“Grass, Soil, Hope.”

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At a farm in Peru, charcoal from bamboo burned in special ovens is used to fertilize the soil. Carbon farming is seen as a way of replenishing depleted farmland and helping reduce damage to the environment. Enrique Castro-Mendivil/Reuters

When Gabe Brown and his wife bought their farm near Bismarck, North Dakota, from her parents in 1991, testing found the soil badly depleted, its carbon down to just a quarter of levels once considered natural in the area.

Today the Brown farm and ranch is home to a diverse and thriving mix of plants and animals. And carbon, the building block of the rich humus that gives soil its density and nutrients, has more than tripled. That is a boon not just for the farm’s productivity and its bottom line, but also for the global climate.

Agriculture is often cast as an environmental villain, its pesticides tainting water, its hunger for land driving deforestation. Worldwide, it is responsible for nearly a quarter of all greenhouse gas emissions.

Now, though, a growing number of experts, environmentalists and farmers themselves see their fields as a powerful weapon in the fight to slow climate change, their very soil a potentially vast repository for the carbon that is warming the atmosphere. Critically for an industry that must produce an ever-larger bounty to feed a growing global population, restoring lost carbon to the soil also increases its ability to support crops and withstand drought.

Mr. Brown’s approach is very different from the techniques of industrial-scale farming that have taken hold in the United States and other wealthy countries, where single crops stretch over many acres, and fertilizers and pesticides are used heavily.

Things are worse in poorer nations, where farmers' desperation often means they are unable to care for the soil, Mr. Lal said. He recalled seeing a Mexican sharecropper carting corn straw away from the fields to sell: "I said, 'Why don't you leave it on the land? The land will be better next year.' And he said, 'This land will not be mine next year, and I need money now.'"

There is some momentum behind a shift. The French government, which helped broker last year's landmark Paris Agreement on climate change, is pushing an effort to increase soil carbon stocks by 0.4 percent annually, which it says would halt the rise in atmospheric carbon dioxide levels.

Mr. Lal called the target unrealistic, but said achieving just a quarter of that sequestration would be meaningful. In a generation, he said, agriculture could become carbon neutral, removing all the emissions it creates, for example through the energy used by farm equipment.

Worldwide, 5 percent to 10 percent of growers are using regenerative, climate-friendly techniques, said Louis Bockel, a policy officer at the United Nations' Food and Agriculture Organization. That number is likely to increase, he said, as multinational institutions and wealthy nations start incorporating carbon sequestration incentives into existing aid to farmers in poor countries.

"More and more additional funding will be available" to encourage such efforts, Mr. Bockel added. "We are moving quite quickly on this."

Farmers need financing to help them adopt new techniques, though generally only through a two-to-three-year transition period, said Eric Toensmeier, author of "The Carbon Farming Solution." That money could come through a higher price charged for foods whose cultivation encourages sequestration, via a carbon tax or through trading systems in which polluters buy credits to offset their emissions, he said. Programs known as payment for environmental services, in which governments or others pay farmers for stewardship of land, are another potential avenue.

With that kind of support, the industry could be ready to do things differently, said Ceris Jones, a climate change adviser at the National Farmers Union in Britain.

"People say that farmers are pretty conservative, but actually practice can change quite quickly," she said.