THE BLACK BOX OF SOIL: A BLUEPRINT FOR THE ELUSIVE SOIL CARBON OFFSET CREDITS IN A POTENTIAL NATIONAL CAP-AND-TRADE MARKET

Michelle Furrer†

† Michelle Furrer (michelle.furrer@mitchellhamline.edu) expects to receive her J.D. degree from Mitchell Hamline School of Law in St. Paul, Minnesota in May 2023. She is the Notes and Comments Editor for Mitchell Hamline Law Review and the president of Mitchell Hamline's Environmental Law Society. Interest in this topic came from researching carbon credit options for her family farm in Washington State. She wishes to thank Professor Mehmet Konar-Steenberg for his expertise, assistance, and support.

ABSTRACT

This article argues the 2023 Farm Bill, an essential piece of U.S. agricultural legislation, presents an opportunity to address climate change through U.S. agriculture.[1] *Part II of this article discusses the challenges with current soil carbon verification protocols and positions them as opportunities for federal standardization. Part III discusses the successes and failures of past, present, and future cap-and-trade markets as well as past legislative efforts. Part IV proposes that the omnibus 2023 Farm Bill should establish a national cap-and-trade market and standardize soil carbon verification protocols and criteria with the help of a national soil measurement database. This legislative framework would overcome many of the current barriers presented by soil carbon offset credits.*[2]

I. INTRODUCTION

Congress is no stranger to carbon regulations, markets, and carbon credit assistance programs. In 2009, The American Clean Energy and Securities Act first proposed a national cap-and-trade market. Twelve years later, the Growing Climate Solutions Act of 2021 proposed a USDA program to help farmers overcome barriers and break into the voluntary, private carbon markets. Both the American Clean Energy and Securities Act and the Growing Climate Solutions Act stalled and failed in Congress.[3]

However, the time is right for a national cap-and-trade market with a farm-based carbon offset program for three reasons. First, Washington has substantial support for this type of regulation. President Biden's commitment to fight climate change domestically, accompanied by Senate support,[4] represents a rare opportunity for the federal government

1. *See* Nick Schultz, *Agricultural Abundance: An American Innovation Story*, U.S. CHAMBER OF COM. FOUND. (Mar. 17, 2022, 10:55 AM), https://www.uschamberfoundation.org/agricultural-abundance-american-innovation-story [https://perma.cc/KSM5-CPJ5] (examining American agriculture as one of the "great technological, humanitarian and productively success story in human history").

2. It is beyond the scope of this article to look at other agricultural offset credit standardization. It is also beyond the scope of this article to address if Congress has the power to enact a cap-and-trade market within the 2023 Farm Bill.

3. *See infra* Part III, Section C.

4. Helena Bottemiller Evich & Ryan McCrimmon, *Biden Wants to Pay Farmers to Grow Carbon-Capturing Crops. It's Complicated.*, POLITICO (June 29, 2021, 4:54 PM), https://www.politico.com/news/2021/06/29/biden-climate-farmers-carbon-496843 [https://perma.cc/56CA-CZMU].

to take action and make progress on domestic climate change policies.[5] Second, as a domestic and international commodity, carbon credits are a key commodity of 2022 and should not be ignored. In November 2021, the United Nations Climate Change Conference finalized rules to the Paris Agreement's international carbon trading market.[6] Officials expect "an explosion of carbon trading and renewable energy investment," despite the volatile pricing and minimal regulation.[7] Finally, the public and private sectors have shown support for American-based carbon offset credits.[8] But the unregulated, voluntary markets

5. *See The Biden Plan for a Clean Energy Revolution and Environmental Justice*, BIDEN HARRIS (Feb. 5, 2022, 1:21 PM), https://joebiden.com/climate-plan/ [https://perma.cc/U67E-63DU] (President Biden outlined his commitment to fighting climate change early in his presidential campaign, stating there was no greater challenge facing the country and the world while publicly recognizing the strong connection between the American economy and the United States' fight against climate change.); *see also Fact Sheet: President Biden Takes Executive Actions to Tackle the Climate Crisis at Home and Abroad, Create Jobs, and Restore Scientific Integrity Across Federal Government*, THE WHITE HOUSE (Jan. 27, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/27/fact-sheet-president-biden-takes-executive-actions-to-tackle-the-climate-crisis-at-home-and-abroad-create-jobs-and-restore-scientific-integrity-across-federal-government/ [https://perma.cc/VBK9-VXZX]; *Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*, THE WHITE HOUSE (Jan. 27, 2021), https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-protecting-public-health-and-environment-and-restoring-science-to-tackle-climate-crisis/ [https://perma.cc/F3RR-8BGH] (reviewing climate policy and actions from January 2017 to January 2021); Antony J. Blinken, *The United States Officially Rejoins the Paris Agreement*, U.S. DEP'T OF STATE (Feb. 19, 2021), https://www.state.gov/the-united-states-officially-rejoins-the-paris-agreement/ [https://perma.cc/9DM3-X9TW]; The Paris Agreement is a legally binding international treaty on climate change adopted by the United States in 2015 by the United States and nearly 200 countries. Matthew McGrath, *Climate Change: U.S. Formally Withdraws from Paris Agreement*, BBC NEWS (Nov. 4, 2020), https://www.bbc.com/news/science-environment-54797743 [https://perma.cc/86JH-RXZC]. Former President Trump announced the United States withdrawal from the Paris Agreement in June 2017 and took effect on November 4, 2020. *Id.*

6. Neal Freyman, *The UN Standardizes International Carbon Markets at COP26*, MORNING BREW (Nov. 15, 2021), https://www.morningbrew.com/daily/stories/2021/11/14/countries-standardize-international-carbon-markets-at-cop26 [https://perma.cc/K6Y6-LH8J].

7. *Id.* (Private cap-and-trade markets are set for record growth with experts estimating more than $1 billion in carbon units traded by the end of 2022.). Carbon credit trading could reach as much as $22 trillion by 2050. Sarah McFarlane, *Energy Traders See Big Money in Carbon-Emissions Markets*, WALL ST. J. (Sept. 1, 2021, 5:33 AM ET), https://www.wsj.com/articles/energy-traders-see-big-money-in-carbon-emissions-markets-11630488780?st=zyyhujr8ao3mjtq&reflink=article_imessage_share [https://perma.cc/CN2V-EFWS].

8. Stacey H. Mitchell et al., *Senate's Passage of Growing Climate Solutions Act*

require correction quickly before they do more harm than good.

II. SOIL CARBON CREDITS

Part II of this paper explores soil carbon offset credit production. It then discusses why the varied soil offset credit verification protocols are problematic and theorizes how the barriers to a successful soil carbon program present an opportunity for beneficial government regulation and standardization.

A. Soil Carbon Production and Offset Basics

Carbon is essential to life on Earth.[9] The carbon cycle demonstrates that the amount of carbon on Earth does not change but continually flows between the atmosphere and organisms as it is absorbed and released.[10] In the past 200 years,[11] increased human activity has upset the natural balance. Our reliance on fossil fuels causes us to release more carbon into the atmosphere than the Earth's natural carbon sinks can absorb.[12] Thus, the role of carbon sinks has never been more critical. Forests, soil, atmosphere, and the ocean are the world's largest carbon sinks.[13] Specifically, the Earth's soil absorbs approximately 25% of human emissions each year.[14] But with the increasing human population, the increasing demand for food production, and climate change affecting soil moisture, the soil is under more pressure and needs stronger laws to protect it.[15]

In order to be considered a carbon offset, the soil, acts as a carbon sink, removing

Highlights Focus on Sustainable Agriculture, AKIN GUMP (July 13, 2021), https://www.akingump.com/en/experience/practices/climate-change/speaking-sustainability/senates-passage-of-growing-climate-solutions-act-highlights-focus-on-sustainable-agriculture.html [https://perma.cc/U6ZL-U9KR] (Farmers have expressed interest in participating in the carbon market but need guidance in the current wild, wild west of third-party soil carbon verification protocols and pricing. Renewable energy credits, agricultural energy credits, and soil carbon offset credits represent a growing industry that remains a largely untapped market for farmers.).

9. *What is a Carbon Sink?*, CLIENTEARTH (Dec. 22, 2020), https://www.clientearth.org/latest/latest-updates/stories/what-is-a-carbon-sink/ [https://perma.cc/F2W3-HKYX] (Carbon is in everything, from our DNA to the air we breathe to the food we eat.).

10. *Id.*

11. KRISTEN OHLSON, THE SOIL WILL SAVE US 15 (2014) (Soil scientist Rattan Lal and his colleges developed a method of estimating the carbon lost from soils in the United States and the world. "With funding from the EPA, USD, and the United States Department of Energy (DOE) and working with students and postdocs around the world, he [Rattan Lal] compared the carbon in forested areas with that in cultivated areas. According to his calculations, Ohio has lost 50 percent of its soil carbon in the last 200 years.").

12. *What is a Carbon Sink?*, *supra* note 11.

13. *Id.* (A carbon sink is anything that absorbs more carbon than it releases.).

14. *Id.*

15. *Id.*

a measurable amount of greenhouse gas (GHG) from the air by capturing and sequestering the gas.[16] In general, an offset takes carbon out of the air from an activity in one location and then uses it to compensate for emissions occurring elsewhere.[17] When an approved offset project reduces its GHG emission by one metric ton, it creates one offset credit.[18]

Because the current carbon cap-and-trade markets have different carbon soil offset project requirements, different protocols, and third-party verifiers, there is no singular way to define offset credit criteria. Common criteria for high-quality soil offset credits are: quantifiable, real, permanent, and additional.[19] Quantifiable means the GHG reductions come from a project capable of being measured.[20] Real generally means a third-party verifier can verify the carbon reductions.[21] Permanence ensures that the carbon stays sequestered and is not released back into the carbon cycle and atmosphere, furthering the climate change crisis.[22] Finally, whether the project is additional means a project is only eligible as a carbon offset credit if the producer's GHG reductions would not have been eliminated

16. Katie Taylor, *Purchasing in an Unregulated Market: Federal Government Procurement of Carbon Offsets*, 39 PUB. CONT. L.J. 141, 142-43 (2009).

17. *Id.* (Soil carbon offsets are specific to the carbon removed from the soil. Carbon, however, is not the only gas that is considered when discussing potential offset projects. "While offsets are referred to as 'carbon offsets,' there are six gases that are generally included in the concept of GHG reductions: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.").

18. *Id.*

19. Lauren Bernadett, *Agricultural Soil Carbon Sequestration Offset Programs: Strengths, Difficulties, and Suggestions for Their Potential Use in AB 32's Cap-and-Trade Program*, 31 UCLA J. ENV'T L. & POL'Y 198, 209, 215 (2013).

20. *Id.*

21. *Id.*

22. *What is Carbon Offset Permanence and How Do You Ensure it?*, CLEARLOOP (June 16, 2021), https://clearloop.us/2021/06/16/carbon-offset-permanence-corporate-sustainability/ [https://perma.cc/QV6W-J4KY] (discussing some agricultural projects, including soil carbon credits, are more susceptible to permanence questions than others. "Tree planting is a popular way of sequestering carbon. Trees 'breathe in' carbon dioxide and 'breathe out' oxygen as a waste product. This is great for all the oxygen-breathing organisms of the world if the trees reach maturity and stick around for at least 100 years. If something happens to disrupt that cycle, like a forest fire or logging cuts them down, the sequestered carbon is released back out into the atmosphere. Agricultural credits, like no till agreements designed to trap carbon in the ground, can be effective in sequestering carbon as long as the soil is not turned over should the land change hands."); *see also Overview*, U.S. DEP'T OF AGRIC. (Feb. 17, 2022, 4:40 PM), https://www.ers.usda.gov/topics/natural-resources-environment/climate-change/ [https://perma.cc/R33C-7PT5] (This percentage also includes the agricultural industry's carbon dioxide emissions associated with agricultural electricity consumption and what it offsets. "U.S. agriculture emitted an estimated 698 million metric tons of carbon-dioxide equivalent in 2018: 12.3 percent as carbon dioxide, 36.2 percent as methane, and 51.4 percent as nitrous oxide. Increases in carbon storage (sinks) offset 11.6 percent of total U.S. greenhouse gas emissions in 2018 (EPA 2020).").

otherwise.[23]

Soil carbon sequestration is an opportunity for the agricultural industry to contribute to the fight against climate change and adopt climate-friendly practices to offset their carbon footprint and help other industries account for their emission practices. The U.S. agricultural industry and forestry accounted for roughly 10% of total U.S. GHGs in 2019,[24] with agricultural soil management practices contributing to half of U.S. agricultural GHGs.[25] Because soil organic carbon (SOC) sequestration occurs naturally, it makes soil carbon offsets a valuable offset opportunity.[26] However, if the soil is disturbed by water,

23. Bernadett, *supra* note 21, at 209.

24. *Sources of Greenhouse Gas Emissions*, ENV'T PROT. AGENCY (Jan. 27, 2022, 11:24 AM), https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions [https://perma.cc/Z5TF-V7WH] (Note first, agriculture is the smallest percentage in the list and second, the common theme of fossil fuels throughout the rest of the categories. As a nation and world, undoubtably we must reduce our reliance on fossil fuels to mitigate and reverse climate change, but agriculture is also a piece of the climate change puzzle. It is worth funding and researching because progress is any area is overall progress. The overview and pie chart shows Agriculture (GHG emissions coming from "such as cows, agricultural soils, and rice production") at 10%, Commercial & Residential (GHG arise from primarily "fossil fuels burned for heat . . . " in houses) at 13%, Industry (GHG primarily arising from "burning fossil fuels for energy as well as greenhouse gas emissions from certain chemical reactions necessary to produce goods from raw materials) at 23%, Electricity ("62% of our electricity comes from burning fossil fuels, mostly coal and natural gas") at 25%, and Transportation (GHG from "burning fossils fuel for our cars, ships, trains, and planes") at 29%.).

25. Bernadett, *supra* note 21, at 211 (Breaking down the agricultural emissions on the farm "The EPA estimates that half of these agricultural emissions come from management practices of agricultural soils, including fertilizer application, irrigation, and tillage methods, and that livestock manure management accounts for 15% of the agricultural emissions. The livestock digestion process accounts for about one third of the agricultural emissions and the remainder comes from smaller sources, such as rice cultivation and burning crop residues. These estimates do not include carbon dioxide emissions from on-farm energy use."); *see also* ERIC TOENSMEIER, THE CARBON FARMING SOLUTION 12 (2016) (When defining carbon farming, author Eric Toensmeier does not include any carbon offsets in his definition nor in his book, defining carbon farming as "Carbon farming involves implementing practices that are known to improve the rate at which CO2 is removed from the atmosphere and converted to plant materials and/or soil organic matter." *Id.* at 6. He is, in fact, against the use of offsets as a climate change mitigation strategy, rather focusing on other methods of sustainable farming to restore carbon in the soil including agroforestry and perennial crops in a multifunctional solution. However, his research regarding carbon in the soil and agricultural contributions make him a valuable addition to this section that does not address offset projects specifically.).

26. *See* Jerry Melillo & Elizabeth Gribkoff, *Soil-Based Carbon Sequestration*, MIT CLIMATE PORTAL (Apr. 15, 2021), https://climate.mit.edu/explainers/soil-based-carbon-sequestration [https://perma.cc/2YCM-L86R] (Soil is made partly by organic, broken-down plant matter, meaning it contains most of the carbon plants took in while they were alive. Soil naturally takes excess carbon dioxide from the atmosphere and stores it in its soil organic matter.).

air, or temperature changes, any stored carbon can be released into the atmosphere.[27] Thus, switching to no-till or conservative tillage practices, utilizing high-diversity crop rotation, planting cover crops, and other agricultural conservation practices, increases the amount of carbon.[28] Because different farming practices have varied amounts of carbon sequestration,[29] the soil's potential to sequester carbon depends mainly on the soil's property.[30]

Soils which are high in organic matter (carbon) do much more than simply sequestering carbon in the atmosphere. When a producer/farmer seeks to sequester carbon in the soil, the soil converts back to its original state and health, meaning higher crop yields, water-holding capacity, and disease prevention.[31] The increase in productivity, improved farm health, and resistance to drought are "co-benefits" to soil sequestration. Such benefits are key to gaining traction and buy-in from producers and rural politicians when discussing potential agricultural emission policies or offset programs.[32]

B. The Current Barriers for Soil Carbon Credit Producers are Drivers for Standardization

Large, influential American companies, such as Microsoft, have taken notice of the power of soil and farm-based offset credits. At an undisclosed price, Microsoft purchased nearly 200,000 farm-based credits, including soil carbon credits, in one of the largest-ever agricultural carbon offset credits purchases.[33] However, before the January 2021

27. Bernadett, *supra* note 21, at 216.

28. *Id.* at 215.

29. *Id.*

30. Tori Timmons, *All I Want for Christmas is a Carbon Sink*, 72 HASTINGS L.J. 1347, 1364 (2021).

31. *See* Ohlson, *supra* note 13 at 42.

32. *See* Keith Duffy, *Soil Carbon Offsets and the Problem of Land Tenure: Constructing Effective Cap & Trade Legislation*, 15 DRAKE J. AGRIC. L. 299, 301 (2010) (discussing why "agricultural interest must be included in any successful global climate change agreement . . . in order to get enough votes to pass any kind of emission legislation, representatives and senators from rural areas must be convinced that the legislation will not unduly burden the agricultural community."; *see also* Brandon Hunnicutt, *Opinion: To Solve the Climate Crisis, We Must Share in the Risk and the Reward*, AGRIC. PULSE (Feb. 9, 2022, 3:29 PM), https://www.agri-pulse.com/articles/17190-opinion-to-solve-the-climate-crisis-we-must-share-in-the-risk-and-the-reward [https://perma.cc/J6T5-KHJK] (Healthy, carbon-sequestering soil not only creates a new income revenue stream for farmers and has long term benefits.).

33. Karl Plume, *Farmers Struggle to Break into Booming Carbon-Credit Market*, REUTERS (Apr. 28, 2021, 6:00 AM CDT), https://www.reuters.com/business/energy/farmers-struggle-break-into-booming-carbon-credit-market-2021-04-28/ [https://perma.cc/W7FB-KTWD]; *see also* Shan Goodwin, *Microsoft Buys Carbon Credits from NSW Cattle Operation*, FARM ONLINE (Jan. 29, 2021, 7:00 PM),

purchase, Microsoft rejected over five million farm-based credits presented to them because of "systemic problems with measuring their climate benefit."[34] Microsoft's purchase and rejection demonstrate the promise of farm-based credits but also highlight the scientific inconsistencies and problems of soil carbon offset credits.

Microsoft indicated that issues with measurement and monitoring variations influenced their decision to reject the millions of credits presented to them.[35] Soil carbon offset credits concerned Microsoft because of the lack of standardization in testing and monitoring the credits. These problems are not new to soil carbon credits producers, who have been exacerbated by the lack of guidelines and scientific consistency among the unregulated third-party protocols.[36] Further problems are created by substantial barriers to entry, such as high up-front costs and low credit prices which do not entice producers to change farming practices,[37] institutional barriers such as tenancy can make it unclear to whom the credits belong,[38] and finally, the available scale of soil carbon credits. Solving these problems is critical for producers to capitalize on carbon markets and to become a part of the fight against climate change through offset projects.

1. Expense of Soil Measurements

Looking at each of these barriers and considering the Microsoft purchase, it is evident that measurement of soil carbon credits is difficult and expensive. On the verification side, soil is a unique beast in that the carbon in the soil may vary from region to region,

https://www.farmonline.com.au/story/7105542/microsoft-buys-carbon-credits-from-nsw-cattle-operation/ [https://perma.cc/4L2W-ERFG].

34. Plume, *supra* note 35 (Discussing the problems with the proposals from agricultural offset projects. Some projects were found to lead to "deforestation or were found to capture some carbon but leak it back into the atmosphere quickly. Simply tilling a field, for example, can release carbon meant to be stored.").

35. *Id.*

36. *Id.*

37. *Id.*; *see also* Vandana Sebastian, *Soil Carbon Credits: The Realities on the Ground*, S&P GLOBAL (Aug. 18, 2021), https://www.spglobal.com/platts/en/market-insights/blogs/energy-transition/081821-soil-carbon-credits [https://perma.cc/PE4L-W3GS] (Before the United States is a unique opportunity to embrace and drive forward climate solutions through agricultural soil. Agricultural soil can naturally sequester carbon by "removing carbon from the atmosphere and storing it in the soil." Soil carbon offset projects are primarily located in Australia and the U.S. because of the land available. Countries with smaller farms and land holdings like in Asia and Europe, soil carbon projects are not currently feasible. The cost of soil carbon verification in Australia, is mirrored here in the United States. "In Australia, key costs include registration of projects, detailed feasibility studies, development of farm management plans, cost of testing as well as auditing expenses. Edmonds said soil sampling across a 1,000-hectare farm can cost up to A$15,000 (US $11,000).").

38. Duffy, *supra* note 34, at 301; *see also* Sebastian, *supra* note 39.

farm to farm, and even field to field.[39] Temperature, season, and weather may also alter carbon readings from the same field, making soil carbon measurements expensive to verify.[40] Further, soil carbon changes often occur slowly, adding to the complexity of measurements.[41] Thus, third-party verifiers often use computer modeling to estimate the carbon makeup of soil.[42] The accuracy of these computer models has proven problematic with producers not likely being paid for the actual carbon sequestered in their fields.[43] Still, private companies are directing millions of dollars to develop soil mapping accuracy and machine learning technologies.[44]

On the producer side, high up-front costs of creating a new project and low carbon credit prices discourage producers from taking on projects that would generate offset credits.[45] Planting cover crops during the harvest offseason is a common method of reducing tillage and creating soil carbon credits. However, the producer must cover the cost of the cover-crop seed and additional labor to prepare the fields for planting in the off-season.[46]

39. Bottemiller Evich & McCrimmon, *supra* note 6.

40. Bernadette, *supra* note 21, at 216.

41. Jane Zelikova et al., *A Buyer's Guide to Soil Carbon Offsets*, (CARBON)PLAN (July 15, 2021), https://carbonplan.org/research/soil-protocols-explainer [https://perma.cc/6S5B-9BPR].

42. *See generally* Feng Tao et al., *Deep Learning Optimizes Data-Driven Representation of Soil Organic Carbon in Earth System Model over the Conterminous United States*, FRONTIERS IN BIG DATA (June 3, 2020), https://www.frontiersin.org/articles/10.3389/fdata.2020.00017/full [https://perma.cc/QX7T-M5UU].

43. *Who Pays for Verification*, AGRI-VIEW (Aug. 18, 2021), https://www.agupdate.com/agriview/news/crop/who-pays-for-verification/article_d6ae3084-25b7-5550-ae28-10d36e0b687b.html [https://perma.cc/U8FS-KVXR].

44. *EarthOptics Raises $10.3 million in Series A Funding, Led by Leaps by Bayer, to Accelerate Carbon Mapping*, PR NEWSWIRE (Sept. 21, 2021, 7:30 AM ET), https://www.prnewswire.com/news-releases/earthoptics-raises-10-3-million-in-series-a-funding-led-by-leaps-by-bayer-to-accelerate-carbon-mapping-301380962.html [https://perma.cc/M4JC-WK4S] [hereinafter *EarthOptics*] (Ensuring the carbon is actually sequestered in the soil is key to establishing soil carbon credits as high-quality credits to offer to investors and to make a dent in climate change.).

45. Plume, *supra* note 35; *see also* Sebastian, *supra* note 39.

46. Plume, *supra* note 35 (Because of the high price to implement new changes in a farming system, private companies have taken it upon themselves to create pilot projects and help subsidize the cost of carbon offset creation. "Agricultural companies from Bayer AG to Cargill Inc. have subsidized projects that encourage farmers to reduce emissions, save water and plant off-season crops that restore nutrients to soil and limit erosion. They hope to aid development of a broader marketplace for credits they sell or keep the credits to counter pollution in their own supply chains. Lukas Fricke, a farmer from Ulysses, Nebraska, planted rye and tiller radishes this winter as part of a program launched by Land O'Lakes. He is among the farmers generating credits being purchased by Microsoft. But the $20 he expects for each credit will not cover the cost of cover-crop seed and hiring specialized labor to prepare his fields for planting.").

Historically, the low price of carbon, even at $20 a credit, is unlikely to cover the cost of the seed and labor.[47]

2. Different Protocols and Criteria Create Unequal Credits

The verification process's lack of standardization and transparency creates unequal carbon credits. Over 14 different protocols have been developed to tackle the complex measurability of the soil but, in doing so, have created the wild west of soil carbon verification.[48] Without an established standard, the varying protocols make soil carbon offset credits an uncertain, unequal, and unstable approach to capturing GHG and mitigating climate change.[49]

47. *Id.* (Environmental nonprofits like The Nature Conservancy and private companies including Bayer and Land O' Lakes, are running pilot soil carbon credit programs to provide monetary support to farmers to cover the costs of seeds and labor); *see also* Robert Mendelsohn et al., *How to Repair the World's Broken Carbon Offset Markets*, YALE ENV'T 360 (Nov. 18, 2021), https://e360.yale.edu/features/how-to-repair-the-worlds-broken-carbon-offset-markets [https://perma.cc/VQR4-QJX7] (Chicago Board of Trade's carbon offset market active from 2003 to 2010, eventually closed when carbon credits plummeted below $1 a credit, far too low a price to entice any farmer nor ensure actual climate change mitigation.); *see also infra* Part IV, Section A, proposing a set carbon price from $35-50, on a national level that would help producers and investors alike.).

48. Zelikova et al, *supra* note 43. (Carbon(Plan) summarized scores of soil carbon protocols on the basis of rigor, additionality, durability, safeguards. These include Verra and Gold Standard, who are third-party offset registries, and new companies like Nori and Regen Network. "More than a dozen protocols exist, and they vary across key dimensions like scientific rigor, additionality, and durability. As a result, getting to the bottom of what these different protocols require is not an easy task. To help address the opacity in today's market, we systematically reviewed 14 soil carbon protocols on 33 technical dimensions. We focused on protocols that were publicly available and could be used to certify or issue credits for soil carbon removal — activities that draw carbon out of the atmosphere and sequester it in soil. We excluded protocols still in development or that credit solely on the basis of avoided emissions. Our findings reveal that robust crediting of soil carbon is hard and that none of the existing protocols is doing enough to guarantee good outcomes. While this conclusion doesn't mean that all projects are generating low-quality credits, the lack of rigorous standards makes it hard to ensure good climate outcomes in the voluntary market. Buyers that care about quality must screen candidate projects themselves, while developers of high-integrity projects must compete against those who might take advantage of lax standards. The additional due diligence required today could limit the role soil carbon can play in effective climate strategy and highlights the need for systematic market reforms.").

49. *Id.* (Looking at additionality as an example, an important factor in any high-quality carbon offset credit, the protocols vary with additionality: Verra's 2020 Improved Agricultural protocol adequately protects against non-additional credits in large scale protects but protocols including Nori, Regan Network and BCarbon do not address additionality at all with Nori

3. Land Tenancy Prevents Participation

Land tenancy and lease type are institutional barriers for producers seeking to adopt soil carbon credits and sustainable practices.[50] In the past, farmers owned and operated their own land. However, given the relatively advanced average age of farmers, 57.5 years,[51] both tenantry and ownership have important implications for agricultural land access. According to a 2017 USDA survey, tenant farmers control a significant percentage of farmland.[52] Tenant farmers often have yearly leases or shorter leases on the land,[53] which contrasts with third-party protocols requiring a five-year to fifty-year commitment. Therefore, the tenant farmer's participation and rented farmland—39% of 911 million acres of American farmland[54]—is indispensable in any soil carbon credit offset program

even paying for backdating projects by five years. Similarly, Climate Action Reserve's protocol (CAR Soil) purports tests that enables all projects to treat any practice as additional. Further, some protocols lack personal with agriculture and forestry experience, making it difficult to relate to producers. "Notably, two of the three protocols with robust sampling requirements — Verra Soil and BCarbon — reference or adopt a common protocol module from 2012, Verra's Estimation of Stocks in the Soil Carbon Pool (VMD0021). Another, Gold Standard, does not require sampling, but when projects choose sampling the protocol suggests using the same Verra module. This pattern demonstrates that the voluntary carbon markets identified a reasonably rigorous sampling standard almost a decade ago, prior to the more recent surge in soil carbon credit interest. Nevertheless, sampling standards have generally fallen since then, potentially reflecting a mismatch between sampling costs and market prices."); *see also* Nathanael Johnson & Ysabell Kempe, *The U.S. is About to Go All-In on Paying Farmers and Foresters to Trap Carbon*, GRIST (July 7, 2021), https://grist.org/agriculture/us-carbon-removal-capture-offset-forests-farms-trees-soil/ [https://perma.cc/8D2V-3KBM] (discussing the problem with backdating and determining how much carbon the soil is actually storing).

50. Duffy, *supra* note 34, at 302.

51. Jodi Halvorson, *Is the Allure of Farming Irresistible?*, U.S. DEP'T OF AGRIC. (June 16, 2021), https://www.usda.gov/media/blog/2021/06/16/allure-farming-irresistible [https://perma.cc/2ZBD-N44W].

52. *Farmland Ownership and Tenure*, U.S. DEP'T OF AGRIC. (Nov. 17, 2020), https://www.ers.usda.gov/topics/farm-economy/land-use-land-value-tenure/farmland-ownership-and-tenure/ [https://perma.cc/Q7NW-LBER] (Tenant farmers control over 39% of U.S. farmland.).

53. *Id.* (Seventy percent of acres rented from operator landlords have been rented to the same tenant for over three years and 28 percent for over 10 years.) (The rental activity is concentrated in cropland, large grain production areas, and cash grains such as rice, corn, soybeans, and wheat. Pastureland, where crops are not grown, rather cattle or other animals graze, is 72% owner -operated and 28% rented according to a 2014 USDA study.); *see also* Duffy, *supra* note 34, at 302. (An effective carbon market must have secure and predictable credits producers and consumers but these shorter lease periods significant limits the ability of the tenant farmers to enact changes that produce soil carbon credits because they cannot guarantee the security of the offsets they create).

54. *Farmland Ownership and Tenure*, *supra* note 54.

and plan.[55]

4. Scale Needed for Soil Carbon Credits

Finally, scale is another significant barrier to producers' access to carbon markets, especially for small farms.[56] One acre of soil sequesters only about eight metric tons of carbon.[57] Other sequestration projects, such as forestry projects or landfills, can generate tens to hundreds of thousands of credits in a single project while using less land.[58] The greater the amount of credits generated, the easier it will be for the producer to cover the cost of implementing the project and verifying the credits.[59]

Despite all these problems, the question lingers: Are soil carbon credits worth paying attention to? Further, are soil carbon offset credits an indication that a national cap-and-trade system would not be efficient at mitigating climate change?

III. CAP-AND-TRADE MARKETS

In the last two decades, private parties and states have formed voluntary and regional cap-and-trade markets. These carbon markets are the most direct, efficient, and cost-effective way to reduce GHGs with allowance and offset, and they serve as models for a

55. Duffy, *supra* note 34, at 302.

56. *See* Plume, *supra* note 35.

57. *Five Dollars a Ton for Carbon*, WHITESCARVER NAT. RES. MGMT., LLC (June 25, 2019), https://www.gettingmoreontheground.com/2019/06/25/five-dollars-a-ton-for-carbon/ [https://perma.cc/MJB2-JXLD].

58. Bottemiller Evich & McCrimmon, *supra* note 6.

59. *Id.*; *see also Family-Owned Farms Account for 96% of U.S. Farms, According to the Census of Agriculture*, U.S. DEP'T OF AGRIC. (Jan. 22, 2021), https://www.nass.usda.gov/Newsroom/2021/01-22-2021.php [https://perma.cc/38MJ-LMK5] (Scale significantly disadvantages small to mid-size farms. Small size family farms, defined as annual sales less than $350,000, account for 88% of all American farms. Additionally, most "family farms" are owner operated. "The data show that small family farms, those farms with a GCFI of less than $350,000 per year, account for 88% of all U.S. farms, 46% of total land in farms, and 19% of the value of all agricultural products sold. Large-scale family farms (GCFI of $1 million or more) make up less than 3% of all U.S. farms but produce 43% of the value of all agricultural products. Mid-size farms (GCFI between $350,000 and $999,999) are 5% of U.S. farms and produce 20% of the value of all agricultural products." Even mid-size farms, defined as annual sales between $350,000 to $999,000 to large scale farms, $999,000 and above, may only sequester a few hundred tons of carbon in a project.); *see also* Sebastian, *supra* note 39 (describing the cost of a 1,000-hectare farm).

national cap-and-trade market with an offset credit program.[60]

A. Cap-and-Trade Basics

In a cap-and-trade market, an agency or government decides emission categories that will be regulated and then sets a corresponding reduction target over a period of time.[61] The cap part is through the emission limits that are "capped" for a specific period to achieve the emission targets. The regulated entities cannot go over the capped emission limit without being heavily fined.[62] The trade part includes allowance trading or offset credit purchases. Allowances trading involves tradable carbon metric tons from one regulated entity to another.[63] Some entities and industries can reduce their emissions easier than others; thus, these entities offer their allowances to those firms facing current high reduction costs.

Offset purchases are also a central part of a cap-and-trade market. The governing entity sets the quantity of emissions reductions and determines the carbon emissions allowances.[64] The entity approves offset projects which allow regulated entities to offset their carbon emissions and enable them to stay under the capped emissions levels.[65]

Some see these mitigation tactics as loopholes utilized by companies who do not reduce their emissions and continue operating as usual.[66] However, the concept of cap-and-trade markets ideally leads to lower emissions over time with a continual lowering or shrinking emission cap. While mitigation and offset credits are a small part of the fight against climate change, it is still important to consider all pieces of the puzzle and not just emission reduction regulation.

60. Sanjay Patnaik & Kelly Kennedy, *Why the U.S. Should Establish a Carbon Price Either Through Reconciliation and Other Legislation*, BROOKINGS (Oct. 7, 2021), https://www.brookings.edu/research/why-the-us-should-establish-a-carbon-price-either-through-reconciliation-or-other-legislation/ [https://perma.cc/8E7U-ARJV] (Discussing carbon pricing as the most basic and effective tool to reduce carbon emissions and urges the U.S. to move forward with carbon pricing like other nations. "If the U.S. continues to stand by while others move forward with carbon pricing, it risks hampering progress towards climate mitigation goals, reducing the global competitiveness or American companies, and diminishing the credibility of its commitment to climate issues on the global stage.").

61. Melissa B. Papke, *Michigan Forests and Farms: Tapping and Marketing Our Land Resources for Carbon Sequestration*, 36 MICH. REAL PROP. REV. 61, 61 (2009).

62. *Id.* at 62.

63. *Id.*

64. *Cap-and-Trade Basics*, CTR. FOR CLIMATE AND ENERGY SOL. (Feb. 7, 2022, 12:35 PM), https://www.c2es.org/content/cap-and-trade-basics/ [https://perma.cc/3CE7-SZ2Z].

65. *See* Papke, *supra* note 63, at 62.

66. *See infra* Part IV. Mitigation tactics include allowance trading and offset credit purchases.

A. Lessons from Past, Current, and Future Cap-and-Trade Markets

The first cap-and-trade system originated in the 1992 United Nations Framework Convention on Climate Change (UNFCCC), an international treaty addressing the effects of climate change.[67] This treaty was updated a few years later to include the Kyoto Protocol, with the primary objective of decreasing GHGs in its signatory countries.[68] The Kyoto Protocol bound its signatory countries to reduce their carbon emission baseline from 1990 by 5% before 2012.[69] The market rose from the compliance options, which included: (1) trading allowances; and (2) purchase of offsets, available to the countries bound by Kyoto and has served as a model for most of the cap-and-trade systems ever since.[70]

While waiting for enough countries to ratify the Kyoto Protocol, a voluntary yet legally binding cap-and-trade system began in 2003 called Chicago Climate Exchange (CCX).[71] Members joined voluntarily and had the same trading opportunities as the Kyoto countries, but CCX offered significantly lower carbon offset prices than the Kyoto Protocol.[72] These low prices would eventually force the market to close in 2010. The market ran successfully for seven years with members ranging from large, private companies such as Ford Motor Company, Sony, and Bank of America,[73] to governmental bodies, which demonstrated the wide range of entities committed to voluntarily reducing emissions.[74] It is worth noting that the CCX lacked transparency. Similar to Microsoft's large carbon purchase at an undisclosed price early last year, the CCX did not publish data to indicate what percentage of its trading is comprised of offsets versus member allowances. This lack of transparency will be addressed in Part IV.

To sell farm-based offset credits, including soil carbon offset credits, on the CCX, producers would have had to use a third-party aggregator.[75] One aggerate corporation was

67. Papke, *supra* note 63, at 62.

68. *Id.*

69. *Id.* (Kyoto became effective in 2005 with an astounding 141 ratifying countries and birthed the "carbon market." The United States signed the Kyoto Protocol in 1998, however Congress failed to ratify the agreement, as dictated by the Constitution, meaning the U.S. never officially signed onto the Kyoto agreement.); *Signing the Kyoto Protocol*, CLINTON DIGIT. LIBR. (Mar. 17, 2022, 1:24 PM), https://clinton.presidentiallibraries.us/exhibits/show/green-building/kyoto-protocol [https://perma.cc/ZA9U-FRTY].

70. Papke, *supra* note 63, at 62.

71. *Id.*

72. *Id.* (By joining the CCX, members made a commitment to reduce their emission by 6% between 2003 and 2010.).

73. *Id.* at 63.

74. Katie Taylor, *Purchasing in an Unregulated Market: Federal Government Procurement of Carbon Offsets*, 39 PUB. CONT. L.J. 141, 141 (2009).

75. A LANDOWNER'S GUIDE TO CARBON SEQUESTRATION CREDITS, CENT. MINN. REG'L

the Aggregate Credit Corporation, formerly part of the Iowa Farm Bureau, which indicated offset credits could be earned through soil conserving farming methods, tree plantings, and methane capture.[76]

1. The Volatility of Regional Markets

Despite the absence of a national cap-and-trade program, in the mid-2000s, states came together to form regional markets that address climate change and create a carbon market.[77] Some of these markets were very active in 2021, issuing more than $100 million in carbon credits from the United States.[78] On the East Coast, the Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort formed among 11 states, including Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Virginia, to cap and reduce power sector CO_2 emissions.[79] As a mandatory cap-and-trade program, the participating states have established a "cap" on the emissions from their power plants.[80] Like the international carbon market and CCX, RGGI has both allowance trading and offset purchase options.[81] RGGI has its own system of tracking project compliance and has also established a minimum reserve price for

SUSTAINABLE DEV. P'SHIP 5 (2022), https://www.cleanenergyresourceteams.org/sites/default/files/publication_files/LandownersCarbonSequestration_CentralRSDP.pdf [https://perma.cc/3LHW-KWC8] ("In order to sell credits on the CCX, landowners need to work through an aggregator. An aggregator combines credits with several landowners to create a bundle of credits large enough to trade on the exchange. When a landowner enters a contract with an aggregator, the landowner has given the aggregator the rights to the carbon sequestrated in exchange for payment. The aggregator chooses when to sell the credits to the market established by the CCX, and within 24 hours of the sale will receive payment from the CCX into the aggregator's account. Then, at varying times throughout the year, depending on the aggregator, sales are totaled, and payments are made to program enrollees (landowners). The payment allocation and disbursement system vary from aggregator to aggregator.").

76. *Id.* at 10 (Large soil offset maps were used to calculate the carbon sequestration rate, often with one entire state in the same zone.).

77. OHLSON, *supra* note 13, at 124.

78. *Id.*

79. *The Regional Greenhouse Gas Initiative*, REG'L GREENHOUSE GAS INITIATIVE 1 (Sept. 2021), https://www.rggi.org/sites/default/files/Uploads/Fact%20Sheets/RGGI_101_Factsheet.pdf [https://perma.cc/N3W9-HMBU].

80. *Id.*; *see also Elements of RGGI*, REG'L GREENHOUSE GAS INITIATIVE (Feb. 7, 2022, 12:52 PM), https://www.rggi.org/program-overview-and-design/elements [https://perma.cc/5S4B-52SU]. (Within the RGGI states, fossil-fuel-fired electric power generators with a capacity of 25 megawatts or greater ("regulated sources") are required to hold allowances equal to their CO_2 emissions over a three-year control period.).

81. *The Regional Greenhouse Gas Initiative*, *supra* note 81, at 1, 2.

allowances and a cost containment reserve, which help provide market stability.[82] RGGI requires offset projects to be from the 11 member states, representing a potential future market for regional soil carbon offset credits.[83] However, soil carbon offset credits are currently not eligible for purchase through the RGGI.[84]

Two other regional cap-and-trade markets began in 2007. Both reveal the volatility of these markets, with one losing a significant portion of its members and the other going inactive.[85] In 2007, the Midwestern Greenhouse Gas Reduction Accord was signed by governors from Minnesota, Wisconsin, Illinois, Iowa, Michigan, Kansas, and the Canadian Province of Manitoba.[86] The cap-and-trade market design included an offset credit purchase market, recognizing the significant opportunity for economic development in the Midwest forestry and agricultural industries.[87] However, it also became apparent that a competing industry in the region, the coal industry, would be heavily impacted by cap-and-trade regulations, which raised concern about the region's fossil-fuel-dependent electricity system.[88] By March of 2010, after leadership in several participating states changed their positions on climate policy, the market members took no further action to implement the market.[89] Thus, the market effectively "died."

Western Climate Incentive (WCI) was founded in 2007 by the governors of

82. *Elements of RGGI*, *supra* note 82. ("The RGGI states have established a Cost Containment Reserve (CCR), consisting of a quantity of allowances in addition to the cap which are held in reserve. These are sold if allowance prices exceed predefined price levels, so that the CCR will only trigger if emission reduction costs are higher than projected. The CCR is replenished at the start of each calendar year. The CCR trigger price is $13.00 in 2021 and will increase by 7% per year thereafter. The size of the CCR is 10% of the regional cap each year.").

83. *See id.*

84. Tara Ritter, *Why Carbon Market Won't Work for Agriculture*, INST. FOR AGRIC. & TRADE POL'Y (Feb. 4, 2020), https://www.iatp.org/documents/why-carbon-markets-wont-work-agriculture [https://perma.cc/WZD6-Y45T] (Carbon credits sold between $5-6 for all of 2019, which is far too low for to drive down emissions as polluters benefit from these cheap carbon credits.).

85. *Midwestern Greenhouse Gas Reduction Accord*, LAND TRUST ALL. (Feb. 7, 2022, 12:59 PM), https://climatechange.lta.org/midwestern-accord/ [https://perma.cc/6KCP-GXGF].

86. *Id.*

87. *See* Papke, *supra* note 63, at 61-62.

88. *Midwest*, GLOBALCHANGE.GOV (Feb. 7, 2022, 1:01 PM), https://nca2014.globalchange.gov/highlights/regions/midwest [https://perma.cc/T4DE-9CSR] (The highly anticipated plans and recommendations presented in December 2008 uncovered disagreements about allowances and whether they are to be auctioned or allocated.).

89. Ken Paulman, *Midwest Cap-and-trade: Not Dead, Just Sleeping*, ENERGY NEWS NETWORK (Mar. 4, 2011), https://energynews.us/2011/03/04/midwest-cap-and-trade-is-it-dead-or-no/ [https://perma.cc/7QAT-B8SH].

Arizona, California, New Mexico, Oregon, and Washington.[90] WCI's initial goal was to cover a broader range of emissions and include a wider range of offset projects than the RGGI.[91] Participants and members have fluctuated throughout the past decade. As of October 2022, the states of California and Washington alongside Canadian providences Nova Scotia (who joined in 2018)[92] and Quebec were the only active WCI partners remaining.

2. California Cap-and-Trade Program: A Success Story

California's Cap-and-Trade Program is the strongest carbon market currently operating.[93] Like the other regional markets, the California Legislature first approved Assembly Bill 32 (AB 32) in 2006, which established the state's 2020 GHG Reduction Target.[94]

90. Papke, *supra* note 63, at 65 (Montana, Utah, and four Canadian providences (British Columbia, Manitoba, Ontario, and Quebec) joined in 2008.).

91. *Id.* (WIC included regulation of electricity, industry, transportation, and residential and commercial fuel use. WIC also offered a wider range of eligible offset credit projects, than RGGI, ranging "methane capture from landfills and manure and wastewater management, and sequestration of CO2 achieved through no-till farming, afforestation/reforestation, forest management, forest preservation/conservation, and creation of long-life forest products.").

92. *Greenhouse Gas Emissions Trading: A Cost-Effective Solution to Climate Change*, W. CLIMATE INITIATIVE (Oct. 27, 2022, 6:49 PM CST), https://wci-inc.org/ [https://perma.cc/3ZD5-4C7J]; *Nova Scotia Joins Western Climate Initiative Inc.*, NOVA SCOTIA (May 14, 2018, 10:33 AM), https://novascotia.ca/news/release/?id=20180514001 [https://perma.cc/ZR4R-ZEQV] (explaining they joined to be a national leader, in Canada, in the fight for climate change).

93. *See* Benjamin Storrow, *Price Hike Marks New Era for Calif. Cap-and-Trade*, CLIMATEWIRE (Jan. 3, 2022, 6:39 AM EST), https://www.eenews.net/articles/price-hike-marks-new-era-for-calif-cap-and-trade/ [https://perma.cc/5PMF-HXFV] (State lawmakers even passed a ten-year extension of the program in 2017, making it arguably the most successful and robust cap-and-trade program to date.).

94. *FAQ Cap-and-Trade Program*, CAL. AIR RES. BD. (Feb. 7, 2022, 1:07 PM), https://ww2.arb.ca.gov/resources/documents/faq-cap-and-trade-program [https://perma.cc/ADY3-25CN] (In addition to establishing the reduction target and approval for a cap-and trade program, AB 32 also mandated that the policies to reduce GHGs, be cost-effective, technologically feasible, and importantly, not disproportionately impact residents in environmental justice communities. "In 2008, CARB adopted the first AB 32 Scoping Plan, which charted the State's path to achieving the 2020 GHG Reduction Target. It included a mix of incentives, regulations, and an economy-wide cap-and-trade program. The AB 32 Environmental Justice Advisory Committee recommendations from 2007 asked for a three-pronged approach of incentives, regulations, and a carbon fee. The only form of a carbon fee authorized by the Legislature in AB 32 was a cap-and-trade program. As demonstrated in the initial AB 32 Scoping Plan and subsequent updates, the Cap-and-Trade Program is just one of a suite of policies to help the State achieve its GHG reduction targets.").

While the start of the cap-and-trade program was delayed until 2013, there continued to be bipartisan and supermajority legislative support for the program.[95] California's Cap-and-Trade Program permits allows trading and offset purchases just like other existing markets, but its carbon price towers over all other markets.[96] As of early 2022, California's carbon price is $28.26 per ton, the highest it's ever been.[97] The California Air Resources Board (CARB) administers the program and approves offset project types.[98] Unsurprisingly, soil carbon sequestration is absent from the list of approved project types.[99] As such, soil carbon credits continue to be a black box of problems and opportunities.[100]

Although not perfect, the continually evolving and improving California Cap-and-Trade Program continues to inspire the nation years after its conception.[101] The Washington State Legislature passed a series of sweeping climate change bills in spring 2021 to create the second state cap-and-trade market beginning in January 2023.[102] The

95. *Id.*

96. Ritter, *supra* note 86.

97. *Id.*; *see also Storrow*, *supra* note 95 (This price hike represents a new chapter in the cap-and-trade programs and shows soil carbon offset credits might not be as unprofitable as previous years.); Lisa Song, *Cap-and-trade is Supposed to Solve Climate Change, but Oil and Gas Company Emissions Are Up*, PROPUBLICA (Nov. 15, 2019, 5:00 AM EST), https://www.propublica.org/article/cap-and-trade-is-supposed-to-solve-climate-change-but-oil-and-gas-company-emissions-are-up [https://perma.cc/A54E-6EST].

98. *Compliance Offset Protocols*, CAL. AIR RES. BD. (Feb. 7, 2022, 1:19 PM), https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program/compliance-offset-protocols [https://perma.cc/A2AQ-XENY] (Current approved agriculturally based offset credit project types include: livestock projects, mine methane capture (livestock methane digester project), rice cultivation projects, and forestry projects.).

99. *See id.*

100. *See* OHLSON, *supra* note 13, at 122 (Kristin Ohlson, an investigative journalist whose journey into the soil carbon credit world culminated in a 2014 book called "The Soil Will Save Us," summarized the soil's struggle to break into the markets: "Since understanding of the soil has generally lagged behind that of other ecosystems, convincing policy makers and others that soil can absorb and hold carbon is a tough task.").

101. Levi Pulkkinen, *Washington Passed its Cap-and-Trade Climate Legislation. Now What?*, U.S. NEWS (May 10, 2021), https://www.usnews.com/news/best-states/articles/2021-05-10/washington-passed-its-cap-and-trade-climate-legislation-now-what [https://perma.cc/T8ED-6739].

102. *Id.* ("Microsoft and Amazon have recently committed to cutting their emissions beyond the levels now set by law."); *see also* Press Release, CQ Roll Call, CFTC Panel Urged to Find Ways to Harmonize Cap-and-Trade Markets (June 8, 2021) (on file with author); Joseph Pisani & Bani Sapra, *'Middle of the Herd' No More: Amazon Tackles Climate Change*, U.S. NEWS (Sept. 19, 2019, 7:15 PM), https://www.usnews.com/news/business/articles/2019-09-19/amazon-vows-to-cut-emissions-to-combat-climate-change?context=amp [https://perma.cc/N36T-3PKK]; Kate Yoder, *After A Decade of Failures, Washington State*

Washington State Legislative effort indicates carbon markets are not dead nor politically unviable; rather, the legislation is a process and an ongoing effort. Other state legislatures, including Hawaii, are now considering similar cap-and-trade programs.[103] California's efforts should be an example for a national cap-and-trade market.

B. Prior Failed Federal Legislative Efforts

1. American Clean Energy and Security Act of 2009

After President Obama took office in January 2009, legislative momentum around the country was at an all-time high for cap-and-trade markets, extending to the federal level. The American Clean Energy and Security Act of 2009, colloquially known as "Waxman-Markey," proposed a national cap-and-trade market headed by the EPA.[104] The bill capped the total GHG emissions emitted nationally and included offset credit purchases and allowance trading.[105] Offset purchases have enabled companies who exceed their limit to buy permits from companies who produce less than their limits.[106] After months of debate, the bill, seen as a hard-won balance between environmentalists and industry, narrowly passed the House in June 2009.[107] However, former Senate Majority Leader Harry Reid never brought the bill to the Senate floor for discussion.[108]

Why the American Clean Energy and Security Act bill did not see the Senate floor is a lesson for future cap-and-trade legislation. Many criticized the legislation for being too weak and wanted additional emission regulations.[109] Questions and concerns about the proposed bill included whether a cap-and-trade market would help in the fight against climate

Passes A Cap On Carbon Emissions, GRIST (Apr. 27, 2021), https://grist.org/economics/after-a-decade-of-failures-washington-state-passes-a-cap-on-carbon-emissions/ [https://perma.cc/X3BG-4PVB].

103. Patnaik & Kennedy, *supra* note 62 (Washington State's previous attempt to create a cap-and-trade system fizzled out in 2009, followed by state voters rejecting two high profile carbon-tax initiatives in 2016 and 2018.).

104. Bernadett, *supra* note 21, at 219 (Then Representative Henry Waxman of California and chairman of the Energy and Commerce Committee and then Representative Edward Markey from Massachusetts, chairman of the Energy and Power subcommittee, introduced the bill in May 2009.).

105. *Id.*

106. *Id.*

107. Bryan Walsh, *Why the Climate Bill Died*, TIME (July 26, 2010), https://science.time.com/2010/07/26/why-the-climate-bill-died/ [https://perma.cc/XEB9-BC5L].

108. *Id.*

109. *See* Kate Sheppard, *Was Waxman-Markey a Waste of Energy?*, MOTHER JONES (Mar. 9, 2010), https://www.motherjones.com/politics/2010/03/waxman-markey-senate-climate-kerry-graham-lieberman/ [https://perma.cc/H64X-YPBY].

change with all the loopholes provided in the bill.[110] These loopholes included accounting for the aging coal power plants and free carbon credits for oil refineries.[111] Additionally, there was not enough public support across the nation to demand the bill be brought to a vote.[112] In 2009, the public concern about climate change was declining across all political parties due to a lack of solid evidence of global warming.[113] "Citizens wouldn't support an approach they couldn't understand to solve a problem our leaders refused to acknowledge."[114] Finally, the lack of bipartisan support and senate opposition stopped the

110. *Id.*

111. *Id.* ("The coal bloc, led by Rep. Rick Boucher (D-Va.), carved out loopholes from pollution rules for aging coal-fired power plants and secured more than $60 billion for so-called "clean-coal" technology. Rep. Collin Peterson (D-Minn.) held the bill hostage until Big Ag's demands were met. A coalition of Southern Democrats watered down a mandate requiring utilities to produce a certain amount of power from renewable sources. Oil refineries, manufacturers, and electric utilities were all handed a significant allotment of pollution credits free of charge.").

112. *Id. ("*Now, the key players on the Senate climate effort are signaling that instead of focusing on a cap-and-trade scheme, they may instead adopt a hybrid approach that would scale back the permit-trading program, cap only electric utilities rather than polluters across the entire economy, and return revenues from the sale of pollution permits to consumers through an energy rebate program known as a dividend.").

113. *Fewer Americans See Solid Evidence of Global Warming*, PEW RSCH. CTR. (Oct. 22, 2009), https://www.pewresearch.org/politics/2009/10/22/fewer-americans-see-solid-evidence-of-global-warming/ [https://perma.cc/4VCA-C637] (One poll of Americans in October 2009 indicated a sharp decline in the belief in solid evidence of global warming. "Just 53% of independents now see solid evidence of global warming, compared with 75% who did so in April 2008. Republicans, who already were highly skeptical of the evidence of global warming, have become even more so: just 35% of Republicans now see solid evidence of rising global temperatures, down from 49% in 2008 and 62% in 2007. Fewer Democrats also express this view – 75% today compared with 83% last year."); *see also* Daniel Weiss, *Anatomy of a Senate Climate Bill Death*, CTR. FOR AM. PROGRESS (Oct. 12, 2010), https://www.americanprogress.org/article/anatomy-of-a-senate-climate-bill-death/ [https://perma.cc/3QXF-W9UT] (When comparing national unemployment rate when the House passage of the American Clean Energy and Securities Act rate to other unemployment levels when other environmental laws pass: "The first Clean Air Act, Clean Water Act, Endangered Species Act, and Resource Conservation and Recovery Act (hazardous waste disposal) were all enacted when unemployment was 6 percent or lower. Unemployment is 50 percent higher now. Only six major environmental laws were enacted with annual unemployment over 7 percent, and none with unemployment greater than 7.7 percent. Unemployment averaged 9.3 percent in 2009 and 9.7 through September 2010. In other words, the worst unemployment in nearly 30 years made the up-hill climb to pass a global warming bill even steeper. And certainly the special interests' opposed to action on global warming played on Americans' concern about unemployment to frighten senators into opposing global warming action.").

114. Walsh, *supra* note 109. (New York Times, Rockefeller Family Fund director Lee Wasserman theorized among other reasons that the "cap-and-trade died because the public

bill in its tracks.[115] However, climate change legislation would receive strong public and partisan support twelve years later in the proposed legislation Growing Climate Solutions Act.

2. Growing Climate Solutions Act

The Democrats regained control of the House in 2019, which marked a renewed interest in climate change.[116] One standout bipartisan bill regarding carbon markets was the Growing Climate Solutions Act,[117] which addressed the increasing demand for American-made nature-based carbon offsets credits.[118] The bill outlined a USDA program to help "American farmers, ranchers and private forest owners adopt, and ultimately profit from, activities that reduce or sequester GHG emissions" in the voluntary, private carbon markets.[119] The bill garnered broad support from many leading environmental and

ultimately wasn't engaged in the fight: 'Citizens wouldn't support an approach they couldn't understand to solve a problem our leaders refused to acknowledge. Even the earth's flagging ability to support life as we know it couldn't stir a public outcry. The loudest voices insisted that leaders in Washington do nothing. They obliged.' Just as Reid knew a carbon cap couldn't get the 60 votes now needed to get anything passed in the recalcitrant Senate, ultimately the threat of global warming didn't galvanize the public to the point where they would demand change. There are lots of reasons for this—disinformation campaigns by fossil fuel interests, the overblown controversy of "climategate," a media corps that too rarely puts global warming in the right context. But until that changes—and the public demands change—ambitious climate legislation will remain dead.").

115. *Id.*; *see also Congress Climate History*, CTR. FOR CLIMATE AND ENERGY SOL. (Mar. 2, 2022, 4:48 PM), https://www.c2es.org/content/congress-climate-history/ [https://perma.cc/BN7A-VB5W].

116. *Congress Climate History*, *supra* note 117.

117. *Growing Climate Solutions Act Reintroduced*, THE U.S. SENATE COMM. ON AGRIC., NUTRITION & FORESTRY (Apr. 20, 2021), https://www.agriculture.senate.gov/newsroom/dem/press/release/growing-climate-solutions-act-reintroduced [https://perma.cc/E6VJ-E8Y4] (Cosponsored by Ranking Member John Boozman (R-AR), and Senators Marco Rubio (R-FL), Amy Klobuchar (D-MN), Mitt Romney (R-UT), Michael Bennet (D-CO), Bill Cassidy (R-LA), Tina Smith (D-MN), Susan Collins (R-ME), Chris Coons (D-DE), Mike Crapo (R-ID), Angus King (I-ME), Joni Ernst (R-IA), Jacky Rosen (D-NV), Deb Fischer (R-NE), Chuck Grassley (R-IA), Lisa Murkowski (R-AK), John Thune (R-SD), Todd Young (R-IN), Sherrod Brown (D-OH), John Hoeven (R-ND), Jeanne Shaheen (D-NH), Martin Heinrich (D-NM), Bill Cassidy (R-LA), Dianne Feinstein (D-CA), Tom Carper (D-DE), Ron Wyden (R-OR), Ben Ray Luján (D-NM), Cindy Hyde-Smith (R-MS), Tammy Baldwin (D-WI), Raphael Warnock (D-GA), and Cynthia Lummis (R-WY).).

118. Mitchell, *supra* note 10.

119. *Id.* (The act addressed some of the technical barriers to entry outlined in Part II by proposing a certification program called *Greenhouse Gas Technical Assistance Provider and*

agricultural organizations. [120] Despite overwhelming bipartisan support in the Senate this time, passing 92-8 in June 2021, as of February 2022, the bill is still waiting on the house desk, stalled by both sides of the aisle with no indication of an upcoming vote.[121]

Because the bill was an entry program to private, voluntary carbon markets, many republicans expressed concern with the federal "big government" getting involved.[122] At the same time, across the aisle, representatives "fret over a boon for big industrial operations."[123] Even though agricultural and environmental groups generally supported the bill,[124] some expressed trepidation regarding the proposed USDA leadership over carbon credits, arguing the agency does not have expertise in verifying practices that reduce emissions.[125] The EPA's level of expertise would be more appropriate in their eyes.[126] Finally, the Growing Climate Solutions Act proposal was overshadowed in the House by two critical infrastructure measures, including raising the debt ceiling and passing fiscal 2022 spending bills.[127]

These past legislative attempts to propose a cap-and-trade market and improve access to voluntary carbon markets foreshadow the future of increased emission regulations. The United States should not lose sight of the opportunity to introduce a national cap-and-trade market with a soil carbon offset program that could benefit a billion acres of farmland in the country.

IV. A FRAMEWORK FOR SOIL CARBON CREDITS IN A NATIONAL CAP-AND-TRADE MARKET

Third-Party Verifier Certification Program, which would allow the USDA to provide transparency and legitimacy of the protocols. Next, it addressed access to information through a proposed one stop shop website with resources for producers and foresters who are interested in participating in carbon markets. The bill would establish an advocacy council composed of producers, scientists, and agricultural experts that would advise and ensure certification programs remains relevant and credible and responsive to participants and producers. Finally, the bill would include an annual program development report to Congress.); *see also Sheppard, supra* note 111 (While directed towards the private, voluntary carbon markets, the bill was seen as a step towards establishing a national carbon market.).

120. *Id.*

121. Growing Climate Solutions Act of 2021, S. 1251, 117th Cong. (2021).

122. Dean Scott & Megan U. Boyanton, *Climate Bill Boosting Growers' Carbon Credits Hits House Hurdles*, BLOOMBERG L. (Aug. 13, 2021, 4:01 AM), https://news.bloomberglaw.com/environment-and-energy/climate-bill-boosting-growers-carbon-credits-hits-house-hurdles [https://perma.cc/P4RB-E2SK].

123. *Id.*

124. *Id.*

125. *Id.*

126. *Id.*

127. Scott & Boyanton, *supra* note 124.

This next portion proposes a legislative solution and framework for introducing high-quality soil carbon credits in a potential national cap-and-trade market in the 2023 Farm Bill.

A. An Opportunity in the 2023 Farm Bill

The farm bill is a sweeping omnibus agricultural bill and the cornerstone of our nation's agricultural policy.[128] It is passed every five years and determines large swaths of federal policy regarding American agriculture for the following five to ten years after its passage.[129] The upcoming 2023 Farm Bill would be an ideal avenue to propose a national cap-and-trade market and a standardized soil carbon offset program due to the bill's history of creating new markets and conservation efforts.[130] The National Association of State Departments of Agriculture (NASDA) met in February 2022 and announced the priorities for the 2023 Farm Bill, which included conservation and climate resiliency.[131] A national cap-and-trade market would align closely with conservation and climate priorities because it incentivizes farmers to choose climate-friendly farming practices through compensation.

While the farm bill may seem like an unlikely place for climate change and environmental regulation proposals, agriculture has been on the front lines of the climate crisis, with farms facing increasingly prolonged droughts, extreme flooding, and wildfires in recent years. The farm bill is "a place where rural and urban meet, make compromises and form unique and sometimes unlikely partnerships."[132] The EPA and the USDA can work together to fight against climate change. Mirroring the popular Growing Climate Solutions Act, the soil offsets approval process should be administered by USDA rather than EPA because farmers are familiar with the USDA, so the USDA leadership would likely harvest a more farm-friendly stance.

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128. *2023 Farm Bill*, RURAL ADVANCEMENT FOUND. INT'L (Mar. 2, 2022, 2:35 PM), https://www.rafiusa.org/2023-farm-bill/ [https://perma.cc/3L6T-TKD5].

129. *Id.*

130. *See* Amie Simpson, *It's Not Too Early to Think About the 2023 Farm Bill*, BROWNFIELD AG NEWS (Mar. 18, 2021), https://brownfieldagnews.com/news/its-not-too-early-to-think-about-the-2023-farm-bill/ [https://perma.cc/4QVN-54HK] (discussing how conservation programs can help achive climate goals and technical assistance can help generate carbon credits); *see also* Thomas J. McClure, *What's The Buzz? 2018 Farm Bill*, 92 WIS. LAW. 30 (2019) (The 2018 Farm Bill opened up a new cannabis market.).

131. *State Agriculture Officials Announce Their Priorities for the 2023 Farm Bill*, MORNING AG CLIPS (Feb. 16, 2022), https://www.morningagclips.com/state-agriculture-officials-announce-their-priorities-for-the-2023-farm-bill/ [https://perma.cc/7J68-WZA9] ("NASDA is a nonpartisan, nonprofit association which represents the elected and appointed commissioners, secretaries and directors of the departments of agriculture in all fifty states and four U.S. territories.").

132. *2023 Farm Bill*, *supra* note 130.

1. A Proposed National Cap-and-Trade Market

The proposed national cap-and-trade market in the 2023 Farm Bill will best work with a "carrot and stick" approach for producers and buyers of soil carbon offset credits. Metaphorically, the carrot is the incentive, and the stick is the punishment.[133] The carrot and the stick work together as a motivational approach.[134] Previously, the American Energy and Securities Act was only a "stick" for farmers and producers. It offered regulations but no way for farmers to participate. The Growing Climate Solutions Act of 2021 was a "carrot" for producers. With no cap or emissions regulation in place, there was "no real lever to force polluters to buy credits."[135] However, with substantial leadership in Washington and the public and private demand for offset credits, a national cap-and-trade market with emission regulations and a soil carbon offsets program could be an effective carrot and stick approach to regulating GHG emissions.[136] An effective national cap-and-trade market should set a minimum carbon price, develop a carbon bank, and have a "shrinking cap" on industry emissions.

A national cap-and-trade market should set a minimum carbon price, ideally with a sufficiently high carbon price per ton ($35-50, increasing 5% every year) to ensure consistency in carbon pricing.[137] While this proposed carbon price is even higher than the current California cap-and-trade carbon price, the "social cost of carbon" (SCC) must be considered. When calculating the SCC, economists and scientists utilize a variety of tools known as integrated assessment models (IAMs).[138] These IAMs, are used to calculate the SCC, a measure of the quantifiable costs and benefits of emitting one additional ton of CO2 in monetary terms.[139] The Biden administration has temporarily raised the SCC to $51 per ton[140] and is preparing to finalize a new social cost calculation. The Fifth Circuit Court of

133. *Carrot and Stick Motivation: Definition and Examples in the Workplace*, INDEED (Dec. 17, 2020), https://www.indeed.com/career-advice/career-development/carrot-and-stick-motivation [https://perma.cc/P865-M6C7].

134. *Id.*

135. Tom Philpott, *The Climate Bill Even Big Agriculture Loves*, GRIST (June 8, 2021), https://grist.org/agriculture/growing-climate-solutioins-act-conservative-support/ [https://perma.cc/KRU9-BDGF].

136. *Id.*

137. *See supra* Part II, Section B; *see also* Storrow, *supra* note 95 (discussing the Feb. 2022 price, $28.26 carbon credits in California's Cap-and-Trade Program as a new era for the market).

138. Jim Krane & Mark Finley, *What is the 'Social Cost of Carbon'? 2 Energy Experts Explain After Court Ruling*, THE CONVERSATION (Mar. 17, 2022, 10:57 AM EDT), https://theconversation.com/what-is-the-social-cost-of-carbon-2-energy-experts-explain-after-court-ruling-176255 [https://perma.cc/BEQ6-SZCA].

139. *Id.*

140. *Id.*

Appeals stayed a Louisiana District Judge's injunction against Biden's SCC metric used in policy and decision making.[141] This decision bolsters the argument that policymaking may take into account future environmental costs to substantiate aggressive carbon pricing rates and increases.

Further, federal pricing involvement provides financial stability for the buyer as well as the agricultural producer. This assured higher carbon price would not jeopardize the buyer's investment or the producers' initial outlay.[142] Additionally, stability allows investors and producers to better plan and understand long-term investment decisions.[143] The stabilized carbon price would also benefit the U.S. non-agricultural economy and spur accelerated low-carbon practices and technology development.[144] This would "help to ensure that U.S. companies can lead the new industries centered on low-carbon technologies that will become the lynchpin of the global economy in the coming decades."[145]

The national cap-and-trade market should include a central carbon bank to ensure producers and buyers have a stable transactional credit system, eliminating the question of payments for approved offset projects. Unlike in 2010, when a lack of buyers collapsed the CCX,[146] the public and private demand for carbon offset credits is skyrocketing.[147] Thus, a recognized carbon bank would stabilize the offset market and be an integral part of a successful cap-and-trade market system.

A shrinking cap is also essential to establishing a national cap-and-trade market. It should likely resemble California's Cap-and-Trade Program, which reduces the allowed emissions from different industries over a period of years. This continual shrinkage of allowed emissions is the stick, ensuring reasonable pressure exists within the market for

141. Alex Guillén, *Appeals Court Revives Key Climate Measure Rejected by Trump Judge*, POLITICO (Mar. 16, 2022, 8:13 PM EDT), https://www.politico.com/news/2022/03/16/appeals-court-social-cost-carbon-biden-trump-00017986 [https://perma.cc/ZLJ9-AYFJ].

142. *See* Patnaik & Kennedy, *supra* note 62 (Discussing the right price of carbon. "Climate economist William Nordhaus estimates that the SCC was $31 per ton in 2015, but will grow to $44 per ton by 2025 and $52 per ton by 2030. The Obama administration EPA calculated similar estimates: $36 per ton in 2015, growing to $46 per ton by 2025 and $50 per ton by 2030. Taking a different approach, the High-Level Commission on Carbon Prices—drafted by the UN Framework Convention on Climate Change—estimated that achieving the Paris Agreement's goal of limiting warming to two degrees would require a universal carbon price of $40-80 per ton by 2020 and $50-100 by 2030 to achieve. Only 3.76% of global emissions are currently covered by a $40-80 price. Economists at the International Monetary Fund went even further, suggesting that major emitters would need a carbon price of $75 per ton to achieve sufficient emissions reductions.").

143. *See id.*

144. *Id.*

145. *Id.*

146. *Id.*

147. *See supra* Part I.

companies and industries to either make changes or purchase carbon offset credits.[148]

2. Creating Equal Carbon Credits Through Verification Protocols and Criteria Standardization

A national cap-and-trade market should introduce soil carbon offset credits as an approved offset project. The current markets have primarily ignored soil projects,[149] but a national market should accept soil carbon offset projects. With the structured introduction of soil carbon credits, the federal government should standardize an approval process for verification protocols and soil carbon credit criteria. This standardization would end the precarious "wild west" of third-party verification protocols that the current voluntary markets face.[150] The private, third-party verification protocols would continue to measure soil but only after a USDA-approved measurement and monitoring protocol application. A producer would be able to contact any of the USDA-approved verifiers and have them measure their project's soil carbon levels. This standardizing of the approval process and criteria would increase the buyer's confidence in high-quality soil carbon offset credits, thus lessening the volatility and inequality of soil carbon credits.[151]

Below is the proposed wording for soil carbon criteria and the integrity safeguards:

Required Soil Offset Protocol Criteria	**Proposed Wording**	**Integrity Safeguards Proposed Wording**
Quantifiable/ Real	The carbon change in the soil must be quantifiable by data. A soil carbon credit must have a physical soil sample benchmark that all future carbon data, either physical or computer modeling, can be measured against. A protocol may use physical soil sampling, an approved modeling tool, or a combination of both approaches to gather data during the project after the initial benchmark.	When testing a physical soil sample for bulk density, the sample must consider any gravel content and volume. Because gravel does not sequester carbon, "gravel volume [is] an essential parameter for accurate bulk density measurements."[152]
Additionality	The offset project or activity must be additional to a producer's regular practices, meaning the carbon sequestered would not have happened without the offset credit buyer or collective buyers in the market.	Cannot backdate a project.[153]
Permanency	To ensure the carbon sequestered is maintained over time, an offset credit must demonstrate a minimum permanence period of 20 years.	Projects must contribute credits equal to 15% of its claimed benefits to its "buffer pool." This buffer pool will be used if an avoidable reversal occurs.[154]
Depth[155]	Physical soil carbon verification must be measured at least 30 cm.	If measured at a depth below 30 cm, the protocol should be placed into a different depth category in the national soil measuring system.[156]

Leakage[157]	The offset credit can't create a corresponding decrease in soil carbon on the same operation.	An agricultural operation's contiguous managed property must, at an aggerated level, create a corresponding increase in soil carbon.
Tenancy	Credits may be available for leases of five years or more if nothing is noted in the lease contract with the landowner.	Unless negotiated in the tenancy agreement, the tenants managing land operations for five years or greater are entitled to a prorated portion of landowners' offset credit value by acre.
Aggregation	To ensure smaller farms' access to the carbon market, offset credits may be aggregated	

148. Patnaik & Kennedy, *supra* note 62 (Critics of the California Cap-and-Trade Program have expressed their concern that low-income and historically marginalized communities do not have reduced emissions in their areas. A national cap-and-trade market should also explicitly address equity and environmental justice and ensuring carbon credit programs are available to all communities, especially historically marginalized populations. The regulating agency must also conduct yearly emission tests in low-com and historically marginalized community to ensure these communities are not being disproportionately affected by the market.).

149. *See supra* Part III, Section B.

150. *See supra* Part II, Section B, Section 2.

151. E.E. OLDFIELD ET AL., ENV'T DEF. FUND, AGRICULTURAL SOIL CARBON CREDITS: MAKING SENSE OF PROTOCOLS FOR CARBON SEQUESTRATION AND NET GREENHOUSE GAS REMOVALS 29 (2021), http://www.edf.org/sites/default/files/content/agricultural-soil-carbon-credits-protocol- synthesis.pdf [https://perma.cc/3BZD-D6S7].

152. Aaron Simmons et al., *U.S. Scheme Used by Australian Farmers Reveals the Dangers of Trading Soil Carbon to Tackle Climate Change*, THE CONVERSATION (June 24, 2021, 4:12 PM EDT), https://theconversation.com/us-scheme-used-by-australian-farmers-reveals-the-dangers-of-trading-soil-carbon-to-tackle-climate-change-161358 [https://perma.cc/DF75-TMEM].

153. *See* Zelikova et al, *supra* note 43 (Nori, a third-party verification protocol, currently allows backdating up to five years. This is a dangerous criterion because there is only an estimated soil carbon benchmark rather than a recorded soil carbon benchmark. This opens up the possibility of fraudulent activity and should be avoided for future soil carbon protocols. Note, this does create a system where early adopted are not recognized for their efforts.).

154. *Id.* at 23.

155. *Id.* at 19; OLDFIELD ET AL., *supra* note 153 (discussing carbon financing programs that have large land requirements. However, scale is also a problem with offset credits because only eight offset credits (or eight metrics ton of carbon) can typically be sequestered in one acre of land. At carbon prices ranging from $9-27 in different markets in 2018-19, this translates to the need for a large amount of land to make carbon offset worth it for a farmer. Australia's Carbon Farming Intuitive, require soil samples to be taken below 30 cm, or the upper level of soil, which is usually disturbed by tilling because "measuring soil carbon at depth provides the most complete picture of how carbon stocks change due to management.").

156. *See infra* Part IV, Section A, Part 3.

157. OHLSON, *supra* note 13, at 123.

	through existing cooperatives or regional groups.	
No Double Counting	All credits will be tracked through a publicly available ledger to avoid double claiming offset credits. Information will include who was issued credits and their location, who currently owns credits, when each credit was retired, and who claimed the GHG benefit along with their location.	The ledger is available for external scrutiny and validation.

By supporting the farmers and farming organizations through greater access to approved protocols, U.S. agriculture and the U.S. economy will transition to more sustainable and climate friendly farming techniques. By creating SCC solutions within the proposed national cap-and-trade market, the federal government could enroll large numbers of producers from rural areas into offset programs and potentially increase political support for the bill.

3. National Soil Measuring Database to Ensure Transparency and Research Acceleration

The national cap-and-trade market should also establish a national soil measuring database through the 2023 Farm Bill to support the standardization of soil carbon credits. Measuring soil carbon data is time and effort-intensive and limits a carbon protocol's data collection ability.[158] A national database is going to be vital to ensuring high-quality soil credits. This database should be open-source and accessible to ensure transparency and the acceleration of research. These open-access datasets would allow aggregation of all historical data from the myriad of current private protocols and help with model calibration, benchmarking, establishing carbon baseline concentrations, additionality determinations, and the acceleration of the soil carbon research. "Regular, standardized comparisons of model results with measured data from multi-field projects would be useful for assessing potential bias, as well as for determining the appropriate geographic and time scales for a desired level of confidence with anticipated SOC change."[159] These datasets would also identify research gaps and narrow areas of critical research.

B. Criticisms

1. Cap-and-Trade Markets

As demonstrated throughout the U.S. legislative history, cap-and-trade markets

158. *See id.* at 78.

159. OLDFIELD ET AL., supra note 153 at 20.

are no strangers to criticism. Some critics see cap-and-trade markets as programs that fail to hold big polluters and industries accountable to reduce or eliminate pollution.[160] Further, they see the carbon markets as a waste of time and resources and only used to present an environmentally responsible public image through "greenwashing."[161] The argument is that big polluters and industries continue to pollute at unprecedented rates. Instead of changing their practices, they shift responsibility to others through offset programs.[162] This shifting of responsibility, which is present in current cap-and-trade markets, has only exacerbated pollution hotspots in low-income communities in the United States and developing countries.[163]

Despite cap-and-trade market flaws, it is time to support all mitigation measures possible regardless of the magnitude of the impact. These regulatory measures can go beyond reducing fossil fuel emissions with federal government involvement.

2. Soil Carbon Credits

Critics of soil carbon credits posture that agricultural and forest offsets are an ineffective policy measure for addressing the climate crisis.[164] Common critics argue that agriculture, representing 10% of GHG emissions, is only a small portion of total GHG emissions in the United States, and soil credits are too slow when the world needs rapid carbon sequestration.[165] Further, critics argue the soil on "Earth is not an endless sponge" and has a limited storage capacity, raising questions about carbon storage permeance.[166] Additionally, the soil carbon verification methods "remain underdeveloped, inconsistent, and influenced by specific climates and geographies."[167] The final criticism is that offset programs are incompatible with sustainable agriculture and may drive further consolidation of smaller farms, and continue to leave out historically underrepresented farmers of

160. *See supra* Part III, Section C.

161. *See* Letter from Biofuelwatch et al., to Members of Congress 1 (Apr. 14, 2021), https://www.foodandwaterwatch.org/wp-content/uploads/2021/04/Oppose-GCSA-2021_Final-2.pdf [https://perma.cc/ZT78-CV6Y].

162. *Id.*; *see* TOENSMEIER, *supra* note 27, at 330 (Tonesmeir is a large proponent of a carbon tax and disfavors cap-and-trade programs. He believes the cap-and-trade programs are susceptible to favoring specific industries and even specific Congressional districts while a carbon tax is "less complicated and opaque than the financial manipulations of carbon trading.").

163. Letter from Biofuelwatch et al., *supra* note 161, at 3.

164. *Id.* at 2.

165. *See id.*

166. *Id.*

167. *Id.* (However, within a short number of years, soil carbon verification methods should be reliable and consistent.); *see generally EarthOptics*, *supra* note 46.

color.[168]

V. CONCLUSION

Soil carbon sequestration has many benefits for the environment through the mitigation of climate change and the reduction in GHG emissions. It also carries benefits for the producers, both as a source of new income and as a tool for improving soil health. But the current unregulated soil carbon offset protocols have created an environment of unequal carbon credits due to the differing criteria. Moving forward, soil carbon offset credits need governmental assistance and regulation to rise to the level of high-quality credits. The federal government should learn from the past and current regional cap-and-trade markets and propose a national cap-and-trade market in the 2023 Farm Bill. This national cap-and-trade market should set a carbon price minimum, establish scientific criteria and third-party verification protocol for soil carbon credits, and a national soil measurement database to ensure integrity, consistency, access, and trust. Although the 2023 Farm Bill is primarily an agricultural policy-based bill, the federal cap-and-trade program falls squarely under the bill's conservation and climate resiliency priorities. This cap-and-trade market proposal with a soil-based offset program offers a carrot and stick approach that may be a successful step towards mitigating climate change while supporting American farmers and the U.S. economy. Despite the criticisms of cap-and-trade markets and soil carbon offset credits, a legislative solution that takes bold action is preferable to the currently problematic world of soil carbon credits.

168. *Id.*