</sup> Finally, Biochar is a practice of “partly burning materials such as logging slash or crop waste to make a carbon-rich, slowly decomposing substance” (biochar), which can be buried or spread onto farmland; biochar is another soil enriching strategy shown to enhance plants' ability to store carbon.<sup>93</sup>

#### A. Carbon Farming Costs and Benefits

At the turn of the century, the USDA's Natural Resources Conservation Services (NRCS) replaced a policy of managing land for erosion control, with a policy of managing for soil health.<sup>94</sup> Managing soil organic matter has the potential to “enhance[] water and nutrient holding capacity and improve[] soil structure” while enhancing productivity and environmental quality.<sup>95</sup> In addition, carbon farming can raise productivity in the face of climate variability.<sup>96</sup> Farmers experience cost savings when implementing regenerative practices. For example, compared to their neighboring farming operations, farmers report savings up to 20% in cost, reduced energy consumption, and conservation of millions of gallons water.<sup>97</sup>

That regenerative agriculture practices can be used to sequester carbon is an added benefit. Compared to other conservation practices like managed grazing, conservation agriculture, and farmland restoration, regenerative agriculture has the potential to sequester the most carbon.<sup>98</sup> As shown in Table 1 below, land management practices have the potential to draw down 23.15 tons of CO<sub>2</sub> by 2050—comparatively more than other approaches.

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89. See Driscoll, *supra* note 88.

90. Toensmeier, *supra* note 23.

91. *Id.*

92. *Id.*

93. Mary Hoff, *8 Ways to Sequester Carbon to Avoid Climate Change*, ECOWATCH (July 19, 2017), <https://www.ecowatch.com/u/ensia> (noting that “three of 10 finalists in a \$25 million Earth Challenge launched by Virgin in 2007 [use] this approach.”).

94. See *Natural Resources Conservation Service Soils*, U.S. DEP'T AGRIC., <https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/health/mgmt/?cid=stelprdb1237584> (last visited Mar. 10, 2020).

95. *Id.*

96. *Id.*

97. See Velasquez-Manoff, *supra* note 27 (cost savings are realized by using beneficial insects for pest control, rather than fertilizer, avoiding herbicide-resistant genetically modified seed, and realizing water savings).

98. See *Food Sector Summary*, PROJECT DRAWDOWN, <https://www.drawdown.org/solutions/food> (last visited Feb. 9, 2020).

**Table 1.** Carbon Draw Down Benefits of Land Management Practices.

<i>Regenerative Agriculture</i> can remove <b>23.15 Billion Tons of CO<sub>2</sub></b> by 2050
<i>Managed Grazing</i> Can remove <b>16.34 Billion Tons of CO<sub>2</sub></b> by 2050
<i>Conservation Agriculture</i> can remove <b>17.35 Billion Tons of CO<sub>2</sub></b> by 2050
<i>Farmland Restoration</i> can remove <b>14.08 Billion Tons of CO<sub>2</sub></b> by 2050

Source: *Drawdown.org* <https://www.drawdown.org/solutions/food>

As more farmers struggle to remain solvent in today's turbulent agricultural economy, farmers increasingly share best practices to improve the profitability of farming operations.<sup>99</sup> Implementation of regenerative practices of nutrient optimization, crop rotation, conservation tillage, and cover crops helps farmers adapt to new seasonal trends of rainfall (which, for most cropping farms, means less rain in winter and more in summer), with conservation tillage realizing the most gains.<sup>100</sup> There are also advantages to no-till agriculture.<sup>101</sup> Farms in the Midwest United States that have adopted conservation tillage have improved productivity under dry conditions.<sup>102</sup> There are many successful case studies of no-till practices in the United States.<sup>103</sup>

Carbon farming experimentation occurs at the state, county, and sub-county levels. The Marin Carbon Project in Marin County, California, is the forerunner in carbon farming experimentation and has published

99. *Farm Bankruptcies Rise Again*, AM. FARM BUREAU FED'N (Oct. 30, 2019), <https://www.fb.org/market-intel/farm-bankruptcies-rise-again> (last visited Feb. 9, 2020); *see also About Marin Carbon Project*, MARIN CARBON PROJECT, <https://www.marincarbonproject.org/about> (last visited Mar. 10, 2020) (for two examples of a clearinghouses for information on soil health, carbon farming best practices for producers); *Goals and Priorities*, SOIL HEALTH INST., <https://soil-healthinstitute.org/goals> (last visited Mar. 10, 2020).

100. *See* Maggie Monast et. al., ENV'T. DEF. FUND, *FARM FINANCE AND CONSERVATION: HOW STEWARDSHIP GENERATES VALUE FOR FARMERS, LENDERS, INSURERS AND LANDOWNERS* 5–6 (2018).

101. *See Home*, HOWARD G. BUFFETT FOUNDATION CENTRE FOR NO-TILL AGRICULTURE, <https://centrefornotill.org> (last visited Mar. 10, 2020) (identifying and discussing some of the advantages of no-till agriculture).

102. *See Natural Resources Conservation Service Soils*, U.S. DEP'T AGRIC., <https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/health/mgmt/?cid=stelprdb1237584> (last visited Mar. 10, 2020).

103. *See*, for example, these farms experimenting with carbon farming: The Dakota Lakes Research Farm (South Dakota), with more information available at Dwayne L. Beck, *Philosophy*, DAKOTA LAKES RES. FARM PROJECT, <http://www.dakotalakes.com/philosophy/> (last visited Jan. 18, 2020); Brandt Farm (Ohio), with more information available at *Better Soil, Better Climate*, U.S. CLIMATE RESILIENCE TOOLKIT (Oct. 24, 2019, 9:59 AM), <https://toolkit.climate.gov/case-studies/better-soil-better-climate>; Brown's Ranch (North Dakota), with more information available at *Soil Health*, BROWN'S RANCH, <https://brownsranch.us/soil-health/> (last visited Jan. 18, 2020). For examples of similar farms located in Colorado, see McCauley Family Farm (Longmont, Colo.), with information available at MCCAULEY FAMILY FARM, <https://www.fromourfarm.org/our-roots> (last visited Jan. 18, 2020); The Golden Hoof (Boulder, Colo.), with information available at *Slow Food*, THE GOLDEN HOOF, <http://www.thegoldenhoof.com/slow-food.html> (last visited Jan. 18, 2020); Ollin Farms (Longmont, Colo.), with information available at *Background*, OLLIN FARMS, <http://www.ollin-farms.com/philosophy.html> (last visited Jan. 18, 2020).

several academic studies on how composting affects carbon sequestration.<sup>104</sup> Studies of the Marin Carbon Project found that a single application of compost on half of California's rangeland would increase its carbon sequestration capacity by 42 million metric tons—roughly equivalent to the annual emissions of the state's commercial and residential energy sectors.<sup>105</sup> Carbon farming experimentation is also growing at the county level in Colorado. The Boulder County, Colorado Carbon Sequestration Pilot project is undertaking several carbon farming projects to determine whether carbon applications on rangeland lead to carbon sequestration.<sup>106</sup> The project is also seeking to discover how to best integrate carbon farming practices into Northern Front Range cropping systems and determine which practices are best to first implement: compost over crops, no-till, or adding windbreaks. Also in Boulder County, the Be a Carbon Farmer Project is enlisting volunteer homeowners to invest \$50, plant a specified list of plants, and routinely measure carbon capture in their vegetable gardens for three years.<sup>107</sup> This project, and others like it, focuses on agriculture as a means to sequester carbon and the role of compost amendments to accelerate the process.<sup>108</sup> These projects seek to collect data and best practices to incentivize farmers and to get more financing available for these practices.

Financing is necessary to offset the added investments necessary to shift into carbon farming practices. Delays in realizing the benefits associated with carbon farming, and the energy cost of using compost, represent the greatest costs to farmers.<sup>109</sup> Carbon farmers in Colorado have noted that there is a three-year “till penalty” in which farmers or ranchers may not see the usual level of yield for the first three years.<sup>110</sup> For specialized practices, like silvopasture, access to finance and information are key because recovering the costs of converting land to specialized practices, like silvopasture, can take three to four years.<sup>111</sup> Also, the criticism with compost use is that compost requires energy to produce; huge machines

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104. See MARIN CARBON PROJECT, <https://www.marincarbonproject.org/science/papers> (last visited Mar. 18, 2020) (for more information about each study, including access to the full paper).

105. See *id.* (reporting the findings from Rebecca Ryals & Whendee L. Silver, *Effects of Organic Matter Amendments on Net Primary Productivity and Greenhouse Gas Emissions in Annual Grasslands*, 23 *ECOLOGICAL APPLICATIONS* 1, 46–59 (2013)).

106. See MARK EASTER ET AL., CARBON SEQUESTRATION PILOT PROJECT FEASIBILITY STUDY 1, 7–9, 36 (Feb. 2018).

107. See ECO-CYCLE, <https://www.ecocycle.org/take-action/community-carbon-farming> (last visited Mar. 10, 2020) (explaining a community carbon farming campaign in which Eco-Cycle and the City of Boulder are working together on a three-year study to explore a range of carbon farming approaches on urban landscapes to determine whether these practices can effectively sequester carbon in the soil and help reverse climate change).

108. See *id.*

109. See generally MARIN CARBON PROJECT, *supra* note 104 (providing information about funding and factoring economic considerations into carbon farm planning); see also CAL. DEP'T FOOD & AGRIC., HEALTHY SOILS PROGRAM INCENTIVES GRANT 2017 *Applicants* (Oct. 16, 2017) (providing a listing of hurdles farmers face when adopting carbon farming practices).

110. See Burwood-Taylor, *supra* note 55.

111. See Toensmeier, *supra* note 23.



are required to shred the material and keep it aerated.<sup>112</sup> And it is unclear if compost, like synthetic fertilizer, can cause nitrogen pollution when put on the land or how much GHG composting itself generates.

Farmers are also skeptical with regard to introducing livestock into their farming operation. While carbon farming does not require the presence of livestock, “some argue that merely accepting them on the land to deposit carbon and till the soil undermines the goal of reaching a carbon-neutral or -negative future.”<sup>113</sup> Livestock methane emissions account for almost half the heat-trapping gases associated with agriculture, so an obvious way to reduce emissions is to decrease the number of cows on the planet.<sup>114</sup> Farmers have similar concerns over the use of compost but, as long as compost mounds are regularly aerated to prevent low-oxygen conditions, composting is thought to produce few emissions.<sup>115</sup>

Case studies help to connect farmers with information and financing. Financing for carbon farming is mostly undertaken at the farm level, and where available, through insurance mechanisms. Some national and international funding is also available by notable donors and institutions.<sup>116</sup> What is needed is a network-of-resources approach to scale carbon farming—an approach that enlists legal mechanisms like public treaties, legislation, and contracting to increase practice adoption. Sections III.A and III.B provide an overview of the network of resources available at this time. Section III.C details how the network expands as a carbon farming certification helps farmers access more financially lucrative resources.

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112. See *Types of Composting and Understanding the Process*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/sustainable-management-food/types-composting-and-understanding-process> (last updated Aug. 29, 2016).

113. Velasquez-Manoff, *supra* note 27.

114. See *FAO Key Facts and Findings*, *supra* note 19.

115. See, e.g., *Sources of Greenhouse Gas Emissions-Land Use/Forestry*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#land-use-and-forestry> (last updated Sept. 13, 2019).

116. Sources of funding for climate smart agriculture include: the Adaptation Fund (AF); the Spanish Agency for International Development Cooperation (AECID); the BioCarbon Fund Initiative for Sustainable Forest Landscapes (ISFL); the Bill & Melinda Gates Foundation (BMFG); the World Bank Community Development Carbon Fund (CDFC); the Clean Development Mechanism (CDM); the Critical Ecosystem Partnership Fund (CEPF); the Climate and Land Use Alliance (CLUA); the Clean Technology Fund (CTF); the United Nations Economic Commission for Latin America and the Caribbean (ECLAC); the United Nations Food and Agriculture Organization (FAO); the Forest Carbon Partnership Facility (FCFP); the Global Environment Facility (GEF); the German Corporation for International Cooperation (GIZ); the Inter-American Institute for Global Change Research (IAI); the U.S. International Development Finance Corporation (DFC), formerly the Overseas Private Investment Corporation (OPIC); the International Finance Corporation (IFC); the Inter-American Development Bank (IADB); the International Fund for Agricultural Development (IFAD); the Japan International Cooperation Agency (JICA); Argentina’s Ministry of Agriculture, Livestock and Fisheries (MAGyP); Nordic Development Fund (NDF); the Partnership for Market Readiness (PMR); the Pilot Program for Climate Resilience (PPRC); Brazil’s governmental agency Secretariat of the Environment and Sustainable Development for the State of the Amazonas (SDS); Sustainable Agriculture Initiative Platform (SAI Platform); the Special Climate Change Fund (SCCF); the Scaling Up Renewable Energy Program in Low Income Countries (SREP); the Spanish Carbon Fund (SCF); the United Kingdom’s International Climate Fund (ICF); the United Nations Development Programme (UNDP); the United Nations Environment Program (UNEP); the Verified Carbon Standard (VCS); and the World Bank.

## II. A “NETWORK OF RESOURCES” APPROACH TO SCALE-UP CARBON FARMING

This Part introduces a network-of-resources approach to scale carbon farming in the United States. A network-of-resources approach can be defined as a set of resources for farmers to finance carbon farming practices. A portion of the network is already available to farmers (international treaties, national and local legislation); a portion of the network is inherent to adopting the Carbon Farming Certification (contracts for the sale of carbon credits, forward contracting, certification finance). In this way, the Carbon Farming Certification is the linchpin to the network, as it unlocks new and greater financial opportunities. A new certification, like the Carbon Farming Certification, can also be used by governments to meet targets with respect to climate mitigation, and others dealing with soil health and carbon sequestration.

### *A. Treaties and International Law Incentives to Adopt Carbon Farming*

The treaties and nontreaty initiatives in this Section show how the Carbon Farming Certification provides farmers with leverage to solicit financing from donors or others networked into the treaty. Farmers who adopt Carbon Farming Certifications will be able to take their recorded carbon sequestration metrics and sell carbon offsets to government agencies, NGOs, and others who need to meet treaty targets and goals. This stream of potential financing comes in addition to using the Carbon Farming Certification to sell carbon offsets in select domestic cap-and-trade programs to nonprofits and corporations.

Given the potential to draw down carbon from the atmosphere, carbon farming practices are becoming more relevant to countries and other stakeholders who have made various international, national, and regional treaties and other commitments reducing GHGs. If climate change treaties continue to specify GHG targets and allow for calculations that include the agricultural sector, like allowing measures of increased soil carbon, then treaties become a pillar in the network-of-resources approach to scaling carbon farming. While a treaty that includes carbon farming language can serve as a mild incentive for farmers and others to adopt carbon farming practices, a treaty that provides a hard numerical target, and allows for carbon farming practices to be considered in reaching GHG reduction goals, creates a greater financial incentive. But as the paragraphs below show, there is one key drawback to this approach.<sup>117</sup> GHG reduction targets seldom include carbon sequestration. Only a few instruments advance an understanding that agriculture is a contributor to climate change and

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117. See *infra* text accompanying notes 119–36.

that sustainable land management policies could be used to mitigate climate change.<sup>118</sup>

Farmers who adopt Carbon Farming Certifications can solicit financing from donors linked up to at least one, if not two, types of treaties. This Article provides an overview of two types of treaties related to carbon farming: treaties that do not mention soil health and/or carbon sequestration in their treaty language (Type I Treaty) and, next, we have treaties that do mention soil health and/or carbon sequestration (Type II Treaty).<sup>119</sup> A disclaimer is in order: this typology is rough and more work is needed to categorize treaties. While some climate change-related treaties cite goals or targets to motivate nations to track GHG emissions and to sequester more carbon, other treaties corral support and financing for a cause. Importantly, farmers who adopt the Carbon Farming Certification may be able to solicit financing by referencing a commitment in a Type II Treaty.<sup>120</sup> Likewise, a company can require the Carbon Farming Certification of their farmer-suppliers to incorporate the Carbon Farming Certification in its corporate target or in its corporate climate change strategy.<sup>121</sup> Treaties can be used by farmers and companies alike to expand their network-of-resources approach.

Several international treaties and instruments of soft law (guidelines, policy declarations, or codes of conduct policies that are not legally binding) mention, but do not give enough attention to, using soil as a tool for climate change mitigation.<sup>122</sup> Many Type I Treaties focus on climate change generally, with a specific emphasis on industrial emissions.<sup>123</sup> In these treaties, there is scant mention of agriculture's pivotal role in climate change—as a contributor to climate change and as a potential solution for drawing down carbon. Meanwhile, Type II Treaties highlight the role that land management policies can play to improve the soil, generally, and sequester carbon, specifically. Such Type II Treaties include language that includes agricultural practices like agroforestry and silvopasture and

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118. This is in contrast to the various international and regional instruments that exist to manage the use, conservation, and development of water and air resources. *See supra* note 116 (quoting various Directives for the European Union, which aim to achieve a uniform approach to the use of natural resources). *See, i.e.*, Council Directive 2000/60, 2000 O.J. (L 327) 1, 9.

119. An example of a Type I Treaty is the United Nations 2030 Agenda for Sustainable Development, which mentions combating climate change, but does not mention soil as an instrument of climate change. *See generally* G.A. Res. 70/1, Transforming Our World: 2030 Agenda for Sustainable Development (Sept. 25, 2015) For an example of a Type II Treaty, see United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, art. 4, art. 6, *opened for signature* Oct. 14, 1994, 1954 U.N.T.S. 3, 6, 8–10 (entered into force Dec. 26, 1996).

120. Such as commitment to soil conservation. *See* United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, *supra* note 119, at art. 6.

121. *Why Commit to Integrating into your Agricultural Supply Chain?*, CLIMATE COLLABORATIVE, <https://www.climatecollaborative.com/agriculture> (last visited Mar. 10, 2020).

122. *See, e.g.*, G.A. Res. 70/1, *supra* note 119 (as a general example of a treaty which mentions combating climate change but does not mention soil as an instrument of climate change).

123. *See, e.g., id.* at 8–9, 20.

restoring land so that it can serve as a carbon sink.<sup>124</sup> Moreover, these Type II Treaties are designed to sync up with other initiatives in a climate change strategy. The following paragraphs describe Type I Treaties that focus on climate change and Type II Treaties that include either carbon farming or carbon sinks and carbon farming.

Conceptually, the United Nations 2030 Sustainable Development Agenda (SD Agenda) is a Type I Treaty that focuses on U.N. Sustainable Development Goals (SDGs)—and also highlights agriculture and soil health by stating that it strives to halt and reverse land degradation. Signed in 2015 by U.N. member countries, the SD Agenda broadly outlines goals to reduce climate change and ensure people lead healthy lives free of hunger.<sup>125</sup> The SD Agenda sets forth the following goals for 2030: end hunger, achieve food and nutrition security, and promote sustainable agriculture, for SDG #2; ensure sustainable production and consumption by reducing food loss at production and in supply chains, for SDG #12; take urgent action to combat climate change and its impacts, for SDG #13; sustainably manage forests, combat desertification, and halt and reverse land degradation, for SDG #15.<sup>126</sup> The SD Agenda is not considered a Type II Treaty because the SD Agenda does not explicitly address or promote agriculture's role in carbon sequestration (though SDG #15 indirectly addresses a symptom of agriculture's role). The SD Agenda is considered a Type I Treaty, which sets a global strategy.

Three Type I Treaties move closer to addressing agriculture by encompassing land protection with provisions that could be used to promote sustainable land use: (1) the 1994 Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, (UNCCD);<sup>127</sup> (2) the 1992 U.N. Convention on Biological Diversity (CBD);<sup>128</sup> and (3) the 1995 U.N. Framework Convention on Climate Change (UNFCCC).<sup>129</sup> These three treaties expressly address agriculture's role in contributing to climate change and the role of land

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124. See Toensmeier, *supra* note 23.

125. See generally Leah Samberg, *World Hunger is Increasing Thanks to Wars and Climate Change*, CONVERSATION (Oct. 17, 2017, 7:51 PM), <https://theconversation.com/world-hunger-is-increasing-thanks-to-wars-and-climate-change-84506> (noting that U.N. member countries adopted the Sustainable Development Goals, which doubled down on this success by setting out to end hunger entirely by 2030); see also *Sustainable Development Goals*, *supra* note 15 (for more information on the U.N.'s Sustainable Development Goals). The Sustainable Development Goals are a collection of seventeen global goals set by the United Nations in 2015. Note, in particular, these three goals: towards meeting goals in ensuring healthy lives (SDG #3), ending hunger (SDG #2), and combating climate change (SDG #13). *Id.*

126. *Id.*

127. See, e.g., United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, *supra* note 119, at art. 5.

128. See, e.g., United Nations Convention on Biological Diversity, art. 8, art. 10, art. 11, *opened for signature* June 5, 1992, 1760 U.N.T.S. 79 (entered into force Dec. 29, 1993).

129. See *United Nations Convention on Climate Change*, <https://unfccc.int/resource/docs/cop1/07a01.pdf> (last visited Feb. 9, 2020).

management policies in mitigating climate change.<sup>130</sup> However, there are drawbacks to using each of the conventions for vehicles to address land degradation: because each of these conventions contain provisions that generally relate to the needs of the soil, but do not address soil needs specifically, additional provisions need to be drafted for sustainable land management.<sup>131</sup>

First, the UNCCD highlighted soil degradation with the UNCCD Global Land Outlook of 2017 by identifying critical drivers of land degradation: agriculture and forestry, urbanization, infrastructure development, energy production, and mining and quarrying, thereby mentioning emissions but not addressing carbon sequestration.<sup>132</sup>

Next, within the framework of the 1992 U.N. Convention on Biological Diversity is the Strategic Plan for 2011–2020, which includes the Aichi Biodiversity Targets.<sup>133</sup> These Targets stipulate the following goals will be met by 2020: areas under agriculture, aquaculture, and forestry will be managed sustainably; diversity will be preserved; genetic diversity on farms will be maintained; and at least 15% of degraded ecosystems will be restored.<sup>134</sup> In this way, the 1992 U.N. Convention on Biological Diversity goes further than the UNCCD because it mentions reversing land degradation to combat climate change. Other protocols should be added to the Convention on Biological Diversity to legislate land degradation and soil conservation at the national level.<sup>135</sup>

Lastly, the UNFCCC legally binds treaty states to reduce GHG emissions based on the scientific consensus of global warming.<sup>136</sup> While the UNFCCC recognizes excessive vegetation clearance as its principal concern and cause of degradation, the UNFCCC also recognizes livestock grazing plays key roles in emissions of GHGs.<sup>137</sup> The UNFCCC realizes agriculture's role in carbon emissions but not in sequestration.

Two treaties enacted in recent years, the Kyoto Protocol and the Paris Agreement, extend the UNFCCC and move it closer to a Type II treaty, or one that mentions the role of carbon sequestration. The Kyoto Protocol, an international treaty adopted in 1997 and entered into force in 2005, extends the 1992 UNFCCC.<sup>138</sup> The Kyoto Protocol establishes state responsibility to promote sustainable forms of agriculture in light of climate change

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130. United Nations Convention on Biological Diversity, *supra* note 128; *United Nations Convention on Climate Change*, *supra* note 129; United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, *supra* note 119.

131. See *supra* note 22 and accompanying text.

132. NIGEL DUDLEY & SASHA ALEXANDER, *GLOBAL LAND OUTLOOK* 43 (1st ed. 2017).

133. *Key Elements of the Strategic Plan 2011–2020, including Aichi Biodiversity Targets*, CONVENTION ON BIOLOGICAL DIVERSITY (May 11, 2018), <https://www.cbd.int/sp/elements/>.

134. *Aichi Biodiversity Targets*, CONVENTION ON BIOLOGICAL DIVERSITY (May 11, 2018), <https://www.cbd.int/sp/targets/>.

135. See *supra* note 22 and accompanying text.

136. *United Nations Convention on Climate Change*, *supra* note 129.

137. *Id.*

138. Kyoto Protocol to the Convention on Climate Change, Dec. 10, 1997, 37 I.L.M. 22.

considerations and recognizes the need to expend and preserve soil carbon sinks and improve agricultural practices in countries where a significant proportion of the emissions are related to the clearing of vegetation for agriculture.<sup>139</sup> The Marrakech Accords provides implementation rules for the Protocol.<sup>140</sup> Several articles within the Kyoto Protocol and the Marrakech Accords explicitly address carbon sequestration.<sup>141</sup>

The Paris Agreement, a framework convention under the UNFCCC, signed in 2015 and entered into force in 2020, explicitly addresses GHG emissions mitigation, adaption, and finance.<sup>142</sup> Under the Paris Agreement, each state party determines plans and regulatory reports on the contribution it should make to mitigate global warming.<sup>143</sup> Paris Agreement Article 2 commits state parties to “enhance[e] the implementation” of the UNFCCC by holding the increase in global average temperature to well below 2°C above preindustrial levels; and limits the increase to 1.5°C to substantially reduce the risks and effects of climate change.<sup>144</sup> UNFCCC Article 3 provides that, while there is no mechanism to force a state party to set a specific target by a specific date, each target should go beyond previously set targets, which has become known as the principle of progression.<sup>145</sup> As of July 2018, 195 UNFCCC members signed the Paris Agreement, and 187 are party to the treaty.<sup>146</sup> Importantly, the Paris Agreement explicitly addresses carbon sinks; the preamble “[r]ecogniz[es] the importance of the conservation and enhancement, as appropriate, of sinks and reservoirs of greenhouse gases referred to in the Convention,” thereby implicating land degradation law.<sup>147</sup> According to the Food and Agriculture Organization of the United Nations, while specific conservation and enhancement actions are not identified, they will likely include a wide range of national sustainable land management actions to control or

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139. *Id.*

140. MARRAKECH ACCORDS & THE MARRAKECH DECLARATION (2001).

141. Kyoto Protocol to the Convention on Climate Change, *supra* note 138; MARRAKECH ACCORDS & THE MARRAKECH DECLARATION, *supra* note 140.

142. *Paris Agreement*, UNITED NATIONS FRAMEWORK CONVENTIONS ON CLIMATE CHANGE, <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement> (last visited Mar. 10, 2020) (adopted by consensus on December 12, 2015. By the end of 2017, 171 of the 197 UNFCCC members had ratified the agreement.).

143. *Id.*

144. The goals are threefold: (a) holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; (b) increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low GHG emissions development, in a manner that does not threaten food production; (c) making finance flows consistent with a pathway towards low GHG emissions and climate-resilient development. *Paris Agreement*, *supra* note 142.

145. Christina Voigt & Felipe Ferreira, ‘Dynamic Differentiation’: *The Principles of CBDR-RC, Progression and Highest Possible Ambition in the Paris Agreement*, TRANSNATIONAL ENV’T. L., CAMBRIDGE UNIV. PRESS 285–86, Oct. 24, 2016.

146. *Paris Agreement—Status of Ratification*, UNITED NATIONS FRAMEWORK CONVENTIONS ON CLIMATE CHANGE, <https://unfccc.int/process/the-paris-agreement/status-of-ratification> (last visited Mar. 10, 2020).

147. *Paris Agreement*, *supra* note 142.

prevent land degradation<sup>148</sup> (like carbon farming). The Paris Agreement is a Type II Treaty and extends beyond climate change to mention carbon farming practices.<sup>149</sup>

Nontreaty commitments can also be leveraged by farmers who adopt Carbon Farming Certifications. Nontreaty commitments exist through contracting, as public-private partners and NGOs collaborate to highlight soil health and land restoration. Oftentimes, nontreaty commitments refer to treaty obligations and targets.<sup>150</sup> For example, the Bonn Challenge is a global effort to restore 150 million hectares of the world's degraded and deforested lands by 2020 and 350 million hectares by 2030.<sup>151</sup> The Bonn Challenge is overseen by NGOs—the Global Partnership on Forest Landscape Restoration and the International Union for Conservation of Nature as its Secretariat.<sup>152</sup> Next, the African Forest Landscape Restoration Initiative (AFR100) is an example of a regional effort; AFR100 aims “to bring 100 million hectares of deforested and degraded landscapes across Africa into restoration by 2030.”<sup>153</sup> AFR100 initiative focuses on land restoration and explicitly addresses soil health and carbon farming, unites other stakeholders (NGOs, public-private organizations, public and private donors), and engages stakeholders through contracting.<sup>154</sup> The initiative links national legislation and goals and “contributes to the achievement of domestic environment and target-setting development commitments,” such as the NGOs Bonn Challenge and Land Degradation Neutrality. It also contributes to the regional government plans, “African Resilient Landscapes Initiative (ARLI), and complements the African Landscapes Action Plan (ALAP), and to the broader Climate Change, Biodiversity and Land Degradation program of the African Union.”<sup>155</sup> AFR100 accelerates achieving the U.N. SDGs and the Paris Agreement. Through contracting, AFR100 has received financing and technical assistance from: the German Federal

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148. REVIEW FOR EVIDENCE ON DRYLAND PASTORAL SYSTEMS & CLIMATE CHANGE: IMPLICATIONS & OPPORTUNITIES FOR MITIGATION & ADAPTION 6 (C. Neely et al. eds., 2009).

149. Not all modern treaties include carbon farming; some do not. For example, in 2014, the heads of States and Government of the African Union adopted the *Malabo Declaration* in an effort to double current agriculture productivity levels and halving post-harvest loss across Africa. This is another instrument aimed at sustainability and climate change, with no explicit mention of soil health, land management, or carbon farming. See AFRICAN UNION, MALABO DECLARATION ON ACCELERATED AGRICULTURAL GROWTH AND TRANSFORMATION FOR SHARED PROSPERITY AND IMPROVED LIVELIHOODS (2014).

150. Hartmut Hillgenberg, *A Fresh Look at Soft Law*, 10 EUR. J. INT'L L. 499, 500 (1999).

151. *The Challenge*, BONN CHALLENGE, <http://www.bonnchallenge.org/content/challenge> (last visited Mar. 10, 2020) (“[a]chieving the 350 million hectare goal will generate about USD170 billion per year in net benefits from watershed protection, improved crop yields and forest products, and could sequester up to 1.7 gigatons of carbon dioxide equivalent annually.”).

152. *Global Partnership On Forest Landscape Restoration*, BONN CHALLENGE, <https://www.bonnchallenge.org/content/global-partnership-forest-landscape-restoration> (last visited Mar. 10, 2020).

153. *African Forest Landscape Restoration Initiative (AFR100)*, WORLD RES. INST., <https://www.wri.org/our-work/project/AFR100/about-afri100> (last visited Mar. 10, 2020).

154. *FAQ*, WORLD RES. INST., <https://www.wri.org/our-work/project/AFR100/faq#project-tabs> (last visited Mar. 10, 2020).

155. *Id.*

Ministry for Economic Cooperation and Development, in-country sources of engagement, partners at the World Bank.<sup>156</sup>

The French-led 4 per 1,000 Initiative,<sup>157</sup> is a country-led initiative launched by the French Minister of Agriculture in 2016 and has grown to include 200 members—including 37 countries.<sup>158</sup> This nontreaty initiative aims to increase—through a variety of agricultural and forestry practices—carbon in cropland and rangeland soil by 0.4% per year.<sup>159</sup> Farmers who adopt Carbon Farming Certifications have additional leverage (verifiable, accredited carbon sequestration data and metrics), that other carbon farmers do not have, to use in securing carbon farming financing.<sup>160</sup> As elucidated in the Section that follows, financing can come from donors and government agencies connected to treaties and nontreaties.

### *B. Legislative Incentives to Adopt Carbon Farming*

In the United States, national- and state-level incentives serve an important role in motivating the adoption of carbon farming practices. The 2019 Intergovernmental Panel on Climate Change Special Report on Climate Change and Land examines the whole land-climate system and concludes that land policies can be critical in mitigating climate change.<sup>161</sup> Scaling-up carbon farming will require a combination of innovative solutions, technical expertise, soil testing, project funding, with support from private and public entities.<sup>162</sup> This Section describes existing federal and state legislation and highlights key policy levers that have potential to move farmers towards carbon farming practices. Regulators should use carbon farming to advance their climate mitigation or compliance goals. As federal and state governments enter into treaty or nontreaty commitments to mitigate climate change, carbon farming regulators should use the carbon sequestration metrics collected by carbon sequestration-certified farms to adhere to set targets.

#### 1. Federal Legislation

Federal agencies are well-positioned to advance sustainable land policy and carbon sequestration for three reasons. First, “interstate commerce, environmental, and agricultural regulations [already] oversee the markets

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156. *Id.*

157. *See The “4 per 1000” Initiative, supra* note 49.

158. *See* Cummins, *supra* note 45.

159. *Id.*

160. *See African Forest Landscape Restoration Initiative (AFR100), supra* note 153.

161. *See Land is a Critical Resource, IPCC Report Says, IPCC* (Aug. 8, 2019), [https://www.ipcc.ch/2019/08/08/land-is-a-critical-resource\\_srcel/](https://www.ipcc.ch/2019/08/08/land-is-a-critical-resource_srcel/) (noting that “[p]olicies that support sustainable land management, ensure the supply of food for vulnerable populations, and keep carbon in the ground while reducing greenhouse gas emissions are important,” said Eduardo Calvo, Co-Chair of the Task Force on National Greenhouse Gas Inventories.”).

162. *See* Monica Dean & Chandler Green, *Key Takeaways From the IPCC Special Report on Climate Change and Land*, UNITED NATIONS FOUND. (Aug. 8, 2019), <https://unfoundation.org/blog/post/key-takeaways-from-the-ipcc-special-report-on-climate-change-and-land/>.



that carbon [sequestration] innovators are pursuing.”<sup>163</sup> Second, the various federal research collective of institutes and labs, including the Department of Energy’s (DOE) seventeen National Labs and National Science Foundation, are unparalleled in their scientific capabilities, and climate change research offers unique opportunities to advance discoveries and innovations in carbon sequestration.<sup>164</sup> Lastly, federal tax and finance policy can accelerate early market adoption of carbon sequestration approaches. This Section describes current policies with these three discrete advantages in mind.

Legislation already in place to encourage farmers to adopt sustainable farming practices can be used to develop carbon farming. Some federal regulations protecting soil in the United States date back to the Dust Bowl, when it became clear that overworking the soil can degrade land.<sup>165</sup> The USDA’s Soil Conservation Research Service, an agency developed to provide technical assistance to farmers, later became the National Resource Conservation Service, which today oversees principal farm conservation programs: the Environmental Quality Incentives Program, the Conservation Stewardship Program, and the Agricultural Management Assistance Program.<sup>166</sup> Many carbon farming practices are eligible for 2018 Farm Bill funding through the Environmental Quality Incentives Program, which provides financial and technical assistance to agricultural producers to plan and implement conservation practices that improve soil, water, plant, animal, air, and related natural resources on agricultural land and non-industrial private forestland.<sup>167</sup>

While these USDA programs can be leveraged to address soil health,<sup>168</sup> other programs found in the Environmental Protection Agency (EPA), for example, are relevant to carbon farming but do not specifically address carbon farming. Legislation such as the Clean Air Act and the 1990 Amendments, National Environmental Policy Act of 1969, and U.S. Clean Power Plan, replaced in 2019 by the Affordable Clean Energy rule (ACE), addresses climate change, air pollution, and ozone layer depletion.

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163. CARBON REMOVAL POLICY: OPPORTUNITIES FOR FEDERAL ACTION, CENTER FOR CARBON REMOVAL 3 (July 2017).

164. *National Laboratories*, U.S. DEP’T ENERGY, <https://www.energy.gov/national-laboratories> (last visited Mar. 10, 2020).

165. See JAMES N. GREGORY, *AMERICAN EXODUS: THE DUST BOWL MIGRATION AND OKIE CULTURE IN CALIFORNIA* 11 (Oxford Univ. Press 1989) (noting an example of land degradation can be seen in the 1930’s Dust Bowl droughts, when large-scale topsoil loss occurred as a combination of intensive agricultural practices and drought conditions).

166. *2018 Farm Bill*, NAT. RESOURCES CONSERVATION SERV., <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/farmbill/> (last visited Mar. 10, 2020).

167. *Related Federal Agencies and Their Programs*, MARIN CARBON PROJECT, <https://www.marincarbonproject.org/policy/usda-nrcs> (last visited Mar. 10, 2020).

168. BEN BOER & IAN HANNAM, *THE OXFORD HANDBOOK OF COMPARATIVE ENVIRONMENTAL LAW* 456 (Emma Lees & Jorge E. Viñuales eds. 2019) (noting examples of laws that focus on soil productivity, prevention of erosion, and protecting land from environmental damage in Canada, Australia, and the United States—Soil Conservation Act 1938, New South Wales, Soil and Land Conservation Act 1945, Soil Conservation Act 1935, US Public Law 74–46, Soil Conservation and Domestic Allotment Act 1936, Public Law 74–761, and Soil Conservation Act 1996).

These rules could be extended in the future to regulate agricultural emissions to reduce GHGs, and to promote carbon farming by including sequestered carbon in environmental impact assessments.<sup>169</sup>

International treaties signed by the United States should be used as part of the network-of-resources approach to motivate carbon farming adoption. The United States, which emits 24% of global GHGs, signed the Paris Agreement and pledged to reduce GHG emissions by 26%–28% below 2005 levels by 2025 to meet the goal of limiting warming to 2°C.<sup>170</sup> At this point, the United States has effectively reduced emissions by 17% below 2005 levels by 2020 and will continue to transition to a low-carbon economy.<sup>171</sup> But to meet its pledge under the Paris Agreement, the United States must reduce emissions from as many sources as possible as soon as possible.<sup>172</sup> There are two obstacles to the United States achieving the 26%–28% Paris Agreement reduction goal. First, the UNFCCC requires emission targets to include reducing emissions “from all sources in every economic sector.”<sup>173</sup> The United States has consistently targeted power plant carbon emissions without focusing on other sectors.<sup>174</sup> Second, despite the Trump Administration’s goal to withdraw the United States from the Paris Agreement by 2020, the United States has enacted regulations to contravene the Paris Agreement targets for a number of years.<sup>175</sup>

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169. See generally Conservation Stewardship Program, 7 CFR § 1470.1 (2020); Federal Air Pollution and Control Act (Clean Air Act), 42 U.S.C. §§ 7401–7671 (2018); National Environmental Policy Act of 1969, *Id.* §§ 4321–4370f; Alexia Brunet Marks, *Feeding the Eco-Consumer*, 42 VT. L. REV. 567, 567–603 (2018) (for a list of federal programs and support that already exists for farmers to adopt conservation programs); *Affordable Clean Energy Rule*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/stationary-sources-air-pollution/affordable-clean-energy-rule> (last visited Mar. 10, 2020) (noting that some of the statutes and regulations listed do not specifically relate to climate change but are included because of their complementary relationship to the evolution of climate change law); *Overview of the Clean Air Act and Air Pollution*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/clean-air-act-overview> (last visited Mar. 10, 2020) (for a description of EPA policies).

170. U.S. Cover Note, *INDC and Accompanying Information*, UNFCCC (Mar. 31, 2015), <https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/United%20States%20of%20America/1/U.S.%20Cover%20Note%20INDC%20and%20Accompanying%20Information.pdf>.

171. *Id.*

172. See Steve Baragona, *Report: U.S. Unlikely to Meet Paris Climate Pledge*, VOA NEWS (Sept. 12, 2018, 6:30 PM), <https://www.voanews.com/usa/report-us-unlikely-meet-paris-climate-pledge> (last visited Mar. 1, 2020); Julia Rosen, *Cities, States and Companies Vow to Meet U.S. Climate Goals Without Trump. Can They?*, L.A. TIMES (Nov. 4, 2019, 1:51 PM), <https://www.latimes.com/environment/story/2019-11-04/cities-states-companies-us-climate-goals-trump> (last visited Mar. 1, 2020).

173. U.S. Cover Note, *INDC and Accompanying Information*, *supra* note 170.

174. See Lisa Friedman, *Trump Administration to Begin Official Withdrawal from Paris Climate Accord*, N.Y. TIMES (Oct. 23, 2019), <https://www.nytimes.com/2019/10/23/climate/trump-paris-climate-accord.html>.

175. See Coral Davenport, *Trump Administration Wants to Make it Easier to Release Methane into Air*, N.Y. TIMES (Sept. 10, 2018), <https://www.nytimes.com/2018/09/10/climate/methane-emissions-epa.html?action=click&module=Top%20Stories&pgtype=Homepage> (last visited Mar. 1, 2020) (describing the Trump Administration’s decision to undermine an important protection for our air quality, ending the EPA’s Methane Rule. In 2014, Colorado developed a state rule that became the model for the rule adopted nationwide by the EPA. In Colorado, two-thirds of our methane emissions

To use international treaties in the network-of-resources approach and incentivize carbon farming, agricultural emissions need to be incorporated in the domestic targets. Fortunately, the two U.S. agencies that are already involved in regulating air quality and transportation emissions—the EPA and the USDA—are also involved in agricultural regulation and are natural starting points for regulating agricultural emissions. Because the EPA already regulates the transportation sector’s new fuel and mileage standards, agriculture is the next important sector to include in these standards.<sup>176</sup> Also, because the EPA is now required to regulate greenhouse gases under the CAA, the EPA should regulate agriculture, particularly methane from livestock operations. Under the CAA, the EPA sets a standard for an air pollutant and states submit plans for reaching federal standards.<sup>177</sup> If livestock operations are included, livestock operators would have to obtain permits and comply with federal and state emissions standards. This could include, for instance, a requirement that dairy producers install anaerobic digesters for methane.<sup>178</sup> Unfortunately, this option may be politically infeasible as agriculture has traditionally been exempt from environmental regulations: agriculture is exempt from the Clean Water Act as a nonpoint source of pollution and confined animal feeding operations (CAFOs) are exempt from compliance with the CAA.<sup>179</sup> Even if the EPA promulgates a rule that includes agriculture, Congress consistently passes appropriation limits prohibiting the EPA from enacting any GHG emissions limits applicable to livestock operations.<sup>180</sup>

There is significant potential for innovation at the federal level. Historically, soil protection has fallen under the jurisdiction of the USDA.<sup>181</sup> In recent years, the USDA’s National Resource Conservation Service has promoted the fostering of soil carbon as an important farming practice.<sup>182</sup> USDA On-Farm Conservation Innovation Trials—a newly authorized

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come from the surrounding states, meaning the EPA’s Methane Rule protects our public health and addresses climate change.); Eric Lipton, *As Trump Dismantles Clean Air Rules, An Industry Lawyer Delivers for Ex-Clients*, N.Y. TIMES (Aug. 19, 2018), <https://www.nytimes.com/2018/08/19/us/politics/epa-coal-emissions-standards-william-wehrum.html>.

176. U.S. Cover Note, *INDC and Accompanying Information*, *supra* note 170; *Regulations for Greenhouse Gas Emissions from Passenger Cars and Trucks*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-greenhouse-gas-emissions-passenger-cars-and> (last updated Sept. 19, 2019).

177. John Verheul, *Methane as a Greenhouse Gas: Why the EPA Should Regulate Emissions from Animal Feeding Operations and Concentrated Animal Feeding Operations Under the Clean Air Act*, 51 NAT. RESOURCES J. 163, 178–79 (2011).

178. See CAROLYN BETTS LIEBRAND & K. CHARLES LING, COOPERATIVE APPROACHES FOR IMPLEMENTATION OF DAIRY MANURE DIGESTERS, at iv, 5 (Apr. 2009) (explaining anaerobic digestion).

179. Claudia Copeland, *Animal Waste and Water Quality: EPA Regulation of Concentrated Animal Feeding Operations (CAFOs)* 1 (2010).

180. Shannon L. Ferrell et al., *ALA Symposium Presenters: The Future of Agricultural Law: A Generational Shift*, 18 DRAKE J. AGRIC. L. 107, 118 (2013).

181. See Soil Conservation and Domestic Allotment Act, Pub. L. No. 74-46, 49 Stat. 163, 163–64 (1935) (creating the Soil Conservation Service (SCS) within the U.S. Department of Agriculture (USDA) and declaring the federal government bears permanent responsibility for reducing water and wind erosion of the nation’s soils).

182. See *supra* text accompanying notes 40, 51–53.

initiative of the 2018 Farm Bill—support “more widespread adoption of innovative approaches, practices, and systems on working lands.”<sup>183</sup> Farm Bill Programs provide e-payments to producers “to offset the financial risk of implementing innovative approaches.”<sup>184</sup> “The Soil Health Demo Trial [] component of On-Farm Trials focuses exclusively on implementation of conservation practices and systems that improve soil health.”<sup>185</sup> Other collaborations have been fruitful, for example, to preserve the Prairie Pothole Region, a critical wildlife habitat in North Dakota, the USDA NRCS teamed up with private and NGO partners to create “a carbon credit system for private landowners in North Dakota who agree to avoid tillage of grasslands.”<sup>186</sup>

Despite the numerous conservation programs found in the Farm Bill, this legislation should be used to further promote carbon farming. Farmers argue that government programs, like the Farm Bill, pit production goals against conservation measures; in their view, adoption of conservation practices is a financially unsound decision, especially when so many farmers are losing money to low-commodity prices and raised tariffs.<sup>187</sup> For example, the Farm Bill could finance farmers who follow the NRCS practices that advance carbon farming; a farm that adopts several production-based conservation practices would receive more financing and would be likely to store more carbon.<sup>188</sup> In addition, a justification for financing conservation practices should be because the practice bolsters soil (an argument which is not politicized), and not because practice helps store carbon and mitigates climate change (an argument which is politicized).<sup>189</sup> Likewise, farmers should focus on the adoption of five categories of agricultural practices that “generate collateral environmental and social benefits: conservation tillage; keeping roots in the ground all year (like using cover crops); using livestock for environmental services like managed grazing; adding crops into rotations; and producing renewable energy.”<sup>190</sup> Finally, soil’s carbon-storing capacity would increase substantially if other

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183. See *Conservation Innovation Grants*, U.S. DEPT. AGRIC. NAT. RESOURCES CONSERVATION SERV., [https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/cig/?cid=nrcs143\\_008205](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/cig/?cid=nrcs143_008205) (last visited Mar. 10, 2020).

184. *Id.*; see also *Farm Bill*, U.S. DEPT. AGRIC. NAT. RESOURCES CONSERVATION SERV., <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/farmland/> (last visited Mar. 10, 2020) (summarizing the Environmental Quality Incentives Program (EQIP), the Conservation Stewardship Program (CSP), and the Agricultural Management Assistance program (AMA)).

185. *Conservation Innovation Grants*, *supra* note 183; see also *Agriculture Improvement Act*, Pub. L. No. 115-334, 132 Stat. 4490, 4563 (2018).

186. Cigi Taylor, *Conservation Innovation Grant Produces Carbon Farming Opportunities in N.D.*, U.S. DEP’T AGRIC., <https://www.nrcs.usda.gov/wps/portal/nrcs/detail/?cid=stelprdb1193341> (last visited July 1, 2019) (partners including “The Climate Trust, American Carbon Registry, The Nature Conservancy, Environmental Defense Fund and Terra Global Capital helped support the project.”).

187. See Leonard & Russell, *supra* note 84 (noting “[f]or pennies a meal, the federal government can incentivize better environmental services.”).

188. See *id.*

189. See Peter Lehner & Nathan A. Rosenberg, *Legal Pathways to Carbon Neutral Agriculture*, 47 ENVTL. L. REP. 10845, 10785–86 (2017).

190. See Leonard & Russell, *supra* note 84.

agencies jointly interested in energy and agriculture began researching carbon farming's potential. For example, the Defense Advanced Research Projects Agency, a U.S. government agency that provides research support for innovative energy technologies, and others, like the DOE and the EPA, could collaborate with USDA to improve, through research and education, crops' capacity to transfer carbon to the soil.<sup>191</sup>

A Carbon Farming Certification would provide farmers with leverage to help the U.S. federal government with its reporting requirements for several climate change emissions targets.<sup>192</sup> Also, if more farms were incentivized to adopt regenerative agricultural practices that enrich their soils, farms would become more productive over time.

In comparison, only a few EU member states have soil legislation. While not subject to a comprehensive and coherent set of rules, the EU has made modest strides toward establishing soil policy. The European Commission stated that, "The continued unsustainable use of soils is compromising the Union's domestic and international biodiversity and climate change objectives."<sup>193</sup> In September 2006, the European Commission adopted a Soil Thematic Strategy, including a proposal for a Soil Framework Directive, recognizing that soil degradation is a serious challenge and providing an objective to protect soils across the EU.<sup>194</sup> Though, ultimately, the Framework Directive was withdrawn, the EU launched the Seventh Environment Action Programme in 2014, providing that by 2020 land in the EU will be managed sustainably, soil will be adequately protected, and remediation of contaminated sites will be underway.<sup>195</sup> The Seventh Environment Action Programme "commits the EU and its Member States to increasing efforts to reduce soil erosion and increase soil organic matter and to remediate contaminated sites."<sup>196</sup> A 2017 study, documenting all national legislation on soil preservation, shows that "only a few EU member states have specific legislation on soil protection . . . [However] [e]xisting EU policies in [complementary] areas such as agriculture, water, waste, chemicals, and prevention of industrial pollution do indirectly contribute to the protection of soils."<sup>197</sup>

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191. *Rhizosphere Observations Optimizing Terrestrial Sequestration*, U.S. DEP'T ENERGY (Dec. 15, 2016), <https://arpa-e.energy.gov/?q=arpa-e-programs/roots>.

192. *See Pledges and Targets*, CLIMATE ACTION TRACKER (Dec. 2, 2019), <https://climateaction-tracker.org/countries/usa/pledges-and-targets/> (summarizing U.S. pledges and targets for reducing greenhouse gas emissions).

193. *Soil*, EUR. COMMISSION, [http://ec.europa.eu/environment/soil/index\\_en.htm](http://ec.europa.eu/environment/soil/index_en.htm) (last updated July 8, 2019).

194. SCIENCE FOR ENVIRONMENT POLICY, 5 IN-DEPTH REPORT—SOIL CONTAMINATION: IMPACTS ON HUMAN HEALTH 5 (2013) (report produced for the European Commission DG Environment).

195. *Soil*, *supra* note 193.

196. *Id.*

197. *Id.*; *see also* ECOLOGIC INSTITUTE, FINAL REPORT: UPDATED INVENTORY AND ASSESSMENT OF SOIL PROTECTION POLICY INSTRUMENTS IN EU MEMBER STATES 21–24 (2017).

## 2. State Legislation

Carbon farming innovation in the United States is typically found outside of the federal level.<sup>198</sup> At the state and substate levels, support for carbon farming has been fueled by a desire for a stronger response to climate change, individual state-level climate commitments, and state climate vulnerability.<sup>199</sup>

Many initiatives at the substate levels were launched in 2017, when the Trump Administration announced its intention to withdraw the United States from the Paris Agreement by late 2020, and when other countries were falling short of their climate targets.<sup>200</sup> In 2017, California Governor Jerry Brown and former New York City Mayor Michael Bloomberg launched America's Pledge, an initiative bringing together thirty mayors, three governors, over eighty university presidents, and one hundred businesses to maintain the Paris Accord targets.<sup>201</sup> The Global Climate Action Summit in 2018 saw a wave of ambitious, new climate announcements from subnational actors from around the world—including officials from U.S. states, regions, cities, businesses, investors, and civil society.<sup>202</sup> The Global Climate Action Summit collectively offered over 500 commitments across five priority areas: healthy energy systems, inclusive economic growth, sustainable communities, land and ocean stewardship, and

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198. See *Country Summary*, CLIMATE ACTION TRACKER, <https://climateactiontracker.org/countries/usa/> (last visited July 1, 2019) (noting, “[a]t the subnational level, some cities, states, businesses, and other organisations are taking action” to the extent that, if “non-state and subnational targets were fully implemented, these measures could come within striking distance of the US Paris Agreement commitment.” Moreover, “22 states, 550 cities, and 900 companies with operations in the US have made climate commitments, and all 50 states have some type of policy that could bring about emissions reduction.”).

199. See *America's Pledge, Phase 1 Report: States, Cities, and Businesses in the United States Are Stepping Up on Climate Action*, BLOOMBERG PHILANTHROPIES 9, 37–38, 83 (2017).

200. See *Country Summary*, *supra* note 198 (providing accurate climate tracking targets for the Paris Accord).

201. See *About America's Pledge*, AMERICA'S PLEDGE ON CLIMATE, <https://www.americaspledgeonclimate.com/about/> (last visited Mar. 11, 2020); see also *Accelerating America's Pledge: Going All-In to Build a Prosperous, Low-Carbon Economy for the United States*, AMERICA'S PLEDGE ON CLIMATE, <https://www.americaspledgeonclimate.com/accelerating-americas-pledge-2/> (last visited Mar. 11, 2020) (defining the America's Pledge as a “bottom up” movement aimed to meet the U.S. commitment to the Paris Agreement, with no federal government support, that includes over 3,000 cities, states, businesses, and other groups among its members); *Country Summary*, *supra* note 198.

202. *UN Climate Action Summit 2019*, CLIMATE ACTION, <https://www.un.org/en/climatechange/un-climate-summit-2019.shtml> (last visited Mar. 11, 2020).

transformative climate investments.<sup>203</sup> Twenty-five states have joined the U.S. Climate Alliance Challenge.<sup>204</sup>

Some state-level support for carbon farming comes from a willingness to pay farmers to adopt regenerative agriculture practices as part of a state's carbon reduction program.<sup>205</sup> While the U.S. government has not yet implemented a nationwide cap-and-trade program for carbon dioxide, several states have developed these markets, along with legislation that promotes healthy soil practices designed to mitigate climate change.<sup>206</sup> The Soil Health Institute compiled a list of legislative efforts, and some key findings are illustrated in Table 2, below.<sup>207</sup> The legislative highlights include California's Healthy Soils Initiative, which provides carbon farmers financial support, including climate-mitigation funds for compost and thirty-four other soil-improving practices approved by the NRCS.<sup>208</sup>

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203. Leila Mead, *GCAS Inspires New Climate Commitments, Urges National Governments to Step Up Climate Action by 2020*, SDG KNOWLEDGE HUB (Sept. 18, 2018), [sdg.iisd.org/news/gcas-inspires-new-climate-commitments-urges-national-governments-to-step-up-climate-action-by-2020/](https://sdg.iisd.org/news/gcas-inspires-new-climate-commitments-urges-national-governments-to-step-up-climate-action-by-2020/) (over one-hundred cities, states, and businesses have committed to achieving carbon neutrality by 2050, including over seventy big cities such as Accra, Los Angeles, Tokyo, and Mexico City. The action by these cities will cut global emissions by 2.5% annually. Moreover, the number of companies committing to science-based emission reduction targets witnessed an increase to 488—up by almost 40% from last year.).

204. See *Alliance Principles*, U.S. CLIMATE ALLIANCE, <http://www.usclimatealliance.org/alliance-principles> (last visited Mar. 11, 2020).

205. See Brianna J. Schroder, *Regenerative Agriculture and Livestock*, JAZEN AG L. (July 26, 2019), <https://www.aglaw.us/schroeder-ag-law-blog/2019/7/26/regenerative-agriculture-and-livestock>.

206. See *id.*

207. See *Soil Health Policy Resources Catalog*, SOIL HEALTH INST., <https://soilhealthinstitute.org/resources/catalog/> (last visited Mar. 11, 2020).

208. See *Healthy Soils Program*, CAL. DEP'T FOOD & AGRIC., <https://www.cdffa.ca.gov/oefi/healthysouils/> (last visited Jan. 27, 2020); see also *GHG and Carbon Sequestration Ranking Tool*, U.S. DEP'T AGRIC., <https://www.nrcs.usda.gov/wps/portal/nrcs/detail-full/national/air/?cid=stelprdb1044982> (last visited Mar. 11, 2010) (listing and ranking NRCS approved practice standards for greenhouse gas emission reduction and carbon sequestration).

**Table 2.** Key Elements of Existing/Proposed Soil Health Laws (2019).

State	Goal for Water Quality or Quantity	Goal to Curb Climate Change	Other Goals	Healthy Soil Definition	Specific Practices Identified	Committee, Task Force, or Coordinated Agencies	Research or Education	Technical Assistance	Funding Assistance or Financial Stream
CA	√	√	Yields, Erosion, Air	√	No-Till, Cover Crops, Compost, Grazing	√	√	√	\$7.5MM
HI	√	√	-	√	Compost, Agroforestry	√	√	√	\$25,000 for study
MD	-	√	-	√	-	DoA	√	√	-
OK	-	√	-	-	Trees, conservation, re-vegetation	√	√	Measurement	Creates Fund
UT	√	√	Productivity, Biodiversity	-	Advance Forestry, Grazing	√	-	“Encourage”	-
MA	-	-	-	Regenerative Agriculture	No Till, Cover Crops, Grazing, Integrated	√	√	√	Creates Fund
NY	√	√	Yields	Carbon Farming	Refers to COMET	-	√	Certificate	Tax Credit
VT	√	√	Resilience	Performance Based	No Synthetic Chemicals	√	-	Certificate	Marketing Program

Source: Author compilation.<sup>209</sup> (-) denotes none specified.

Finally, states and other substate entities are supporting carbon farming and other climate initiatives due to the direct effects of climate variability.<sup>210</sup> States engage in climate initiatives when they have something at stake: to protect state interests or to engage with multijurisdictional projects implicating critical geographical points (e.g., coastlines, estuaries, wildlife habitats). For example, the Secretary of the Environment for the State of Maryland highlights the importance of focusing not only on Maryland but also on the Chesapeake Bay—the nation's largest estuary.<sup>211</sup> To improve water quality, Maryland is focusing on soil health and phosphorus management through a Maryland Healthy Soils Program, a pollution reduction budget, and a nutrient credit-trading system to bring more partners to the table.<sup>212</sup> The Maryland Healthy Soils Program and Maryland's nutrient credit trading system work with, rather than against, the agriculture industry—Maryland's largest industry.<sup>213</sup>

209. See Ben Lilliston, *State Soil Health Initiatives Respond to Climate Change*, INST. FOR AGRIC. & TRADE POL'Y (Feb. 10, 2019), <https://www.iatp.org/blog/201902/state-soil-health-initiatives-respond-climate-change>; *Soil Health Policy Resources Catalog*, *supra* note 207; *State Policy, SOIL SOLUTION*, <https://soilsolution.org/u-s-state-policy/> (last visited Jan. 27, 2019); *Summary of State Efforts to Promote Healthy Soils and Soil Carbon Sequestration*, REGENERATION INT'L (July 12, 2017), <https://regenerationinternational.org/2017/08/09/summary-state-efforts-promote-healthy-soils-soil-carbon-sequestration/>.

210. See *Soil Health Policy Resources Catalog*, *supra* note 207.

211. See *id.*

212. See *Soil Health Information*, MD. DEP'T AGRIC., [https://mda.maryland.gov/resource\\_conservation/Pages/Soil-Health.aspx](https://mda.maryland.gov/resource_conservation/Pages/Soil-Health.aspx) (last visited Mar. 11, 2020).

213. *Id.*



### III. SOLUTION: A NEW CARBON FARMING CERTIFICATION

Part III presents a plan for the Carbon Farming Certification. The Carbon Farming Certification is the linchpin of the network-of-resources approach, because the Carbon Farming Certification is feasible, combines many of the stakeholders participating in the network, expands the network of resources for farmers, and provides farmers access to more financing opportunities.

A Carbon Farming Certification would be placed on a farm product's label; thus, a carbon label would facilitate consumers to identify products with the smallest carbon emissions footprints and also facilitate producers to reduce the carbon emissions footprints of their products.<sup>214</sup> There is a need for the Carbon Farming Certification because existing carbon footprinting certifications do not account for carbon sequestration nor align with international goals.<sup>215</sup> A Carbon Farming Certification would be key in the “network of resources” approach to scale-up carbon farming, because a certified farm would tap into new and greater financial resources in the network.

A Carbon Farming Certification would equip consumers with knowledge to make consumer decisions with the carbon footprint of a product in mind (not only tracking carbon emissions). A Carbon Farming Certification would provide farmers with an incentive, in the form of a price premium, for their foods. Additionally, a carbon farming certification gives producers and governments—local, state, and national—a mechanism to meet corporate sustainability goals, treaty-based emissions targets, and additional financial opportunities for carbon trading. To the extent that certification initiatives promote regenerative agricultural practices and enhance soil health, they can also play an important role in maintaining global carbon sequestration capacity and, thus, in mitigating the greenhouse effect.

In practical terms, the Carbon Farming Certification presented below will be the only one available to date. The Carbon Farming Certification leverages existing certifications and uses a proven methodology to track carbon sequestration. Section III.A discusses other issues, including consumer concerns with carbon labelling, generally.

#### *A. Leveraging Existing Agricultural and Sustainability Certifications*

A future carbon farming label will have two components: (1) agricultural practices from already-existing labels used to promote soil health—such as the ‘USDA’s ‘Organic Standard Certification’ and ‘Regenerative

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214. *Following the Footprints*, ECONOMIST (June 2, 2011), <https://www.economist.com/technology-quarterly/2011/06/04/following-the-footprints> (last visited Mar. 11, 2020).

215. *Product Footprint Certification*, CARBON TR., <https://www.carbontrust.com/what-we-do/assurance-and-certification/product-footprint-certification> (last visited Mar. 11, 2020).

Agriculture Alliance's 'Regenerative Agriculture Certification'—and (2) an add-on module for tracking carbon sequestration.

### 1. Agricultural Certifications

Given that the goal of the Carbon Farming Certification is to build soil health, the agricultural practices falling under the certification will preserve the soil. The Organic Standard Certification<sup>216</sup> is primarily a soil quality certification<sup>217</sup> and is a natural fit for the Carbon Farming Certification. The soil benefits provided from organic farming techniques are proven; soils found on organic farms store away appreciably larger amounts of carbons—and for longer periods—than conventionally farmed agricultural soils.<sup>218</sup>

Yet, even when the soil benefits of organic farming are visible and scientifically grounded, organic strategies are technically complex and can have serious financial barriers.<sup>219</sup> For conventional farms that have relied on synthetic pesticides and fertilizers, rebuilding soil health the way organic standards stipulate—with compost, manure, cover crops, and other methods—takes time.<sup>220</sup> Added costs of transitioning to organic farming often include new irrigation systems and more labor-intensive approaches to weed and pest management. According to the USDA Organic Standard, conventional farmers must use organic methods for three years before they can call their products organic.<sup>221</sup> As a result, farmers may need additional financing during the conversion period.<sup>222</sup> This explains why less than 1% of U.S. farmland is certified organic, despite a 300% increase in the number of organic farms since 2002.<sup>223</sup>

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216. Products made entirely with organic ingredients are labeled “100 percent organic”; products that are 95% organic can be labeled “organic”; products that are at least 70% organic won’t get the organic seal, but can call out specific certified ingredients in statements like “made with organic oats and raisins.” U.S. DEP’T AGRIC., LABELING ORGANIC PRODUCTS (Dec. 2016).

217. See Nadia El-Hage Scialabba & Maria Müller-Lindenlauf, *Organic Agriculture and Climate Change*, 25(2) RENEWABLE AGRIC. & FOOD SYS. 158, 165 (2010) (noting that most of these studies center on the effects in developed nations, without much literature on the developing nations).

218. Organic Center, *Breakthrough Study Shows Organic Cuts Agriculture’s Contribution to Climate Change*, INTRADO GLOBALNEWSWIRE (Sept. 11, 2017), <https://www.globenewswire.com/news-release/2017/09/11/1117507/0/en/Breakthrough-study-shows-organic-cuts-agriculture-s-contribution-to-climate-change.html>.

219. ADRIAN MULLER, IOP CONF. SERIES EARTH & ENVTL. SCI, BENEFITS OF ORGANIC AGRICULTURE AS CLIMATE CHANGE ADAPTATION AND MITIGATION STRATEGY IN DEVELOPING COUNTRIES 2, 7 (Feb. 2009).

220. See Joe Fassler, *While Demand Soars Less than 1% is Certified Organic. Why Don’t Farmers Switch?*, COUNTER (Feb. 28, 2017) <https://newfoodeconomy.org/kashi-certified-transitional-organic/>.

221. See *id.*

222. See MULLER, *supra* note 219, at 7; see also El-Hage Scialabba & Müller-Lindenlauf, *supra* note 217, at 159 (noting that negative yields are mostly seen in developed countries; developing countries generally see no change in their yield or a positive change; and organic agriculture can help small farmers in developing nations as it reduces their dependency on nitrogen fertilizer, which often sees high price increases).

223. See Fassler, *supra* note 220; see also Press Release, *USDA Reports Record Growth In U.S. Organic Producers*, U.S. DEP’T AGRIC. (Apr. 4, 2016) <https://www.usda.gov/media/press->

A new certification class, “certified transitional,” is available for farmers to begin the organic certification process while collecting a price premium for their nearly organic products.<sup>224</sup> The best known transitional program is a joint initiative of Kashi—the Kellogg-owned, La Jolla-based maker of organic cereals and snack bars—and Quality Assurance International—one of the world’s largest organic certifiers.<sup>225</sup> Another label, California Certified Organic, offers an expedited organic certification program for farmers and growers that need certification in less than twelve weeks.<sup>226</sup> These labels may also appeal to companies sourcing organic but unable to find it. For example, organic food sales are projected to grow at a 7.6% rate leading up to 2025, roughly three times faster than overall food consumption growth.<sup>227</sup>

New multidimensional certifications should also be incorporated for the Carbon Farming Certification. Regenerative farming is not a new practice,<sup>228</sup> but the Regenerative Organic Certification is new concept.<sup>229</sup> The Regenerative Organic Certification is an “organic plus” label because it encompasses three certifications: pasture-based animal welfare, fairness for farmers and workers, and robust requirements for soil health and land management.<sup>230</sup> To meet the standards for the Regenerative Organic Certification, farmers must adopt a series of certifications in the course of four years.<sup>231</sup> The Regenerative Organic Alliance oversees the Regenerative

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releases/2016/04/04/usda-reports-record-growth-us-organic-producers (last visited Mar. 11, 2020) (examples of sustainable and organic certifications include: USDA Organic, UTZ, Food Alliance, Rainforest Alliance, Salmon Safe, Nespresso AAA Sustainable Quality Program, Linking Environment and Farming (LEAF), Alliance for Water Stewardship, Better Cotton Initiative, Bon Suco, Certified Sustainable Palm Oil (a/k/a Roundtable on Sustainable Palm Oil), Marine Stewardship Council (MSC), Aquaculture Stewardship Council (ASC), Marine Eco-label Japan (MEL-J), Friend of the Sea (FOS), Friend of the Earth, Naturland, 4C, Bird-Friendly Habitat, LIVE Certified, Regenerative Organic Certified, GlobalGAP, and Starbucks CAFÉ.).

224. Fassler, *supra* note 220.

225. *Id.* (noting that Kashi’s transitional certification doesn’t quite hold itself to the organic standard: a product with 70% transitional ingredients can be called “certified transitional.” A product that is only 51% transitional cannot make the claim “certified transitional,” but will still receive a transitional organic seal on kasha products.). Another study also found that organic has other carbon farming benefits. Press Release, Organic Center, *New Research Shows Organic Farming Can Curb Nitrogen Pollution* (Mar. 7, 2018) <https://www.newhope.com/news/new-research-shows-organic-farming-can-curb-nitrogen-pollution> (finding that Organic farming releases 64% less new reactive nitrogen into the environment than conventional farming, the study found, meaning that more benign, nonpolluting nitrogen remains in the soil and the atmosphere).

226. See *Expedited Certification Program*, CALIFORNIA CERTIFIED ORGANIC FARMERS, <https://www.ccof.org/documents/expedited-certification-program> (last visited Mar. 11, 2020).

227. See Press Release, John David Roeg, *Sales of Organic Food are Very Much on the Up in Western Europe and the U.S.*, RABOBANK, (Oct. 24, 2016), <https://www.rabobank.com/en/press/search/2016/rabobank-sales-of-organic-food-are-very-much-on-the-up-in-western-europe-and-the-us.html>.

228. See TARA WADE, ROGER CLAASSEN, & STEVEN WALLANDER, U.S. DEP’T AGRIC. ECON. RES. SERV., *CONSERVATION-PRACTICE ADOPTION RATES VARY WIDELY BY CROP AND REGION* (Dec. 2015).

229. See REGENERATIVE ORGANIC CERTIFIED, <https://regenorganic.org/> (last visited Mar. 11, 2020).

230. *Id.*

231. *Id.*

Organic Certification framework and guidelines, and after a pilot in 2020, the certification will launch.<sup>232</sup>

It is worthwhile to discuss the benefits and costs of the USDA Organic and Regenerative Organic certifications. With adoption rates of sustainable labelling schemes on the rise—with over a quarter of all coffee and cocoa now produced according to third-party sustainability schemes<sup>233</sup>—one might wonder why farmers would adopt these practices.

Certification schemes create a mandatory public standard (e.g., a soil standard, conservation standard, organic standard), which facilitates national pride and sovereignty and levels the playing field for smallholders.<sup>234</sup> For farmers who can afford to certify their products, certifications are used by farmers to obtain a price premium—the additional price needed to buy a higher quality product.<sup>235</sup> An organic certification is a great example of a certification that offers a price premium to farmers: organic sales soared to \$100 billion USD in 2018, earning organic sales the “top ethical label”; consumers are willing to pay more for the organic label.<sup>236</sup> Another benefit of an organic label is increased collaboration, in particular with government entities, which can be used to leverage grants or subsidies for certification costs and increase farmer and consumer knowledge, leading to preference for certified good.

The two largest roadblocks for farmers, and smaller farmers in particular, are certification costs and education. The cost to adopt a certification scheme includes the cost of the certification itself, third-party certifications, “yield delay”—expected to decrease initially, then increase—to convert a field to meet certification standards, and the cost of converting to the certifications (e.g., new irrigation systems and more labor-intensive approaches to weed and pest management). Certification costs are especially severe for soil components because the soil takes a long time to turn over and reach the required standards.<sup>237</sup> Farmers may be able to offset certification costs by joining a co-op such as Fairtrade, who certifies a farmer group or a co-op.<sup>238</sup> Another cost barrier to certification for co-ops is that sales in organic incur a payment delay.<sup>239</sup>

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232. *Id.*

233. See *Sustainable Foods Summit 2019 Key Outcomes*, NEW HOPE NETWORK (Jul. 25, 2019), <https://www.newhope.com/news/sustainable-foods-summit-2019-key-outcomes>.

234. See Pieter Glasbergen, *Smallholders Do Not Eat Certificates*, 147 *ECOLOGICAL ECON.* 243, 247 (2018).

235. See *id.* at 246 (RSPO, Fairtrade, MSC\*, UTZ, and Bird-Friendly all provide price premiums).

236. See Karen Asp, *Is the Organic Label as Valuable as You Thought?*, NYC FOOD POL’Y CTR. (Dec. 6, 2018), <https://www.nycfoodpolicy.org/is-the-organic-label-as-valuable-as-you-thought/>.

237. See Patrick Clark & Luciano Martínez, *Local Alternatives to Private Agricultural Certification in Ecuador: Broadening Access to ‘New Markets’?*, 45 *J. RURAL STUD.* 292, 298–301 (2016) (highlighting challenges to the Participatory Guarantee System in Pichincha because farmers are “unable to meet technical standards for agro-ecology” as required by the system).

238. See Brian Chiputwa, David J. Spielman & Matin Qaim, *Food Standards, Certification, and Poverty Among Coffee Farmers in Uganda*, 66 *WORLD DEV.* 400, 401 (2015).

239. *Id.* at 408.

Farmers cannot always rely on receiving a price premium for a certification, although results from organic coffee and cocoa certifications show otherwise. What this means is that return on investment to certification is highly variable based on factors such as location, soil, climate, and market access. For instance, a 2017 study evaluated certified coffee with certifications such as Starbucks C.A.F.E., Fairtrade, organic, Rainforest Alliance, and UTZ to noncertified coffee.<sup>240</sup> The study showed that the average price received by a farmer for coffee with a certification was significantly higher for all of the certifications except UTZ when compared to non-certified.<sup>241</sup> Organic and Fairtrade had the highest prices—28% higher than non-certified—but UTZ had the lowest altitude, and likely lower quality coffee, which had a larger impact on coffee price; however, there is not a significant correlation between price and altitude.<sup>242</sup> Starbucks C.A.F.E. had the highest net revenue at 48%, while Fairtrade farms were 43% higher than non-certified farms, even though the cost of production was higher and the land similarly productive to non-certified farms.<sup>243</sup> An earlier 2011 study shows Fairtrade had a better price, which was also shown to be more stable, but Starbucks C.A.F.E. had a higher yield and quality performance.<sup>244</sup> Given price premium volatility, some certifications have taken to offering a “premium fee,” regardless of the price premium.<sup>245</sup>

In terms of environmental impact, there is a significant benefit to having a certification when it comes to carbon stock, biodiversity, soil, and water.<sup>246</sup> An education campaign is necessary on the farmer and consumer sides of the certification for three primary reasons.

First, farmers may not recognize the difference between standards and know that they participate but not in which one, or may not understand the benefits of sustainable farming for their farm and crops.<sup>247</sup> The educational barrier creates a challenge around the willingness and ability to change.<sup>248</sup> The lack of willingness stems from a lack of knowledge and

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240. See Jeremy Haggard et al., *Environmental-Economic Benefits and Trade-Offs on Sustainably Certified Coffee Farms*, 79 *ECOLOGICAL INDICATORS*, 330, 331–32 (2017).

241. *Id.* at 333; see also BETTER COTTON INITIATIVE, <https://bettercotton.org/> (last visited Mar. 11, 2020) (noting cost savings for certifications that use a “train the trainer” model which provides the opportunity to decrease the cost of certification as people are trained down the supply chain and at various levels. This removes paying for an expensive third-party to visit as there are many trainers in the area.).

242. Haggard et al., *supra* note 240, at 333–34.

243. *Id.* at 333, 336.

244. Chiputwa, Spielman & Qaim, *supra* note 238, at 401.

245. See Glasbergen, *supra* note 234, at 246. A premium fee is a premium that is paid to the farmer for participating in the certification scheme, and it allows farmers to live a better life and will enable more farmers to become certified, contributing to improving the environment. Chiputwa, Spielman & Qaim, *supra* note 238, at 401–02. For example, Fairtrade guarantees farmers a minimum floor price whenever the international free market price falls below the threshold. RSPO, Fairtrade, MSC\*, UTZ, and Bird-Friendly give premium fees. Rainforest Alliance does not guarantee a minimum price but states that farmers often generate a significant higher price for their crops.

246. See Haggard et al., *supra* note 240, at 332–33.

247. Chiputwa, Spielman & Qaim, *supra* note 238, at 409.

248. *Id.* at 404.

information on more sustainable production, and the fact that technical guidelines can be complex.<sup>249</sup> In a study of Nicaraguan farmers, those who had UTZ or Starbucks C.A.F.E. certifications had a secondary or technical education.<sup>250</sup> Additionally, large-scale farmers are more likely to enter into Rainforest Alliance and Starbucks C.A.F.E, while Fairtrade and Organic are promoted by an NGO and social enterprise focusing on smaller, more disadvantaged farmers.<sup>251</sup>

Second, education on the certifier's side is also needed. Certifications are industry-driven, in combination with a government agency and/or environmental NGO, but have minimal input from smallholders, which can lead to the perception that the certification is culturally nonresponsive.<sup>252</sup>

Third, from the consumer side, a Carbon Farming Certification presents another challenge: climate certifications are not widely recognized by consumers compared to other eco-labels.<sup>253</sup> A 2010 survey conducted by a British consumer group found that only a fifth of British shoppers recognized the carbon footprint label, compared with recognition rates of 82% for Fairtrade and 54% for organic labelling.<sup>254</sup> This is intuitive as carbon labelling is a much more recent development—organic labelling dates back to the 1970s and Fairtrade to the late 1980s—and accurate carbon footprinting is still a work in progress.<sup>255</sup> A Carbon Farming Certification label is a complex, and often costly, process that involves tracing its ingredients back up their respective supply chains and through their manufacturing processes to evaluate their associated emissions.<sup>256</sup> According to 3M—an American industrial giant that makes over 55,000 different products—retracing a product through its supply chain can cost \$30,000 for a single product.<sup>257</sup> To further complicate matters, different carbon footprinting and labelling standards have emerged in different countries, preventing direct comparisons between the various types of label.<sup>258</sup> In Britain, a pioneer in carbon labelling, nine out of ten households bought products with carbon labels last year for more than \$3.1 billion.<sup>259</sup> However, most consumers did so unwittingly.<sup>260</sup> This exceeded the \$1.8 billion in organic product sales and \$980 million in Fairtrade product sales. Britain's higher sales is largely due to Tesco's, Britain's biggest retailer,

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249. See Rachel Cernansky, *We Don't Have Enough Organic Farms. Why Not?*, NAT'L GEOGRAPHIC (Nov. 20, 2018), <https://www.nationalgeographic.com/environment/future-of-food/organic-farming-crops-consumers/#close>.

250. Hagggar et al., *supra* note 240, at 333.

251. *Id.* at 335–36.

252. See Wilf Swartz et al., *Searching for Market-Based Sustainability Pathways: Challenges and Opportunities for Seafood Certification Programs in Japan*, 76 MARINE POL'Y 185, 185 (2016).

253. See generally Marks, *supra* note 169, at 602–03.

254. *Following the Footprints*, *supra* note 214.

255. *Id.*

256. *Id.*

257. *Id.*

258. *Id.*

259. *Id.*

260. *Id.*

addition of carbon labels to more than 100 of its own-brand products including pasta, milk, orange juice, and toilet paper.<sup>261</sup>

## 2. Sustainability Certifications

Given the costs and benefits of certifications, a Carbon Farming Certification would accomplish two goals: (1) measure and track carbon sequestration and (2) track adoption of a list of organic or regenerative agricultural farming principles. Theoretically, a Carbon Farming Certification could be managed and owned by an organic certification or a regenerative agriculture certification, in which case a soil carbon metric could be an add-on to either the organic or regenerative certifications.<sup>262</sup> The successful Swedish Climate Label is a certification that successfully incorporates a climate metric to a preexisting organic certification. A carbon sequestration model does not currently exist; however, an example of a certification with an add-on climate module is the Sustainable Agriculture Network (SAN) certification.<sup>263</sup> The proposed Carbon Farming Certification does not use the SAN model because the climate module reference material mentions that the add-on climate module “is not intended to be a carbon footprinting or life cycle analysis methodology, nor a ‘carbon neutral’ module or label, and does not attempt to generate carbon offsets.”<sup>264</sup> The Carbon Farming Certification uses a carbon sequestration model.

Among the metrics discussed earlier, the COMET-Planner<sup>TM</sup> was developed to explicitly track carbon emissions and sequestration.<sup>265</sup> Other tools, like farm-level calculators (e.g., the Cool Farm Tool),<sup>266</sup> do not measure carbon sequestration. The SAN Rainforest Alliance<sup>267</sup> Climate Module, and other certification systems, (e.g., UTZ Certified, Fairtrade Labelling Organization) are considering climate add-ons for specific crops but have not finalized plans.<sup>268</sup>

A review of certification best practices provides a list of such practices for those seeking a new certification. Many noteworthy certifications are members of the ISEAL Alliance and conform to ISEAL’s Code of Good Practice and benchmarks against international standards (like United Nations Sustainable Development Goals).<sup>269</sup> For example, the Marine Stewardship Council (MSC) used the Forest Stewardship Council to develop its standards and benchmarks against the U.N.’s FAO guidelines and

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261. *Id.*

262. *See, e.g.,* REGENERATIVE ORGANIC CERTIFIED, *supra* note 229.

263. SUSTAINABLE AGRIC. NETWORK, SAN CLIMATE MODULE CRITERIA FOR MITIGATION AND ADAPTATION TO CLIMATE CHANGE 7 (2011).

264. *Id.*

265. COMET PLANNER, <http://comet-planner.com/> (last visited Apr. 24, 2020).

266. *Cool Farm Tool*, FCRN, <https://www.fcrn.org.uk/research-library/cool-farm-tool> (last visited Mar. 12, 2020).

267. *See* SUSTAINABLE AGRIC. NETWORK, *supra* note 263, at 5.

268. *Id.*

269. *See* ISEAL ALLIANCE, SUSTAINABILITY BENCHMARKING GOOD PRACTICE GUIDE 19 (July 2019).

is an ISEAL organization.<sup>270</sup> MSC was also the first global seafood certification to achieve Global Sustainable Seafood Initiative recognition.<sup>271</sup> Rainforest Alliance (a/k/a IMAFLORA in Brazil and NEPCo in Europe) benchmarks against the Sustainable Action Network and is an ISEAL organization.<sup>272</sup> Nespresso AAA Sustainable Quality Program benchmarks against Rainforest Alliance, the U.N. Sustainable Development Goals, and the SAN.<sup>273</sup> The Global Coffee Platform benchmarks against the U.N. Sustainable Development Goals and is an ISEAL Alliance member.<sup>274</sup>

The Global Coffee Platform, UTZ, Rainforest Alliance, ISEAL, and COSA are aligning sustainability metrics in the coffee sector with the Coffee Data Project initiatives.<sup>275</sup> The Coffee Data Project aims to “develop a technical standard for common metrics to facilitate data interoperability and exchange for collective impact reporting, based on a structured repository of most commonly used indicators, related to the ISEAL Common Core Indicators and the [Sustainable Development Goal] indicators.”<sup>276</sup> The Coffee Data Project is a one-year project that focuses on farm-level sustainability performance data and aims to have the standard piloted in February of 2019.<sup>277</sup> Unfortunately, this project does not seek to include carbon emissions nor carbon sequestration measurement, but it does include a measurement of soil erosion.<sup>278</sup>

In sum, this Article’s Carbon Farming Certification is a key feature of a network-of-resources approach to scale-up carbon farming, as it would align consumer and producer incentives. A Carbon Farming Certification would provide consumers with more accurate information on carbon farming; provide farmers with an incentive and price premium for their foods; and provide producers and local, state, and national governments with a means to achieve emissions targets and opportunities for carbon trading. A Carbon Farming Certification label would include the soil practices under the Organic Standard and Regenerative Organic Standard and a soil carbon metric, perhaps coming from the COMET-Farmer

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270. *How We Meet Best Practice*, MARINE STEWARDSHIP COUNCIL (June 2018), <https://www.msc.org/about-the-msc/how-we-meet-best-practice>.

271. Press Release, Marine Stewardship Council, MSC is the First Global Seafood Certification to Achieve GSSI Recognition (Mar. 14, 2017), <https://www.msc.org/en-au/media-centre-anz/press-releases/msc-is-the-first-global-seafood-certification-to-achieve-gssi-recognition>.

272. See *The Positive Cup*, NESTLE NESPRESSO, <https://www.nestle-nespresso.com/sustainability/the-positive-cup> (last visited Jan. 18, 2020); see also DEANNA NEWSOM & JEFFREY C. MILDER, RAINFOREST ALLIANCE IMPACTS REPORT 13 (June 2018).

273. See *Nespresso AAA Sustainable Quality™ Program: A Triple-Win Collaboration Between Nespresso and the Rainforest Alliance 2013*, NESPRESSO, <https://www.nestle-nespresso.com/newsandfeatures/nespresso-aaa-sustainable-quality-tm-program-a-triple-win-collaboration-between-nespresso-and-the-rainforest-alliance> (last visited Mar. 12, 2020).

274. *Id.*

275. See generally *Coffee Data Project*, GLOBAL COFFEE PLATFORM (July 17, 2018), <https://www.globalcoffeeplatform.org/resources/coffee-data-project>.

276. GLOBAL COFFEE PLATFORM DEMONSTRATING COLLECTIVE IMPACT IN THE GLOBAL COFFEE SECTOR: A PROJECT ON INDICATOR ALIGNMENT (July 2018).

277. *Id.*

278. See generally INT’L INST. FOR SUSTAINABLE DEVEL., SEEKING SUSTAINABILITY COSA PRELIMINARY ANALYSIS OF SUSTAINABILITY INITIATIVES IN THE COFFEE SECTOR (2008).



program or similar farm-level carbon-tracking tool. The carbon metric tool would harmonize with the product specific ISO 14067—which today only focuses on emissions—or the ISO 14040, which covers broader environmental product life cycle without addressing land use.<sup>279</sup>

### *B. Leveraging Existing Metrics for Tracking Carbon Emissions*

The most reputable certifications, like International Standardization Organization certifications, are backed up by third-party audits, conducted by accredited independent auditors, to verify compliance with metrics defined in the certification.<sup>280</sup> Consumers who purchase certified foods rely on certifications as indicators of a certain characteristic.<sup>281</sup> For example, the carbon metric for gluten-free-identified foods would be the amount of gluten in a food product.<sup>282</sup> As the demand for eco-friendly and sustainable foods continues to rise, consumers are demanding more carbon footprinting data for the purchases they make.<sup>283</sup> To meet this demand, companies search for identifiable and measurable metrics, certification for the metrics, and an enforcement mechanism to be able to label their products as “climate-friendly.”<sup>284</sup> The next generation of carbon footprinting methodologies should track not only carbon emissions but also carbon sequestration.

#### 1. Measuring Carbon Emissions

One significant challenge in understanding and enhancing food system sustainability is a lack of comprehensive tools that quantify economic and environmental benefits for farmers to identify farm management options. Similar to efficiency ratings for household items such as refrigerators (e.g., Energy Star in the United States or Nordic Swan in Sweden),<sup>285</sup> and other consumer goods, climate labels for food are starting to enter the market. This Section begins by discussing carbon footprinting methodologies and the global standards and technologies that have

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279. See generally CARBON TR., PRODUCT CARBON FOOTPRINTING: THE NEW BUSINESS OPPORTUNITY (Oct. 2008).

280. See generally *What is Auditing?*, ASQ, <https://asq.org/quality-resources/auditing> (last visited Feb. 3, 2020).

281. *Why Get Certified?*, GLUTEN-FREE CERTIFICATION ORG., <https://gfco.org/get-certified/why-get-certified/> (last visited Mar. 12, 2020).

282. *Id.*

283. *Calculate Your Carbon Footprint*, NAT. CONSERVANCY, <https://www.nature.org/en-us/get-involved/how-to-help/consider-your-impact/carbon-calculator/> (last visited June 1, 2019); see also *Carbon Labelling Policies*, WORLD FUTURE COUNCIL (June 2, 2014), <https://www.worldfuturecouncil.org/carbon-labelling-policies/> (noting that, in Europe, a “Eurobarometer survey showed that for an overwhelming majority of Europeans (83 percent) the impact of a product on the environment plays an important aspect in their purchasing decisions.”).

284. Joe Bowman, *Climate Change: Green Branding—Cashing in on the Eco-Market*, WIPO MAG. (Apr. 2008), [https://www.wipo.int/wipo\\_magazine/en/2008/02/article\\_0003.html](https://www.wipo.int/wipo_magazine/en/2008/02/article_0003.html).

285. *Find Energy Star Products*, ENERGY STAR, <https://www.energystar.gov/products?s=mega> (last visited Feb. 3, 2020); see also *All Ecolabels on Food*, ECOLABEL INDEX, <http://www.ecolabelindex.com/ecolabels/?st=category,food> (last visited Mar. 12, 2020).

developed to facilitate this market; this Section ends by introducing the carbon footprinting methodologies of the future.

As of 2006, a standard approach to measuring product carbon footprints did not exist—nor did a credible means to communicate product carbon footprints to consumers.<sup>286</sup> Today there are various metrics to track GHG emissions as well as evolving tools to track carbon sequestration and land use.<sup>287</sup> International standards and technology are evolving quickly to provide countries, industries, and sectors with more sophisticated and accurate GHG emissions tracking for food at the producer and product levels.

The practice of adding labels to foods and other products that display the quantity of carbon emissions associated with making and transporting them began in 2007 when the Carbon Trust, a not-for-profit company set up by the U.K. government, placed two certifications on packages of food on the market.<sup>288</sup> The Carbon Trust label is a producer-label and appears on the packaging or website of a product as a symbol.<sup>289</sup> The label includes a symbol, a black footprint, the number of CO<sub>2</sub> grams embodied by the product, and that the brand is working with the Carbon Trust to reduce its emissions.<sup>290</sup> To participate in the Carbon Trust program, the product must reduce its emissions over a two-year period or the label is lost from the packaging.<sup>291</sup> The Carbon Trust label includes all stages of production, starting from mining of raw material to product disposal, including inputs such as fertilizers and pesticides in crop production but omitting consumer use.<sup>292</sup> The Carbon Trust program approach does not currently use reference systems in its footprinting, meaning that it does not account for land-use changes in any carbon balance.<sup>293</sup> This means that carbon farming is not considered. For example, beef produced on savannah ranch land would be given the same carbon footprint as that produced on land previously covered in rainforest, despite the fact that deforestation leads to carbon emissions.

Among the first products to have carbon labels applied are the cheese-and-onion potato crisps by Walkers, a brand owned by PepsiCo and discovered by the Carbon Trust to have a footprint of 75 grams per packet.<sup>294</sup> The information printed on the products as part of the Carbon

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286. Michael Specter, *Big Foot in Measuring Carbon Emissions, It's Easy to Confuse Morality and Science*, NEW YORKER (Feb. 18, 2008), <https://www.newyorker.com/magazine/2008/02/25/big-foot>.

287. Maria Fara, *Greenhouse Gas Emission Metrics*, FM LINK (May 2016), <https://fmlink.com/articles/greenhouse-gas-emission-metrics/>.

288. See CARBON TR., *supra* note 279, at 2, 9; see also John Thøgersen & Kristian S. Nielson, *A Better Carbon Footprint Label*, 125 J. CLEANER PRODUCTION 86, 86 (Apr. 2016).

289. Thøgersen & Nielson, *supra* note 288.

290. *Id.*

291. See CARBON TR., *supra* note 279, at 24.

292. *Id.* at 10.

293. *Id.* at 23.

294. See *Following the Footprints*, *supra* note 214.

Trust's label represents the emissions associated with: growing the potatoes, processing potatoes into crisps, packaging the crisps, delivering the packaged crisps to stores, and disposing of the packaging after use.<sup>295</sup> Providing this information to consumers facilitates the comparison of the carbon footprints of various products and allows consumers to decide whether to switch brands or products. In addition, these labels facilitate companies to improve their product carbon intensity, compete on green credentials, influence the supply chain, and move away from carbon intensive products. By 2009, thirty-four carbon footprinting schemes existed worldwide, mostly through collaborations between northern-based, multinational corporations and international NGOs.<sup>296</sup>

Carbon labelling initiatives and carbon measurement techniques are developing.<sup>297</sup> Carbon footprinting and life cycle analysis provide insight into the environmental impacts in the supply chain of a product.<sup>298</sup> Carbon footprint analysis is a subset of a complete *life cycle assessment* of a product, which, in addition to tracking GHG emissions, measures environmental impacts that are generated in the manufacture, and sometimes use of a product, to come up with a total impact on the environment. The difference between life cycle assessment and carbon footprint “relate[] to the impact categories [which are] studied.”<sup>299</sup> A carbon footprint focuses on one environmental impact category: GHG emissions (CO<sub>2</sub>), while a life cycle analysis “takes more impact categories into account, such as land use, water use and acidification.”<sup>300</sup>

Two similar standards exist for placing the number of CO<sub>2</sub> emissions on a product, keeping in mind the parameters or the scope of services used in the calculation.<sup>301</sup> First, the Publicly Available Specification (PAS) 2050, developed by the British Standards Institution in 2008 and revised in 2011, is a specification for the assessment of the life-cycle GHG emissions of goods and services.<sup>302</sup> PAS 2050 was the first consensus-based and internationally applicable standard on product carbon footprinting and formed the basis for the development of other standards internationally.<sup>303</sup>

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295. *Id.* (noting that “[n]ational averages were used to calculate the transport and disposal emissions.”).

296. *See* Glasbergen, *supra* note 234, at 243.

297. JAMES MACGREGOR, CARBON CONCERNS: HOW STANDARDS AND LABELLING INITIATIVES MUST NOT LIMIT AGRICULTURAL TRADE FROM DEVELOPING COUNTRIES, at iv (Int’l Inst. for Environment & Devel. (IIED) ed., 2010).

298. CARBON TR., CARBON FOOTPRINTS IN THE SUPPLY CHAIN—THE NEXT STEP FOR BUSINESS 7 (2006).

299. *Life Cycle Assessments & Carbon Footprints*, AGRI-FOOTPRINT, <http://www.agri-footprint.com/life-cycle-assessments-carbon-footprints/> (last visited Mar. 12, 2020).

300. *Id.*

301. *See Quantifying the Greenhouse Gas Emissions of Products PAS 2050 & the GHG Protocol Product Standard*, GREENHOUSE GAS PROTOCOL, [https://ghgprotocol.org/sites/default/files/standards\\_supporting/GHG%20Protocol%20PAS%202050%20Factsheet.pdf](https://ghgprotocol.org/sites/default/files/standards_supporting/GHG%20Protocol%20PAS%202050%20Factsheet.pdf) (last visited Mar. 3, 2020). Other life cycle assessment standards include: ISO 14040, ISO 14044, and ISO 14064-3. United Nations Statistics Division, Carbon Dioxide Information Analysis Center, U.S. Environmental Protection Agency, U.S. Department of Energy.

302. *Id.*

303. *Id.*

Importantly, in PAS 2050 soil carbon is excluded unless provided for in supplementary requirements.<sup>304</sup> Second, the Greenhouse Gas Protocol was developed by two environmental organizations, the World Resources Institute and the World Business Council for Sustainable Development.<sup>305</sup> The Greenhouse Gas Protocol goes beyond the PAS to include requirements for public reporting. Finally, the International Standards Organization developed ISO 14064 and ISO 14067. ISO 14064 was developed for quantifying GHG emissions at the company level,<sup>306</sup> while ISO 14067 was developed for quantifying the carbon footprint of products.<sup>307</sup> These standards either measured emissions at a company-level rather than a product level (e.g., the GHG Protocol and ISO 14064) or covered broader environmental product life-cycle measurement but did not address issues unique to GHG emissions such as land use or aircraft emissions (e.g., ISO 14040, 14044).<sup>308</sup> In the ISO 14067 Product Standard, soil carbon is included but is not a requirement—it can be included in the inventory results if companies can reasonably measure it.

With respect to the environmental impacts assessment portion of Carbon Footprint Analysis, several organizations within Europe are developing methodologies to assess the environmental footprints of foods at the producer level and product level. The European Food Sustainable Consumption and Production Round Table (the Round Table) is an initiative cochaired by the European Commission and food supply chain partners and supported by the U.N. Environment Programme, and European Environment Agency. Participation in the Round Table is “open to consumer representative organizations and environmental/nature conservation NGOs.”<sup>309</sup> Currently, the Round Table is developing a methodology for assessing the environmental footprint of individual food and drink items.<sup>310</sup> The Round Table “promotes a science-based, coherent approach to sustainable consumption and production in the food sector across Europe, while taking into account environmental interactions at all stages of the food chain.”<sup>311</sup>

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304. *Id.*

305. *Id.*

306. See INTERNATIONAL STANDARDS ORGANIZATION, ISO 14064-1:2018 GREENHOUSE GASES (2018).

307. See INTERNATIONAL STANDARDS ORGANIZATION, ISO 14067:2018 GREENHOUSE GASES (2018).

308. See REGENERATIVE ORGANIC CERTIFIED, *supra* note 229.

309. *European Food Sustainable Consumption and Production Round Table*, LOBBY FACTS.EU, <https://lobbyfacts.eu/representative/efd3be9a8fc547d9bc6793af62f1465f/european-food-sustainable-consumption-and-production-round-table> (last visited Mar. 12, 2020).

310. DECLAN O'BRIEN, PRESENTATION AT THE EUROPEAN FOOD SUSTAINABLE CONSUMPTION AND PRODUCTION ROUND TABLE: BUILDING CONVERGENCE & PARTNERSHIP (Mar. 28, 2011).

311. *European Food Sustainable Consumption and Production Round Table*, *supra* note 309; see generally *Retail Forum for Sustainability*, EUR. COMMISSION, <https://ec.europa.eu/environment/industry/retail/about.htm> (other groups are also promoting voluntary action to reduce the environmental footprint of the retail sector and its supply chain, in addition to using more sustainable products and helping consumers buy green).

In addition to the actions undertaken by NGOs, countries have also developed their own carbon footprint programs. Forty-two states and the federal government have specific statutes to monitor and counter the effects of global climate change. “These statutes range from greenhouse gas monitoring to the creation of regional carbon markets to carbon sequestration programs.”<sup>312</sup> Sweden has been successful in developing a climate label for food. The Swedish climate labelling initiative has become the first comprehensive and country-wide policy of its kind in Europe.<sup>313</sup> The labelling initiative was developed in 2007 by KRAV, an organic farming certifier, and Swedish Seal, a subsidiary of the Federation of Swedish Farmers, with other major dairy and meat agricultural cooperatives.<sup>314</sup>

The Swedish climate labelling initiative illustrates the benefits and drawbacks to developing a label. Covering the food chain from the farm to the supermarket shelf, including distribution and packaging, the criteria has been set for meat, fish, milk, greenhouse vegetables, and agricultural crops. “Products with at least 25% greenhouse gas savings will be marked in each food category, starting with plant production, dairy and fish products.”<sup>315</sup> The Swedish climate labelling initiative was developed to encompass requirements on energy usage, nutrient balance, and slaughter age.<sup>316</sup> One positive aspect of the Swedish climate label is that it can only be used, in combination with another certification scheme (criteria are specified in the standard) that certifies components of sustainable food production (so it is an add-on, essentially).<sup>317</sup> The ability to layer certifications prevents label fatigue found in having too many labels in front of the consumer.

On the other hand, there are two issues with the Swedish climate label. First, it is difficult to include all of the climate impacts of food: how far it has traveled from farm to table, what kind of pesticides are used, and how much water was needed.<sup>318</sup> The difficulty of measuring the climate impacts of food is further complicated by plant-based substitutes, such as the soy in the product that is produced in South America.<sup>319</sup> Second, because the Swedish climate label focuses on the climate friendliest products

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312. L. Paul Goeringer & Kerri Boling, *Climate Change Statutes*, NAT’L AGRIC. L. CTR., <http://nationalaglawcenter.org/state-compilations/climate-change/> (last visited Mar. 12, 2020); see also *Climate Change Statutory Citations United States Federal Laws*, NAT’L AGRIC. LAW CTR., <http://nationalaglawcenter.org/wp-content/uploads/assets/climatechange/federal.pdf> (last visited Mar. 12, 2020) (noting a list of statutory citations).

313. See *Criteria for Mitigation of Climate Impact from Food Production and Distribution*, KLIMATMARKNING FÖR MAT, <http://www.klimatmarkningen.se/in-english>; see also Bettina Dahlbacka, SWEDISH CLIMATE LABELING BECAME CLIMATE CERTIFICATION (2010).

314. *Criteria for Mitigation of Climate Impact from Food Production and Distribution*, *supra* note 313.

315. *Sweden Introduces Climate Labelling for Food*, EURACTIVE (July 6, 2009), <https://www.euractiv.com/section/agriculture-food/news/sweden-introduces-climate-labelling-for-food/>.

316. See *Criteria for Mitigation of Climate Impact from Food Production and Distribution*, *supra* note 313.

317. See generally ÅSA BRUGÅRD KONDE ET AL., SWEDISH DIETARY GUIDELINES (2015).

318. *Id.*

319. See Marks, *supra* note 169, at 570 n.9.

within a group,<sup>320</sup> it does not facilitate consumer choice between meat and beans; instead, the Swedish climate label facilitates consumer choice of a climate friendlier option within every product category. An additional issue exists because the label only tracks GHG emissions and does not factor in carbon sequestration.

Businesses concerned about sustainability and their impact on the environment must have an accurate accounting of their carbon footprint. A company's corporate carbon footprint (CCF) shows a company's carbon balance, calculated in accordance with international standards such as the abovementioned Greenhouse Gas Protocol. Companies track carbon emissions for corporate sustainability reports, top-level management, and various stakeholders such as shareholders. More often than not, companies track carbon emissions for the purpose of marketing and profitability. Climate labelling, a rapidly emerging practice of labelling products with a company's commitment to reducing the negative climate effects in food production, allows consumers to make a conscious climate choice while also strengthening food-producer competitiveness.

Though still in their infancy, farm-level calculation tools provide farmers with the tools and data to make optimal farm management decisions. As noted earlier, most tools allow farmers to measure GHG emissions, but only one tool measures both GHG emissions *and* carbon sequestration.<sup>321</sup> The Cool Farm Tool<sup>322</sup> is an on-farm calculator for GHG emissions that intends to evaluate how different crops and farming practices affect GHG emissions. Another tool that comes closer to measuring emissions and sequestration is the food certification SAN/Rainforest Alliance with the add-on climate module.<sup>323</sup> The SAN Climate Module was launched in 2012 for use with cattle and is intended to be used as a guideline only. Reference material states that, "It is not intended to be a carbon footprinting or Life Cycle Analysis methodology, nor a 'carbon neutral' module or label, and does not attempt to generate carbon offsets."<sup>324</sup> To become *SAN Climate Module* verified, a farm must meet or increase soil carbon through a voluntary set of fifteen climate change adaptation and mitigation criteria, which supplement the existing *SAN* Standard.<sup>325</sup> Other certifications, like *UTZ Certified* and *Fairtrade Labelling Organization*, have adopted an add-on module for products like coffee, tea, cocoa, sugar,

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320. See generally KONDE ET AL., *supra* note 317.

321. USDA/NRCS Comet-Planner Tool, <http://comet-planner.com/>.

322. See *Cool Farm Tool*, *supra* note 266.

323. See SUSTAINABLE AGRIC. NETWORK, *supra* note 263, at 4; *Sustainable Agriculture Certification*, RAINFOREST ALLIANCE, <https://www.rainforest-alliance.org/business/certification/> (last visited Mar. 12, 2020) (The Sustainable Agriculture Certification, a farm-based certification offered by the Rainforest Alliance, "helps farmers produce better crops, adapt to climate change, increase their productivity, and reduce costs.").

324. SUSTAINABLE AGRIC. NETWORK, *supra* note 263, at 7.

325. *Id.* at 7–8.

soy, palm oil, and tropical products, but there are so far no published standards.<sup>326</sup>

Many of the add-on approaches track agricultural emissions. Generally, agricultural emissions are challenging to accurately measure because they present high degrees of spatial variability, from different environmental conditions on the ground and management practices, temporal variability, local weather patterns, and how farmers respond to them.<sup>327</sup> Furthermore, agricultural emissions are fugitive and, thus, “diffuse, transitory, and elusive” and can only be measured using either a bottom-up or top-down approach, neither of which is perfect.<sup>328</sup> A bottom-up approach is superior because a bottom-up approach measures the emissions from one cow to determine an emission factor, then multiplies that by the number of livestock, while a top-down approach takes ambient atmospheric measurements and then tries to attribute the emissions to their sources.<sup>329</sup>

The Digital ERP Tool is a farm-level tool developed by farmer-cooperative Land O’ Lakes. This tool aims “to help its farmer members implement sustainable management practices and increase their profitability,” and helps “food companies to measure and monitor the sustainability credentials of their supply chains.”<sup>330</sup> In 2018, Land O’ Lakes launched the Truterra Insights Engine (Truterra), a more sophisticated, interactive, fee-based, on-farm digital platform that uses soil, weather, economic, and farm management data. Truterra allows users to create customized reports, showcasing the potential impacts—conservation and economic performance—of various stewardship practices on a field-by-field level basis.<sup>331</sup> Projects in the Chesapeake Bay wheat sourcing region are piloting Truterra to measure sustainable agriculture decisions by working with agricultural advisors and the Environmental Defense Fund.<sup>332</sup>

If a farmer notices a low return on investment on fertilizer costs, possibly due to low-quality soil or drainage, the farmer can use online

326. UTZ CERTIFIED, [https://utz.org/what-we-offer/certification/products-we-certify/?gclid=EAlaIqobChMIrCf\\_POD6AIVEqvsCh1ong7QEAAAYASAAEgJEPD\\_BwE](https://utz.org/what-we-offer/certification/products-we-certify/?gclid=EAlaIqobChMIrCf_POD6AIVEqvsCh1ong7QEAAAYASAAEgJEPD_BwE) (last visited Mar. 12, 2020).

327. See generally Taylor, *supra* note 17.

328. LATTANZIO ET AL., *supra* note 24, at 23.

329. *Id.*

330. Louisa Burwood-Taylor, *Land O’ Lakes Launches Digital ERP Tool to Measure Profitability of Sustainable Farming Practices*, AGFUNDER NETWORK PARTNERS (Sept. 24, 2018), [https://agfundernews.com/breaking-land-o-lakes-launches-digital-erp-tool-to-measure-profitability-of-sustainable-farming-practices.html/?utm\\_source=AgFunder+Updates&utm\\_campaign=b1ce8a5c2c-September\\_28&utm\\_medium=email&utm\\_term=0\\_7b0bb00edf-b1ce8a5c2c-97956713&goal=0\\_7b0bb00edf-b1ce8a5c2c-97956713](https://agfundernews.com/breaking-land-o-lakes-launches-digital-erp-tool-to-measure-profitability-of-sustainable-farming-practices.html/?utm_source=AgFunder+Updates&utm_campaign=b1ce8a5c2c-September_28&utm_medium=email&utm_term=0_7b0bb00edf-b1ce8a5c2c-97956713&goal=0_7b0bb00edf-b1ce8a5c2c-97956713).

331. *Id.* (“The Stewardship report card scores fields on management stewardship—including nutrient management and pest management, soil & nutrient loss management—including nutrient leaching and soil runoff, and conservation adoption—including soil quality and water resources. The Insights Score also gives more in-depth data points including net greenhouse gas emissions, soil quality according to the soil conditioning index, and nitrogen use efficiency. The platform can also identify which part of a field measures the worst or best for each indicator.”).

332. Chris Clayton, *Minnesota Cooperative Rolls Out New Platform To Help With Conservation Practices*, PROGRESSIVE FARMER (Dec. 1, 2018, 6:01 AM), <https://www.dmpf.com/agriculture/web/ag/news/article/2019/06/18/minnesota-cooperative-rolls-new-farm>.

programs to compare the difference in profitability of maintaining that piece of land under crop or moving it into a conservation reserve program. The farmer can also try scenarios like strip tillage, post-harvest winter crop, and improved residue cover and compare side-by-side the dollar profitability of: certain practices, the stewardship performance of their farm, carbon emissions, and available revenue incentives from the federal government for cover-cropping.<sup>333</sup> These farm-level tools track GHG emissions but do not track carbon sequestration.

## 2. Measuring Carbon Sequestration

While there are many tools for measuring carbon emissions, there is only one tool for measuring carbon sequestration. The California State Coastal Conservancy Climate Ready Program cites COMET-Planner™ as the tool for measuring carbon benefits of carbon farming.<sup>334</sup> The calculator for the California State Coastal Conservancy Climate Ready Program measures carbon farming using output measurements from three distinct models: the benefits of carbon farming (COMET-Planner), carbon emissions (from Denitrification-Decomposition model and the California Climate Investments Quantification Methodology Emission Factor Database).<sup>335</sup> The COMET-Planner™ tool estimates the net GHG benefit of the proposed project.

COMET-Planner™ is one in a series of online programs that includes COMET-Farm™ and COMET-Planner™. COMET-Farm™ and COMET-Planner™ are free, online tools, designed by Colorado State University and sponsored by the USDA, that “allow farmers and ranchers to quantify their atmospheric outputs (emissions) and carbon benefits (sequestration) based on their site-specific soils, crops, and management practices.”<sup>336</sup> COMET-Farm™ is a web-based decision support system for assessing the field-level and livestock herd-level GHG balance of agricultural conservation practices in the United States.<sup>337</sup> COMET-Planner™ runs in COMET-Farm™ and is a three-click tool supporting conservation planning efforts in U.S. agriculture. While both programs are quantifiably rigorous methodologies, only COMET-Planner™ is able to calculate carbon sequestration.<sup>338</sup> COMET-Global™ extends the COMET-Farm™

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333. *Id.* (“Land O’ Lakes will start offering the product to SUSTAIN’s North American network of 30 retailers, who pay a membership fee for access to all SUSTAIN’s services.”).

334. CAL. AIR RESOURCES BOARD, QUANTIFICATION METHODOLOGY CALIFORNIA STATE COASTAL CONSERVANCY CLIMATE READY PROGRAM 4 (June 13, 2019).

335. See CCI *Quantification, Benefits, and Reporting Materials*, CA.GOV, <http://www.arb.ca.gov/cci-resources> (last visited Mar. 12, 2020).

336. *Sizing Up California’s On-Farm Carbon Footprint*, National Resources Conservation Service California, USDA, <https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ca/soils/health/?cid=nrcseprd407886> (last visited Mar. 12, 2020).

337. *COMET Farm*, National Resources Conservation Service, USDA, <http://comet-farm.nrel.colostate.edu/> (last visited Mar. 5, 2020) (follow “What information do I need?”).

338. See generally U.S. DEP’T AGRIC., COMET PLANNER: CARBON AND GREENHOUSE GAS EVALUATION FOR NRCS CONSERVATION PRACTICE PLANNING (COMET-Planner is largely derived using a sample-based approach and model runs in COMET-Farm, which utilizes USDA entity-scale



framework to land use and management systems in other parts of the world.<sup>339</sup> The Carbon Benefits Project is funded by the U.N. Global Environment Facility and provides decision support systems for assessing the GHG benefits of sustainable land use projects in developing nations.<sup>340</sup> COMET-Planner™ is unique in that it can be used to provide the metric system for a carbon farming certification, which will be outlined in the next Section.

The COMET tools come with many benefits: they are free, online, and accessible for anyone with an internet connection. More significantly, these tools harmonize with national efforts and are used by U.N. bodies to assess climate change mitigation. “Farmers who use the COMET tools will end up with a report that uses the same quantification methodologies as the US Greenhouse Gas Inventory—a national report that ultimately represents our nationwide greenhouse gas emission and carbon sequestration.”<sup>341</sup> “The National Greenhouse Gas Inventory is submitted to the United Nations on an annual basis and the report contains individual chapters on agriculture and land use.”<sup>342</sup>

As noted, the Climate Ready Program Benefits Calculator tool relies upon COMET-Planner™ for the key benefits of carbon farming, and two other models primarily to measure carbon emissions. First, the Climate Ready Program Benefits Calculator tool uses project-specific outputs from the Denitrification-Decomposition Model: a process-based computer simulation model of carbon and nitrogen biogeochemistry that was developed for quantifying carbon sequestration and emissions of greenhouse gases in agroecosystems.<sup>343</sup> The core of the Denitrification-Decomposition Model consists of microbe-mediated biochemical processes commonly occurring in terrestrial soils, and the processes simulated include decomposition, nitrification, denitrification, fermentation, and methanogenesis.<sup>344</sup> Next, emission factors for the Climate Ready Program come from the CARB repository for emission factors, referred to as the California Climate

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GHG inventory methods. *Id.* at 14. Coefficients were generalized by multicounty regions defined by USDA Major Land Resource Areas. *Id.* at 7. Emissions estimates represent field emissions only, including those associated with soils and woody biomass as appropriate, and do not include off-site emissions, such as those from transportation, manufacturing, processing, etc. *Id.* at 10–11. “COMET-Farm is a web-based, whole farm, GHG accounting systems that employs methods outlined in the USDA Methods for Entity-Scale Inventory guidance []. Estimation methods used for most GHG sources in COMET-Planner rely on advanced methods (commonly referred to as “Tier 3” methodologies in IPCC quantification methods[]), such as process-based modeling in DayCent and regionally-specific empirical calculations[].” *Id.* at 9.

339. See *COMET Global: Whole-farm GHG estimation and environmental diagnostics platform, Sustainable Agroecosystems*, ETH ZURICH, <https://sae.ethz.ch/research/CompletedProjects/CometGlobal.html>. (last visited Mar. 12, 2020).

340. See *SFM: Carbon Benefits Project (CBP): Modeling, Measurement and Monitoring*, GLOBAL ENV'T FACILITY, <https://www.thegef.org/project/sfm-carbon-benefits-project-cbp-modeling-measurement-and-monitoring> (last visited Mar. 12, 2020).

341. *Sizing Up California's On-Farm Carbon Footprint*, *supra* note 336.

342. *Id.*

343. INST. FOR THE STUDY EARTH, OCEANS, & SPACE, U. N.H., THE DNDC MODEL (last visited Mar. 12, 2020).

344. *Id.*

Investments Quantification Methodology Emission Factor Database.<sup>345</sup> Together, these three modeling tools—COMET-Planner, the Denitrification-Decomposition Model and California Climate Investments Quantification Methodology Emission Factor Database—provide the State of California with the ability to measure the net GHG benefits of specific projects.

### *C. Leveraging Carbon Farming Certification for Financial and Other Gain*

Consistent with the IPCC Report, current investment levels in addressing agriculture's impact on climate action are insufficient to drive sectoral transformation.<sup>346</sup> Agriculture, forestry, land use, and natural resource management received only \$7 billion of the total public climate finance of \$141 billion in the United States in the 2015–2016 budget year.<sup>347</sup> Innovative approaches to enhance investment flows must be pursued such as: increased private sector finance, impact investing, and blended finance.<sup>348</sup> If farmers do not receive financing for carbon farming, they may be more inclined to till the land and plant row crops, particularly in the context of high commodity prices.

While federal farm-level investments in carbon farming practices have been relatively modest, farmers are searching for new sources of financing for regenerative agriculture and carbon farming initiatives. For example, in Colorado, half of the cost of the individualized carbon farming plans for farmers or ranchers is paid for by the National Resource Conservation Service, a branch of the of the USDA, and “the other half of the cost is split between the farmer and other stakeholders.”<sup>349</sup> For farmers to purchase and implement carbon farming plans, farmers need to generate their share of the costs. If farmers want to become certified carbon farmers, this will require even more financing. Federal assistance would help to alleviate farmers of this significant cost burden.

#### 1. Carbon Credits

Where do farmers acquire financing to transition their farm to regenerative agricultural practices and pursue certification? Once certified, what financial opportunities does certification unlock? This Section presents four streams of revenue available to farmers to pursue a transition to regenerative agricultural practices, carbon farming certification, and to generate additional revenue: (1) carbon credits and investment finance, (2) insurance markets, (3) certification finance, and (4) supply chain

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345. See *CCI Quantification, Benefits, and Reporting Materials*, *supra* note 335.

346. See MARC SADLER ET AL., MAKING CLIMATE FINANCE WORK IN AGRICULTURE 1–4 (2016).

347. See BARBARA BUCHNER ET AL., GLOBAL LANDSCAPE OF CLIMATE FINANCE 2017, at 11 (2017).

348. See ANA MARIA LOBOGUERRERO ET AL., FEEDING THE WORLD IN A CHANGING CLIMATE: AN ADAPTATION ROADMAP FOR AGRICULTURE 10–11 (2018).

349. Antonacci, *supra* note 66.

incentives like forward contracting. This Section also presents legal considerations associated with each of these financial decisions.

Farmers who want to adopt carbon farming practices, and are willing to participate in the cap and trade market, are eligible to receive financing for selling verified carbon credit offsets.<sup>350</sup> As shown in the case studies below, farmers must be prepared to make a legal decision concerning their land. They must also be willing to voluntarily place lands under a perpetual easement which means retaining rights to work the land. Cap and trade commitments require decisions regarding land tenure, or who owns land, and renters may not have rights to make legal decisions concerning the land.<sup>351</sup>

To provide background on carbon credit transactions, a cap and trade program establishes a cap on total emissions and then allocates emission allowances to regulated entities. Regulated entities can buy, sell, and trade allowances but, at the end of the compliance period, entities need to surrender enough allowances to cover all of their emissions during that period.<sup>352</sup> While many countries or regions have implemented cap and trade programs, none have actually included the agricultural sector as a regulated entity under the cap. However, some have included agricultural projects in the program as offsets.

California's functioning cap and trade market includes agricultural offsets but does not include agriculture in the cap. Under Assembly Bill 32, California must reduce its emissions to 1990 levels by 2020 and make deeper reductions by 2050.<sup>353</sup> The cap and trade program covers 600 industrial facilities, but California also has complementary policies such as a low-carbon fuel standard, increasing methane capture from landfills, a tire pressure program for drivers, and decreasing diesel fuel emissions from ports by providing electricity to berthed ships.<sup>354</sup> Notably, none of California's mandatory programs cover agricultural producers who may only voluntarily participate by creating certain approved offsets. The exception to the agriculture-producer-regulatory exemption is select food

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350. *California Cap and Trade*, CTR. FOR CLIMATE AND ENERGY SOLUTIONS, <https://www.c2es.org/content/california-cap-and-trade/> (last visited Apr. 24, 2020).

351. See Marks, *supra* note 169, at 582–84 (discussing land tenure and how it affects conservation practice adoption).

352. See generally James W. Coleman, *Unilateral Climate Regulation*, 38 HARV. ENVTL. L. REV. 87, 105–06 (2014); David M. Driesen, *Capping Carbon*, 40 ENVTL. L. REV. 1, 4–5 (2010); Victor B. Flatt, *C(R)ap and Trade: The Brave New World of Non-Point Source Nutrient Trading and Using Lessons From Greenhouse Gas Markets to Make It Work*, 52 HOUS. L. REV. 301, 334–35 (2014); David B. Hunter & Nuno Lacasta, *Lessons Learned from the European Union's Climate Policy*, 27 WIS. INT'L L. J. 575, 602 (2009); Brant M. Leonard, *Carbon Sequestration as Agriculture's Newest Market: A Primer on Agriculture's Role in Carbon Cap-And-Trade*, 15 DRAKE J. AGRIC. L. 317, 324–32 (2010); Richard Schmalensee & Robert N. Stavins, *The SO<sub>2</sub> Allowance Trading System: The Ironic History of a Grand Policy Experiment*, 27 J. OF ECON. PERSPECTIVES 103, 106 (2013); Daniel A. Sumner & John Thomas Rosen-Molina, *Impacts of AB 32 on Agriculture*, 14 GIANNINI FOUND. AGRIC. ECON. 16, 19 (2010).

353. See Daniel A. Farber, *California Climate Law -- Model or Object Lesson?*, 32 PACE ENVTL. L. REV. 492, 493 (2015).

354. *Id.* at 494–95.

processors who emit more than 25,000 tons of CO<sub>2</sub> annually—e.g., tomato processing facilities, wine distilleries, and dairy and cheese processors.<sup>355</sup> While some believe complementary programs harm cap and trade because complementary programs undermine the goal of finding the cheapest way to reduce emissions, others believe complementary programs are necessary for sectors like agriculture with difficult-to-measure emissions.<sup>356</sup> Despite these limitations, California's sizeable economy is a good laboratory to test these programs.<sup>357</sup>

In general, carbon and GHGs generally have qualities that render them well-suited to a cap and trade program for three primary reasons. First, GHGs are fungible in space, meaning that an emission reduction anywhere in the world provides the same benefit as far as reducing carbon in the atmosphere.<sup>358</sup> Therefore, regulated entities could trade among themselves to accomplish the most cost-effective GHG abatement. Second, GHGs are fungible in time, meaning that emissions reductions now, or in ten years, will have the same effect on the climate provided the same amount of emissions are abated.<sup>359</sup> Finally, because GHGs are well-mixed in the atmosphere, reducing emissions in one location will not cause "hot spots" or negative effects from pollution in another location.<sup>360</sup> To date, New Zealand is the only country to attempt to include agriculture within the cap in its cap and trade program.<sup>361</sup> However, agricultural producers thus far face only reporting requirements and are not actually obligated to surrender allowances yet.<sup>362</sup> The major problems are the difficulties in administering such a broad program, including over 40,000 farmers, and concern about negative impacts enforcement poses to these farmers.<sup>363</sup>

In addition to fitting into a cap and trade program, GHGs have characteristics that would make a broad cap and trade program difficult to administer. First, CO<sub>2</sub> cannot be removed from emissions with technology like installing scrubbers to remove SO<sub>2</sub> from smokestacks—a successful solution in the SO<sub>2</sub> trading program dealing with acid rain.<sup>364</sup> Second, CO<sub>2</sub> is harder to measure at the point of emission. Third, focusing on only the electricity sector, as the SO<sub>2</sub> program did is insufficient to deal with the magnitude of the climate change problem.<sup>365</sup> Incorporating multiple sectors across the economy will make a GHG cap and trade program much

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355. See Sumner & Rosen-Molina, *supra* note 352, at 17.

356. Farber, *supra* note 353, at 497–98.

357. *Id.* at 499–500.

358. See Holly Doremus & W. Michael Hanemann, *Of Babies and Bathwater: Why the Clean Air Act's Cooperative Federalism Framework is Useful for Addressing Global Warming*, 50 ARIZ. L. REV. 799, 821–22 (2008).

359. See generally *id.* at 820–33.

360. *Id.* at 803.

361. See Toni E. Moyes, *Greenhouse Gas Emissions Trading in New Zealand: Trailblazing Comprehensive Cap and Trade*, 35 ECOLOGY L.Q. 911, 916, 921, 922, 955 (2008).

362. See generally MINISTRY FOR THE ENV'T, NEW ZEALAND'S GREENHOUSE GAS INVENTORY 1990–2017 SNAPSHOT (Apr. 2019).

363. See Moyes, *supra* note 361, at 927, 957.

364. See Press Release, *supra* note 271.

365. *Id.*

more difficult to administer.<sup>366</sup> Instead, working within the framework of what is currently available is the most feasible option at this time.

Carbon credits thus provide a better approach to curbing GHG emissions than a cap and trade system. Two projects illustrate the potential of carbon credits to advance carbon farming. The USDA-Chevy Agreement and the USDA-Microsoft Agreement illustrate how carbon credits can be used on working grasslands in North Dakota and in rice fields in Arkansas to preserve soil habits and provide landowners with revenue options other than tillage.<sup>367</sup> These examples show that carbon credits can be used as incentive for farmers to pursue carbon farming and to further carbon markets.<sup>368</sup> In each case, a public-private collaboration joined the federal government, working through the Natural Resource Service Conservation Innovation Grants (CIG) competitive program, with private sector innovators.<sup>369</sup> Each transaction involved the following steps: (1) landowners voluntarily placed lands under a perpetual easement but retain rights to work the land, such as raising livestock and growing hay; (2) the carbon storage benefits of this avoided conversion of grasslands were quantified, verified, and formally registered resulting in carbon credits; (3) the carbon credits were made available to entities interested in purchasing carbon offsets.

The USDA-Chevy Agreement took place between the USDA CIG, and Chevrolet—a division of General Motors. In 2014, Chevrolet “purchased almost 40,000 carbon dioxide reduction tons generated on working ranch grasslands in the Prairie Pothole region of North Dakota.”<sup>370</sup> Here, the USDA's NRCS awarded \$161,000 through a CIG to Ducks Unlimited. The award led Ducks Unlimited to develop the necessary methodology to quantify the carbon stored in the soil by avoiding grassland conversions, resulting in the generation of carbon credits.<sup>371</sup> A new methodology, the Avoided Conversion of Grasslands and Shrublands offset quantification methodology, was developed and approved by the American Carbon Registry to quantify and verify carbon reductions—which in the form of carbon credits were sold into voluntary carbon markets.<sup>372</sup>

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366. See *Cap and Trade FAQs*, NICHOLAS INSTITUTE FOR ENVIRONMENTAL POLICY SOLUTIONS, <https://nicholasinstitute.duke.edu/focal-areas/cap-and-trade/cap-and-trade-faqs> (last visited Mar. 5, 2020).

367. See Sylvia Rainford, *USDA and Partners Complete First-of-its-Kind Sale of Carbon Credits from Working Ranch Grasslands*, U.S. DEP'T AGRIC., (Nov. 17, 2014) <https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ne/programs/?cid=stelprdb1264269>; Ciji Taylor, *Conservation Innovation Grant Produces Carbon Farming Opportunities in N.D.*, U.S. DEP'T OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERV., <https://www.nrcs.usda.gov/wps/portal/nrcs/detail/?cid=stelprdb1193341> (last visited Mar. 5, 2020).

368. Rainford, *supra* note 367.

369. See *Conservation Innovation Grants*, *supra* note 183.

370. U.S. DEP'T AGRIC., *USDA AND PARTNERS COMPLETE FIRST-OF-ITS-KIND SALE OF CARBON CREDITS FROM WORKING RANCH GRASSLANDS* (Nov. 17, 2014) (“Chevrolet’s first purchase of third-party verified carbon credits generated on working ranch grasslands was undertaken voluntarily as part of its commitment to reduce eight million tons of carbon dioxide from being emitted.”).

371. *Id.*

372. *Id.*

The USDA-Microsoft Agreement took place between the USDA, CIG, and Microsoft, and was the first-ever issuance and sale of GHG emission reduction credits from the sustainable production of rice.<sup>373</sup> In 2017, Microsoft purchased carbon credits from “conservation practices cover[ing] more than 2,000 acres” of sustainable rice cultivation from “two farmers in California and five farmers in Arkansas and Mississippi.”<sup>374</sup> The plan was “to reduce methane, a greenhouse gas over 20 times more potent than carbon dioxide[] ... [by] implement[ing] a variety of groundbreaking voluntary conservation practices [] include[ing] alternate wetting and drying and early drainage of their fields as well as crop residue management.”<sup>375</sup> This project also implemented a new technology; Carbon credits were verified using “PRESTO (Producer's Environmental Sustainability Tool) developed by a Terra [Global Capital] that was used to capture data directly from the field, perform automated quantification, and deliver information to buyers of emission reductions.”<sup>376</sup>

While the companies in these two examples, Chevrolet and Microsoft, were responsible for making mandatory offsets, they were also investors seeking an opportunity. There is a need to match investors with farms. The Global Climate Action Summit, which took place in San Francisco in 2018, “launched the “Investor Agenda” to align financial flows with climate objectives.”<sup>377</sup> “The coalition brought together nearly 400 investors managing US\$32 trillion of assets – just over a third larger than the US economy, which has a GDP of US\$19.4 trillion.”<sup>378</sup> “Their members’ commitments range from pledges to increase low-carbon investments to goals for lowering the carbon intensity of their portfolios or ending coal-related investments.”<sup>379</sup>

Other companies are starting to see opportunities in carbon marketplaces. Some examples are the Nori Marketplace,<sup>380</sup> a blockchain-based carbon credit registry and marketplace with ambitions to fund sequestration through voluntary credit purchases. Another company, Indigo Carbon, is part of a global effort to remove one trillion metric tons of carbon dioxide from the atmosphere and use it to enrich our agricultural soils.<sup>381</sup> In partnership with the Rodale Institute and the Soil Health Institute,

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373. *U.S. Farmers Earn World's First Carbon Credits from Rice Cultivation*, AM. CARBON REGISTRY (June 14, 2017), <https://americancarbonregistry.org/news-events/news/u-s-farmers-earn-world2019s-first-carbon-credits-from-rice-cultivation-conservation-practices-result-in-credible-sustainability-benefits-including-reduced-greenhouse-gas-emissions-and-savings-in-water-and-energy-use> (“[t]his project was made possible because of the collaboration of Terra Global and American Carbon Registry with partners USDA-NRCS, Entergy, California Rice Commission, White Rive Irrigation District, and Environmental Defense Fund.”).

374. *Id.*

375. *Id.*

376. *Id.*

377. *Global Climate Action Summit Delivers Raft of Pledges, Calls for Leaders to Step up Efforts*, *supra* note 16.

378. *Id.*

379. *Id.*

380. NORI MARKETPLACE, <https://nori.com/> (last visited Mar. 12, 2020).

381. TERRATON INITIATIVE, <https://www.indigoag.com/terraton> (last visited Mar. 12, 2020).

Indigo is spearheading a research study, “[t]he Terraton Experiment,” which aims to assess tens of thousands of farms for over a decade to quantify and rate farming practices that maximize the amount of soil carbon and to tailor farming practices by region, crop, and soil type.<sup>382</sup>

a. Insurance

There is also value to be gained from farmers’ financial partners, such as crop insurance providers, who could incorporate the added value of carbon farming into their decision-making process and have a financial interest in conservation. In addition to more, and better directed, financing, other economic incentives can also drive transformation in the sector. For example, index-based agricultural insurance, an innovation that triggers payouts based on an index (e.g., rainfall or sampled yields) is being used to protect farmers’ productive assets in the face of extreme climate events. Well-designed index insurance embedded in comprehensive agriculture risk management approaches needs to be in place. “There has been progress: some 650,000 farmers in Africa now have access to insurance[,] but th[is] is still very limited coverage” and far from what is needed “given more than 40 million smallholdings.”<sup>383</sup> In addition to insurance, extension of credit to farmers to adopt climate-resilient technologies and practices is critical.

b. Regenerative and Certification Finance

Financing is available for farmers who adopt selective certifications. In the United States, the USDA Organic Standard has shared funds available through different USDA sections, there is also a Federal-State Marketing program that aids farmers in achieving certification and a variety of nonprofits.<sup>384</sup> For example, a Colorado nonprofit, Mad Agriculture, helps farmers overcome the barriers to transition to regenerative and organic agriculture by helping farmers transition to a new farming system that “works for people, not corporations.”<sup>385</sup> Mad Agriculture partners with the Perennial Fund to provide farmers with organic transition loans and carbon farm planning services.<sup>386</sup> Perennial Fund loans have favorable terms such as only requiring the borrower to pay when profitable, delaying all payments for thirty-six months, and providing borrower with on-the-ground farm planning and marketing.<sup>387</sup>

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382. *Id.*

383. Phillip Thornton et al., *Agriculture in a Changing Climate: Keeping Our Cool in the Face of the Hothouse*, 47 *OUTLOOK ON AGRIC.* 283, 286 (2018).

384. *Organic Certification Cost Share Programs*, U.S. DEP’T AGRIC., <https://www.ams.usda.gov/services/grants/occp> (last visited Mar. 12, 2020).

385. PERENNIAL FUND, <https://www.theperennialfund.com/forfarmers> (last visited Mar. 12, 2020).

386. *Id.*

387. *Id.* (How it works: The Perennial Fund loans \$50-200 per acre per year to the farmer for three years to transition to organic in exchange for a 5%–25% gross profit share after the acreage is certified organic until 150% of the initial loan is returned. The gross revenue share is based on a

Climate Smart Agriculture is a concept that aims to connect agricultural development and climate responsiveness.<sup>388</sup> Promoted by the U.N. Food and Agricultural Organization (FAO) and adopted by the World Bank and other global institutions, Climate Smart Agriculture is the preferred path to increased agricultural productivity and climate change mitigation.<sup>389</sup> As farmers around the globe identify and adopt climate smart practices, Climate Smart Agriculture acts as a governance and planning tool to help determine the most efficient investments for improving agricultural productivity under climate change.<sup>390</sup>

While the Climate Smart Agriculture tool is still evolving in the United States, farmers around the globe—and particularly across the developing world—are already using hundreds of Climate Smart Agriculture practices to cope with various production risks. For example, the Global Alliance for Climate-Smart Agriculture (GACSA), consisting of over 170 members, supports 500 million farmers' adoption of Climate Smart Agriculture practices by 2030.<sup>391</sup> Countries are using Climate Smart Agriculture targets and key performance indicators in national investment plans and strategies as well as broader development policies. “Ambitious and explicit targets have been set globally, regionally, and nationally” to scale Climate Smart Agriculture practices, driving several billion dollars of investment in Climate Smart Agriculture over the past decade.<sup>392</sup>

Some of the Climate Smart Agriculture collaborations and investments are intuitive. For example, Climate Smart Agriculture figures

percentage above the regional average costs for that crop—similar to a net profit share without the need to track costs. Included in the transitional loan is technical assistance and secure market off-take for transitional and organic crops, as well as soil carbon credits).

388. See *Climate-Smart Agriculture*, *supra* note 17.

389. See *Climate Smart Agriculture Country Profile for Latin America and the Caribbean*, CGIAR, <https://ccafs.cgiar.org/publications/climate-smart-agriculture-country-profiles-latin-america-and-caribbean#.XTc4ZUF7nb0> (last visited Mar. 10, 2020); *but see* Taylor, *supra* note 17 (noting that by conceptually isolating CSA as a technical fix to address climate change impacts, the Bank conspicuously avoids interrogating the sociopolitical dimensions of the contemporary food system. It thereby proposes a paradigm shift in agriculture without acknowledging the vast inequalities of access to land, inputs, water and food, etc.).

390. See *Shaping a Climate-Smart Global Food System*, WORLD BANK, <https://www.worldbank.org/en/topic/agriculture/publication/shaping-a-climate-smart-global-food-system> (last visited Mar. 10, 2020); *see also* FOOD & AGRIC. ORG., CLIMATE-SMART AGRICULTURE SOURCEBOOK 16 (2013) (noting that trade-offs are an inevitable component of changes in agricultural techniques and technologies, for instance, “[w]hatever the ‘efficiency’ considered, there is a need to look at the allocation of factors and at the issue of scale. Indeed, production efficiency, GHG-efficiency, economic efficiency and food security do not always go hand in hand. For instance, to increase the workforce in the mix of factors of production might go against economic efficiency at the farm level, but may have a positive effect on food security.”).

391. Press Release, CGIAR RESEARCH PROGRAM ON CLIMATE CHANGE, AGRIC. & FOOD SEC., *CGIAR Commits to Help 500 Million Farmers around the World Prevent Climate Change from Causing a Global Food Crisis* (Sept. 23, 2014), <https://ccafs.cgiar.org/news/media-centre/press-releases/cgiar-commits-help-500-millionfarmers-around-world-prevent-climate#.XjXrqBNKiqA>.

392. Andreea C. Nowack et al., *Measurement and Reporting of Climate-Smart Agriculture: Technical Guidance for a Country-Centric Process* 8 (CGIAR RESEARCH PROGRAM ON CLIMATE CHANGE, AGRIC. & FOOD SEC., Working Paper No. 274, 2019), <https://ccafs.cgiar.org/publications/measurement-and-reporting-climate-smart-agriculture-technical-guidance-country-centric#.XTdpEEF7nb0>.



prominently in the World Bank's ambitious Africa Climate Business Plan that projects a decade-long program of social and infrastructural transformation, backed by an envisaged \$17 billion of loans and private investment.<sup>393</sup> This collaboration is beneficial for the World Bank, which sees meeting Climate Smart Agriculture targets as improving soil and ultimately achieving higher levels of production and loan repayment.<sup>394</sup> In the Africa Climate Business Plan, Climate Smart Agriculture also contributes to other goals (e.g., the Paris Agreement, Africa Union's Vision 25x25, and the Sustainable Development Goals, etc.).<sup>395</sup> Climate Smart Agriculture goals help countries implement their Nationally Determined Contributions (NDCs) in the agriculture sector, and by assisting with implementation, contribute to progress on the U.N. Sustainable Development Goals for climate action, poverty, and the eradication of hunger.<sup>396</sup> As discussed below, Climate Smart Agriculture is part of a network of resources to scale carbon farming because Climate Smart Agriculture goals align with treaty targets.

Around the globe, several certifications offer funding for adopting Climate Smart Agriculture practices.<sup>397</sup> Farmers can partner with a Rainforest Alliance-certified supporter to lock in a contract with a supply chain; however, farmers who take advantage of the Rainforest Alliance supporter program are responsible for paying for their audit, which varies widely in cost.<sup>398</sup> In addition, "farmers are also responsible for covering all costs associated with meeting the Sustainable Agriculture Standard" (e.g., taking parts of a farm out of use, new practices, building infrastructure, and other technology improvements).<sup>399</sup> Rainforest Alliance suggests that smallholders reduce auditing and administrative expenses by seeking group certification and having an internal management system.<sup>400</sup> Rainforest Alliance charges a royalty to companies that directly benefit from the certification and use the seal and other intellectual property.<sup>401</sup> The Rainforest Alliance royalty fee is paid once, and the terms are detailed in a licensing

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393. See *Stepping Up Climate Adaptation and Resilience in Africa*, WORLD BANK (Mar. 11, 2019), <https://www.worldbank.org/en/news/feature/2019/03/11/stepping-up-climate-adaptation-and-resilience-in-africa>.

394. *Id.*

395. See *Africa Climate Business Plan Executive Summary*, WORLD BANK 4 (Nov. 2018), <https://www.worldbank.org/en/programs/africa-climate-business-plan#1>.

396. See *Climate Smart Agriculture*, WORLD BANK, <https://www.worldbank.org/en/topic/climate-smart-agriculture>, (last updated Sept. 12, 2019).

397. *What Does Rainforest Alliance Certified Mean?*, RAINFOREST ALLIANCE (Sept. 25, 2019), <https://www.rainforest-alliance.org/faqs/what-does-rainforest-alliance-certified-mean> (noting that farms that earn the Rainforest Alliance Certified seal protect shade trees, plant native species, maintain wildlife corridors, and conserve natural resources. These farms also reduce their reliance on pesticides in favor of biological and natural alternatives, and they are prohibited from using any banned pesticides).

398. *How Much Does Rainforest Alliance Certification Cost?*, RAINFOREST ALLIANCE (Oct. 17, 2019), <https://www.rainforest-alliance.org/business/sas/get-certified/responsibilities-costs/>.

399. *Id.*

400. *Id.*

401. *Id.*

agreement, with a volume fee for coffee, tea, cocoa, and bananas.<sup>402</sup> Under the UTZ certification regime, if independent smallholders must pay all the costs themselves, sustainability would be profitable, but only if the smallholders receive the premium fee.<sup>403</sup>

Moreover, some farmers are subsidized by their provincial government agency. Without subsidization, it is estimated that coffee farmers would need about twice the current fee to remain profitable and self-funded.<sup>404</sup> Other supply chains may differ on who pays for the certification. For example, in the palm oil industry, it varies: certification costs are paid by a miller company, or in full by some farmers, or are cost-shared by an NGO.<sup>405</sup> In Tuangurahua, Ecuador UCALT, a provincial government membership organization, created an arms-length, nonprofit organization that certifies small-scale producer in sustainable or clean agriculture production.<sup>406</sup> UCALT organizes Campesino farmers—typically poor farmers with small landholdings—and received support from international NGOs like Trias, which is based in Belgium, and Heifer, which is based in the United States.<sup>407</sup>

### c. Forward Contracting

Financial incentives often come from supply chains who face demand for organic and sustainable foods. Forward Contracting Agreements allow farmers to lock-in premiums for their carbon farming practices.<sup>408</sup> Under Forward Contracting Agreements, food manufacturers and processors initially pay a premium for crops from farms transitioning into organic certification in return for a guaranteed supply of certified organic crops later.<sup>409</sup> “Some organic crops are in such short supply domestically[] ... that food companies are willing to essentially finance [the] cost of a farmer’s transition—just to lock in contracts” with transition organic suppliers while they are able to do so.<sup>410</sup>

Examples of companies that are offering financial incentives for carbon farming, organic, or regenerative practices include Annie’s<sup>TM</sup> (parent company is General Mills). In an effort to meet a growing demand for sustainable food, Annie’s<sup>TM</sup> decided to grow regenerative organic certified

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402. *Id.*

403. UTZ CERTIFIED, *supra* note 326 (noting that UTZ requires all products to receive premium fee).

404. Glasbergen, *supra* note 234, at 246–47 (this is also true for palm oil).

405. *Id.*

406. Clark & Martínez, *supra* note 237, at 297–98.

407. *Id.* at 297.

408. Fassler, *supra* note 220.

409. *Id.* (noting that Kashi’s transitional certification doesn’t quite hold itself to the organic standard: a product with 70% transitional ingredients can be called “certified transitional.” A product that’s only 51% transitional cannot make the claim “certified transitional,” but will still receive a transitional organic seal on Kashi products).

410. *Id.*

wheat and finances farms willing to plant this crop.<sup>411</sup> As a major manufacturer, Annie's™ can afford a gradual transition to more sustainable agriculture and intends to support farmers who adopt regenerative farming practices while they make the three-year transition to organic farming by using their products in brands that are not yet organic certified.<sup>412</sup> Other manufacturers and retailers including “Stonyfield Farms™, Organic Valley™, Whole Foods™, and Nature's Path Foods are among those who have offered grants and technical assistance to farmers in an effort to boost supply” of organic ingredients.<sup>413</sup>

#### CONCLUSION

While the IPCC Special Report on Climate Change and Land considers the potential for, and benefits related to, sequestering carbon in soil, research demonstrates that soils have vast potential to trap carbon from the atmosphere.<sup>414</sup> The need to scale-up carbon farming is imminent and real.

Scaling-up will require a network-of-resources approach—one that connects various legal mechanisms including treaties, legislation, and contracts, and provides incentives for all stakeholders. Scaling-up requires an interdisciplinary approach that connects public entities, the private sector, and NGOs from around the globe and enlists financial innovations like carbon credits. Ultimately, scaling-up will be achieved by incentivizing farmers to adopt carbon farming practices, earn the Carbon Farming Certification proposed in this Article, and track these practices across time. An enhanced Carbon Farming Certification, like the one proposed in this Article, is a linchpin to scaling-up carbon farming.

This Article is the first to consider and attempt to develop the only available certification for carbon farming. Other certifications (Organic, Regenerative Agriculture, SAN) are deficient. The Carbon Farming Certification proposed by this Article is superior because it combines existing certifications for agricultural practices (Organic or Regenerative Agriculture) with the add-on of a climate module (which calculates carbon sequestered using the USDA COMET-Planner™ tool). The proposed Farming Carbon Certification results are harmonized to international standards and can be used upstream by companies (for corporate sustainability requirements), and governments (to meet climate targets). To be sure, future efforts should be directed towards further developing the certification and ultimately commercializing it; future efforts by the private sector, federal labs, and universities should also be made to answer research questions

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411. *Regenerative Agriculture, Responsibility*, GENERAL MILLS <https://www.generalmills.com/en/Responsibility/Sustainability/Regenerative-agriculture> (last visited Mar. 12, 2020).

412. *Id.*

413. Caroline Macdonald, *Growing Demand for Ingredients Leads to Supply Challenges*, FOODDIVE (May 11, 2017), <https://www.fooddive.com/news/growing-demand-for-organic-ingredients-leads-to-supply-challenges/441770/>.

414. *See generally Intergovernmental Panel on Climate Change*, IPCC, <https://www.ipcc.ch/> (last visited Mar. 12, 2020).

concerning carbon farming. Questions that should be considered include: What processes maximize soil carbon and the rate of absorption? What microbes are correlated with carbon sequestration? How do carbon-enriched soils impact farm profitability? How much do soil carbon levels contribute to improved drought and flood resilience? To what degree do healthier soils produce healthier crops?

Ultimately, a network-of-resources approach realizes that future efforts to measure soils' potential to mitigate climate change will involve a network of resources that expands over time. While this Article introduced several existing resources, this Article highlights the fast rate at which new innovations—particularly in the financial sector and in the carbon marketplace—enter the scene. These resources include innovative collaborations involving many stakeholders—countries, corporations, and farmers—who can all benefit from tracking and sequestering carbon to mitigate climate change and protect food security and public health.<sup>415</sup>

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415. See BOER & HANNAM, *supra* note 168 (noting that from a food security standpoint alone, protecting soil from degradation is becoming an international human rights issue).