

Carbon Farming Could Sequester Billions of Tonnes of CO₂, with U.S. Pilot Project as One First Step

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A concerted, well-supported effort by the world’s farmers to restore and protect soil health could reduce atmospheric carbon dioxide by as much as 65 parts per million (ppm) from the current, alarming level of more than 413 ppm, participants heard during an April 10 carbon farming webinar hosted by Washington, DC-based Environmental Entrepreneurs (E2).

That number would be a stretch goal, to say the least. It represents the estimated amount of carbon human activity has removed from the soil since the dawn of industrial agriculture. But even if its eventual contribution to climate stabilization falls well short of the extreme potential, drawing more active attention to soil carbon sequestration could still elevate a climate solution that too often receives scant consideration compared to more complex, costlier, often riskier “negative emissions” options.

A critical step in advancing climate-friendly soil health in the United States is the groundbreaking Soil Health Demonstration Trial, a carbon farming pilot project that a determined and innovative coalition of farmers, agricultural technology entrepreneurs, and

environmentalists managed to persuade a deeply divided U.S. Congress to accept in the December 2018 farm bill, the *Agricultural Improvement Act of 2018*.

“The farm bill is always an opportunity. If you have good ideas and a fair bit of good will, you can find common ground,” said Oregon Senator Ron Wyden, whose enthusiastic support for the pilot project was critical in securing its success in Congress.

The idea for the carbon farming pilot emerged in the wake of COP23 in Bonn, said E2 co-founder and chair Nicole Lederer. World leaders at COP23 affirmed that regenerative agriculture practices that naturally conserve and protect topsoil and support its fertility and resilience are “a huge carbon capture opportunity.” With carbon farming, soil carbon gains its proper recognition as an agricultural product, becoming a commodity that farmers grow, measure, and sell.

Having the carbon farming pilot approved and included in the farm bill is such a critical step forward because it “directs the development of metrics to certify the amount of carbon that has been sequestered,” Lederer explained. Such metrics will be “key to defining a pathway for farmers to sell carbon offsets in public and private carbon markets.”

As a brand new agricultural product, soil carbon would be “immune to so many of the variables that challenge farmers,” she said, and would be “of increasing value to society,” with the potential to entirely transform the map of U.S. states that support policies to confront climate change. “It’s good for farmers, good for the climate, and good for business,” she said.

‘Farmers Are Motivated’

David Kolsrud, a South Dakota corn and soy farmer, wind entrepreneur, and president of DAK Renewable Energy, played “a seminal role in connecting E2 to the farming community,” Lederer said. Addressing the question of what brought farmers to support the carbon farming provision, he told participants that “farmers are generally always motivated to take care of their soil for next generations,” and many among them “recognize the opportunity to define a new revenue stream based on carbon performance.” The growing number of extreme weather events, including the recent flooding in South Dakota, is also driving interest in soil health.

And then there are the “mountains of data” farmers have acquired thanks to their investments in state-of-the-art technologies, such as “tractors with more monitors than you can imagine.” With such equipment, farmers now calculate “by the inch, not the acre,” and producers drawn to the promise of carbon sequestration are curious to see how their data banks might be put to further good use.

Kolsrud reviewed the regenerative agriculture techniques already in play in the regions where he farms. Generations of farmers have used crop rotation to reduce weeds and interrupt pest cycles, thereby reducing chemical inputs. Using cover crops, though, is relatively new. Within the past five years, he said, farmers have protected about 25% of local land with cover crops such as rye and radish, and they're also adopting minimum- and zero-till practices.

“Consumers increasingly want to know how their food is produced and if it is done sustainably,” Kolsrud said. Carbon farming fits well into a suite of practices that serve that consumer demand.

A ‘Natural, Massive Carbon Sink’

Paul Zorner, CEO of Solon, Ohio-based Locus Agricultural Solutions, spoke about the science behind carbon farming, noting that global soil contains three times more exchangeable carbon than the atmosphere. “Soil is a natural and massive carbon sink,” and “all that carbon adds to the productivity of the soil,” he said.

Globally, five billion acres of land are devoted to agriculture, including pasture and forestry; one billion of those acres are in the United States. “This sheer, massive scale and potential to sequester carbon makes agricultural soil a very powerful tool to mitigate greenhouse gas concentrations,” Zorner said. Adding to the promise of carbon farming are two billion farmers who, “with the right tools and knowledge,” could become two billion foot soldiers in the battle “to amplify carbon in the largest carbon sink in the world.”

[This point didn't arise explicitly during the webinar, but The Energy Mix subscriber Faris Ahmed of USC Canada points out that soil carbon sequestration must be done in a way that supports smallholders' land rights and livelihoods, rather than undercutting them. – Ed.]

Zorner traced the “wonderful and natural process that drives the deposition of carbon in the soil.” Through photosynthesis, plants remove vast amounts of CO₂ from the atmosphere and convert it into sugars. They use as much as 30% of these sugars to “recruit and nurture” huge, diverse populations of microbes around their root systems. The microbes help the plants take up nutrients, retain water, and tolerate stress, functioning as a key part of the process by which plants produce the roots and leaves that end up as carbon in the soil. When they die, the tiny creatures deposit huge amounts of carbon into the soil.

Like Taking 4.3 Million Cars Off the Road

Recognizing microbes as key to both soil health and climate-friendly carbon accumulation in soil, Zorner and other agronomists at Locus developed a new microbial soil amendment that substantially increased soil carbon sequestration in trial applications to California grapes and Florida citrus. In the citrus trial, after scientists treated one acre of land three to four times over the course of a year, soil carbon increased by 32%, to 4.3 tons. Soil greenhouse gas emissions decreased by 2.33 tons, Zorner said—the “rough equivalent” of the CO₂ produced by driving an internal combustion car for a full year. He calculated that depositing four tons of carbon per acre in just 10% of California’s agricultural land would be the equivalent of taking 4.3 million cars off the road.

Locus Agricultural Solutions is also collaborating with [SoilCQuest](#), an Australian non-profit, to develop a soil fungus that works with plants to produce a particularly stable form of soil carbon known as melanin.

A lot of work remains to be done to determine how soil type, time of year, and other factors affect carbon sequestration levels. But the Locus and SoilCQuest projects are “examples of what is possible now, especially when combined with farming practices like cover crops and no-till,” Zorner said. “Envision one billion acres in the U.S. with all the farmers working with regenerative agriculture.”

Attorney Claire O’Connor, director of water and agricultural policy at the Natural Resources Defense Council (NRDC), challenged the assumption that farmers and environmentalists “are always opposed.” Introducing herself as a “farm girl environmentalist,” a member of the fifth generation to grow up on her family farm in Nebraska, O’Connor said NRDC “has a long history of engaging with agricultural issues” like pesticides and human health. While the organization and farmers have “not always seen eye-to-eye” on these issues, they share “vast common ground” around the need for healthy soil.

In fact, she told participants, the environmental community “has taken a while to catch up [to farmers] to realize how many of our problems might be solved by giving soil the love it deserves.” In this case, thanks in large part to E2’s efforts, NRDC found itself working with the U.S. National Corn Growers Association, the Minnesota Farmer’s Union, and the American Coalition for Ethanol to insert what is effectively a climate bill into a farm bill.

Farmers on the Climate Front Lines

The soil health provision *should* be understood as a climate bill, O’Connor said, because farmers are on the front lines of climate change, both as victims of its escalating impacts and as invaluable partners in its mitigation, thanks to the huge sequestration potential of their land. The U.S. National Academy of Sciences calculated recently that with a no-till

regime, cover crops, and diversified rotations, the country's farmland could sequester up to 250 million tonnes of greenhouse gases per year—equivalent to the annual emissions from 64 coal-fired power plants,

She called the carbon farming pilot a “huge step in the right direction in terms of addressing climate change and providing a new revenue stream, which farmers are so hungry for in this tough market,” while generating critical data to build into existing models.

The “idea of building the base for a carbon market” has broad support within the farming community, O'Connor said. And there are co-benefits to scaling up carbon farming, as well. In drought-vulnerable California, for example, the regenerative practices that support carbon sequestration also backstop the micro-aggregate structure that is so critical to helping soil hold on to water.

But the first step in that direction will be to get the pilot project off the ground. That will mean prompting the U.S. Department of Agriculture to prioritize the rulemaking process that will determine exactly how the pilot is implemented, and ensuring that the \$15 million allocated in the farm bill actually makes its way to the project. O'Connor explained that when the Senate draft of the bill was conferenced with the House version, “the pilot was rolled up into other programs with more money attached,” adding one more step to ensuring that the original funding is re-secured for the pilot.

After that, progress will have to be tracked through implementation to ensure that the pilot makes it easy for farmers to sign up, and that “we are getting the robust data we need to make the models work.”

Wyden stressed that the soil health provision has everything to do with climate health.

“Storing carbon is critical to minimizing climate change,” he said, and what is unique about the pilot is that “it has the support of a wide variety of stakeholders bringing practical business approaches to the climate change fight.”

Noting wryly that corn growers and NRDC “are not a natural fit,” Wyden praised E2 for “deftly” managing “tough negotiations” to build the alliance the moment demanded. It was that coalition's capacity to find common ground that “got this key provision into the farm bill,” he added.

In the discussion period, a participant asked why American farmers are not already using practices that are good for soil health, and why it took so long for them to realize they could be involved in climate change mitigation. Kolsrud pointed to an innate conservatism that kept farm producers content with the status quo while agricultural prices were high.

But attitudes are changing, he said: the prices farmers receive dropped, and they have been hit hard by repeated blasts of extreme weather. There is also “a lot more buzz about soil health and carbon farming in farming papers,” and farmers are recognizing that they have “a mountain of data they can use to help monetize carbon farming.”

65 ppm Out of the Atmosphere

A participant asked whether there is a limit on how much carbon soil can sequester. Zorner cited an estimate in one recent paper that “since the beginning of industrialized agriculture, we’ve lost as much as 130 billion tonnes of carbon from our soil through excessive tillage practices” and other factors. He added that, “if all we do is contribute back this amount,” that action would be “the equivalent of taking 65 parts per million CO₂ out of the atmosphere.” Another recent paper placed the potential soil carbon sink capacity of “managed ecosystems” at 55 to 78 billion tonnes, and historical losses as high as 130 billion—a cumulative total that could be restored over the course of 50 to 100 years.

Asked how long sequestered carbon remains in the soil, Zorner said that question “really needs to be addressed.” Referring to SoilCQuest’s experiments with manufacturing extra-stable forms of carbon, he expressed a high degree of confidence that 21st-century agriculture technology, coupled with age-old techniques for preserving soil structure by avoiding excessive tillage, could ensure soils hold their carbon “for decades.”

Participants asked for details about the implementation of the soil health pilot, including the minimum acreage for participation and how sequestration will be measured. O’Connor said those and other decisions will be made through the USDA rulemaking process. The coalition will be advocating that the program “be available to all scales and types of farming” to achieve the diversity of data needed to “better understand what roles agriculture can play” in carbon sequestration. Wyden encouraged participants to get the word out on the pilot project by talking to “farmers, ranchers, and local business, especially in places where people say ‘no one ever thinks about us.’”

Asked how carbon farming could be deployed in less-developed countries, Zorner said microbial amendments “don’t do well in transport”. But regenerative agriculture practices could easily be (re)introduced where they are not already practiced, and microbial amendments could be produced onsite.

Lederer concluded the webinar with a call to action. She urged participants to write a short email to the USDA to support the Soil Health Demonstration Trial authorized in the 2018 farm bill, and ask the department to prioritize implementation and full funding for the pilot. Emails should identify “who you are, where you live, what your connection to agriculture is, and your support,” she advised.

