Could Our Farms Become the World's Great Untapped Carbon Sink?

By John J. Berger, *Sustain Europe* U.S. Correspondent

Carbon farming, an agricultural movement taking root in Northern California, aims to improve the soil and help stabilize the climate.

The San Francisco Bay Area's upscale restaurateurs and market owners know Loren Poncia's Stemple Creek Ranch for its premium grass-finished organic beef and lamb. But during an early fall day on Poncia's scenic ranch, there was little green in sight. Following the summer's record-breaking heat, his rolling coastal prairie hills were brown and dotted with rocky grey outcrops and Black Angus cattle, all hemmed in by weathered wooden fencing.

Poncia, 43 and a fourth-generation cattle rancher, manages 5,000 acres of range in west Marin County. In bygone days, he thought of himself as a grass farmer, but today, thanks to the Marin Carbon Project, he prizes the quality of his soil—and sees himself as a carbon farmer.

Ranchers like Poncia who are allied with the project are working with scientists in Northern California to popularise, and scale up carbon farming, a way of tending the land that restores soils to health and simultaneously benefits the climate. Techniques include composting, planting cover crops, reducing tillage, leaving crop residues on the land, and managing grazing. The Marin Carbon Project believes these practices have the potential to remove millions of tonnes of carbon from the air in California, and billions of tonnes worldwide.

You needn't go far to understand why. In contrast to the black, sandy clay loam on Poncia's farm, the earth beneath millions of acres of grazed American rangeland is light-coloured, depleted soil that's lost much of its carbon-containing organic matter—as well as its ability to capture and store carbon. These conventionally grazed farms are also less fertile; carbon-poor soil produces lower crop yields, less forage, and less biodiversity.

Over the past decade, the Marin Carbon Project has initiated more than $15 million (€13 million) worth of field and laboratory research and demonstration projects that have conclusively linked restorative land management practices with increases in durable soil carbon. Through this work, the organisation has shown that farmers who coax carbon back into their soils reduce excess atmospheric carbon dioxide, the principal heat-trapping gas now overheating the Earth. For example, project cofounder John Wick and his colleagues found that for each hectare (roughly 2.5 acres) of land they topped with about half an inch of dry organic compost, the land gained a tonne of durable soil carbon—and according to Dr. Whendee Silver, a specialist in soil biogeochemistry, that carbon could remain locked in the soil for 30 to 100 years. The researchers were amazed to see that following the initial compost application, the soil gained an additional tonne *every year* over their four-year study period. The initial treatment had jump-started the soil's microbial community and energised the plants.

These findings have proved instrumental in influencing state agricultural policies in favour of carbon farming. The Marin Carbon Project assembled a coalition of agricultural stakeholders that successfully launched a statewide Healthy Soils Initiative, adopted in 2015. State agencies and departments are now collaborating to promote the development of healthy, carbon-rich soils on California farms and ranchlands.

NRDC's soil health expert Lara Bryant points out that California is a leader in regenerative agriculture. Farmers with the Marin Carbon Project add a new dimension to that work through their reliance on compost. "They're closing a waste loop by taking a product that could have gone to a landfill, where it would have decayed and contributed to global warming," she says. "Instead they're putting that resource back into the earth, where it protects and improves the soil."

Like Poncia, farmers and ranchers around the state are now signing up to adopt carbon farm plans patterned on the Marin Carbon Project's pioneering work. In addition to adding organic compost to his fields and using organic manure as fertilizer, Poncia plants trees and protects the lands bordering the property's namesake creek. He also uses what he calls rotational pulse grazing, in which cattle graze intensively in confined areas for short periods before farmers move them to other pastures.

To incentivise greenhouse gas–reducing initiatives like the Marin Carbon Project, California now offers participants in the program small grants to help defray the costs of demonstration projects that increase soil organic matter, improve soil structure and water-and nutrient-holding capacity, and result in net long-term greenhouse gas benefits. There is also an embryonic voluntary market for soil carbon storage offsets, however, at their current low price—they're worth only $10 each—a farmer can't rely on them for much income.

In the meantime, by focusing on his soil, Poncia has been able to raise more cows. "In the last 15 years, we've doubled our carrying capacity in terms of the amount of grass that we grow," he says. Before he began working his land, he points out, it had already been ranched for some 200 years. Over time, that probably caused some loss of native perennial grasses and forbs, deep-rooted plants that are key to soil health. Today a mixture of perennials and plenty of introduced annual grasses grow across the property.

Because of these vegetation changes over the ranch's two centuries of operation, Poncia doesn't expect to be able to return the soil to exactly its original state. To get closer, however, he continues working to establish more perennial plants that keep live roots in the soil year-round and thereby sequester more carbon. Since his land typically experiences six months of drought a year, he also values the fact that the deeper-rooted perennials can reach moisture inaccessible to annual grasses, thus keeping the land green for much of the year while bringing valuable micronutrients to the surface. Their powerful roots also help de-compact the soil.

"We're reaping the benefits of storing more carbon and water in the soil," Poncia says. "Carbon in the soil is like a sponge," he adds, and it fosters a cycle: The more carbon, the more water the soil will store and the more perennial plants can grow; the more perennial plants, the more carbon stored in their roots. When perennials decompose in the soil, that too adds more healthy organic material to the earth.

The enterprise of carbon farming still has a long way to go, of course. Because healing the land is at least a multiyear process, and there is not yet a well-developed supporting infrastructure to defray the extra labour and financial costs of the practice, not all farmers can take advantage of the opportunity. Poncia points out that his operation is not more profitable as a direct result of carbon farming, and that to subsidize up to half of those costs, he participates in federal and state cost-sharing programs. He also sold his development rights to a local land trust, which added to his bottom line and prevents the land from ever being developed.

Advocates see a promising future for carbon farming. If its practices were widely adopted across U.S. and global rangelands, it could have profound climate benefits—maybe even shifting the world's atmosphere toward its preindustrial composition. California alone has a vast expanse of rangeland, of which about 16.2 million hectares (40 million acres) are grazed. By some estimates, global crop and grazing lands cover 3.6 billion hectares (9 billion acres). If a tonne of carbon per hectare could be stored annually on even a small fraction of that land area, reason Wick and his colleagues, *billions* of tonnes of carbon dioxide might ultimately be taken out of the earth's atmosphere.

Above: True Grass Farms' Guido Frosini checks the soil surface after moving his cows in a short-duration, high-intensity rotational grazing pattern

Left: Jeffrey Creque, director at Carbon Cycle Institute and cofounder of the Marin Carbon Project, checks a compost pile for quality with Poncia

IMAGES: MARIN CARBON PROJECT

Opposite page: Loren Poncia on his Stemple Creek Ranch, in Marin County, California

IMAGE: PAIGE GREEN

John J. Berger, PhD. (www.johnjberger.com) is an energy and environmental policy specialist who has produced ten books on climate, energy, and natural resource topics. He is the author of Climate Peril: The Intelligent Reader's Guide to the Climate Crisis, and Climate Myths: The Campaign Against Climate Science, and is at work on a new book about climate solutions.

Follow John J. Berger on Twitter: www.twitter.com/johnjberger